

LECTURE NOTES

For Health Officers

Surgery



**Ethiopia Public Health
Training Initiative**

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CHAPTER ONE

SHOCK

Learning Objectives

At the end of this chapter, each student should be able to:

- State the clinical definition of shock
- List the chief characteristics and causes of all types of shock
- Describe the clinical symptoms and signs that are indicative of shock
- List the immediate treatment measures to prevent complications

Introduction

Shock is a life-threatening condition which occurs when the circulatory system fails to deliver oxygen and nutrients to the body tissues and becomes unable to remove waste products from the body. It is a descriptive term based on the symptoms and signs secondary to one or more of a wide range of problems. If not recognized and corrected as early as possible, shock may rapidly progress to an irreversible state with subsequent multi-organ failure and death.

DEFINITION

Shock is defined as a pathological state causing inadequate oxygen delivery to the peripheral tissues and resulting in lactic acidosis, cellular hypoxia and disruption of normal metabolic condition.

CLASSIFICATION

Shock is generally classified into three major categories:

1. *Hypovolemic* shock
2. *Cardiogenic* shock
3. *Distributive* shock

Distributive shock is further subdivided into three subgroups:

- a. *Septic* shock
- b. *Neurogenic* shock
- c. *Anaphylactic* shock

Hypovolemic shock is present when marked reduction in oxygen delivery results from diminished cardiac output secondary to inadequate vascular volume. In general, it results from loss of fluid from circulation, either directly or indirectly.

- e.g.
- Hemorrhage
 - Loss of plasma due to burns
 - Loss of water and electrolytes in diarrhea
 - Third space loss (Internal fluid shift into inflammatory exudates in the peritoneum, such as in pancreatitis.)

Cardiogenic shock is present when there is severe reduction in oxygen delivery secondary to impaired cardiac function. Usually it is due to myocardial infarction or pericardial tamponade.

Septic Shock (vasogenic shock) develops as a result of the systemic effect of infection. It is the result of a septicemia with endotoxin and exotoxin release by gram-negative and gram-positive bacteria. Despite normal or increased cardiac output and oxygen delivery, cellular oxygen consumption is less than normal due to impaired extraction as a result of impaired metabolism.

Neurogenic shock results primarily from the disruption of the sympathetic nervous system which may be due to pain or loss of sympathetic tone, as in spinal cord injuries.

PATHO PHYSIOLOGY OF SHOCK

Shock stimulates a physiologic response. This circulatory response to hypotension is to conserve perfusion to the vital organs (heart and brain) at the expense of other tissues. Progressive vasoconstriction of skin, splanchnic and renal vessels leads to renal cortical necrosis and acute renal failure. If not corrected in time, shock leads to organ failure and sets up a vicious circle with hypoxia and acidosis.

CLINICAL FEATURES

The clinical presentation varies according to the cause. But in general patients with hypotension and reduced tissue perfusion presents with:

- Tachycardia
- Feeble pulse
- Narrow pulse pressure
- Cold extremities (except septic shock)
- Sweating, anxiety
- Breathlessness / Hyperventilation
- Confusion leading to unconscious state

Summary: Clinical features of hypovolemic shock in adults with estimated volume loss.

Estimated blood loss	750-1500ml	1500ml-2000ml	>2000 ml
Blood pressure	Normal	Reduced	Severely Reduced
Pulse rate	>100/min	>120/m	>140/m very feeble
Capillary refill	Slow	Slow	Undetectable
Respiratory rate	20-30/m	30-40/m	>35/m
Urinary flow rate (Normal: 30-60 ml/hr or 0.5-1ml/kg/hr)	20-30/hr	10-20/hr	0-10/hr
Mental state(CNS)	Anxious	confused	Lethargic, comatose

MANAGEMENT OF SHOCK

Treatment is aimed at restoring oxygen delivery to the cells of vital organs as rapidly as possible. The management depends on the cause and type of shock.

General Management

- Monitor the airway, breathing and circulation as first priority
- Stop bleeding
- Fluid resuscitation, preferably crystalloids
- Head down position
- Treat the cause
- Transfusion of compatible blood if indicated
- Oxygen and other supportive measures like inotropic agents
- *Monitoring of resuscitation effectiveness:* e.g. determine hourly urine output, blood pressure and pulse rate

Specific Management

Hypovolemic Shock: The goal of treatment is to restore vascular volume. This is effected by:

- General approach as above
- Fluid and blood replacement
- Oxygen support etc.

Septic Shock

- Initial management as above
- Appropriate antibiotics especially for gram-negative microorganisms
- Inotropic support such as adrenaline and dopamine
- Surgical eradication of the infection focus

Cardiogenic shock

- Initial management as above
- Inotropes
- Treat the causes
- Etc.

Neurogenic shock

- Initial management as above
- Pain relief
- Treat the causes, give supportive measures like inotropic support

COMPLICATIONS OF SHOCK

The main complications of severe shock include:

1. Shock lung (ARDS)
2. Acute renal failure
3. Gastrointestinal ulceration
4. Disseminated intravascular clotting
5. Multiorgan failure
6. Death

Therefore, a patient in shock requires immediate emergency treatment. Early diagnosis and immediate correction of shock prevents permanent organ damage and death.

CHAPTER TWO

FLUID AND ELECTROLYTES

Learning Objective

At the end of this chapter, the learner should know:

- The anatomy and physiology of body fluids and electrolytes
- The common fluid and electrolyte changes, their causes and management
- The common acid base imbalances and their treatment

Introduction

Knowledge about fluid electrolyte and acid base changes and their management is basic to the care of the surgical patient. Many disease processes result in changes that could result in rapid deterioration of the patient and death. Anyone caring for surgical patients should have a basic knowledge of fluid, electrolyte, acid and base disturbances, as well as their causes and their management.

DEFINITIONS

Moles or millimoles: number of particles present per unit volume

Equivalents or milliequivalents: number of electric charges per unit volume.

Osmoles or milliosmoles: number of osmotically active particles or ions per unit volume.

A mole of a substance is the molecular weight of that substance in grams. An equivalent of an ion is its atomic weight expressed in grams divided by the valence. In case of univalent ions, one milliequivalent (meq) is the same as one millimole. In case of divalent ions such as calcium or magnesium, one mole equals two meq. When the osmotic pressure of a solution is considered, it is more descriptive to use units of osmole or milliosmole.

These units refer to the actual number of osmotically active particles present in solution but they are not dependent on the chemical combining capacities of the substances. Thus, a millimole of sodium chloride which dissociated into sodium and chloride contributes 2 milliosmole.

NORMAL DISTRIBUTION OF BODY FLUIDS

Total body water

The total body water constitutes 50 – 85% of total body weight depending on age and lean body mass (muscle mass). In regard to this, 55% - 60% of body weight for a 70 Kg young

man is water. Females have lower body water (45 –60%) because of the high fat content of their body. The total body water in neonates is 80%-85%, which is higher than in adults.

Total body water is further divided into two:

1. Intracellular fluid, comprising 2/3 of total body water
2. Extra cellular fluid, comprising 1/3 of total body water. The extra cellular fluid is sub divided into *Intravascular* (plasma) comprising 2/3 of extra cellular fluid and *Interstitial* which comprises 1/3 of extra cellular fluid.

N.B. Physiologically all compartments of body water are interdependent.

CHEMICAL COMPOSITION OF BODY FLUID COMPARTMENTS

CATIONS	ANIONS
154meq/l	154 meq/L
	103
NA + 142	HC3- 27
	SO4- 3
	PO4-
K+ 4	ORGANIC
ca ++ 5	ACID 5
Mg ++ 3	Protein 16

Plasma

CATIONS	ANIONS
200 meq/L	200 meq/L
NA+ 144	CL 114
	HCO3- 30
	SO4- 3
	PO4-
K+	Organic
Ca++ 3	Acid 5
Mg ++	protein 1

Intracellular fluid

CATIONS	ANIONS
154meq/l	154 meq/L
K+ 150	HPO ₄ =
	So ₄ = 150
Mg ++ 40	HCO ₃ - 10
Na+	Protein 40

Interstitial fluid

AVERAGE DAILY WATER EXCHANGE

Out put	Urine:	1500 ml
	Insensible loss:	1000 ml (up to 1700 in hot climate)
	Stool:	200 ml
	Total:	2700-3400ml
Intake	Endogenous:	200 ml (from oxidation of ingested food.)
	Net requirement:	2500-3200

N.B: A minimum urinary output of approximately 400 ml in 24 hours is required to excrete the end products of metabolism.

Commonly available replacement fluids

	Ions (millimol per liter)			Carbohydrate (gram per liter)	Used for replacement of
Fluid	Na ⁺	Cl	Ka ⁺		
Physiologic saline (Normal saline)	154	154	0	0	Blood/ extra cellular fluid loss
Hartmann's solution (Ringer's lactate) (Contains lactate and calcium)	131	112	5	0	Blood, intracellular fluid loss
5% glucose in water (D/W)	0	0	0	50	Maintenance and for medication

DISTURBANCES OF FLUID AND ELECTROLYTES

CLASSIFICATION

Disturbances in body fluids can be classified into three:

- Disturbance in fluid volume
- Disturbance in composition
- Disturbance in acid base balance

DISTURBANCE IN FLUID VOLUME

Volume deficit

Extra cellular fluid (ECF) volume deficit is the most common fluid volume disorder in the surgical patient. The lost fluid is not water alone, but water and electrolytes in approximately the same proportion as they exist in normal extra cellular fluid.

Causes

- Losses of gastro-intestinal fluids: e.g. vomiting, gastric tube, diarrhea and enterocutaneous fistulas
- Sequestration or loss of fluid in soft tissue injuries and infections such as burns
- Intra-abdominal and retroperitoneal inflammatory processes such as peritonitis, intestinal obstruction, etc.

Clinical feature

Depends on the severity of fluid loss

Moderate (5-10%): sleepiness, orthostatic hypotension

Severe (more than 15%): signs of hypotension, stupor or coma, sunken eye balls, dry oral mucosa and tongue, poor skin turgor and decrease in body temperature.

Treatment

Placement of extra cellular loss with fluid of similar composition:

Blood loss: Replace with Ringer's Lactate, Normal Saline or Blood, if needed

Extra cellular fluid: Replace with Ringer's Lactate, Normal Saline

Rate of fluid replacement

The Rate depends on the degree of dehydration. It should be fast until the vital signs are corrected and adequate urine output is achieved. One liter over 30 minutes to one hour can be given for severe dehydration.

Monitoring

The general condition and the vital signs of the patient should be followed.

The urine out put should be monitored hourly.

Auscultate the chest to follow overload especially in children and the elderly.

Volume Excess

Extra cellular fluid volume excess is generally iatrogenic or secondary to renal insufficiency, cirrhosis, or congestive heart failure.

Clinical feature

Subcutaneous edema, basilar rales on chest auscultation, distention of peripheral veins, and functional murmurs may be detected. Children, the elderly, patients with cardiac or renal problems are at increased risk of dangers of fluid replacement.

Treatment

- Stop IV fluids (Fluid restriction)
- Diuretics: e.g. frusemide

DISTURBANCE IN ELECTROLYTES

Even though there can be disturbance in any of the electrolytes, the most commonly encountered ones are discussed here.

Sodium (Na^+)

- It is the most abundant cation of the extra cellular fluid
- After trauma and surgery, there is a period of shut down of sodium excretion for up to 48 hours. During this period, it may not be advisable to administer large quantities of isotonic saline.
- The concentration of serum sodium is not related to the volume status of extra-cellular fluid. A severe volume deficit may exist with a normal low or high serum level.
- Daily requirement of sodium is one millimol/kg. The excretion of sodium by the kidneys is under the control of aldosterone.

Sodium depletion (Hyponatremia): Na^+ less than 130 milliequivalent/liter

Hyponatremia can be associated with

1. Volume depletion, sodium and water depletion. Most frequent cause of sodium and water depletion in surgery is small intestinal obstruction. Duodenal, Biliary, pancreatic and high intestinal fistula are also causes of hyponatremia.
2. Water intoxication with excess volume and edema, over-prescribing of intravenous 5% D/W and colorectal washouts with plain water

Clinical feature

It can present with signs and symptoms of either fluid excess or fluid overload depending on the primary cause.

Laboratory:

Serum sodium and other electrolytes, hematocrit drops

Treatment

Ringer's Lactate or Normal Saline In cases of volume depletion.

Fluid restriction and sodium sparing diuretics In case of fluid excess.

Sodium Excess (Hypernatremia): Na^+ more than 145 mmol

Causes

- Excessive water loss in burns or sweating, insensible losses through the lungs.
- Excess amount of 0.9% saline solution is given IV during the early operative period where there is some degree of retention of sodium.

Clinical feature

Depending on the cause it can be of fluid excess or fluid deficit.

Treatment

5% D/W can be infused slowly

Potassium (K^+)

Potassium is the most abundant intracellular cation. 98% of potassium is found intracellular with $\frac{3}{4}$ of the total body potassium in skeletal muscles. The average daily requirement is 1 mmol/kg.

Potassium depletion (Hypokalemia): $K^+ < 3.5 \text{ mmol/L}$

Causes

1. Loss in gastrointestinal secretions such as vomiting in Gastroenteritis or diarrhea
2. Movement of potassium into cells e.g. in alkalosis
3. Prolonged administration of potassium free parenteral fluids with continued obligatory renal loss of potassium
4. Excessive renal excretion – e.g. Diuretic use.

Clinical features

Most patients are asymptomatic. Clinical symptoms and signs such as listlessness, slurred speech, muscular hypotonia, and depressed reflexes are presenting features. Abdominal distension results due to paralytic ileus.

Treatment

- Oral potassium in the form of milk, meat extracts, fruit juices, honey and KCl tablets
 - 40 mmol KCl IV added to 1 liter of fluid run over 6 -8 hours. Never directly IV.
 - Correct the underlying cause
- N.B.: Administration should be properly controlled, the level of potassium should be checked daily and the urine output must be adequate.

Potassium Excess (Hyperkalemia): $K^+ > 5 \text{ mmol/L}$

Significant quantity of intracellular potassium is released into the extra cellular space in response to severe injury, surgery, acidosis and a catabolic state. A significant rise in serum potassium concentration may occur in these states in the presence of oliguric or anuric renal failure. A renal insufficiency with hypoaldosteronism can cause hyperkalemia.

Clinical features

Nausea, vomiting, intermittent intestinal colic and diarrhea are the presenting pictures. Cardiovascular signs are apparent on ECG with high peaked T waves, widened QRS complex and depressed ST segment. Disappearance of T waves, heart block and cardiac arrest may develop with increasing levels of potassium.

Treatment

Measures to reduce K⁺ level:

- Administration of bicarbonate and glucose with insulin. 10 to 20 units of regular insulin and 25 to 50 g of glucose can be used.
- 10 ml of 10% calcium gluconate to suppress the myocardial effect
- Enteral administration of cation exchange resin (Kayexalate).
- Dialysis
- Avoid exogenous potassium

Calcium (Ca++)

Normal serum level is 8.5 to 10 .5 mg/dl. An increase in pH causes a fall in the ionized proportion of calcium. Calcium imbalance is not frequently encountered.

Hypocalcaemia (serum level below 8mg/dl)

Common causes include:

- Hypoparathyroidism after thyroid surgery
- Acute pancreatitis
- Massive soft tissue infection (necrotizing fascitis) and
- Pancreatic and small bowel fistulas

Clinical feature

Latent hypocalcemia: Positive Chovestek's and Trousseau's sign.

Symptomatic: Numbness and tingling, hyperactive tendon reflexes, muscle and abdominal cramp, tetany with carpopedal spasm and convulsions.

Treatment

IV Calcium gluconate (10ml of 10% solution over 10 minute) or calcium chloride.

Calcium lactate may be given orally with or without Vitamin D.

Hypercalcaemia (serum calcium over10.5mg/dl)

Hypercalcaemia occurs with hyperparathyroidism, Vitamin D intoxication, cancer and prolonged immobilization. It is uncommon in surgical patients.

Clinical feature

Most are asymptomatic. Symptoms can include fatigue, lassitude, weakness of varying degree, anorexia, nausea and vomiting. Other symptoms include severe headaches, pain in the back and extremities, thirst, polydypsia and polyuria.

Treatment

A serum level of calcium of 15 mg/dl or higher requires emergency treatment.

- Vigorous volume repletion with salt solutions.
- Oral or IV inorganic phosphate or mithramycin.

ACID – BASE BALANCE

Normally, the blood pH lies within the range of 7.36-7.44. The control of this tight balance is accomplished by:

- *Blood buffer*:- which includes the bicarbonate and carbonic acid, phosphates ,serum proteins and meth-hemoglobin(play a greatest role from the blood buffers)
- *The lung*:- excretes acid(CO_2)
- *Kidney* :- the ultimate organ to maintain imbalance to near normal by its capacity to excrete both acid and base.

Alkalosis (accumulation of Base or loss of acid)

Metabolic Alkalosis

Causes

- Loss of acid from the stomach by repeated vomiting or aspiration
- Excessive ingestion of absorbable alkali
- Hypokalemic alkalosis in patients with pyloric stenosis: potassium loss due to repeated vomiting.

Clinical Features

- Cheyne-stokes respiration with periods of apnea
- Tetany sometime occurs.

Treatment

- Repletion of volume + potassium (check urine output)
- Use of 0.1 N or 0.2 N HCl is also effective in treatment of resistant metabolic alkalosis.

Respiratory Alkalosis (PCO₂ below the normal range of 31 – 42 mmHg)

Causes

Most common cause is excessive pulmonary ventilation by anesthetized patients in surgical practice. It can also be caused by hyperventilation due to severe pain, hyper pyrexia and high altitude.

Clinical Features

The dangers of a severe respiratory alkalosis are those related to potassium depletion and include the development of ventricular arrhythmias and fibrillation.

Treatment

Can be corrected by breathing into a plastic bag, or insufflation of carbon dioxide.

Acidosis (accumulation of acid or loss of base)

Metabolic Acidosis

Causes

Increase in fixed acids due to:

- Anaerobic tissue metabolism (shock, infection, tissue injury)
- Retention of metabolites in renal insufficiency
- Formation of ketone bodies in diabetes or starvation

Loss of bases in:

- Chronic diarrhea, gastro colic or high intestinal fistula, excess intestinal aspiration

Clinical Features

Besides signs and symptoms of the primary etiology like shock and infection, rapid, deep, noisy breathing is found. The urine becomes strongly acidic.

Treatment

- Tissue hypoxia should be treated by reperfusion
- Sodium bicarbonate can be given where bases have been lost or where the degree of acidosis is so severe that myocardial function is compromised.

Respiratory Acidosis

Causes

Impaired alveolar ventilation due to:

- Airway obstruction
- Thoracic and upper abdominal incisions, abdominal distention in ileus
- Pulmonary diseases (pneumonia, atelectasis especially post operative)
- Inadequate ventilation of the anesthetized patient

Clinical Features

Restlessness, hypertension and tachycardia may indicate inadequate ventilation with hypercapnia.

Treatment

- Must focus on relieving the primary cause.
- Relieving airway obstruction, adequate analgesia, and draining pleural effusion are some of the definitive measures.
- Intubation and mechanical ventilation may be used in severe cases.

ACID BASE BALANCE SUMMARY

Type of Acid-Base Disorder	Defect	Common Causes	Compensation
Respiratory acidosis	Retention of CO2 (Decreased alveolar ventilation)	Respiratory center depression: morphine, CNS injury, Pulmonary disease: emphysema, pneumonia	<u>Renal</u> Retention of bicarbonate, excretion of acid salts, increased ammonia formation Chloride shift into red cells
Respiratory alkalosis	Excessive loss of CO2 (increased alveolar ventilation)	Hyperventilation: Emotional Severe pain Assisted ventilation Encephalitis	<u>Renal</u> Excretion of bicarbonate, decreased excretion of acid salts decreased ammonia formation
Metabolic acidosis	Retention of fixed acids or Loss of base bicarbonate	Diabetes, Azotemia, Lactic acid accumulation, Starvation. Diarrhea, Small-bowel fistula	<u>Pulmonary</u> (rapid) Increased rate and depth of breathing <u>Renal</u> (slow) As in respiratory acidosis
Metabolic alkalosis	Loss of fixed acids Gain of base bicarbonate Potassium depletion	Vomiting Gastric suction (pyloric obstruction) Excessive bicarbonate intake Diuretics	<u>Pulmonary</u> (rapid) Decrease rate and depth of breathing <u>Renal</u> (slow) As in respiratory alkalosis

Review Questions

1. What types of acids base balance and electrolyte changes will a patient with GOO have? Which kind of fluid will you use for resuscitation?
2. What is the role of the kidney in electrolyte and acid -base balance?
3. What are the buffer systems of the body? Which is the most rapid one?
4. Outline treatment of a patient with metabolic acidosis

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CHAPTER THREE

BLOOD TRANSFUSION

Learning objectives

After reading this chapter students should be able to:

1. Identify indications for blood transfusion
2. Mention types of blood component therapy
3. Know blood transfusion reactions and their preventions

Definition

Blood transfusion is the procedure of introducing the blood of a donor, or pre-donated blood by a recipient into the recipient's bloodstream.

Indications for blood transfusion

The need for blood transfusion in patients with acute hemorrhage is based on

- The volume lost
- The rate of bleeding
- The hemodynamic status of the patient; hematocrit may be normal if determined.
- A patient with acute blood loss of more than 2000ml certainly requires replacement of blood. It must be remembered that crystalloid infusions should be provided while the blood compound is obtained.

For patients with chronic blood loss or chronic anemia replacement of blood (RBC) should be based on the hematocrite level. The optimal hematocrite is considered to be in the range of 30%. But patients with chronic anemia (e.g. renal failure) seem to tolerate hematocrite as low as 18%-20%. Symptomatic patients exhibiting air hunger, dizziness, significant tachycardia or cardiac failure should, of course, be transfused.

Component therapy is indicated when specific factor deficiencies are demonstrated. For instance, factor VIII concentrates is the preferred mode of therapy for classic hemophilia.

Compatibility tests

If administrated blood is incompatible with the patients own blood, life threatening reactions may result. Blood banks routinely test for incompatibilities of the ABO and RH systems. Cross matches allow for detection of rare antibodies (e.g. kell, duffy, kidd) that are not detected in ABO and RH tests. Group-A contains anti-B antibodies, Group-B contains anti-A antibodies, Group-O contains anti-A and anti B antibodies. AB-group can receive any blood.

Blood prepared after a full typing and cross match can be transfused safely in 99.95% cases. In some instances when fully cross- matched compatible blood is depleted or unavailable; type specific or O negative blood should be given. Type O Rh negative blood can be transfused without lysing the recipient's blood.. Irregular recipient antibodies cannot be detected and extra vascular hemolysis can also occur. Overall, O negative blood, if randomly transfused, has a serologic safety of about 99.8%.

Component therapy

Treatment of specific hematologic abnormality often requires only a single component of whole blood. For example, factor VIII for classic hemophilic or platelet transfusion for patients with bone marrow suppression. Blood banks reduce the whole blood received from donors to a variety of components. The available products include whole blood, red blood cells, white blood cells, platelet concentrates and plasma in several forms.

