



DEDER GENERAL HOSPITAL

EMERGENCY AND CRITICAL CARE DEPARTMENT

Standard Treatment Guidelines (STG) Protocol

“Adapted from National STG 2021 4th Edition”

October 2024

Deder, Eastern Ethiopia

SMT APPROVAL SHEET

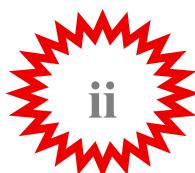
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SECTION 1:

INTRODUCTION

1.1 Background

The Emergency & Critical Care Department (ECCD) of Deder General Hospital serves as the first point of contact for patients with acute, life-threatening illnesses and injuries from across the hospital's catchment area in Eastern Ethiopia. This department operates 24/7, providing triage, stabilization, and either definitive emergency care or timely referral/admission to appropriate inpatient services.

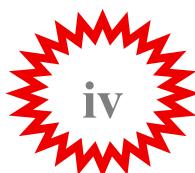
In Ethiopian Fiscal Year (EFY) 2016, the department recorded a high volume of patient visits, with many cases requiring rapid interventions to prevent death or severe disability. A hospital-based review of mortality and morbidity data identified the following top ten leading causes of emergency presentations:

Rank	Disease	Percentage (%)
1	Dyspepsia (including complications such as GI bleeding)	20
2	Pneumonia (severe and complicated)	19
3	Intestinal helminthic infestations (severe/complicated)	16
4	Diabetes mellitus (emergency presentations such as DKA, HHS)	12
5	Heart failure (acute decompensation)	11.0
6	Asthma (acute severe attacks)	7.0
7	Typhoid & paratyphoid fever (severe cases)	4.1
8	TB infections (including advanced pulmonary TB)	3.7
9	Glomerular diseases (acute nephritic syndrome, rapidly progressive GN)	2.6
10	Urologic disorders (acute urinary retention, obstructive uropathy)	2.5
11	Urinary tract infections (pyelonephritis, urosepsis)	2.2

1.2 Role of the Emergency & Critical Care Department in the Health System

The ECCD functions as both a gateway and a critical intervention hub. Patients present directly from the community or are referred from lower-level facilities. **The department provides:**

- Rapid triage and assessment to prioritize care for the most critically ill
- Stabilization of vital functions using the Airway, Breathing, Circulation (ABC) approach
- Initiation of life-saving interventions before definitive diagnosis
- Coordination with inpatient and specialty units for continued care
- Discharge planning for ambulatory emergency cases with safe follow-up



1.3 Need for an Emergency Department-Specific STG

While the National STG 2021 provides comprehensive guidance for common diseases, the emergency context in Deder General Hospital presents unique challenges:

- **Time-sensitive decisions** — many cases require immediate interventions before diagnostic confirmation
- **High patient load** — demanding rapid clinical decision-making and streamlined protocols
- **Resource constraints** — necessitating prioritization of essential diagnostics and treatments
- **Evolving resistance patterns** — requiring adaptation of antimicrobial regimens to local data
- **Varied case mix** — from medical and surgical emergencies to infectious disease outbreaks

This ED-specific STG aims to address these realities while ensuring alignment with national standards.

1.4 Objectives of the ECCD Clinical Practice Protocols

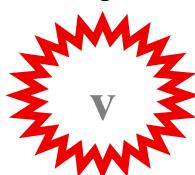
The primary objectives of these protocols are to:

- Standardize emergency diagnosis, stabilization, and treatment of high-priority conditions.
- Ensure rapid initiation of life-saving measures in line with evidence-based practice.
- Promote rational use of medicines and resources in the emergency setting.
- Reduce mortality and prevent disability through timely interventions.
- Support continuous training of ED healthcare providers.
- Provide a reference tool for interns, junior doctors, nurses, and other ED staff.

1.5 Guiding Principles

The ECCD protocols are based on the following principles:

- **Triage First:** Always prioritize patients with airway compromise, breathing difficulty, shock, or altered consciousness.
- **Stabilize Before Definitive Care:** Apply ABC principles to ensure patient safety.
- **Evidence-Based Interventions:** All treatments align with National STG 2021 recommendations and local antibiograms.
- **Team-Based Approach:** Coordination between doctors, nurses, lab staff, and pharmacy is critical.
- **Ethical Care:** Provide treatment without discrimination and with respect for patient dignity.
- **Continuous Evaluation:** Monitor patient response and adapt management accordingly.



SECTION 2:

PURPOSE, RATIONALE, AND

EMERGENCY CARE PRINCIPLES



2.1 Purpose

The Emergency & Critical Care Department (ECCD) Clinical Practice Protocols have been developed to: Standardize emergency diagnosis and treatment for the top causes of morbidity and mortality in the ECCD. Provide clear, step-by-step guidance for rapid assessment, stabilization, and early management of emergency cases.

Support rational and effective use of medicines, laboratory tests, and equipment in resource-limited emergency settings.

Promote timely initiation of life-saving interventions in line with the Airway, Breathing, Circulation (ABC) approach.

Align ED management with the National Standard Treatment Guidelines (STG) 2021, while adapting to the realities of Deder General Hospital.

Serve as a training and orientation tool for new emergency staff, interns, and students.

2.2 Rationale

The ECCD handles a diverse and critical patient load where delays or errors in care can have immediate consequences. The top 10 conditions seen in EFY 2016 account for the majority of preventable emergency deaths and complications. **A department-specific STG is necessary because:**

- National guidelines are comprehensive but may not address the time-sensitive nature of ED interventions.
- Emergency management requires streamlined algorithms for diagnosis and treatment.
- Deder General Hospital's resource constraints necessitate prioritization of essential drugs, equipment, and diagnostics.
- Antimicrobial resistance (AMR) trends require local adaptation of treatment regimens.
- High staff turnover in the ED calls for consistent, easily accessible protocols to ensure continuity and quality of care.

2.3 Principles of Emergency Care in ECCD

The following principles guide all clinical practice in the ED:

2.3.1 Triage and Prioritization

All patients should be triaged immediately on arrival using the Ethiopian Emergency Triage System (or equivalent).

- **Red category (Immediate):** Life-threatening conditions — treat without delay.
- **Yellow category (Urgent):** Potentially serious conditions — treat within minutes to an hour.
- **Green category (Non-urgent):** Minor injuries or illnesses — safe to wait.

2.3.2 Airway, Breathing, Circulation (ABC)

Always address airway first — ensure patency, consider airway adjuncts, suction, or intubation if needed. Assess and support breathing — administer oxygen, manage pneumothorax, provide ventilation if required. Evaluate circulation — check pulse, blood pressure, perfusion; manage shock with fluids, control bleeding, start vasopressors if indicated.

2.3.3 Rapid Diagnostics

Order only essential investigations that will change immediate management (e.g., random blood sugar in suspected DKA, chest X-ray in severe pneumonia).

Use point-of-care tests where available (urine dipstick, rapid malaria test, pregnancy test, troponin, H. pylori stool antigen).

2.3.4 Early Stabilization and Definitive Care

Begin empiric treatment when the diagnosis is clear or strongly suspected; do not delay for confirmatory results in life-threatening situations.

Once stabilized, transfer to appropriate ward or refer if advanced care is not available in-house.

2.3.5 Documentation and Communication

Record initial presentation, triage category, vital signs, interventions given, and patient response.

Provide a structured handover to inpatient teams or referral facilities using the SBAR method (Situation, Background, Assessment, Recommendation).

2.3.6 Ethical and Patient-Centered Care

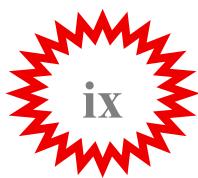
Provide care without discrimination based on age, gender, ethnicity, religion, or socioeconomic status.

Communicate with patients and families clearly, even in emergencies, and obtain verbal consent where possible.



SECTION 3:

ANTIMICROBIAL STEWARDSHIP, EMERGENCY PATIENT CARE PATHWAYS, AND ETHICAL CONSIDERATIONS



3.1 Antimicrobial Stewardship in the Emergency Department

3.1.1 Background

The Emergency & Critical Care Department (ECCD) is a high-impact area for antimicrobial prescribing because:

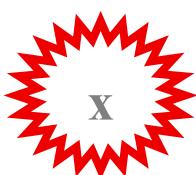
- Many cases are infectious or suspected infectious diseases
- Time pressures may lead to empirical antibiotic use without adequate justification
- Inappropriate antimicrobial use contributes to antimicrobial resistance (AMR), treatment failure, and increased mortality
- Local resistance trends at Deder General Hospital show reduced susceptibility to commonly used antibiotics for pneumonia, urinary tract infections, and typhoid fever. This makes judicious antibiotic prescribing in the ED crucial.

3.1.2 Core Principles for ED Antimicrobial Use

- Prescribe only when there is a strong clinical indication — avoid antibiotics for clearly viral illnesses.
- Prefer narrow-spectrum antibiotics guided by likely pathogens and local antibiogram.
- Use correct dose, route, and duration as per STG.
- Start with empiric therapy only when delaying treatment poses a risk (e.g., sepsis, meningitis).
- De-escalate or stop antibiotics once culture results or clinical reassessment indicate no bacterial infection.
- Educate patients about adherence and not sharing or storing leftover antibiotics.

3.1.3 Operational Strategies for Antimicrobial Stewardship in ECCD

- Maintain an ED-specific antibiotic formulary aligned with the Essential Medicines List (EML).
- Ensure ready access to local antibiogram for prescribers.
- Conduct regular prescription audits and give feedback to ED staff.
- Involve pharmacists in point-of-care antimicrobial decision-making.
- Integrate antimicrobial stewardship into ED orientation and training programs.



3.2 Emergency Patient Care Pathways

3.2.1 Ambulatory Emergency Care

- Some emergency cases can be treated and discharged safely after initial stabilization and management.
- Examples: uncomplicated dyspepsia, mild asthma exacerbations, early UTI, helminthic infestations without complications.
- Provide clear written instructions for medication use, warning signs, and follow-up appointments.
- Ensure the patient understands their diagnosis and care plan before discharge.

3.2.2 Hospital Admission Pathway

Patients who are unstable or at risk of rapid deterioration should be admitted for further management.

Examples: severe pneumonia, acute heart failure, diabetic ketoacidosis, severe glomerulonephritis.

Admit to appropriate ward (medical, ICU, isolation) based on condition and bed availability.

Complete structured handover to the admitting team.

3.2.3 Referral Pathway

Some emergencies require transfer to a higher-level facility for advanced care not available at Deder General Hospital.

Indications: need for surgical subspecialty, advanced ICU care, or dialysis.

Ensure stabilization before transfer — airway secured, bleeding controlled, IV access established.

Provide referral documentation summarizing diagnosis, interventions, and current status.

3.3 Ethical Considerations in Emergency Care

3.3.1 Patient Rights in Emergencies

All patients have the right to receive timely and appropriate emergency care regardless of ability to pay.

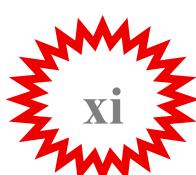
Care must be provided without discrimination.

Maintain privacy and confidentiality even in busy ED settings.

3.3.2 Consent in Emergencies

In life-threatening situations where the patient cannot consent and no legal guardian is present, care should proceed under the principle of implied consent.

Document the clinical justification for urgent interventions.



3.3.3 End-of-Life Care in ECCD

For patients with terminal illness presenting in crisis, prioritize comfort and dignity alongside necessary medical interventions.

Initiate palliative measures when appropriate and communicate with families compassionately.

3.4 Good Prescribing and Dispensing Practice in ECCD

3.4.1 Principles of Good Prescribing

- Prescribing in the emergency department must balance speed with accuracy. Poor prescribing can lead to treatment failure, adverse events, drug interactions, and wasted resources.
- Core principles:
- Prescribe only when there is a clear indication — Avoid unnecessary medicines.
- Use the generic name and select from the Ethiopian Essential Medicines List (EML) and hospital formulary.
- Choose the most appropriate drug considering efficacy, safety, cost, and availability.
- Consider patient-specific factors — age, pregnancy, comorbidities, allergies, renal/hepatic function.
- Write clearly — avoid abbreviations, ensure legibility.
- Specify dose, route, frequency, and duration — no vague instructions like “take as needed” unless clinically appropriate and explained.
- Avoid polypharmacy unless justified.
- Document all prescriptions in patient records.
- Review and adjust treatment as patient status changes.

3.4.2 Steps in Rational Prescribing (Adapted from WHO Guide to Good Prescribing)

- **Define the patient's problem** — accurate and rapid diagnosis based on history, examination, and urgent investigations.
- **Specify the therapeutic objective** — symptom relief, cure, prevention of deterioration.
- **Select the standard treatment** — per ECCD STG, adapted from national guidelines.
- **Verify the suitability** — check contraindications, drug interactions, special population adjustments.
- **Initiate the treatment** — provide full written instructions.
- **Educate the patient/family** — especially for discharge medications.
- Monitor and stop when objectives are achieved or if adverse effects occur.

3.4.3 Principles of Good Dispensing

- Dispensing in emergencies requires speed without compromising safety.
- **Key steps:**
 - ⊕ **Verify the prescription** — ensure dose, frequency, duration, and drug are correct.
 - ⊕ **Prepare and label medicines clearly** — patient name, drug name (generic), dosage, frequency, route, duration, and any special instructions.
 - ⊕ **Provide counseling** — purpose of medicine, how and when to take it, possible side effects, and storage.
 - ⊕ **Encourage adherence** — explain the importance of completing the course for antibiotics.
 - ⊕ **Document the dispensed items** — in the patient chart and pharmacy records.
 - ⊕ **Report adverse drug reactions** — through the national pharmacovigilance system.

3.5 Palliative Care in the Emergency & Critical Care Department

3.5.1 Definition

Palliative care is an active, holistic approach that improves the quality of life for patients and families facing life-threatening illness, through the prevention and relief of suffering.

In the ECCD, palliative care often involves managing acute crises in patients with advanced, incurable disease.

3.5.2 Goals of Palliative Care in ECCD

- ⊕ Relieve pain and distressing symptoms rapidly and effectively.
- ⊕ Support the patient's emotional and psychological well-being.
- ⊕ Provide clear, compassionate communication about prognosis and treatment choices.
- ⊕ Respect the patient's values, beliefs, and cultural practices.
- ⊕ Support family and caregivers during crisis and bereavement.

3.5.3 Core Principles

Early identification of patients needing palliative care — often possible during triage.

Holistic assessment — physical, emotional, social, and spiritual needs.

WHO Analgesic Ladder for pain management:

Step 1: Non-opioids (e.g., paracetamol, NSAIDs) for mild pain.

Step 2: Weak opioids (e.g., tramadol, codeine) ± non-opioids for moderate pain.

Step 3: Strong opioids (e.g., morphine) ± adjuvants for severe pain.

Symptom control for breathlessness, nausea, constipation, delirium, anxiety.

Interdisciplinary care — doctors, nurses, pharmacists, social workers, and spiritual support.

Continuity of care — ensure follow-up through home-based or outpatient palliative services when possible.

3.5.4 Ethical and Cultural Considerations

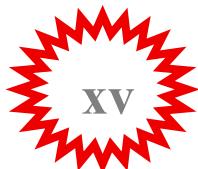
- Always seek the patient's informed preferences when possible.
- If the patient is unconscious, involve the family while respecting confidentiality.
- Provide truthful but sensitive information about prognosis.
- Avoid unnecessary invasive interventions when the burden outweighs the benefit.
- Ensure privacy and dignity for dying patients, even in busy ED settings.

3.5.5 Integration into ECCD Workflow

- Triage nurses should identify palliative care needs early.
- Create a palliative care corner/room in ED for privacy.
- Maintain an emergency palliative care kit — morphine, antiemetics, oxygen, antisecretory agents, sedatives.
- Develop a referral pathway to link ED patients to the hospital's palliative care clinic or community services.

SECTION 4:

DISEASE-SPECIFIC TOPICS



CHAPTER I:

DYSPEPSIA AND PEPTIC ULCER DISEASE

BRIEF DESCRIPTION

- Dyspepsia describes a wide and common clinical entity which presents in one of the three ways:
 1. Epigastric pain/burning (epigastric pain syndrome)
 2. Postprandial fullness
 3. Early satiety
- Dyspepsia is caused by a number of disorders.
- The most common cause is functional (non-ulcer) dyspepsia followed by peptic ulcer disease.
- Gastro esophageal reflux disease (GERD), gastric cancer, medication induced dyspepsia, biliary pain, chronic abdominal wall pain and pancreatitis are other possible causes.

CLINICAL FEATURES

- Depending on the type of dyspeptic syndrome patients may present with predominant epigastric burning sensation/pain/discomfort, postprandial discomfort and fullness or be unable to finish a regular meal.

ALARM SIGNS (need to be further investigation for cancer)

- Advanced age (>55years)
- Previous gastric surgery
- Unintended weight loss
- Persistent vomiting
- Hematemesis
- Progressive dysphagia/Odynophagia
- Otherwise, unexplained anemia
- Palpable abdominal mass
- Lymphadenopathy
- Jaundice

INVESTIGATIONS

- **H. Pylori test:** IgG serology or stool antigen or ¹³C-urea test
- Hemoglobin/hematocrit, stool for occult blood-when indicated
- Upper GI endoscopy
- H. Pylori test needs to be done for the following patients
 - Long standing dyspepsia
 - Younger than 55 years
 - No alarm symptoms
 - No use of non-steroidal anti-inflammatory drugs
 - No features of GERD (Gastro Esophageal Reflux Disease)
- “Test and treat” for H. Pylori can be practiced in these group of individuals

TREATMENT OBJECTIVES OF TREATMENT

- Decrease symptoms/improve quality of life
- Prevent development of complications

NON PHARMACOLOGIC

- Avoid offending foods/drinks

PHARMACOLOGIC

- **H. Pylorinegative**
 - First line: **Proton pump inhibitors**
 - Omeprazole, 20mg P.O., twice per day for 4-8 weeks
 - Esomeprazole, 40mg P.O., daily for 4-8 weeks
 - Pantoprazole, 40mg P.O., BID for 4-8 weeks
 - Alternatives: **H2 receptor blockers**
 - Cimetidine, 400mg P.O., BID for 4-8 weeks
 - Ranitidine, 150mg P.O. BID for 4-8 weeks
 - Famotidine, 20-40mg P.O. daily for 4-8 weeks
- **H. Pylori positive: H. pylori eradication therapy**
 - **First line therapy:** All drugs for 7-14 days
 - Amoxicillin, 1gm, P.O. BID
PLUS
 - Clarithromycin, 500mg, P.O., BID
PLUS
 - Proton pump inhibitors (see the daily doses above)
 - **Alternative** (for penicillin allergic patients): This regimen has a higher failure rate. All drugs should be given for 7-14 days

- Clarithromycin, 500mg P.O.BID
PLUS
- Metronidazole, 500mg, P.O.BID
PLUS
- Proton pump inhibitors (see the daily doses above)

GASTROESOPHAGEAL REFLUX DISEASE (GERD)

BRIEF DESCRIPTION

- Gastroesophageal reflux refers to the return of stomach contents into the esophagus.
- Some degree of brief reflux occurs physiologically; usually after a meal or during sleep.
- GERD refers to a pathologic reflux associated with symptoms and complications.
- GERD is a common in primary care practice. Due to its symptoms, it can also be misdiagnosed.
- Based on the endoscopic appearance GERD is classified into two types: Erosive and non-erosive.
- Erosive GERD (Erosive esophagitis) is diagnosed when there are endoscopically visible breaks in the esophageal mucosa while non-erosive GERD shows no visible mucosal injury on endoscopy.
- GERD is associated with significant esophageal or extraesophageal complications.
 - **Esophageal complications**
 - Barrett's esophagus: a precancerous change in the esophageal mucosa (from squamous epithelium to columnar epithelium)
 - Esophageal stricture: which manifests with solid food dysphagia

and intermittent food impaction?

- **Extraesophageal complications**
 - Triggering Asthma
 - Laryngeal and pharyngeal reflux: which manifests with chronic cough, repetitive throat cleaning, hoarseness of voice

CLINICAL MANIFESTATIONS

- **Symptoms**
 - The two major symptoms of GERD which are considered classic (typical) are heartburn and regurgitation.
 - Heartburn is a commonly described by patients as a burning sensation behind the sternum (retrosternal area).
 - Regurgitation is defined as back flow of gastric contents in to the mouth or pharynx. Patients feel an acidic (sour) content coming to the mouth mixed with small amounts of undigested food.
- **Other symptoms**
 - Chest pain: GERD associated chest pain can mimic angina (pain from ischemic heart disease)
 - Triggering asthma attacks (wheezing)
 - Hoarseness of voice
 - Persistent cough
 - Nausea
 - Sensation of a lump in the throat (Globus sensation)
 - Increased salivation (Water brash)

DIAGNOSIS

- In patients with typical symptoms i.e., heartburn or regurgitation, the diagnosis of GERD can be considered on clinical grounds without additional investigations, if there are no alarm signs. In such cases empiric

therapy should be started.

INVESTIGATIONS

- **Upper GI (gastrointestinal) endoscopy**

- Endoscopy is not necessary to make a diagnosis of GERD but it is indicated in patients with alarm features to see evaluate for possible malignancy.
- The alarm features are weight loss, age above 60 years, iron deficiency anemia, dysphagia, persistent vomiting or family history of cancer in parents or siblings.
- If GERD symptoms have been there for more than 5-10 years,endoscopy can be considered to look for evidence of Barrett's esophagus.

TREATMENT

OBJECTIVES OF TREATMENT

- Relive symptoms
- Decrease the risk of complications such as Barrett's esophagus, esophageal stricture

NON-PHARMACOLOGIC TREATMENT

- **Life style modifications**

- Weight loss in overweight and obese patients.
- Avoiding meals 2 -3 hours before bed is also advisable.
- Head elevations to 15-20 cm during sleep.
- Dietary selection should not be forced or recommended universally unless patients identify the specific food item as triggering factor. e.g., caffeine, spicy foods, food with high fat content, carbonated beverages, and chocolate)
- Other life style modifications are not supported by evidence.

- **Surgery**

- Surgical intervention (usually fundoplication) in GERD patients is rarely

indicated. Surgery may be considered in the following circumstances:

- Large hiatal hernia causing the reflux symptoms
- Evidence of aspiration
- Esophagitis refractory to medical therapy
- Persistent symptoms documented as being caused by refractory GERD: after checking compliance to PPI and optimizing PPI use.

PHARMACOLOGIC TREATMENT

- **First line: Proton-pump inhibitors (PPIs)**
 - No major difference in between the available PPIs
 - Omeprazole 40mg PO daily for 8 -12 weeks
OR
 - Esomeprazole 40mg PO daily for 8-12 weeks
OR
 - Pantoprazole 40mg PO daily for 8-12 weeks
- Stop therapy on symptom resolution to assess response
- After the first 8 -12 weeks, resume therapy as needed
 - Intermittent
OR
 - On demand
- **Alternatives:** If PPIs are not available and the symptoms are mild Histamine-2 receptor blockers (H2 blockers) can be considered as alternatives.
 - Cimetidine 400mg BID for 8 weeks
OR

- Ranitidine 150mg BID for 8 weeks

OR

- Famotidine 20mg BID for 8 weeks

REFERRAL

- Patients with alarm symptoms need to be referred without any delay after the initial evaluation.
- Patients with persistent symptoms after 8 weeks of therapy should be referred for specialist evaluation and follow up.

FURTHER READING

1. Philip O. Katz Lauren B. Gerson, and Marcelo F.Vela. Guidelines for the Diagnosis and Management of Gastroesophageal Reflux Disease. Am J Gastroenterol 2013;108:308 – 328
2. World Gastroenterology Organization Global Guidelines: GERD, Global Perspective on Gastroesophageal Reflux Disease. Update October 2015.

GASTROINTESTINAL BLEEDING

UPPER GASTROINTESTINAL (GI) BLEEDING

BRIEF DESCRIPTION

- Upper GI bleeding refers to gastrointestinal blood loss originating from the gastrointestinal tract proximal to the ligament of Treitz at the duodenojejunal junction.
- It can be overt or occult bleeding.
- Overt upper GI bleeding can manifest in the following ways:
 - Hematemesis: vomiting of frank red blood or a “coffee-grounds” material.

- Melena: Passage of black, tarry stool
- Hematochezia: passage of bright red or maroon (dark red) blood from the rectum. Upper GI bleeding causes hematochezia rarely, when it is massive and very acute.
- Occult upper GI bleeding present with symptoms anemia such as lightheadedness, or a positive fecal occult blood test on routine testing.
- The causes of upper GI bleeding are summarized in the table below.
- The two major causes that should be considered in every patient with overt upper GI bleeding are peptic ulcer disease and esophageal varices.

Table 6.1: Causes of Upper GI bleeding

1. Peptic ulcer disease
2. Esophageal varices
3. Gastroduodenal erosions
4. Mallory-Weiss tears (esophageal mucosal tear due to vomiting or retching)
5. Esophagitis
6. Vascular malformations,
7. Neoplasm
8. Coagulopathy
9. Obscure upper GI bleeding: often from small intestinal lesions

CLINICAL FEATURES

- **Symptoms**
 - Nausea
 - Vomiting of bright red blood or coffee-ground matter
 - Melena

- **Hematochezia:** rare in upper GI bleeding but can occur in massive acute bleeding.
- Symptoms related to the underlying cause;
 - Medication history: antiplatelet (aspirin, clopidogrel), non-steroidal anti-inflammatory drugs or anticoagulants
 - Symptoms of portal hypertension or liver cirrhosis in patients with variceal bleeding e.g., ascites, fatigue.
 - The bleeding in varices is generally bright red, painless, brisk, and voluminous.
 - Long standing epigastric pain: Suggestive of peptic ulcer disease
 - Preceding forceful vomiting or retching suggests Mallory-Weiss tears
 - **Weight loss:** may indicate neoplasm
- **Signs**
- In general, the physical signs (physical examination focuses on the following two elements)

4. The hemodynamic status of the patient and the degree of anemia

- Blood pressure: check for supine BP. If supine BP is normal check for postural hypotension (supine, followed by measurement after 3 minutes of standing)
- Pulse rate: assess for resting tachycardia
- Degree of pallor

5. Signs of the underlying cause of the upper GI bleeding

- Signs of chronic liver disease or portal hypertension indicating the possibility of bleeding varices: Ascites, splenomegaly, encephalopathy.
- Other site bleeding: platelet related disorders or coagulopathies

INVESTIGATIONS

- CBC (complete blood count)
- Serial hemoglobin/hematocrit every 8 hour: the initial hemoglobin/hematocrit may be normal as the loss is whole blood (both plasma and cells)
- Coagulation profile: PT (INR) and PTT
- Urea and Creatinine
- Liver enzymes
- Upper GI endoscopy; see above on diagnosis

DIAGNOSIS

- The diagnosis of upper GI bleeding is made on clinical grounds mainly based on history: a history of hematemesis or melena establishes the diagnosis.
- The next step in the diagnosis is trying to establish the cause of the upper GI bleeding.
- In addition to history and physical examination, identifying the cause of the upper GI bleeding requires upper GI endoscopy.
- Upper GI endoscopy has both diagnostic and therapeutic value.

RISK STRATIFICATION

- There are a few risk stratification tools which are useful to assess the likelihood of a person with upper GI bleeding to need further interventions like endoscopic treatment and transfusion.
- The Glasgow-Blatchford bleeding score (GBS) is one of the scores. It is simple risk stratification tool which does not require endoscopy. We recommend using the score.

Table. 6.2: Glasgow-Blatchford bleeding score (GBS)

Risk marker	Value	Score
• Urea (blood urea) (mg/dl)	38 - 46	2
	47 - 57	3
	58 - 146	4
	≥ 147	6
• Hemoglobin (g/dl) in males	12 - 13	1
	10 - 12	3
	< 10	6
• Hemoglobin (g/dl) in females	10 - 12	1
	< 10	6
• Systolic BP (mmHg)	100 - 109	1
	99 - 90	2
	< 90	3
• Pulse ≥ 100 (per min)		1
• Presentation with melena		1
• Presentation with syncope		2
• Hepatic disease		2
• Heart failure		2
Note: Score 0: low risk		
Score > 0: high risk, keep in hospital as the patient is likely to require transfusion or endoscopic intervention		
Score > or = 8: requires ICU admission		

TREATMENT OBJECTIVES OF TREATMENT

- Hemodynamic restoration
- Arresting or decreasing bleeding
- Preventing recurrence of bleeding

PHARMACOLOGIC AND NON-PHARMACOLOGIC TREATMENT

- **Hemodynamic stabilization**
 - Monitor airway, blood pressure and heart rate.
 - Do NOT give patient anything by mouth
 - Establish two large bore IV lines (16 gauge)
 - Treat hypotension initially with rapid, bolus infusions of isotonic crystalloid
 - Provide transfusion if either of the following is present
 - Hemodynamic instability (hypotension) is present.
 - Hemoglobin <9 g/dL in high-risk patients (e.g., elderly, coronary artery disease)
 - Hemoglobin <7 g/dL (70 g/L) in low-risk patients
- **Pharmacotherapy for all patients**
 - **Intravenous proton pump inhibitor**
 - Omeprazole 80mg IV loading followed by 40mg IV BID
OR
 - Esomeprazole 40 mg IV BID
OR
 - Pantoprazole 40 mg IV BID

- **Arresting bleeding**
- **Endoscopic** therapy is the main stay of therapy to arrest bleeding.
 - After hemodynamic stabilization consult or refer to facility with endoscopic services.
 - Balloon tamponade may be performed as a temporizing measure for patients with uncontrollable hemorrhage after tracheal intubation.
- **Open surgery**
- **Indications** for surgery;
 - Hemodynamic instability despite vigorous resuscitation (> 3 units three of transfusion)
 - Shock associated with recurrent hemorrhage
 - Perforated PUD along with bleeding
 - Failed endoscopic therapy for bleeding PUD
- No access to endoscopy therapy with ongoing bleeding
- Relative indications: difficult crossmatch, refusal of transfusion, shock on presentation,
- **Treating the underlying cause**
 - Patients with H. Pylori associated ulcer bleeding should receive eradication therapy.
 - In NSAID or Aspirin associated bleeding ulcers: stop the drug and re-evaluate the need.
 - Anticoagulants: stop and re-evaluate for continued need, dose adjustment if c
 - Variceal bleeding: band ligation and non-selective beta-blocker therapy (propranolol)

- Idiopathic (non-H. pylori, non-NSAID) ulcers: long-term PPI is recommended

LOWER GASTROINTESTINAL (GI) BLEEDING

BRIEF DESCRIPTION

- Gastrointestinal (GI) Bleeding refers to any bleeding that occurs from the mouth to the anus. Anatomically GI bleeding is divided into upper and lower.
- The ligament of Treitz is used as the anatomic reference to differentiate lower and upper GI bleeding.
The incidence of lower GI bleeding is higher in older age groups, particularly in those taking anti-platelet agents like aspirin, non-steroidal anti-inflammatory drugs or anticoagulants.
- Lower GI bleeding can be overt or occult.
 - Overt lower GI bleeding presents with either frank red bleeding (hematochezia) or dark, tarry stool (melena).
 - Occult GI bleeding presents with evidence of iron deficiency anemia but no hematochezia or melena.
- Over GI bleeding is labeled to be massive when it is associated with hemodynamic instability.
- The major causes of lower GI bleeding are categorized as follows:
 - Vascular causes
 - Hemorrhoids
 - Ischemic bowel
 - Vascular dysplasia (angiodysplasia)
 - Post procedure (postpolypectomy)
 - **Neoplastic causes**
 - Colon cancer
 - Polyps
 - **Anatomic causes**
 - Diverticulosis

- **Inflammatory causes**
- Inflammatory bowel disease
- Infectious colitis

CLINICAL MANIFESTATIONS

- **Symptoms**

- **Hematochezia:** passage of bright red or dark red (maroon) blood or clots per rectum.
- Bleeding from the left colon tends to be bright red in color while bleeding from the right colon appears to be dark or maroon colored and may be mixed with stool.
- Bleeding from the right colon might rarely cause melena (the stool itself is dark)
- **Symptoms of anemia or hemodynamic compromise:** fatigue, postural dizziness, light headedness

- **Signs**

- **Signs of hemodynamic compromise:**
- Hypotension (supine or postural)
- Resting tachycardia.
- **Signs of anemia**
- Pallor
- Tachycardia
- Ejection systolic murmur

INVESTIGATIONS

- The following important investigation in patients with lower GI bleeding
 - CBC (complete blood count): in massive acute bleeding the hemoglobin may appear normal.
 - Serial hemoglobin; every 8 hours
 - Coagulation studies: INR (PT) and PTT
 - Liver enzymes
 - BUN and creatinine
 - **Colonoscopy:** when the clinical diagnosis is lower GI bleeding

- **Upper GI endoscopy:** when the clinical diagnosis is upper GI bleeding.

DIAGNOSIS

- The diagnosis of lower GI bleeding requires the following important steps:

I. Identifying whether the bleeding is upper or lower GI in origin.

- Massive upper GI bleeding can cause hematochezia; hence, differentiating Upper from lower GI bleeding is necessary.
- The presence of hemodynamic instability favors upper GI bleeding
- The presence of clots suggests lower GI bleeding
- When there is suspicion of upper GI source: insert NG tube and do gastric lavage with normal saline
 - Gastric lavage with coffee-ground material or bright red blood= upper GI bleeding
 - Gastric lavage is bilious = lower GI bleeding
 - If the gastric lavage is neither of the above = indeterminate (it can be either of the two)

Identifying possible causes or precipitants of the bleeding.

- The history should focus on the following
 - **Medications:** Antiplatelets (e.g., Aspirin or clopidogrel), non-steroidal anti-inflammatory drugs (e.g., Diclofenac, indomethacin, ibuprofen), anticoagulants
 - Prior history of bleeding
 - Significant abdominal pain: suggests inflammatory or ischemic bowel disease or perforation
 - Significant **weight loss:** suggests malignancy
- Digital rectal examination

3. Localization of the bleeding and definitive diagnosis

- All patients with a clinical diagnosis of lower GI bleeding require colonoscopic examination to identify the cause of bleeding, arrest the bleeding if identifiable.

TREATMENT

OBJECTIVES OF TREATMENT

- Restore hemodynamic status
- Correct precipitating factors

INITIAL TREATMENT AND REFERRAL

- The following are components of the initial treatment of patients suspected of acute lower GI bleeding:

Hemodynamic status evaluation and resuscitation

- In patients with hemodynamic compromise secure two wide bore IV cannulae and resuscitate with crystalloids.
- While crystalloids are being given, blood should be requested for transfusion.
- Do not depend on the initial hemoglobin or hematocrit to for transfusion, as it is apparently (“falsely”) normal.
- Discontinue antiplatelets, non-steroidal anti-inflammatory drugs or anticoagulants
- Correct coagulopathies
 - E.g., If INR is high or patients are on warfarin, give fresh frozen plasma and/or vitamin K

REFERRAL

Patients should be referred to a facility with gastroenterology specialty service for colonoscopy, after hemodynamic stabilization.

In patients who continue to bleed massively and who are unstable to be transferred to a center with colonoscopy facility, surgical consultation should be made.

CHAPTER 2:

PULMONARY INFECTIONS

I. COMMUNITY ACQUIRED PNEUMONIA (CAP)

BRIEF DESCRIPTION

- Pneumonia refers to acute inflammation of the distal lung-terminal airways, alveolar spaces, and interstitium.
- Pneumonia is a common
- The clinical presentation and the etiology vary greatly depending on the age of the patient, the infecting organism, the site/s the infection has involved, immune status of the patient and the place of acquisition of infection.
- **Etiology of CAP**
 - *Streptococcus pneumoniae* is the most common etiology.
Others: *Mycoplasma*, *Chlamydia*, *H. influenzae*, *M. catarrhalis*, *Legionella* (especially in elderly, smokers), *viral* (especially in young) , *Klebsiella* & other gram-negative bacteria (mainly in alcoholics & during aspiration),
S. aureus (especially post-viral infection)
 -

CLINICAL FEATURES

- Although signs, symptoms & imaging do *not* reliably distinguish between “typical” and “atypical” pneumonia, the following can give clues.
- “**Typical**” (*S. pneumonia, H. influenzae*)
 - Acute onset of fever, cough with purulent sputum, dyspnea
 - Consolidation on CXR.
- “**Atypical**” (*Mycoplasma, Chlamydia, Legionella, viral*)
 - More insidious onset of dry cough
 - Extrapulmonary symptoms may be present (nausea/vomiting, diarrhea, headache, myalgias, sore throat)
 - Patchy interstitial infiltrates on CXR
 - Elevated transaminases & low serum sodium with *Legionella*.

IDENTIFYING SITE OF CARE

- Although it can't completely replace clinical judgement, clinicians need to use prognostic criteria to decide at the setting of treatment pneumonia (inpatient versus outpatient).
- The CURB-65 is relatively easy to use criteria for this purpose.

Table 8.35: CURB-65 criteria for deciding the setting of treatment in CAP

C	Confusion * (1 point)
U	U rea >20 mg/dL (7 mmol/L)** (1 point)
R	R espiratory rate ≥30 breaths per minute (1 point)
B	B lood pressure (1 point) Low systolic (<90 mmHg) or diastolic (≤60 mmHg)
65	Age ≥65 years (1 point)

* Defined as an Abbreviated Mental Test Score ≤ 8 or new disorientation to person, place, or time.

**Urea is blood urea nitrogen [BUN], expressed in mg/dL or serum urea concentration, expressed in mmol/L

CURB-65 score	Site of management
0	Outpatient treatment, PO antibiotic
1-2 point	Inpatient management, with IV antibiotics, in a general ward. Those with a score of 1, due age ≥ 65 can be managed as an outpatient.
3 to 5 points	Inpatient management with IV antibiotics; evaluate for ICU admission.

- Indications for ICU admission: ICU admission is required if the patient has severe CAP only. See the table below for criteria defining severe CAP.

Table 8.36: Criteria for defining severe CAP

Major criteria: the presence of one of the following two major criteria

1. Septic shock requiring vasopressor
2. Respiratory failure requiring mechanical ventilation

Minor criteria: three or more of the following (nine) criteria found in a patient

1. Confusion/disorientation
2. Hypotension requiring aggressive fluid resuscitation
3. Respiratory rate ≥ 30 breaths/min
4. Multilobar infiltrates
5. Blood urea nitrogen level ≥ 20 mg/dl
6. White blood cell count $<4,000$ cells/ml
7. Platelet count $<100,000$ /ml
8. Hypothermia (core temperature, $<36^{\circ}\text{C}$)
9. $\text{PaO}_2/\text{Fi O}_2$ ratio ≤ 250

INVESTIGATIONS AND DIAGNOSIS

- **Chest X-ray (CXR):** it is the most important investigation in the diagnosis of pneumonia and all patients considered to have pneumonia should have CXR.
- **Sputum gram stain and culture:**
 - It is not routinely recommended for majority patients.
 - In patients with severe pneumonia requiring hospitalization, pretreatment sputum or endotracheal aspirate (if intubated) along with blood culture need to be sent.
 - Patients to be treated empirically for MRSA or P. aeruginosa need also pretreatment sputum gram stain and culture plus blood culture.
- PCR for specific viruses (e.g., SARS COV-2): in the right epidemiologic setting.
- Thoracentesis and pleural fluid analysis
 - Do thoracentesis and pleural fluid analysis, if the size of pleural effusion is >2.5 cm in lateral decubitus position or obvious large (more than ½ of hemithorax), loculated, or with presence of pleural thickening
 - Do pleural fluid: cell count with differential, gram stain and culture, chemistries (glucose, LDH, protein), if there is blood gas analyzer do PH,
- **Other laboratories**
 - CBC with diff
 - In patients with severe pneumonia: BUN/Cr, LFT, serum electrolytes, and blood glucose.

TREATMENT OBJECTIVES

- Achieve clinical cure
- Prevent complications and associated morbidity and mortality.

NON PHARMACOLOGIC

- Bed rest
- Frequent monitoring of all the vital signs in order to detect complications early and to monitor response to therapy, for all patients.
- Give attention to fluid and nutritional replacements as required.
- Administer Oxygen via nasal prongs or face mask (e.g., if saturation <94%)

EMPIRIC ANTIBIOTIC

- Evaluate the patient for the following two parameters before starting empiric antibiotic
 - Look for risk factors include of MRSA (Methicillin Resistant *Staphylococcus aureus*) or *P. aeruginosa*
 - Recent hospitalization
 - Receipt of parenteral antibiotics in the last 90 days
 - Prior isolation of the organisms from the respiratory samples
 - Comorbidities
 - Chronic heart, lung, liver, or renal diseases
 - Diabetes mellitus
 - Alcoholism
 - Malignancy
 - Asplenia
- The duration of antibiotic therapy is generally 5 to 7 days; however, it needs to be guided by clinical response as well. Improvement in vital sign abnormalities (HR, RR, BP, oxygen saturation, and temperature), ability to eat, and normal mentation are needed for hospitalized patients.
- The antibiotic should be continued until the patient achieves stability but for no less than a total of 5 days.

Table 8.37: Empiric antibiotic recommendations for outpatient management of CAP

CAP categories	Etiology	First line	Second line
CAP :outpatient No-comor- bidities AND No risk factors*	S.pneumoniae H.influenzae Atypicals	Amoxicillin X 5- 7 days	Doxycycline OR Clarithromycin/Azi- thromycin
CAP: out pa- tient With comorbidi- ties	Above + beta-lact- amase-pro- ducing organisms catarrhalis	<u>Combination</u> <u>therapy</u> Amoxicillin-clavula- nate AND Clarithromycin/ Azithromycin X 5-7 days	<u>Combination</u> <u>therapy</u> Cefuroxime or Cefpodoxime AND Clarithromycin/Azi- thromycin
CAP for hospitalized patients	Gram positive and negative and atypical microorgan- isms	Ceftriaxone OR cefotaxime IV + Clarithromycin or Azithromycin for 5 to 7 days	Amoxicillin-clavula- nate + azithromycin or Clarithromycin

*Risk factors = risk factors for MRSA or *P. aeruginosa* infections (see the text above)

Table 8.38. Empiric antibiotic recommendations for inpatient management of CAP

CAP category	First line	Second line	Recent Hospitalization and parenteral antibiotics use (in the last 90 days)
CAP: requiring admission to wards Does not have severity signs requiring ICU admission (see table 2 above)	<u>IV Third generation cephalosporin + Macrolide</u> Ceftriaxone OR Cefotaxime PLUS Azithromycin/Clarithromycin	Levofloxacin or Moxifloxacin alone	Take culture and Add coverage for P. aeruginosa*
CAP requiring ICU admission (Severe CAP)	<u>IV Third generation cephalosporin + Macrolide</u> Ceftriaxone OR Cefotaxime PLUS Azithromycin/Clarithromycin	<u>IV Third generation cephalosporin + Levofloxacin/ Moxifloxacin</u>	Take culture and Add coverage for MRSA and P. aeruginosa*

* Options for P.aeruginosa coverage: piperacillin-tazobactam , cefepime , ceftazidime , imipenem, Meropenem

* MRSA coverage:Vancomycin

Table 8.39: Adult dose recommendations for CAP

Antimicrobial agent	Adult dose	Comments
Amoxicillin (A)	1000mg PO TID	First line for outpatient with no comorbidities
Amoxicillin-clavulanate (A)	625mg PO TID or 875 mg/125 mg BID, or 2,000 mg/125 mg BID	First line for outpatient with comorbidities
Benzyl penicillin (A)	2-3 million IU I.V. QID	Can be used as an alternative to amoxicillin
Ampicillin-sulbactam	1.5 to 3 g IV QID	Alternative to cephalosporin's in hospitalized patient, also consider for aspiration pneumonia if anaerobic coverage needed
Cefuroxime (Wa)	500mg PO BID	Alternative to Amoxicillin-clavulanate
Cefpodoxime (Wa)	200mg PO BID	Alternative to Amoxicillin-clavulanate
Ceftriaxone (Wa)	1-2 g IV 12 hourly	First line in severe cases with macrolides
Cefotaxime (Wa)	2 g IV 6 hourly	First line in severe cases with macrolides
Clarithromycin (Wa)	500mg PO BID	WHO recommend it over Azithromycin due to safety concerns
Azitromycin (Wa)	500mg PO, first day then 250mg PO, for 4 days	Associated with cardiovascular issues
Doxycycline (A)	100mg PO, BID	Second line for mild to moderate cases

Levofloxacin (Wa)	500-750 mg PO/IV BID	More side effect (including masking TB), thus only used when no alternative, e.g in sever penicillin allergy
Moxifloxacin (Wa)	400 mg PO BID	See above comment for levofloxacin
Cloxacillin	500mg PO QID	Alternative add on for staph
Vancomycin (Wa)	Ig IV BID	Reserved only for MRSA suspicion and used only after culture sample taken
Ceftazidime (Wa)	2g IV q6-8h	Reserved only for pseudomonas suspicion and used only after culture sample taken
Cefepime (Wa)	2 g IV 8-12 hourly	See above comments for ceftazidime
Piperacillin + tazobactam (Wa)	2g IV Q8hr	See above comments for ceftazidime
<p><i>A = access group antibiotics</i></p> <p><i>Wa = watch group antibiotics</i></p> <p><i>Re= reserve group antibiotics</i></p>		

PREVENTION

- Smoking cessation should be encouraged during the initial visit
- Other infection prevention measures

SPECIAL POPULATION CONSIDERATIONS

- Pregnant:Floroquinolones and tetracyclines (if used) are not recommended in pregnancy.
- Elderly: elderly patients are more likely to have an altered/unusual clinical presentation and increased risk of severe disease. Frequent monitoring schedules are recommended for this group of population.

2. HOSPITAL-ACQUIRED AND VENTILATOR-ASSOCIATED PNEUMONIA

DEFINITIONS

- Hospital-acquired (or healthcare associated) pneumonia (HAP) is pneumonia that occurs 48 hours or more after admission and did not appear to be incubating at the time of admission.
- Ventilator-associated pneumonia (VAP) is a type of HAP that develops more than 48 hours after endotracheal intubation.
- Healthcare associated pneumonia (HCAP):is no more used currently.
- HCAP is now classified under CAP, with risk factors MDR pathogens, particularly MRSA and *P aeruginosa*.

INVESTIGATION AND DIAGNOSIS

- Clinical diagnosis: Clinical diagnosis of HAP and VAP requires the following three parameters to be present.
 - A new or progressive lung infiltrate on chest X-ray.
 - Clinical evidence to indicate the lung infiltrate is of infectious origin: one or more of the followings
 - A new onset of fever
 - Purulent sputum
 - Leukocytosis/leukopenia
 - Decline in oxygenation.

- Time of presentation: after 48 hours of admission for HAP and after 48 hours of intubation for VAP.
- Identification of pathogen: Cultures from lower respiratory samples should be taken before initiation of antibiotic.
- Risk factors for increased mortality in HAP
 - Septic shock
 - Requirement for mechanical ventilator support
- Risk factors for Multidrug resistant pathogens in HAP/VAP.
 - Risk factors for MDRVAP:
 - Prior intravenous antibiotic use within 90 days
 - Septic shock at time of VAP
 - ARDS preceding VAP
 - Five or more days of hospitalization prior to the occurrence of VAP
 - Acute dialysis needed prior to VAP onset
 - Risk factors for MDR HAP
 - Prior intravenous antibiotic use within 90 days

EMPIRIC TREATMENT FOR COMMONLY SUSPECTED ETIOLOGIES OF HAP/VAP

- The empiric antibiotic choice for HAP and VAP: needs to consider *Pseudomonas aeruginosa*, other gram-negative bacilli, and *Staphylococcus aureus*.
- Since delayed and inappropriate therapy is associated with high mortality, early and aggressive treatment with early and aggressive de-escalation is an important composite for HAP/VAP (particularly for VAP) management
- If possible, hospitals need to regularly generate and disseminate a local antibiogram, tailored to their HAP population.
- Duration of therapy: a seven days course is generally adequate for both HAP and VAP. A shorter or longer duration can be considered based on clinical response.

Table 8.40: Empiric antibiotics for HAP (not VAP)

Population	Antibiotic choices	Remarks
HAP with one of the following <ul style="list-style-type: none"> • Septic shock • Requiring mechanical ventilation • Received antibiotic in the last 90 days 	<p><u>A combination of three antibiotics: one from of the following lists</u></p> <ul style="list-style-type: none"> • One of the following <ul style="list-style-type: none"> ◦ Cefepime 2 g IV q8h ◦ Ceftazidime 2 g IV q8h ◦ Meropenem 1 g IV q8h ◦ Imipenem 500 mg IV q6hd ◦ Piperacillin-tazobactam 4.5 g IV q6h <p>PLUS</p> • One of the following <ul style="list-style-type: none"> ◦ Gentamicin 5–7 mg/kg IV q24h ◦ Ciprofloxacin 400 mg IV q8h <p>PLUS</p> • Vancomycin 15 mg/kg IV q8–12h (for severe cases, loading dose 25–30 mg/kg, maximum 3g) 	<ul style="list-style-type: none"> • Double antipseudomonal coverage + MRSA coverage • Antibiotics need to be deescalated based on culture and sensitivity results, if there is clinical improvement. • Doses need to be adjusted in patients with impaired renal function.

HAP with none of the following <ul style="list-style-type: none"> • Septic shock • Requiring mechanical ventilation • Received antibiotic in the last 90 day 	<p>A combination of two antibiotics</p> <ul style="list-style-type: none"> • One of the following <ul style="list-style-type: none"> ◦ Ceftazidime 2 g IV q8h ◦ Meropenem 1 g IV q8h ◦ Imipenem 500 mg IV q6hd ◦ Piperacillin-tazobactam 4.5 g IV q6h <p>PLUS</p> ◦ Vancomycin 15 mg/kg IV q8–12h (for severe cases, loading dose 25–30 mg/kg, maximum 3g) 	<p>If the proportion of the unit's <i>Staphylococcus aureus</i> isolates thus far has been known to be < 20%, the vancomycin can be omitted and one of the following can be used:</p> <ul style="list-style-type: none"> ◦ Piperacillin-tazobactam 4.5 g IV q6h ◦ Cefepime 2 g IV q8h
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Table 8.41: Empiric antibiotics for VAP

Population	Antibiotic choices	Remarks
<p>VAP with one of the following risk factors</p> <ul style="list-style-type: none"> • IV antibiotic use within the previous 90 days • Septic shock at the time of VAP • ARDS preceding VAP • ≥5 days hospitalization prior to the occurrence of VAP • Dialysis prior to VAP onset 	<p>A combination of three antibiotics: one from of the following lists</p> <ul style="list-style-type: none"> • One of the following <ul style="list-style-type: none"> ○ Cefepime 2 g IV q8h ○ Ceftazidime 2 g IV q8h ○ Meropenem 1 g IV q8h ○ Imipenem 500 mg IV q6hd ○ Piperacillin-tazobactam 4.5 g IV q6h PLUS • One of the following <ul style="list-style-type: none"> ○ Gentamicin 5–7 mg/kg IV q24h ○ Ciprofloxacin 400 mg IV q8h PLUS <p>Vancomycin 15 mg/kg IV q8–12h (for severe cases, loading dose 25–30 mg/kg, maximum 3g)</p>	<ul style="list-style-type: none"> ➤ Double antipseudomonal coverage + MRSA coverage • Antibiotics need to be deescalated based on culture and sensitivity results, if there is clinical improvement.. • Doses need to be adjusted in patients with

VAP with none of the above risk factors	<u>A combination of two antibiotics</u> <ul style="list-style-type: none"> • One of the following <ul style="list-style-type: none"> ○ Ceftazidime 2 g IV q8h ○ Meropenem 1 g IV q8h ○ Imipenem 500 mg IV q6hd ○ Piperacillin-tazobactam 4.5 g IV q6h <p>PLUS</p> <p>Vancomycin 15 mg/kg IV q8–12h (for severe cases, loading dose 25–30 mg/kg, maximum 3g)</p>	If the proportion of the unit's <i>Staphylococcus aureus</i> isolates is < 10%, the vancomycin can be omitted and one of the following can be used: <ul style="list-style-type: none"> ○ Piperacillin tazobactam 4.5 g IV q6h ○ Cefepime 2 g IV q8h
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CHAPTER 3

I. INTESTINAL HELMINTHIC INFESTATIONS

BRIEF DESCRIPTION

- These are infestation caused by intestinal worms (nematodes and cestodes), which are commonly associated with poor personal and environmental hygiene.
- Although they may not be fatal, they contribute to malnutrition and diminished work capacity.

CLINICAL FEATURES

- Include abdominal cramps, nausea, bloating, anorexia
- Anemia
- Perianal itching
- Passage of adult worms

INVESTIGATIONS

- Mainly by direct stool microscopy:A single stool microscopy may not be diagnostic.A repeated stool microscopy may be needed.

TREATMENT

OBJECTIVES

- Reduce symptoms
- Break the cycle of transmission

Pharmacologic (See table below)

Table 8.55: Treatment of common intestinal helminthic parasitic infestations

Name of infestation Etiology	Treatment	Remark
Mode of transmission		
Ascariasis <i>Ascaris lambri-</i> <i>coids</i> Ingestion of the larvae of the parasite together with food	First line-options Albendazole , 400mg P.O. as a single dose, for children: 1 – 2 years, 200mg as a single dose. Mebendazole , 100mg P.O.BID for 3 days or 500mg, once Alternative (pregnant women) Pyrantel pamoate , 700mg P.O. as a single dose	Presence of migrating larvae in the lungs can provoke pneumonia

Enterobiasis <i>Enterobius vermicularis</i> Ingestion of the eggs of the parasite together with food	First line-options Mebendazole , 100mg P.O. BID for 3 days, repeat in two weeks OR Albendazole , 400mg P.O. as a single dose, repeat in two weeks, Alternative Piperazine , 4g in a single dose. <ul style="list-style-type: none"> • Simultaneous treatment of the entire household is warranted due to high transmission possibilities 	Common in children and auto infection may occur
Hookworm infestation <i>Necator americanus</i> or <i>Ancylostoma duodenale</i> Penetration of the larvae of the parasite through skin	First line-options Albendazole , 400mg P.O. as a single dose (preferred) OR Mebendazole , 100mg P.O. BID for 3 days or 500mg stat Alternatives: Pyrantel pamoate , 700mg P.O. as a single dose	

Strongyloidiasis <i>Strongloides stercoralis</i>	<p>First line</p> <p>Ivermectin, 200mcg/kg daily for 2 days. For disseminated strongyloidiasis, treatment with ivermectin should be extended for at least 5–7 days or until the parasites are eradicated.</p> <p>Alternatives-options</p> <p>Albendazole 400mg P.O.BID for three consecutive days (less effective than ivermectin). OR</p> <p>Thiabendazole, 1500mg, P.O. BID, for children: 25mg/kg p.o. for three consecutive days (comparable efficacy to ivermectin).</p>	<p>Larvae migrate to the lungs where they cause tissue destruction and bleeding.</p> <p>Treat concomitant anemia if any</p>
Trichuriasis <i>T.tricura</i>	<p>First line-options</p> <p>Mebendazole, 500mg P.O., single dose (preferred over Albendazole) OR</p> <p>Albendazole, 400mg, P.O. for three days</p> <p>oxantel pamoate 15 to 30 mg/kg (if available) plus albendazole 400 mg on consecutive days is superior than other therapies</p>	<p>Heavy infestation leads to bloody diarrhea, bleeding & weakness</p>

<p>Taeniasis</p> <p><i>T.saginata</i></p> <p><i>T.solium</i></p>	<p>First line-Intestinal infestation</p> <p>Praziquantel P.O. 600mg or 10mg/Kg, single dose</p> <p>Alternative</p> <p>Niclosamide, 2g in a single dose P.O.</p> <p>Treatment of neurocysticercosis</p> <p>Albendazole P.O. 15mg/kg per day for 8- 28 days</p> <p>or</p> <p>Praziquantel 50–100mg/kg daily in three divided doses for 15–30 days.</p> <p>Longer courses are often needed in patients with multiple subarachnoid cysticerci</p> <p>PLUS</p> <ul style="list-style-type: none"> -High-dose glucocorticoids -Anti epileptics (if there is seizure) 	<p><i>T. solium</i> (pork tapeworm) may cause fatal cysticercosis</p>
<p><i>Hym enolepis nana</i></p>	<p>First line</p> <p>Praziquantel, 25mg/kg or 1800mg P.O. single dose, followed by repeat dose 10 days later</p> <p>Alternatives</p>	
	<p>Niclosamide, 2g P.O. on the first day followed by 1g QD for 6 days</p>	

CHAPTER 4

DIABETES MELLITUS

BRIEF DESCRIPTION

- Diabetes mellitus describes a group of disorders which are characterized by persistently high blood glucose levels.
- Diabetes is the leading cause of cardiovascular disease, chronic kidney disease, visual loss and non-traumatic amputations worldwide.
- The classification of diabetes includes four clinical classes
 - **Type I diabetes**- results from cell destruction (immune mediated or idiopathic), leading to absolute insulin deficiency.
 - **Type 2 diabetes**-results from a progressive insulin secretory defect on the background of insulin resistance.
 - **Gestational diabetes mellitus (GDM)**-diabetes diagnosed during pregnancy in previously non-diabetic woman
 - Other specific types of diabetes e.g., genetic defects in cell function genetic defects in insulin action, diseases of the exocrine pancreas, and medicine induced

Table 5.1: Current diagnostic criteria for diabetes mellitus

Diagnostic test	Pre-diabetes	Diabetes	Remarks
Fasting blood glucose	100-125mg/dl	≥ 126 mg/dl	At least 2 tests needed*
Hemoglobin A1C [#]	5.7-6.4%	$\geq 6.5\%$	At least 2 tests needed*

02-hour plasma glucose	140-199mg/dl	$\geq 200\text{mg/dl}$	At least 2 tests needed
Random blood glucose		$\geq 200\text{mg/dl}$	Only classic symptoms of hyperglycemia or hyperglycemic crisis
<p>*If both fasting blood sugar and hemoglobin A1C are done initially and both are in the diabetic range, repeat test is not necessary for the diagnosis.</p> <p># If there is significant discrepancy between HbA1C and blood glucose measurements, use the blood glucose level.</p>			

- The clinical course and treatment of the different types of diabetes are different; hence, classification of the type of diabetes is very important to determine therapy.
- The traditional thinking that type 2 diabetes as the disease of adults and type I diabetes as the disease of children is not accurate as both diseases can occur in both age groups.

CLINICAL FEATURES

- **Symptoms**
 - Asymptomatic: there are no recognizable symptoms in the majority of patients individuals with type 2 diabetes.
 - Type I diabetic patients tend to be much more symptomatic than type 2 diabetic patients (weight loss, polyuria, polydipsia).
 - Fatigue, unexplained weight loss
 - Large amounts of urine (polyuria) and excessive thirst (polydipsia)
 - Unexplained weight loss
 - Blurred vision
 - Recurrent skin infections
 - Recurrent itching of the vulva (candida infections)
 - Symptoms related to chronic complications can be present at initial

diagnosis in type 2 diabetic patients;

- Numbness or pain over the lower limbs
- Visual impairment
- Foot abnormalities (ulcer, ischemia, deformity)
- Body swelling

INVESTIGATIONS

- In newly diagnosed patients
 - Diagnostic tests: Fasting or random blood glucose, glycated hemoglobin (HbA1c)
 - Urine ketones
 - Urine albumin
 - Blood urea and creatinine
 - Fasting lipid profile
 - ECG (adults)
- In diagnosed patients, follow up investigations
 - Glycemic control: HbA1c, fasting plasma glucose, post prandial plasma glucose
 - Screening for complications: Urine albumin/protein, retinal screening by ophthalmologist, serum creatinine and urea.
 - Other cardiovascular risk screening: Lipid profile (if not already on statin).

DIAGNOSIS

- The diagnosis diabetes is made based on the diagnostic criteria depicted above.
- Individuals with any one of the following need screening for type 2 diabetes. If the result is normal, repeat screening every three years; but if the result

is in the prediabetes range repeat the test every year.

- Age 45 or above
- Overweight or obese individuals ($BMI > 25\text{kg}/\text{m}^2$)
- Physical inactivity
- Hypertension
- HDL $< 35\text{mg/dl}$ and/or triglyceride level $> 250\text{mg/dl}$
- Women with history of gestational diabetes mellitus
- Individuals with prediabetes should be tested yearly
- First-degree relative with diabetes
- History of atherosclerotic cardiovascular disease
- Women with polycystic ovary syndrome.

TREATMENT

OBJECTIVES OF TREATMENT

- Relieve symptoms
- Prevent acute hyperglycemic complications
- Prevent/delay chronic complications of diabetes
- Prevent treatment-related hypoglycemia
- Achieve and maintain appropriate glycemic targets
- Ensure weight reduction in overweight and obese individuals

2. TREATMENT OF TYPE-2 DIABETES MELLITUS

NON-PHARMACOLOGIC TREATMENT

A. MEDICAL NUTRITION THERAPY (MNT): GENERAL

GUIDANCE

- **Principles of nutritional therapy**
 - Focus on supporting the patient on choosing healthy eating behaviors.
 - Consider the literacy of the individual, access to food, and willingness.
 - Try to maintain the pleasure of eating as much as possible
 - Respect and address the individual preferences, cultural, and religious choices.
 - Be nonjudgmental
 - Be practical
 - Limit food choices when only supported by scientific evidences
 - Help overweight and obese individuals to decrease body weight
 - Help attain individualized glycemic, blood pressure, and lipid goals.
- **General advice**
 - Avoid refined sugars: soft drinks with sugar, or adding sugar/honey to teas/other drinks.
 - **Carbohydrate**
 - Reduce overall carbohydrate intake
 - Carbohydrate sources high in fiber and minimally processed are preferred: whole grains, non-starchy vegetables, fruits, and dairy products
 - Be encouraged to have complex carbohydrates
 - **Fat**
 - Reduce saturated fat (animal fat) intake: butter, ghee, fatty

cuts of meat, cheese.

- Reduce Trans-fat (hydrogenated oil): solidified vegetable oils

- Mono-saturated and polyunsaturated vegetable oils are preferred

- **Protein**

- Should be left to the individual choice.
- When there is chronic kidney disease, reduction (not stopping) protein intake.

- **Sweetened beverages**

- Individuals who have had the habit sugar added beverages, taking low-calorie or nonnutritive- beverages can serve as short- term transition. However, they should be encouraged to replace with water intake.

B.EXERCISE

- Regular moderate-intensity aerobic physical activity: for at least 30 minutes at least 5 days a week (at least 150 min/week)
- Encourage resistance training three times per week.

C.WEIGHT MANAGEMENT

- For obese and overweight individuals
 - Eating plans (focusing on reduction of overall carbohydrate intake) and exercise

D. Stop smoking

E. Moderation of alcohol intake

- A maximum one drink for women and two drinks for men.
 - - One drink is roughly equivalent to a bottle of beer, a glass of wine, or a unit of spirit.

F. Self-blood glucose monitoring (SBGM)

G. Screening for micro and macro vascular complications

PHARMACOLOGIC TREATMENT

- **Management of blood sugar**

- A. Target blood glucose**

- Target should be individualized.
 - In young patients with recent diagnosis, without significant chronic complications, tight glycemic control should be encouraged.
 - Individuals for whom less stringent ($\text{HbA1C} < 8$ to 8.5%) should be considered
 - History of severe hypoglycemia
 - The elderly and those limited life expectancy
 - Established cardiovascular disease
 - Advanced microvascular disease e.g., advanced chronic kidney disease
 - Significant comorbid conditions e.g., liver disease, malignancy
 - Long duration of diabetes

- B. Target in most non-pregnant adults without significant comorbidities:** depicted in the table below.

Table 5.2: Glycemic targets for non-pregnant adults without significant

comorbidities

Table. Glycemic targets for non-pregnant adults without significant comorbidities

	TARGET	Remark
Fasting capillary glucose	100 -130mg/dl	In young, highly motivated, well supported patients a hemoglobin A1C target <6.5% and fasting blood glucose of 80-130mg/dl can be aimed, if it can be achieved without causing recurrent hypoglycemia.
HbA1C	<7.5%	
Post meal capillary glucose (1-2hr from the beginning of meal)	<180mg/dl	

C. Blood glucose lowering medicines

- **First line: Metformin**

- Initial dose 500mg to 1000mg/day daily or in two divided doses with meals.
- Titrate dose **every two weeks** depending on the fasting blood sugar
- Maximum dose = **2000mg/day (1000mg BID)**
 - The major side effects of metformin are gastrointestinal intolerance: bloating, abdominal discomfort, and diarrhea. This can be reduced by gradually increasing the dose.
 - Metformin is contraindicated in patients with advanced chronic kidney disease (eGFR <30ml/min), advanced liver disease, and hypoxia.

- **Alternative to Metformin**

1. **Add on to Metformin:** If glycemic target is not achieved by metformin alone after **three months**, add either of the following.
 - **Sulfonylureas:** if Metformin is contraindicated a sulfonylurea can be started

- Glibenclamide, Glimepiride, Gliclazide

OR

- Basal insulin
 - Basal insulin can also be started as an alternative (see for indications for starting insulin in type 2 diabetes)

2. Initiating two oral agents at diagnosis

Patients with severe hyperglycemia at presentation (Fasting blood sugar > 250mg/dl or HbA1C>10%) and prefer oral agents than insulin, need to be started on a combination of metformin and sulfonylurea.

- Glibenclamide (Glyburide)
 - Starting dose is 2.5-5mg/day, 30 minutes before breakfast.
 - Titrate dose slowly to maximum of 20mg/day
 - When 10mg/day is needed, divide the total dose into two, with the larger dose in the morning.
 - Avoid in the elderly and patients with renal impairment.
- Glimepiride
 - Starting dose is 1-2 mg/day, 30 minutes before breakfast.
 - Titrate dose slowly to maximum of 8mg/day
- Gliclazide, modified release
 - Starting dose 30mg/day
 - Titrate the dose slowly to a maximum dose 120mg/day
- **The major side of sulfonylureas is hypoglycemia.**
 - Individuals should be educated about the risk, manifestations, prevention and treatment of hypoglycemia.
 - Sulfonylureas should be avoided or given at lower doses in individuals at high risk of hypoglycemia (e.g., the elderly, with significant comorbidities, history of hypoglycemia)

3. Insulin therapy in type 2 diabetes

Indications for insulin therapy

- Failure to control blood glucose with oral medicines
- Temporary use for major stress, e.g., surgery, medical illness
- Severe kidney or liver failure
- Pregnancy
- In patients difficult to distinguish type 1 from type 2 diabetes
- Ketonuria
- Unexplained weight loss accompanied by poorly controlled blood sugar
- Initial therapy for a patient presenting with very high blood sugar
 - HbA1C >10% or fasting blood glucose >250 mg/dl or random glucose consistently >300 mg/d
- Dosing basal insulin in type 2 diabetes
 - If started on as an add on therapy to Metformin
 - ✓ Starting dose = NPH 10 units at bed time
 - ✓ A higher dose might be started for higher blood glucose
 - ✓ Dose increment 2-4 units in 3-7 days with self-monitoring of blood sugar
 - If started as a replacement for oral agents
 - ✓ Starting dose = NPH 15 -20 units at bed time
 - ✓ A higher dose might be started for higher blood glucose
 - ✓ For doses above 20units divided in two (about 2/3 in the morning and 1/3 in the evening)
 - ✓ Dose increment 2- 4 units in 3-7 days with self-monitoring
- Addition of prandial regular insulin

- Indications to start regular insulin before meal
 - ✓ If FBS is well controlled but HbA1c is above target
 - ✓ If HbA1c is above target despite increasing basal insulin to >0.5 unit/Kg/day
- Dosing prandial regular insulin
 - ✓ Starting dose of prandial insulin: Regular insulin 4units
 - ✓ Preferred time: before the largest meal of the day
 - ✓ Dose increment 1-2 units in 2-3 days with self-monitoring of the next pre-meal blood glucose

D. Other oral diabetic medications for the care of patients with type 2 diabetes mellitus.

- The above recommendations on the choice of pharmacotherapy for type 2 diabetes indicate sulfonylureas or basal insulin to be the preferred add-on therapies next to metformin. This is mainly based on cost related factors.
- There are other medications which have been extensively studied and demonstrated to have benefits for different groups of patients with type 2 diabetes.
- For patients who can afford to buy or get access to these medications, decision on which agent to add to Metformin, combine with Metformin from the beginning or sometimes start an initial treatment should be individualized based on the following factors.
 - The need for weight loss
 - Risk of hypoglycemia in the patient
 - the presence of cardiovascular disease
 - The presence of chronic kidney disease.
- The following table shows the list of the available medications at the time of publication, their mechanism of action and the preference (see the table below)

Table 5.3:Available medications and their mechanism of action and the preference

Class of medication	Available drugs and formulations in Ethiopia	Mechanism of glucose lowering	Clinical states in which the drug is most beneficial	Common side effects
SGLT2 inhibitors (Sodium glucose transporter -2 inhibitors)	Dapagliflozin 10mg or 5mg tablet Dosage: 5 or 10mg, po, once daily	Increased urinary glucose excretion by the kidneys	<ul style="list-style-type: none"> • Heart failure • Early stages of CKD • Compelling need to decrease the risk hypoglycemia • Compelling need to decrease weight loss or reduce weight • Need to improve glycemic control <p>Additional benefit of BP lowering</p>	<ul style="list-style-type: none"> • Increased urination • Vulvovaginal fungal infections and UTI • Might increase the risk of DKA <p>Avoid in advanced CKD</p>

DPP4-in-hibitors (Dipeptidyl peptidase -4 inhibitors)	Saxagliptin 2.5 or 5mg (also, as fixed drug combination with Metformin 500mg or 1000mg) Dosage: 2.5 -5mg, po, once daily	<ul style="list-style-type: none"> Inhibition of DPP-4 enzyme, increase the level of incretins. Increases glucose-dependent insulin secretion. Reduce glucose release from liver after meals 	<ul style="list-style-type: none"> Compelling need to decrease the risk hypoglycemia Need for intensification of glycemic control Weight neutral (no increment or significant decrement) 	<ul style="list-style-type: none"> Upper respiratory tract infections Headache <p>Dose reduction need in patients with CKD.</p>
	Vildagliptin 50mg (also, as fixed drug combination with Metformin 500mg or 1000mg) Dosage: 50mg, po, once daily or BID			

E. Management of other cardiovascular (CV)risks

- **Cardiovascular risk calculation**
 - All patients 10-year cardiovascular risk factor needs to be calculated (see section on ischemic heart disease)
- **Blood pressure management** (See section on hypertension)
 - Target blood pressure:<130/80mmHg

- First line if there is proteinuria: ACE inhibitors or ARBs
 - First line if no proteinuria: Calcium channel blocker, thiazide diuretics or ACE inhibitors or ARBs.
 - Preferred two drug combinations for patients with proteinuria
 - ✓ ACE inhibitors/ARB + Calcium channel blockers
 - ✓ ACE inhibitors/ARB + Thiazide diuretics
 - Preferred combination for patients with no proteinuria
 - ✓ Calcium channel blockers + ACE inhibitors/ARB
 - ✓ Calcium channel blockers + Thiazide diuretics
 - Preferred three drug combinations
 - ✓ ACE inhibitors/ARB + calcium channel blockers + Thiazide diuretic
- **Lipid lowering therapy**
 - **Indications**
 1. Age above 40 without additional CV risk
 - Start moderate intensity statin
 - Make it high intensity if there is additional CV risk
 2. All ages with a history of cardiovascular risk
 - Start high intensity statin
 3. Age 20-39 years with one or more CV risk factor
- **Antiplatelet therapy**
 - **Aspirin (81-162mg/day)**
 - It is only indicated for patients who have CV disease (coronary artery disease, ischemic stroke or peripheral arterial disease)

3. TREATMENT OF TYPE I DIABETES MELLITUS

NON PHARMACOLOGIC TREATMENT

- See in the management type 2 Diabetes

PHARMACOLOGIC

- Insulin is the main stay of treatment in type I diabetes

- Insulin regimen in type I Diabetes Mellitus:

- **Conventional insulin therapy**

- It encompasses simpler non-physiologic insulin regimens.
 - These include single daily injections, or two injections per day (including a combination short-acting and -NPH insulin)

- **Intensive insulin therapy**

- It describes treatment with >3 injections/day or continuous insulin infusion
 - It requires frequent monitoring of blood sugar: fasting, before lunch, before dinner & before bed.
 - It also requires the following
 - ✓ Counting and recording carbohydrates.
 - ✓ Adjusting insulin doses in response to given glucose patterns.
 - ✓ Coordinating diet, exercise, and insulin therapy.
 - ✓ Responding appropriately to hypoglycemia

- **Designing insulin therapy**

- Total insulin dose per day Initiation, 0.2 to 0.4 units/kg/day
 - Maintenance – highly variable roughly 0.6 to 0.7 units/kg/day

- Regimen options-with NPH and regular insulin

A. Preferred regimen: NPH with premeal regular insulin

- NPH before breakfast and at bed time

PLUS

- Regular Insulin three times daily injection: before breakfast, lunch, and dinner

A. Other options: If the patient work, routines, social circumstances, and support do not allow the patient to do the preferred regimen

- NPH with pre-breakfast and pre-dinner regular insulin
- Mixed NPH and regular insulin -70/30 (70% NPH & 30% regular)
- Twice daily NPH injections only: Before breakfast and before bedtime

4. DIABETIC KETOACIDOSIS (DKA) AND HYPERGLYCEMIC HYPEROSMOLAR STATE(HHS)

BRIEF DESCRIPTION

- Diabetic ketoacidosis (DKA) is a condition in which there is a severe deficiency of insulin resulting in very high blood glucose.
- Fat is broken down as an alternative source of energy with ketones/ketoacids as a by-product.
- This state of severe hyperglycemia and ketone body production results in severe metabolic, fluid and electrolyte abnormalities.
- DKA often occurs in type I diabetes patients but may also occur in type 2 diabetes.
- The most common settings in which DKA occurs include:
 - Previously undiagnosed and untreated diabetes

- Interruption therapy
- Stress of inter-current illness (e.g., infection, myocardial infarction, stroke, surgery, complicated pregnancy etc.)
- Hyperglycemic hyperosmolar state (HHS) is a hyperglycemic emergency that occurs in type 2 DM due to relative insulin deficiency and inadequate fluid intake.
- Apart from acidosis the manifestations, risk factors and management of HHS is similar to DKA

CLINICAL FEATURES

- **Symptoms**
 - Excessive urination
 - Excessive thirst and drinking of water
 - Nausea, vomiting
 - Abdominal pain
 - Symptoms of infection or other precipitants
- **Signs**
 - Deep and fast breathing
 - Low blood pressure
 - Fast and weak pulse
 - Alteration in sensorium or collapse
 - Dehydration with dry skin, reduced skin turgor or sunken eyes
 - Fruity' breath (smell of acetone) in DKA
 - Evidence of infection, recent surgery, stroke etc.