Cellular component

Whole blood

This is collected in citrate phosphate dextrose- adenine solution (CPDA-) and contains 450 ml of whole blood and approximately 60ml of anticoagulant preservative. When it is used within 24 hours it is considered fresh, whole blood and after this time it is referred to as stored. Whole blood has a shelf life of 35 days. In acute massive hemorrhage transfusion with one unit of whole blood raises the recipient's hematocrite by 3%.

Packed RBC

These are the remains after the plasma has been separated from whole blood. One unit raises the recipient's hematocrite by 3%. Packed RBC may be warmed to a temperature not exceeding 37°c before transfusion. The storage life of red blood cells is 35 days.

Platelet concentrate

Platelets are separated from one unit of blood and suspended in a small volume of the original plasma. Depending on this technique, platelets may be stored for 3-7 days. One unit of platelet concentrate contains about 5.5×10^{10} platelets and increases the platelet count by 5000/ml. For a patient with platelet count below 25,000/mm³, 6-8 units are usually given. Platelet concentrate must be administered through a special platelet filter.

Plasma components

Fresh frozen plasma

This is anti-coagulated plasma separated from a person's blood and frozen within 6 hours of the time of collection. It may be stored up to 1 year. It contains all clotting factors and also provides proteins for volume expansion.

Cryoprecipitate

This is a protein fraction removed from a unit of fresh frozen plasma that is thawed at 4^oC. This white precipitate is then removed and frozen. It has a shelf life of about 1 year. It contains factor VIII, fibrinogen and factor XIII. It is used for the treatment of:

- classic hemophilia,
- certain consumptive coagulopathies such as DIC or
- Other clotting abnormalities with specific therapy commonly not available.

Albumin

This is a plasma component used for oncotic support and plasma expansion. Its disadvantages are rapid excretion as well as expense.

Plasma protein fraction

Similar to albumin but contains additional protein molecules.

Complications and risks of blood transfusion

Hemolytic transfusion reactions

Intravascular hemolytic transfusion reactions; are potentially life threatening reactions that can occur by blood transfusion. They are almost always due to incompatibility of the ABO system involving the donor red blood cells and recipient plasma. These reactions are very rare occurring in 1 out of 15,000 -20,000 transfusions.

Pathophysiology

During hemolytic transfusion reaction all donor cells hemolyze, leading to hemoglobinemia, hemoglobinuria and renal failure. These reactions also activate the complement system with subsequent release of vasoactive amines causing hypotension. Complement activation also initiates the clotting mechanism which can produce intravascular thrombosis, DIC and hemorrhage

Clinical manifestation: Patient often experiences fever, chills and dyspnea.

Treatment

- Stop transfusion immediately
- Administration of fluids and diuresis with mannitol or frusemide
- Transfused blood with patients blood sample should be sent for analysis
- Sodium bicarbonate may prevent precipitation of hemoglobin in the renal tubules
- Steroids may ameliorate the immunologic consequences.

Transfusion reactions from mismatches involving the Rh system or minor antibodies usually induce extravascular hemolysis, since these reactions occur slowly, serious complications do not often develop.

Non-hemolytic transfusion reaction

Non-hemolytic reaction may occur after transfusions.

Febrile reaction: occurs in 0.5% -1% of all transfusions and is usually treated with antipyretic drugs.

Allergic reaction: occurs in 2-3% of all transfusion and manifests by urticaria and rashes. Antihistamines, steroids or epinephrine as indicated can accomplish treatment.

Transmission of disease: With the exception of albumin and PPF, the use of all blood products carries risk of transmitting infectious diseases. These include:

- hepatitis
- malaria
- Epstein- bar virus, cytomegalovirus, brucellosis, trypanosomiasis and other diseases potentially transmitted by blood transfusions

Of great concern these days is the risk of transmission of the HIV virus. It is required to screen the donated blood using enzyme- linked immunosorbent assay (ELISA).

Other complications: Complications that can occur with massive transfusion include

- Citrate toxicity
- Acidosis
- Hyperkalemia

N.B:- As blood transfusion is accompanied by various complications mentioned above, the decision to transfuse should only be made when it is believed to be life saving.

Review Questions

1. What factors determine the need for blood transfusion in patients with chronic blood loss or chronic anemia?
2. Enumerate the routine compatibility tests performed in blood banks.
3. List the cellular components of blood with their specific importance.
4. Outline the management principle of patients with hemolytic transfusion reaction.

References

1. Bailey and Loves: Short Practice of Surgery 22nd, ed.
2. Hardy's Textbook of Surgery



CHAPTER FOUR

PRE-OPERATIVE AND POS-OPERATIVE CARE

Learning objectives

At the end of this chapter, students are expected to

- Be familiar with pre and post-operative care and complications
- Identify factors which make patients high risk for surgery
- Differentiate postoperative complications
- Manage common post operative complications

Introduction

In the management of patients with surgical procedures, the overall outcome of the operation mainly depends on the pre-operative diagnosis and the surgical procedure. But in addition to this, the patient's pre-operative situation should be well evaluated so as to make the patient able to withstand the stress of surgery. Factors which make the patient high risk for surgery should be controlled as much as possible. Also, the patients' postoperative course highly depends on the postoperative care given, and anticipation with early diagnosis and management of postoperative complications.

General consideration

Preoperative evaluation should include a general medical and surgical history, a complete physical examination and laboratory tests. The most important laboratory tests are:

- Complete blood count
- Blood typing and Rh-factor determination
- Urinalysis
- Chest x-ray

Further laboratory tests should be performed only when indicated by the patients' medical condition or by the type of surgery to be performed.

Assessment and Minimization of Surgical Risks

Cardiovascular System

Cardiac problems

The preoperative period is associated with significant cardiovascular stress. Patients with heart disease should be considered high-risk surgical candidates and must be fully evaluated.

- Patients with symptoms of previously undiagnosed heart disease (E.g. chest pain, dyspnea, pretibial edema or orthopnea)
- Recent history of congestive heart failure
- Recent myocardial infarction
- Severe hypertension
- Varicose vein and deep venous thrombosis

Such patients should be evaluated with the assistance of medical or cardiology consultation. The perioperative monitoring, induction, and maintenance techniques of anesthesia, and post – operative care can be tailored to the specific cardiovascular diseases.

Pulmonary system

The following respiratory tract problems make patients high risk for surgery;

- Upper airway infections
- Pulmonary infections
- Chronic obstructive pulmonary diseases: chronic bronchitis, emphysema, asthma

Elective surgery should be postponed if acute upper or lower respiratory tract infection is present. Pulmonary infections also predispose to postoperative bronchitis and pneumonia. If emergency surgery is necessary in the presence of respiratory tract infection, regional anesthesia should be used if possible and aggressive measures should be taken to avoid postoperative atelectasis or pneumonia.

Renal system

Renal function should be appraised

- If there is a history of kidney disease, diabetes mellitus and hypertension
- If the patient is over 60 years of age
- If the routine urinalysis reveals proteinuria, casts or red cells

It may be necessary to further evaluate renal function by measuring creatinine clearance, blood urea nitrogen and plasma electrolyte determination.

Rheumatologic system

Anemia

Anemia affects the oxygen carrying capacity of the blood, which can complicate the stress of surgery. Anemia in pre-operative patients is of iron deficiency type caused by inadequate diet, chronic blood loss or chronic disease. Care must be taken to differentiate iron deficiency anemia from other anemias. Iron deficiency anemia is the only type of anemia in which stained iron deposit cannot be identified in the bone marrow. Megaloblastic, hemolytic and aplastic anemia usually are easily differentiated from iron deficiency anemia on the basis of history and simple laboratory examinations. Patients with iron deficiency anemia respond to oral or parenteral iron therapy. In emergency or urgent cases, a preoperative blood transfusion preferably with packed red cells may be given.

Thrombocytopenia

The normal platelet count ranges from 150,000 to 350,000/ml. In the patient with thrombocytopenia but normal capillary function, platelet deficiency begins to manifest itself clinically as the count falls below 100,000/ml. typical manifestations include

- Petechia
- Epistaxis in both sexes and
- Menorrhagia in females of reproductive age
- Uncontrolled bleeding which could be intra or post-operative.

Treatment - treat the underlying cause and support with platelet transfusions and clotting factors as necessary.

Endocrine system

Diabetes mellitus

Diabetics with poor control are especially susceptible to post-operative sepsis. Preoperative consultation with an internist may be considered to ensure control of diabetes before, during and after surgery.

In type - II patients, avoid hypoglycemia by closely monitoring blood sugar on the day of surgery, and possibly by not using the longer acting oral hypoglycemic agents -2 days before operation. Insulin dependent diabetics with good control should be given half of their total morning dose as regular insulin on the morning of surgery. This is preceded or immediately followed by 5% dextrose solution intravenously to prevent hypoglycemia. Regular insulin should then be given every 6 hrs based on plasma glucose level. Chronic medical conditions associated with diabetes may also complicate the preoperative period, e.g. Hypertension,

myocardial ischemia which may be silent. These patients should have an extended cardiac work up and receive metoclopramide as well as a non particulate antacid before surgery.

Thyroid disease

Elective surgery should be postponed when thyroid function is suspected of being either excessive or inadequate. In Hyperthyroidism, The patient should be rendered euthyroid before surgery if possible. This may take up to 2 months with anti-thyroid medications.

In hypothyroidism, thyroxin should be started before surgery if possible. In all cases, treatment should be started with a very low dose of thyroid replacement to avoid sudden and large workload on the myocardium. The usual tests of thyroid function include T3, T4, and TSH levels.

In addition to the above discussed factors, there are issues which might need special consideration in preoperative patients. The diagnosis of early pregnancy must be considered in the decision to do elective major surgery in reproductive age female.

History of serious reactions or sickness after injections, oral administration or other uses of substances like narcotics, anesthetics, analgesics, sedatives, antitoxins or antisera should be sought.

The patients' general hydration status should be assessed and made optimal. Nutritional status of the patient also needs evaluation and correction.

After all this, prior to the operation, it is important to have an empty stomach because full stomach can result in reflux of gastric contents and aspiration pneumonitis. In elective surgery, patients should not eat or drink anything after midnight on the day before surgery.

Post-operative care, complications and their Treatment

Post-operative care

Post-operative care is care given to patients after an operation in order to minimize post operative complications. Early detection and treatment of post operative complications is possible if there is optimal care. Some of the care is given to all post operative patients, while the rest are specific to the type of operation. Routine cares include:

Immediate care:

- a. Vital sign checking
- b. Chest auscultation
- c. Input and output monitoring
- d. Checking for bladder and abdominal distention
- e. Potent analgesics for pain relief

On subsequent post-operative days:

- a. Oral intake can be started
- b. Patients encouraged to ambulate

In the following sessions, we will focus on common postoperative complications.

Cardiovascular complications

Shock

Postoperative efficiency of circulation depends on blood volume, cardiac function, neurovascular tone and adrenal secretions. Shock, or failure of the circulation, may follow:

- Excessive blood loss
- Escape of vascular fluid into the extra vascular compartments ("third spacing")
- Marked peripheral vasodilatations
- Sepsis
- Adrenocortical failure
- Pain or emotional stress
- Airway obstruction

Treatment includes

- Arresting hemorrhage
- Restore fluid and electrolyte balance
- Correct cardiac dysfunction
- Establish adequate ventilation
- Maintain vital organ function and avert adrenal cortical failure
- Control pain and relief apprehension
- Blood transfusion if required.

Thrombophlebitis

Superficial thrombophlebitis

It is usually recognized within the first few days after operation.

Clinical features

A segment of superficial saphenous vein becomes inflamed manifested by:

- Redness
- Localized heat
- Swelling
- Tenderness

Treatment includes

- Warm moist packs
- Elevation of the extremity
- Analgesics

Anticoagulants are rarely indicated when only superficial veins are involved.

Thrombophlebitis of the deep veins

Occurs most often in the calf but may also occur in the thigh or pelvis.

Clinical features

It may be asymptomatic or there may be dull ache or frank pain in the affected leg or calf. The area may be tender and spasm felt in the same area. Examination may reveal slight swelling of the calf. Dorsiflexion of the foot may elicit pain in the calf (Homan's sign). Major complication is pulmonary embolism.

Treatment

- Elevation of the limbs
- Application of full leg gradient pressure elastic hose
- Anticoagulants

Prevention: Early ambulation

Pulmonary embolism

Pre-disposing factors

- Pelvic surgery
- Sepsis
- Obesity
- Malignancy and
- History of pulmonary embolism or deep vein thrombosis

It usually occurs around the seventh to tenth post-operative day. The diagnosis should be suspected if cardiac or pulmonary symptoms occur abruptly.

Clinical features

Patients with large emboli develop chest pain; severe dyspnea, cyanosis, tachycardia, hypotension or shock, restlessness and anxiety. In small emboli, the diagnosis is suggested by the sudden onset of pleuritic chest pain sometimes in association with blood-streaked sputum, and dry cough may develop. Physical examination may elicit pleural friction rub, but in many cases there are no classical diagnostic signs.

Investigation

Chest X-ray- findings are pulmonary opacity in the periphery of the affected lung which is triangular in shape with the base on pleural surface, enlargement of pulmonary artery, small pleural effusion and elevated diaphragm. ECG may show characteristic changes.

Treatment

- Cardiopulmonary resuscitation measures
- Treatment of acid-base abnormality
- Treatment of shock. Immediate therapy with heparin is indicated even in the absence of a definitive diagnosis.

Pulmonary Complications

About 30% of deaths that occur within six weeks after operation are due to pulmonary complication. Atelectasis, pneumonia, pulmonary embolism and respiratory distress syndrome from aspiration or sepsis, fluid overload or infection are the most common pulmonary complications.

Atelectasis

Definition

Atelectasis is a pulmonary complication of early postoperative period. It is a condition characterized by areas of airway collapse distal to an occlusion.

Predisposing factors

Include chronic bronchitis, asthma, smoking and respiratory infection. Inadequate immediate postoperative deep breathing and delayed ambulation also increase the risk.

Clinical features

- Fever in the immediate post operative period
- Increased pulse and respiratory rate
- Cyanosis
- Shortness of breath
- Dull percussion note with absent breath sounds

Investigation

X-ray findings include patchy opacity and evidence of mediastinal shift towards the atelectatic lung.

Prevention and treatment

- Encourage to stop smoking
- Treat chronic lung diseases
- Postpone elective surgery in presence of respiratory tract infections
- Post operatively, encourage sitting, early ambulation and breathing exercise while administering analgesics
- Intensive chest physical therapy
- Supplemental oxygen

Pneumonia and aspiration pneumonitis

Pneumonia may follow atelectasis or aspiration of vomits or other fluids. Preexisting bronchitis also predisposes to this complication.

Clinical features

- Fever in the first few postoperative days
- Respiratory difficulty
- Cough becomes productive
- Physical examination may reveal evidence of pulmonary consolidation

Investigation

Chest-x-ray may show diffuse patchy infiltrates or lobar consolidation.

Prevention and treatment

Chance of pulmonary aspiration can be minimized by

- Fasting
- Naso-gastric tube decompression

If aspiration of gastric content occurs; an endotracheal tube should be placed and the air way suctioned and lavaged.

Treatment of pneumonia includes:

- Deep breathing and coughing
- Change position frequently to encourage expectoration
- Broad spectrum antibiotics therapy should be instituted and revised as indicated by subsequent sputum culture and sensitivity

Gastrointestinal complication

Paralytic Ileus

It is a functional intestinal obstruction usually noted within the first 48-72 hours

Clinical features

- Abdominal distention
- Absent bowel sounds
- Generalized tympanicity on percussion

Investigation

- Plain x-ray-generalized dilatation and gaseous distention of the bowel loops

Treatment

- NGT decompression
- Fluid and electrolyte balance

Post operative intestinal obstruction

Causes

- Peritonitis
- Peritoneal irritation
- Fibrinous adhesion

Clinical features

- Manifests between the 5th and 6th postoperative day
- Significant and protracted vomiting
- Crampy abdominal pain
- Focal tympanicity of the abdomen on percussion
- Exaggerated bowel sounds

Investigation

Plain film of the abdomen usually reveals distension of a portion of small bowel with air fluid levels.

Treatment

Vigorous hydration and careful electrolyte monitoring is needed. This often results in realignments of the bowel loops and relief of the obstruction. Patient should be kept NOP and NGT inserted for decompression. If the obstruction doesn't respond within 48-72 hours, re-operation is necessary.

URINARY TRACT COMPLICATIONS

Urinary retention

Urinary retention can follow pelvic operations and when spinal anesthesia is used. Inability of the patient to void is often due to pain caused by using the voluntary muscles to start the

urinary stream. The patient should be encouraged to get out of bed. Bladder drainage by means of a urethral catheter should be instituted.

Urinary tract infection

Predisposing factors

- Pre-existing contamination of the urinary tract
- Catheterization

Clinical presentation

- Fever
- Suprapubic or flank tenderness
- Nausea and vomiting

Investigation

-Urine analysis (pus or bacteria will be seen in the urinary sediments)

Treatment

- Increase hydration
- Encourage activity.
- After urine specimen is obtained for culture, appropriate antibiotic therapy should be instituted

Wound complications

Wound infections

Pre disposing factors

- Age
- General health
- Nutritional status
- Personal hygiene habits
- Malignancy
- Poor surgical technique

Diagnosis: clinical

- Fever during the 4th to 5th day
- Redness or indurations at operation site

Treatment

- Sutures should be removed
- The wound should be explored and cultured
- Ample drainage should be established together with local wound care
- Appropriate antibiotics if systemic manifestations like fever are persistent.

Hematoma, Abscess and Seromas

These may occur either in the pelvis or under the fascia of abdominal rectus muscle. They are suspected during falling of hematocrite in association with low-grade fever. Small hematoma or seroma often resolve spontaneously, but some can become infected. Ultrasonography is an excellent adjunct to physical examination. Drainage of infected hematoma should be accomplished extraperitoneally.

Review Questions

1. What are the important components of preoperative patient evaluation?
2. List important laboratory investigations which need to be done in almost all pre-operative patients despite the specific diagnosis.
3. What are the risks of untreated respiratory tract infection in surgery?
4. Why is diabetes mellitus considered to be pre operative risk?
5. About post-operative shock
 - a) List the causes, what is the commonest cause?
 - b) What are the clinical manifestations?.
 - c) What are the important measures to be taken to combat shock?
6. What is the most common cause of fever in the immediate postoperative period ?
7. Outline the care for an infected post-operative wound.

References

1. Bailey and Loves: Short practice of Surgery, 22nd ed.
2. Hardy's Textbook of Surgery
3. Current Textbook of Obstetrics and Gynecology, 8th ed.



CHAPTER FIVE

ASEPTIC AND ANTISEPTIC TECHNIQUES

Learning Objectives

After reading this chapter, the student should know

1. The definition of the different terms used in asepsis and antisepsis
2. The properties of the most frequently used antiseptics and their use in surgical and traumatic wounds.
3. How choose the most suitable antiseptics for his/her institution

Introduction

The most serious outcome (important factor) of impaired wound healing is infection. Antiseptics and aseptic techniques are used in an attempt to prevent contamination to an acceptable level making the wound less receptive to bacterial growth. It should be noted, however, that the corner stones in decreasing wound infection are: gentle tissue handling, sharp dissection, good homeostasis, and accurate apposition of wound edge without tension. Proper wound debridement (wound excision) is vital in post traumatic wounds to prevent infection.

Therefore, knowledge of aseptic and antiseptic techniques is very important for the medical practitioner, be it in the ward, minor/major operation theaters or in the emergency out patient department: this knowledge can help prevent infection, unnecessary morbidity and sometimes mortality of patients.

DEFINITIONS

Aseptic technique: the prevention of microbial contamination of tissues and sterile materials by excluding, removing or killing microorganisms

Disinfection: involves the killing or removal of sufficient microbes to render an inanimate object safe for its intended purpose

Antiseptics: Chemicals which can be applied to living tissues to kill or inhibit the growth of microbes.

Cross infection: the transfer of microbes in hospitalized patients to other patients.

Auto infection: infection caused by organisms already colonizing the patient's body or in septic lesions.

CHOICE OF ANTISEPTIC

The ideal antiseptic will have the following four properties

- a. The spectrum of activity would be broad
- b. It would be resistant to inactivation by organic materials, such as blood & feces
- c. There would be no toxicity or allergic reaction, and the antiseptic should be non – staining
- d. It would be inexpensive.

USE OF ANTISEPTICS AND ASEPTIC TECHNIQUES

Prevention of infection in surgical wounds

For prevention of infection in surgical wounds one has to identify the sources and routes of infection. The source of infection in surgical wounds can be:

- The patient
- Staff (a healthy carrier, incubating an infectious disease or with overt clinical illness)
- The operation room
- Occasionally instruments.

The routes of infection are

- Personal contact: patient -to- patient, patient -to- staff, staff -to-patient
- Airborne

Ward and OPD

Patient:-

Common organisms in the absence of infection are gram-positives like

Staphylococcus and streptococcus found on the skin resisting dryness. Gram-negatives are not resistant and are not common causes in clean wounds.

Preventative Measures

- Short hospital stay preoperatively
- Shower a day before surgery
- Treatment of any infectious site before surgery
- Aseptic methods with sterile equipment for all procedures.
- Special preparations e.g. bowel preparation for colonic surgery

Staff:-

Preventative Measures to be taken

- Skin disinfection between contact with patients by detergent (soap and water) in the wards or OPD and use of antiseptic in intensive care and neonatal units.
- Treatment for identified carriers and full blown cases e.g. boils
- Prophylactic antibiotics when indicated

Operating Theater

Most bacteria infecting surgical incisions are implanted during the operation. Therefore strict asepsis has to be maintained.

Staff

- Wear clean clothes, shoes or covers, mask and cap or hood beyond the green line
- Scrubbing up of all operating team before each operation for at least 5 minutes with an antiseptic soap or detergent. To prevent skin damage, brushes should be used only to clean under the nails. Finally, dry with sterile towel and apply 70% alcohol or Povidone iodine if available.
- Put on sterile gloves and gowns in an aseptic manner

Patient

- Shave hair immediately before surgery
- Clean the operation field with antiseptic containing:
 - Chlorohexidin and 2.5% Iodine for adults
 - 70% alcohol for children
 - Podovine Iodine for all ages if available
- Finally, cover with sterile drapes.

Operating Room

There are few bacteria in the air of an empty theatre but every individual liberates about 10,000 organisms per minute into the air. Therefore, to decrease airborne infections, keep the number of personnel reduced to a minimum. Unnecessary movement should also be discouraged.

There should be adequate ventilation for most procedures. If there is no system to provide this, windows should be open to allow ingress of fresh outside air and escape of anesthetic gases.

Keep all doors closed except as needed for passage of equipment and personnel.

Clean operating rooms between operations. At regular intervals, conduct a more thorough cleaning by mopping the floor and washing the walls with detergents.

Instruments

All instruments and garments to be used in surgical procedures must be sterile and this is attained by sterilization.

Sterilization: - is a process by which inanimate objects are made free of all microorganisms.

Widely used methods of sterilization in a hospital are.