INVESTIGATIONS AND DIAGNOSIS

- **Investigations**

- Random blood glucose: usually >300mg/dl)
 - Urine glucose (usually >3+)
 - Urine ketones (usually >2+)
 - BUN and Creatinine
 - Serum electrolytes, particularly serum potassium
 - Investigations for precipitants: CBC, blood film for malaria parasites and others based on the suspected precipitating factors
- **Diagnosis**
 - Diagnosis of DKA or HHS is made with the presence of severe hyperglycemia, clinical features and ketone in the urine (in case of DKA)
 - Sometimes DKA can occur in relatively lower blood sugar (euglycemic DKA)

TREATMENT

OBJECTIVES OF TREATMENT

- Replace fluid losses
- Replace electrolyte losses and restore acid-base balance
- Replace deficient insulin
- Seek the precipitating cause and treat appropriately

NON-PHARMACOLOGIC

- Admit to intensive care unit (or a ward patient can be very closely observed)
- Closely monitor fluid input and urine output

PHARMACOLOGIC

- Replace **fluids**: Individualize fluid needs based on the patient hydration status; the following is a guide to severely dehydrated patients.
 - **Initial fluid**

- 1000ml NS the first hour.
 - Reassess for hydration status: if still severely dehydrated, give another 1000ml NS over the next 01 hour.
- **Subsequent fluid**
 - Depends on the hydration status and urine output of the patient.
 - On average give about 250 mL/hour (1000ml over 04 hour) in the first 24 hours or until patient is able to take enough oral fluids.
 - Reassess the patient hydration status to decide subsequent IV fluid needs.
- **Changing fluid**
 - Change the NS to 5% DW9D when plasma glucose reaches 250 mg/dl in DKA and 300mg/dl in HHS.
- HHS requires more fluid.
- Assess hydration status, BP and urine output frequently.
- In patients with impaired kidney function and cardiac disease more frequent monitoring must be performed to avoid iatrogenic fluid overload.
- Administer **short-acting insulin**
 - **Regular Insulin**
 - 10units IV- and 10-units IM, stat,
 - If there is perfuser: 0.1units/kg per hour by continuous IV infusion.
 - If there is no perfuser: 5 units, I.M, every hour.
- **Goal**

- Reduce serum glucose by 50 to 70 mg/dl in the 2-3 hours
 - If the drop is <50mg/dl in 2-3 hours, double the regular insulin.
 - If the drop is faster, reduce the dose by half for continuous infusion and give the IM insulin every 2 hour.
- **Potassium**
 - All patients with DKA have potassium depletion irrespective of the serum K+ level.
 - If the initial serum K+ is <3.3 mmol/l, do not administer insulin until the K is corrected.
 - If the initial serum K + is >5.3 mmol/l, do not supplement K until the level reaches < 5.3.
 - If K+ determination is not possible delay initiation of K replacement until there is a reasonable urine output (>50 ml/hr)
 - Add intravenous KCl in the IV fluids
 - Add 40–60 mmol/l of IV fluid when serum K+ < 3.7 mmol/l
 - Add 20-40 mmol/l of IV fluid when serum K+ < 3.8-5.2 mmol/l
 - The serum potassium should be maintained between 4.0 and 5.0 mmol/l
- **Precipitant identification and treatment**
 - Noncompliance, infection, trauma, infarction. Initiate appropriate workup for precipitating event (cultures, CXR, ECG)
- **Follow up of response**
 - Blood glucose every 1–2hrs
 - Urine ketones every 4hr
 - Electrolytes (especially K+) every 6 h for first 24 h.
- **Continuation of treatment**

- The above treatment should continue until the patient is stable, clinically acidosis improves, and patient is able to take oral feeding.
 - The urine ketone might still be positive, as it usually lags behind the improvement of acidosis.
- **Transition**
 - Once the patient is able to take oral feeding and clinically the acidosis improved.
 - **Reduce regular insulin:** 2-3 units hourly (5 units every 2 hour) or for continuous infusion by 0.05/kg per hour
 - **Overlap** regular insulin with subcutaneous NPH insulin for 2-3 hours
 - **NPH insulin dosing**
 - ✓ If previously on insulin: start the pre DKA or pre-HHS dose
 - ✓ If Insulin naïve: 80% of the 24-hour requirement or 0.5 to 0.8kg/day (divided in to basal and bolus)

5. HYPOGLYCEMIA IN DIABETES

BRIEF DESCRIPTION

- Hypoglycemia is a blood sugar level low enough to cause symptoms and signs.
- It is a common complication of glucose lowering therapy in diabetes.
- Sulfonylureas and insulin are the most common causes of hypoglycemia.
- The elderly, patients with impaired kidney function and multiple comorbidities are at higher risk of hypoglycemia.
- A value <70mg/dl is agreed as alert level to define hypoglycemia in diabetes.

- It should be remembered some patients might be symptomatic at levels $>70\text{mg/dl}$ and some might not develop symptoms at level $<70\text{mg/dl}$.
- Pseudo hypoglycemia is an event during which the person with diabetes reports typical symptoms of hypoglycemia but with a measured blood glucose concentration $>70\text{ mg/dl}$. These patients commonly have chronically high blood sugar and they experience symptoms of hypoglycemia at plasma glucose levels $>70\text{ mg/dl}$ as glucose levels starts to improve.
- Whipple's **triad** is a combination of three essential elements useful for the diagnosis of hypoglycemia in general.
 - Symptoms and signs of hypoglycemia
 - Documented low blood glucose level
 - Relief of symptoms up on correction of the low blood glucose.
- Hypoglycemia unawareness** is a situation where symptoms of hypoglycemia are not felt by the patient in spite of having low blood glucose levels. It is a common and challenging problem in patients with long standing diabetes.

CLINICAL FEATURES

- The symptoms of hypoglycemia are classified into adrenergic and neuroglycopenic

Adrenergic(autonomic)	Neuroglycopenic (brain glucose deprivation)
<ul style="list-style-type: none"> Palpitation Tremor Anxiety Hunger Sweating Tingling 	<ul style="list-style-type: none"> Difficulty concentrating Difficulty in speaking Blurred vision Incoordination Confusion Loss of consciousness Seizure

- Asymptomatic: diabetic patients with hypoglycemia can be asymptomatic; this hypoglycemia unawareness results from autonomic dysfunction.

INVESTIGATIONS

- Glycemia related: FBS, postprandial blood sugar and HbA1c
- Creatinine and urea

DIAGNOSIS

- The diagnosis of hypoglycemia in diabetes is made with either of the following
 - A documented blood glucose level <70mg/dl
- OR
- Presence of symptoms which improve with treatment
- Classification of diabetes associated hypoglycemia based on severity

Level 1	Blood glucose 54-70 mg/dl
Level 2	Blood glucose <54 mg/dl
Level 3	A severe event characterized by altered mental and/or physical status requiring assistance for treatment of hypoglycemia

TREATMENT

OBJECTIVES OF TREATMENT

- Reverse hypoglycemic symptoms
- Prevent brain damage
- Prevent recurrence

NON-PHARMACOLOGIC

- The main stay of management of level 1-2 (mild to moderate) and level-3 (severe) hypoglycemia with preserved consciousness taking or providing glucose rich food/drinks(sweets).

- Pure glucose is preferred but any carbohydrate rich food can be used
 - Give 04 tea spoon of sugar diluted in water
 - Monitor blood sugar every 20-30 minutes
 - If no improvement, repeat the above
 - Once blood sugar improves, the patient must take a meal or snack
- Alternatives: regular soft drinks
 - 200ml of Mirinda® or Cola® contains about 20gram sugar can replace the above.
- Avoid protein rich foods as they increase insulin response
- For hypoglycemia unawareness: a 2-3 weeks period of avoiding hypoglycemia through frequent self-monitoring of blood glucose and keeping the blood glucose at higher levels may restore awareness.

PHARMACOLOGIC

- In patients who present to health facilities with decreased level of consciousness from severe hypoglycemia
 - 40% Dextrose (20ml vial)
 - Give 03 vials IV, fast
 - Monitor blood sugar every 20-30 minutes
 - If blood sugar is <70mg/dl, give another 03 vials of 40% dextrose and start 5-10% dextrose infusion. Continue to monitor blood sugar every 20-30 minutes.
 - When the patient can take orally give regular meal or snack..

PREVENTION OF HYPOGLYCEMIA IN DIABETICS

- Self-monitoring of blood sugar
- Patient, family/care giver education

- A standardized education on rigorous avoidance of hypoglycemia
- On conditions which increase the risk of hypoglycemia
 - Fasting or delayed meals
 - Consumption of alcohol
 - Intense exercise
- Symptoms of hypoglycemia and possibility of hypoglycemia unawareness
- Treatment of hypoglycemia at earliest warning symptoms or at <70mg/dl
- Adjusting glycemic targets to higher levels, if hypoglycemia is recurrent
- Reporting episodes of hypoglycemia to physician

6. CHRONIC COMPLICATIONS OF DIABETES

Brief description

- The complications of diabetes are classified in two major groups
 1. Microvascular: Diabetic kidney disease, retinopathy and nephropathy
 2. Macrovascular: coronary artery disease, stroke and peripheral vascular disease
- Diabetic foot disease is also a major complication which results from multifactorial causes
- Prevention, detection, delaying progression and supportive management of these complications is an important part of care of patients with diabetes
- Prevention of these complications can be achieved through optimal glycemic control, optimal blood pressure management, lipid control, quitting smoking and maintaining a healthy life style.

- Screening, follow up, prevention and treatment of the microvascular complications is summarized in the table below

Table 5.4: screening and management of chronic complication of diabetes

Complications	Initial screening	Follow up screening	Prevention& Treatment
Nephropathy	<ul style="list-style-type: none"> T1DM-after 5 years T2DM - at diagnosis Screening tool: <ul style="list-style-type: none"> - Albuminuria - Creatinine, eGFR 	<ul style="list-style-type: none"> No nephropathy -annually Nephropathy- 2x/ yr Refer if eGFR <30ml/ min 	<ul style="list-style-type: none"> Optimize glycemic control Optimize BP control ACEi/ARB for proteinuria
Retinopathy	<ul style="list-style-type: none"> T1DM-after 5 years T2DM – at diagnosis Before and at time of pregnancy Screening tool: <ul style="list-style-type: none"> - Dilated eye examination by ophthalmologist 	<ul style="list-style-type: none"> No retinopathy- in 1-2yr Retinopathy-1yr Sight threatening retinopathy - more frequent evaluation 	<ul style="list-style-type: none"> Optimize glycemic control Optimize BP control Optimize lipid control Pan retinal laser photocoagulation Intravitreous injections of anti- vascular endothelial growth ASA is not in patients with retinopathy

Neuropathy	<ul style="list-style-type: none"> • T1DM-after 5 years • T2DM – at diagnosis <p>Screening tool</p> <ul style="list-style-type: none"> • Careful history • Temperature/pin-prick & vibration sensation • 10-g monofilament testing 	Annually	<ul style="list-style-type: none"> • Optimize glycemic control • Symptomatic management • Painful neuropathy <ul style="list-style-type: none"> ○ Amitriptyline: 12.5-50mg PO/bedtime • Gastroparesis <ul style="list-style-type: none"> ○ Metoclopramide 10mg PO,TID(syrup preferred) <p>Alternatives (2nd line)</p> <ul style="list-style-type: none"> ○ Domperidone 10mg PO TID ○ Erythromycin syrup, 50-250mg,TID • Diabetic diarrhea ○ Symptomatic treatment Loperamide 2-4mg, PO, 6-8hrly <p>or</p> <p>Codeine 30mg, PO,6-8hrly</p> <ul style="list-style-type: none"> ○ Treatment of bacterial overgrowth:Antibiotics 7-10days <p>Norfloxacin 400mg, BID</p> <p>Or</p> <p>Metronidazole500mg TID + Cephalexin 500mg TID/or Cetrioxazole 960mg BID</p> <ul style="list-style-type: none"> • Postural hypotension ○ Change posture slowly ○ Elevate head by 10-20° ○ Dorsiflexion of feet and handgrip (before standing) ○ Tensing legs by crossing (when standing) • Bladder dysfunction ○ Remove drugs which worsen it (Amitriptyline, calcium channel blockers) ○ Strict voluntary voiding schedule ○ Crede maneuver (lower abdominal pressure by hands) ○ If severe: Self intermittent catheterization • Erectile dysfunction <p>Use PDE5 inhibitors</p> <ul style="list-style-type: none"> - Take 01 hr before sexual encounter - On empty stomach - Avoid use with nitrates ○ Sildenafil 25-100mg (start with 50mg) ○ Vardenafil 10-20mg ○ Tadalafil 10-20mg <p>If refractory</p> <ul style="list-style-type: none"> ○ Tadalafil2.5-5mg/daily
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CHAPTER 5

HEART FAILURE

BRIEF DESCRIPTION

- Heart Failure is an abnormality of cardiac structure or function leading to failure of the cardiac output to meet the body's metabolic requirements despite normal filling pressures.
- Clinically it is a syndrome consisting of typical symptoms (shortness of breath, fatigue, orthopnea, ankle swelling) and signs (raised JVP, pulmonary crackles, displaced apex beat, edema).
- Identification of the underlying cause of the Heart Failure is central to diagnosis.
- It could result from valvular disease, ischemic heart disease, hypertension, cardiomyopathies, thyrotoxicosis, congenital heart disease, etc.

I. ACUTE HEART FAILURE

- **Definition:** The new onset or recurrence of gradually or rapidly developing symptoms and signs of HF requiring urgent or emergent therapy and resulting in hospitalization. It can be worsening of symptoms in known cardiac patients (the majority) or a new onset heart failure (Denovo).

- Acute heart failure syndromes are classified based on the relative absence and/or presence of congestion and hemodynamic compromise.

Key Questions

- Does the patient have heart failure?
- If so which syndrome among the acute heart failure syndromes?
- Is it a new onset or worsening of a previously known cardiac disease?
- Is there a treatable precipitating factor?
- Does the patient require admission to the ICU or a general medical ward?

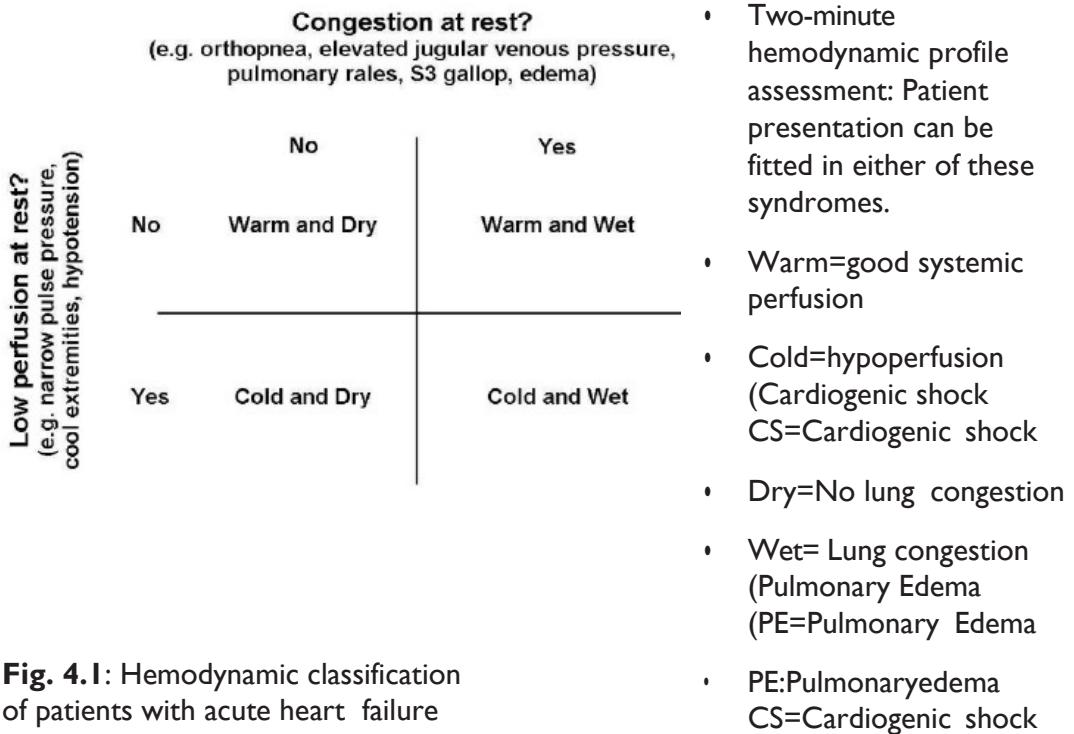


Fig. 4.1: Hemodynamic classification of patients with acute heart failure

- The following management approach works for all acute heart failure syndromes. Additional Specific management recommendations for pulmonary edema and cardiogenic shock are given separately.

CLINICAL FEATURES

- **Symptoms:** dyspnea, orthopnea, PND, cough, leg swelling, RUQ pain, abdominal distension
- **Signs:** tachycardia, tachypnea, high/normal/low BP, basal crepitations, pleural effusion, distended neck veins, raised JVP or Positive hepatojugular reflex, displaced AI, active/quite precordium, S3/S4 gallop, +/- murmurs, tender hepatomegaly, ascites, leg edema

<ul style="list-style-type: none">• Factors leading to rapid deterioration<ul style="list-style-type: none">- Tachy/brady arrhythmia- Acute Coronary Syndrome (ACS)- Acute pulmonary embolism- Hypertensive crisis- Cardiac tamponade- Aortic dissection	<ul style="list-style-type: none">• Factors leading to less rapid deterioration<ul style="list-style-type: none">- Non adherence to drugs/diet or under dosage- Infections (pneumonia, IE)- Anemia- Thyroid disorders- Pregnancy- Renal failure- Drugs (BB, CCB, NSAIDS)
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- Also look for precipitating factors through history and P/E

<ul style="list-style-type: none">• Indications for admission to the ICU<ul style="list-style-type: none">- Cardiogenic shock- Dyspnea at rest ($\text{SO}_2 < 90\%$ which doesn't improve with intranasal O₂)- Hemodynamically significant arrhythmia- Acute Coronary Syndrome (ACS)- Hypertensive emergency- Altered mental status	<ul style="list-style-type: none">• Indications for admission to General ward<ul style="list-style-type: none">- Worsened congestion- Dyspnea at rest (tachypnea or $\text{SO}_2 < 90\%$) which improves with intranasal O₂
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INDICATIONS FOR ADMISSION

DIAGNOSIS

- **Diagnosis** of heart failure is clinical. But investigations are necessary to identify the underlying cause, precipitating factor, and to guide and monitor management.

- **To identify the underlying cause:** Echocardiography, ECG, CXR
- **To identify precipitating factors based on clinical evaluation** (in addition to the above investigations): CBC, ESR, U/A, blood culture, TFTs, Urine HCG, Cr, BUN, etc..
- **To guide and monitor management:** K+, Na+, Cr, BUN, ALT, AST

Class I	<ul style="list-style-type: none">○ Patients with cardiac disease but without resulting limitation of physical activity. Ordinary physical activity does not cause undue fatigue, palpitations, dyspnea, or anginal pain.
Class II	<ul style="list-style-type: none">○ Patients with cardiac disease resulting in slight limitation of physical activity. They are comfortable at rest. Ordinary physical activity results in fatigue, palpitation, dyspnea, or anginal pain.
Class III	<ul style="list-style-type: none">○ Patients with cardiac disease resulting in marked limitation of physical activity. They are comfortable at rest. Less than ordinary activity causes fatigue, palpitation, dyspnea, or angina.
Class IV	<ul style="list-style-type: none">○ Patients with cardiac disease resulting in inability to carry on any physical activity without discomfort. Symptoms of heart failure or the anginal syndrome may be present even at rest. If any physical activity is undertaken, discomfort is increased.

NEW YORK HEART ASSOCIATION (NYHA) CLASSIFICATION OF SEVERITY /FUNCTIONAL CAPACITY

Stage of Heart Failure

Stage A	High risk for HF, without structural heart disease or symptoms
Stage B	Heart disease with asymptomatic left ventricular dysfunction
Stage C	Prior or current symptoms of HF
Stage D	Advanced heart disease and severely symptomatic or refractory HF

TREATMENT

GOALS OF MANAGEMENT

- Improve symptoms (congestion and low output symptoms)
- Restore normal oxygenation
- Optimize volume status
- Identify and manage precipitating factor
- Identify etiology and manage if possible (e.g.,ACS,arrhythmias)
- Optimize chronic oral therapy when needed
- **NB.** Management should be instituted **early** in parallel with the diagnostic work up. If patient has pulmonary edema or cardiogenic shock (see the respective sections for *initial management approach*)

Non-Pharmacologic

- Salt restriction (< 2gm or added salt), fluid restriction (< 1.5-2l/day) for hyponatremic patients
- Administer O₂ if SO₂< 90%.

Pharmacologic

- **Diuresis:**

- Send sample for Cr, BUN, K⁺ and Na⁺ initially and proceed with diuresis.
- For diuretic naive patients start furosemide 40 mg IV if BP>90/60 mmHg and double the dose every 2-4 hour until the urine output is >1 ml/kg/hr (40-70ml/hr). Response to IV dose occurs 2-4 hours later.
- For those already on oral furosemide, start with equal dose of IV furosemide.
- Maintain the dose of furosemide which gave adequate response on a TID basis.
- Start spironolactone 25-50 mg/day unless K⁺> 5.0 meq/l or Cr> 1.6 mg/dl or GFR<30 ml/min (*main reason is to prevent hypokalemia due to furosemide*).
- If patients were already taking ACEIs and BBs, they can continue to take them during hospitalization as long as they are not severely congested, are hemodynamically stable and have normal renal function.
- Temporary discontinuation or dose reduction of BB may be necessary if BP is low or borderline and patient is severely congested (pulmonary edema).
- Temporary discontinuation or dose reduction of ACEIs/ARBs may be necessary if BP is low or borderline and recent renal function derangement.
- Manage the identified precipitating factors.

Follow up

- Use the standard heart failure management follow up sheet posted by the bedside.
- V/S including orthostatic hypotension and SO₂ every 1hr until patient stabilizes and then every 4-6 hrs.
- 24 hrs urine output and fluid balance documented every 6hrs together with V/S.

- Weight every 24hrs (morning prior to eating and voiding, same scale).
 - Goal is 1kg/day weight loss
- Signs of heart failure every 12hrs (JVP, basal crackles, S3 gallop, hepatomegaly, edema).
- Symptoms (**dyspnea, orthopnea**).
- **Cr, BUN, K+, Na+** every 24hrs until patient stabilizes and then every 3-5 days and manage accordingly

Table 4.4: Sample heart failure follow up form

Date	time	PR	RR	BP	T	Wt	SO2	UOP	Creps	Hepato megaly	JVP	Edema	Cr	Na+	K+	sign

Goal of diuresis

- Negative fluid balance
- Weight loss (0.5-1kg/day)
- Clearance of crepitations in the lungs
- Decrement in edema, hepatomegaly, JVP
- Improvement of dyspnea, orthopnea, improvement in renal function (Cr, BUN)

Signs of excess diuresis

- Signs of dehydration
- Hypotension (overt/orthostatic)
- Elevated RFTs despite improvement of congestion
- Severe hypokalemia

Patient not responding

- Make sure that
 - Patient is taking medications as prescribed and is on salt free diet.
 - Precipitating factors is managed.
 - Patient is not getting drugs like NSAIDS, CCBs, BBs.
 - NB: *Patients with deranged renal function and hypoalbuminemia require higher doses of frusemide from the outset.*
- Adjust the diuresis
 - Increase the dose of furosemide (max. 400-600mg/day) and increase spironolactone to 50-100mg/day.
 - Increase the frequency of administration of furosemide 4-6 times per day. Repeated IV bolus doses are recommended than continuous infusion.
 - In ICU continuous furosemide infusion by perfuser according to protocol: (10-80mg/hr) can be used if still refractory to the above measures.
 - If patient not responding with the above approaches, add hydrochlorthiazide 12.5 mg/day in the morning 30 minutes before frusemide administration.
- **Digoxin** 0.125-0.25 mg/day for positive inotropy and rate control in patients with atrial fibrillation.
 - For patients with hypertension and severe Acute MR intravenous nitroglycerin infusion can be considered in addition to diuretics. (*See pulmonary edema section*)

PATIENT IMPROVING

- Decrease the dose of diuretics every day depending on patient condition.
 - The goal is to use the lowest possible dose and frequency to keep patient dry.

- For patients in whom previous BB and ACEIs/ARBs have been discontinued consider reinitiating the drugs as soon as possible sequentially (ACEIs/ ARBs followed by B blockers)
- For HFrEF previously not taking ACEIs/ARBs or BB.
 - Start one of the ACEIs/ARBs as soon as BP and RFTs permit and escalate until discharge (see chronic heart failure section)
 - Start one of the BB following ACEIs/ARBs when BP and PR permit and escalate until discharge (see chronic heart failure section)
 - Start Spironolactone 25mg/d.
- Change IV furosemide to PO and observe the patient with ambulation for a day or two.

Patients requiring higher dose of furosemide may require a double dose.

- Institute further management for the underlying heart disease (see *specific topic and comorbidities*)

Before Discharge

- Proper advice: *salt consumption, activity, adherence to medications and follow up.*
- Prescribe adequate medications and give requests for further planned outpatient investigations.
- Document medications with dose and further plans clearly on the discharge note.
- Early appointment preferably in one week time to follow up clinic.

4.2.1 PULMONARY EDEMA

BRIEF DESCRIPTION

- Principles of management and follow up is similar but more frequent than other AHF syndromes.

- Early oxygenation and ventilation support is lifesaving.
- Treatable precipitating causes (e.g., Arrhythmia, hypertensive crisis, ACS) should be looked for and managed promptly

CLINICAL FEATURES

- Rapid development of dyspnea at rest
- cardiorespiratory distress
- Tachypnea
- SO₂< 90%
- High/normal BP
- crepitations and wheeze in the lung
- Raised JVP, S3 gallop
- Treatable causes of pulmonary edema (eg. Hypertensive emergency, ACS, arrhythmia like AF) should be seriously looked for and managed according to the respective protocol together with management of pulmonary edema.

TREATMENT

Non pharmacologic

- **Oxygenation**
 - Sitting position
 - If SO₂< 90%, administer O₂ by nasal canula at 4-6 l/min.
 - If SO₂ doesn't improve in 10 min, administer high flow O₂(10-12 l/min) by face mask.
 - If SO₂ is still low, give ventilator support by CPAP in conscious cooperative patients or intubate if patient cannot protect his /her airways and put on MV with low PEEP.
 - If SO₂ is persistently higher than 90% and cardiorespiratory distress improves with treatment, revert O₂ administration to nasal canula and

progressively decrease O₂ flow and discontinue

PHARMACOLOGIC

- Administer **morphine** 2-4 mg IV bolus every 2-4 hr.
- **Furosemide** 40mg IV for naïve (intravenous dose which is equal to their previous oral dose for those already taking oral furosemide) and double the dose every 1hr until adequate urine output AND crackles in the chest start to decrease and maintain the dose of furosemide that gave adequate response every 4hrs for the first 24 hr and decrease frequency in subsequent days.
- Follow up of response and other management principles are similar to management of other acute heart failure syndromes (see *acute heart failure section*)
- For patients not responding adequately to diuretics with systolic BP >110mmHg, the following vasodilator therapies can be used:
 - Intravenous nitroglycerine infusion started with 10-20ug/min and escalated to 200ug/min depending on response and development of hypotension can be used.
 - If nitroglycerine not available, either of the following can be tried:
 - **Isosorbide dinitrite** 10mg po TID (8AM, 1PM and 6PM) escalated to 40mg po TID or
 - **Captopril** 12.5 mg or enalapril 2.5 mg and increase dose every 6hrs depending on response.

CARDIOGENIC SHOCK

BRIEF DESCRIPTION

- Systemic hypoperfusion secondary to decreased cardiac output and sustained systolic BP less than 90 mmHg despite an elevated filling pressure with evidence of organ hypoperfusion.

CLINICAL FEATURES

- Apprehensive and diaphoretic,
- Cold extremity,
- Poor capillary refill,
- Change in mentation,
- Systolic BP< 90mmhg,
- Decreased Urine output,
- Symptoms and signs of heart failure
- Inquire for history of fluid loss (vomiting, diarrhea, bleeding)

TREATMENT

Non pharmacologic

- Administer O₂ if SO₂<90%

PHARMACOLOGIC

- Administer **NS** 250ml over 30 min and see the change in BP, UOP and worsening of HF.
 - If BP improves then consider hypovolemic shock and continue slowly replacing the fluid with NS.
 - No response to fluid or worsening heart failure, use either of the following vasopressor therapies:
 - **Norepinephrine** 0.2 ug/kg/min escalated to 1ug/kg/min by doubling the dose q20 min until BP> 90/60 mmHg. Maintain the dose that maintained the BP> 90/60 mmHg
 - Alternative
 - **Dopamine** infusion at 5ug/kg/min and escalate to 40ug/kg/min by

doubling the dose q20 min until BP> 90/60 mmHg. Maintain the dose that maintained the BP> 90/60 mmHg.

- If patient has concomitant pulmonary edema resulting in hypoxia
 - Continuous infusion of frusemide started at 5-10 mg/hr should be started through another IV line (escalate dose based on Blood Pressure).
 - Taper the dose of vasopressor in the same way as it was escalated if BP is maintained.
- More frequent follow up of V/S, SO₂ and UOP q 20-30min until patient stabilizes
- Further follow up and management is similar to other heart failure syndromes.

2. CHRONIC HEART FAILURE

BRIEF DESCRIPTION

- This guideline focuses on the management and follow up of non-rheumatic chronic heart failure in those with depressed LV function (EF<40%). Management of chronic rheumatic valvular heart disease is given separately.

AT FIRST ENCOUNTER:

History:

- Low output: fatigue, weakness, exercise intolerance, change in mental status, anorexia
- Congestive: left sided: dyspnea, orthopnea, PND
- Right sided: peripheral edema, RUQ discomfort, bloating, satiety
- Functional classification: using NYHA classification
- Stage the disease: see below

DIAGNOSTIC WORK UP:

- Basic: CXR, ECG, Echocardiography
- Lab tests: BUN, Cr, electrolyte, urinalysis, FBS, lipid profile

- Evaluate for possible risk factor and treat.
- Follow steps in the management of Heart Failure with Reduced Left Ventricular Systolic Function

OBJECTIVES:

Relieve symptoms, reduce hospitalization, improve survival, reduce complications

- Step 1: Start low dose ACEs
- Step 2: review after two weeks: Check tolerance and side effects
 - BP, symptoms
 - Side effects ACEs
- Step 3: Increase dose of ACEs
 - If there is troubling cough related to the ACEs (not because of heart failure), switch therapy to ARBs
- Step 4: review after one month and assess for Beta blocker therapy
 - If a candidate; start low dose Betablocker
- Step 5: Review after two weeks for assessment
 - If tolerated, increase dose
- Step 6: Review heart failure status (symptom, NYHA class, congestion)
 - Optimize therapy as per evidences
- Step 7: Monitor therapy at each visit (RFT, Electrolytes, optimize risk factors)
- Step 8: Early referral for refractory cases for cardiologist evaluation

Table 4.5: Management of heart failure

<ul style="list-style-type: none"> Diet, exercise 	<ul style="list-style-type: none"> Avoid table salt intake, alcohol and smoking Avoid stimulant caffeine other like khat, marijuana Avoid excess free water consumption Exercise training in ambulating patients
<ul style="list-style-type: none"> ACEI Optimal doses are more efficacious Watch for azotemia, increased K+, cough, angioedema Contraindicated; pregnancy, renal artery stenosis, hyperkalemia 	<ul style="list-style-type: none"> Escalate every 1-2 week Enalapril dose 2.5mg/day - 20mg BID Alternative Lisinopril dose 10-40mg/day
<ul style="list-style-type: none"> ARBs (ATII receptor blockers) Alternative to ACEI (cough, angioedema) but not a substitute Others same with ACEI 	<ul style="list-style-type: none"> Candesartan 8-32 mg/day in 1-2 divided doses Alternative Valsartan 40 -80 mg PO BID
ARNI (Angiotensin-Neprolysin Inhibitors)	<ul style="list-style-type: none"> Sacubutril/Valsarthan combination starting with 50 mg (24/26) PO BID to increase to the most tolerable dose of 200 mg (97/103) PO BID
<ul style="list-style-type: none"> Beta-blockers High doses are more efficacious Caution: severe COPD/asthma, AV block(bradycardia), hypotension(shock) 	<ul style="list-style-type: none"> Preferred: (long releasing and escalate every 2 week) Metoprolol dose 6.75 - 200mg per day Carvedilol dose 3.125-25mg BID Bisoprolol 1.25 mg Po-10 mg Po daily Nebivolol 1.25 mg PO-10 mg Po daily

<ul style="list-style-type: none"> Aldosterone antagonist Consider in severe HF or post MI Caution: renal function, Increased K 	<ul style="list-style-type: none"> Spironolactone 25mg po per day NB: 50mg/day patients with high dose furosemide and hypokalemia
<ul style="list-style-type: none"> Diuretics Patients with congestion (ie. Not only right sided but also orthopnea, PND, nocturnal cough) Watch electrolyte (Na, K, Cl) and BUN, Cr 	<ul style="list-style-type: none"> Loop diuretics Lasix(furosemide) 20mg/day up to 100-120mg TID/QID (preferred to keep low dose) Thiazide:HCT 12.5-25mg per day (congestion not improved with high dose lasix) see diuretic resistance
<ul style="list-style-type: none"> Digoxin Caution: renal failure, hypokalemia, Rheumatic heart disease (MS) Use: rate control in AFFVR and added on therapy 	<ul style="list-style-type: none"> Dose 0.125-0.25mg per day

In every follow up visit:

Assess	Manage
<ul style="list-style-type: none"> Symptoms Functional status Adherence Medication tolerance P/E: V/S, signs of heart failure, precordial exam Investigations: Cr, BUN, K+, Na+ as appropriate 	<ul style="list-style-type: none"> Escalate dose of ACEIs and BBs if no problem Consider add on therapies like spironolactone, digoxin if patient not improving after optimal diuretic, ACEI and BB therapy on adherence to treatment and life style modifications

CHAPTER 6

ASTHMA

I.BRONCHIAL ASTHMA

Definition

- Asthma is a heterogeneous disease, usually characterized by chronic airway inflammation.
- It is defined by the history of respiratory symptoms such as wheeze, shortness of breath, chest tightness and cough that vary over time and in intensity, together with variable airflow limitation.

CLINICAL MANIFESTATION AND DIAGNOSIS

- The diagnosis of Asthma is made clinically using history and physical examination after excluding alternative diagnosis.
- Characteristic pattern of symptoms with wheezing, shortness of breath, cough, chest tightness varying over time and in intensity.
- Symptoms usually get worse during night or early morning and/or with known triggers (Eg. infection, allergy exposure, weather change, exercise, medications, occupational risk and emotional disturbances).
- Peak Expiratory Flow (PEF) can aid the diagnosis.
- Most asthmatics has family history of asthma and has history of wheezing starting from early child hood.

Table 14.1: Symptom based diagnosis of Asthma

Increased probability that symptoms are due to asthma	Decreased probability that symptoms are due to asthma
<ul style="list-style-type: none">More than one type of symptom (wheeze, shortness of breath, cough, chest tightness)Symptoms often worse at night or in the early morningSymptoms vary over time and in intensitySymptoms are triggered by viral infections, exercise, allergen exposure, changes in weather, laughter, irritants such as car exhaust fumes, smoke, or strong smells	<ul style="list-style-type: none">Isolated cough with no other respiratory symptomsChronic production of sputumShortness of breath associated with dizziness, light-headedness or peripheral tinglingChest painExercise-induced dyspnoea with noisy inspiration (stridor)

- Physical Examination helps in excluding alternative diagnosis. Normal finding doesn't exclude the possibility of asthma.
- Examine the nose, throat and upper airways for (nasal polyp, nasal congestion and/or blockage). Look also for features of Atopy or eczema on the skin.
- The most frequent finding is wheezing on auscultation, especially on forced expiration.
- Silent Chest on chest auscultation might signify severe asthma.
- Wheezing is also found in other conditions, for example: Respiratory infections (Viral), COPD, Upper airway dysfunction, Endobronchial obstruction
- The diagnosis of asthma in general hospital should be based on:

- A history of characteristic symptom patterns mentioned above with evidence of variable airflow limitation, from PEF, bronchodilator reversibility testing or response to treatment.
 - A 20% or more change in PEF values from morning to afternoon or from day to day or before and after bronchodilator therapy suggests a diagnosis of asthma or inadequately controlled asthma.
 - PEF values less than 200 L/min indicate severe airflow obstruction.
- A trial of glucocorticoids (e.g. 30 mg daily for 2 weeks) may be useful in establishing the diagnosis, by demonstrating an improvement in either PEF or symptoms.

TREATMENT

GOALS OF ASTHMA MANAGEMENT

- The long-term goals of asthma management are:
 - Symptom control: to achieve good control of symptoms and maintain normal activity levels
 - Risk reduction: to minimize the risk of asthma-related death, exacerbations, persistent airflow limitation and medication side-effects
- Achieving these goals requires a partnership between patient and their health care providers
 - Ask the patient about their own goals regarding their asthma. Shared decision-making is associated with improved outcome.
 - Good communication strategies are essential.
 - Consider the health care system, medication availability, cultural and personal preferences and health literacy.

TREATMENT TO CONTROL SYMPTOMS AND MINIMIZE RISK

- Establish a patient-clinician partnership
- Train every patient in essential skills and guided asthma self-management including:

- Asthma information
- Inhaler skills
- Adherence
- Guided self-management education
- Written asthma action plan
- Self-monitoring
- Regular medical review.
- Follow the continuous control-based asthma management cycle:
 - Assess symptom control and risk factors
 - Adjust treatment (pharmacological and non-pharmacological)
 - Review the response: symptoms, exacerbations, side effects
- Approaches of Asthma Management
 - Medications: Every patient with asthma should have a reliever medication
 - Most adults and adolescents with asthma should have a controller medication to reduce the risk of serious exacerbations, even in patients with infrequent symptoms
 - Treating modifiable risk factors and comorbidities
 - Non-pharmacological therapies and strategies

INITIAL CONTROLLER TREATMENT

- Start controller treatment early;
 - For best outcomes, initiate controller treatment as early as possible after making the diagnosis of asthma because delayed initiation decreases lung function.
 - All adults and adolescents with asthma should receive ICS-containing controller treatment to reduce their risk of serious exacerbations and to control symptoms.

- For safety, treatment of asthma in adults and adolescent with SABA alone is no longer recommended.
- For patients presenting with mild symptoms (asthma symptoms or need for reliever twice a month or more), treatment with regular low-dose ICS, with SABA is highly effective.
- Consider starting at a higher step (e.g., Medium dose ICS or Low dose ICS/LABA) if;
 - Patient has troublesome asthma symptoms on most days.
 - Waking from asthma once or more a week, especially if any risk factors for exacerbations.
- If initial asthma presentation is with Severely uncontrolled asthma or an exacerbation;
 - Give a short course of oral corticosteroids (OCS) and start regular controller treatment (e.g. high dose ICS or medium dose ICS/LABA, then step down after 3 months when well controlled).

INITIATION AND MONITORING OF CONTROLLER TREATMENT

- Before starting initial controller treatment;
 - Record evidence for diagnosis of asthma, if possible.
 - Record symptom control and risk factors, including lung function.
 - Consider factors affecting choice of treatment for this patient.
 - Ensure that the patient can use the inhaler correctly.
 - Schedule an appointment for a follow-up visit.
- After starting initial controller treatment;
 - Review response after 2-3 months, or according to clinical urgency.
 - Adjust treatment (including non-pharmacological treatments).
 - Consider stepping down when asthma has been well-controlled for 3 months.

Presenting symptoms	Asthma symptoms up to 2 times per month (Mild asthma), GINA step 1 & 2	Troublesome asthma symptoms most days (Moderate asthma) GINA step 3	Severe uncontrolled asthma GINA step 4 & 5
Treatment	Step GREEN(G) (Use 1 or more controller medication)	Step YELLOW (Y) (Use 2 or more controller medications)	Step RED (R) (Use 3 or more controller medications)
	Daily Low dose ICS with as-needed SABA	Medium dose ICS with as-needed SABA	High dose ICS with as-needed SABA (concomitantly use 1 or 2 of the add on therapy)
	Low dose ICS taken whenever SABA is taken	Low dose ICS-LABA as maintenance and reliever therapy with ICS-formoterol	Daily medium to high dose ICS-LABA, with as-needed SABA Add on tiotropium
	As-needed low dose ICS-formoterol (Budesonide-formoterol)	Low dose ICS-LABA, with as-needed SABA	Medium to high dose ICS-LABA with as-needed SABA Add on LTRA
	Daily LTRA, with as-needed SABA	Low dose ICS with daily LTRA, with as-needed SABA	Medium to high dose ICS-LABA with as-needed SABA Add on Theophylline sustained-release preparation
		Low dose ICS with daily Theophylline sustained-release preparation, with as-needed SABA	Medium to high dose ICS-LABA with as-needed SABA Any of the add on drugs Add on low dose OCS Add on azithromycin

Figure 14.1: Stepwise approach to asthma therapy according to the severity of asthma and ability to control symptoms (adopted from the Ethiopian Asthma and COPD management guideline, 2020)

NOTES ON STEPWISE APPROACH TO ASTHMA THERAPY

- Provide guided self-management education
- Treat modifiable risk factors and comorbidities
- Advise about non-pharmacological therapies and strategies
- Consider stepping up if ... uncontrolled symptoms, exacerbations or risks, but check diagnosis, inhaler technique and adherence first.
- Consider stepping down if ... symptoms controlled for 3 months + low risk for exacerbations. Stopping ICS is not advised in adults with asthma because of risk of exacerbations

ASSESSING ASTHMA SEVERITY

- How do you assess Asthma severity?
 - Asthma severity is assessed retrospectively from the level of treatment required to control symptoms and exacerbations
- When do you assess Asthma Severity?
 - Assess asthma severity after patient has been on controller treatment for several months
 - Severity is not static it may change over months or years, or as different treatments become available
- Categories of asthma severity.
 - *Mild asthma:* well-controlled with GINA Steps 1 or 2 or step G (low dose ICS, with as-needed SABA)
 - *Moderate asthma:* well-controlled with GINA Step 3 or step Y (low- dose ICS/LABA)
 - *Severe asthma:* requires GINA Step 4/5 or step R (moderate or high dose ICS/LABA ± add-on), or remains uncontrolled despite this treatment. It may appear similar to asthma that is uncontrolled due to lack of treatment.

REVIEWING RESPONSE AND ADJUSTING TREATMENT

- How often should asthma be reviewed?
 - 1-3 months after treatment started, then every 3-12 months.
 - During pregnancy, every 4-6 weeks.
 - After an exacerbation, within 1 week.
- Stepping up asthma treatment;
 - Sustained step-up, for at least 2-3 months if asthma poorly controlled;
 - Important: first check for common causes (symptoms not due to asthma, incorrect inhaler technique, poor adherence, persistent environmental exposures and drugs, comorbidities that may contribute to respiratory symptoms).
 - Short-term step-up, for 1-2 weeks, e.g. with viral infection or allergen;
 - May be initiated by patient with written asthma action plan.
 - Day-to-day adjustment;
 - For patients prescribed low-dose ICS/formoterol maintenance and reliever regimen*
- Stepping down asthma treatment;
 - Consider step-down after good control maintained for 3 months.
 - Find each patient's minimum effective dose that controls both symptoms and exacerbations.

TREATING MODIFIABLE RISK FACTORS

- Exacerbation risk can be minimized by optimizing asthma medications, and by identifying and treating modifiable risk factors.
- Provide skills and support for guided asthma self-management
 - This comprises self-monitoring of symptoms and/or PEF, a written asthma action plan and regular medical review.

- Encourage adherence to medications and appointments
- Give asthma information
- Prescribe medications or regimen that minimizes exacerbations
 - ICS-containing controller medications reduce risk of exacerbations
 - For patients with ≥ 1 exacerbation in the last year, consider low-dose ICS/formoterol maintenance and reliever regimen*
- Encourage avoidance of tobacco smoke (active or environmental tobacco smoke (ETS))
 - Provide smoking cessation advice and resources at every visit
- For patients with severe asthma
 - Refer to a specialist center, if available, for consideration of add-on medications and/or sputum-guided treatment
- For patients with confirmed food allergy:
 - Appropriate food avoidance
 - Ensure availability of injectable epinephrine for anaphylaxis

NON-PHARMACOLOGICAL STRATEGIES AND INTERVENTIONS

- Reduce indoor air pollution by cooking outside or using smokeless cooking stoves
- Avoid allergens that the patient is sensitive to:
 - contact with furry animals (e.g. cats, dogs)
 - Reduce pollen exposure
 - Reduce exposure to house dust mite
- Avoidance of tobacco smoke exposure
 - Provide advice and resources at every visit; advise against exposure of children to ETS (house, car).

- Occupational asthma
 - Ask patients with adult-onset asthma about work history. Remove sensitizers and irritants like dust and fumes as soon as possible. Refer for expert advice, if available.
- Encourage Physical activity
 - Encouraged because of its general health benefits. Provide advice about managing exercise-induced bronchoconstriction.
- Avoid medications that may worsen asthma
 - Always ask about asthma before prescribing NSAIDs or beta-blockers.
- Remediation of dampness or mold in homes
 - Reduces asthma symptoms and medication use in adults.

PATIENTS WITH POOR ASTHMA CONTROL SHOULD BE ASSESSED FOR THE FOLLOWING:

- Reasons for poor adherence and misunderstanding the difference between relievers and controllers
- Poor inhaler technique
- Exposure to trigger factors at home and work
- Presence of gastro-esophageal acid reflux disease (GERD)
- Rhinitis and sinusitis
- Use of medications that may aggravate asthma such as aspirin, non-steroidal anti-inflammatory drugs and β blockers
- Other medical conditions mimicking asthma symptoms (e.g. cardiac disease).

INDICATIONS FOR CONSIDERING REFERRAL

- Difficulty confirming the diagnosis of asthma
- Suspected occupational asthma

- Persistent uncontrolled asthma or frequent exacerbations
- Risk factors for asthma-related death
- Significant side-effects (or risk of side-effects)
- Symptoms suggesting complications or sub-types of asthma
- Asthma with confirmed food allergy.

ASTHMA EDUCATION

Goals of asthma education include:

- An explanation of the nature of asthma and its inflammatory basis
- A description of the different classes of drugs and their purpose in treatment (i.e. as-needed “relievers” and regular “controllers”)
- Advice on prevention strategies (allergen, irritant, and tobacco smoke avoidance)
- The correct choice and use of inhalers and the opportunity to practice under supervision
- How to recognize worsening asthma and how and when to implement their action plan
- In some patients, particularly those requiring stabilization or patients who have had a recent exacerbation or deterioration, the use of a PEF meter and chart.

ASTHMA MEDICATIONS AND COMMON SIDE EFFECTS

- Asthma medications can be divided into two categories, quick-relief and long-term control medications
- Quick-relief medications that act principally by direct relaxation of bronchial smooth muscle, thereby promoting prompt reversal of acute airflow obstruction to relieve accompanying symptom.
 - Short acting beta agonists (SABA) are the main stay of treatment.
 - SABAs are the most effective bronchodilators during exacerbations and provide immediate relief of symptoms.

- Salbutamol (Albuterol) Inhaler is available in Ethiopia.
- Regularly scheduled use is not generally recommended.
- SABA alone therapy is no longer recommended. Common but benign side effects include tremor and tachycardia
- Long-term control (controller) medications that act primarily to attenuate airway inflammation and that are taken daily independent of symptoms to achieve and maintain control of persistent asthma.
- Steroids (ICS or OCS), long-acting beta agonists (LABA), and leukotriene modifiers comprise the important long-term control medications.
- LABAs provide bronchodilation for up to 12 hours after a single dose.
 - Salmeterol and formoterol are the LABAs available for asthma.
 - LABAs should not be used as monotherapy since they have no anti-inflammatory effect, use with inhaled corticosteroids.
 - They should not be used for symptom relief or exacerbations.
- Corticosteroids are the most potent and consistently effective anti-inflammatory agents currently available.
 - They decrease both acute and chronic inflammation, resulting in reduced symptoms and improved lung function.
 - These agents may also potentiate the action of beta-adrenergic agonists.
 - ICS (See tables 14.2 below) and OCS (prednisolone 5mg tabs) are used for asthma treatment.
 - Inhaled corticosteroids are preferred, first-line agents for all patients with persistent asthma.
 - Patients with persistent symptoms or asthma exacerbations who are not taking an inhaled corticosteroid should be started on one.
 - Inhaled corticosteroids have few side effects at standard treatment doses.
 - Some of the local side effects include oral candidiasis, dysphonia, reflex

cough and bronchospasm.

- High dose ICS and long-term use of oral steroids predisposes to systemic side effects which includes adrenal suppression, osteoporosis, skin thinning, easy bruising, diabetes, hypertension, infections, glaucoma and cataracts.
- Theophylline provides mild bronchodilation in asthmatic patients.
 - Theophylline also has anti-inflammatory and immunomodulatory properties, enhances mucociliary clearance, and strengthens diaphragmatic contractility.
 - Sustained-release theophylline preparations (e.g., theophedrine 120/11mg tablets 1-4 times per day) are effective in controlling nocturnal symptoms
 - As an added therapy in patients with moderate or severe persistent asthma whose symptoms are inadequately controlled by inhaled corticosteroids.
 - When added to an inhaled corticosteroid, theophylline may allow equivalent control at lower corticosteroid doses.
 - Theophylline use needs to be monitored closely owing to the medication's narrow therapeutic-toxic range, individual differences in metabolism, and the effects of many factors on drug absorption and metabolism.
 - At therapeutic doses, potential adverse effects include insomnia, aggravation of dyspepsia and gastroesophageal reflux, and urination difficulties in men with prostatic hyperplasia.
 - Dose-related toxicities include nausea, vomiting, tachyarrhythmias, headache, seizures, hyperglycemia, and hypokalemia.
- Leukotriene receptor antagonists (LTRA) are less effective than ICS particularly for exacerbations.
 - They may be appropriate for initial controller treatment for some patients who are unable or unwilling to use ICS; for patients who experience intolerable side-effects from ICS; or for patients with

concomitant allergic rhinitis.

- Before prescribing montelukast (adult dose 10 mg once daily), health professionals should counsel patients about the risk of neuropsychiatric events.
- Add-on tiotropium (long-acting muscarinic antagonist) in patients whose asthma is not well controlled with ICS-LABA.
- It (mostly 5 µg once daily by mist inhaler) modestly improves lung function and modestly increases the time to severe exacerbation requiring oral corticosteroids.
- Add-on azithromycin (three times a week) for adult patients with persistent symptomatic asthma despite moderate-high dose ICS and LABA reduced asthma exacerbations.
- Common side effects include diarrhea, ototoxicity and cardiac arrhythmia.
- Before considering add-on therapy with azithromycin, ECG should be checked for long QTc.

Table 14.2: Inhaled corticosteroids (ICS) and Combinations for Adults and adolescents (≥ 12 years) (Adopted from the Ethiopian Bronchial asthma and COPD management guideline, 2020)

Inhaled corticosteroid	Total daily dose (mcg)		
	Low	Medium	High
Beclomethasone dipropionate (CFC)	200–500	500–1000	>1000
Beclomethasone dipropionate (HFA)	100–200	200–400	>400
Budesonide (DPI)	200–400	400–800	>800
Fluticasone propionate (DPI or HFA)	100–250	250–500	>500
Fluticasone/salmeterol (DPI)	100/50	250/50	500/50
Budesonide/formoterol*(HFA _d MDI)	80/4.5	160/4.5	320/9
Mometasone furoate (HFA-dMDI)	200-400		>400

NB: DPI-Dry Powder inhaler, MDI -Metered dose inhaler CFC-Chlorofluorocarbon HFA-Hydroflouroalkane

*When Budesonide/formoterol is prescribed as maintenance and reliever therapy, the maximum recommended dose of formoterol in a single day is 72 mcg.

HOW TO USE INHALERS FOR ASTHMA MANAGEMENT

- An inhaler is a medical device used for delivering medication into the body via the lungs.
- It is mainly used in the treatment of asthma and chronic obstructive pulmonary disease.
- The two most common forms are: metered-dose inhaler; dry powder inhalers
- Some of the types of inhalers include: Auto halers (Breath Activated aerosol devices), Nebulizers mists and nasal inhalers
- Most patients (up to 80%) cannot use their inhaler correctly. This contributes to poor symptom control and exacerbations.
- To ensure effective inhaler use:
 - Choose the most appropriate device for the patient before prescribing
 - Check in haler technique at every opportunity
 - Correct using physical demonstrations
 - Paying attention to incorrect steps and
 - Confirm that you have checklists.

METERED-DOSE INHALER (MDIS)

- The medicine is in a small canister, inside a plastic case. When the inhaler is pressed, a measured dose of medicine comes through the mouthpiece.
- MDIs require good technique and coordination by pressing down on the inhaler and breathing in at the same time.

- Because using the inhaler correctly can be difficult, spacer devices are recommended for use with MDIs.
- The spacer is attached to the MDI to make it easier to use the inhaler and get more medicine into the lungs.

HOW TO USE METERED DOSE INHALER

- Remove the cap and check the mouthpiece is clean and free of objects.
- Shake the inhaler four or five times.
- Holding the inhaler upright with your thumb on the base, breathe out as far as comfortable
- Place the mouthpiece in your mouth closing your lips around it to form a good seal, do not bite.
- Start to breathe in slowly; press down firmly on the top of the canister to release a dose; while continuing to breathe in slowly and deeply.
- Removing the inhaler from your mouth; hold your breath for about 10 seconds, or as long as is comfortable.
- Breathe out gently away from your inhaler mouthpiece
- For a second dose, wait approximately 30 seconds before repeating steps
- Replace the cap



Figure 14.2: Metered Dose Inhaler (Adopted from the Ethiopian Bronchial asthma and COPD management guideline)

DRY POWDER INHALER (DPI)

- Dry powder inhalers are handheld devices that deliver medication to the lungs and airways as you inhale through it.
- Examples of dry powder inhalers include:Turbuhaler;Accuhaler;Handihaler; Ellipta inhaler and Breezhaler.
- The common forms available in Ethiopia are Turbuhaler (eg.Symbicort) and Accuhaler (eg. Seritide)



Figure 14.3: Different forms of devices delivering DPIs (Adopted from the Ethiopian Bronchial asthma and COPD management guideline, 2020)

HOW TO USE ACCUHALER® (DRY POWDER INHALER-DPI)

- Check dose counter.
- Open cover (Use thumb grip)
- Hold the casing of the Accuhaler® in one hand while sliding the thumb grip away until a click is heard
- Holding your Accuhaler® with the mouthpiece towards you slide the lever away from you until a click is heard.This makes the dose available for inhalation and moves the dose counter on.
- Holding the inhaler horizontally,breathe out as far as comfortable
- Place the mouthpiece in your mouth; closing your lips around it to form a good seal - do not bite

- Breathe in as strongly and deeply as possible
- Removing the inhaler from your mouth; hold your breath for about 10 seconds, or as long as is comfortable
- Breathe out gently away from your inhaler mouthpiece
- To close the Accuhaler®, slide the thumb grip back towards you as far as it will go until it clicks.



Figure 14.4: Dry Powder Inhaler (Accuhaler) (Adopted from the Ethiopian Bronchial asthma and COPD management guideline, 2020)

TURBUHALER (DPI)

- Since the turbuhaler is a breath-activated device, to use the turbuhaler properly, you must be able to breathe in deeply.
- Adults and children 7 years of age and older should be able to use the turbuhaler.



Figure 14.5: Dry Powder Inhaler (Turbuhaler)
(Adopted from the Ethiopian Bronchial asthma and COPD management guideline, 2020)

HOW TO USE TURBUHALER (DPIS)

- Open by unscrew and remove the cap.
- Hold the turbuhaler upright
- Load the dose: twist the base anticlockwise and then back in the other direction until you hear a click. Your turbuhaler is now loaded with one dose of medicine
- Breathe out, away from the turbuhaler, do not blow directly into the turbuhaler
- Place the mouth piece in your mouth and form a seal with your lips and breathe in deeply.
- Remove the turbuhaler and hold your breath for up to 10seconds.
- To close, replace the cap and twist until it is on properly.
- Cleaning and storing your turbuhaler: wipe the mouthpiece with a clean dry tissue.

- Do not wash or allow the mouthpiece it to get wet when cleaning.
- Keep the cap on when not in use.
- The device may clog if exhaled or dribbled into or if stored in an area of high humidity with the cap off or unsealed.

COMMON PROBLEMS WHEN USING A TURBUHALER

- To get the most benefit, it is important to use the correct technique.
- Here are a few common problems:
 - Not holding your turbuhaler upright (vertical) while loading the dose.
 - Covering the air inlets with your lips.
 - Breathing in through your nose instead of your mouth.
 - Shaking the inhaler to see how much is left.
 - Storing your turbuhaler in a damp place with the cap off.

HOW TO USE SPACERS

- If patient unable to use an inhaler correctly, add a spacer to increase drug delivery to the lungs, especially if using inhaled corticosteroids. This may also reduce the risk of oral candida.
- Clean the spacer before first use and every second week: remove the canister and wash spacer with soapy water. Allow it to drip dry. Avoid rinsing with water after each use.
- Spacers are not commonly available in Ethiopia so a plastic water bottle. See figure 14.6 below to modify a 500ml plastic bottle for use as an effective spacer

How to make a spacer from a plastic bottle¹



- 1 • Wash a 500ml plastic cold-drink bottle with soapy water.
- Leave to air-dry.
- Discard the lid.



- 2 • Wind a steel wire around the open mouth of inhaler to form a mould.
- Keep some wire for a handle.
- Heat the mould with a flame until it is red hot.



- 3 • Insert mouth of Inhaler immediately to create a tight fit.
- Apply quick-setting glue to seal the inhaler permanently to the spacer.

Figure 14.6: How to make a spacer from a plastic bottle (Adopted from the Ethiopian Bronchial asthma and COPD management guideline, 2020)

How to use a bottle spacer

- Use a modified 500ml plastic bottle in a similar way to a conventional spacer

How to use an inhaler with a spacer²



- 1 Shake Inhaler and Insert Into spacer.



- 2 Stand up and breathe out.
- Then form a seal with lips around mouthpiece.



- 3 Press pump once to release one puff into spacer.



- 4 Then take 4 breaths keeping spacer in mouth.
- Repeat steps 3 and 4 for each puff.
- Rinse mouth after using inhaled corticosteroids.

Figure 14.7: How to use an inhaler with a spacer (Adopted from the Ethiopian Bronchial asthma and COPD management guideline, 2020)

CHRONIC OBSTRUCTIVE PULMONARY DISEASES (COPD)

BRIEF DESCRIPTION

- Chronic obstructive pulmonary disease (COPD) is a common, preventable and treatable disease
- It is characterized by persistent respiratory symptoms and airflow limitation that is due to airway and/or alveolar abnormalities usually caused by significant exposure to noxious particles or gases.

CLINICAL FEATURES

- Chronic and progressive dyspnea
- Cough
- Sputum production
- Wheezing and chest tightness
- Others – including fatigue, weight loss, anorexia, syncope, rib fractures, ankle swelling, depression, anxiety.
- Chest auscultation may demonstrate bilateral wheeze or crackles.

DIAGNOSIS

- The diagnosis of COPD is based on signs and symptoms and is confirmed by spirometry.
- Spirometry is required to make the diagnosis of COPD
- The presence of a post-bronchodilator $FEV_1/FVC < 0.70$ confirms the presence of persistent airflow limitation.

- However, spirometry is often not available hence clinical criteria can be used to determine probability of COPD.
- COPD should be considered in any patient over the age of 40 years who has dyspnea, chronic cough or sputum production, and/or a history of exposure to risk factors for the disease.
- Other diagnostic tests can be employed to rule out concomitant disease or tailor additional treatment
 - CXR, CBC to exclude anemia or polycythemia
 - ECG and echocardiography in patients with signs of cor pulmonale
- Pulse oximetry at rest, with exertion, and during sleep should be performed to evaluate for hypoxemia and the need for supplemental oxygen.

MANAGEMENT OF COPD

An effective COPD management plan includes four components:

- Assess and monitor disease
- Reduce risk factors
- Manage stable COPD
- Manage exacerbations

The goals of effective COPD management are to:

- Prevent disease progression
- Relieve symptoms
- Improve exercise tolerance
- Improve health status
- Prevent and treat complications
- Prevent and treat exacerbations
- Reduce mortality

MANAGEMENT OF STABLE COPD

- The management of stable COPD focuses on improving breathlessness, reducing the frequency and the severity of exacerbations, and improving health status and prognosis.
- It includes avoidance of modifiable risk factors, vaccinations, pharmacologic therapies, oxygen therapy and pulmonary rehabilitation.
- Avoidance of modifiable risk factors: smoking cessation and reduction of indoor air pollution.
 - Smoking cessation: This is known to affect the natural course of COPD and should be advised to all patients irrespective of the level of symptom control or severity of disease. For details on smoking cessation, see the session under “COPD Prevention” below.
 - Reduction of indoor air pollution through introduction of non-smoking cooking devices or alternative fuels should be encouraged.
- Vaccinations:
 - Influenza vaccination reduces serious illness and death.
 - It is recommended for all patients with COPD.
 - Pneumococcal vaccination (PCV13 and PPSV23) is recommended for all patients ≥ 65 .
 - The PPSV23 is also recommended in younger patients with significant comorbidity including chronic lung or heart diseases.
- Pharmacological therapies: These are used to reduce symptoms, reduce the frequency and severity of exacerbations, and improve exercise tolerance and health status.
 - Beta-2 agonists:
 - Short-acting bronchodilators (SABA) like Salbutamol may be used for patients with mild disease
 - Longer-acting bronchodilators (LABA) like Salmeterol and

Formoterol inhalers are usually more appropriate for those with moderate to severe disease.

- Regular and as needed SABAs improves symptoms and FEV1.
 - The effect of SABAs usually wears off in 4 – 6 hours whereas those LABAs have duration of action up to 12 hours.
 - SABAs can also be used as needed (in between doses of LABAs). Important side effects include tachycardia and somatic tremor.
- Antimuscarinic (Anticholinergic) drugs:
 - These include the Short Acting Muscarinic Antagonist (SAMA) like Ipratropium and the Long-Acting Muscarinic Antagonist (LAMA) like Tiotropium.
 - Ipratropium has a duration of action that is between 6 – 8 hours whereas Tiotropium lasts for up to 24 hours.
 - LAMAs generally improve symptoms and health status, and reduce exacerbations and related hospitalizations.
 - Dryness of the mouth is the most important side effect of these drugs.
 - Oral bronchodilator therapy:
 - Methylxanthines (theophedrine) may be contemplated in patients who cannot use inhaled devices efficiently.
 - Side effects include palpitations caused by atrial and ventricular arrhythmias, grand mal convulsions, headaches, insomnia, nausea, and heartburn.
 - Combined inhaled glucocorticoids and bronchodilators:
 - The fixed combination of an inhaled glucocorticoid and a LABA (e.g. fluticasone with salmeterol, budesonide with formoterol)
 - It improves lung function, reduces the frequency and severity of exacerbations and improves quality of life especially in patients with moderate to very severe COPD and exacerbations.

- These advantages may be accompanied by an increased risk of pneumonia, particularly in the elderly.
 - Use this combination especially when there is history of hospitalization for exacerbation, two or more exacerbations per year, blood eosinophils >300/micL or history of (concomitant) asthma.
 - Because there is no loose preparation of LABAs in the market, we generally tend to use combination of LABA/ICS.
- o Oral glucocorticoids:
 - Oral glucocorticoids are useful during exacerbations but maintenance therapy contributes to osteoporosis and impaired skeletal muscle function, and should be avoided.
 - Oral glucocorticoid trials assist in the diagnosis of asthma but do not predict response to inhaled glucocorticoids in COPD.
- Pulmonary rehabilitation:
 - o Exercise should be encouraged at all stages and patients reassured that breathlessness, while distressing, is not dangerous.
 - o Physical training, disease education and nutritional counseling reduce symptoms, improve health status and enhance confidence.
 - Oxygen:
 - o The long-term administration of oxygen (>15hrs/day) to patients with severe resting hypoxemia increases survival.
 - o It is indicated for patients with a PaO₂ <55mmHg or SaO₂ <88% confirmed twice over three-weeks period
 - o It is also indicated for patients with PaO₂ 55 – 60mmHg or SaO₂ <88% if there is evidence of pulmonary hypertension, peripheral edema suggesting congestive heart failure or polycythemia (Hct >55%).

MANAGEMENT OF EXACERBATION OF COPD

- Most COPD patients in our country are undiagnosed, a few of them are told they have “bronchitis” without confirmatory spirometry and still fewer have confirmed COPD.
- Therefore, COPD with acute exacerbation should be considered in every patient presenting with a recent worsening of his/her long standing cough or dyspnea or sputum color change (purulence).
- COPD exacerbations can be classified into 4 categories based on severity
 - Mild: can be managed at home with SABAs only.
 - Moderate: can be managed as outpatient with SABAs + antibiotics+ steroids.
 - Severe without respiratory failure: can be treated in the wards with SABAs + antibiotics+ steroids.
 - Severe with respiratory failure: Needs ICU admission for respiratory support (Noninvasive or invasive ventilation).

PHARMACOLOGIC MANAGEMENT INCLUDES:

- Bronchodilators
 - Short acting bronchodilators:
 - Metered dose inhaler (MDI)= Salbutamol inhaler: 2-3 puffs every hour and then tapered to 2 puffs every 4hrs.
 - Nebulization of salbutamol or combined salbutamol/ipratropium bromide solution.
 - Long-acting bronchodilators + ICS: should be continued if patient was using them and should be started at discharge if they were not being used.
- Corticosteroids
 - Only used when having a significant exacerbation (moderate or severe disease), as they may lead to development of pneumonia and sepsis
 - Can be given orally (prednisolone 40mg) or IV (hydrocortisone or methylprednisolone)

ORAL AND IV ROUTES ARE EQUIALLY EFFECTIVE

- Recommended for 5-7days only
- Antibiotics
 - Recommended for moderate to severe illness or when the sputum is purulent.
 - Antibiotics are usually given for 5-7days
 - The specific antibiotic given should depend on the sensitivity pattern of the hospital.
 - Commonly Amoxicilime/clavulanic acid, cefalosporins, quinolones or macrolids can be used.
 - Sputum culture is generally not helpful except in few conditions which may be associated with Gram negative infections like pseudomonas aeruginosa.
 - Patient has recurrent exacerbation.
 - Patient is on invasive mechanical ventilation.
- Oxygen therapy
 - Delivers a flow rate of <15L/min.
 - Source of oxygen can be a cylinder (>99% pure oxygen) or oxygen concentrator (90% oxygen, 10% nitrogen).
 - Titrated to achieve a saturation of oxygen of 88-90% to avoid oxygen induced hypercapnia.

REFERRAL

- Patients who need further therapy and optimization
- Those requiring
 - High flow oxygen
 - Non-invasive ventilation: BIPAP devices
 - Invasive Mechanical ventilation

Pregnant women who cannot avoid travel to a malarious area during pregnancy

- Mefloquine is relatively safe and can be used for prophylaxis
- Avoid doxycycline.
- Safety data on atovaquone-proguanil is limited.

A. Pediatrics:

- For infants < 5 kg of body weight and with uncomplicated *P. falciparum* malaria: Give Arthemete Lumfantrene (AL) as for children weighing 5 kg.
- Chloroquine is a safe drug that can be used in all children with only *P. vivax* infection.

CHAPTER 7

TYPHOID FEVER (ENTERIC FEVER)

BRIEF DESCRIPTION

- Typhoid fever (Enteric fever) is an acute febrile illness characterized by fever and severe systemic illness.
- The causative organism is *Salmonella enterica* serotype Typhi (formerly *S. typhi*).
- Other *Salmonella* serotypes like *S. enterica* serotypes Paratyphi A, B, or C, can cause a similar illness; however, differentiation is not easy but it is not clinically useful.
- Enteric fever is a collective term which refers to both typhoid and paratyphoid fever; however, the term enteric fever and typhoid
- Humans are the only reservoir for *S. Typhi*, the mode of transmission is via contaminated food or water.

Clinical features

- The clinical presentation of typhoid fever can vary from a mild to life threatening in severity.
- Fever is the most important clinical manifestations.
 - For consideration of typhoid fever there must be fever that lasted at least three days
 - The fever characteristically increases daily ("stepwise") reaching as high as in the forties ⁱⁿ degree celsius.
- Relative bradycardia (pulse-temperature): normal pulse rate in spite of high-grade fever may be observed.
- Other manifestations: headache, fatigue, malaise, loss of appetite, cough, constipation or mild diarrhea and skin rash or rose spots, hepatosplenomegaly.
- In the late courses of the disease the patient may develop neurologic manifestations

- “Typhoid encephalopathy”: altered consciousness, delirium, and confusion.
- Acute psychosis
- Meningeal signs
- Life threatening complications: intestinal perforations, gastrointestinal hemorrhages, and encephalitis.

Table 8.33: Case definitions of typhoid fever

Probable or Suspected case of typhoid fever	A patient with documented fever (38°C and above) for at least 5 days prior to presentation, with rising trend AND Having no other focus to explain the cause of the fever (e.g., malaria, meningitis, pneumonia, abscess, pyelonephritis etc.)
Confirmed case of typhoid fever	A patient with persistent fever (38°C or above) lasting 3 or more days and <i>S. Typhi</i> isolated on culture (blood, bone marrow culture, stool or urine)
Chronic carrier	An individual excreting <i>S. Typhi</i> in the stool or urine for longer than one year after a blood culture confirmed episode of typhoid fever.

INVESTIGATIONS AND DIAGNOSIS

- The criterion standard for diagnosis of typhoid fever has long been culture isolation of the organism. Cultures are widely considered 100% specific.
- CBC: Usually normal, mild anemia relative leucopenia and occasional thrombocytopenia may be observed
- Liver transaminase and serum bilirubin: usually rise mildly.

DIAGNOSIS

- Microbiologic diagnosis
- The definitive diagnosis of typhoid fever based on culture:
 - Blood culture: the mainstay for the diagnosis
 - Bone marrow culture: has the highest yield
 - Stool or urine cultures
 - Serological tests (Widal test)

- It is not recommended for diagnosis of typhoid fever.
- Based on studies done in different parts of Ethiopia the positive predictive value of the Widal test, among febrile patients with suspected typhoid fever is <6%. Hence, a positive or high titer Widal test is by in large a false positive.
- Clinical diagnosis: a patient with documented high-grade fever which is persistent, after exclusion malaria and other causes of fever should be suspected of fever.
- Wrong diagnosis (malpractice)
 - Testing for typhoid fever in patients with non-specific complaints such as headache, malaise, and arthralgia but without high grade fever is malpractice.
 - Diagnosis of typhoid fever based on a positive or high titer Widal test alone in patients without high grade fever is a malpractice.
 - Diagnosis of typhoid fever in patients with high grade fever with Widal test alone without excluding malaria, clinical evaluation and investigation for other cause of fever is malpractice.

TREATMENT OBJECTIVES

- Treat acute infection: decrease morbidity and mortality
- Prevent chronic carriage

Non pharmacologic

Symptomatic treatment:

- Use of antipyretics e.g., paracetamol to control fever, cooling

Pharmacologic treatment

First line

Table 8.34: Drug of choice for complicated and uncomplicated typhoid fever

Drug	First line	Alternative
Uncomplicated Typhoid fever	Ciprofloxacin 500mg P.O., BID for 7 - 10 days	Azithromycin 1 g orally once then 500 mg orally daily OR 1 g orally once daily for 5 to 7 days
Complicated/severe Typhoid fever	Ceftriaxone 2gm IV daily or 1 gm Iv BID OR in 2 divided doses I.M. OR I.V. for 10 to 14 days	Only if no alternative: IV Ciprofloxacin: 20 mg/kg per day in two divided doses (maximum 800 mg per day) then, Oral: 30 mg/kg per day in two divided doses (maximum 1000 mg per day)

ADJUNCT CORTICOSTEROID TREATMENT:

- Indications: Severe systemic illness (delirium, obtundation, stupor, coma, or shock)
- Dexamethasone (3 mg/kg sat, followed by 1 mg/kg every 6 hours for a total of 48 hours)

PREVENTION

- As enteric fever infects from the ingestion of contaminated food or water, sanitation and hygiene, access to clean water and careful consumption of non-cooked/raw foods is critical.
- Typhoid conjugate vaccine for infants and children six months or older is recommended by WHO in endemic areas like Ethiopia.

Special population considerations

- **Pregnant women:** Fluoroquinolone are contraindicated in pregnant mothers. Third generation cephalosporins should be used in pregnant mothers in place of fluoroquinolone or azithromycin.

CHAPTER 8

TUBERCULOSIS

DRUG SUSCEPTIBLE TUBERCULOSIS

BRIEF DESCRIPTION

- Tuberculosis is a chronic bacterial infection caused by a group of bacteria, *Mycobacterium tuberculosis complex*, the most common of which is *Mycobacterium tuberculosis*. Less frequently, it can be caused by *Mycobacterium bovis* and *Mycobacterium africanum*.
- Tuberculosis usually affects the lungs in which case it is called pulmonary TB.
- In addition to the lungs, any part of the body can be affected with this bacterium and in this case, it is called extra-pulmonary TB.
- Common extra-pulmonary sites affected include the lymph nodes, pleura, spine, urinary tract, the brain, joints, bone and abdomen.
- HIV infection is one of the most important risk factors for the development of active tuberculosis.

CLINICAL FEATURES

- The clinical features of tuberculosis depend on the specific organ affected.
- The clinical features can be grouped: general (non-specific) and organ specific

- The general symptoms of TB (pulmonary or extra-pulmonary):
 - Weight loss, fever, night sweats, loss of appetite, fatigue, malaise
 - Malnourished and chronically sick appearance
- Organ specific
 - Pulmonary tuberculosis
 - Cough that lasts for more than 2 weeks with or without sputum production
 - Chest pain
 - Hemoptysis
 - Shortness of breath
 - Tuberculous lymphadenitis
 - Slowly growing painless lymph node enlargement
 - Initially firm and discrete, later become matted and fluctuant.
 - Formation of abscesses and discharging sinuses, which heal with scarring.
 - Tuberculous pleurisy
 - Pleuritic chest pain (pain while breathing/coughing/sneezing)
 - Intermittent cough
 - Shortness of breath
 - Signs of pleural effusion (dullness, decreased/absent air entry and decreased tactile fremitus)
 - TB of bones and/or joints
 - Localized pain and/or swelling +/- discharge, stiffness of joints
 - Spine (TB spondylitis): localized swelling over the back(gibbus), back pain paralysis (weakness of the lower extremities)

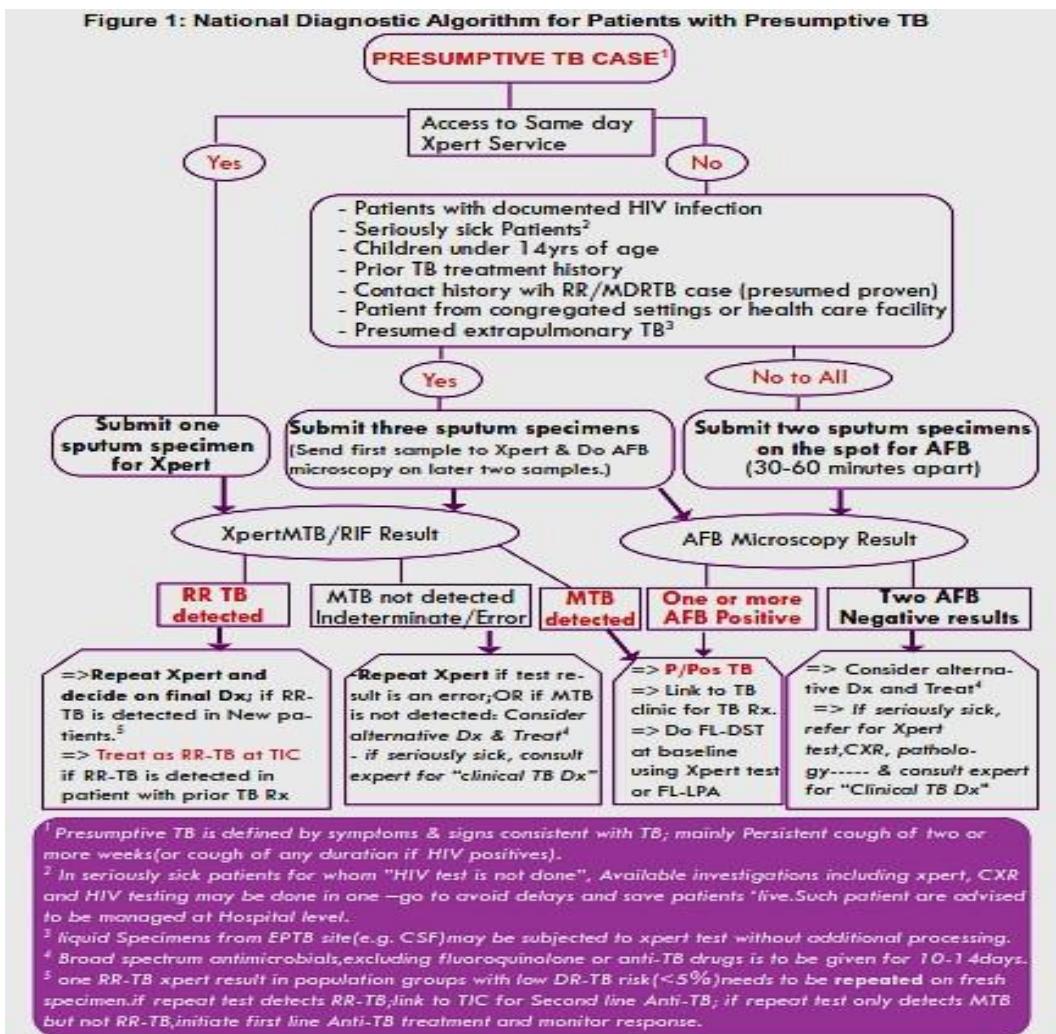
- Abdominal TB
 - Chronic non-specific abdominal pain with diarrhea or constipation,
 - Fluid in the abdominal cavity (ascites).
 - Mass (inflammatory mass) in the abdomen
- Tuberculous meningitis
 - Headache, fever, vomiting: insidious onset
 - Neck stiffness, impaired level of consciousness.
- Tuberculous pericarditis
 - Chest pain (pleuritic)
 - Shortness of breath
 - Pericardial friction rub or distant heart sounds

INVESTIGATIONS AND DIAGNOSIS

- The diagnosis of tuberculosis requires clinical suspicion and microbiologic identification of the bacilli.
- Microbiologic tests to identify the bacilli
 - **Sputum direct microscopy:** Ziehl Nielsen (acid fast bacilli) (**AFB**) staining
 - Three sputum specimens (SPOT-EARLY MORNING-SPOT) need to be collected and examined in two consecutive days
 - Result must be available on the second day.
 - **Gene Xpert MTB/RIF**
 - A fully automated DNA/molecular diagnostic test to detect TB and Rifampicin resistance simultaneously.
 - It is recommended as the initial diagnostic test for all persons being evaluated for TB.