Autoclaving: - This is the preferred method of sterilization. It uses steam at a pressure of 750 mmHg above atmospheric pressure and temperature of 120°C for 15-30 minutes. The steam is helpful for penetration even into spores. Appropriate indicators must be used each time to show that the sterilization is accomplished.

Dry heat:-

This is a poor alternative but suitable for metal instruments. It uses a temperature of 170°C for two hours.

N.B. Boiling is an unreliable means of sterilization and it is not recommended.

APPENDIX: properties of commonly used antiseptics

Alcohols (e.g. ethyl, isopropyl): -

Broad spectrum, rapid action, moderately expensive, most active against bacteria at 70% concentration

Chlorhexidine:-

Good activity against staphylococci and streptococci, moderate activity against gram-negative bacteria, persistent action, moderately expensive, non-toxic, unpleasant taste

Iodine (lugols solution):-

Broad spectrum, cheap, stains, hypersensitive

Povidone iodine:-

Broad spectrum, moderately expensive, some hypersensitivity, rapid inactivation by blood

Hexachlorophane:-

Slow, but cumulative action against staphylococci and streptococci, systemic toxicity for neonates, moderately expensive

Triclosan:-

Similar activity but less toxic than hexachlorophene

Chlorine (chlorinated lime and Boric acid (Easol):-

Broad spectrum, locally toxic, expensive

Dilute sodium hypochlorite solution:-

Broad spectrum, cheap, locally toxic

Quaternary ammonium compounds :-(e.g. cetrimide in benzalkonium chloride)

Poor gram-negative activity, readily contaminated, detergent, cheap, non-toxic.

Noxythiolin:-

Releases formaldehyde in contact with tissues, broad spectrum, expensive, weak and slowly bactericidal

Alcohol plus chlorhexidine
Alcohol plus povidon iodine
Chlorhexidine plus cetrimide

useful mixtures

Review Questions

1. Using your knowledge of the properties of the different antiseptics which one would you choose for your health center?
2. Which antiseptics do you recommend for preoperative skin preparation for adults? What about for children?
3. What is the most important measure you would take for a patient who comes to the emergency room with a contaminated wound?

References

1. General Surgery at the District hospital: WHO 1998.
2. Mark Farrington, Infection and the Surgery, Surgery, The medicine group (UK) ltd, 1988



CHAPTER SIX

SUTURE MATERIALS AND SUTURING

Definition

Suture is a thread like material used to close surgical wounds and unite two edges of cut tissue.

Types of Suture Materials

Suture materials can generally be classified as absorbable and non absorbable.

Absorbable:

This is a type of suture material that gets absorbed by the tissue.

E.g. *Catgut* (natural or biologic type)

Vicryl (Synthetic)

Non absorbable:

This is a type of suture material that remains unabsorbed by the tissue.

E.g. *Silk* (natural or biologic type)

Nylon (Synthetic)

SELECTION OF SUTURE MATERIALS

Different surgical stitches are used in various types of tissues for different purposes.

Important factors considered when selecting suture material for surgery include:

- Type and site of the operation
- Healing characteristics of the tissue involved
- Properties of the suture and needle
- Security of knots
- Behavior of the material in presence of infection
- Suture size (The commonest surgical suture size is between 4/0 and 1)

SUTURING TECHNIQUES

The basic principles of suturing technique include:

1. Inserting the needle at right angle and gently advance through the tissue
2. Avoiding tension
3. Size and interval between bites are dependent on the tissue thickness and type of tissue to be sutured

FORMS OF SUTURING TECHNIQUES

Important types of suturing techniques commonly used include:

- Simple interrupted
- Continuous simple
- Vertical and horizontal mattress
- Subcuticular stitches

Figure 1: Simple Interrupted Sutures

Figure 1a

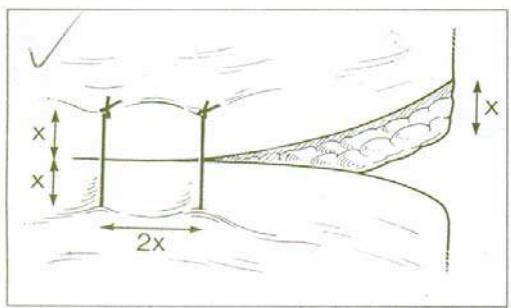


Figure 1b

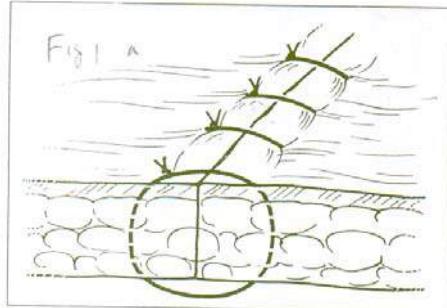


Figure 1c

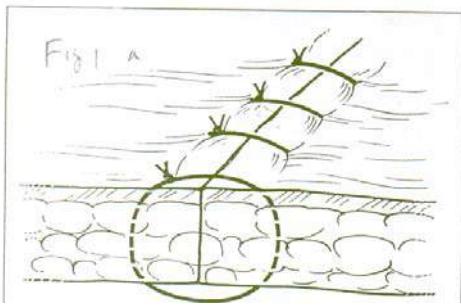
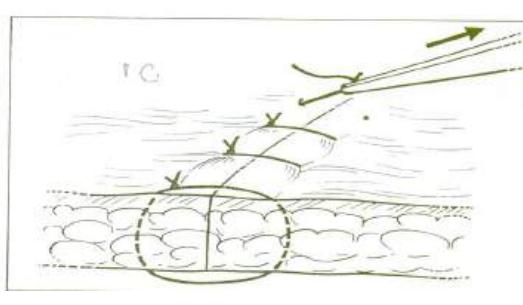


Figure 1d

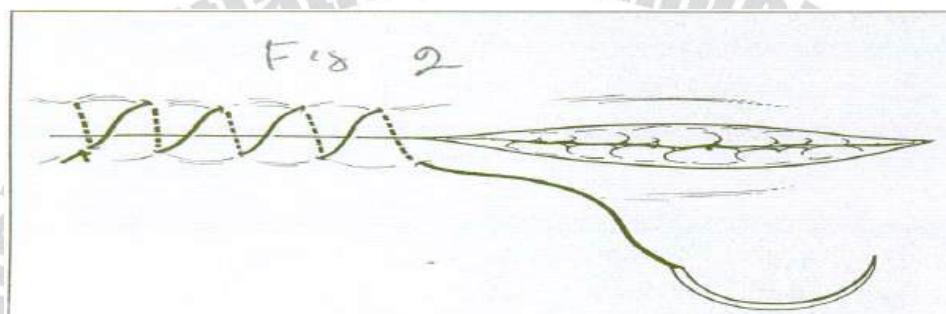


Useful Tips:

- Insert the needle carefully at right angles to the tissue edges. Advance through, gently avoiding shearing force.

- For long wounds being closed with interrupted sutures, it is advisable to start in the middle and to keep on halving the wound.
- Tie a careful reef knot and lay to one side of the wound.
- Cut suture end about 0.5cm long to allow length for grasping during removal.
- When removing sutures, cut flush with the tissue surface so that the exposed length of the suture, which is potentially infected, does not have to pass through the tissues.

Figure 2: Continuous Sutures



Useful Tips:

- Place a single suture and ligate but only cut the short end of the suture.
- Continue to place sutures along the length of the wound keeping tension through an assistant following by holding the suture at the same tension as it is when handed.
- Take care and avoid too much tension.
- Secure the suture at the end by an additional reef knot.

Figure 3: Mattress Sutures

Fig 3 a: Horizontal

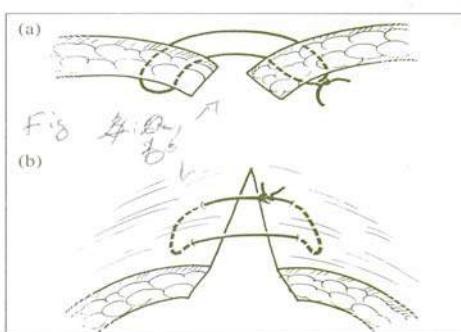
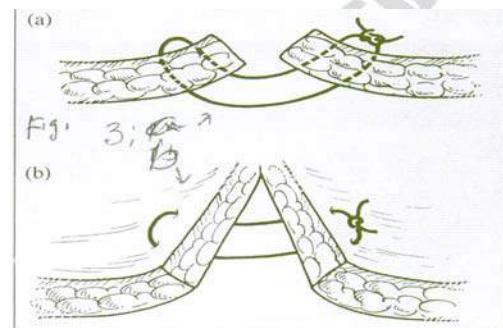
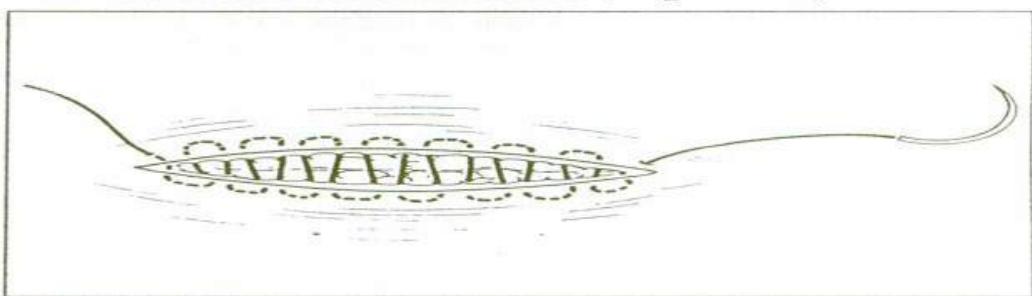


Fig 3 b: Vertical



Mattress sutures may be either vertical or horizontal. They may be useful for ensuring either eversion or inversion of a wound edge.

Figure 4: Subcuticular Sutures



This technique may be used with absorbable or non-absorbable sutures. For non-absorbable sutures, the ends may be secured by means of beads etc. For absorbable sutures, the ends may be secured by means of buried knots.

Small bites of the subcuticular tissues on alternate sides of the wound are taken and then pulled carefully together.

CHAPTER SEVEN

WOUNDS-WOUND HEALING AND CARE

Learning Objectives

At the end of this chapter, each student will be able to:

- Define a wound clearly
- Understand the types of wounds
- Understand managing wounds according to type
- Understand the process of healing.

Introduction

Successful wound management with rapid and complete healing and minimal complication depends on understanding the basic principles of assessment, bacteriology and application of the general principles of wound care.

The primary goal of wound management is to aid the natural body process to produce optimal functional and cosmetic result. This requires an understanding of the basic principles of wound care and the process of healing. Failure to do this may result in delay of healing and unwanted secondary complications which may be distressing to the physician, patient and family and may lead to greater economic loss.

DEFINITION

Wound is defined as a break in the normal continuity of a tissue. It is caused by a transfer of any form of energy into the body which can be either to an externally visible structure like the skin or deeper structures like muscles, tendons or internal organs.

WOUND HEALING

Wound healing is a complex biologic process of restoring normal tissue continuity. There are integrated sequences of events leading to cellular proliferation and remodeling. under normal conditions it starts immediately following the event of wounding and passes through basic mechanisms with the following four phases in all wounds.

Phases of healing

1-Coagulation phase:

This is the first phase of healing which is induced immediately following injury. It is characterized by vaso-constriction, clot formation and release of platelets and other substances necessary for healing and help as a bridge between the two edges.

2- Inflammatory phase:

This phase takes place from time of wounding up to three days. It is characterized by classical inflammatory response, vasodilatation and pouring out of fluids, migration of inflammatory cells and leukocytes and rapid epithelial growth.

3- Proliferate Phase:

This phase, also known as phase of fibroplasia, starts around the 3rd day of injury and stays for about three weeks. This is a phase during which important events occur for healing of the wound. It is characterized by fibroblast, epithelial and endothelial proliferation, Collagen synthesis, and ground substance and blood vessel production.

4- Maturation phase:

Also known as phase of remodeling, this takes the longest period which may extend for up to one year. Equilibrium between protein synthesis and degradation occurs during this phase with cross linking of collagen bundles leading to slow and continuous increase in tissue strength of the wound to return to normal.

Clinical types of healing

Traditionally, wound healing can be classified into three clinical types: Healing by first, second and third intention.

Healing by first intention:

This is a type of healing of clean wound closed primarily to approximate the ends. Healing takes place by epithelialization and leaves minimal scar.

Healing by Second intention:

This occurs in wide, contaminated wounds, which are not primarily closed. Healing takes place by granulation tissue formation, tissue contraction and epithelialization.

Healing by third intention:

This occurs in wounds which are left open initially for various reasons and closed later (delayed primary closure)

Factors affecting healing

Healing of a wound can be affected by various conditions. The following are examples of factors which down grade a healing process.

Local factors

- Ischemia and decreased oxygen tension
- Presence of foreign bodies
- Closure under tension
- Infection
- Irradiation...

Systemic factors

- Systemic diseases like diabetes, cirrhosis, renal failure, malignancy...
- Poor nutritional State (hypo proteinemia vitamin and mineral deficiency)
- Decreased resistance due to immune suppression, chronic infection
- Drug therapy like steroids, cytotoxic agents

WOUND ASSESSMENT AND CLASSIFICATION

Assessment of wounds

For proper wound management, adequate assessment, based on relevant history and physical examination is important. In the history, one has to answer the following principal questions:

- How the wound was caused and what caused it? (Mechanism of injury)
- When did the wounding happen? (Time)
- Where was it caused? (Place and circumstances)
- Patient's past and current medical and vaccination/immunization history that may influence wound healing

Careful physical examination is important to assess the integrity and function of the structures. General inspection and specific tests have to be done to assess the following conditions:

- Extent of skin loss
- Degree of circulation
- Damage to nerves, tendons, bone and other structures (deep under) the skin
- The degree of contamination
- Presence of foreign body and tissue necrosis

Classification of wounds

Once wound is carefully assessed, it is necessary to classify into a specific type in order to plan a proper management scheme. There are many approaches of classifying wounds. However, wounds can generally be grouped into two categories.

Closed wounds: These are wound types, which have an intact epithelial surface, and skin cover not completely breeched.

Example: Contusion, Bruise, Hematoma

Open wounds: These are wounds caused by injury which leads to a complete break of the epithelial protective surface.

Example: Abrasion, Laceration, Puncture, Missile injuries, Bites...

The following method is the traditional surgical wound classification scheme that was introduced in 1964. This method classifies wounds according to the likelihood or rate of wound infection.

Clean: Non-traumatic, non-infected wound, no break in sterility technique, the respiratory, gastrointestinal or genitourinary tracts not entered.

Clean-contaminated: Minor break in technique, oropharynx entered, gastrointestinal or respiratory tracts entered without significant spillage, genitourinary or biliary tracts entered in absence of infected urine or bile.

Contaminated: Fresh traumatic wounds, major break in sterility, gross spillage from gastrointestinal tract, and entrance of genitourinary or biliary tracts in the presence of infected urine or bile

Dirty and Infected: Acute bacterial inflammation without pus, wound with heavy contamination and evidence of infection, transection of "clean" tissue for the purpose of surgical access for collection of pus, traumatic wound with retained devitalized tissue, foreign bodies, fecal contamination, and/or delayed treatment, or from dirty sources

WOUND MANAGEMENT

GENERAL

In managing wounds, care should be taken not to overlook life threatening conditions by concentrating on less important wounds. If other serious conditions exist, which endanger the patient's life, the wound should be covered with sterile gauze and priorities attended to.

Therefore, the patient requires thorough examination before instituting wound management. The following priority has to be set and followed.

- Stabilize the patient and correct all life threatening conditions, like airway obstruction and bleeding.
- Take quick general history on the incident.
- Do gross physical examination to assess associated injuries.
- Assess the wound or soft tissue injury in detail.
- Plan and institute treatment according to the goal and specific wound type.
- Follow up, re-inspect the wound and assess the outcome of your management after a day or two.

Treatment of the wound begins following initial assessment. The initial care of all wounds is generally governed by several principles. However, the goal in all cases is to establish a good environment to assist wound healing and prevent infection. Proper wound care includes the following measures:

- Adequate hemostasis locally to stop bleeding.
- Adequate irrigation to reduce bacterial load and foreign particles.
- Careful debridement to remove all dead tissues and non-vascularized fragments.
- Careful decision on whether to close or leave the wound open for later closure.
- Supplementing with antibiotics and tetanus prophylaxis as required.
- Improving host response by correcting systemic diseases.

Regarding primary wound closure, each condition must be individualized. However, general guidelines that can be followed are:

- Clean wounds should be closed primarily
- Clean-contaminated wounds can be primarily closed if they can be converted, into clean wounds
- Untidy, contaminated wounds which cannot be converted to tidy wounds should not be closed primarily
- All missile wounds, animal and human bites should never be primarily closed unless strongly indicated

Primary closure

Primary closure is effective in wounds presenting within 6-8 hours and can accurately be debrided. This is usual in civilian practice.

Delayed primary closure

Is done for traumatic or contaminated wounds to avoid the risk of wound sepsis. It is done within 3 days of initial treatment.

Secondary closure

This is usually done in 3-7 days of initial treatment. It is effected in contaminated or traumatic wounds. It provides a reliable drainage and opportunity for repeated inspection and debridement as necessary.

SPECIFIC WOUND MANAGEMENT

As mentioned earlier, the management of specific wound types should be individualized. This is mainly governed by local wound factors. The common wound types and their specific management is listed below.

Bruises

These wounds are very superficial. There is no specific management needed except local compress and analgesics if pain is severe.

Hematoma

This is a collection of extravasated blood in the soft tissues.

Management:

- It usually gets absorbed spontaneously and should be left
- Local compress to alleviate pain
- Aseptic evacuation or aspiration only if very large (expanding) or over a cosmetic area or leading to compression of vital structures.

Abrasions

An abrasion is rubbing or scraping of skin or mucous membrane. It may affect only a part or full layer of skin. Dirt particles can be imbedded into the skin defect.

Management:

- Cleanse using scrubbing brushes
- Use antiseptic or lean tap water and soap
- Analgesic

Punctures

These may be compound wounds which involve deeper structures. They require careful management.

Management:

- Evaluate the depth of damage
- Remove pricking or other foreign bodies
- Excise damaged tissue
- Cover with antibiotics
- Tetanus prophylaxis

Lacerations

These are open wounds caused by an object moving across the skin, commonly by sharp and thin objects which slice with minimal energy, like a knife, or glass, but can also be due to high-energy impact. Their management should be as follows.

Management:

- Careful inspection
- Adequate cleansing
- Closure, if feasible, under appropriate anesthesia
- Proper wound debridement if needed
- Appropriate antibiotic prophylaxis
- Tetanus Prophylaxis
- Analgesics as needed

Crush and avulsion wounds

These are compound complicated wounds. They are usually associated with systemic involvement and have more extensive damage than may appear. Manage these conditions as follows.

Management:

- Correct associated life threatening conditions
- Proper wound debridement
- Early skin cover if possible or late graft, wound left open if contaminated
- Appropriate antibiotics
- Tetanus Prophylaxis
- Analgesics as needed

Missile injuries

These are type of wounds which are compound and complicated. There is excessive tissue damage and high degree of contamination. They usually present with severe life threatening conditions and should be carefully managed.

Management:

- Correct life threatening conditions to stabilize the patient's vital functions
- Careful wound inspection
- Careful wound debridement
- Adequate effective antibiotics
- Tetanus Prophylaxis and analgesics as needed
- Avoid primary closure of the wound

BITES

Bites can be caused by humans or other animals. The wounds can be puncture or laceration and are contaminated. Management of common bites is discussed below.

Human bites

These are relatively rare but more heavily contaminated than those of most animalss due to polymicrobial nature including anaerobic organisms as a normal oral flora. Management should include the following aspects.

- Careful wound inspection
- Take culture from wound site
- Thorough scrubbing and liberal irrigation with saline or plain water
- Adequate debridement
- Leave wound open except early face and head wounds
- Do not suture severed tendons and nerves primarily
- Broad-spectrum antibiotics, later to be changed to specific antibiotics according to culture result
- Tetanus Prophylaxis
- Wound observation

Dog bites

Peculiar to dog bites is that infected animals can transmit the rabies virus from the saliva which leads to rabies, a deadly disease. To avoid this complication the animal must be kept for observation for at least 10 days. These wounds should be urgently and carefully managed as follows.

Local management:

- Vigorous irrigation and repeated swabbing and flushing with soap and water or antiseptics
- Local anti-rabies serum infiltration under the wound if available
- Leave wound open

Systemic management:

- Post exposure anti rabies prophylaxis (1ml, IM) on the 1st, 3rd, 7th, 14th and 28th day of bite.
- Tetanus prophylaxis
- Antibiotics

Snake Bites

Poisonous snakes cause severe local and systemic effects due to highly active substances in their venom. Immediate aggressive measures should be taken to limit the affects. Management should include:

First aid measures:

- Local wound irrigation
- Apply pressure bandage proximally to avoid or reduce venom spread with caution on the blood supply
- Immobilize the limb to minimize venom absorption
- Transport patient immediately to nearby hospital

Hospital Measures:

- Identify the species
- Conduct necessary laboratory investigations like hemoglobin, renal function...
- Anti-venom injection, if available
- Supportive care for severe conditions
- Rest
- IV-infusions to combat shock
- Antibiotics
- Blood transfusion
- Tetanus Prophylaxis
- Surgery, if local complications
- Wound excision
- Fasciotomy for compartment syndrome

WOUND COMPLICATIONS

Handled and managed improperly, wounds can result in variants from normal healing and become complicated, causing local systemic complications.

Local: Local complications may manifest as one or more of the following conditions-

- Hematoma
- Seroma

- Infection
- Dehiscence
- Granuloma formation
- Scar formation
- Contracture leading to loss of joint function etc

Systemic:

- Death may occur if un controlled sepsis or hemorrhage
- Systemic manifestations of hemorrhagic shock due to massive bleeding
- Bacteremia and sepsis from a source of locally infected wound

Review Questions

1. Which of the following is important in assessing a wound to manage it properly?
 - A) Duration of injury
 - B) The circumstance of wounding
 - C) The mechanism of injury
 - D) Local appearance of the wound
 - E) All of the above
2. Which of the following wounds can be categorized as “clean”?
 - A) Bullet wound of one hour duration
 - B) Human bite of 30 minutes duration
 - C) Glass laceration of five hours duration
 - D) Crush injury of the leg following car accident
 - E) None of the above
3. A proper wound care includes all measures except
 - A) Removing all devitalized tissue
 - B) Removing foreign bodies impregnated to the wound
 - C) Wound inspection following primary management
 - D) Inadequate hemostasis of a bleeding artery
 - E) Decision to close a wound primarily
4. Which of the following wounds should never be primarily closed?
 - A) Forearm laceration from a knife
 - B) Dog bite to the calf of one hour duration
 - C) Blast wound to the thigh of two hours duration
 - D) Stick wound to the scalp of four hours
 - E) B and C are correct
5. Which of the following wounds requires no surgical procedure?
 - A) Gas gangrene
 - B) Bruise
 - C) Abscess
 - D) Lacerations
 - E) Pyomyositis

6. In a contaminated wound left open to heal without closure, healing is effected by
- A) First intention
 - B) Second intention
 - C) Third intention
 - D) Purely by epithelialization
 - E) All of the above
7. Which of the following factors is unlikely to affect the healing of a wound?
- A) Presence of foreign body
 - B) Systemic illness
 - C) Sex of the patient
 - D) Poor patient nutritional state
 - E) Presence of infection

Key to the Review Questions

1. E
2. C
3. D
4. E
5. B
6. C
7. C

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CHAPTER EIGHT

SURGICAL INFECTIONS

Learning Objectives

At the end of this chapter, each student will be able to:

- Define a surgical infection clearly
- Have a clear understanding on the pathogenesis of surgical infections
- Understand and define the common types of surgical infections
- Understand the management of surgical infection according to its type
- Identify types of surgical infections that require emergency procedure

Introduction

Surgical infection encompasses a wide pathologic aspect. It can be defined broadly as an infection related to or complicating a surgical therapy and requiring surgical management.

Many infections occupy a non-vascularized space of tissue, thus are likely to respond to non-surgical treatments. These types of infection therefore definitely require surgery as a primary or definitive therapeutic approach.

Examples of such infections, which definitely need surgery, can be:

- Gas gangrene
- Abscess
- Appendicitis...

On the other hand, any infection that is related to surgical therapy but that may not definitely require surgery is also categorized as a surgical infection.

Examples:

- Urinary tract infections after catheterization for surgical purpose
- Pulmonary complications following intubation for surgery
- Tracheotomy site infection

All wounds that follow operative procedure or incision are also grouped as surgical infections.

Example:

Post-operative wound infection

CLASSIFICATION

Surgical infections can be classified in relation to specific conditions. According to temporal relation to surgery, surgical infections are grouped into three types.

Ante/pre operative infections:

These infections happen before a surgical procedure. The time of initial infection may or may not be known.

Example:

- Accidents
- Appendicitis
- Boils
- Carbuncle
- Pyomyositis...

Operative infections:

These are types of surgical infections that happen during a surgical procedure. It can occur either due to contamination of the site or poor tissue handling technique.

Postoperative infections:

These infections occur after a surgical procedure. The contamination is usually from the patient's source.

Example:

- Surgical wound infections
- Urinary and respiratory tract infections

PATHOGENESIS

There are certain elements or factors present for a surgical infection to occur. These include:

- An infectious agent
- A susceptible host
- Favorable external factors or local condition with closed, less or non-perfused space.

An infection becomes overt only when the equilibrium between the bacterial and host factors becomes disturbed.

Infectious agents:

Surgical infections are caused by various types of microorganisms either separately or in combination (poly microbial). The common organisms in decreasing order are:-

1- Aerobic bacteria

- Staphylococcus aureus
- Streptococci
- Klebsiella
- E. coli...

2- Anaerobic bacteria

- Bacteroids
- Peptostreptococci
- Clostridia...

3- Fungi

- Histoplasma
- Candida
- Nocardia and actinomycetes...

4- Parasites

- Entameba histolytica causing amebic liver abscess
- Echinococcus causing hydatid cyst...

The organisms get access through skin breaks, operative wounds, tubes, and catheters...They lead to overt infection by various mechanisms, which commonly include tissue invasion, local damage and toxin production. Later, the organisms or their toxins impose more danger by systemic spread.

Host Susceptibility:

Reduced immune host defense predisposes to surgical infections. Conditions affecting the specific and non-specific immunity and systemic diseases that suppress the immune response, like diabetes mellitus, TB and AIDS can reduce the body's immune defense, thus increasing the susceptibility to infection.

Local and external factors:

Closed spaces, usually with poor vascularization, are areas susceptible to infection. Favorable situations under such condition contributing to infection include:-

- Poor perfusion of blood and oxygen
- Presence of dead tissue

- Presence of foreign bodies
- Closure under tension etc.

External factors like a break in the sterility technique also contribute to the development of surgical infection.

DIAGNOSIS

Once an infection develops, it can be diagnosed by the clinical manifestation and supportive laboratory investigation:-

Clinical manifestation: Patients with overt surgical infection may present with the following symptoms and signs:

Symptoms and signs of local inflammation such as hotness, redness, edema/swelling, local pain and loss of function

Non-Specific symptoms like fever, chills, tachycardia, etc.

Constitutional symptoms: Fatigue, low-grade fever, etc.

Laboratory investigations:

WBC count: usually elevated

Staining and culture of discharges and fluids can be diagnostic

Blood culture: Especially if there is bacteremia will be positive

Biopsy: Histologic inspection of tissues can also be diagnostic of infection of various structures

Imaging studies like X-ray and ultrasound can be diagnostic.

SPECIFIC TYPES OF INFECTIONS

Common surgical infections are discussed below separately.

Post-Operative Wound Infection

This is contamination of a surgical wound during or after a surgical procedure. The infection is usually confined superficially to the subcutaneous tissue. If it extends below the fascia, it is considered a deep infection.

Source of infection:

The source of contamination in more than 80% cases is the patient (endogenous). Organisms may come from the patient's skin or transected viscera. In about 20% of cases, the source is from the environment, operating staff or unsterile surgical equipment (exogenous).

Clinical findings:

The infection usually becomes evident on the 5th-7th postoperative day. The following clinical features may accompany the infection.

- Fever
- Wound pain
- Wound edema and induration
- Local hotness and tenderness
- Wound/stitch abscess
- Serous discharge
- Crepitation occasionally

Management:

- Remove stitches to allow drainage
- Local wound care
- Antibiotics only if systemic manifestations or signs of local spread accompany.

Abscess

An abscess is a localized collection of pus. It contains necrotic tissue and suppuration from damage by the bacteria, and white blood cells. It is surrounded by area of inflamed tissue due to the body's response to limit the infection.

Etiology:

Pyogenic organisms, predominantly staphylococci are the leading causes. These organisms lead to tissue necrosis and pus formation.

Clinical features:

Patients with an abscess anywhere in the body may present with the following findings.

- Clinical features of inflammation when superficial (Heat, pain, edema, redness and loss of function)
- Local fluctuation if superficially located.
- Spontaneous discharge and sinus formation
- Systemic manifestations like fever, sweating, tachycardia
- Chronicity especially in granulomatous infection like mycobacteria,

Treatment:

- Primary treatment is drainage of the abscess by making incision
- Debridement and curettage to break all septations and loculations
- Delayed primary or secondary closure is preferred
- Antibiotics should not be given until systemic symptoms or signs of spread occur

Cellulitis

Cellulitis is an inflammation of the subcutaneous tissue characterized by invasion without definite localization. Thin exudate spreads through the cleavage planes of tissue spaces. It usually involves the extremities and identifiable portal of entry is detectable.

Etiology: The most common etiologic organisms are

- Beta hemolytic streptococci
- Staphylococci
- Clostridium perfringens

Clinical Features: There is usually an identifiable portal of entry which can be a surgical wound, puncture site, skin ulcer or dermatitis. Other features include:

- Local signs of inflammation, which may be very intense
- Poorly defined brown-red edema
- Blebs and bullae in severe cases; tissue destruction and ulceration may follow
- Central necrosis and suppuration may occur late in some complicated cases
- Systemic signs of bacteremia and toxemia due to spread and toxin release

Management:

- Rest to limit spread of infection and pain
- Elevation of the involved limb
- Hot, wet pack
- High dose broad spectrum antibiotics IV

Impetigo

This is a skin infection characterized by a series of intraepithelial abscesses which present as multiple small pustules coalescing together. Later these pustules form lesions with erosion and crust formation. The disease is contagious in nature.

Etiology: The causative agents are streptococci and staphylococci.

Clinical Pictures:

- Series of small intra epithelial abscesses , multiple
- Bullous lesions
- Skin erosion and
- Crust formation.

Management:

- Local care
- Careful washing with antiseptic soap
- Local antibiotic ointments like neomycin if available
- Systemic antibiotics like cloxacilline only in resistant cases

Furuncle (Boil)

Furuncle is an acute infection of hair follicles with Para follicular inflammation. It commonly occurs over the axillae, back of the neck and buttocks. Poor hygiene, immune suppressive diseases and irritation are known contributing factors.

Etiology:

The causative agents are staphylococci aureus.

Clinical feature:

- There is an intense local irritation of acute onset
- Painful firm, reddish, round swelling initially, which later becomes fluctuant
- Suppuration and central necrosis occurs later
- The condition subsides and is self-limited to recur in multiple lesions (chronicity)

Treatment:

- It may subside spontaneously without suppuration (Blind boil)
- Incision /Excision if complicated
- Antibiotics

Carbuncle

Carbuncle is an infective gangrene of subcutaneous tissue which commonly occurs in patients with diabetes and other immune suppressive conditions. It is commonly found over the nape of the neck.

Etiology: It is caused by staphylococcus aureus.

Clinical Feature:

- Formed by multiple furuncles
- Pain
- Erythema
- Induration
- Progressive suppuration of thick pus
- Tissue loss with shallow and deep ulcer surrounded by smaller areas of necrosis

Treatment:

- Adequate systemic antibiotics in early stages
- Aggressive debridement
- Local wound care
- Detect and treat predisposing factors like diabetes mellitus

Pyomyositis

Pyomyositis is an acute bacterial infection of skeletal muscles with accumulation of pus in the intra-muscular area. It usually occurs in the lower limbs and trunk spontaneously or following penetrating wounds, vascular insufficiency, trauma or injection. Poor nutrition, immune deficiency, hot climate and intense muscle activity are highly associated factors.

Etiology: The most common causative agent is *Staphylococcus aureus*. *Streptococci* can also be detected in acute form.

Clinical Features: It usually has sub-acute onset and can present with

- Localized muscle pain and swelling, late tenderness
- Induration, erythema and heat
- Muscle necrosis due to pressure
- Fever and other systemic manifestations later after some days

Treatment:

- Immediate intravenous antibiotics before surgery
- Surgical drainage of all abscess
- Excision of all necrotic muscles
- Supportive care

Madura Foot

This is a chronic granulomatous disease commonly affecting the foot with extensive granulation tissue formation and bone destruction. The disease is common in the tropics and occurs through a prick in barefoot walkers in 90% of cases.

Etiology: The causative microorganisms for this infection are various fungi or actinomycetes found in road dust.

Clinical Manifestation:

- Firm, painless, pale nodule appears initially followed by others
- Vesicles surrounding the nodules which later burst and form sinuses
- Watery discharge, which may contain granules appearing yellow, red or black color
- Flattening of the convexity of inner foot
- Deep spread to bones subcutaneous plane leading to secondary infection.

Treatment:

- Sulphonamides and Dapson (prolonged course)
- Broad spectrum antibiotics for secondary infection
- Amputation if severe and disfiguring infection

Necrotizing fasciitis

This is an acute invasive infection of the subcutaneous tissue and fascia characterized by vascular thrombosis, which leads to tissue necrosis. The skin is secondarily affected. It is idiopathic in origin but minor wounds, ulcers and surgical wounds are believed to be initiating factors. The condition is described as "Meleney's synergistic gangrene" if it occurs over the abdominal wall and "Fournier's gangrene" if in the scrotum and perineal area.

Bacteriology:

Mixed pathogens of the following microorganisms are usually cultured.

- Streptococci
- Staphylococci
- Gram negative bacteria
- Anaerobes and
- Clostridia

Clinical Features:

- Sudden onset of localized pain
- Rapidly spreading inflammation
- Spread along chemic fascial planes
- Hemorrhagic bulla and edema
- Skin devascularization
- +/- Crepitations
- +/- Muscle necrosis
- Systemic signs of toxemia

Management:

- Broad spectrum combined antibiotics
- Gentamycin or Ceftriaxone for coverage of aerobic organisms and
- Cloxacilline or chloramphenicol or Metronidazole for coverage of anaerobic organisms
- Circulatory support with intravenous fluid as much as required and transfusion of cross matched blood when necessary
- Surgery soon as possible. The following surgical procedures may be required:
 - Debridement and excision of all dead tissue
 - Multiple incisions for drainage
 - Repeated wound inspection
 - Skin graft may be needed later if extensive skin involved.

CLOSTRIDIAL INFECTIONS

Tetanus

Tetanus is a non-invasive infection caused by anaerobic micro-organisms which requires favorable wounds like abortions, lacerations, injections, open fractures, burns, deep contused wounds with dead tissues and foreign body... It can practically be eliminated by tetanus vaccine immunization if properly initiated and maintained.

Etiology:

Clostridium tetani, a gram-positive rod found in soil and manure is the causative agent. It require anaerobic environment for growth, invasion and elaboration of toxin, tetano-spasmin for its dramatic virulence.

Clinical Features:

- Can be latent with healed and forgotten wounds
- Local or generalized weakness
- Stiffness or cramping pain on the back, neck and abdomen
- Difficult of chewing and swallowing
- Tonic muscles spasms
- Sardonic smile as evidence of onset of tonic spasm
- Severe pain and opisthotonus due to reflex convulsion of all muscles
- Progressive difficulty of respiration
- Fever, tachycardia, cyanosis
- Respiratory failure and death due to repeated cyanotic convulsive attacks.

Treatment:

- Meticulous surgical excision of the wound regardless of immunization state to eliminate the bacterial infection and the dead contaminated tissue
- Isolation, quietness and comfort
- Sedation with chlorpromazine up to 200mg IM/day barbiturates or diazepam 50mgIV under close followup and observation for central signs of drug over dose
- Antibiotics: crystalline penicillin is the drug of choice for parenteral medication. Tetracycline can be an alternative antibiotic for oral therapy.
- Intensive nursing care
- Naso-gastric tube for feeding to maintain protein balance
- Immunization
- Respiratory support and consider tracheostomy if spasms becomes frequent leading to cyanosis
- Human antitetanus globulin if available to neutralize circulating toxin
- Active immunization with 0.5 ml of tetanus toxoid if the patient is not immunized or the wound is tetanus prone

Prevention:

Prevention of clinical tetanus depends on adequate immunization of the population and careful surgical management of all traumatic wounds, even those which appear to be minor. Patients with grossly contaminated wounds and no or unclear history of immunization should receive an intramuscular antitoxin therapy. Active immunization with tetanus toxoid should also be started.

Gas Gangrene

Gas gangrene is another clostridia associated with soft tissue infection (Clostridial myonecrosis). It is a rare but devastating infection characterized by muscle necrosis and systemic toxicity due to the elaboration and release of toxins. It usually follows wounding with trauma or surgery and requires factors contributing to tissue hypoxia like foreign bodies, vascular insufficiency or occurs as a complication of amputation.

Etiology:

Clostridium perfringens is responsible for over 80% of cases. More than one species can be isolated or polymicrobial infection with other microorganisms can occur.

Clinical features:

It is characterized by fulminant local and systemic manifestations. Patients may appear normal at early state. Clinical features include:

- Sudden and persistent severe pain at wound site.
- Localized tense edema, pallor and tenderness
- Gas noted on palpation or radiographs
- Progressive brownish discoloration of skin and hemorrhagic bullae formation
- Dirty brown discharge with offensive, sweetish odor
- Severe systemic manifestations including fever, tachycardia, hemolytic anemia, hypotension, renal failure and finally death
- Gram's stain from the discharge can be diagnostic

Management:

- Surgery is most important component
- Extensive, wide excision of involved muscles
- Amputation of an extremity may be needed.
- Antibiotics: high dose penicillin is the preferred drug
- Supportive measures including
 - Intravenous infusions
 - Blood transfusions
 - Close monitoring and follow up

Review Questions

1. Which of the following is not categorized as “surgical infection”?
 - A) Urinary tract infection after catheterization for Prostatectomy
 - B) Abscess formation following injection on the thigh
 - C) Wound abscess following excision of big lipoma on the back
 - D) Lung atelectasis following intubation for laparotomy
 - E) None of the above

2. Which of the following is a requirement for a surgical infection to occur?
 - A) Virulent microorganism
 - B) A tissue of decreased or no blood supply
 - C) A decrease in the immune response of a patient
 - D) All of the above
 - E) None of the above

3. Which of the following are the most common microorganisms of surgical infection?
 - A) Viruses
 - B) Staphylococcus species
 - C) Clostridia
 - D) Candida
 - E) Entoameba

4. Which of these clinical states may indicate a presence of surgical infection?
 - A) Fever
 - B) Loss of function of body part
 - C) Local hyperemia
 - D) Tachycardia
 - E) All of the above

5. Which investigation can be helpful for diagnosing a surgical infection?
 - A) Gram's stain from a discharge if there is any
 - B) Blood culture
 - C) WBC count
 - D) Tissue biopsy
 - E) All of the above

6. The correct way of managing a patient with an abscess is

- A) Start with effective antibiotics and send home
- B) Drainage and no antibiotics if no systemic signs
- C) Apply local ointments for aiding the abscess to burst
- D) Give effective antibiotics and analgesics
- E) All except B

7. In a patient with gas gangrene

- A) Little circulatory support is needed
- B) Surgical removal of gangrenous tissue is the primary management
- C) Penicillin is the preferred antibiotic
- D) B and C are correct
- E) Systemic signs are not commonly seen

Key to the Review Questions

1. E
2. D
3. B
4. E
5. E
6. B
7. D

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CHAPTER NINE

TRAUMA

Learning Objectives

After reading this chapter, the student should be able to:

- Identify the various types of trauma; understand their epidemiology, predisposing factors and methods of their prevention.
- Learn the general approach and treatment priorities of a trauma victim.
- Learn the specific management of missile injuries and burn.

Introduction

Trauma is one of the leading causes of mortality, morbidity and disability worldwide. In developing countries, the magnitude of the problem has been increasing consuming more and more of the meager health resources of these nations. Moreover, trauma mostly affects people in their productive years of life, hence the high economic and social burden to society.

The causes of trauma are various and their relative incidence varies in different populations. Deaths due to trauma tend to occur in three patterns:

1. Immediate death (50%)

- Occur in the first few minutes after the accident
- Are due to extensive and lethal injuries to the brain, heart & major blood vessels

2. Early deaths (30%)

- Occur in the first few hours
- Are due to the collections and bleedings in the chest and abdomen, extensive fractures and increased intracranial pressure
- Early resuscitation, diagnosis and appropriate management can prevent these deaths.

3. Late deaths (20%)

- Occur days or weeks after the injury
- Are due to sepsis and organ failure
- May be decreased by early resuscitation and appropriate treatment

DEFINITION

Trauma is tissue damage, which occurs due to transfer of different forms of energy either intentionally or unintentionally.

Types of Trauma: Trauma can be classified according to the:

- I- Cause:
 - Homicidal injuries
 - Road traffic accident and falls
 - Industrial accidents, burn, etc.
- II- Mechanism:
 - A/ *Blunt Injury*: Caused by acceleration, deceleration, rotational or shearing force
 - B/ *Penetrating Injury*: Caused by a direct breach by penetrating object
 - E.g. Bullet injury, stab injury

TREATMENT PRIORITIES

Management of trauma requires adherence to an established order of priorities like the advanced trauma life support (ATLS) protocol developed by the American College of Surgeons. The ATLS generally consists of a primary survey and resuscitation followed by a secondary survey and definitive management.

I- The primary survey and resuscitation

This part of management comprises a quick evaluation of the patient to detect immediately life threatening situations and institution of measures to correct them. It has the following components:

- A- *Air way*: Assess the patency of air way. In a trauma victim, it may be compromised by the back fallen tongue, broken tooth, vomitus, blood etc. If the air way is compromised, use suctioning, jaw trust, positioning, oropharyngeal tube or endotracheal tube to open it, taking care of the cervical spine.
- B- *Breathing*: Assess adequacy of breathing. It may be compromised by pneumothorax, hemothorax or multiple rib fractures causing flail chest.
- C- *Circulation*: Assess the circulatory volume. Look for external hemorrhage and arrest it by pressure, bandaging or tourniquet if the other methods fail. Tachycardia, hypotension, pallor may mean bleeding into the body cavities or from an obvious external wound. Open a wide bore

IV line, take blood sample for cross match and start resuscitation with Normal saline or Ringer's lactate.

D- Do a quick neurologic examination to assess consciousness. Use the Glasgow coma scale (GCS) to determine the level. Look for any Neurological deficit or lateralizing sign.

E- Expose (undress) the patient fully for examination not to miss serious injuries.

II- Secondary survey and definitive management

This is done after the life threatening conditions have been evaluated and resuscitative measures are instituted. It includes the following aspects:

A- *Take History*: The informant may be the injured patient, relatives, police or ambulance personnel. The history should include:

- Time of injury,
- Mechanism of injury,
- Amount of bleeding,
- Loss of consciousness,
- Any intervention performed or drugs given should be asked for.

B- Do a proper and *systematic examination* of all body systems.

C- Make necessary investigations such as hematocrite, cross-match, urinalysis, X-ray, ultrasound, etc. However, **never** send a patient with unstable vital signs for investigation or referral before resuscitation.

D- Institute the appropriate *specific treatment* like laparotomy for possible abdominal organ injury, POP cast for tibio-fibular fracture.

ROAD TRAFFIC ACCIDENTS (RTA)

Road traffic accident is the leading cause of trauma deaths in industrialized nations and many developing countries. Several factors contribute to the high magnitude. These include poor condition and design of roads, traffic mix (sharing of road by vehicles of different speeds and pedestrians), poor condition of the vehicles and poor traffic rule enforcement.

The incidence of this serious problem can be reduced by improving the public awareness and the quality of training given to the drivers and strict enforcement of traffic rules. Moreover, improving the design and quality of the roads and regular checkup of vehicle fitness would help alleviate the problem.

Injuries are caused by sudden acceleration e.g. a pedestrian hit by car or decelerations causing the passenger to collide with the interior of car, other passengers or be ejected out of the car. There are certain patterns of injury in RTA .The presence of one of the following injuries should alert to the possible presence of the other:

- Head and cervical spine injury
- Lower rib fractures and spleen or liver injuries
- Pelvic fracture and urinary tract injury etc

Certain factors indicate that a RTA victim has a high risk of serious and multiple injuries.

These include:

- Presence of flail chest
- Roll over
- Death of another person in the car

FIREARM INJURIES

In civilian practice, these injuries are mostly due to homicidal violence, although accidental injuries also occur. In many developing countries like Ethiopia, the magnitude of the problem is big due to high distribution of firearms among civilians who have little or no knowledge on safe handling and usage. It is made worse by the presence of large number of land mines, which are remnants of repeated wars and conflicts in these poor nations.

Generally, missile injuries may be caused by bullets from pistols, rifles, machine guns or fragments from exploded grenades and mines. The degree of injury sustained depends on the amount of energy transferred from the missile to the patient as formulated below.

$$E = \frac{1}{2}mv^2 \quad (E = \text{energy transferred}, m = \text{mass of the missile}, v = \text{velocity of the missile})$$

Thus, the speed and weight of the missile are the determinant factors. The extensive tissue injury with the high degree of contamination creates a perfect medium for life threatening infection to occur.

Missile injuries are classified into:

I- Low- velocity missile injuries

- Comprise missiles fired from hand guns ($<400\text{m/s}$)
- Injury is limited to the path of the bullet.