- **Sputum culture and drug susceptibility**
 - Culture is the gold standard
 - It takes weeks to get the results.
 - If sputum AFB and/or Gene Xpert are negative and there is a strong suspicion, sputum culture can be sent to a referral laboratory. However, treatment for an alternative diagnosis or “clinical TB” should not be delayed.
- **Line Probe Assay(LPA)**
 - A test to identify the presence of specific mutations on the genes of TB bacilli which are responsible for Isoniazid and Rifampicin resistance.
 - It is a rapid and accurate test to identify cases with MDR-TB.
 - The test may be available in referral laboratory for patients suspected of MDR-TB.
- Body fluid analysis and identification of pathogen
 - Pleural fluid, ascitic fluid,CSF
 - Cell count with differential
 - Protein,glucose
 - LDH
 - Gene Xpert
 - Cytology (cytopathology)
- Fine needle aspiration and histopathologic examination: enlarged lymph nodes
- Tissue biopsy and histopathology: pleural, skin, endometrium, bronchial, colon/cecum, liver
- Imaging:

- Chest X-ray.
- Depending on the suspected extra pulmonary sites other imaging modalities may be needed: abdominal ultrasound, brain/spinal MRI, Joint/bone X-ray, image guided FNA or biopsy
- Other investigation: HIV test, CBC, ESR, CSF analysis



Case definitions

- **A case of tuberculosis:** is a definite case of TB or a patient whom an experienced health worker has diagnosed TB and has decided to treat the patient with a full course of TB treatment.
- **A definite/proven case of tuberculosis** is a patient with either of the following
 - Two sputum smears (one sputum positive is enough for HIV positive patients)

OR
 - Sputum culture positive for *Mycobacterium tuberculosis*.

OR
 - *Mycobacterium tuberculosis* is identified from a clinical specimen, either by culture or by a newer molecular technique.

TREATMENT OF DRUG SUSCEPTIBLE TB

Objectives

- Cure
- Prevent death from active TB or its late complications
- Restore quality of life and productivity
- Decrease transmission
- Prevent relapse
- Prevent the development and transmission of medicine resistance

Non pharmacologic

- Counseling: adherence, the nature of treatment, contact screening
- Good nutrition
- Adequate rest

- Admission for severely ill patients e.g., Tb meningitis, pericarditis

Pharmacologic

- Standardized combination treatment: all patients in a defined group receive the same treatment regimen.
- A combination of 4 or more anti-TB medicines.
- Directly observed treatment (DOT)

First line anti-TB Medicines

- The first line anti-TB medicines available for TB treatment in Ethiopia are:
 - Rifampicin (R):** the most bactericidal and potent sterilizing agent
 - Isoniazid (H):** highly bactericidal especially in the first few days
 - Pyrazinamide (Z):** only active in acidic environment and bacilli inside macrophages
 - Ethambutol (E):** bacteriostatic and effective to prevent drug resistance when administered with other potent drugs

Table 8.64: The essential anti-TB drugs and their dose recommendations

Recommended adult dose and children \geq 25 kg body weight		First line TB drugs	Recommended pediatric dose	
Daily dose (mg/kg weight)	Maximum (mg)		Daily dose (mg/kg weight)	Maximum (mg)
5 (4-6)	300	Isoniazid (H)	10 (7-15)	300
10 (8-12)	600	Rifampicin (R)	15 (10-20)	600
25 (20-30)	2,000	Pyrazinamide (Z)	35 (30-40)	-
15 (15-20)	1,600	Ethambutol (E)	20 (15-25)	-

- Standardized first line treatment regimen for new drug susceptible (presumed to be drug susceptible) tuberculosis
 - New pulmonary TB (PTB) patients presumed or known to have drug-susceptible TB
 - New extrapulmonary TB (EPTB) patients
 - Standardized regimen: 6 months total (2 months intensive and 4 months continuation phase) 2RHZE/4RH
 - Intensive phase: 2 months Rifampicin, Isoniazid, Pyrazinamide & Ethambutol (2RHZE)
 - Continuation: 4 months Rifampicin and Isoniazid (4RH)

Table 8.65: First line TB treatment adult and pediatric dosing chart using body weight bands

Adult and pediatric ≥ 25 kg weight			Pediatrics			
Patient weight band (kg)	Regimen and dose in two phases		Daily dose (mg/kg weight)	Regimen and dose in two phases		
	Intensive: 2(RHZE)	Continuation: 4(RH)		Intensive: 2(RHZ E)	Continuation: 4(RH)	RHZ75/50/150
20-29	1 1/2	1 1/2	4-7kg	1	1	1
30-39	2	2	8-11kg	2	2	2
40-54	3	3	12-15kg	3	3	3
≥ 55	4	4	16-24kg	4	4	4

- Previously treated TB patients presumed or known to have drug-susceptible TB
 - In all previously treated TB patients who require re-treatment, specimen for rapid molecular-based drug susceptibility testing for first line TB

drugs should be obtained at or before the start of treatment.

- While awaiting the result, the standard first line treatment regimen is recommended: 2(RHZE)/4(RH)
- A “retreatment regimen” with addition of streptomycin **is not recommended**.
- **Patients who presented with is for patients activeTB after known contact with a patient documented to have drug-resistant TB**
 - Sample should be sent for rapid Drug Susceptibility Test (DST)
 - Treatment should be decided based on rapid DST result.
 - While awaiting DST result, the patient may be initiated treatment with the regimen based on the DST of the presumed source case.
- **Extended continuation phase**
 - The following extrapulmonary forms of Tb require prolonged continuation phase
 - CNS (TB meningitis or Tuberculoma)
 - Bone or joint TB (Vertebral (TB spondylitis), joint and osteomyelitis), which require prolongation of the continuation phase for
 - Regimen (a total of 12 months: 2months intensive phase and 10 months continuation phase);2RHZE/10RH
- **Adjuvant corticosteroid therapy**
 - Adjuvant corticosteroid therapy, dexamethasone or prednisolone tapered over 6-8weeks should be used for patients with the following two extrapulmonary forms
 - TB meningitis
 - TB pericarditis

Table 8.66: Prednisone dose for adult TB patients with TB pericarditis

Weeks of treatment	Prednisolone dosage
1-4	60mg/day
5-8	30mg/day
9-10	15mg/day
11 th week	5mg/day (then discontinue at end of 11 th week)

- **Corticosteroid for TB meningitis**

- Dexamethasone 12 mg/day OR Prednisolone 60mg/day for 3 weeks and then decreased gradually during the subsequent 3 weeks.

MONITORING OF PATIENTS ON TREATMENT

- **Clinical monitoring:** during scheduled visit, a patient receiving anti-TB treatment should be checked for the following
 - Persistence or reappearance of clinical feature of TB
 - Weight monitoring: weight is a useful indicator of clinical improvement especially in children and should be monitored monthly.
 - Occurrence of Adverse drug reaction
 - Development of TB complications.
 - Adherence: by reviewing the “treatment supporter card” or UNIT TB register
 - Risk for drug resistance, and need for drug susceptibility testing screening
 - Unsatisfactory response to treatment beyond two months of treatment should alarm the possibility of drug resistance or alternative diagnoses.

- **Bacteriologic monitoring for initially bacteriologically confirmed pulmonary TB**
 - Sputum AFB (direct microscopy) should be done at end of 2nd, 5th and 6th month of therapy.
 - Molecular technique like Gene Xpert MTB/RIF cannot be used to monitor treatment as the technique may give false positive result by identifying dead bacilli.
 - If AFB positive at the end of second month: send sputum sample for Xpert and line probe assay (LPA) for DST.
 - If at least Rifampicin sensitive: continue to the continuation phase.
 - If Rifampicin resistance: Mark as Rifampicin-resistant Tb (RR- TB) and the outcome is labelled as “MDR TB”. Treatment will be started as MDR-TB.
 - If AFB is positive at the end of 5th or 6th month: the outcome is treatment failure. DST testing and treatment will proceed as MDR-TB suspect.
- **Management of adverse reaction to First line Anti-TB drugs**
 - Health workers should regularly monitor for occurrence of side effects to the Anti-TB drugs administered to the patient.

Table 8.67: Adverse reactions and drug interactions of first line TB medicines

Medicine	Adverse reaction	Drug interactions
Isoniazid (H)	Skin rash, Sleepiness and lethargy, Peripheral neuropathy (paresthesia, numbness and limb pain), Hepatitis. Rare: Convulsions, pellagra, arthralgia, anemia, lupoid reactions	Al(OH)3 decreases its absorption INH inhibits metabolism of phenytoin, diazepam carbamazepine and warfarin hence increases the serum concentrations
Rifampicin (R)	Gastrointestinal reactions (abdominal pain, nausea, vomiting), Hepatitis, Generalized cutaneous reactions, Thrombocytopenic purpura. Rare: Osteomalacia, pseudomembranous colitis, acute renal failure, shock, hemolytic anemia	Increase metabolism of warfarin, corticosteroids, antifungal agents, protease inhibitors, non- nucleoside reverse transcriptase inhibitors, oral hypoglycemic agents, oral contraceptives hence reduces serum levels of these medicines
Ethambotol (E)	Retrobulbar/Optic neuritis, (impairment of vision, red-green blindness, blurring) Rare: Generalized cutaneous reactions, arthralgia, peripheral neuropathy	
Pyrazinamide (Z)	Arthralgia, Hepatitis; Rare: Gastrointestinal reactions, cutaneous reactions, sideroblastic anaemia	

Table 8.68: Symptom based approach to the management of An-ti-TB medicines induced adverse effects

	Adverse-effects	Responsible Medicines	Management
Minor (Continue Anti-TB medicine/s)	Anorexia, nausea, abdominal pain	Rifampicin; Pyrazinamide	Give tablets with small meals or before bed-time
	Joint pains	Pyrazinamide	NSAIDs
	Burning sensation in feet	Isoniazid	Pyridoxine 100mg daily
	Orange/red urine	Rifampicin	Reassurance
Major (Stop the responsible medicine/s)	Itching, skin reaction	Rifampicin or Isoniazid	Stop and replace with ethambutol; Stop, then reintroduce with desensitization
	Jaundice; hepatitis	Most anti-TB medicines (R, H,Z)	Stop all anti-TB medicines and refer
	Vomiting and confusion	Most anti-TB medicines	Stop all anti-TB medicines and refer
	Visual impairment	Ethambutol	Stop Ethambutol and refer
	Shock, purpura and acute renal failure	Rifampicin	Stop Rifampicin and refer

- **Treatment of patients with renal failure:**
 - In patients with estimated GFR <30ml/min or those on dialysis the dose of Ethambutol and Pyrazinamide need to be reduced from daily to three times per week.
 - Rifampicin and Isoniazid do not need adjustment in patients with renal failure.
 - To reduce Ethambutol and Pyrazinamide without reducing Rifampicin and Isoniazide make using the available fixed drug combinations, use the following regimen.
 - Intensive phase: RHZE three days per week and RH the remaining four days(for 2 months)
 - Continuation phase: RH daily
- **Treatment of patients with (previously known) liver disorder (e.g. hepatitis, cirrhosis):**
 - Most anti-TB medicines can cause liver damage.
 - Do not give Pyrazinamide.

- Isoniazid & Rifampicin plus one or two non- hepatotoxic medicines (Ethambutol and/or Streptomycin) can be used, for a total duration of eight months: 2SERH/6RH
- If the patient has severe liver damage or jaundiced: Streptomycin plus Isoniazid plus Ethambutol in the initial phase followed by Isoniazid & Ethambutol a total duration of 12 months: **2 SHE /10 HE.**
- **Treatment during pregnancy and breast-feeding**
 - Avoid Streptomycin because of the risk of toxic effects on the fetus.
 - Other medicines should not be discontinued during pregnancy or breast-feeding.
 - When a breast-feeding mother has PTB, the infant should, regardless of prior vaccination with BCG, be given chemo-prophylaxis and get BCG vaccination, if not previously vaccinated.
- **Treatment of patients also infected with HIV**
 - All patients with HIV and active TB who are not on ART should be started on ART as described below:
 - CD4 <50 cells/mm³: Initiate ART within 2 weeks of starting TB treatment
 - CD4 counts ≥50 cells/mm³: Initiate ART within 8 weeks of starting TB treatment.
 - During pregnancy, regardless of CD4 count: Initiate ART as early as feasible, for to prevent HIV transmission to the infant (AIII).
 - With **tuberculous meningitis**: Initiate ART after 8 weeks of TB treatment.
 - Rifampicin can interact certain ARVs, particularly, some protease inhibitors; hence, drug interaction should be checked.

DRUG RESISTANT TB

BRIEF DESCRIPTION

- TB is considered drug-resistant (DR) when the causative agent (*mycobacterium tuberculosis*) is not killed by one or more of the available anti-TB medicines.
- Medicine- resistant TB can be primary or secondary (acquired).
- Primary resistance is medicine resistance among new cases i.e. persons who have never been previously treated for TB.
- Secondary resistance is medicine resistance among previously treated individuals.
- There are five different types of medicine resistance:
 - Mono-resistance: Resistance to one anti-tuberculosis medicine.
 - Poly-resistance: Resistance to more than one anti-tuberculosis medicine, other than Isoniazid and Rifampicin.
 - Multidrug-resistance (MDR)-TB: Resistance to at least isoniazid and rifampicin, two most important first-line drugs.
 - Extensive drug-resistance (XDR-TB): Resistance to any of the fluoroquinolones, and at least one of the injectable Second Line Medicines (capreomycin, kanamycin and Amikacin), in addition to resistance to INH and rifampicin.
 - Since XDR-TB progresses from MDR-TB in two steps, the term “pre-XDR-TB” was introduced to recognize MDR-TB with additional resistance to either one but not both of these classes of medicines.

- Total drug-resistance (TDR-TB): resistance to all anti TB medicines. The clinical features of medicine susceptible and medicine resistant TB are the same.

INVESTIGATION AND DIAGNOSIS

- Direct smear microscopy
- Gene Xpert MTB/RIF test
- Line Probe Assay (LPA) directly from the sputum specimen or cultured sample
- Culture and Drug Susceptibility Test (DST)
- The definitive diagnosis of medicine-resistant TB depends on laboratory diagnosis through Medicine Susceptibility testing (DST); it requires that M.tuberculosis is isolated and medicine susceptibility test is completed.
- Other investigations: Chest X-ray, HIV test, CBC, urinalysis, FBS, LFT, RFT, Serum electrolyte, TSH, HCG, Audiometric test.

TREATMENT OF MDR-TB

Objectives

- Cure the TB patient and restore quality of life and productivity
- Prevent death from active TB or its late effects
- Prevent TB relapse
- Prevent the development and transmission of extensive medicine resistance
- Decrease transmission

Non pharmacologic

- Surgery (see the adjunct therapies section below)
- Adherence counseling
- Psychosocial and emotional support

- Nutritional support

Pharmacologic

- **Treatment of isoniazid monoresistant TB**
 - Rifampicin, Ethambutol, Pyrazinamide and Levofloxacin for duration of 6 months.
- **Treatment of Rifampicin resistant or Multi drug resistant TB (RR/MDR-TB)**
 - Treatment with second-line TB regimens.
- **Recommended MDR-TB treatment approach**
 - **Standardized treatment approach:** a pre-defined shorter treatment regimen (STR) once the diagnosis of RR-/MDRTB is confirmed using rapid first line DST techniques (i.e., Xpert MTB/RIF or LPA).
 - **Individualized treatment approach:** a regimen tailored to the individual patient when they do not meet the preset criteria to receive the standardized shorter treatment regimen.
 - **Patients who are not eligible for standardized shorter treatment regimen**
 - Confirmed resistance to a medicine in the shorter MDR-TB regimen
 - Exposure to one or more second-line medicines in the shorter MDR-TB regimen for >1 month (unless susceptibility is confirmed)
 - History of Pre-XDR-TB or XDR-TB
 - Intolerance to medicines in the shorter MDR-TB regimen or risk of toxicity
 - Fluoroquinolone resistance
 - Pregnancy

- Extensive pulmonary TB or severe extrapulmonary TB like CNS TB.
 - Any extrapulmonary disease in people living with HIV
- One or more medicines in the shorter MDR-TB regimen not available **General principles for the use the standardized shorter treatment regimen**
 - Intensive phase: Seven agents administered together for up to 4-6 months
 - Continuation phase (CP): four agents for a fixed duration of 5 months.
 - The “core drugs”: Bdq, Mfx, Cfz, and Pto, while Z, E and H are considered as add-on components of the STR.
 - Intensive phase (IP) consists of Bdq, Mfx, Cfz, Z, E, HH, and Pto administered for 4 to 6 months (Bdq better given for 6 months).
 - The continuation phase (CP) consists of Mfx, Cfz, E, and-Z for the fixed duration of 5 months.
 - The regimen: 4 Bdq -Mfx-Pto-Cfz-Z-HH-E / 5 Lfx-Cfz-Z-E
 - Intensive phase may be prolonged up to six months, if the patient remains smear positive after month four of treatment.
- **Individualized DR-TB regimens**
 - For patients for whom the standardized regimens cannot be initiated or cannot be continued with it for clinical reasons or as a result of DST results.
 - It is often needed to be adjusted based on patient clinical history, once additional history or when DST results becomes available.
 - Indications for use of individualized treatment regimens
 - Presumed or confirmed PreXDR-/XDR-TB
 - Known contact with patient failing second line treatment
 - Pregnancy

- Disseminated, meningeal or central nervous system TB
- Any extrapulmonary TB in people living with HIV
- Laboratory evidence of resistance to quinolone or injectable and/or other agents,
- Occurrence of severe drug toxicities,
- Failure of standardized DR-TB treatment
- Re-treatment after treatment interruption beyond eight consecutive weeks o
- Risk of intolerance because of possible serious drug-drug interactions
- Severe adverse drug reactions to core drugs used in regimen

Table 8.69: Constructing individualized treatment regimen (see the step wise approach below)

Steps to Design individualized MDR Treatment Regimen	
Step I	<p>Choose one later generation fluoroquinolone (Levofloxacin or Moxifloxacin)</p> <ul style="list-style-type: none"> • Ofloxacin susceptibility is routinely done. In addition to ofloxacin, every attempt should be made to determine susceptibility to moxifloxacin and Levofloxacin • If only ofloxacin DST is known (and resistant) use Levofloxacin unless thought to be compromised (e.g., previous fluoroquinolone use); Moxifloxacin should be a last resort.

Step 2	Choose both of these prioritized drugs: Bedaquiline (Bdq) and Linezolid (Lzd) <ul style="list-style-type: none"> • If a drug is considered to have induced severe toxicity, do not include it in the regimen • Bdq is strongly recommended for adults >18 years, also can be used for 6–17 years.
Step 3	Choose both of these prioritized drugs: Clofazimine, Cy-closerine/terizidone <ul style="list-style-type: none"> • If a drug is considered not to be effective or it has induced severe toxicity, do not include it in the regimen • If effectiveness is difficult to judge, the drug can be added to the regimen, but should not be counted as one of the effective agents.
Step 4	Choose one of the injectables (Amikacin (Amk) or streptomycin (S)) <ul style="list-style-type: none"> • If a regimen cannot be assembled with five effective oral drugs outlined in step 1 to 3, and if the isolate is susceptible to the injectable, use Amikacin for adults aged >17 years. • Streptomycin is an alternative under similar conditions. Ototoxicity should be closely monitored. • If resistant to all injectable drugs, do not include injectable.
Step 5	If needed or if oral agents preferred over injectables in Step 4, use the following drugs: Delamanid, Pyrazinamide, Ethambutol <ul style="list-style-type: none"> • Use pyrazinamide and ethambutol only when the isolate is documented as susceptible

Step 6	<p>Other SL agents</p> <ul style="list-style-type: none"> • Ethionamide (Eto) or prothionamide (Pto) • Imipenem–cilastatin or meropenem with clavulanate (IV route), • p-Aminosalicylic acid • High-dose isoniazid <ul style="list-style-type: none"> ○ Add drugs thought to meet the criteria of an effective drug and do not induce severe toxicity ○ If effectiveness is difficult to judge, the drug can be added to the regimen, but should not be counted as one of the effective drugs. ○ Ethionamide or prothionamide and/or p-aminosalicylic acid may be included in longer regimens only if bedaquiline, linezolid, clofazimine or delamanid are not used or if better options are not possible. ○ Mutations in the inhA region of the M.tuberculosis genome can confer resistance to Eto/Pto and INH. In this situation, ethionamide/prothionamide may not be a good choice.
None	The following drugs are no longer recommended for inclusion in individualized MDR-TB regimens: Capreomycin and kanamycin; Amoxicillin/clavulanate (when used without a carbapenem); Azithromycin and clarithromycin; thioacetazone; gatifloxacin; perchlozone, interferon gamma or sutezolid

- **Extra pulmonary and central nervous system drug resistant TB**
 - The same strategy and duration of treatment as pulmonary drug-resistant TB with the only exception of CNS involvement.

- The treatment of drug resistant tuberculous meningitis should be guided by drug susceptibility results and the drugs to penetrate the central nervous system.
- The treatment duration in meningitis: a minimum of 20 months,

Table 8.70: Penetration of Anti-TB Drugs in Cerebrospinal Fluid

CNS Penetration level	Anti-TB drugs
Good penetration	Isoniazid, rifampicin, pyrazinamide, ethionamide, prothionamide, cycloserine, linezolid, imipenem, meropenem.
Penetration only through inflamed meninges	Aminoglycosides (streptomycin, kanamycin, amikacin), Fluoroquinolones (moxifloxacin, or levofloxacin.)
Poor or no penetration	Ethambutol, PAS
No or little data	Capreomycin, clofazimine, bedaquiline, Delamanid.

• **Treatment of MDR-TB in Special populations**

○ **HIV Infection**

- Higher pill burden, drug-drug interactions, immune reconstitution inflammatory syndrome pose unique challenges Drug interactions between antiretroviral and anti-TB agents:
- Efavirenz can produce a decrease in serum bedaquiline concentrations, avoid this combination.
- Protease inhibitors can result in increased serum bedaquiline levels.
- Check for overlapping toxicities and drug-drug interaction.

○ **Pregnant women**

- Treating MDR-TB during pregnancy outweighs the harm of not treating to mother, child, and the community.

- Most of the drugs are pregnancy category C, Bedaquiline and meropenem, are category B, and aminoglycosides are category D
 - Aminoglycosides and ethionamide can be avoided
- **Pyridoxine supplementation**
 - Pyridoxine (Vitamin B6) supplementation for all patients and for the period of the whole treatment duration.
 - For patient receiving the shorter standardized regimen: pyridoxine 25 to 50mg tablet.
 - Patients receiving cycloserine containing regimens receive 50mg of pyridoxine for every
- **Adjunct therapy**
 - Corticosteroids
 - Beneficial as an adjunctive therapy in DR-TB patients with severe respiratory insufficiency, central nervous system or pericardial involvement.
 - Prednisone is commonly used, started at approximately 1 mg/kg of body weight with gradual tapering dosage after one to two weeks.
- **Surgery in treatment of drug-resistant TB**
 - Emergency indication: Severe hemoptysis and tension spontaneous pneumothorax.
 - Urgent indication: recurrent hemoptysis that cannot be stopped by other treatment methods.
 - Elective indications: Localized cavitary TB with positive sputum after 4-6 months, M/XDR-TB characterized by failure of anti-TB chemotherapy, local complications and sequelae
- **Monitoring patient response to MDR-TB treatment using culture**
 - Treatment response should be monitored clinically, radiographically, and bacteriologically.

- Sputum smear microscopy and culture monthly.
- When cultures remain positive after 3 months of treatment, do drug susceptibility tests
- **Care and support for patients with MDR/RR-TB**
 - Health education and counselling on the disease and treatment adherence.
 - One or more of the following treatment adherence interventions (complementary and not mutually exclusive) may be offered to patients
 - Tracers and/or digital medication monitor;
 - Material support to the patient
 - Psychological support to the patient
 - Staff education.
- **Treatment of Contacts Exposed to MDR-TB**
 - For close contacts with presumed MDRTB latent infection, give 6 to 12 months treatment with a fluoroquinolone alone or with a second drug, on the basis of source-case isolate DST.
 - Pyrazinamide should not be used as the second drug.

Table 8 . 7 I : Symptom based approach to the management of 2nd line Anti-TB medicines induced adverse-effects

ADR	Suspect-ed agent	Management	Remarks
Nausea (N), vomiting (V)	Eto/Pto, PAS, H, E, Z, Cfz	<p>1. Assess for dehydration; and rehydrate if indicated.</p> <p>2. If mild symptoms and no signs of dehydration,</p> <ul style="list-style-type: none"> ○ Advise patient to take medicines with porridge. ○ Initiate antiemetic therapy if needed (Metoclopramide) ○ Encourage patient to continue treatment ○ Encourage patients to increase fluid intake(water, juice, tea) <p>3. If there is dehydration or persistence of symptoms,</p> <ul style="list-style-type: none"> · Initiate rehydration accordingly · Refer patient to treatment initiating center 	<p>1. N and V are very common in early weeks of therapy and usually abate with time and adjunctive therapy.</p> <p>2. Electrolytes should be monitored and replaced if vomiting is severe.</p> <p>3. Reversible upon discontinuation of suspected agent.</p> <p>4. Clofazimine can cause severe abdominal pain and acute abdomen. This is rare, but if occurs, clofazimine should be suspended.</p>

Gastritis	PAS, Eto/ Pto	<ol style="list-style-type: none"> 1. Give antiTb medicines with small food, avoid caffeine, cigarettes and assess for signs of severity 2. If mild symptoms give H2-blockers, proton-pump inhibitors, or antacids. 3. If severe (severe persistent dyspepsia, hematemesis/coffee ground vomitus, black tarry stool, initiate rehydration and refer). 	<ol style="list-style-type: none"> 1. Severe gastritis, as manifested by haematemesis, melaena or haematechezia, is rare. 2. Dosing of antacids should be carefully timed so as to not interfere with the absorption of antituberculosis medicines (take 2 hours before or 3 hours after antituberculosis medications). 3. Reversible upon discontinuation of suspected agent(s).
Hearing loss	Km,Am, Cm	<ol style="list-style-type: none"> 1. Confirm that this is not due to ear wax or other conductive problems. 2. Check whether patient has history of hearing loss previously 3. Document hearing loss and compare with baseline audiology if available. 4. Refer if it is new event or worsening of complaint. 	<ol style="list-style-type: none"> 1. Patients with previous exposure to aminoglycosides may have baseline hearing loss. In such patients, audiology may be helpful at the start of MDR-TB therapy. 2. Hearing loss is generally not reversible. 3. The risk of further hearing loss must be weighed against the risks of stopping the injectable in the treatment regimen. 4. While the benefit of hearing aids is minimal to moderate in auditory toxicity, consider a trial use to determine if a patient with hearing loss can benefit from their use

<p>Electrolyte disturbance (Low K&Mg) Manifesting as fatigue, muscle cramp, muscle spasm</p>	<p>Cm, Km, Am,</p>	<ol style="list-style-type: none"> 1. Check potassium (if available). 2. If potassium is low also check magnesium (& calcium if hypocalcemia is suspected). 3. Initiate potassium supplement if $K+ > 3.0\text{meq/L}$ and monitor Potassium weekly 4. Correct if there are contributing causes of hypokalemia (Vomiting, diarrhea) 5. Refer if $K+ < 3.0\text{meq/L}$ 	<ol style="list-style-type: none"> 1. If severe hypokalemia is present, consider hospitalization. 2. Amiloride 5–10 mg QD or Spironolactone 25 mg QD may decrease potassium and magnesium wasting and is useful in refractory cases. 3. Oral potassium replacements can cause significant nausea and vomiting. Oral magnesium may cause diarrhea.
<p>Peripheral neuropathy</p>	<p>Cs, H, Km, Am, Cm, Eto/ Pto</p>	<ol style="list-style-type: none"> 1. Increase pyridoxine to maximum daily dose (200 mg per day). 2. Initiate therapy with tricyclic antidepressants such as amitriptyline. Non-steroidal anti-inflammatory medicines or acetaminophen may help alleviate symptoms. 3. If no improvement, refer. 	<ol style="list-style-type: none"> 1. Patients with co-morbid disease (e.g., diabetes, HIV, alcohol dependence) may be more likely to develop peripheral neuropathy, but these conditions are not contraindications to the use of the agents listed here. 2. Neuropathy may be irreversible; however, some patients may experience improvement when offending agents are suspended

Seizure	Cs, H, FQs	<ol style="list-style-type: none"> 1. Suspend suspected agent pending resolution of seizures. 2. Initiate anticonvulsant therapy (e.g., Phenytoin, Valproic Acid). 3. Increase pyridoxine to maximum daily dose (200 mg per day). 4. Refer after controlling seizure 	<p>1. Anticonvulsant is generally continued until MDR-TB treatment is completed or suspected agent discontinued.</p> <p>2. History of previous seizure disorder is not a contraindication to the use of agents listed here if a patient's seizures are well controlled and/or the patient is receiving anticonvulsant therapy?</p> <p>3. Patients with history of previous seizures may be at increased risk for development of seizures during MDR-TB therapy a contraindication to the use of the agents listed but may increase the likelihood of depression developing during treatment.</p>
Hypothyroidism (swelling, slowing, fatigue, day time sleepiness)	PAS, Eto/ Pto	<p>Check TFT if available to confirm, Refer to TIC</p>	<p>1. Completely reversible with discontinuation of the medicine More frequent with combination medicine therapy</p>
Blurring of vision	E, Eto	Refer	
Arthralgia	Z, FQ	<ol style="list-style-type: none"> 1. Initiate therapy with NSAIDs (e.g Ibuprofen) 2. Refer if severe or no improvement. 	

CHAPTER 9

GLOMERULAR DISEASES

I. NEPHRITIC SYNDROME:

ACUTE GLOMERULONEPHRITIS (AGN) AND RAPIDLY PROGRESSIVE GLOMERULONEPHRITIS (RPGN)

BRIEF DESCRIPTION

- Acute glomerulonephritis (**AGN**) and rapidly progressive glomerulonephritis (**RPGN**) are important causes of acute kidney injury. in that they have clearly identifiable clinical features and can rapidly progress to end stage renal disease.
- AGN and RPGN present more or less in a similar fashion. Their presentation is commonly described as the **nephritic syndrome**.
- The clinical difference between AGN and RPGN: It is not easy to clinically differentiate between the two.
 - In RPGN: The kidney function keeps of deteriorating over days to weeks, unless treated. It progresses to end stage renal disease unless treated early.
 - In infection related AGN: The kidney function usually improves.
- The most common causes of self-limiting AGN are bacterial infections (also called infection related glomerulonephritis).
- As opposed to pediatric AGN, where the commonest cause is streptococcal infection of the skin or the throat, adult AGN can occur following any bacterial infection at any site.
- The most important causes of RPGN are autoimmune diseases: SLE (systemic lupus erythematosus), systemic small vessel vasculitis (ANCA-vasculitis), antibody direct to glomerular basement membrane (Anti-GBM disease).
- The histopathologic finding in both AGN and RPGN is described as diffuse proliferative glomerulonephritis and crescentic glomerulonephritis respectively.

CLINICAL FEATURES

Symptoms and signs

- **Clinical features of the AGN/RPGN: the nephritic syndrome**
 - Acute onset body swelling (Edema) and shortness of breath
 - Decreased urine amount (oliguria)
 - Reddish urinary discoloration (typically tea or cola colored urine)
 - High blood pressure
- **Clinical features of suggesting the underlying causes (systemic diseases)**
 - Hair loss/diffuse non-scarring alopecia – SLE
 - Malar rash, photosensitive rash, non-pruritic rash over the body– SLE
 - Joint pain, evidence of arthritis (swelling and tenderness of joints) – SLE
 - Hemoptysis, cough and dyspnea – Vasculitis, Anti-GBM disease or pulmonary edema
 - Petechiae/purpura – Vasculitis or SLE
 - Pleural effusion – Part of the complication or SLE associated
 - Pericarditis (friction rub or distant heart sound) – SLE or uremic pericarditis
 - Cardiac murmurs – Infective endocarditis or SLE
 - Focal neurologic deficit – SLE (Lupus cerebritis) or vasculitis
- **Clinical features related to marked decrement in the kidney function**
 - Pulmonary crackles – pulmonary congestion
 - Nausea and vomiting – uremic gastropathy
 - Change in mental status – uremic or hypertensive encephalopathy

- Mucocutaneous bleeding – uremic bleeding

DIAGNOSIS AND INVESTIGATIONS

Diagnosis

- The diagnosis of AGN or RPGN should be made clinically in any patient presenting with the nephritic syndrome (acute onset body swelling, tea/ cola colored urine, oliguria, and high BP)
- Further investigations are needed for three purposes: For confirming the nephritic syndrome, for identifying possible etiologies, and complications.

INVESTIGATIONS

- **Investigation for evidencing the presence of the nephritic syndrome (AGN/RPGN)**
 - **Urinalysis:**
 - Hematuria and proteinuria
 - The RBCs in the urinalysis: Significant proportion are dysmorphic
 - RBC casts: may or may not be present. Their presence is not mandatory for diagnosis)
 - **24hour urine protein:** above 500mg (usually $>1000\text{mg}$), it can sometimes be nephrotic range($>3000\text{mg}$)
 - **Serum creatinine and urea**
- **Investigations for assessing potential complications**
 - **Serum electrolytes:** particularly serum potassium (to look for hyperkalemia).
 - **Chest X-ray:** for evidence of pulmonary edema or pleural effusion.
- **Investigations for identifying possible etiology**
 - **Basic serologies: to be done at initial evaluation**
 1. **Anti-streptolysin titer (ASO):** For preceding streptococcal infection

- It may be falsely low or negative in patients with skin infections.
- It remains a useful test in those with pharyngitis but antibiotics may decrease the titer

2. The streptozyme test

- It is a much better than ASO alone (has high sensitivity and specificity) for checking a preceding streptococcal infection.
- Hepatitis B (HBV) and C (HCV) serology: HBSAg and HCV antibody.
- HIV screening
- ANA (anti-nuclear antibody)
- **Additional important diagnostic investigations:** to be ordered by specialist who would decide on definitive management
 - Anti-double strand DNA antibody(anti-dsDNA)
 - Anti-neutrophil cytoplasmic antibody test (ANCA)
 - Anti-glomerular basement antibody (Anti-GBM antibody)
 - Serum complement level (complement -3 and 4/C3 and C4 levels)
 - Renal biopsy
- **Investigation for looking evidence of chronicity**
 - **Abdominal ultrasound:** bilateral small kidneys in adults (<9cm longitudinally) indicate chronic kidney disease. Normal or increased kidney size can be found in both acute and chronic glomerular diseases.

TREATMENT

Non-pharmacologic treatment

- Salt and fluid restrictions
- Dialysis: if there are indications (see the topic acute kidney injury for indications)

PHARMACOLOGIC TREATMENT

Supportive (symptomatic) management

- **Loop diuretics**
 - **Oral Furosemide:**
 - For patients with mild peripheral edema.
 - Starting dose 40mg PO BID.
 - Follow every 2-3 days, increase the dose to higher dose (Maximum dose 600mg/day) or admit for IV diuresis, if response is suboptimal or there is worsening.
 - **IV Furosemide:**
 - For patients with pulmonary congestion or severe edematous state
 - Start with 40mg IV, stat. See response every 2 hours. If urine output of 150ml and above is achieved in 2 hours and give the 40mg IV BID or TID.
 - If urine output is <150ml in 2hours, increase the dose by 40mg and reassess the urine output in another 2 hours.
 - Give the dose which resulted in adequate once diuresis (>150ml/2hour) as standing e.g. 80mg or 120 IV BID or TID. Maximum bolus dose 200mg.
 - IV Furosemide above 100mg should be given slowly (over 15-20minutes)
 - **Avoid prophylactic potassium tablet or spironolactone:** due to the risk of hyperkalemia in patients with AGN/RPGN.
- **Antihypertensives**

- **Loop diuretics** are the preferred Antihypertensives: see above on diuretic
- **Additional Antihypertensive:** If BP is not well controlled with loop diuretics alone
 - **Add Calcium channel blocker on loop diuretics:**
 - ✓ **Amlodipine** 5-10mg PO once daily
 - OR**
 - ✓ **Nifedipine** 20-40mg PO BID.
 - **If a third agent is needed** (on top of Furosemide and Calcium channel blocker combination) add a beta-blocker:**Alterantaives**
 - ✓ **Carvedilol** 6.25 to 25mg BID
 - ✓ **Bisoprolol** 2.5 to 10mg/day or
 - ✓ **Metoprolol** 25-100mg/day or
 - ✓ **Atenolol** 25-100mg/day
 - **Avoid ACE inhibitors, Angiotensin receptor blockers (ARBs):** due to the risk of hyperkalemia and potential for deterioration in kidney function.
 - **Avoid Spironolactone** in patients with AGN/RPGN: due to risk of hyperkalemia and worsening kidney function.
- **Management of hyperkalemia**
 - Start shifting treatment with regular insulin < if serum potassium is >6.0mmol/l
 - **Regular Insulin:** 10IU regular insulin IV, immediately followed by 03vials (60ml) of 40% dextrose IV, to be given every 6 hours. Monitor blood sugar every 4-6 hourly.
 - If potassium is >7mmol/l or there are ECG changes hyperkalemia start IV calcium

- **Calcium gluconate (10%) 10ml, IV**, to be given over 5 minutes followed by regular insulin (as above).

DEFINITIVE MANAGEMENT OF THE UNDERLYING CAUSE

- Definitive management of the underlying cause might require early initiation of intensive immunosuppressive therapy; hence, patients should be referred to nephrologist as soon as possible.

REFERRAL

- All patients with nephritic clinical presentation should be referred to a hospital where there is a nephrology service.