II- High velocity missile injuries

- Comprise bullets fired from rifles, machine guns and blast fragments ($\geq 1000\text{m/s}$)
- Cause a small entrance and a larger exit wounds

- Tissue damage occurs in the surrounding tissue as well, due to the temporary cavitation effect
- Foreign bodies, dirt and clothing materials are sucked deep in the wound due to the vacuum effect

Management of missile injuries

The most important factor in the management of missile injuries and prevention of serious infection is appropriate wound debridement. Wound debridement consists of:

- Excision of all dead tissue, e.g., dead muscle
- Removal of all dirt, foreign bodies and free bone fragments
- Thorough irrigation of wound with copious amount of saline
- The debrided wound should be left open for closure later

N.B: Never close missile wounds primarily, not even the very trivial looking ones!

All patients with missile injuries should receive broad spectrum antibiotics and tetanus prophylaxis.

BURN INJURIES

Burn is a coagulation necrosis of tissue due to thermal or chemical injury. It is mostly seen in developing countries where there is overcrowding, poor housing designs and wide spread usage of open fire for cooking. Women and children are affected most as majority of the burns occur at home. Types of burns, according to the mechanism, include:

- Flame burn
- Scalding
- Chemical burn
- Electrical burn, etc.

The severity of a burn injury is a function of the burn depth (degree) and the extent or percentage of the body surface that is burned. Determining the percentage of burn surface is important to calculate the amount of fluid requirement while determination of burn depth is important for burn wound management.

Classification of Burn according to depth (degree)

- 1- *First degree burn:* It involves the epidermis only and manifests with erythema.
- 2- *Second degree (partial thickness) burn:* This involves part of dermis. It manifests with blisters, edema, moist surface and pain at the affected site.

- 3- Third degree (full thickness) burn: Involves complete burn of the dermis. The burned skin looks charred, white or grayish and the surface is pain free.

The extent or percentage of burn is determined by the “rule of nine” in which the body surface is divided into eleven parts each constituting 9% of the total (fig.). In children, the size of the hand may be used to estimate the burn surface, which is approximately 1%.

Management of a burn victim

General management:

Like all trauma patients, adhere to ATLS system.

- Airway obstruction may occur rapidly after inhalation injury or delayed for 24-48 hours. Endotracheal intubation or tracheotomy may be needed in patients with burns involving the air way.
- Major burn (> 20% body surface area) needs fluid resuscitation. Open IV line with wide bore cannula and infuse saline containing IV fluid (Ringer's lactate if available)
 - The amount of IV fluid needed for the first 24 hours is calculated as a product of percent of the burned surface area and the body weight in kilograms added to the daily maintenance (%BSA X Wt.) + daily maintenance. *Half* of the calculated volume is given in the *first 8 hours* and the remaining half over the *next 16 hours from the time of burn*.
 - Volume and rate of fluid administration should be valid according to the vital signs and urine output, hence the need to catheterize the patient. The optimal urine output is 30-50ml /hr in adults and 1ml/kg/hr in children

Criteria for admission

- Adults \geq 20% BSA burn
- Children \geq 10% BSA burn
- Burns involving the face, hands, feet and genitalia
- Suspicion of inhalation injury
- Chemical and electrical burns

Burn wound management: There are several methods of managing a burn wound. The choice depends on the degree, size and site of the burn, and availability of facilities and expertise.

- 1- The *exposure method*: The burn wound is cleaned by antiseptic agents and left exposed to air. It is used for burns of the face and burns of large surface area.

- 2- The *occlusive method*: A thick dressing after cleaning with antiseptics covers the burn wound. It is used mostly for outpatient treatment of small burns.
- 3- The *plastic bag method*: The burned part is wrapped in a transparent plastic bag. It is used for burns of hands and feet.
- 4- The *saline method*: The burn wound is intermittently irrigated with half strength saline solution. This is used for large surface deep burns.
- 5- Early *excision and skin grafting*: This needs skill of grafting and transfusion facilities. It is used for deep burns.

Emergency escharotomy and fasciotomy should be done for deep circumferential burns of limbs, neck or trunk.

Analgesia: Most burn patients are in severe pain. Therefore, analgesic doses of IV narcotics regularly to control the pain should be stressed as part of the management.

Prevention of Infection: Burn patients have impaired resistance against infection. Most deaths occur due to pneumonia and wound sepsis. Prophylactic antibiotics (penicillin) are given for severe burns but, routine administration has no value. Topical antimicrobials e.g. 1% silver sulfadiazine are helpful for deep 2nd and 3rd degree burns.

Nutrition: Naso-gastric tube should be inserted after admission for patients with more than 25% burn and those who have nausea and vomiting. Enteral feeding should be resumed as soon as possible.

Burn patients are in catabolic state and tend to lose weight very fast, thus special attention to their diet is important. The daily calorie required is 20 Kcal/Kg + 70 Kcal/%burn. Daily protein requirement for burn patients is 1 gm/kg + 3 gm/%burn.

Prophylaxis against tetanus: Tetanus prophylaxis should be supplemented as burn is potentially infected wound.

Prevention of contractures and rehabilitation: Patients should constantly be urged and made to move all joints. Failure to do this results in contractures, which may be very disabling, unsightly and difficult to treat.

Prevention

The magnitude of burn injuries can be reduced by keeping the high risks, like children and epileptics, away from open fire or boiling pots and enforcing strict safety precautions in working places like factories etc.

Review Questions

- 1- A 20 year old man was brought in unconscious after car accident. Describe how you would proceed managing him.
- 2- What are the predisposing factors for road traffic accidents and describe the methods of prevention.
- 3- What does wound debridement mean?
- 4- How would you manage a 24 year-old housewife who was brought in eight hours after sustaining a 30% flame burn to her chest, arms, and face?

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HEAD AND SPINAL INJURIES

Learning objectives

At the end of this chapter students are expected to:

- Identity types of head injuries
- List the effects of head injury
- Outline assessment of patients with head or spinal injury
- Plan for management of patients with head injury
- Outline evaluation and management of spinal injuries

HEAD INJURY

Head injury is one of the most common causes for attending emergency departments. Craniocerebral trauma is consequently a source of major disability and huge financial and psychological burden. Trauma to the cranium can be either blunt or penetrating and involve the scalp, the skull or the brain. These injuries can take many forms.

Scalp Injury

Scalp lacerations are common and can result in severe hemorrhage if not controlled. Scalp lacerations can be sutured after ruling out possible associated skull or brain injuries.

Skull Injury

Different clinical forms of skull injury may follow trauma to the skull. These include:

Simple Linear Fracture

This is a line of fracture which usually marks of severe forces of injury. No specific neurological management is required.

Depressed skull fracture

This type of fracture is usually a result of blunt trauma. It could be either open or closed. The open type of fracture (compound depressed fracture) has a high risk of infection so that it should be handled as an emergency. The depressed fragments may lacerate the dura and brain tissue.

Treatment

- Debride and irrigate contaminated wounds
- Full course of intravenous antibiotics
- Elevation if indicated: deeper than the thickness of the skull in adults or if there is any neurologic complication

Fracture of the base of skull

Basal skull fractures can occur at different sites (anterior, middle or posterior fossa)

They often result in CSF leak. Anterior fossa fractures present with subconjunctival hematoma, anosmia, epistaxis and CSF rhinorrhoea. Middle fossa fracture presents with CSF rhinorrhea or otorrhea, hemotympanum and bruising behind the ear.

Brain injuries

Mechanisms of brain injury

Abrupt deceleration of a moving head results in minor injury at site of impact (coup injury) or contusion of the brain opposite the point of impact (contra coup injury). From clinical point of view, brain injuries could be primary (occurring at the time of impact) or secondary (develops subsequently).

Primary brain injury

Cerebral concussion

This is a clinical diagnosis characterized by temporary dysfunction. It is most severe immediately after injury and resolves after variable period of time. It is often accompanied by loss of consciousness and amnesia for the moment is common. Post-concussion syndrome which consists of headache, irritability, depression and lassitude may be seen as late manifestations.

Cerebral contusion and Laceration

Pia and arachnoid tearing and intracerebral bleeding characterize these conditions. It usually produces focal neurologic deficits that persist for more than 24 hours. Blood brain barrier defects and cerebral edema are common. Contusions may resolve spontaneously or persist.

Secondary brain injuries

Secondary brain injuries are effects which develop secondary to subsequent anatomical and physiological derangements. The role of the health worker is to early detect and manage these.

Intracranial hematomas

- A. *Extradural hematoma:* This condition usually follows temporal bone fracture with tearing of middle meningeal artery leading to hematoma collection. Patients may present in coma after a lucid interval. Urgent evacuation of the hematoma is required.

- B. *Acute Subdural hematoma*: This state is the most common intracranial mass lesion following head injury. Mostly, it results from tearing of bridging veins. The lesion is rapidly evolving and early evacuation is mandatory.
- C. *Chronic subdural hematoma*: This is most common in infants and adults over 60 years of age. Patients usually present with progressive neurological deficit more than 2 weeks after the trauma.
- D. *Intracerebral hematoma*: Intracerebral hematoma results from areas of contusion coalescing into contusion hematoma.

Cerebral swelling (Brain edema)

This results from vascular engorgement, due to loss of auto regulation and increased extra and intracellular fluid. If not corrected early, it results in cerebral ischemia.

Infections

Compound depressed fractures or basal skull fractures can lead to meningitis or cerebral abscess.

Patient assessment

In unconscious head injury patient, *primary survey* followed by resuscitation, if any impairment, should be the initial approach. Air way, breathing and circulation should be secured. This has to be followed by *secondary survey* and definitive management.

History

Points to determine in the history are:

- Period of loss of consciousness
- Period of post traumatic amnesia
- Cause and circumstance of the injury
- Presence of headache and vomiting.
- Presence of seizures.

Physical examination

Then Patients will be examined for evidences of injury

- Assess level of consciousness (Glasgow coma scale)
- Pupillary response
- Complete neurologic examination, look for lateralizing signs.
- Look for evidences of basal skull fracture

Based on Glasgow coma scale, patients can be classified as severe, moderate or mild. These have significant contribution on subsequent management decision and outcome.

Table 1: Glasgow coma scale.

Eye opening	Best motor response		Verbal response
	Obeys	6	
	Localizes	5	Oriented 5
Spontaneous 4	Withdraws	4	Confused 4
To speech 3	Abnormal flexion	3	Inappropriate words 3
To pain 2	Extension	2	Incomprehensible sound 2
Nil 1	Nil	1	Nil 1

Investigation

- Chest X-ray is mandatory in unconscious polytrauma patients to rule out hemothorax or pneumothorax
- Film of cervical spines in unconscious patients
- Skull X-ray when fracture is suspected
- CT- Scan helps to visualize hematoma contusions and edemas if indicated

Management

ABC

After ensuring adequate oxygen and blood flow to the patient's body, treatment of intracranial hypertension follows. This can be done through:

- Controlled hyperventilation
- Diuretics or
- Hyper-osmotic agents

The role of surgery in head injury is to remove mass lesions and to prevent the delayed development of infection by treating open head injuries. Any hematoma found should be rapidly evacuated; otherwise it can lead to deterioration of the patient's status due to brain compression.

Compound depressed skull fracture requires immediate operation to prevent intracranial infection. Fractures are debrided and bone fragments washed in antibiotic solutions and immediately replaced. Elevation is done if indicated.

Intracranial hypertension must also be controlled in postoperative period. Post-operative control of amount of fluid (not to be given more than 2/3 of the daily requirement), electrolytes, positioning in 20-30 degree elevation of the bed and management convulsion and of late sequel of head injury should be accomplished.

SPINAL CORD INJURIES

INTRODUCTION

The spinal cord terminates at the caudal end of first lumbar vertebrae. Loose nerve roots of cauda equina fill the lumbar spinal canal. Fracture and dislocation of the 24 movable vertebrae can occur at any level. Displaced bone fragments and inter-vertebral disks may herniate to the spinal cord causing compression, commonly seen in cervical and thoraco lumbar region.

Most spinal injuries result in immediate and total paralysis. But there could also be incomplete injuries. Among incomplete injuries, the following ones are commonly seen.

- i. *Brown-seguard Syndrome*: Ipsilateral paresis and contra-lateral loss of pain and temperature sensation. Vibration and position sensations are diminished on ipsilateral side.
- ii. *Anterior spinal cord syndrome*: Paralysis occurs below the level of the lesion with loss of temperature, touch and pain sensation.
- iii. *Central cord syndrome*: hand and upper extremities are affected with sparing of lower extremities.

Both complete and incomplete injuries of the spinal cord can result in neurogenic bladder. Immediately after injury, spinal shock ensues in which bladder reflex does not develop. Catheterized drainage is essential in this state. There could be a finding of flaccid paralysis, depressed deep tendon reflex and sensory level.

Patient assessment

Early detection of spinal injury will prevent further injury to the cord. During assessment and resuscitation, the spine must be carefully immobilized. Multiple injuries, seat belt markings and neurologic findings should alert the possibility of spinal injury. Examination should include:

- Secure the airway, breathing and circulation (ABC rule of trauma management)
- Local examination: Sign of bruise, swelling, echymosis, pain and tenderness at any site of spine could be secondary to fracture dislocation or disc herniation
- Sensory examination: Assess for any loss of sensation and its level
- Motor examination: Check for weakness of muscle power and tendon reflexes

Investigation

After complete physical examination, x-rays should be taken. In conscious patients biplanar x-rays of the symptomatic part of spine are adequate. In cervical spines, unstable injuries are easily overlooked in lateral and A-P films. One option is to have real-time flexion and extension x- rays.

Treatment

- IV resuscitation should be started in patients with spinal shock.
- Majority of simple compression fractures heal without consequences. It is treated symptomatically initially with rest, then with splinting and mobilization as necessary.
- Adequate immobilization is mandatory in unstable cervical injuries. Further neurologic damage is prevented by suitable immobilization.
- If there is deterioration of neurological function after initial assessment, surgery should be considered to stabilize the spine and to decompress the spinal cord and nerve roots. Careful transfer to appropriate centers is therefore important.
- High dose steroids may improve recovery after spinal cord injuries.
- Bladder care.
- Bed sore prevention by bed care and frequent position changes.

Review Questions

1. Discuss the basic mechanisms of brain injury in head injury patients
2. List the secondary brain injuries following head injury
3. A patient comes to you after sustaining a road traffic accident. On physical examination, there are no evidences of external injury. When you assess his level of consciousness, he opens his eyes when pinched, withdraws from pain and he is confused.
 - a) What is his Glasgow coma scale?
 - b) What further history and physical examination do you require?
 - c) List the investigation you order
 - d) Suggest your management plan

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CHAPTER TEN

ORTHOPEDIC SURGERY

Learning Objective

After reading this chapter, the students should be able to:

- Understand the etiology, pathology and clinical presentation of bone and joint infections.
- Learn the mechanism, classification and healing of fractures and dislocations.
- Learn the general steps and the various modalities of fracture treatment and their complications.
- Learn about amputations, their indications and complications.

Introduction

Orthopedics deals with disorders of the musculoskeletal system. Although the musculoskeletal system can be affected by several conditions like congenital, metabolic or neoplastic diseases, traumatic and infectious disorders are the most important ones in developing countries.

INFECTIONS OF BONES AND JOINTS

ACUTE OSTEOMYELITIS

Acute osteomyelitis is an acute bacterial infection of the bone and its medullary cavity. It commonly affects children, boys more than girls.

Etiology

- *Staphylococcus aureus* is the agent in 80% of cases
- Gram negative rods and *Staphylococcus* in neonates
- *H. Influenza* is seen in children under 5 years of age
- History of trauma is common and may predispose children to osteomyelitis

Pathology

Bacteria reach the bone mostly via the hematogenous route. Infection begins in the metaphysis of a long bone and spreads through the cortex and medullary cavity causing thrombosis to vessels and bone infarction. Pus collects under the periosteum peeling it off the cortex.

Diagnosis

- History of
 - Pain, which is gradually increasing in severity
 - Fever, Toxicity
 - Failure to use the involved limb
- Physical Examination
 - Localized bony tenderness (most important)
 - Adjacent joint may contain effusion
- Lab. Investigation
 - Leucocytosis and raised ESR
 - Positive blood culture
 - X-ray changes of bone: late to develop (10-15 days) and is thus not helpful for diagnosis of acute osteomyelitis.

Treatment

Antibiotics

- IV antibiotic should be started empirically after taking blood sample for culture
- Choice of antibiotics depends on the age:
 - Neonates:- Penicillinase resistant penicillins + Aminoglycosides
 - E.g. Cloxacillin + Gentamycin
 - Children under 5 years:- Penicillinase resistant penicillins + Anti H.influenzae
 - E.g. Cloxacillin + Chloramphenicol
 - Patients above 5 years:- Penicillinase resistant penicillin
 - E.g. Cloxacillin

The duration of antibiotic treatment is 6 weeks. IV route is changed to oral after fever and leucocytosis have disappeared (about 7-14 days).

Surgery: Surgery to drain abscess is recommended if fever and pain fail to subside after 48 hours of IV antibiotic treatment or if there is evidence of pus collection.

Analgesics and splinting: Analgesics and splinting of the limb in functional position using POP casts or skin traction reduces pain in the acute phase.

CHRONIC OSTEOMYELITIS

Chronic osteomyelitis usually follows a delay or inappropriate treatment of an acute stage osteomyelitis. It may also follow direct infection of bone in compound fracture.

Pathology: The dead bone (sequester) lies in an abscess cavity surrounded by a newly formed bone (Involcrum) under the elevated periosteum.

Diagnosis: The usual presentation is periods of quiescence and acute exacerbation of persistently discharging sinus. There may be skin hyper pigmentation around the sinus and palpable bone thickening. X-ray may show sequester, abscess cavity, involucrum or diffuse sclerosis.

Treatment

Antibiotics: Used for acute exacerbation and perioperative for about six weeks.

Surgery: Surgery is done to remove a dead bone (sequestrectomy) or to eliminate an abscess cavity (saucerization). Conservative treatment is considered in a patient with minimal discharge and no obvious sequestrum or bone cavity. Amputation may be considered for extensive bone involvement and heavy discharge or frequent flare-ups which incapacitate the patient.

SEPTIC ARTHRITIS

Definition: Septic arthritis is an acute bacterial infection of joints.

Etiology: It varies in different age groups and is similar to that of acute osteomyelitis. *Neisseria gonorrhoea* should be considered in the sexually active age group.

Pathology: The hip and knee joints are the commonly affected joints. Bacteria may reach the joint via the blood, local extension of osteomyelitis or directly in penetrating wounds of the joint. The pus formed in the joint is chondrolytic and destroys the joint cartilage if not evacuated.

Diagnosis:

History: The usual presenting symptoms are joint pain, swelling and fever.

Physical examination: The joint becomes swollen with effusion, tender and warm. The range of active and passive movement also gets severely limited.

Lab: Joint fluid analysis reveals opaque yellow to green fluid with

- High cell count (mostly $>100,000/\text{mm}^3$, with $>90\%$ PMN).
- Decreased glucose level (50 mg/dl lower than blood)
- Culture is often positive.

Treatment

Start with *IV antibiotics*. Do joint *aspiration* repeatedly under aseptic condition. If frank pus is found, drain it by making *arthrotomy*. *Immobilize* the affected joint in functional position until inflammation subsides and physiotherapy to prevent joint stiffness.

Complications

Early: Destruction of articular cartilage, dislocation, epiphyseal necrosis.

Late: Secondary osteomyelitis, joint stiffness and ankylosis

TUBERCULOUS ARTHRITIS

Tuberculosis of bones and joints is mostly due to hematogenous spread from a pulmonary focus. The intervertebral discs, the hip and knee joints are the most frequently affected.

Pathology

- Necrosis and granulation tissue formation in the synovium
- Destruction of sub chondral bone and articular cartilage
- Fibrous fusion (ankylosis) of the joint

Diagnosis

History: Insidious onset of dull aching pain, weight loss, anorexia, low grade fever

- Examination:**
- Muscular atrophy of affected limb
 - Joint swelling and warmth of overlying skin
 - Joint effusion
 - Limitation of joint movement

- Laboratory:**
- *Raised ESR*
 - Joint fluid analysis reveals turbid joint fluid with increased leukocyte count (predominantly mononuclear)
 - Acid-fast stain may reveal AFB.

- X-ray:**
- *Joint space narrowing*
 - Sub chondral bone destruction
 - Periarticular osteoporosis

Open biopsy of the joint is done if diagnosis is still in doubt.

Treatment

- Anti-TB drug treatment
- Splint joint in functional position to avoid contracture

FRACTURES

Definition: A fracture is a structural breech in the normal continuity of bone.

Mechanism of injury

- 1- Tubular bone:
 - Direct violence to the bone
 - Indirectly due to twisting or angulation

- 2- Cancellous bone: - may be fractured by compression
 E.g. Clash fracture of vertebral body or by traction
 E.g. Transverse fracture of the patella

Bone Healing

- o Progresses through the phase of hematoma, cellular proliferation, callus formation and remodeling
- o Generally takes longer than soft tissue healing
- o In general, a long bone takes 6-12 weeks to heal in an adult and 3-6 weeks in children.
- o Several factors, both local and systemic, affect fracture healing
 - *Local factors:* - Degree of soft tissue injury
 - Pattern and site of fracture
 - Presence of Infection
 - Adequacy of reduction
 - Adequacy of immobilization
 - *Systemic factors:* like debilitating diseases and immunosuppressive drugs impair healing.

Classification

- Fractures may be classified in several ways. the most important clinical classification is:
- Closed vs open (compound) fracture

Diagnosis

- Clinical:**
- History of trauma
 - Pain, swelling, inability to use the injured body part
 - Tenderness, swelling and bruising
 - Deformity, abnormal movement (sure signs of fracture)

X-ray: A suspected fractured bone should be x-rayed.

- X-ray should be taken in at least two planes (AP and lateral)
- Should always include the joints proximal and distal to the fracture
- Look in the X-ray for:
 - Presence of fracture
 - The part of bone fractured
 - The pattern of the fracture which can be transverse, comminuted, oblique, spiral, segmental.

- Presence and type of displacement which can be lateral shift, angulation, rotation, overlap, distraction
- Quality of bone: check for:
 - Osteoporosis
 - Pathological fracture, etc

Management of a patient with fracture

A) GENERAL TREATMENT

- Like any trauma patient, follow the ATLS system. Associated life threatening injuries may be missed if evaluation of the patient is not systematic.
- Always assess the status of distal circulation and neurological function.
- Administer anti pain and splint all fractures before sending the patient for x-ray or referring.

B) Local treatment of the fracture:-

I-Reduction

- Means bringing the fractured bone to normal or near normal anatomic position.
This is needed only for displaced fractures
- Age and function of the patient are important in considering the goals of reduction
- Reduction may be done in various ways:
 - 1- Using gravity E.g. Humeral shaft fracture
 - 2- Closed reduction by:
 - A- Manipulation e.g. Colle's fracture
 - B- Traction e.g. Femoral shaft fracture
 - 3- Open (Operative) reduction: Used when other methods are not possible, have failed or a perfect anatomic reduction is needed.
E.g. displaced intra articular fractures.

II- Immobilization

The purpose of immobilization is to:

- prevent re displacement of a reduced fracture
- decrease movement at the site of fracture and prevent further soft tissue injury
- relieve pain

Methods of Immobilization

1- Plaster of Paris (POP) cast

- Is the safest and cheapest method of immobilization
- Immobilization should always include the two adjacent joints
- Joints should be immobilized in a functional position
- Complications include joint stiffness and compartment syndrome.

2- Traction

- A) Using gravity: e.g. U-slab for humeral shaft fracture
- B) Skin traction: A method of applying traction using bandage, usually used in children and temporarily in adults. The maximum weight that can be applied is 2kg.
- C) Skeletal traction: Traction applied via a pin inserted into the bone distal to the fracture. E.g. Tibial pin traction for femoral fracture

3- External fixation

- This is a method of fixing the fracture by metal pins passed through the bone above and below the fracture and connected to a metal frame.
- It is mostly used in compound fractures as it combines good access for wound care with immobilization

4- Internal fixation

- Internal fixation is a method of operative fixation of fractures by plates, nails, screws, pins and wires
- The rigid fixation allows patients to get out of bed early
- It's employed when operative reduction has been done for any of the reasons mentioned before.
- It's also indicated in poly traumatized patients whose confinement in bed if treated otherwise results in high morbidity and mortality.
- Infection is the main complication and may result in chronic osteomyelitis
- It also needs expertise and orthopedic surgical facilities.

III- Rehabilitation

- Preserving muscle and joint function both during and after treatment is an essential component of fracture treatment for a good result.

Compound (open) fractures

Open (compound) fracture

- This is a fracture in which the fracture hematoma communicates with skin or mucous membrane.
- Infection is the most feared complication of compound fractures and may cause delayed healing, non union, sepsis or even death.
- It is a surgical emergency

Principles of management:

- Early wound debridement and thorough irrigation with saline
- Antibiotics: Broad spectrum e.g. Penicillin + Aminoglycoside should be given IV at least for 48 hrs.
- Tetanus prophylaxis
- Rigid immobilization with access to the wound e.g. external fixation
- Delayed wound closure!

N.B: Never close a compound fracture immediately in an attempt to convert it to a closed one. You'll cause a severe anaerobic infection!

Complications of Fractures

I- Soft tissue Injuries

- Arteries, Nerves and Viscera may be injured

II- Compartment syndrome

- Is a dangerously increased pressure within the enclosed fascial compartments of extremities, especially forearm and leg.
- The high compartmental pressure causes Ischemia and necrosis of soft tissues in the compartment.
- It may be aggravated by application of tight bandages or circular POP casts on a freshly injured limb.
- Severe pain, especially with passive flexion of fingers is the earliest indicator.
- Paresthesia, Paralysis, Pallor or Pulselessness may develop later,
- Early diagnosis and complete splitting of a tight bandage or circular POP cast may resolve the situation.
- Fasciotomy is done if the above measures have failed.

III- Infection

- Usually complicates open fractures
- Chronic osteomyelitis may be the result.
- Adequate debridement is the most critical factor in preventing infection.

IV- Bone healing abnormalities

- 1- Delayed Union
 - Failure of a fracture to heal in the expected time period.
- 2- Non union
 - Total failure of the fracture to heal with formation of a false joint between the fractured ends (pseudoarthrosis)
- 3- Malunion
 - Healing occurs with deformity
- 4- Avascular necrosis
 - Necrosis of part of the fractured bone occurs due to disruption of its vascular supply. E.g. Femoral head.

V- Joint complications

- Joint stiffness
- Secondary Hemarthrosis
- osteoarthritis

VI- Systemic complications

- Usually follow polytrauma and major long bone fracture
- Include ARDS and fat embolism syndrome

DISLOCATIONS

A dislocation is a total disruption of joint with no remaining contact between the articular surfaces.

A subluxation is partial joint disruption with partial remaining but abnormal contact of articular surfaces.

Types of Dislocation

- 1- Traumatic dislocations
 - This is a type of dislocation caused by trauma. A force strong enough to disrupt the joint capsule and other supporting ligamentous structures dislocates a previously normal joint.

2- Pathological /Spontaneous dislocation

- This is a type of dislocation which occurs when a pathological condition in the joint causes abnormality in the structural integrity of the joint.

E.g. Septic hip dislocation

3- Recurrent dislocation

- This is a dislocation which repeatedly occurs after trivial injuries due to weakening of the supportive joint structures

4- Congenital dislocation

- A type of dislocation which is present congenitally since birth.

E.g. Congenital hip dislocation

Diagnosis

- The limb assumes an abnormally fixed position with loss of normal range of movement in the affected joint.
- Associated soft tissue injuries should be looked for:
 - E.g. Popliteal artery in knee dislocation Sciatic nerve in posterior hip dislocation
- X-ray in various planes and views confirms diagnosis

Management

- Early reduction of the dislocation
- Immobilizing the joint to allow time for the supporting structures of the joint to heal
- Rehabilitation of the joint

AMPUTATIONS

An amputation is removal or excision of part or whole of a limb.

Indications

1- Dead limb (Gangrene)

- Due to:
 - Atherosclerosis
 - Embolism
 - Major arterial injury
 - Diabetic gangrene...

2- Deadly limb

- Life threatening infection (e.g. Gas gangrene) or malignancies which can't be controlled by other local measures

3- Dead loss

- Severe soft tissue injury especially associated with major nerve injury, which may occur in compound fractures.

Level of amputation

The choice for the level of amputation depends on:

- Age
- The nature and extent of the pathology e.g. Neoplasm, trauma
- The vascularity of tissues
- Presence of infection
- Status of the joints
- Access to the various types of prostheses

Generally, the most distal level that will heal and still provide a functional stump is selected.

- In the upper limb, attempt should be made to conserve every possible inch.
- In the lower limb, the most important factor is to try and conserve the knee joint whenever possible.

Amputations performed in the face of infection should be left open for a later closure.

Complications of amputation

- Edema
- Hematoma
- Secondary and reactionary hemorrhage
- Infection
- Ischemic necrosis
- Flexion contracture
- Chronic pain-psychogenic, neuromas, etc.

Review Questions

1. Describe the pathogenesis of acute osteomyelitis.
2. A 25 year old man presents with severe pain and swelling of his right knee joint of two days duration. Discuss his management.
3. Describe the management of a patient with compound fracture.
4. What is compartment syndrome? Describe its clinical manifestation and management.
5. List the indications for amputation.
6. What are the factors considered in deciding the level of an amputation?

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CHAPTER ELEVEN

ANESTHESIA

Learning Objective

After reading this chapter, the student should be able to:

- Get basic information and understanding about the proper pre-anesthetic preparation of a patient before surgery,
- Get basic knowledge on different types of anesthesia with their characteristics.
- Get basic knowledge about the steps in the assessment and management of a patient with cardio-respiratory arrest, needing cardiopulmonary resuscitation.

PRE-ANESTHETIC PATIENT EVALUATION AND PREPARATION

INTRODUCTION

The purpose of pre anesthetic assessment is to present the patient for surgery in the best possible condition. Pre anesthetic assessment and preparation should include:

- Medical History
- Relevant physical examination
- Checking the results of tests or investigation
- Correct or improve any medical conditions before surgery
- Prescribing any drugs for pre-medication (if needed)
- Explaining to the patient the procedure of anesthesia

History

- Diagnosis and planned surgery
- Actual medical and surgical history

Respiratory system: Ask if there is history of shortness of breath, cough, sputum production and wheezing

Cardiovascular system: Check if there is history of:

- Angina/previous myocardial infarction, current orthopnea, ankle swelling

Past medical history: Such as bleeding disorders, hypertension, asthma, seizures, psychiatric disorders, previous anesthesia and any problem related to anesthesia

Drug therapy: History of intake of drugs like:

- Anti-diabetics
- Anticoagulants
- Steroids
- Anti-hypertensive

Additional history on:

- Excessive alcohol intake, smoking and allergies to drugs
- Pregnancy
- Dental status (loose teeth)
- Fasting

Physical Examination

Respiratory System

Check for cyanosis, finger clubbing, pattern and frequency of breathing, position of trachea, presence of added sounds on auscultation and their localization.

Cardiovascular system

Check the pulse rate, rhythm and character; blood pressure (raised or lowering of the blood pressure), peripheral dependent edema, apex beat, extra heart sounds.

State of nutrition and hydration

Assess the body weight and height (BMI) and state of hydration.

Skin color

Check for pallor, cyanosis, jaundice (suspect liver disease which needs some attention during anesthesia), and hyper-pigmentation.

Psychological status of the patient

This will influence the choice between regional and general anesthesia and also to give pre-medication.

CNS: Should be assessed for level of consciousness and neurological deficit

The airway:

Assess for difficulty of the airway maintenance and laryngoscopy, anatomical problems like receding lower jaw, protruding teeth; pathological problem like difficulty in opening jaw or neck-extension, tumors, inflammation or burn-contractions on the neck

Ease of venous cannulation: Finally, check for the ease of venous access

Investigations: There are routine investigations prior to any surgery which requires anesthesia. This depends on the facilities and the condition of patient and type of surgery. Special investigations should be ordered according to the condition of the patient.

District Hospital: (Where the facilities are restricted)

- Hemoglobin
- Urine analysis

Referral Hospital:

- Hemoglobin and full blood count
- Urine analysis
- Blood Urea Nitrogen/Creatinine
- Serum electrolytes
- Electrocardiogram (age over 40 years)

Correct or improve any medical conditions before surgery (preoperative care)

In case of elective surgery

Fluid imbalance: The volume of circulating fluid should be corrected.

Electrolyte imbalance: Correct, especially sodium and potassium imbalance.

Smoking: Smoking should be given up at least three days preoperatively because of the increased risk of bronchial exudation and the bronchospasm.

Dental treatment should be carried out if necessary before any major surgery.

Anemia: A value below 10 g/dl should be corrected.

Cardiovascular diseases: A period of 6 months should be allowed after an attack of myocardial infarction. Cardiac failure must be treated for achieving a maximum compensation. Arrhythmias must not be too severe to interfere with patient's cardiac output and hypertension should be treated properly.

Respiratory disease: Acute respiratory disease is contraindication for elective general anesthesia. Asthma must be treated with appropriate bronco-dilators until the chest is clear to auscultation.

Metabolic diseases: Diabetes mellitus must be controlled. After severe case of infective hepatitis, operation is best postponed for a minimum of 6 months. Thyroid disorders (both hyper and hypothyroidism) must be corrected.

In case of emergency surgery: Patients presenting for emergency surgery face additional problems to those with elective surgery. These include full stomach with high risk of aspiration and hypovolemia due to blood or fluid loss which has to be replaced as fast as possible. Measures which should be taken in case of full stomach include:

- Postpone surgery for at least 4 hours.
- Empty the stomach using Naso-Gastric Tube of largest possible size.
- Magnesium tricilicate to reduce the pH of the gastric content.
- Especial "Crash induction" can be employed in the case of general anesthesia.

Crash induction:

This is a procedure used to prevent aspiration when full stomach is suspected.

- First preoxygenate the patient and give induction agent to make sleep.
- An assistant apply pressure on the cricoids just below the thyroid cartilage to occlude the esophagus.
- Then, muscle relaxant given
- The pressure will be removed when the endotracheal tube is in the trachea and the balloon is inflated

N.B.: In case of a life-threatening emergency, there is no contraindication for general anesthesia!

Measures before leaving the ward to the theater

- Food and drink withheld for 6 hours
- Lipstick removed, nails cleaned, etc.
- Dentures, artificial limbs and eyes removed
- Bladder emptied
- Premedication given

Premedication

Definition: Premedication is administration of drugs before surgery.

Purposes:

- To alleviate anxiety and fear with sedatives (Diazepam)
- To reduce secretions especially salivary and bronchial (Atropine)
- To prevent undesirable reflexes, e.g. bradycardia (Atropine)
- To facilitate induction and reduce the dose of anesthetic used

Commonly used drugs:

- Diazepam 10 mg
- Atropine 0.01 mg/kg IV / 0.02 mg/kg IM (ideally 30 min prior surgery)

Route of administration:

- Oral with small amount of water
- Intramuscular (for children)
 - Intravenous injection:
- Pre medication has not been given earlier in the ward
 - In patients who have already intravenous infusion running
 - In shocked patients
 - In a patient who has a bleeding tendency

CARDIOPULMONARY RESUSCITATION (CPR)

Definition: Cardiopulmonary resuscitation is the attempt to restore the vital functions of the body, which are the respiration and the circulation.

ABC of Cardiopulmonary Resuscitation
A = Assessment and Airway
B = Breathing
C = Circulation
D = Drugs

A. Assessment: Assess the patient for response by

- gently shaking the shoulders
- shouting, "are you all right?"

If the patient responds by moving or answering, leave him/her in the position in which they were found (assuming there is no further danger) and look for any obvious injuries or causes for collapse (Diabetic, intoxication, etc).

If there is any suspicion of a neck injury, protect the cervical spine by manual immobilization. Provide first aid for any injuries present and carefully reassess the patient at the regular interval.

If the patient does not respond, shout for help.

Fig. 1: Opening the Airway

By tilting the head back, open the airway by lifting the tongue off the fall by lifting the chin. Inspect the posterior pharyngeal wall. Remove any obvious obstruction from the mouth including loose denture.



Fig. 1: Opening the airway.

Top: Airway obstruction produced by tongue and epiglottis

Bottom: Relief by head tilt –chin lift

B. Breathing:

- Look, listen and feel for breathing (Fig. 2).
- Look for chest movement.
- Listen at the mouth for breathing sounds.
- Feel for expired air with your cheek.
- Look, listen and feel for up to 10 seconds before deciding whether breathing is present or absent.



Fig. 2: Determining breathlessness

If the patient is breathing:

- Turn the person into the recovery position (lateral position) unless you would aggravate any injuries (cervical spine injuries).
- Observe him/her closely checking that uninterrupted breathing continues and pulse is present.

If the patient is not breathing:

- Turn the patient into supine position and give two breaths of expired air ventilation (mouth to mouth breathing) (Fig. 3) then check the circulation.
- Expired air ventilation provides oxygen concentration of 16%, which is adequate to oxygenate the collapsed patient in the initial phase.



Fig. 3: Rescue breathing: Mouth to mouth breathing

C. Circulation (Fig. 4)

- Check the carotid pulse just lateral to the laryngeal prominence. Major pulses like the carotid or femoral pulses are more reliable in an emergency than peripheral pulses.
- Feel up to 10 seconds before deciding about the presence or absence of pulse.
- Look for any other signs of circulation (movement, swallowing, etc).



Fig. 4: Determining pulselessness. Locate the larynx while maintaining the head-tilt position (left). Slide the fingers into the groove between the trachea and the muscles at the side of the neck where the carotid pulse can be felt (right).

If pulse is present:

- Continue ventilation giving 10 breaths per minute.
- Reassess for signs of continuing circulation every minute, taking no more than 10 seconds to do so on each occasion.
- If signs of a spontaneous respiratory effort appear, stop and reassess ABC again.

If there are no signs of circulation, this is a **cardiac arrest**.

- Start external chest compression (Fig. 5).
- Give 15 chest compressions.
- Reopen the airway and give a further 2 breathes of expired air ventilation.
- External chest compression provides only 20% of normal cardiac output.

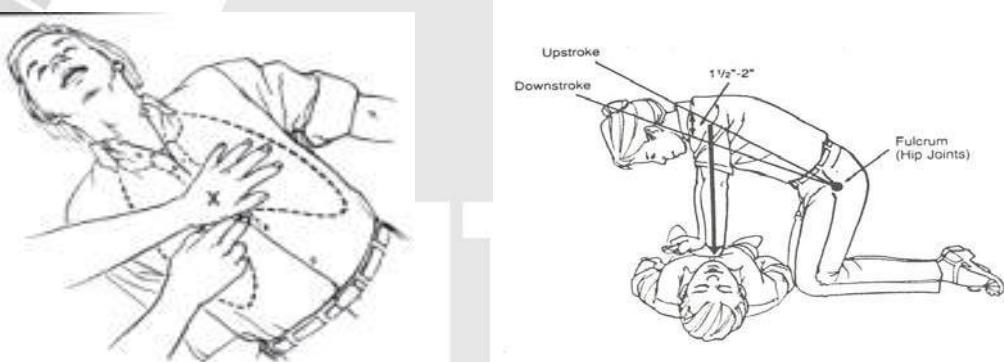
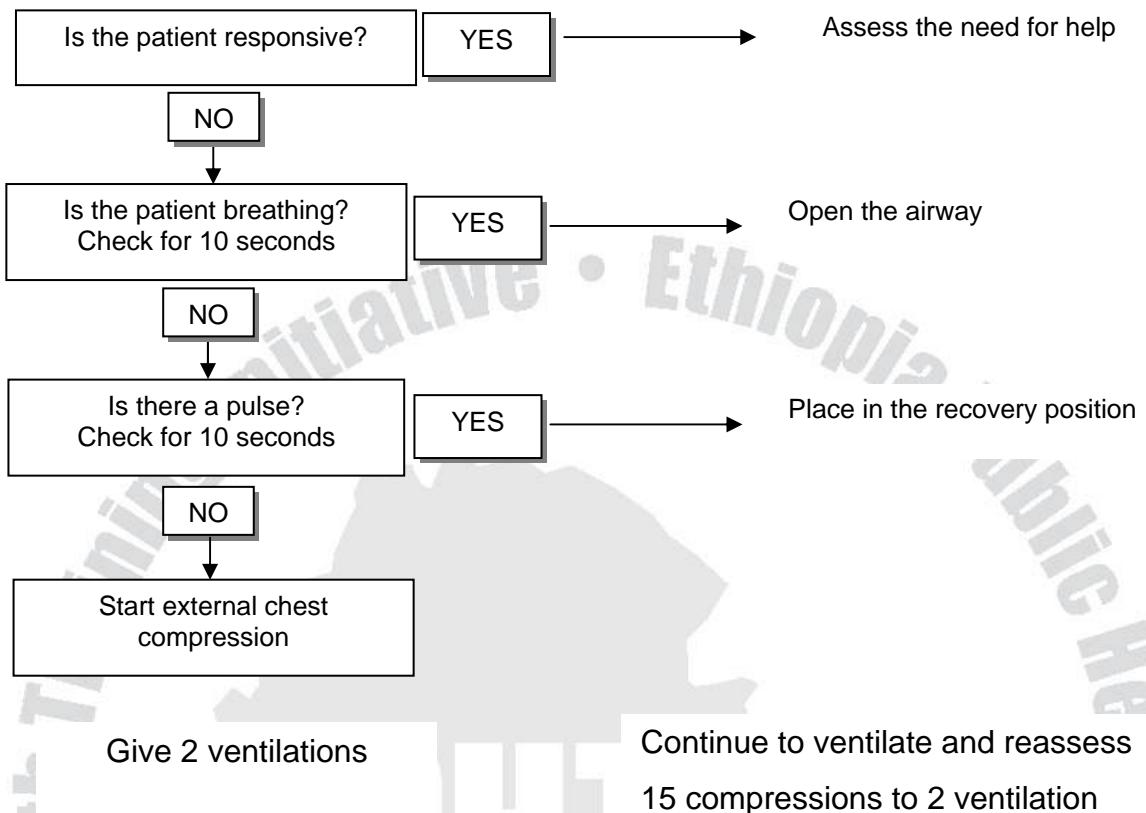


Fig. 5: External chest compression.

Left: Locating the correct hand position on the lower half of the sternum

Right: Proper position of the rescuer with shoulder directly over the victim's sternum and elbows locked

SUMMARY: ABC OF LIFE SUPPORT



D. Drugs:

Open the intravenous line and start with resuscitation fluid and at the same time one of the assistants can prepare adrenaline and give 1 mg every 3 minutes. In the meantime continue with breathing and external cardiac compression. Check for pupillary reaction as well. After 20-30 minute if there is no sign of heart beat and pupillary reaction one can stop resuscitation.

SYSTEMIC (GENERAL) ANESTHESIA

Definition: Several different types of drugs with different properties can produce the state of anesthesia.

General Anesthesia: the method of making the patient pain free and unaware about what is going on during the surgery.

Regional anesthesia: a method of blocking of nerve impulses before they reach the central nervous system using local acting drugs in order to induce analgesia and /or relaxation.

Advantages of General Anesthesia

- It can be given quickly
- It makes the patient's whole body insensitive to pain
- It makes the patient unconscious

A general anesthesia may cause both respiratory and cardio-vascular complications, which will require intervention. To fight against the complications, one should:

- Keep a vein open before anesthesia
- Have to prepare equipments for securing air way and possible ventilation.

Steps of general anesthesia

- Premedication
- Induction
- Maintenance
- Recovery

Premedication

Premedication can be started in the ward and /or in the OR before surgery.

Induction of Anesthesia

Induction of anesthesia is to make the patient unconscious. Before giving the drugs to make the patient sleep you should let him/her breathe 100% oxygen, which will be used as a reserve during the time of intubation. Induction can be performed:

- With intravenous anesthetic agents: Ketamine + Atropine or Thiopentone
- With inhalation agent (e.g. Halothane)

After the patient is induced, the anesthesia can be continued with intubation or with out (mask ventilation or spontaneous breathing).

Endo tracheal intubation:

It is a technique of passing an endotracheal tube into the trachea of the patient for securing the airway, and to make easier ventilation. For Intubation the patient should be adequately relaxed with inhalation agent or muscle relaxant. The relaxant used for intubation is Suxamethonium, which has fast onset of action and short effect.

Equipment necessary for intubation and resuscitation:

- Face mask
- Self inflating bag (Ambo)
- Oropharyngeal air way (different sizes)
- Suction machine with suction tip
- Laryngoscope with different blade sizes
- Endotracheal tubes

Maintenance of Anesthesia: The anesthesia can be maintained with:

- inhalation agent (halothane or ether ± muscle relaxant)
- inhalation agent + ketamine ± muscle relaxant
- intermittent Ketamine or Ketamine drip ± muscle relaxant
- Muscle relaxants for maintenance which usually are long-acting ones (e.g. Pancuronium, Vecuronium).

Monitoring: During anesthesia it is important to do strict monitoring of heart beat, blood pressure, respiration, temperature, fluid balance and urine output.

The carrier gas for volatile anesthetic agent can be atmospheric air or oxygen from compressed source depending on the type of Anesthesia machine in use.

Recovery and Extubation:

During recovery phase the patient recovers from:

- Inhalation agents by exhalation and/or metabolism
- Ketamine by excretion and metabolism
- Muscle relaxants by excretion and/or metabolism and/or reversal with neostigmine

Before extubation

- Be sure that the patient is breathing adequately (reversed from relaxant)
- Suck oropharyngeal secretion
- Deflate the cuff (which is used for adults) and remove the endotracheal tube

Transportation and immediate postoperative care:

- Transport in the recovery position
- Check and observe closely the pulse rate, blood pressure, respiratory rate, urine output hourly, any abnormal and continuing blood loss and presence of pain.

Ketamine Anesthesia

Ketamine can make the patient unconscious with good analgesic effect. Because of these reasons it can be used alone for short procedures and surgery, which does not require relaxation and intubation.

Dose and route of administration:

- Intramuscular: 5-10 mg/kg
- Intravenous: 1-2 mg/kg

The effect of one single dose lasts for about 15 min. A dose of 0.5 mg/kg can be repeated intravenously for maintenance. IM-maintenance is not recommended.