2. NEPHROTIC SYNDROME (NS) IN ADULTS

BRIEF DESCRIPTION

- Nephrotic syndrome (NS) is a clinical state which results from heavy (massive) proteinuria.
- The presence of nephrotic syndrome (NS) is a definitive indicator of glomerular pathology.
- Nephrotic syndrome is defined if all the following three clinical and laboratory findings are fulfilled

- **Heavy proteinuria:** defined as urine protein $>3000\text{mg}(3\text{gm})$ in a 24hr urine protein
- **Hypoalbuminemia:** Defined as serum albumin $<3\text{g/dl}$
- **Edema (edematous state)**
- **Hyperlipidemia,** usually severe, is a common finding. Some experts include it as requirement for the diagnosis of NS.
- Some patients might have heavy proteinuria ($>3000\text{mg}$ in 24-hour urine) but do not have the other features of the NS. They are said to have nephrotic range proteinuria, but not the nephrotic syndrome.
- Increased susceptibility to infection, venous thrombosis, and acute kidney injury are the major complications of the NS.
- Nephrotic syndrome is not a single disease. It is a manifestation of several diseases. Hence, once the presence of NS is confirmed, the etiology should be identified.
- Nephrotic syndrome in adults is different from pediatric NS in etiology, the needed investigation, treatment, and outcome. Hence, **adult NS should never be treated like pediatric NS.**
- The causes of nephrotic syndrome are classified in to two major groups: Primary (diseases limited to the glomeruli) and secondary (systemic diseases with glomerular manifestations or complications)
- Diabetes (diabetic kidney disease) is the leading cause of nephrotic range proteinuria worldwide.

Table 9.5. Major causes of nephrotic syndrome in adults

A. Major cause of primary nephrotic syndrome	B. Major causes of secondary nephrotic syndrome
I. Primary Focal segmental glomerulosclerosis (FSGS) II. Minimal change disease (MCD) III. Primary membranous nephropathy (MN) IV. Primary membranoproliferative glomerulonephritis (MPGN)	I. Diabetes II. Autoimmune disease: SLE III. Infectious: HBV, HCV, HIV, Syphilis, Schistosomiasis IV. Amyloidosis: primary or secondary amyloidosis V. Drugs: NSAIDS VI. Preeclampsia VII. Malignancy: Multiple myeloma, lymphoma, carcinomas

CLINICAL FEATURES

Symptoms and signs

- **Symptoms and signs related to the nephrotic state**
 - **Body swelling:** Periorbital edema, peripheral edema, scrotal or labial edema
 - **Third space fluid collection:** ascites, pleural effusion
 - **Fatigue and shortness of breath**
 - **Urine:** excessive foaming
 - **Nail:** white horizontal bands on the nail
- **Clinical features suggestive of specific secondary causes**
 - **Diabetes:** Known history of diabetes, presence of diabetic retinopathy

- **SLE:** diffuse non-scarring hair loss, malar rash, photosensitivity, polyarthritis
- **Preeclampsia:** third trimester pregnancy or peripartal state with high BP
- **Multiple myeloma:** bone pain, pathological fracture, anemia
- **Lymphoma:** Lymphadenopathy, splenomegaly
- **Carcinomas:** Local symptoms (breast lump, abdominal mass, cough/ hemoptysis, lymphadenopathy)

DIAGNOSIS AND INVESTIGATION

Diagnosis

- The following steps are helpful in guiding the diagnosis nephrotic syndrome in adults

Step 1: Confirming the presence of nephrotic syndrome:

- 24-hour urine protein
- Serum albumin
- Lipid profile

Step 2: Investigation for common causes of nephrotic syndrome

- **Retinal screening** for diabetic retinopathy: any time for type 2 diabetics and after a minimum of five years of type 1 diabetes
- **HBSAg, HCV antibody, HIV screening, VDRL(RPR), ANA**
- **AntiPLA2R antibody:** For screening primary membranous nephropathy
- **Work up for multiple myeloma:** If suspected, serum free light chains and serum electrophoresis.
- **Work up for other malignancies:** only if there are clinical clues.

Step 3: Renal biopsy

- Unlike pediatric patients almost all non-diabetic adult patients with nephrotic syndrome need renal biopsy to confirm the etiology. Hence, they need to be referred to a hospital with nephrology service.
- **Investigations: Additional helpful investigations**
 - Urinalysis: hematuria and proteinuria
 - **Renal function tests (serum creatinine):** AKI can occur as a complication of the NS or over-diuresis or could be part the glomerular disease (nephrotic-nephritic presentation)
 - **Serum electrolytes:** As baseline for diuretic therapy
 - **Abdominal ultrasound:** to see kidney sizes
 - **Investigations when complications are suspected:** e.g., if deep vein thrombosis (a common complication is suspected), do doppler ultrasound of suspected limb veins.

TREATMENT

Non-pharmacologic treatment

- Salt restriction
- Fluid restriction (less than 1 - 1.5 liter/day)
- Encourage ambulation
- Protein should not be restricted rather encourage patients to take adequate protein and high calorie diet

PHARMACOLOGIC TREATMENT

I. Treatment of the edematous state

- **Loop diuretics:** nephrotic syndrome is associated with relative diuretic resistance
 - **Oral Furosemide:**
 - Starting dose 40mg, PO, BID -TID.
 - Increase the dose to 80 mg PO BID-TID, then 120mg. PO, BID-TID.

- **Aim:** decrease weight by 0.5 to 1kg/day.
- **IV Furosemide:** If no adequate weight loss with increasing dose, admit for IV Furosemide
 - Start with 40mg, IV,TID.
 - Increase the dose to 80 mg IV TID, then 120mg. PO,TID
 - If no adequate response with IV Furosemide, add **hydrochlorothiazide 12.5 to 25mg BID** (to be given 30 minutes before the IV Furosemide)
- Addprophylactic **KCl tablets(600mg BID-TID) or Spironolactone 25-50mg** PO/daily and monitor serum electrolytes every 2-3days.

2. Anti-proteinuric treatment

- **ACE inhibitors or Angiotensin receptor blockers (ARBs)**
 - Start after adequate diuresis.
 - The kidney function must be stable before starting.
 - The dose should be escalated gradually with monitoring of serum creatinine and potassium. Monitoring should be done within 2 weeks of initiation and dose escalation.
 - ACE inhibitors (particularly Enalapril) are preferred over ARBs due to their low cost and wide availability.
 - **Preferred**
 - ✓ **Enalapril:** starting dose 5mg BID, Maximum dose 20mg BID
 - **Alternatives**
 - ✓ **Lisinopril:** starting dose 5mg/day, Maximum dose 40mg/day
 - ✓ **Perindopril:** starting dose 5mg/day. Maximum dose 15mg/day

- ✓ **Telmisartan:** Starting dose: 40mg/day maximum dose 80mg/day
- ✓ **Irbesartan:** Starting dose: 75-150mg/day, maximum dose 300mg/day
- ✓ **Losartan:** Starting dose 50mg/day maximum dose 100mg/day
- ✓ **Valsartan:** Starting dose 80 -160mg/day, maximum dose 320mg/day
- ✓ **Candesartan:** Starting dose 8-16mg/day maximum dose 32mg/day

3. Pharmacologic treatment for complications of the nephrotic syndrome

- **Treatment of hyperlipidemia:** as per dyslipidemia treatment guideline (see section on dyslipidemia). Many patients require statins due to severe hyperlipidemia.
- **Prophylactic anticoagulation:** Indicated if serum albumin is <2g/dl and patient is hospitalized
 - **Unfractionated heparin 5,000IU, BID** until discharge
 - Or
 - **Enoxaparin 40mg, SC, daily** until discharge
- **Therapeutic (Full dose) anticoagulation: Indications**
 - If there is active venous thromboembolic disease (e.g. DVT/PE, renal vein thrombosis)
 - If their albumin is low and the following risk factors are found: Pregnancy, active malignancy, recent major surgery, NYHA class III or IV heart failure or morbid obesity
 - **Unfractionated heparin 17,500 SC, BID or Enoxaparin 1mg/kg/dose BID + Warfarin** (dose to be adjusted according to INR)

- **Overlap heparin with warfarin** until two therapeutic INRs (2-3) achieved, and then followed by Warfarin alone.
- **Duration of anticoagulation:** Until the nephrotic syndrome resolves or 6-12 months (if it does not resolve).

4. Treatment of the specific cause of the nephrotic syndrome

- **Empiric steroid or any immunosuppressive should not be started** for adults with nephrotic syndrome without doing renal biopsy; hence, all adult patients with non-diabetic nephrotic should be referred to a hospital with nephrology service.

REFERRAL

- All adult patients with non-diabetic nephrotic syndrome should be referred.

CHAPTER 10

URINARY TRACT INFECTION

BRIEF DESCRIPTION

- Urinary Tract Infection (UTI) refers to the presence of microorganisms in higher numbers to cause invasion of the urinary tract (UT) epithelium and inflammation that cannot be accounted for contamination.
- UTI is classified in different ways that have implication to treatment and outcome

ACCORDING TO ANATOMIC SITE OF INVOLVEMENT:

- Lower UTI:cystitis, urethritis
- Upper UTI:pyelonephritis

ACCORDING TO THE PRESENCE OF STRUCTURAL URINARY TRACT PROBLEMS

- **Uncomplicated UTI:** UTI that occurs in individuals with no structural or functional abnormalities in the urinary tract that interfere with the normal flow of urine.
 - Typically, in women
- **Complicated UTI:** UTI that occurs in individuals with structural or functional abnormalities in the urinary tract.
 - E.g., congenital distortion, obstructive stone, indwelling catheter, vesicoureteral reflux, prostatic hypertrophy, or neurologic bladder.
 - UTI in men should be considered complicated unless proven otherwise.
 - UTI in patients with recent urinary tract instrumentation,postoperative UTI, in patients with kidney transplantation should be considered complicated.
- **Catheter associated UTI:** UTI occurring in a person whose urinary tract is currently catheterized or has been catheterized within the past 48 hours.
 - **Urosepsis** is defined as life threatening organ dysfunction caused by a

body's response to infection originating from the urinary tract or male genital organs.

- **Recurrent UTI-** symptomatic and culture-proven UTI occurring two or more times in six months or three or more times in a year. Recurrent UTI is not necessarily complicated.
- **Asymptomatic bacteriuria:** Bacteriuria $> 10^5$ bacteria/ml of urine without symptoms.
- **Symptomatic abacteriuria:** Symptoms of urinary frequency and dysuria in the absence of significant bacteriuria in urine culture.

The presence of pyuria (≥ 10 WBC/mm³ of uncentrifuged urine) alone is not sufficient for diagnosis of UTI or bacteriuria. More than 60% of samples in women with asymptomatic pyuria have no bacteriuria.

ETIOLOGIC AGENTS

- Uncomplicated UTI: *Escherichia coli* is the commonest pathogen.
- Complicated or hospital acquired UTI: In addition to *E. coli*, *pseudomonas*, *klebsiella*, *enterobacteria*, *proteus*, *serratia* and assume greater importance.

CLINICAL FEATURES

- **Lower UTI (Cystitis)**
 - Dysuria, frequent urination and urgency
 - Occasionally, gross hematuria
 - Suprapubic pain
 - Elderly people may have nonspecific symptoms: urinary incontinence chronic, malaise, abdominal pain and decreased eating or drinking)
 - N.B: cloudy or malodorous urine are nonspecific features that should not routinely swift for cystitis evaluation OR treatment.
- **Upper UTI (pyelonephritis)**
 - Flank pain

- Fever, chills and rigors
- Vomiting
- Significant costovertebral angle tenderness
- If associated cystitis (lower UTI), not always present: dysuria, urgency, frequency
- In elderly: fever or poor feeding or disorientation without another sign
- **Acute prostatitis:** acutely ill, fever, chills, malaise, myalgia, dysuria, frequency, urgency, urge incontinence), pelvic or perineal pain, and cloudy urine.
- **Chronic prostatitis:** usually, symptoms of recurrent UTI (frequency, dysuria, urgency) perineal discomfort, a low-grade fever, with repeated isolation of the same organism from the urine

INVESTIGATIONS AND DIAGNOSIS

Investigation

- Urinalysis
 - Microscopy for WBC, RBC
 - Dipstick: leukocyte, nitrite
- Urine culture: clean catch mid-stream urine specimen
- CBC
- RFT
- Ultrasound kidneys and prostate (in men 40 years): If complicated only

DIAGNOSIS

- The diagnosis is based on clinical findings plus urinalysis
- Urine analysis
 - Pyuria (WBC > 10 cells/mm³) is present in almost all patients with UTI
- Urine culture:

- Significant bacteriuria = presence of 10⁵ bacteria (CFU) /ml of urine
- In symptomatic UTI a lower bacterial count should still be considered positive
- The diagnosis of recurrent UTI requires culture confirmation
- Digital rectal examination (DRE): For men suspected of having prostatitis; tender or swollen/edematous prostate.
- Ultrasound: when complicated UTI is suspected.

TREATMENT OBJECTIVES

- Eradicate infection and improve quality of life
- Prevent recurrence

Non pharmacologic

- Recurrent UTI: Postcoital voiding, avoiding spermicide use and liberal fluid intake
- Complicated UTI: correction of the underlying anatomical or functional abnormality. This requires urologic/gynecologic consultation.

Pharmacologic

A. Acute, Uncomplicated UTI in women

Table 8.54:Antimicrobial regimen selection for urinary tract infections for adults

Scenario	First line options	Alternatives
Acute uncomplicated UTI (cystitis) in women	Ciprofloxacin 250- 500mg PO, BID or Norfloxacin, 400mg PO., BID, for 3 days. OR Nitrofurantoin 50mg P.O., QID for 5 days (effective if available) OR Cotrimoxazole (TMP-SMO) 160/800mg P.O, BID for 3 days (Only if the local resistance is known to be <20%)	Fosfomycin 3g single dose OR Cefpodoxime 100mg PO, BID for 5 days OR Amoxicillin-clavulanate 500/125mg TID for 5 days
Uncomplicated mild to moderate pyelonephritis (Mild to moderate): able to take orally, no vomiting, no dehydration, no sepsis)	Ciprofloxacin, 500mg P.O., BID, oral for 7-10 days.	Cefpodoxime, 200mg P.O., BID for 10 days preceded by a single dose of ceftriaxone 1gm IV/IM.
Severe pyelonephritis vomiting, dehydration, or evidence of sepsis) without risk of resistant infections— start IV	Ciprofloxacin, 400mg, IV, BID. Complete 10-14 days with oral Ciprofloxacin 500mg BID at discharge OR Ceftriaxone, 1- 2gm, IV, daily, followed by oral ciprofloxacin. OR Cefotaxime 1gm IV TID, followed by oral ciprofloxacin	If no response to these options within 48- 72 hours, use options listed in the category (severe pyelonephritis with risk of resistant pathogens)

<p>Severe pyelonephritis with the either of following three risk factors for resistant pathogens in the last 3 months</p> <ul style="list-style-type: none"> 1. Multidrug-resistant urinary isolate 2. Inpatient stay at a health care facility 3. Use of a broad-spectrum antibiotic (fluoroquinolone, third or later generation cephalosporin trimethoprim-sulfamethoxazole) 	<p>Meropenem 1gm IV TID OR Imipenem 500mg IV QID</p>	<p>OR Cefepime 2 gm IV TID OR Ceftazidime 2 gm IV TID OR Piperacillin-tazobactam 3.375 gm IV QID</p> <p>Addition of aminoglycoside: Gentamycin 3-5mg/Kg, IV, once daily can be considered.</p>
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RECURRENT UTI

- Antibiotic prophylaxis is recommended for women who experience two or more symptomatic UTIs within six months or three or more over 12 months.
- The degree of discomfort experienced by the woman needs to be considered in the decision.
- Recurrent pyelonephritis deserves prophylaxis.
- Any prophylaxis should be given after current active infection is treated.
- Prophylaxis regimen options
 - Continuous: daily (sometimes three times per week)
 - Postcoital: a single dose of antibiotic after every sexual activity; if there is clear temporal relationship between episodes of the recurrent UTI and sexual intercourse.

- Self-treatment (Not actual prophylaxis): A 3 days short course treatment in a patient who clearly understand the symptoms. To be started at the first onset of symptoms. Risk of recurrence remains high.
- **The antibiotic prophylaxis options**
 - **Trimethoprim-sulfamethoxazole** 40 mg/200 mg once daily or 3 times per week
 - **Nitrofurantoin** 50 mg or 100mg once daily
 - **Cefaclor** 250 mg once daily
 - **Cephalexin** 125 mg -250mg once daily
 - **Norfloxacin** 200 mg once daily
 - **Ciprofloxacin** 125 mg once daily

PROSTATITIS

- **Acute bacterial Prostatitis:** Floroquinolones or Trimethoprim/sulfamethoxazole is first line agent. Duration of treatment is 4 weeks (28 days).
- **Chronic bacterial prostatitis:** Difficult to treat. Similar antibiotics to acute bacterial are use but for a duration of 1–4 months.

ASYMPTOMATIC BACTERIURIA

- It should not be treated with antibiotics.
- The only two indications to treat with antibiotics: pregnancy and prior to invasion urinary tract instrumentation.

PREGNANCY AND UTI

- Antibiotics to be avoided for pregnant women: fluoroquinolones, aminoglycosides and trimethoprim/sulfamethoxazole
- Antibiotics recommended for uncomplicated UTI in pregnant women: amoxicillin/clavulanate, cephalexin or cefpodoxime for 3-5 days
- Antibiotics recommended for severe or complicated scenarios: third generation cephalosporin's (cefotaxime or ceftriaxone).

CHAPTER II

ANEMIA

APPROACH TO ADULTS WITH ANEMIA

BRIEF DESCRIPTION

- Anemia is functionally defined as reduction in red blood cell (RBC) mass, accompanied by a decrease in oxygen carrying capacity.
- Laboratory wise anemia is defined as a reduction in one or more of the three RBC measurements in the CBC: hemoglobin (Hg), hematocrit (HCT), or RBC count. For practical purposes, hemoglobin or hematocrit are commonly used.
- WHO criteria for diagnosing anemia in men and women are hemoglobin values <13 and <12 g/dl, respectively.
- Anemia is not a single disease entity; it is rather a manifestation of several pathologies.
- Anemia can be classified based on RBC morphology (size), as measured by mean corpuscular volume (MCV).
- Classification based on of RBC size is useful for considering possible causes; however, it should never be taken as diagnostic.
 - Microcytic: MCV<80 fl
 - Common causes: iron deficiency anemia and anemia of chronic disease
 - Normocytic: MCV 80-100 fl

- Common causes: anemia of chronic disease, CKD
 - Macrocytic: MCV > 100 fl
 - Common cause: vitamin B12 deficiency, alcohol abuse, chronic liver disease
- Base on the cause, anemia can be divided in to two broad categories:
 - Anemia due to increased RBC loss or destruction
 - Hemorrhage
 - Hemolysis
- Anemia due to defective or decreased RBC production
 - Iron deficiency anemia
 - Vitamin B12 or folate deficiency
 - Anemia of chronic disease
 - Chronic kidney disease
 - Hypothyroidism,
 - Aplastic anemia
 - Bone marrow infiltration: Leukemia, lymphomas, other cancers, granulomatous diseases
 - Chemotherapy induced anemia

CLINICAL FEATURES

Symptoms

- Fatigue, dyspnea, palpitation, syncope
- Headache, lightheadedness, tinnitus, vertigo, difficulty of concentration
- Anorexia, nausea, indigestion
- Symptoms of the underlying disease e.g., melena in GI bleeding, heavy menstrual bleeding, generalized body swelling in CKD signs

Signs

- Pallor, tachycardia, wide pulse pressure /ejection systolic murmur.
- Signs of Heart Failure (raised JVP, S3, hepatomegaly, edema)
- Signs of the underlying disease-causing anemia: lymphadenopathy, splenomegaly, angular chelitis, tumors (abdominal/ pelvic mass) etc.
- Investigation and diagnosis
- CBC with RBC indices
- Peripheral blood smear
- Reticulocyte count and index
- Further investigations: depends on the suspected cause/s of anemia based on the above tests, the history and physical examination findings.
 - **Suspected iron deficiency anemia:** serum ferritin, total iron binding capacity (TIBC), transferrin saturation ($[\text{serum iron} \div \text{TIBC}] \times 100\%$)
 - **Once iron deficiency is diagnosed:** stool for occult blood, stool microscopy for hookworm infestation, upper GI endoscopy or colonoscopy may be needed based on the clinical suspicion.
 - **Suspected megaloblastic anemia:** serum vitamin B12 level, serum folate and if serum folate level is normal.
 - **Suspected hemolytic anemia:** Reticulocyte count or percentage bilirubin (indirect hyperbilirubinemia), LDH, Coomb's test.

TREATMENT

OBJECTIVES OF TREATMENT

- Improve the functional status of the patient by correcting the hemoglobin.
- Treatment of the underlying cause

NON PHARMACOLOGIC

- Transfusion of packed RBC: Indications for transfusion
 - Hemoglobin $\leq 7\text{ g/dl}$: for most hospitalized medical or surgical patients

- For ambulatory patients with chronic anemia transfusion may not be needed even at hemoglobin is <7g/dl, unless the patients have severe symptoms e.g., heart failure
- Hemoglobin < 8g/dl: for those with pre-existing chronic cardiac disease, undergoing orthopedic or cardiac surgery
- In trauma or acutely bleeding patients
 - Do not use hemoglobin or hematocrit for transfusion decision as they are falsely elevated
 - Hemodynamic status and ongoing nature of bleeding should be used
 - Whole blood is preferable if there is acute or ongoing bleeding
- For the following patients higher hemoglobin target might be aimed
 - Acute coronary syndrome
 - Severe thrombocytopenia in hematology/hematology patients
- Nutritional support
- Non pharmacologic treatment pertinent to the underlying cause

PHARMACOLOGIC

- Pharmacologic treatment depends on the underlying cause of anemia.

REFERRAL

- Patients with anemia suspected due to primary bone marrow disease, malignancy, autoimmune disease, GI bleeding, and unknown/unclear cause should be referred to a referral hospital.

I. IRON DEFICIENCY ANEMIA

BRIEF DESCRIPTION

- Iron deficiency anemia is a common cause of anemia worldwide.
- The major causes of iron deficiency anemia are nutritional deficiency, impaired absorption from the GI tract, and chronic blood loss from the GI or genitourinary tract Examples: hook worm infestation, colonic cancer, bleeding peptic ulcer or gastric cancer, prolonged or excessive menstrual bleeding, gynecologic malignancies.

CLINICAL FEATURES

- In addition to the general clinical features of anemia (mentioned above), chronic iron deficiency anemia might show unique clinical features.
 - Pica: desire (craving) to eat unusual substances like soil, ice.
 - Koilonychia: Thin, brittle nail with depressed (concave or spoon) distal half.
 - Glossitis or angular stomatitis: the tongue and angel the mouth inflamed and sore.
 - Plummer-vinson syndrome: Difficulty of swallowing due to esophageal webs.
- Investigations specific for iron deficiency anemia**
 - CBC: low Hg and hematocrit, low MCV, low MCH, and increased RDW.
 - Iron studies
 - Serum Ferritin: usually low (it could be high in patients with chronic inflammation or CKD in spite of iron deficiency)
 - Serum iron: may be low or normal
 - Total iron binding capacity (TIBC): usually high
 - Transferrin saturation (TSAT) = serum iron/ TIBC X 100%: low (<20%)

- Clinical evaluation and investigation to identify the possible cause of bleeding
 - Stool for ova of parasites
 - Digital rectal examination
 - Gynecologic examination
 - Upper GI endoscopy and/or colonoscopy.
- **Pharmacologic treatment of iron deficiency anemia**
 - **Treatment of the underlying cause**
 - The cause of the iron deficiency state should be identified and treated.
 - Oral iron (tablet): For at least three months following correction of the anemia
 - Ferrous sulfate, 325mg (has 65mg elemental iron), PO,TID.
OR
 - Ferrous fumarate, 324mg, (has 106 elemental iron), PO, BID.
OR
 - Ferrous gluconate, 325mg P.O. (39mg elemental iron), 1-2tabs, TID
 - Oral iron (solutions/syrup): if the tablets are not tolerated or patient preference
 - Iron hydroxide polymaltose syrup (Each 5ml contains 50mg elemental iron), 10ml PO, BID to TID.

OR
 - Ferrous gluconate syrup (Each 5ml contains 24mg elemental iron), 15ml, PO TID.

OR

- Ferric ammonium citrate syrup (Each 15ml contains 32.8mg elemental iron), give 30ml,TID.
- **How to instruct oral iron intake?**
 - Preferably to be taken 2 hours before or 4 hours after meal.
 - If separating from food is difficult due to gastrointestinal side effects, foods which significantly interfere with iron absorption should be avoided when the iron is given e.g. milk, eggs, tea, and coffee.
 - GI side effects are very common with oral iron administration. These include epigastric pain, nausea or vomiting, constipation or diarrhea, metallic taste.
 - For patients who do not tolerate, they may be advised to take it with meals, or to take a smaller dose, solutions or elixir forms.
- **Intravenous (IV) iron**

Indications for IV iron therapy

 - Intolerance to oral iron therapy.
 - Anemia secondary to chronic kidney disease with a requirement for erythropoietin.
 - No improvement in hemoglobin after 4 weeks of oral iron.
 - Existence of conditions that interfere with absorption of iron from the GI tract e.g., atrophic gastritis, gastrectomy, inflammatory bowel disease
 - Blood loss difficult to cope with oral iron therapy e.g., heavy menstrual bleeding, bleeding telangiectasia
 - Severe anemia during late second or third trimester of pregnancy
- **IV iron administration**
 - **For patients not on hemodialysis:**
 - **Iron sucrose** 200mg, IV, administer over 5 minutes, every 3 days for a total of 5 doses (a total of 1000mg). This dose is usually

sufficient but if hemoglobin is not corrected, additional doses can be given.

OR

- **Iron sucrose** 200mg diluted in 100ml NS; administer over 30 minutes.
- **For patients on hemodialysis**
 - **Iron sucrose** 100mg, IV, over 2-5 minutes, given early during dialysis sessions (within the first hour) until iron deficiency is corrected. It needs to be given again, if iron deficiency persists or recurs.

2. MEGALOBLASTIC ANEMIA

BRIEF DESCRIPTION

- Megaloblastic anemia is a morphologic term that describes abnormal red blood cells with maturation defects; the red blood cells tend to be large.
- The major causes of megaloblastic anemia are vitamin B12 (Cobalamin) and folate deficiency or a combination of both,
- The pathologic process which results in megaloblastic anemia can also result in leukopenia and thrombocytopenia. In case of Vitamin B12 deficiency the nervous system can be affected.
- Major causes of vitamin B12 deficiency
 - **Gastric origin (pernicious anemia, chronic atrophic gastritis)**
 - **Small intestine malabsorption (chronic diarrhea from small bowel/ileal pathologies)**
 - Strict vegetarians.
- Major causes of folate deficiency
 - Poor nutritional status
 - Increased demand during pregnancy and lactation

- Alcoholism
- Drugs: anti-epileptic drugs (phenytoin, phenobarbitone) or drugs which affect Folate metabolism (Methotrexate, cotrimoxazole)
- Malabsorption
- Critical illness

CLINICAL FEATURES

- In addition to the clinical features of anemia due to any other cause, some clinical manifestations may suggest megaloblastic anemia.
 - Gossitis (pain over the tongue with smooth, beefy red tongue)
 - Angular
 - Jaundice
 - Neurologic or neuropsychiatric manifestation: specific to vitamin B12 deficiency, but not folate deficiency
 - Neuropathic pain in the lower limbs
 - Decreased position sensation and gait disturbance
 - Weakness of the lower extremities
 - Irritability, depression, disorientation, dementia, frank psychosis

DIAGNOSIS AND INVESTIGATIONS

- Investigations for megaloblastic anemia
 - CBC
 - Anemia with high MCV ($>100\text{fl}$). When there is concomitant iron deficiency, the MCV can be normal or low.
 - Leukopenia and thrombocytopenia may also be found.
 - Peripheral morphology: hypersegmentation of neutrophils, large RBCs (macro-ovalocytes).
 - Hypersegmentation of neutrophils is defined as $>5\%$ of neutrophils with 5 or more lobes.
 - Bilirubin: Indirect hyperbilirubinemia
 - Determination of the levels of vitamin B12 and Folate
 - Serum vitamin B12 level
 - Serum folate level
 - RBC folate level: to be requested if serum folate level is normal
 - Bone marrow aspiration: indications
 - If the serum vitamin B12 and folate levels are normal but there is strong clinical suspicion.
 - When there is need to exclude other causes.
 - Determining the cause of the deficiency: if the cause is not clinically obvious, further work up will be needed to identify the underlying cause.

TREATMENT

- **Objectives of treatment**
 - Improve functional status of the patient by correcting the anemia
 - Correct existing and prevent further neuropsychiatric manifestations

- Identify and treat the underlying cause
- **Pharmacologic treatment of vitamin B12 (Cobalamin) deficiency**
 - **Cyanocobalamin (Vitamin B12)** 1000micrograms (1mg), IM, to be given according to the following schedule
 - Every day for one week
 - Every week for four weeks. If hemoglobin has not normalized, continue weekly until it gets normal.
 - If the underlying disorder persists, 1mg every month for the rest of the patient's life.
- **Pharmacologic treatment of folate deficiency**
 - **Folic acid**, 1 to 5mg P.O., daily for 1-4 months, or until complete hematologic recovery.
 - **Vitamin B12** level should be checked before giving folic acid alone; as treatment with folic acid alone might worsen neurologic manifestation of vitamin B12 deficiency.
 - If vitamin B12 can't be checked, both Folic acid and vitamin B12 should be started at the same time.
- **Follow up of treatment response**
 - Symptomatic improvement
 - Hemoglobin level

3. ERYTHROCYTOSIS (POLYCYTHEMIA)

BRIEF DESCRIPTION

- Erythrocytosis, also called polycythemia, refers to abnormally increased red blood cell count as measured by hematocrit, hemoglobin or RBC count above the sex-specific normal range.
- The following terminologies are important
 - **Relative versus absolute erythrocytosis**
 - **Relative erythrocytosis** is a clinical situation in which there is a decrease in plasma volume resulting in apparent erythrocytosis. It is the result volume contraction, not an increase in RBC count.
 - **Absolute erythrocytosis** indicates a true increase in the RBC mass.
 - **Primary versus secondary erythrocytosis:** Absolute erythrocytosis can be primary or secondary.
 - **Primary erythrocytosis** is an autonomous production of RBCs by the bone marrow without any physiologic stimuli. The most important cause of primary erythrocytosis is polycythemia vera (PV).
 - Secondary erythrocytosis results pathologies which increase serum erythropoietin level and stimulate RBC production (see the table below).

- Polycythemia Vera (PV) is a myeloproliferative neoplasm characterized by high RBC count, increased risk of thrombosis and vasomotor symptoms. A gain-of-function mutation in Janus kinase 2 (JAK2) is found in about 98% of patients with PV
- Distinguishing Polycythemia Vera (PV) from secondary erythrocytosis is very crucial.

Table 7.1: Major causes of secondary erythrocytosis

Mechanism	Major causes
Hypoxia driven	Chronic lung diseases e.g., COPD, fibrotic lung diseases
	Obstructive sleep apnea
	Smoking
	Long term carbon monoxide exposure
	Cyanotic congenital heart diseases
Renal causes (renal hypoxia driven)	Renal cysts
	Hydronephrosis
	Renal artery stenosis
Paraneoplastic erythropoietin secretion	Renal cell carcinoma
	Hepatocellular carcinoma
	Uterine myoma
Miscellaneous	Post kidney transplant erythrocytosis
	Drug induced erythrocytosis: Erythropoietin, testosterone

CLINICAL FEATURES

- **Asymptomatic:** erythrocytosis is mainly a laboratory finding, the patient could be asymptomatic.
- **Symptomatic:** the symptoms and signs in patients with erythrocytosis can originate from the following reasons.
 - Due to increased blood viscosity (high RBC mass)

- Due to the underlying cause in secondary erythrocytosis
 - Symptoms and signs specifically related to polycythemia vera
- Clinical features due to the increased viscosity of blood
 - Myalgia, fatigue, headache
 - Blurred vision or transient loss of vision, decreased cognition.
 - Paresthesia
 - Chest discomfort, abdominal pain
- Symptoms and signs suggestive polycythemia vera (PV)
 - Pruritus after bathing
 - History of arterial or venous thrombosis (e.g., ischemic stroke) or venous thrombosis (e.g., DVT, PE, hepatic vein thrombosis)
 - Erythromelalgia (episodic or persistent, intense pain over the toes or fingers with erythema or hotness)
 - Splenomegaly.
- Clinical features that suggest specific secondary causes
 - Symptoms of chronic lung diseases: cough chest tightness, wheezing, and shortness of breath.
 - Symptoms suggestive of obstructive sleep apnea: day time sleepiness, fatigue, apneic (breathless) spells at night, and snoring.
 - History of smoking or long-term exposure to carbon monoxide (indoor smoke).
 - Clinical evidence of neoplasm for paraneoplastic causes: e.g., hepatocellular carcinoma, renal cell carcinoma

DIAGNOSIS AND INVESTIGATION

Investigations

Investigations useful to identify possible causes

- CBC
 - Thrombocytosis and/or leukocytosis: suggestive of PV
 - Erythrocytosis with low MCV: suggestive of PV
- Chest X-ray: if the history and physical examination suggest underlying lung disease.
- Abdominal ultrasound: to look for liver mass, renal cysts or solid mass.
- **Serum erythropoietin (EPO) level**
 - When there are no obvious secondary causes, determination of the serum EPO level helps to differentiate primary from secondary causes.
 - Elevated EPO = secondary causes
 - Low or normal EPO = primary cause, mainly PV.
- **Testing for the JAK2 (Janus kinase 2) mutation**
 - It is essential to test for JAK2 mutation when PV is considered.
 - This test should only be ordered by a specialist who would treat and follow these patients i.e., a hematologist or an internist who follows these patients.
 - 95 – 100% of patients with PV have a JAK2 mutation involving either exon 14 or 12.
- **Bone marrow biopsy**
 - May be needed if secondary cause is not apparent and JAK2 cannot be done.

DIAGNOSIS

- Erythrocytosis is said to be present in adults when one or more of the followings is present:
 - Hematocrit >48% in women or >49 % in men.
 - Hemoglobin: >16.0 g/dL in women or >16.5 g/dL in men.

TREATMENT OBJECTIVES OF TREATMENT

- Treating the underlying cause
- Decrease symptoms related to hyper viscosity
- Decrease the risk of thrombosis

TREATMENT OF SECONDARY ERYTHROCYTOSIS

- **Treat the underlying cause: Examples**
 - Stop smoking,
 - Decrease/avoid indoor carbon monoxide exposure
 - Treatment of the underlying lung disease e
 - Surgery for renal cell carcinoma.
- **Limited phlebotomy for secondary erythrocytosis**
 - Limited phlebotomy is appropriate in secondary erythrocytosis, if there are symptoms of hyper viscosity (headache, slow mental function, transient loss of vision, paresthesias) and hematocrit is usually $> 65\%$.

TREATMENT OF POLYCYTHEMIA VERA

- **Risk stratification:** patients with either of the following two characteristics are considered high risk
 - History of arterial or venous thrombosis, irrespective of age.
 - Age > 60 years are considered high risk. The rest are considered low risk.
- **Phlebotomy (Therapeutic phlebotomy)**
 - For all patients with PV (both low and high risk)
 - Target hematocrit is $< 45\%$
 - One to two units per week until target is achieved. For those who do not tolerate (elderly, women, cardiac or pulmonary disease) reduce to half to one unit per week.

- **Aspirin**
 - **For all patients with PV**
 - **Aspirin 75-100mg, PO, day.**
- **Cytoreductive therapy**
 - To be decided by a specialist.

4. THROMBOCYTOPENIA

THROMBOCYTOPENIA IN HOSPITALIZED PATIENTS

Brief description

- Thrombocytopenia is defined as a platelet count less than 150×10^3 per μl .
- The degree of thrombocytopenia can be divided from mild to severe. However, these numbers should be interpreted cautiously as severity definitions may vary.
 - Mild = 100,000 to 150,000/ μl
 - Moderate = 50,000 to 99,000/ μl
 - Severe <50,000/ μl
- The safest platelet count at which bleeding is unlikely to occur is not precisely known. It also varies significantly with the underlying cause.
 - Surgical bleeding risk is high when platelet counts <50,000/ μl . (<100,000/ μl for neurosurgery or major cardiac or orthopedic surgery).
 - Severe spontaneous bleeding: the risk is high when platelet counts <20,000 - 30,000/ μl
- Thrombocytopenia is not only a risk for bleeding but it can also be a manifestation of life-threatening thrombotic disorders.
 - Common clinical disorders which can cause thrombosis and thrombocytopenia at same time
 - DIC (disseminated intravascular coagulation)
 - HIT (Heparin induced thrombocytopenia)

- TTP/HUS (thrombotic thrombocytopenic purpura/hemolytic uremic syndrome)
- APS (antiphospholipid antibody syndrome)
- Thrombocytopenia is common in hospitalized patients. The risk is even much higher in critically ill patients.
- The causes of thrombocytopenia in hospitalized patients are numerous causing diagnostic challenges. Some of them are listed in the table below.

Table 7.2: The major causes thrombocytopenia in hospitalized patients

1. Spurious thrombocytopenia (Pseudothrombocytopenia)
2. Hemodilution: massive transfusion or crystalloid resuscitation
3. Sepsis
4. Malaria
5. Disseminated intravascular coagulation (DIC)
6. Heparin induced thrombocytopenia (HIT)
7. Drug induced thrombocytopenia
8. Pregnancy complications: gestational thrombocytopenia, preeclampsia, HELLP syndrome, acute fatty liver of pregnancy, DIC
9. Chronic liver disease and hypersplenism.
10. Alcohol or nutritional deficiencies (Vitamin B12 and/or folate deficiency)
11. Thrombotic microangiopathies (TMA): TTP/HUS (Thrombotic thrombocytopenic purpura/Hemolytic uremic syndrome), catastrophic APS
12. Autoimmune (Rheumatologic) diseases: SLE
13. Post transfusion purpura
14. Viral infections: HIV, Hepatitis C

CLINICAL EVALUATION OF THROMBOCYTOPENIA IN ACUTELY ILL HOSPITALIZED PATIENTS

- Confirmation of the thrombocytopenia:
 - Platelet clumping is a laboratory artifact than cause spurious thrombocytopenia.
 - Repeat CBC

- Using EDTA-free tubes (e.g. heparin or citrate tubes)
 - Do peripheral morphology to see if the thrombocytopenia is genuine or not.
- Detailed clinical history and physical examination: Evaluate if the underlying disease (e.g., sepsis) is a possible cause
- Evaluating for life threatening causes
 - Severe malarial peripheral blood smear (thin and thick)
 - HIT: History of heparin administration, date of administration, the presence of thrombosis, the degree of decrease in platelet count from baseline in percentage.
 - TTP/HUS: Peripheral morphology for fragmented RBCS, serum LDH, BUN and serum creatinine, urinalysis
 - Acute leukemia: other cell line, peripheral smear and bone marrow aspiration
 - DIC: determine PT(INR) and PTT, peripheral smear
 - Transfusion history: transfusion associated purpura
- Detailed drug history
- Evaluate for other common causes
 - Liver disease: clinical evaluation and liver function tests
 - Viral causes: HIV and HCV screening
 - Alcohol intake
 - Nutritional status: Peripheral blood smear to see evidence of megaloblastic anemia.

TREATMENT

- Treatment of the underlying cause: is the main stay of management in acutely ill hospitalized patients with thrombocytopenia.
- Platelet transfusion: Indications

- **Active bleeding:** If there is active bleeding and the platelet count <50,000cells/ μ l.
- **Prophylactic platelet transfusion:** In patients without active bleeding prophylactic platelet transfusion should be avoided unless the platelets count < 10,000 cells/ μ l.
- Hold antiplatelet agents and anticoagulants, if platelets count < 30,000cells/ μ l.

REFERRAL

- Patients in whom the cause of thrombocytopenia is not identified.
- Patients in whom the cause of thrombocytopenia is identified but treatment cannot be provided in that setting

5. IMMUNETHROMBOCYTOPENIA (ITP)

BRIEF DESCRIPTION

- Immune thrombocytopenia (ITP) is an acquired autoimmune disorder characterized by a low platelet count resulting from platelet destruction
- Other conditions which can cause immune related thrombocytopenia should be excluded before the diagnosis ITP. E.g., HIV, HCV infection, H. Pylori infection, systemic lupus erythematosus, chronic lymphocytic leukemia should be excluded before the diagnosis of ITP. Hence, ITP is a diagnosis of exclusion.
- Patients with other associated conditions (e.g., other autoimmune diseases) are described as having secondary immune thrombocytopenia.
- The incidence of ITP is higher in children than adults. Preceding viral infections are common precipitants of ITP in children.
- Classification of ITP based on the duration of the disease
 - Newly diagnosed ITP: ITP duration of less than 3 months
 - Persistent ITP: ITP duration of 3-12 months
 - Chronic ITP: ITP duration of more than 12 months

CLINICAL FEATURES

- Asymptomatic: The vast majority of patients with ITP are not symptomatic, unless the platelet is very low.
- Bleeding mucocutaneous bleeding also called “Platelet-type” bleeding)
 - Petechiae, purpura, and easy bruising.
 - Epistaxis, gingival bleeding, menorrhagia, gross hematuria
 - Gastrointestinal bleeding: bloody vomitus, bleeding per rectum
 - Intracranial bleeding: headache, change in mental status or focal neurologic deficit
 - Signs of anemia: Pallor, tachycardia, low blood pressure or postural drop in blood pressure (if massive bleeding)

INVESTIGATIONS AND DIAGNOSIS

- The diagnosis of ITP is made based on clinical grounds after exclusion of other causes of thrombocytopenia.
- A platelet count of $< 100,000/\mu\text{l}$ is needed for consideration of the diagnosis.
Peripheral blood smear: is required to exclude other causes of thrombocytopenia and to confirm the presence of true thrombocytopenia.
- Serologies: HIV and HCV (hepatitis C Virus) serology tests are needed in all patients
- H. Pyolri test: is indicated in all patients.
- ANA might be needed if there is a clinical evidence of SLE.
- TSH: autoimmune thyroid diseases are common in patients with ITP.
- Bone marrow aspiration/biopsy:
 - It is not generally indicated for the diagnosis of ITP
 - It is indicated in individuals with atypical features such as B-symptoms, lymphadenopathy, splenomegaly, unexplained leukocyte abnormalities or unexplained anemia, and age > 60 years.
 - It is also indicated before splenectomy.

TREATMENT

OBJECTIVES OF TREATMENT

- Increase the platelet count to a safe level to prevent major bleeding. Safe level of platelet is $>30,000/\mu\text{l}$.

N.B.:The aim of ITP treatment is not to bring the platelet to normal levels

NON PHARMACOLOGIC

- **Emergency platelet transfusion**
 - Generally, platelet transfusion should be avoided.
 - Indication for platelet transfusion: life-threatening bleeding only.
 - If platelet transfusion is indicated, intravenous steroids should be started immediately.
- **Splenectomy:** is an option of treatment for patients who have corticosteroid refractory or dependent disease.

PHARMACOLOGIC

Not all patients with ITP need treatment. Those with no indications to treatment should be followed with CBC and clinical assessment of bleeding. The patients should be given enough information about bleeding.

- **Indications for treatment**
 - Platelet count < 30,000/ μ l, irrespective of bleeding status.
 - Platelet count > 30,000/ μ l and significant bleeding (other than minor mucocutaneous bleeding)
- **First line: Corticosteroids**
 - **Dexamethasone**, 40mg, oral or IV, daily for 04 consecutive days with no tapering. Repeat this 4 day cycles every 2-4 weeks for 4-6 cycles.

OR

- **Prednisolone**, 1mg/kg for 1-2 weeks, if there is response taper over a period of six weeks or less.
 - Typical tapering regimen: After response, reduce by 10 mg/week until 0.5 mg/kg is reached; then taper by 5mg/week.
- **Treatment response**
 - Response: is defined if there is a platelet count >30,000/ μ l and at least doubling from the baseline both must be fulfilled.
 - Durable response: if there is response persisting up to 6 months.
 - Remission: is defined if platelet count is >100,000/ μ l for >12 months

- **Steroid dependent:** Ongoing need for continuous prednisolone > 5 mg/d (or equivalent) or frequent courses of corticosteroids needed to keep a platelet count >30,000/ μ l.

ALTERNATIVE TREATMENTS:

- Intravenous immunoglobulin (IVIg)
- Anti-D
- Rituximab
- Splenectomy

Note: alternative treatments are indicated for steroid resistance or dependent, special population with specific indications and these treatments should only be

CHAPTER 12: EMERGENCY CONDITIONS

General approaches to emergencies

Basic life support and advanced life support

- The actions taken during the first few minutes of an emergency are critical to victim survival.
 - IHCA and OHCA differences should be emphasized
 - **IHCA:** Early recognition and prevention → Activation of emergency response → High quality CPR → Defibrillation → Post cardiac care → Recovery
 - **OHCA:** Activation of Emergency response → High quality CPR → Defibrillation → Advanced resuscitation → Post Cardiac Care → Recovery
- Basic Life Support (BLS) defines this sequence of actions and saves lives.
- BLS includes
 - Prompt recognition and action for myocardial infarction and stroke to prevent respiratory and cardiac arrest
 - Rescue breathing for victims of respiratory arrest
 - Chest compressions and rescue breathing for victims of cardiopulmonary arrest
 - Attempted defibrillation of patients with ventricular fibrillation (VF) or ventricular tachycardia (VT) with an automated external defibrillator (AED)
 - Recognition and relief of Foreign Body Airway Obstruction
- With the inclusion of AED use in BLS skills, BLS is now defined by the first 3 links in the Chain of Survival: early access, early CPR, and early defibrillation.
- The following Adult BLS Algorithm is recommended by American Heart association for health professionals.
 - Step1. Ensure scene safety
 - Step 2. Check for response
 - Step3. Responder should shout for nearby help. The resuscitation team can be activated before or after checking breathing and pulse.
 - Step4. A check for no breathing or only gasping and a check of pulse ideally should be done simultaneously. Activation and retrieval of the AED/emergency equipment

by either the lone healthcare provider or by a second person must occur immediately after the check of breathing and pulse identifies cardiac arrest.

- Step4. CPR begins immediately, and the AED/defibrillator is used if available.

The recommended CPR sequence of steps by the new guidelines is CAB (chest compressions, airway, breathing) rather than ABC (airway, breathing, chest compressions). The AHA 2015 guideline offers the following recommendations for performance of CPR:

- Chest compressions should be performed at a rate of 100-120/min
- During manual CPR, chest compressions should be at a depth of at least 2 inches for an average adult (5 cm), while avoiding excessive chest compression depths (>2.4 inches)
- Total preshock and post shock pauses in chest compressions should be as short as possible
- For adults in cardiac arrest receiving CPR without an advanced airway, it is reasonable to pause compressions for less than 10 seconds to deliver two breaths
- In adult cardiac arrest with an unprotected airway, it may be reasonable to perform CPR, in which case, the chest compression target fraction should still be as high as possible (at least 60%)
- If the patient is unresponsive with no breathing or only gasping, the patient should be assumed to be in cardiac arrest and the emergency response system should be immediately activated.
- If a pulse is not definitely felt within 10 seconds, chest compressions should be initiated (with cycle of 30 compression and 2 breathes should be provided).
- It is reasonable for healthcare providers to provide chest compressions and ventilation for all adult patients in cardiac arrest, from either a cardiac or noncardiac cause (However, note that chest compression must pause during rhythm analysis by an AED.)
- Rapid defibrillation is the treatment of choice for ventricular fibrillation of short duration for victims of witnessed OHCA or for IHCA in a patient whose heart rhythm is monitored
- For a witnessed OHCA with a shockable rhythm, it may be reasonable for EMS systems with priority-based, multitiered response to delay positive-pressure ventilation for up to three cycles of 200 continuous compressions with passive oxygen insufflation and airway adjuncts

- Routine use of passive ventilation techniques during conventional CPR for adults is not recommended
- When the victim has an advanced airway in place during CPR, rescuers need no longer deliver cycles of 30 compressions and two breaths (i.e., interrupt compressions to deliver breaths); instead, it may be reasonable for one rescuer to deliver one breath every 6 seconds (10 breaths per minute) while another rescuer performs continuous chest compression
- For healthcare providers, if there is evidence of trauma that suggests spinal injury, a jaw thrust without head tilt should be used to open the airway.
- Holding the mask in place with the EC clamp technique and lifting the jaw to open the airway is recommended. Also Squeezing the bag for one second while watching for the rise and fall of the chest.
- During breathing and bag mask ventilation Change ventilation volumes and inspiratory times for mouth-to-mask or bag-mask ventilation as follows:
 - a. Without oxygen supplement: tidal volume approximately 10 mL/kg (700 to 1000 mL) over 2 seconds
 - b. With oxygen supplement ($\geq 40\%$): a smaller tidal volume of 6 to 7 mL/kg (approximately 400 to 600 mL) may be delivered over 1 to 2 seconds.
- Alternative airway devices (i.e., laryngeal mask airway and the esophageal-tracheal Combi tube) may be acceptable when rescuers are trained in their use.
- If an FBAO is present in a *responsive* adult victim, the trained rescuer should attempt to clear the airway (the Heimlich maneuver) before activating the help system.

NB: Clinicians are advised to see updated adult BLS algorithms from credible sources to facilitate the clinical care. (For instance, *the 2020 “American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care” can be used*)

Advanced cardiovascular life support (ACLS)

- Although management of cardiac arrest begins with BLS and progresses sequentially through the links of the chain of survival, there is some overlap as each stage of care progresses to the next.
- ACLS comprises the level of care between BLS and post-cardiac arrest care. The transition between basic and advanced life support should be seamless as BLS will

continue during and overlap with ALS interventions.

- Advanced life support includes all the components of BLS with administration of antiarrhythmic medications, treating of reversible causes of Asystole and Pulseless electrical activity, delivering shock and advanced airway management.

NB: Clinicians are advised to see updated adult ACLS algorithms from credible sources to facilitate the clinical care. (For instance, *the 2020 “American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care” can be used*)

Cardiac arrest in pregnancy

- Priorities for pregnant women in cardiac arrest should include providing high quality CPR and relief of aortocaval compression with lateral uterine displacement.
- Perimortem cesarean delivery is aimed at improving maternal and neonatal outcomes. Perimortem cesarean delivery is ideally performed within 5 minutes depending on the provider resource and skill.
- Approaches to cardiac arrest in pregnancy
 - 1) Continue BLS/ACLS (i) high quality CPR, ii) defibrillation if indicated, iii) other ACLS interventions (e.g. epinephrine))
 - 2) Organize maternal cardiac arrest team (obstetric, neonatal, emergency, anesthesiology, intensive care and cardiac arrest services)
 - 3) Consider etiology of arrest. Potential etiologies of maternal cardiac arrest can be easily traced as ABCDEFGH (Anesthetic complications, Bleeding, Cardiovascular, Drugs, Embolic, Fever, General non-obstetric causes of cardiac arrest, Hypertension)
- 4a) Perform material interventions (i) perform airway management, ii) administer 100% oxygen, avoid excess ventilation, iii) place IV above diaphragm iv) if receiving IV magnesium, stop and give calcium chloride or gluconate), Then proceed to continuous BLS/ALS back.
- 4b) perform obstetric interventions (i) provide continuous lateral uterine displacement, ii) detach fetal monitors, iii) prepare for perimortem cesarean delivery) = perform perimortem cesarean delivery (if no ROSC in 5 minutes, consider immediate perimortem cesarean delivery)=transfer neonate to the neonatal team

Advanced airway

- In pregnancy a difficult airway is common needing the most experienced provider. Provide endotracheal intubation or supraglottic advanced airway. Preform waveform capnography or capnometry to confirm and monitor ET tube placement. Once advanced airway is in place, give 1 breath every 6 seconds (10 breaths/min) with continuous chest compression.

NB: Clinicians are advised to see updated pregnant Cardiac arrest algorithms from credible sources to facilitate the clinical care. (For instance, *the 2020 “American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care” can be used*)

Acute respiratory failure

Brief description

- Respiratory failure occurs when there is either insufficient oxygenation and/ or inadequate CO₂ elimination. Broadly defined as PaO₂ <50 mm Hg or PaCO₂ >50 mm Hg and arterial pH <7.35 when baseline ABGs are considered normal. The PaCO₂/FIO₂ ratio is generally <200.
- Respiratory failure generally classified as i) hypoxemic (type I, PaO₂ <60 mm Hg or low PaCO₂)-Hypoxemic RF is most common type, ii) hypercapnic (type II, PaCO₂ >50 mm Hg), iii) Mixed: multiple pathophysiologic processes that contribute to both hypoxemia and hypercarbia; iv) In postoperative patients with a normal respiratory pump and normal lungs who are sedated or paralyzed or when the metabolic demands are too high for the patient to compensate for it
- RF may also be classified as acute or chronic.

Clinical presentation

- Tachypnea, dyspnea
- Diminished breath sounds, wheezing and rhonchi, crackles
- Use of accessory muscles to breathe
- Tachycardia and cardiac arrhythmias
- Cold, clammy skin; diaphoresis
- Ashen skin
- Peripheral cyanosis of skin, oral mucosa, lips, and nailbeds
- Sitting bolt upright or slightly hunched over
- Asterixis if severe hypercapnia
- Agitation, anxiety
- Restlessness, lethargy, altered mental status (confused, disoriented), somnolence
- Seizures, coma
- Can lead to sepsis and ventilator-associated pneumonia after intubation

Diagnostic tests

- ABGs
- CXR and sputum cultures
- Pulmonary function tests
- CBC especially WBC, Hgb, and Hct
- ECG, echocardiogram may be helpful
- CT scan
- V/Q' scan
- Angiography

- Toxicology screen
- Serum chemistry tests

Treatment

Approach with the ABC of life. Follow primary and secondary surveys on evaluating every patient.

- Asses and maintain the airway
- Assess adequate oxygenation and ventilation status and administer O₂ via mask or mechanical ventilation.
- Hemodynamic stabilization
- Assess neurologic status
- Monitor VS, heart rhythm, fluid and electrolyte balance, intake and output.
- Asses the underlying cause and treat

Altered mental status and coma

Brief description

- Is a clinical state in which patients have impaired responsiveness to the external stimulation and are either difficult to arouse or are unarousable?
- Coma is defined as unarousable unresponsiveness
- Stupor, Lethargy, and Obtundation refer to the state between alertness and coma.

Generally, causes of coma are

- Drugs/Toxins
- Metabolic disorders
- Infectious or inflammatory
- Structural brain lesions
- Others; heat stroke, Non convulsive status epilepticus etc

Clinical features

- It should always be addressed on the Emergency bases (ABCDE). While the patient is managed with the ABCD of life, the following features can be captured to make the underling diagnosis.

History

- Ask detailed history from the family, friends, witnesses or relatives about the circumstances during and prior to altered mental state
- Ask any known medical or psychiatric condition and drug or alcohol abuse
- If available previous medical charts will help for reaching in a diagnosis

Signs

- Perform detailed physical examination including
- looking for evidences of metabolic derangements
- Detailed neurologic examination including Glasco Coma Scale, Motor and sensory

examination, meningeal signs, evidences of raised ICP and herniation syndromes, cranial nerve examination

Diagnosis and investigations

- The goal of diagnostic testing is to identify treatable causes for coma.
- Neurologic recovery lies on early treatment.
- Testing should be prioritized according to presentation and clinical suspicion
- Some of the investigations that should be done in accordance to clinical suspicion includes:
 - CBC
 - Organ function test including LFT and RFT
 - Serum electrolyte
 - PT, PTT, INR
 - CT scan
 - Toxicologic screen
 - Lumbar puncture and EEG based on the clinical presentation

Treatment

- Evaluate and resuscitate the ABC
- Take vital signs, blood for laboratory and establish the GCS
- Consider intubation for patients with GCs < 8 or frequent vomiting or poor gag or cough reflex
- Treat both hypotension and hypertension
- Give Dextrose for patients with unknown causes of coma while waiting for determination of blood glucose level and add thiamine for patients with malnutrition or alcohol consumption, and give Naloxone for those with opioid overdose.
- If raised intracranial pressure is suspected elevate the bed to 45 degree and give mannitol (1 gm /kg IV) and/or cautiously hyperventilate patients on Mechanical ventilator
- Treat hyperthermia by efforts to lower temperature like cooling of the blanket and giving antipyretics. Also treat the underlying cause for fever
- Treat seizure with loading with phenytoin through Nasogastric tube or if IV is available by using IV phenytoin and diazepam as needed. If nonconvulsive seizure is suspected treat it as a seizure
- Establish the precise diagnosis and give the definitive treatment

Anaphylaxis

Brief description

- An acute allergic reaction or anaphylaxis is the most dramatic and severe form of immediate hypersensitivity that may cause death and requires emergent diagnosis and

treatment.

- Anaphylaxis can develop within minutes of injection or ingestion of medicines or contact with trigger factors.
- Common causes are, medicines, intravenous contrast media, vaccines and antisera (e.g. TAT), insect bites, foods and additives (e.g. sea foods, nuts). But any agent capable of producing a sudden degranulation of mast cells or basophils can induce anaphylaxis including latex hypersensitivity

Clinical features

- Severe itching
- Urticular rash
- Difficulty in breathing
- Collapse
- Facial edema
- Angio-edema causing difficulty in breathing due to laryngeal edema and obstruction
- Bronchospasm with wheeze
- Shock with severe hypotension
- Tachycardia
- Cyanosis

Investigation

- Diagnosis is clinical
- Clinical diagnosis of Anaphylaxis can be made if either of the three is fulfilled.
 - 1) Urticaria, generalized itching or flushing, or edema of lips, tongue, uvula, or skin developing over minutes to hours and associated with at least one of the following:
 - Respiratory distress or hypoxia
 - Hypotension or cardiovascular collapse
 - 2) Two or more signs or symptoms that occur minutes to hours after allergen exposure:
 - Skin and/or mucosal involvement
 - Respiratory compromise
 - Hypotension or associated symptoms
 - Persistent GI cramps or vomiting
 - 3) Consider anaphylaxis when patients are exposed to a known allergen and develop hypotension

Treatment Objectives

- Maintain airways, breathing and circulation
- Remove the offending cause if possible

Non pharmacologic

- **Airway:** Immediate intubation if evidence of impending (stridor's, wheezes, tachypnea and difficulty swallowing) airway obstruction from angioedema; delay may lead to complete obstruction; cricothyrotomy may be necessary
- **Oxygen:** Administer oxygen to maintain oxygen saturation above 90%
- **Circulation:** All patients with anaphylaxis should receive intravenous fluids. Some patients may require large amount of intravenous fluids due shift of intravascular fluid to the interstitial space.
 - Adults-1 to 2 liters NS fast, then depending on the patient response to adrenaline and the initial bolus of NS.
- **Position-**recumbent position, if tolerated, and elevate lower extremities
- **Remove-**the offending agent, if possible

Pharmacologic

- **Adrenaline**, IM, 0.5ml (500microgram) of 1:1000 at mid-anterolateral t high; can repeat every 3 to 5 minutes as needed. If symptoms are not responding to epinephrine injections, prepare IV adrenaline 1 to 10 micrograms per minute by infusion; mix 1 milligram (1 mL of 1:1000 dilution) in 500 mL NS and infuse at 0.5 mL/min; titrate dose as needed

PLUS

- **Hydrocortisone**, IV, 200mg, IV, stat; then 100mg 6-8 hourly for 3 – 4 days and discontinue without tapering.

PLUS

- **Promethazine** hydrochloride, IM, 25mg 8-12 hourly or **Diphenhydramine** ,25–50 milligrams every 6 hrs. IV, IM, or PO. Then cetirizine 10mg. P.O., once/day OR Loratadine 10mg, P.O., once /day OR Chlorpheniramine 4mg, P.O., QID

PLUS

- If wheeze develops **Salbutamol**, aerosol, 100 μ g/dose, 2-4 puffs every 4-6 hr.
- If the patient has concurrent use of betablocker and has refractory hypotension add glucagon 1 milligram IV every 5 min until hypotension resolves, followed by 5–15 micrograms/min infusion.

Sudden cardiac arrest

Brief description

- Sudden cardiac arrest (SCA) refers to the sudden cessation of cardiac activity with hemodynamic collapse, typically due to sustained ventricular tachycardia/ventricular fibrillation when the event is reversed with intervention or spontaneously; if it is not reversed it will be labeled as sudden cardiac death.
 - It usually occurs in individuals with structural heart disease but in the absence of detectable clinical findings. Acute myocardial ischemia, electrolyte abnormalities, antiarrhythmic medicines and worsening Heart Failure can precipitate sudden cardiac arrest.

Clinical features

- Instantaneous or abrupt onset collapse with or without prodrome
- Absent pulse
- Absent or gasping type of breathing
- Unresponsive

Investigations

- During the episode no work up is needed except having continuous ECG monitoring together with emergency management.
- Post SCA work up is needed-Troponin, Echocardiography, Electrolytes, RFT

Treatment Objectives

- Achieve adequate ventilation
- Control cardiac arrhythmia
- Stabilize blood pressure and cardiac output
- Restore organ perfusion

Non pharmacologic

- Provide Basic life support (BLS) and refer with escort

Hypoglycemia

Brief description

- Hypoglycemia is a clinical syndrome in which low serum (or plasma) glucose concentrations leads to symptoms of sympathoadrenal activation and neuroglycopenia.
- Hypoglycemia can cause significant morbidity and may be lethal if not promptly recognized and managed.

Clinical features Adrenergic

symptoms:

- Sweating, sensation of warmth, anxiety, tremor or tremulousness, nausea, palpitations and tachycardia, and perhaps hunger.

Neuroglycopenic symptoms:

- Fatigue, dizziness, headache, visual disturbances, drowsiness, difficulty speaking, inability to concentrate, abnormal behavior, loss of memory, confusion, and ultimately loss of consciousness or seizures.

The presence of **Whipple's triad**

- 1. Symptoms consistent with hypoglycemia (see above)
- 2. A low blood glucose (<55mg/dl) level measured with a precise method (not a glucometer)
- 3. Relief of those symptoms after treatment the plasma glucose level is raised. In diabetic patients on insulin or insulin secretagogue plasma glucose level of 70mg/dl or less is alerting.

Hypoglycemia unawareness-absent symptoms (usually related to autonomic diabetic neuropathy)

Major causes of hypoglycemia:

- In patients with Diabetes Mellitus-Insulin and sulfonylureas excess dose or previous doses with unaccustomed exercise or omission of meals. Development of CKD, AKI, and sepsis as well.
- In non-diabetic patients with critical illnesses – Hepatic or renal failure, adrenal insufficiency, sepsis, malaria.
- Seemingly normal patients-endogenous hyperinsulinemia, accidental or surreptitious use sulfonylureas or insulin.

NB: Hypoglycemia caused by sulfonylureas can be prolonged for several days hence these patients should not be discharged with emergency room correction of hypoglycemia alone

Treatment Objectives

- Quickly bring the level of blood glucose within the normal range to prevent serious brain damage.
- Maintain the level of blood glucose within the normal range until the patients begin eating normally.

Non-pharmacologic

- 2-3 teaspoons of granulated sugar or 3 cubes of sugar or 1/2 a bottle of soft drink to individuals who are conscious.
- The above measures should be followed immediately by a meal or snack.

Pharmacologic

- **Dextrose**, 40%, IV, 40-60ml over 1 to 3 minutes through a large vein, followed by 10%
- **Glucose** IV, 500ml, 4 hourly until the patient is able to eat normally.
- **Glucagon** SC/IM 1mg in adults particularly in type I DM patients.

Shock

Approach to shock

- Shock is a state of circulatory insufficiency that creates an imbalance between tissue oxygen supply (delivery) and oxygen demand (consumption) resulting in end-organ dysfunction.
- Reduction in effective perfusion may be due to a local or global delivery deficiency or utilization deficiency with suboptimal substrate at the cellular or subcellular level.
- The mechanisms that can result in shock are frequently divided into four categories:
 1. hypovolemic
 2. cardiogenic,
 3. distributive, and
 4. obstructive.

Table 15. 1. Types, characteristics and etiologist of shock

Type	Hemodynamic change	Etiology
Hypovolemic	Decreased preload, increased SVR, decreased Cardiac output (CO)	Hemorrhage, capillary leak, GI losses, burns
Cardiogenic	Increased preload, increased afterload, increased SVR, decreased CO	MI, dysrhythmias, heart failure, valvular disease
Obstructive	Decreased preload, increased SVR, decreased CO	PE, pericardial tamponade, tension PTX
Distributive	Decreased preload, increased SVR, Mixed CO	Sepsis, neurogenic shock, Anaphylaxis

- **Hypovolemic shock** occurs when decreased intravascular fluid or decreased blood volume causes decreased preload, stroke volume, and CO. Volume loss from different etiologies including severe blood loss (hemorrhage) can cause decreased myocardial oxygenation, which decreases contractility and CO. This action may lead to an autonomic increase in the SVR.
- In **cardiogenic shock**, the left ventricle fails to deliver oxygenated blood to peripheral tissues due to variances in contractility, as well as preload and afterload. Myocardial infarction is the most common cause of cardiogenic shock. Dysrhythmias are another common cause because they can lead to a decreased CO. Bradyarrhythmia's result in low CO, and tachyarrhythmias can result in decreased preload and stroke volume.
- **Obstructive shock** is due to a decrease in venous return or cardiac compliance due to an increased left ventricular outflow obstruction or marked preload decrease. Cardiac tamponade and tension pneumothorax are common causes.
- In **distributive shock**, there is relative intravascular volume depletion due to marked systemic vasodilatation. This is most commonly seen in septic shock. Anaphylaxis, neurogenic shock and adrenal insufficiency are additional causes of distributive shock.

First line

- **Norepinephrine (noradrenaline)**, Initial: 0.5-1 mcg/minute and titrate to desired response; 8-30 mcg/minute is usual range. Goal: MAP>65mmhg
- If myocardial infarction suspected aspirin should be loaded and immediate reperfusion.

Alternatives

- **Dopamine**, 5-20mcg/kg/min IV diluted with dextrose 5% in Water, or in sodium chloride solution 0.9%;

OR

- **Dobutamine**, 2.5-40 micrograms/kg/min IV diluted in dextrose 5%.

Never initiate Dobutamine alone in a patient with cardiogenic shock and Systolic BP< 70

OR

- **Adrenaline, I . V . infusion**: Initial: 0.1-0.5 mcg/kg/minute (7-35 mcg/minute in a 70 kg patient); titrate to desired response

Hypovolemic shock

- **Infusion of fluid (Normal saline or Ringer lactate)** 1-2 liters fast;
- reassess the patient for adequacy of treatment; if needed repeat the bolus with maximum tolerated dose being 60 – 80 ml/kg with in the first 1 – 2 hr,
 - if needed open double IV line.
- If due to hemorrhage, apply transfusion of packed Red Blood Cells (RBC) or whole blood 20ml/kg over 4 hrs, repeat as needed until hemoglobin level reaches 10gm/dl and the vital signs are corrected.

- Definitive care
- The primary and secondary surveys should be repeated frequently to identify any change in the patient's status that indicates the need for additional intervention.
- Patients are assessed, and their treatment priorities are established, based on their injuries, vital signs, and the injury mechanisms.
- In severely injured patients, logical and sequential treatment priorities must be established based on overall patient assessment.
- The patient's vital functions must be assessed quickly and efficiently.
- Management consists of a rapid primary survey, resuscitation of vital functions, a more detailed secondary survey, and, finally, the initiation of definitive care.
- This process constitutes the ABCDEs of trauma care and identifies life-threatening conditions by adhering to the following sequence:

 - Airway maintenance with cervical spine protection
 - Breathing and ventilation
 - Circulation with hemorrhage control
 - Disability: Neurologic status
 - Exposure/Environmental control: Completely undress the patient, but prevent hypothermia
 - F: FAST (Focused Assessment of Sonography in Trauma)

- This prioritized sequence is based on the degree of life threat so that the abnormality that poses the greatest threat to life is addressed first.
- A quick assessment of the A, B, C, and D in a trauma patient can be conducted by asking the patient for his or her name, and asking what happened. Appropriate response indicates that there is no major compromise in A, B and D.

Airway maintenance with cervical spine protection

- Upon initial evaluation of a trauma patient, the airway should be assessed first to ascertain patency (the easiest way of assessing airway patency is asking the patient his name or get him to talk).
- This rapid assessment for signs of airway obstruction should include suctioning and inspection for foreign bodies and facial, mandibular, or tracheal/laryngeal fractures that can result in airway obstruction.
- Measures to establish a patent airway should be instituted while protecting the cervical spine (Inline stabilization). Initially, the chin-lift or jaw-thrust maneuver is recommended to achieve airway patency. In addition, patients with severe head injuries who have an altered level of consciousness or a Glasgow Coma Scale (GCS) score of 8 or less usually require the placement of a definitive airway.
- While assessing and managing a patient's airway, great care should be taken to prevent excessive movement of the cervical spine.
- The patient's head and neck should not be hyperextended, hyper flexed, or rotated to

establish and maintain the airway.

- Based on the history of a traumatic incident, loss of stability of the cervical spine should be assumed.
- Neurologic examination alone does not exclude a diagnosis of cervical spine injury. Initially, protection of the patient's spinal cord with appropriate immobilization devices should be accomplished and maintained (Cervical Collar should be applied until cervical injury is ruled out). Assume a cervical spine injury in patients with blunt multisystem trauma, especially those with an altered level of consciousness or a blunt injury above the clavicle.

Breathing and ventilation

- Airway patency alone does not ensure adequate ventilation. Respiratory rate, saturation and air entry should be checked.
- Adequate gas exchange is required to maximize oxygenation and carbon dioxide elimination.
- Ventilation requires adequate function of the lungs, chest wall, and diaphragm. Each component must be rapidly examined and evaluated.
 - The patient's neck and chest should be exposed to adequately assess jugular venous distention, position of the trachea, and chest wall excursion.
 - Auscultation should be performed to ensure gas flow in the lungs.
 - Visual inspection and palpation can detect injuries to the chest wall that may compromise ventilation.
- Injuries that severely impair ventilation in the short term include tension pneumothorax, flail chest with pulmonary contusion, massive hemothorax, and open pneumothorax.
- Appropriate measures including putting the patient on oxygen to maintain saturation, chest decompression for tension pneumothorax should be done while assessing breathing and ventilation.

Circulation with hemorrhage control

- Circulatory compromise in trauma patients can result from many different injuries.
- Hemorrhage is the predominant cause of preventable deaths after injury. Identifying and stopping hemorrhage are therefore crucial steps in the assessment and management of such patients.
- Once tension pneumothorax has been eliminated as a cause of shock, hypotension following injury must be considered to be hypovolemic in origin until proven otherwise.
- The elements of clinical observation that yield important information about the patient's hemodynamic status within seconds are level of consciousness, skin color, and pulse.
- The source of bleeding should be identified as either external or internal. External

hemorrhage is identified and controlled during the primary survey. Rapid, external blood loss is managed by direct manual pressure on the wound. The major areas of internal hemorrhage are the chest, abdomen, retroperitoneum, pelvis, and long bones.

- The source of the bleeding is usually identified by physical examination and imaging (e.g., chest x-ray, pelvic x-ray, or focused assessment sonography in trauma [FAST]).
- **Management** may include:
 - chest decompression, pelvic binders, splint application, and surgical intervention.
 - Definitive bleeding control is essential along with appropriate replacement of intravascular volume.
 - A minimum of two large-caliber intravenous (IV) catheters should be introduced.
 - Blood samples taken for cross match as well.
 - IV fluid therapy with crystalloids should be initiated. A bolus of 1 to 2 L of an isotonic solution may be required to achieve an appropriate response in the adult patient.
 - If the patient is unresponsive to initial crystalloid therapy, blood transfusion should be given.

Disability (neurologic evaluation)

- A rapid neurologic evaluation is performed at the end of the primary survey.
- This neurologic evaluation establishes the patient's level of consciousness, pupillary size and reaction, lateralizing signs, and spinal cord injury level.
- The GCS is a quick, simple method for determining the level of consciousness that is predictive of patient outcome, particularly the best motor response.
- A decrease in the level of consciousness may indicate decreased cerebral oxygenation and/or perfusion, or it may be caused by direct cerebral injury.
- An altered level of consciousness indicates the need for immediate reevaluation of the patient's oxygenation, ventilation, and perfusion status.
- Hypoglycemia and alcohol, narcotics, and other drugs also can alter the patient's level of consciousness. However, if these factors are excluded, changes in the level of consciousness should be considered to be of traumatic central nervous system origin until proven otherwise.
- Primary brain injury results from the structural effect of the injury to the brain.
- Prevention of secondary brain injury by maintaining adequate oxygenation and perfusion are the main goals of initial management.

Exposure and environmental control

- **Undress:** The patient should be completely undressed, usually by cutting off his or her garments to facilitate a thorough examination and assessment.
- **Log roll:** Log roll should be done here by at least 3 health care workers two for rolling the patient and one examining. So, examiner should:

- palpate vertebra from cervical till lumbosacral area for any tenderness or deformity,
- check for any open wound at the back and
- do Per Rectum examination to asses for tone and any blood on examining finger.
- **Warming:** After patient's clothing has been removed and the assessment is completed,
 - Cover patient with warm blankets or an external warming device to prevent hypothermia in the trauma receiving area.
 - Intravenous fluids should be warmed before being infused, and
 - A warm environment (i.e., room temperature) should be maintained.

Adjuncts to primary survey

- Adjuncts that are used during the primary survey include electrocardiographic monitoring; urinary and gastric catheters; other monitoring, such as ventilatory rate, arterial blood gas (ABG) levels, pulse oximetry, blood pressure, and x-ray examinations (e.g., chest and pelvis).

Secondary survey

- The secondary survey does not begin until the primary survey (ABCDEs) is completed, resuscitative efforts are underway, and the normalization of vital functions has been demonstrated.
- When additional personnel are available, part of the secondary survey may be conducted while the other personnel attend to the primary survey.
 - In this setting the conduction of the secondary survey should not interfere with the primary survey, which takes first priority.
- The secondary survey is a head-to-toe evaluation of the trauma patient, that is, a complete history including mechanism of injury and AMPLE history and physical examination, including reassessment of all vital signs.
 - AMPLE history stands for Allergies, Medications currently used, Past illnesses/Pregnancy, Last meal, Events/Environment related to the injury.
- Each region of the body is completely examined.

NB. All trauma patients should have repeated evaluations of both the primary survey and secondary survey to monitor response to interventions and to detect new abnormalities. Whenever there is a need, trauma patients should be transferred to trauma treating hospitals.

Poisoning and Overdose

Approach to a patient with poisoning and toxicodromes

- Poisoning represents the harmful effects of accidental or intentional exposure to toxic amounts of any substance. The exposure can be by ingestion, inhalation, injection, or through skin.
- The effects may occur immediately or several hours or even days after the exposure.
- The damage could be local or systemic.
- Poisoning can be from household substances (e.g. bleach), industrial (e.g. methanol), pesticides e.g. organophosphates), therapeutic medicine overdose (e.g. phenobarbitone, Amitriptyline), toxic plants (e.g. poisonous mushrooms, toxic herbal medications), bites and stings of venomous animals (e.g. snakes, bees).