- Diazepam 5-10 mg should be given for adults to prevent bad dreams of Ketamine.
- Atropine 0.01mg/kg IV or 0.02 mg/kg IM should be given as premedication to decrease intra-bronchial secretion, which is increased by Ketamine.

REGIONAL ANESTHESIA

Before performing conduction block, full facilities for resuscitation should be available.

Toxicity of local anesthetics

All local anesthetic drugs are potentially toxic due to:

- Allergic reactions
- Systemic toxicity due to accidental intravascular injection or overdose
 - CNS-Toxicity:
 - Drowsiness

This presents with unconsciousness, which progresses to convulsion, cardiovascular toxicity, hypotension and cardiac dysrhythmia.

Treatment of systemic toxicity

- The best treatment of systemic toxicity is prevention by meticulous attention to technique and recognition of intravascular injection.
- Oxygen must be administered at the first sign of toxicity.
- Control seizure with Diazepam or Thiopental.

Commonly used local anesthetic drugs

Lidocaine (Xylocaine) 1%, 2% or 5% with or without Adrenaline in dose of:

With Adrenaline: 7 mg/kg

Without Adrenaline: 3 mg/kg

- **Bupivacaine** (Carbosthesin, Marcain) 0.25%, 0.5%, 0.75% without Adrenaline

Maximum dose: 2 mg/kg

Adding Adrenaline to Lidocaine has two useful effects:

- Allows larger dose of Lidocaine without toxic effect, by causing vasoconstriction which reduces the rate of absorption of the drug.
- As the rate of absorption of local anesthetic drug is slow, the duration of anesthesia increases.
- Never use local anesthetic drugs with adrenaline in areas supplied with end arteries
 - e.g.
 - For finger block
 - At the ear lobe
 - For circumcision (on penis)

Contraindications to conduction anesthesia

- True allergy to local anesthetic drugs
- Infection at the intended site of injection
- Systemic treatment of the patient with anti coagulant drugs

Types of conduction blocks

A) Spinal Anesthesia

Definition: Spinal anesthesia is a conduction block of nerve roots achieved by injecting a small volume of concentrated local anesthetic solution into the subarachnoidal space through the lumbar puncture. The level of lumbar puncture is at the interspaces between the 3rd and 4th lumbar vertebrae. The procedure should be performed with strict aseptic technique.

Drugs used

- Heavy or isobaric 0.5% Bupivacaine, duration of anesthesia 2-3 hours
- Heavy 5% Lidocaine, duration of anesthesia 90 minutes

Indications

Spinal anesthesia is appropriate for procedures involving below the level of umbilicus like in the lower extremities, hip, perineum, lower abdomen, lumbar spine.

Contraindications:

Complications for spinal anesthesia include:

- Patient refusal
- Patient with uncorrected hypovolemia
- Local infection
- Bleeding tendency
- Raised intracranial pressure

Procedure of spinal anesthesia

- Choose the lumbar interspace below the 2nd lumbar vertebrae (usually the 3rd or the 4th interspace) (Fig. 6 + 7).
- Clean and drape.
- Do the lumbar puncture (Fig. 8 top left).
- When the cerebro-spinal fluid starts to drip on removal of the stylet from the spinal needle, (Fig. 8 top right) slowly inject a local anesthetic solution 2 - 3 ml 0.5% Bupivacaine (Fig.8). Turn the patient to a supine position with pillow under the head in the case of heavy (hyperbaric) local anesthetic drug.

Complications of spinal anesthesia and measures to take

- Drop in blood pressure-due to high spinal block
 - Give Oxygen - Make faster the drip if that does not help.
 - Give smaller dose of ephedrine starting with 5mg and bolus, usually, 1-2. If prolonged effect is required give 25-50 mg IM.
- Bradycardia
 - Give Atropine 0.01 mg/kg IV
- Total spinal block with anesthesia and paralysis of the whole body
 - Intubate and ventilate
 - Treat Hypotension
- Post spinal headache
 - Bed rest
 - Hydration

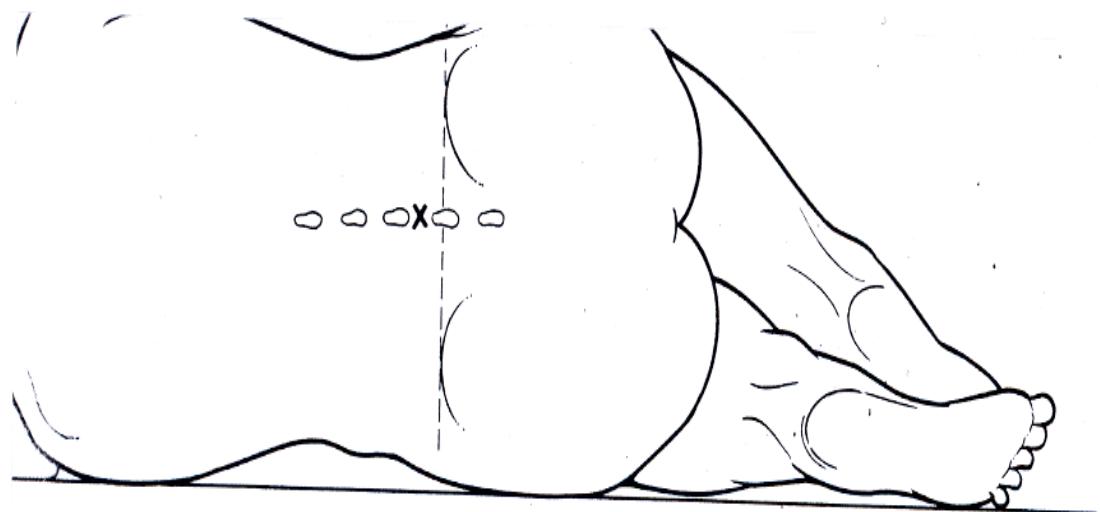


Fig. 6: Lateral positioning of the patient and selecting the lumbar interspace

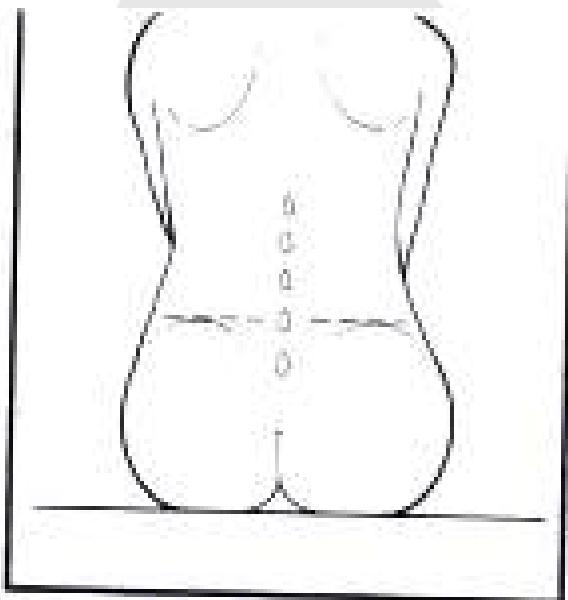


Fig. 7: Sitting position of the patient and selecting the lumbar interspace

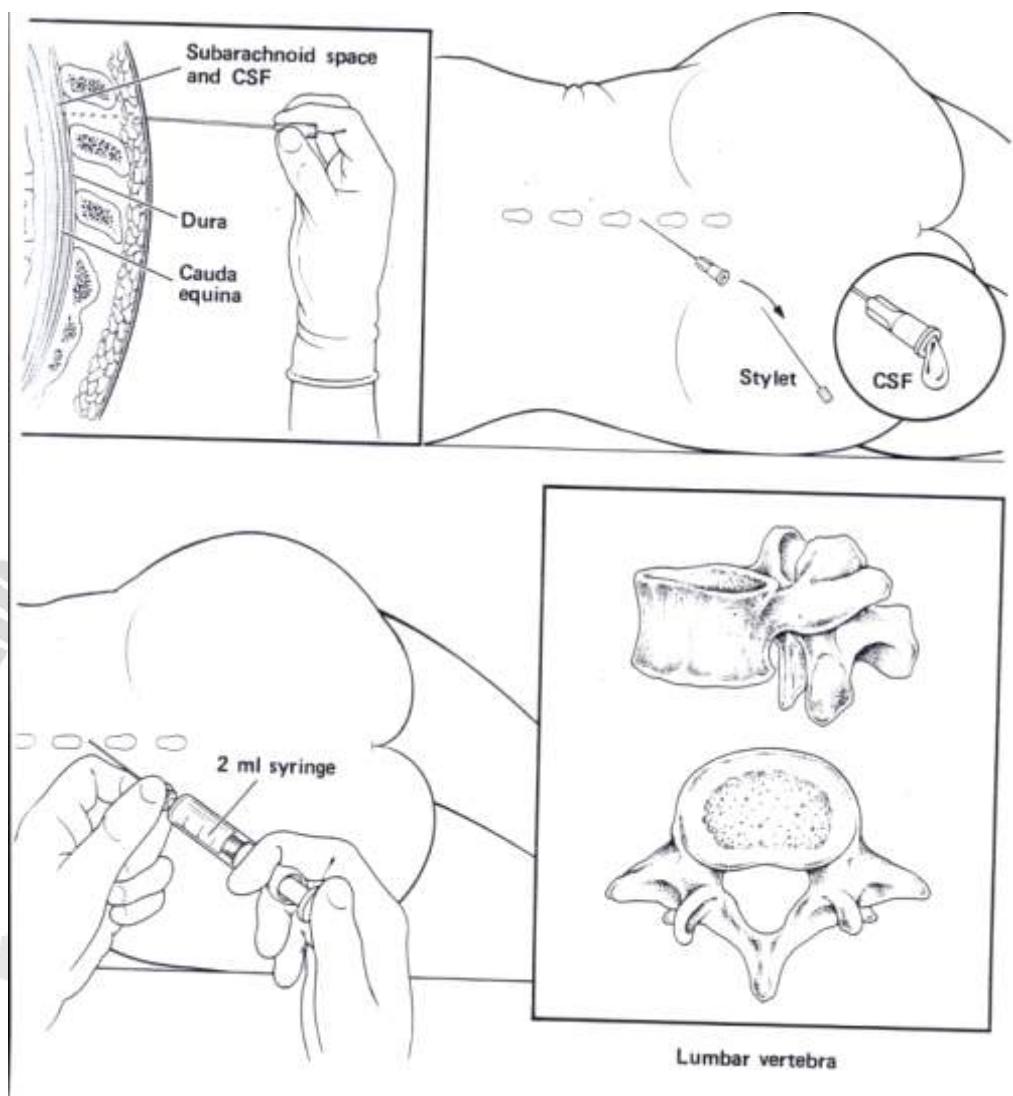


Fig. 8: Technique of Spinal Anesthesia

B) Nerve block

Definition: Nerve block is injection of a solution of local analgesic drug near the nerve or nerves supplying the area to be operated on. The commonly used local anesthetic drug is Lidocaine with concentration of 1-2%.

Commonly performed nerve blocks:

- Digital nerve block
- Axillary block of the brachial plexus
- Wrist-block

C) Field block

Field block is injection of local analgesic so as to create a zone of analgesia around the operative field. It can be used for:

- Repair of an inguinal hernia
- Caesarean section
- Circumcision

D) Infiltration

Infiltration is direct injection of drugs into the area to be incised and between bone ends in fractures. Lidocaine 0.5% is adequate for simple infiltration.

E) Topical anesthesia

This can be performed simply by applying 4% lidocaine to the mucus membrane, for minor surgery and instrumentation of:

- Nose
- Mouth
- Eye
- Pharynx and larynx
- Urethral procedures

Review Questions

1. A 60 year old male patient presents to Emergency OPD with persistent vomiting, abdominal distension and failure to pass flatus and feces. After evaluation by the surgeon, it is decided to take him to the operating theater.
What preoperative preparation should be performed before surgery?
2. 35 year old man with wt of 60 kg comes for inguinal herniorrhaphy which is planned to be done under local anesthesia.
 - a) What is the maximum volume of 1% Lidocaine (with Adrenaline) you can give?
 - b) Immediately after injection of Lidocaine, the patient tries to say something to you, subsequently he fails to communicate and the pulse is getting weak. What are your immediate measures?
3. A 17 year old girl is brought to the Emergency department with polytrauma after a car accident. At arrival her BP is not recordable, she is unconscious and cyanotic. How do you manage this patient?
4. You receive a patient from the OR, who had major surgery. How do you follow this patient in the immediate post-operative period?

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SYSTEMIC SURGERY

CHAPTER ONE THE THYROID GLAND

Learning objective

After reading this chapter students are expected to:

1. List common causes of thyroid enlargement
2. Know course and treatment of simple goiter
3. Identify clinical manifestation of hyper and hypothyroidism
4. Enumerate types of thyroid carcinomas
5. Outline management options for thyroid carcinomas

Thyroid Enlargement: Goiter

Goiter refers to a generalized enlargement of the thyroid gland which is normally impalpable.

Classification of thyroid swelling

1. Simple goiter (euthyroid)
 - Diffuse hyper plastic
 - (Multinodular)
2. Toxic
 - Diffuse (Grave's disease)
 - Nodular
 - Toxic adenoma
3. Neoplastic
 - Benign
 - Malignant
4. Inflammatory
 - Autoimmune (chronic lymphocytic thyroiditis, Hashimoto's disease)
 - Infectious
 - Acute (bacterial thyroiditis, viral,)
 - Chronic (tuberculous, syphilitic)

Simple Goiter

Patho-physiology: Simple Goiter is enlargement of the thyroid gland as a result of stimulation of the thyroid gland by high levels of circulating thyroid stimulating hormone. This high level of TSH might be due to dietary deficiency of iodine as in endemic goiter. Defective hormone synthesis also cause goiter and it accounts for many sporadic goiters. It has stages of development. All stages of simple goiter are far more common in females.

Diffuse hyper-plastic goiter: Persistent stimulation by TSH causes diffuse hyperplasia of the thyroid gland. The goiter is soft, diffuse and may become large enough to cause discomfort. In endemic goiter, it usually occurs at puberty when metabolic demands are high, this is reversible if stimulations cease. But, it tends to recur later at times of stress such as pregnancy. As a result of fluctuating stimulation of the thyroid gland, areas of active lobule and inactive lobules will develop. Active lobules become more vascular and hyperplastic until hemorrhage occurs causing necrosis. These necrotic lobules coalesce to form nodules filled with either iodine free colloid or inactive follicles. This is the *nodular stage* of simple goiter. Nodular goiter can be solitary or multinodular. The nodules can be colloid when filled with colloid or cellular. Secondary changes like cystic degeneration, hemorrhage and calcification occur at late stages.

Diagnosis

Clinical presentation:

Discrete swelling in one lobe with no palpable abnormality elsewhere is called solitary (isolated) nodule. And if there is abnormality elsewhere in the gland it is termed dominant nodule.

Nodules are palpable and usually visible. They are smooth, firm and not hard. The Goiter is painless and freely moves with swallowing and usually patients are euthyroid.

Investigation

- Thyroid function test (T_3 , T_4 , TSH) is necessary to exclude hyper or hypothyroidism.
- Chest or thoracic inlet x-rays may show calcification, tracheal deviation and compression.
- Estimation of thyroid antibody titers to exclude auto-immune thyroiditis.

Complications

- Tracheal obstruction can occur due to gross lateral displacement or compression.
- Secondary thyrotoxicosis may develop after long standing cases.

- Carcinoma: malignant changes of the follicular layer might develop in simple goiter.

Prevention and treatment

Prevention

In endemic areas the incidence of goiter can be significantly reduced by the introduction of iodized salt. In early stages, a hyper-plastic goiter may regress if thyroxin is given in a dose of 0.1mg daily for few months. The nodular stages of simple goiter are irreversible. But most of the patients are asymptomatic and do not require operation.

Operation might be indicated

- On cosmetic grounds
- Tracheal compression and
- When malignancy cannot be excluded

The options of surgical treatment are

- Near total thyroidectomy
- Subtotal thyroidectomy

Toxic goiters

Thyrotoxicosis - is a condition in which there is increased metabolic rate due to high level of circulating thyroid hormone. It is about eight times more commonly seen in females than males.

Clinical features

The most significant symptoms are

- Loss of weight in spite of good appetite,
- A recent preference of cold
- Palpitation.
- Tiredness
- Emotional lability.

The most important clinical signs of thyrotoxicosis commonly seen are

- excitability of the patient,
- the presence of goiter,
- hot and moist palms,
- exophthalmus in primary type
- tachycardia with cardiac arrhythmia

- Weakness of the proximal limb muscles
- The goiter in primary thyrotoxicosis (Grave's disease) is diffuse and vascular, it may be large or small, firm or soft and bruit may be present. Whereas in secondary thyrotoxicosis the goiter is nodular.

Diffuse toxic goiter: Primary toxic goiter or Grave's disease is a diffuse vascular goiter appearing at the same time as symptoms of hyperthyroidism. It usually occurs in younger women and frequently associated with eye signs. The hypertrophy and hyperplasia are due to abnormal thyroid stimulating antibodies

Toxic nodular goiter: A simple nodular goiter is present for a long time before the hyperthyroidism, and hence termed secondary thyrotoxicosis. It is usually seen in middle aged or elderly people and less frequently associated with eye signs. In many cases of toxic nodular goiter, the nodules are inactive and it is the intermediate thyroid tissue that is involved in hyper secretion.

Toxic nodule: This is a solitary hyperactive nodule which may be part of a generalized nodularity or a true toxic adenoma. It is autonomous and its hypertrophy and hyperplasia are not due to thyroid stimulating antibodies. Because TSH secretion is suppressed by the high level of circulating thyroid hormones, the normal thyroid tissue surrounding the nodule is suppressed and inactive.

Diagnosis of thyrotoxicosis

- Most cases are easily diagnosed by the clinical picture.
- The thyroid functional status can be determined by estimation of serum thyroxin hormones and TSH.
- Isotope scanning is used to investigate discrete thyroid swelling. This helps to determine the functional activity relative to the surrounding gland according to isotope uptake.

Treatment of thyrotoxicosis

Treatment of thyrotoxicosis includes specific and non-specific measures. The specific measures are

- the use of antithyroid drugs
- surgery
- radioiodine

The nonspecific measures which include rest and sedation are not commonly recommended.

Anti thyroid Drugs:

Antithyroid drugs are used to resume the patient to a euthyroid state and to maintain this for a prolonged period. But it should be clear that antithyroid drugs cannot cure a toxic nodule since the overactive thyroid tissue is autonomous and recurrence of the hyperthyroidism is certain when the drug is discontinued.

Surgery:

Surgery cures thyrotoxicosis by reducing the mass of overactive tissue below critical mass. Preoperatively, the patient must be prepared with antithyroid drugs so that the patient becomes euthyroid. The preferred procedure is subtotal thyroidectomy.

Post-operative complications

- Hemorrhage - a tension hematoma may develop deep to the cervical fascia – which is potentially life threatening
- Respiratory obstruction - can occur due to laryngeal edema or secondary to tension hematoma.
- Recurrent laryngeal nerve paralysis may be unilateral or bilateral and could be transient or permanent.
- Thyroid insufficiency. This is insidious and usually occurs after 2 years.
- Parathyroid insufficiency - is due to removal of parathyroid gland and usually seen in immediate post operative period.
- Thyrotoxic crisis (storm) - is an acute exacerbation of hyperthyroidism. It occurs if a thyrotoxic patient has been inadequately prepared for thyroidectomy.
- Wound infection - a subcutaneous or deep cervical abscess may occur rarely and necessitates drainage.

Neoplasms of the thyroid

Classification of thyroid neoplasm

Benign: follicular adenoma

Malignant: *Primary*
- **Follicular epithelial:** follicular, papillary, anaplastic
- **Para follicular epithelium:** medullary
- **Lymphoid cells:** lymphoma

Secondary

- Metastatic
- Local infiltrations

Benign tumors

Follicular adenomas present as clinically solitary nodules and the distinction between a follicular carcinoma and an adenoma can only be made by histological examination. Treatment of follicular adenoma is by wide excision preferably lobectomy.

Malignant Tumors

Clinical feature: The commonest presenting symptom is

- thyroid swelling
- Enlarged cervical lymph node may be the presentation of papillary carcinomas.
- Recurrent laryngeal nerve paralysis may be a presenting feature on locally advanced disease.
- Anaplastic growths are usually hard, irregular or infiltrating.

Diagnosis

Differentiated cancers: Diagnosis largely depends on

- history
- physical examination
- investigations: Thyroid function tests(T3,T4,TSH), fine needle aspiration, antibody assays, and radio isotope scanning

Treatment: Treatment of differentiated thyroid carcinoma principally is surgery.

Prognosis: Prognosis is influenced by histological type, age, extra thyroid spread, and size of tumor. With regard to age, males of more than 40 years of age and females over 50 years have worse prognosis. Distant metastatic disease has worse prognosis.

Undifferentiated (anaplastic) Carcinoma

This occurs mainly in elderly woman. Local infiltration is an early feature of these tumors with spread by lymphatics and blood stream. They are extremely lethal tumors with death occurring in most cases within months. Many lesions present in advanced stages with tracheal obstruction and require urgent tracheal decompression. Radiotherapy should be given in all cases and may provide a worth while period of palliation.

Review Questions

1. Discuss stages of simple goiter.
2. List the most important clinical signs of thyrotoxicosis.
3. What is the most common presenting symptom of thyroid malignancies?
4. Compare and contrast papillary and follicular thyroid carcinoma with respect to root of metastasis, overall mortality and location of recurrence?
5. What is the most important investigation in solitary thyroid nodule?

References

1. Bailey and Loves, Short Practice of Surgery 22nd Ed.
2. Hardy's Text Book of Surgery



CHAPTER TWO

THE BREAST

Learning objectives

After reading this chapter, the student is expected to:

- ◆ Identify the common causes of lumps in the breast
- ◆ Mention the possible methods of investigating breast lumps
- ◆ Understand clinical presentation and treatment of benign breast lumps
- ◆ Understand the staging evaluation of breast carcinoma
- ◆ Outline the management principle of carcinoma in the breast
- ◆ Diagnose and manage infectious diseases of the breast

Introduction

The breast is a modified sweat gland that produces milk under hormonal influences. Breast carcinoma is the most common cause of death in the developed world. In underdeveloped countries patients present usually with late stage of disease. This is due to lack of screening facilities, low index of suspicion among health professionals, poverty and lack of knowledge. Benign conditions of the breast are important because of the discomfort they produce and frequent confusion with neoplastic disease.

Anatomy

- The protuberant part of the human breast is generally described as overlying the 2nd to 6th ribs,
- It extends from the lateral border of the sternum to the anterior axillary line, between clavicle and to the 7th and 8th ribs below.
- The ligaments of cooper are hollow conical projections of fibrous tissue filled with breast tissue the apices of cones being attached firmly to the superficial fascia and thereby to the skin overlying the breast.
- The areola contains involuntary muscles arranged in concentric rings as well as radially in the subcutaneous tissue.
- The nipple is covered by thick skin with corrugations. Near its apex lie the orifices of the lactiferous ducts. The nipple contains smooth muscle fibers arranged concentrically and longitudinally.
- Lymphatics of the breast drain predominantly into the axillary lymph nodes on the ipsilateral side.