Clinical features

- Clinical presentation is variable depending on the type of poison/medicine, route and dose.
- Many of the manifestation are nonspecific.
- Toxicodromes are sets of clinical findings which could help in guiding the possible class of the poison/medicine
- It is very helpful to have a sample of the substance or the container in which it was stored as only few poisons can be identified instantly

Table 15. 2. Toxicodromes (adapted from Hand book for the Management of poisoning and overdose, Singapore MOH, 2000)

Toxicdrome	Mental status	Pupil	Vital signs	Other	Examples of toxic agents
Cholinergic		Miosis	Bradycardia	Salivation, urinary	Organophosphate
			Hypertension or	& fecal incontinence, diarrhea, vomiting,	and carbamate insecticides, nerve agents,
			Hypotension	lacrimation,	
				bronchoconstrictio	
				n, fasciculations,	
	Confusion			weakness, seizures	
	Coma				

Anticholinergic	Agitation, hallucination s, delirium with mumbling	Mydriasis	Hyperthermia, tachycardia, hypertension, tachypnea	Dry skin & mucous membranes, decreased bowel sounds, urinary	Antihistamines, tricyclic antidepressants, antiparkinson agents, antispasmodics,
	speech, coma			retention, myoclonus,	phenothiazines, atropine
				choreoathetosis	
Tricyclic antidepressants	Confusion, agitation, coma	Mydriasis	Hyperthermia, tachycardia, hypertension then hypotension	Seizures, myoclonus, choreoathetosis, cardiac arrhythmias	Amitriptyline, nortriptyline, imipramine,
Sedative- hypnotic	CNS depression,	Miosis	Hypothermia, bradycardia,	Hyporeflexia	Benzodiazepines,
	stupor, coma		hypotension, hypoventilation		barbiturates, alcohols,
Opioid	CNS depression , coma				hypoventilation
		Sympatic	Hyperalert, agitation, hallucinations, paranoia	Mydriasis	Hyperthermia, tachycardia, hypertension, widened pulse pressure, tachypnea,
					Dia tre mo hy sei

Investigations

- Random blood sugar
- CBC
- BUN and creatinine,
- Electrolytes
- Liver function tests
- Chest X-ray for possible aspiration pneumonia
- Toxicological analysis of identified substance (e.g. Gastric aspirate) or from serum

Treatment Objectives

- Maintain airway, breathing and circulation
- Reduce absorption and enhance elimination
- Antagonize or neutralize the effects
- Relieve symptoms
- Prevent organ damage or impairment

Non-pharmacologic

Supportive care

- Airway protection
- Treatment of hypoxia
- correct hypotension/arrhythmia
- Treatment of seizures
- Correction of temperature abnormalities
- Correction of metabolic derangements

Pharmacologic and other cares

- **Prevention of further poison absorption**
 - Gastric lavage
 - Should be done within an hour of ingestion
 - Contraindicated in patients with unprotected airway, corrosive and hydrocarbon poisoning
 - Decontamination of eye
 - Skin decontamination
 - Activated charcoal
- **Enhancement of elimination**
 - Multiple-dose activated charcoal
 - Hemodialysis
 - Urinary pH alkalinization
 - Hyperbaric oxygenation
- **Administration of anti-dotes**
 - Neutralization by antibodies
 - Metabolic antagonism
 - Physiologic antagonism
- **Prevention of re-exposure**
 - Child-proofing
 - Psychiatric referral

N.B-Induction of vomiting is contraindicated in patients who ingested caustic or corrosive substances and hydrocarbons, comatose patients and those with seizures.

Initial management

1. Hypoglycemia

- **40% Dextrose**, IV, 40-60ml over 1-3 minutes

PLUS

2. Hypotension

- **Normal saline**, IV, 1000ml fast then according to response

3. Seizure management and medicine-associated agitated behavior

- **Diazepam 10mg**, IV, stat repeat doses as needed.
 - CAUTION-respiratory depression
- **Activated charcoal**, 50gram, P.O., or via NG tube, diluted in 400–800ml water
 - Activated charcoal may reduce systemic absorption of a variety of substances.
 - The greatest benefit is achieved if activated charcoal is given within one hour after ingestion.
 - When mixing, add a small amount of water to charcoal in a container cap and shake container to make a slurry and then dilute further.

Catharsis

- Should be given only with the first dose of multiple dose charcoal in order to prevent

electrolyte abnormalities and osmotic diuresis.

- **Magnesium sulphate**, 250mg/kg

OR

- **Sodium sulfate**, 250mg/kg

Alkalization of urine

- This is a high-risk procedure and should only be performed in consultation with a specialist.
- May be of benefit in salicylate, lithium, barbiturate and, tricyclic antidepressant poisoning.
- **Sodium bicarbonate**, IV, 50–100mEq in 1 L sodium chloride 0.45%. Administer 250–500mL over 1–2 hours. Attempt to achieve urine pH of 7.5.

Table 15. 3. Common antidotes (adapted from hand book for the management of poisoning and overdose, Singapore MOH, 2000)

Poison	Antidote(s)	Dose for adults
Carbon monoxide	Oxygen	high-flow oxygen by tight-fitting facemask or ventilator
Benzodiazepines	Flumazenil	Initial dose: 0.1-0.2mg IV over 30-60 sec, repeat 0.1-0.2mg IV every minute up to 1mg
Acetaminophen	N-acetylcysteine	Initial oral dose: 140mg/kg, then 70mg/kg q 4h x 17 doses
Heparin	Protamine sulfate	1 mg neutralizes 90-115 U heparin; Initial dose: 1 mg/min to total dose 200mg in 2 h
Isoniazid	Pyridoxine (Vitamin B6)	Initial dose: 1 gm pyridoxine for every gm INH ingested or empiric 5gm IV over 10 min if amount ingested unknown

Opiates	Naloxone	Initial dose: 0.1-2.0mg IV push (opioid dependent patients should receive 0.1 mg IV every 30-60 sec until clinical response)
Ticyclic antidepressants	Sodium bicarbonate	Initial dose: 1-2 ampules (50-100mEq) IV push, then IV infusion to maintain blood pH 7.45-7.55 (Preparation: 3 amps 50mEq of NaHCO ₃ in 1liter D5W infused at 200-250 mL/h)
Organophosphates Carbamates Nerve agents	Atropine	Initial dose: 0.5-2.0mg IV; repeat q 3-5 min until sweat and secretions clear
	Pralidoxime	Initial dose: 1 gm IV over 15 min, then IV infusion of 3-4mg/kg/h for 24-72 hrs

Specific poisons and overdoses

Carbamates and organophosphates Brief

description

- Poisoning due to parathion, malathion and other organophosphates.
- Absorption occurs through the skin or the agent is taken orally.
- Patients present with muscarinic and nicotinic manifestations of intoxication.

Clinical features

- The killer signs are the 3B's: bradycardia, bronchospasm and bronchorrhea
- Muscarinic overstimulation causes salivation, lacrimation, vomiting, diarrhea and increased bronchial secretions.
- Nicotinic overstimulation causes muscle fasciculations and paresis or paralysis.
- Patients may present with either bradycardia or tachycardia.

Investigations

- Clinical

- Toxicological analysis

Treatment

- For all poisoning patients the principles of management are
 - ABC's of life comes first,
 - Give coma cocktail (Naloxone, thiamine, dextrose and oxygen),
 - decontamination,
 - Antidote and,
 - Supportive care

Objectives

- Support physiological function
- Treat symptoms
- Remove the poison from the body

Non pharmacologic

- Supportive treatment

Pharmacologic

- **Atropine**, IV, 1-3 mg, every 3-5 minutes, until pulmonary secretions are dry
- Do not stop atropine therapy abruptly. Wean the rate of administration slowly.
- During weaning monitor the patient for possible worsening.
- Our goal in atropinization is chest clearance and not tachycardia.

Carbon monoxide

Clinical features

- Poisoning with carbon monoxide is common where there is incomplete combustion of charcoal.
- Acute poisoning results in headache, nausea and vomiting, mental confusion and agitation.
- Severe toxicity causes confusion, impaired thinking, and may progress to coma, convulsions, and death.

Investigations

- Clinical
- Toxicological analysis

Treatment

Objectives

- Support physiological function
- Treat symptoms
- Remove the poison from the body

Non pharmacologic

- Supportive treatment
- Take the patient out to open air.

Pharmacologic

- **Oxygen**, 100% via face mask

Barbiturates (Commonly)

phenobarbitone) Clinical features

- Overdose is associated with depression of the CNS, coma, hypotension, loss of reflexes, hypothermia, respiratory arrest, and death.
- A characteristic of a barbiturate overdose is the persistence of the pupillary light reflex even with stage IV coma.
- Bullous skin lesions often occur over the hands, buttocks and knees.

Investigations

- Clinical
- Toxicological analysis (determination of barbiturate levels)

Treatment

Objectives

- Support physiological function
- Treat symptoms
- Remove the poison from the body

Non-pharmacologic

- Mechanical ventilation required in severe cases
- Hemodialysis

Pharmacologic

- **Activated charcoal** – see doses above
- Multiple-dose activated charcoal every 4 to 6 hours is specifically indicated

PLUS

- **Alkaline diuresis**-see above

Environmental emergencies

Burn

- Burn is a traumatic injury to the skin or other tissues caused by thermal, chemical, electrical, radiation or cold exposures. Burns are an acute wound and pass-through series of healing steps. The most common type of burn in children is from a scald injury; in adults, the most common burn occurs from a flame.

Table 15. 4. Classification of burns based on the depth of injury (Adapted from, Med Clin North Am 1997 and Am Fam Physician 1992)

Depth	Appearance	Sensation	Healing time
First degree (Superficial)	Dry (no blister) Erythematous Blanches with pressure	Painful	3-6 days
Second degree (partial-thickness)-superficial	Blisters Moist, red, weeping Blanches with pressure	Painful (even to air)	7 to 21 days
	Blisters (easily unroofed) Wet or waxy dry	Senses pressure only	Perceptive >21 days-requires

Second degree (partial-thickness)-deep	Variable color (cheesy white to red) Does not blanch with pressure		surgical treatment
Third degree (full thickness)	Waxy white to gray or black Dry and inelastic No blanching with pressure	Deep pressure only	Rare, unless surgically treated
Fourth degree (extending beyond the skin)	Extends into fascia and/or muscle	Deep pressure only	Never, unless surgically treated

A thorough and accurate estimation of burnt surface area is essential to guide therapy.

Table 15. 5. Burn injury severity grading (modified from the American Burn Association burn injury severity grading system. J Burn Care Rehabil 1990)

Burn type	Criteria	Disposition
Minor	<10% TBSA burn in adults <5%TBSA burn in young or old <2% full-thickness burn No face, hand, perineum or feet involvement	Outpatient

Moderate	10-20%TBSA burn in adults 5-10% TBSA burn in young or old 2-5% full-thickness burn High voltage injury Suspected inhalation injury Circumferential burn Medical problem predisposing to infection (e.g., diabetes mellitus)	Admit
Major	>20% TBSA burn in adults >10% TBSA burn in young or old >5 %full-thickness burn High voltage burn Known inhalation injury Any significant burn to face, eyes, ears, genitalia, or joints Significant associated injuries (fracture or other major trauma)	Refer after emergency management (Make sure the referral center provides burn services)

TBSA: total body surface area; Young or old: <10 or >50 years old; Adults: >10 or <50 years old

Treatment

Objectives

- Prevent ongoing burn
- Secure airway and maintain ventilation

- Correction of fluid and electrolyte deficits
- Prevention and management of infection
- Avoid or minimize permanent disability

Non pharmacologic

Emergency measures

- Remove clothing and jewelry.
- Maintain adequate airway and give oxygen via face mask

- Consider early intubation for any sign of breathing difficulty, airway burn, swelling, or suspected inhalation injury, full-thickness burns of the face or perioral region, circumferential neck burns, acute respiratory distress, progressive hoarseness or air hunger, respiratory depression or altered mental status,
- Establish two large-bore peripheral IV lines in unburned skin.
- Insert NG tube and avoid oral fluids in children with burns greater than 15% BSA and adults with partial thickness burns of >20% of body surface area due to frequent development of ileus.
- Insert Foley catheter
- Wrap all wounds with sterile towels until further decision is made.

Pharmacologic management Fluid resuscitation

- Ringer's lactate or NS 4mL/kg/% BSA burned: 1/2 the fluid is given over the first 8 hrs calculated from the time of onset of the injury and the remaining 1/2 is given at an even rate over the next 16 hrs. (Parkland formula)
- The rate of the infusion is adjusted according to the patient's response to therapy.
- Adequacy of the resuscitation is reflected by vital signs, skin turgor, adequate urine output (1mL/kg/hr. in children and 0.5 mL/kg in adults). Clinical signs of adequate perfusion are monitored every hour for the first twenty-four hours
- During the 2nd 24 hrs. patients begin to reabsorb edema fluid and to diurese. $\frac{1}{2}$ of the first day fluid requirement is needed as Ringer's lactate in 5% dextrose.
- Oral supplementation may be started after 48hr

post burn **Estimate body surface area of the burnt**

body-see annex 15 Pharmacologic management

Wound

management

Minor burns

- Treated in an outpatient setting
- Debride all loose skin. Blisters are better not excised
- Cleanse with mild soap and irrigate with isotonic saline.
- The wound is then covered with Silver sulfadiazine and properly dressed.
- The first dressing change and dressing evaluations are performed 24-48 hrs after injury
- **Silver sulfadiazine cream 1%,** apply daily with sterile applicator (not on the

face or
in patients with a sulfa allergy)

OR

- **Fusidic acid**, thin films of 2% cream applied to skin 3-4 times daily.

Moderate and severe burns

- Do all recommended for minor burns
- Apply local antibiotic or Vaseline coated dressing
- Antibiotic prophylaxis is not recommended unless there is obvious infection.

Prevention of stress ulcer – for severe burns only

First line for patients who are able to take oral medications

- **Omeprazole**, 40mg, oral, daily
- **First line** for patients who are unable to take oral medications
- **Cimetidine**, 200mg-400mg IV, every 12 hours

Tetanus prophylaxis

- **Tetanus immunization** should be updated for any burns deeper than superficial- thickness.

Pain management:

First line use depending on pain severity and response in step wise fashion

- **Paracetamol**, 500-1000mg P.O., 4-6 times a day

OR

- **Tramadol** 50-100mg, Slow IV or P.O, 3-4 times daily (maximum 400mg/day)

OR

- **Morphine hydrochloride injection** (for severe pain only), 10-20 mg IM OR SC, repeat every 4 hours PRN.

OR

- **Pethidine** 50mg IM every 4 hrs (depending on the need) or 5-10 mg IV 5 minutes

Systemic antibiotics

- Not indicated for prophylaxis
- When there is evidence of infection (e.g. persistent fever, leukocytosis) take specimens for culture and start empiric antibiotics based on suspected site of infection.
- If wound infection is the suspected source of infection empiric antibiotics should cover

Pseudomonas aeruginosa, other gram-negative bacteria's and *Staphylococcus aureus*

Prevention, management and follow up of complications

- Electrolytes-Hyperkalemia, hyponatremia/hypernatremia
 - Acute Kidney Injury-Correction fluid deficit, avoidance of nephrotoxic medication
 - Malnutrition-burn patients require high calorie and high protein diet
 - Deep vein thrombosis-Prophylaxis with heparin if patient is immobilized
 - Joint Contractures-proper wound care and physiotherapy
 - Psychiatric attention
 - Urine output should be strictly followed with goal of 1-2ml/kg/hr, do urinalysis to check for rhabdomyolysis
- Always suspect and report burns mainly in children and the elderly as abuse especially hand and glove type of pattern

Mammalian and human bites

Brief description

- Dog bites-cause a range of injuries from minor wounds (scratches, abrasions) to major complicated wounds (deep open lacerations, deep puncture wounds, tissue avulsions).
- Cat bites-scratches typically occur on the upper extremities or face. Deep puncture wounds are of particular concern because cats have long, slender, sharp teeth. When the hand is the target of such a puncture wound, bacteria can be inoculated below the periosteum or into a joint and result in osteomyelitis or septic arthritis.
- Human bites – human bites cause a semicircular or oval area of erythema or bruising that is usually visible; the skin itself may or may not be intact.
- The predominant organisms in animal bite wounds are the oral flora of the biting animal (notable pathogens include Pasteurella, Capnocytophaga, and anaerobes) as well as human skin flora (such as staphylococci and streptococci).

Clinical features

- Pain
- Bleeding
- Swelling
- Teeth impression on bitten site
- Foreign body

- Fever
- Tenderness

Investigations

- CBC
- X-ray of the affected area if bone involvement
- Ultrasound of the abdomen if visceral involvement suspected
- Culture from the wound discharge

Treatment

Objectives

- Treat associated infections

- Prevent

tissue loss

Non

pharmacologic Wound

care

- The surface should be cleaned with 1% povidone iodine
- Irrigate the depths with copious amounts of saline using pressure irrigation.
- Debridement of devitalized tissue
- Explored to identify injury to underlying structures and presence of a foreign body
- For dog bites: easy mnemonic:
- RATS. Rabies, antibiotics, tetanus and soap

Primary closure

- Nearly all cat, human and most dog bites are left open (to heal by secondary intention).
- When primary closure is strongly considered because of cosmetic reasons the wound should be:
 - Clinically uninfected,
 - Less than 12 hours old
 - NOT located on the hand or foot

Pharmacologic

Antibiotic prophylaxis Indications

- Deep puncture wounds
- Associated crush injury

- Wounds on the hand (s) or in close proximity to a bone or joint
- Wounds requiring closure
- Bite near or in a prosthetic joint
- Cat bites
- Delayed presentation > 12 hours for most wounds
- Bite wounds in compromised hosts (e.g., immunocompromised and adults with diabetes mellitus)

First line

- **Amoxycillin-clavulanate**, 500/125mg, P.O., TID for 3-5 days or 875/125 mg, P.O., BID for 3-5 days

Alternative

- **Doxycycline**, 100mg, P.O., BID for 3-5 days

OR

- **Cotrimoxazole** 960mg, P.O., BID for 3-5 days

OR

- **Cefuroxime** 500mg, P.O., BID for 3-5 days

PLUS

- **Metronidazole** 500mg, P.O., TID for 3-5 days

NB: Cloxacillin and cephalexin should be avoided in human, dog or cat bites

1. Infection treatment

- For infected wound use the above antibiotics mentioned for prevention but for prolonged duration 10-14 days

2. Tetanus and rabies prevention

- **Tetanus toxoid (TT)**, I.M.0.5ml once, for primary or booster immunization
- **TAT** (Tetanus Antitoxin), 3000 units, SC, stat, for all adults with animal or human bites except for those with clean and minor wounds after skin test
- **Rabies prophylaxis** both passive administration of rabies immune globulin (with as much of the dose as possible infiltrated into and around the wound) and active immunization
- For the details see the -Rabies|| section, under the infectious disease chapter.

Snake bites

Brief description

- The majority of snakebites are non-poisonous; only few species are venomous (poisonous).
- Most common venomous snakes are the pit vipers (vasculotoxic) and the elapidae and hydrididae (primarily neurotoxic).
- Children, because of their smaller body size, are far more likely to have severe envenomation.

Clinical features

- Cranial nerve paralysis-ptosis, ophthalmoplegia, slurred speech
- Bulbar respiratory paralysis-drooling, and inability to breath properly
- Impaired consciousness, seizures
- Meningism
- Tender and stiff muscles
- Rapid progression of swelling to more than half of bitten limb
- Blistering, necrosis and bruising
- Fascial compartmentalization on bitten digits.
- oral swelling or paresthesia's, metallic or rubbery taste in the mouth, hypotension,
- tachycardia.
- Anaphylaxis reaction could occur

Investigations

- CBC
- BUN and Creatinine, electrolytes
- 20 minutes whole blood clotting test (leave 2-5ml of blood in dried test tube. Failure to clot after 20 minutes implies incoagulable blood)
- Liver function test

N.B. Avoid venopuncture in state of generalized bleeding

Treatment

Objectives

- Relieve pain and anxiety
- Support the respiration or circulation if indicated
- Counteract the spread and effect of the snake venom
- Prevent secondary infection

Non

pharmacologic

First Aid

- Move patient to a safe area
- Remove anything tight around the bitten area (ankle bracelets, Rings)
- Immobilization/splinting of the affected limb.
- Do not move the limb
 - Carry the person on a stretcher and tie the limb to a straight piece of wood.
 - Clean the wound and reassure the patient.

At the hospital

- Bed rest, reassure, keep warm
- Assess patient's airway, breathing and circulation (ABC of resuscitation)
- For probable venomous bites:
 - Clean site of bite with antiseptic lotion or soap and water
 - Do not attempt to suck or make any incisions at the site of the bite
 - Leave wound open; punctured wounds are especially likely to be infected.
 - If the snake is identified as non-poisonous or there is absence of swelling or systemic signs after 6 hours reassure the patient
 - Surgical debridement when required

Pharmacologic

Secondary

infection: First

line

- **Amoxicillin/clavulanic acid**, oral, 500/125mg, TID for 5-7 days.
- **Immunization, primary or booster:**
- **Tetanus toxoid vaccine**, IM, 0.5mL immediately.

Analgesia

For mild pain:

- **Paracetamol**, 1 g 4–6 P.O., hourly when required to a maximum of 4 doses per 24 hours.

For severe pain:

ADD

- **Tramadol**, 50-100mg, 2-3X per day

N.B. The use of an NSAID is not recommended due to the potential danger of Acute

Kidney

Injury in a hypotensive patient.

Polyvalent antivenom

Indications for polyvalent antivenom:

- worsening of local injury (e.g., pain, ecchymosis, or swelling), abnormal results on laboratory tests (e.g., worsening platelet count, prolonged coagulation times), or systemic manifestations (e.g., unstable vital signs or abnormal mental status).
- All patients with confirmed mamba bites before symptom onset
- Patients with confirmed puff adder or Gaboon adder bites should receive antivenom at the onset of any symptoms

N.B.

- In most cases patients do not need and should not be given antivenom.
- The dose of antivenom is the same for adults and children.
- Serum sickness is a relatively common adverse event.
- Even after the administration of antivenom, patients with neurotoxic snakebites may need ventilation.

Polyvalent snake antivenom, slow IV infusion. Dilute 100 mL in 300ml of NS.

- Have resuscitation tray ready (adrenaline 1: 1000)
- Test dose-0.2 ml, subcutaneous, to test for anaphylaxis
- Administer slowly for the first 15 minutes, as most allergic reactions will occur within this period.
- Increase the flow rate gradually to complete the infusion within one hour.
- Continue to observe for progression of edema and systemic signs of envenomation during and after antivenom infusion. Measure limb circumference at several sites above and below the bite, and outline the advancing border of edema with a pen every 30 minutes. These measures serve as an index of the progression as well as a guide for antivenom administration.
- Repeat laboratory determinations every 4 hours or after each course of antivenom therapy, whichever is more frequent. Repeat if there is no clinical improvement after the infusion.
- Mild hypersensitivity reactions should not be a reason not to give polyvalent.
- If there are signs of compartment syndrome elevate the leg, consider additional dosing of the infusion and consider fasciotomy if there is no response for conservative management.

Near drowning

Brief description

- Drowning is death from suffocation (asphyxia) following submersion in a liquid medium.
- Near-drowning is survival, at least temporarily, after suffocation with/without loss of consciousness.

Risk factors of near-drowning:

- Inability to swim or overestimation of swimming capabilities.
- Risk-taking behavior.
- Use of alcohol and/or illicit medicines.
- Inadequate adult supervision.
- Hypothermia, which can lead to rapid exhaustion or cardiac arrhythmias.
- Concomitant trauma, cerebrovascular accident, or myocardial infarction.
- Undetected primary cardiac arrhythmia,
- Hyperventilation prior to a shallow dive which can lead to cerebral hypoxia, seizures, and loss of consciousness, which again can result in drowning.

Clinical features

- Shortness of breath, difficulty breathing, apnea
- Persistent cough, wheezing
- In stream, lake, or salt water immersion, possible aspiration of foreign material
- Level of consciousness at presentation, history of loss of consciousness, anxiety
- Vomiting, diarrhea
- Bradycardia or tachycardia, dysrhythmia
- Clinical deterioration mostly develops within 7 hours of immersion.
- Suffocation by submersion leads to hypoxemia by means of either aspiration or reflex laryngospasm. Hypoxemia in turn affects every organ system, with the major being cerebral hypoxia.

Treatment

Objectives

- Quickly restoring ventilation and oxygenation
- Prevent end organ damage Has three phases: prehospital care, emergency unit care, and inpatient care.

Prehospital care

- Rapid cautious rescue Cervical spine precautions
- Cardiopulmonary resuscitation (CPR) as indicated, oxygen for all patients and transport
 - CPR should be done as soon as possible without compromising the safety of the rescuer or delaying the removal of the victim from the water.
- High flow supplemental oxygen should be administered to the spontaneously breathing patient by facemask, while the apneic patient should be intubated.
- Rewarming all hypothermic patients with a core temperature <33°C should be initiated, either by passive or active means as available.

N.B. The Heimlich maneuver or other postural drainage techniques to remove water from the lungs have no proven value.

Emergency unit management

- **Rule out** injuries to the axial skeleton and internal injuries to the abdomen and chest.
- **Elective intubation:** In the symptomatic patient, indications for elective intubation include signs of neurologic deterioration and an inability to maintain a SPO₂ >90mmHg on high fractions of supplemental oxygen.

Inpatient management

- Symptomatic patients require hospitalization for supportive care and treatment of organ specific complications.

Useful modalities of treatment:

- Mild hyperventilation to reduce intracranial pressure.
- Elevate head of the bed, if potential cervical spine injuries are excluded.
- Diuretics to avoid hypervolemia
- Seizure activity should be controlled. Phenytoin is the preferred agent as it does not depress consciousness.
- Manage both hypoglycemia and hyperglycemia

Respiratory failure

- Bronchospasm is treated similarly to acute asthma; most cases rapidly improve with inhaled beta-adrenergic agonists.
- Antibiotics should be used only in cases of clinical pulmonary infection or if the victim was submerged in grossly contaminated water.

Hypotension

- Persons with hypothermia can have significant hypovolemia and hypotension due to a "cold diuresis." Optimal fluid replacement and inotropic

support.

- If Glasgow coma scale (GCS)>13, PSO2 >96%, and clear concomitant traumas, monitor O₂, and observe for 4-6 hours,
 - reassess patient chest condition, mentation, and PSO2, and
 - if normal discharge home
- If GCS<13, PSO2 <96 keep patient for rigorous care, and
 - if need for intubation or non-invasive ventilation (NIV) refer to a center with ICU.

Conditions Needing Emergency Surgery:

1. **Acute Appendicitis**
2. **Perforated Peptic Ulcer**
3. **Trauma (e.g., Gunshot wounds, Stab wounds, Blunt trauma)**
4. **Bowel Obstruction**
5. **Ectopic Pregnancy**
6. **Ruptured Abdominal Aortic Aneurysm (AAA)**
7. **Severe Abdominal Trauma**
8. **Cholecystitis with Perforation or Gangrene**

I. Acute Appendicitis

Diagnosis:

- Clinical Examination:
 - Right lower quadrant tenderness (McBurney's point).
 - Rebound tenderness: Pain upon release of pressure, indicative of peritoneal irritation.
 - Elevated WBC count: Typically between 10,000–20,000/mm³.
 - Fever: Often present in advanced stages.
 - Ultrasound/CT Scan: To confirm diagnosis, especially in atypical cases.

Management:

- Surgical Intervention:
 - Appendectomy: Laparoscopic or open surgery to remove the appendix.
 - Laparoscopic Appendectomy: Preferred due to faster recovery and fewer complications.
 - Open Appendectomy: Used in complicated cases (e.g., perforation or abscess).
 - Antibiotics: Administer broad-spectrum antibiotics (e.g., ceftriaxone, metronidazole) preoperatively and postoperatively if there's concern of rupture or peritonitis.
 - Hydration: IV fluids for hydration and electrolyte correction.

Lifestyle Modifications:

- Diet: After surgery, the patient should start with clear liquids and gradually move to solid foods as tolerated.
- Pain Management: Use of NSAIDs or opioids, as appropriate.

Follow-Up:

- Wound Care: Monitoring for infection at the surgical site.
- Pain Management: Control pain levels with prescribed medication.
- Return to Activity: Gradual return to regular activities within 2–4 weeks.
- Signs of Complications: Patients should be educated to seek medical attention for signs of infection (fever, wound redness, increased pain).

2. Perforated Peptic Ulcer

Diagnosis:

- **Clinical Examination:**
 - Sudden, severe upper abdominal pain, often described as "knife-like" pain.
 - Signs of peritonitis: Guarding, rigidity, and rebound tenderness.
- **Imaging:**
 - X-ray or CT Scan: Shows free air under the diaphragm (pneumoperitoneum), a hallmark of perforation.
- **Blood Tests:** Elevated WBC, metabolic acidosis, low hemoglobin if there's bleeding.

Management:

- **Surgical Intervention:**
 - Exploratory Laparotomy: Open surgery to explore the abdominal cavity and repair the perforation.
 - Omental Patch: The omentum is used to cover the perforated ulcer and seal the perforation.
 - Antibiotics: Broad-spectrum antibiotics (e.g., ceftriaxone, metronidazole) for peritoneal infection.
 - Acid Suppression: Proton pump inhibitors (PPIs) or H2 blockers to reduce gastric acid production and prevent further ulcers.

Lifestyle Modifications:

- **Dietary Adjustments:** Avoid spicy, greasy, or acidic foods; gradual reintroduction of foods post-surgery.
- **Stress Management:** Reduction of stress via relaxation techniques.

Follow-Up:

- **Postoperative Care:** Monitor for signs of infection, bleeding, or peritonitis.
- **Pain Management:** Appropriate use of analgesics.
- **Dietary Progression:** Start with liquids, progressing to solids as tolerated.
- **Regular Follow-up Visits:** For ulcer healing, signs of recurrence, and post-surgical complications.

3. Trauma (e.g., Gunshot Wounds, Stab Wounds, Blunt

Trauma)

Diagnosis:

- **Clinical Symptoms:**
 - **History of trauma, pain, and potentially altered consciousness.**
 - **Physical exam shows external wounds, contusions, and tenderness.**
- **Imaging:**
 - **CT Scan or Ultrasound:** To assess internal organ damage, bleeding, fractures, and presence of free fluid.
 - **FAST (Focused Assessment with Sonography for Trauma):** A quick ultrasound examination to assess internal bleeding in trauma.

Management:

- **Surgical Intervention:**
 - **Exploratory Laparotomy:** For abdominal trauma, to assess and repair damage to organs like the liver, spleen, bowel, or blood vessels.
 - **Hemorrhage Control:** Surgical techniques like ligation or cauterization to control bleeding.
 - **Fracture Stabilization:** External fixation or internal stabilization for broken bones.
 - **Wound Closure:** Suturing or using staplers for lacerations.
 - **Drains:** To prevent fluid buildup and further complications.
- **Fluid Resuscitation:** IV fluids to prevent shock and maintain blood pressure.

Lifestyle Modifications:

- **Physical Therapy:** Early rehabilitation, especially for fractures or immobility.
- **Psychological Support:** Trauma recovery may involve counseling and emotional support.

Follow-Up:

- **ICU Care:** If critical, the patient may need intensive monitoring post-surgery.
- **Pain Management:** Adequate pain control using NSAIDs or opioids.
- **Wound Monitoring:** Regular checks for infection, drainage, and healing.
- **Fracture Healing:** Regular X-rays to monitor bone healing and recovery.
- **Emotional Support:** Psychological follow-up for trauma recovery.

4. Bowel Obstruction

Diagnosis:

- **Clinical Symptoms:**
 - **Abdominal bloating, vomiting, inability to pass gas or stool, and crampy abdominal pain.**
- **Imaging:**
 - **X-ray:** May show distended bowel loops with air-fluid levels.
 - **CT Scan:** Provides more detailed information on the level and cause of the obstruction.
- **Blood Tests:** Elevated WBC, electrolyte disturbances due to vomiting and dehydration.

Management:

- **Surgical Intervention:**
 - **Exploratory Laparotomy:** To identify the cause of the obstruction and remove it (e.g., adhesions, tumor, hernia).
 - **Bowel Resection:** In cases of strangulation or necrosis of the bowel, resect the affected part.
 - **Anastomosis:** Reconnecting the healthy ends of the bowel after resection.
 - **Colostomy:** For cases where bowel reconnection is not possible.

Lifestyle Modifications:

- **Postoperative Diet:** Gradual return to oral intake, starting with clear liquids and advancing to solids.
- **Fluid and Electrolyte Management:** Careful monitoring and correction of dehydration and electrolyte imbalances.

Follow-Up:

- **Wound Care:** Regular monitoring for signs of infection.
- **Stoma Care:** For patients with colostomies, proper care and education on stoma management are essential.
- **Nutritional Support:** Monitoring for nutritional deficiencies or complications related to bowel function.

5. Ectopic Pregnancy

Diagnosis:

- **Clinical Presentation:**
 - Abdominal pain, vaginal bleeding, positive pregnancy test, and signs of shock in severe cases.
- **Ultrasound:** Confirming the location of the pregnancy outside the uterus.
- **Beta-hCG Levels:** Elevated but not doubling as expected in normal pregnancies.

Management:

- **Surgical Intervention:**
 - **Laparoscopy:** Preferred method for surgical removal of the ectopic pregnancy. Involves salpingectomy or salpingostomy.
 - **Methotrexate:** A non-surgical option for stable, small ectopic pregnancies. Methotrexate stops the growth of the ectopic tissue.
 - **Blood Transfusion:** If hemorrhage occurs, transfusion may be necessary.

Lifestyle Modifications:

- **Avoid Pregnancy for Some Time:** It is often recommended to avoid pregnancy for at least 3–6 months after an ectopic pregnancy to allow full recovery.
- **Contraceptive Counseling:** If a fallopian tube is removed, counseling on fertility and contraception is critical.

Follow-Up:

- **Beta-hCG Monitoring:** Serial measurements to confirm resolution of the ectopic pregnancy.
- **Wound Care:** Postoperative wound management to ensure healing and prevent infection.
- **Psychological Support:** Emotional and psychological support for women who experience pregnancy loss.

6. Ruptured Abdominal Aortic Aneurysm (AAA)

Diagnosis:

- **Clinical Presentation:**
 - Sudden severe abdominal or back pain, hypotension, shock, and pulsatile mass in the abdomen.

- **CT Scan:** The definitive imaging test for detecting AAA and rupture.
- **Ultrasound:** To confirm the presence of an aneurysm in patients with suspicious symptoms.

Management:

- **Surgical Intervention:**

- **Endovascular Aneurysm Repair (EVAR):** Preferred in stable patients; involves inserting a stent graft via a catheter.
- **Open Repair:** In cases where EVAR is not feasible, open surgery with graft replacement is performed.
- **Hemodynamic Resuscitation:** IV fluids and blood transfusions to stabilize the patient.

Lifestyle Modifications:

- **Blood Pressure Management:** Post-surgery, keeping blood pressure under control to prevent rupture.
- **Avoid Smoking:** Smoking cessation is crucial for the prevention of further aneurysms.

Follow-Up:

- **Imaging:** Regular follow-up imaging to ensure the stent graft or repaired area remains intact.
- **Blood Pressure Control:** Ongoing monitoring and medication to maintain a stable blood pressure.
- **Physical Activity:** Gradual return to physical activities once cleared by the surgical team.

General Post-Surgical Follow-Up for Emergency Surgeries:

- **Regular Monitoring:** Checking vital signs, pain levels, and wound status frequently.
- **Pain Management:** Adequate analgesia, including opioids or NSAIDs.
- **Nutritional Support:** Nutritional counseling, especially for bowel-related surgeries.
- **Rehabilitation:** Physical therapy to aid recovery, particularly after trauma or bowel surgery.
- **Psychological Support:** Counseling for trauma recovery and emotional healing, if necessary

Implementation and Review Process

1. Monitoring Frequency:

- **Monthly:** Conduct compliance checks and document findings.
- **Quarterly:** Summarize and review compliance trends and performance.
- **Annually:** Comprehensive review of the STG utilization and its impact on clinical outcomes.

2. Review Meeting:

- Conduct regular review meetings with emergency and critical care staff to address non-compliance, discuss findings, and implement corrective actions.

3. Training Needs:

- Identify training needs based on observed compliance gaps and provide targeted refresher sessions to ensure adherence.

4. Resource Management:

- Ensure availability of essential medications, diagnostic tools, and equipment necessary for adherence to STG protocols.

5. Feedback Mechanism:

- Develop a feedback system for staff to provide insights into protocol usability and any barriers faced in the implementation process.

FREQUENCY OF MONITORING

1. Department level Monitoring:

- ❖ **Monthly audits** will be performed on randomly selected cases to evaluate adherence to key performance indicators.
 - ✓ For areas with recurring non-compliance, specific action plans with timelines and responsible personnel will be developed.
 - ✓ The implementation of these plans will be monitored during subsequent audits to ensure progress.

2. Quality Unit Monitoring:

- ❖ The hospital's quality unit should perform **quarterly monitoring** of protocol adherence across all departments, utilizing standardized monitoring tools.
 - ✓ Findings from these reviews will be summarized in quarterly reports that highlight trends, successes, and areas requiring improvement.
 - ✓ Any deviations identified during monitoring will be addressed through corrective action plans with timelines and responsible personnel developed collaboratively by the Quality Unit and Department teams.

General STG Protocol Utilization Monitoring Tool

Indicator	Compliance Check (Y/N)	Findings	Comments/Action Required
1. Protocol Accessibility: Protocols are readily available to all clinical staff in the department			
2. Staff Training: Staff have received training on the protocols, including updates and new guidelines			
3. Documentation Compliance: Documentation is completed thoroughly for all cases, with adherence to diagnostic and treatment steps as per protocol			
4. Initial Assessment: Patients receive timely initial assessment, including vital signs and primary condition evaluation			
5. Accurate Diagnosis: Conditions are diagnosed accurately, using appropriate tests or assessments as specified in protocols			
6. Treatment Timeliness: Treatment is initiated within the recommended timeframe for each protocol			
7. Protocol-Specific Treatment: Treatments and medications follow the standard guidelines for each condition (e.g., medication type, dosage, administration)			
8. Monitoring and Follow-up: Patients are monitored according to protocol guidelines, with follow-up assessments documented			
9. Patient Education: Patients and/or family members receive education on the diagnosis, treatment, and signs for seeking further care			
10. Referral Protocols: Cases requiring specialized care are referred according to protocol recommendations			

11. Discharge Planning: Discharge plans are developed for each patient, with clear instructions and follow-up care arrangements			
12. Outcome Documentation: Patient outcomes and final status (e.g., recovery, discharge, referral) are recorded in line with protocol requirements			
13. Infection Control Measures: Staff follow infection control guidelines during patient treatment (e.g., hand hygiene, PPE usage)			
14. Multidisciplinary Collaboration: Collaboration among healthcare team members (doctors, nurses, specialists) follows the protocol recommendations for integrated care			
15. Pain Management: Pain is assessed and managed according to the protocols, ensuring timely and appropriate interventions			
16. Risk Stratification: Patients are risk-assessed for complications as per protocol guidelines (e.g., for sepsis, respiratory failure)			
17. Patient Safety and Monitoring: Adherence to safety checks and monitoring during critical interventions (e.g., use of monitoring equipment for vital signs, oxygen levels, etc.)			
18. Documentation of Patient Information: Accurate and complete documentation of patient history, treatment, and progress according to the protocol			
19. Adherence to Medication Protocols: Administration of prescribed medications in accordance with the clinical practice protocol for each condition			
20. Patient and Family Education: Patients and their families receive education about the diagnosis, treatment, and follow-up care as per protocol			



DEDER GENERAL HOSPITAL

EMERGENCY AND CRITICAL CARE DEPARTMENT

Standard Treatment Guidelines (STG) Protocol

“Adapted from National STG 2021 4th Edition”