Breast lumps

Among all the problems women develop in their breasts, breast lumps are the most common. These could be secondary to either benign disease conditions, or fatal carcinomas. Hence, it is essential to identify different types of breast lumps. Students should be familiar with some of differentiating mechanisms between malignant and benign breast lumps.

Breast cysts

This is a rare condition which may occur in the last decade of reproductive life due to a non-integrated involution of stroma and epithelium. They are often multiple and may be bilateral. Diagnosis can be confirmed by aspiration and/or ultrasound.

Treatment – solitary or small cysts are aspirated. If there is residual lump after aspiration, if fluid is blood stained, or if cyst recurs, local excision for histological diagnosis is advisable. .

Fibroadenoma

Usually occurs during 15-25 years of age and arises from hyperplasia of a single lobule. It can usually grow up to 2-3 cm in size surrounded by well-marked capsule. It is smooth, solitary, usually painless and moves freely in the breast. Most fibroadenomas can be excised through periareolar incision with good cosmetic result.

Phyllodes Tumor

- Are benign tumors
- Usually occur in women over 40 years but can appear in younger woman.
- Present as large, massive tumor with unevenly lobulated surface and occasionally with ulceration of overlying skin.
- Can be treated by enucleation, but massive and recurrent tumors may require simple mastectomy.

Ductectasia/ periductal mastitis

Definition: This is dilatation of the breast ducts associated with periductal inflammation.

Pathogenesis: Dilatation of lactiferous ducts that will be subsequently filled with a stagnant brown or green secretion. The secretion may discharge. The fluid sets up an irritant reaction in surrounding tissue leading to periductal mastitis, even abscess or fistula formation. Some causes chronic indurated mass, which mimics carcinoma.

Clinical presentation

- Nipple discharge of any color,
- a subareolar mass,
- Abscess,
- Mammary duct fistula and/or nipple retraction.

Treatment:

- Excision of all major ducts.
- In case of nipple retraction, carcinoma must be excluded by mammography and histology.

When the diagnosis of carcinoma is in doubt

There are cases where one cannot be sure whether the particular lump in the breast is area of mammary dysplasia, benign tumor or an early carcinoma. If there is doubt on clinical, cytological or radiological examination, it is essential to obtain a tissue diagnosis. Table '1' gives an algorism for investigating a breast lump

Table "1" Investigation of a breast lump

Lump in the breast					
Cystic		Solid			
FNA		Clinically benign		Clinically malignant	
Cytology	Cytology	FNA		FNA	
Benign, breast lump disappears	Malignant, lump persists or bloody	Cytology	Cytology	Cytology	
Follow-up	Urgent biopsy	Benign	Malignant	Benign	
		Follow-up or excise	Treat cancer	Urgent biopsy	

Acute mastitis

Definition

This is acute inflammation of the breast. Bacterial mastitis is the commonest variety of mastitis and nearly always commences acutely. It is associated with lactation in the majority of cases

Cause

Most cases are caused by staphylococcus aureus.

Clinical presentation

- Pain
- Swelling
- Redness
- Tenderness and hotness of the affected side.
- Later on, abscess may develop.

Treatment

- Initiation of appropriate antibiotics (e.g.- cloxacilline)
- Affected breast rested with breast-feeding on the opposite side only.
- Support of breast
- Local heat and analgesics for reduction of the pain.

Complication: - *breast abscess*

If acute infection of breast doesn't resolve with in 48 hours, or if after emptied of milk there is an area of tense induration, the inflammation has resulted in an abscess. Unlike majority of localized infections; fluctuation is a late sign so incision must not be delayed. When doubt exists an incision and drainage should be done.

Drainage of breast abscess

Under general or local anesthesia, incision is sited in a radial direction over the affected segment. The incision passes through the skin and superficial fascia. A long hemostat is then inserted into the abscess cavity. Every part of abscess is palpated against the point of hemostat and its jaw opened, all loculi that can be felt are entered. Finally the hemostat having been removed, a finger is introduced and any remaining septa are disrupted. The wound may then be lightly packed with gauze or drain inserted to allow dependent drainage.

Carcinoma of the Breast

Breast cancer is the commonest cause of death in middle-aged women in western countries. In our set up, increasing incidence is being observed.

Risk factors

- Geographical - it occurs commonly in the western world accounting for 3-5 percent of deaths but is rare tumor in Far East like Japan. In developing countries it accounts for 1-3 percent of death.

- Age - it is extremely rare below the age of 20, but the incidence thereafter steadily rises so that by the age of 90 nearly 20% of women are affected.
- Genetic - it occurs more commonly in women with a family history of breast cancer.
- Diet- since it is more common in “developed” world, dietary factor may play role, a high intake of dietary fat is associated with an increased risk.
- Endocrine - common in nulliparous women, having the first child at early age especially if associated with late menarche. Early menopause is protective.
- Obesity.

Pathology: Breast cancer may arise from the epithelium of the duct system starting from the nipple to the end of lactiferous ducts which is in the lobule. It may be entirely in situ (without breaching basement membrane) or may be invasive. The degree of differentiation of a tumor is usually described by three grades well differentiated, moderately or poorly differentiated. *Ductal carcinoma is the most common variant.* Lobular carcinoma occurs in up to 10 percent of cases.

Spread of breast cancer

1. *Local spread:* Tumor increases in size and invades other parts of the breast. It tends to involve the skin and to penetrate the pectoral muscles, and even the chest wall.
2. *Lymphatic spread:* Occurs primarily to the axillary lymph nodes. Involvement of lymph nodes is not necessarily a chronological event in the evolution of the carcinoma, but rather a marker of the metastatic potential of that tumor. In advanced diseases there may be involvement of supraclavicular nodes and of any contralateral lymph nodes.
3. *Spread by the blood stream:* (hematological spread). It is by this route that skeletal metastasis occurs in decreasing frequency to the lumbar vertebra, femur, thoracic vertebra, rib and skull. They are generally osteolytic. Metastasis can also occur to the liver, lungs and brain and occasionally to the adrenal glands and ovaries.

Clinical presentation

While any portion of the breast may be involved, breast cancer commences most frequently in the upper outer quadrant.

Local findings

- Hard, irregular lump.
- Indrawing of the nipple (nipple retraction).
- Skin involvement with peau d' orange (orange peel) appearance.
- Frank ulceration and fixation to the chest wall.

Signs of metastasis

- depends on the part of the body involved
- Lymph node enlargement
- Bone pain
- cough

These patients must undergo a staging evaluation which includes careful clinical examination, chest x-ray, serum alkaline phosphates and liver ultrasound.

Prognosis of breast cancer: The best indicators of likely prognosis in breast cancer are tumor size and lymph node status. Other prognostic factors include:

- Invasive and metastatic potential
- Histological grade of tumor
- Estrogen receptor status
- Patient age and menopausal status are some of the factors

Treatment of Breast Cancer: Treatment of breast cancer is a multi disciplinary approach. It largely depends on clinical stage and other tumor characteristics described previously.

Modes of treatment include:

- surgery
- radiotherapy and
- Medical therapy (including chemotherapy and hormonal therapy.)

Review Questions

1. What are the differential diagnoses of a lump in the breast?
 2. A 20 year old female patient presents with a solitary painless lump in the breast. Examination reveals a freely mobile 3cm lump. The most likely diagnosis is
 - A. Fat necrosis
 - B. Fibroadenoma
 - C. Breast cancer
 - D. Phylloides tumor
 3. What is the peculiar feature of breast abscess as compared to other abscesses? How can the diagnosis be confirmed?
 4. Discuss the spread of breast cancer.
 5. What are the mainstays of treatment of early breast cancer?
 6. A thirty-five year-old nulliparous woman comes with history of swelling in the breast of 2-months duration. The swelling is reported to be painful and persistent. In association with this, the patient has moderate fever, decreased appetite and weight loss.
 - A. What is the most likely diagnosis?
 - B. What further History and physical examination do you need to reach a diagnosis?
 - C. List the most important laboratory investigations which help you confirm the diagnosis.
- On Physical examination, the tumor measured 4cm, its non-mobile and rough surfaced. There is freely mobile axillary lymphadenopathy on the same side.
- D. What is the stage of the disease?
 - E. Outline the management approach.

References

1. Bailey and Loves, Short Practice of Surgery 22nd Ed.
2. Hardy's Text Book of Surgery



CHAPTER THREE

THE CHEST

Learning Objectives

After reading this chapter, the student should be able to:

- Recognize upper airway obstruction, identify causes and suggest appropriate management.
- Identify life threatening thoracic injuries, which need immediate lifesaving measures
- Highlight the most commonly encountered thoracic injuries and their management.
- Understand the causes, clinical manifestation, surgical management and complication of empyema thoracis and lung abscess.

Introduction

Acute upper airway obstruction is a surgical emergency with no time to lose. Infants are vulnerable more than adults due to small diameter of the airway, longer soft palate, more posterior pharyngeal soft tissues, compliant epiglottis, etc. Generally, in any patient with thoracic problem, chest physiotherapy, that is incentive spirometry if available or inflating a glove or intravenous fluid bag with deep inspiration and expiration and early movement is of paramount importance for smooth recovery of the patient.

Upper Airway Obstruction

DEFINITION: Upper airway obstruction is an obstruction at or above the vocal cord characterized by inspiratory stridor.

AETIOLOGY:

Acquired

- Inhaled **foreign body**
- **Infection:** - viral laryngotracheobronchitis; most common cause in children
 - epiglottitis, bacterial croup, trachitis and retropharyngeal abscess
- Laryngeal **spasm**: e.g. tetanus
- **Trauma** to the neck: Most common cause in adult
- Vocal **cord paralysis** (Acquired or congenital)
- Complication from endotracheal intubation or tracheostomy
- External **compression**: e.g. huge goitre, haematoma after thyroidectomy
- **Malignancy** like laryngeal carcinoma

Congenital

- Laryngomalacia
- Laryngeal or tracheal web and stenosis
- Subglottic tumour (haemangioma, polyp)
- Aberrant vessels
- Adenoids

CLINICAL FEATURES

In most cases, clear history suggesting foreign body aspiration, infection or trauma can be elicited. It is usually characterized by *stridor* (noisy breathing); suprasternal retraction; tachycardia and cyanosis develop as obstruction becomes complete.

TREATMENT

Every effort should be made short of tracheostomy to save life or treat a cause. If a foreign body aspiration is suspected, *tilt* the patient's head down *and slap* the patient sharply across the back. Then, *explore* the pharynx and mouth by finger and if possible, urgent *laryngoscopy* should be done.

If indicated, *intubate* the airway immediately, otherwise do emergency *cricothyroidotomy* (insert wide bore needle to the cricothyroid membrane) and give 100% oxygen until intubation or proper tracheostomy is done. *Tracheostomy* is indicated if long-term airway management is considered.

TRACHEOSTOMY

DEFINITION

Tracheostomy is provision of an artificial airway by opening the trachea. It is indicated to bypass upper airway obstruction, for drainage of the respiratory tract and to provide assisted ventilatory support.

PROCEDURE (see figures for illustration):

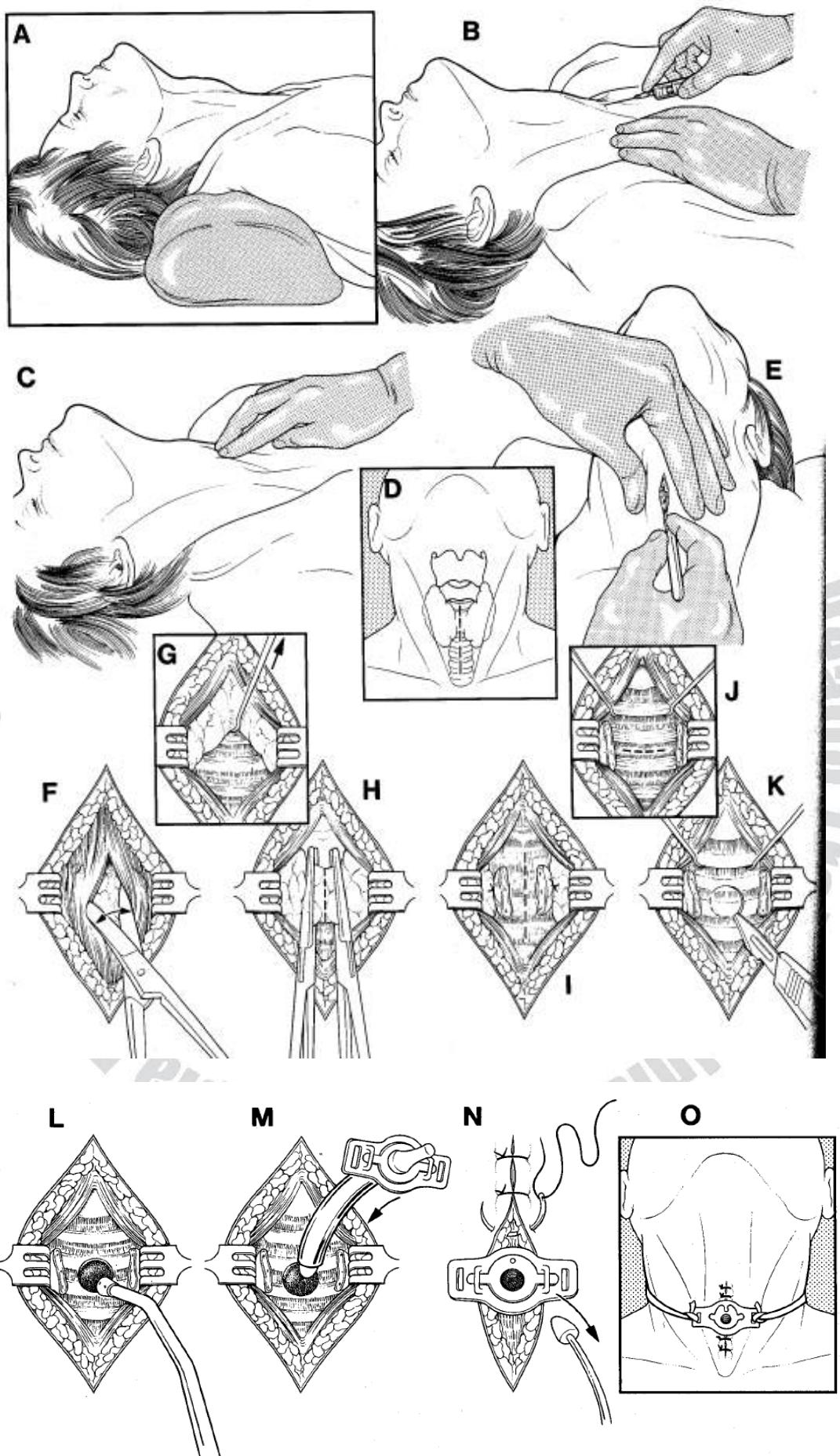
1. Tracheostomy should be performed in operating room under general anaesthesia with intubation, if possible, especially in case of children. But if very urgent situation is encountered, do cricothyroidotomy while preparing for tracheostomy.
2. Fully extend the head by putting pillows under patient's shoulder
3. Palpate and count the tracheal rings. Make incision over fourth tracheal ring transversely or vertically in case of emergency.

4. Dissect strictly in midline to separate the strap muscles and pre tracheal fascia to expose the trachea.
5. Achieve complete haemostasis.
6. Open the trachea by midline incision through three adjacent tracheal rings, usually 3rd, 4th and 5th, after holding upper end of cricoid cartilage using fine cricoid hook. Hold open cut edge by tracheal dilator and insert a tube which comfortably fits the trachea while the anaesthetist withdraws the endotracheal tube. Connect the tube to the ventilator.
7. Aspirate tracheal secretion soon after initial incision on the trachea and repeat after the tube in place.
8. Fix the tube by tape tied around the neck.

N.B: Placement of a traction stay stitch on each side of the tracheal incision is helpful in case the tube accidentally dislodges, in order to pull up the opening for reinsertion

Figure 1: Tracheostomy procedure illustrated (next page)

- A Positioning the patient with hyperextension of the neck
- B Infiltration of local anesthetic agent
- C/D Palpating the location of the trachea
- E Making a vertical incision
- F Splitting the overlying muscles
- G Retraction of the thyroid gland
- H Dividing the isthmus of the gland if necessary
- I Visibly cleared tracheal rings
- J Elevation of the rings using ring hooks
- K Opening the trachea/ cutting the rings
- L Suctioning secretion from the opened trachea
- M Inserting a tracheostomy tube
- N Suturing of the skin incision/ removing inner tube
- O Securing the tube around with a tape



POST OPERATIVE TRACHEOSTOMY CARE

1. Humidify inhaled gas as near to body temperature as can be achieved by frequent application of saline soaked gauze over the tube.
2. Suction with a sterile catheter frequently.
3. Tracheostomy toilet from 10 minutes to as long as two hours as needed and if there is inner tube take it out every four hours and wash it.
4. Chest physiotherapy.
5. Watch for gastric distension: to avoid aspiration.

COMPLICATIONS

1. Infection
2. Obstruction by inspissated secretions, tracheal casts or membranes
3. Tracheal ulceration and perforation (e.g. Esophagus, major vessel)
4. Haemorrhage
5. Cannulation of right main bronchus
6. Accidental dislodgement
7. Granuloma of the trachea
8. Stricture of the trachea
9. Pneumothorax

REMOVAL OF THE TUBE

Before removing a tracheostomy tube, check whether the patient breathes adequately with the stoma closed. A tight dressing should be applied over the tracheal opening after removal.

CHEST INJURIES

INTRODUCTION

25% of all trauma deaths are a result of chest injuries alone and respiratory problems contributes significantly in 75% of traumatic deaths. The terrible death toll related to chest injuries is avoidable by simple measures.

CLASSIFICATION

- 1. Blunt trauma:** It accounts for 85% of all chest injuries. In 70%-80% cases, it results from motor vehicle accident. The rest are due to fall and crush injuries. 84% of cases are associated with injury to other sites.
- 2. Penetrating trauma:** accounts for 15% of all chest injuries. Stab and gunshot wounds are the most frequent causes. It results in hemothorax in more than 80% and pneumothorax

in nearly all cases. It should be considered as thoracoabdominal if penetration is below fourth intercostal space.

PATOPHYSIOLOGY

Inadequate delivery of oxygen to tissue results from

1. Ventilation-perfusion mismatch i.e. perfusion of non ventilated lung mostly as a result of lung contusion
2. Decreased tidal volume due to pain or other cause
3. Hypovolemia from bleeding
4. Mechanical obstruction due to tension pneumothorax and cardiac tamponade

INITIAL ASSESSMENT AND MANAGEMENT

Ensuring adequate airway: Keep cervical spine neutral. The oropharyngeal airway should be cleared from debris and secretion. Cricothyroidotomy till intubation or tracheostomy is made if indicated.

Ensuring adequate ventilation: Give 100% oxygen. Tightly dress any sucking wound and look for signs of *tension pneumothorax* (distended neck veins, shift of the trachea, hyper resonance with decreased air entry), *cardiac tamponade* (hypotension, distended neck vein and distant heart sounds), massive *hemothorax* and *flail chest* all of which can compromise ventilation despite patent airway and adequate oxygenation.

Control extreme hemorrhage and restore circulation: Insert wide bore cannula for fluid and blood transfusion.

N.B: If one suspects tension pneumothorax, massive hemothorax or cardiac tamponade, the management should be dealt as part of resuscitation and patients should not be sent for confirmatory investigations. Besides, in case of suspected cardiac tamponade, simple insertion of a needle through xiphoid angle pointing towards the left shoulder tip can help enter the pericardium and aspirate accumulated blood. This could salvage the patient's life to reach a proper centre. Generally injury to the chest can involve:

- A. The chest wall
- B. Lung
- C. Mediastinal structures
- D. The diaphragm.

Chest wall injuries:

Simple rib fracture: Most common injury, defined as less than three rib fractures other than first and second rib. Present with pain, reduced motion during breathing and point tenderness. Confirm by Chest x-ray. Pain relief and chest physiotherapy is needed.

Major chest wall injuries: *Flail chest:* paradoxical movement of a segment of chest wall as a result of fracture of four or more ribs at two points or bilateral costochondral junction separation.

Diagnosis: Usually clinical, by closely observing paradoxical chest motion, chest x-ray shows multiple segmental fractures.

Treatment: Aggressive chest physiotherapy, effective analgesia, close ICU observation if available, Oxygen supplement to keep saturation $\geq 90\%$. Administer fluid only to restore hemodynamic stability and selective use of intubation for PPV.

Fracture of first, second rib and the sternum: These are considered to be major injuries since a considerable force, which usually causes associated injury to underlying structures like vessels or nerves, is required. It is otherwise managed as simple rib fracture.

Lung contusion:

This presents with bloody sputum upon coughing.

Diagnosis: Chest x-ray (parenchymal opacity immediately after injury and increasing in the next 24-48 hours).

Treatment: Pulmonary physiotherapy and prevention of fluid load.

Injury to mediastinal structure: Injury to trachea, bronchus, major vessel and heart are fortunately rare. But if they occur, they are usually fatal and patient often does not reach health facility.

Diaphragmatic rupture: Mostly occurs on the left side and diagnosis needs high index of suspicion. Symptoms and signs are usually due to herniation of intra abdominal organ like stomach or colon in to the chest.

Diagnosis: Insert nasogastric tube. Auscultate the chest simultaneously while insufflating air in to the tube. Chest x-ray may reveal tube, loop of bowel or fluid level in the thorax

Treatment: Immediate repair

PNEUMOTHORAX

DEFINITION: Pneumothorax is a presence of air in pleural cavity.

TYPE: Open: This is associated with chest wall wound which communicate with the external environment.

Tension: This is a surgical emergency associated with development of pressure which compromise breathing as well as circulation.

Simple: This is collection which is not associated with compromised breathing and no breach of chest wall

CAUSE

Blunt and penetrating injuries

MECHANISM

- *Fractured rib penetrating the lung*
- Deceleration and crush disrupting the alveoli
- Sucking effect of negative intrapleural pressure

N.B: In most cases of traumatic pneumothorax, there will be associated bleeding which may not be apparent.

CLINICAL FEATURE

Presume pneumothorax in any chest injury until proved otherwise since pain and splinting make physical examination difficult. Look for decreased chest expansion, tracheal shift, hyper resonant percussion note and decreased air entry. If patient's condition is stable, confirm by erect chest x-ray.

TREATMENT

The principal objective is to remove trapped air through tube thoracostomy (chest tube). In case of tension pneumothorax, insertion of needle at second intercostal space over the mid clavicular line of the same side relieves the tension until chest tube insertion.

HEMOTHORAX

DEFINITION

Hemothorax is collection of blood in the pleural cavity. Bleeding usually occurs from intercostal or internal mammary arteries. Bleeding from parenchymal injury is nearly always self-limiting. **Massive Hemothorax** is a bleeding of more than 1500ml in to pleural cavity and rarely occurs in blunt trauma.

CLINICAL FEATURE

There is a history of trauma to chest. Signs of fluid collection in the pleural cavity (decreased air entry, dull percussion note) are found on physical examination.

Chest x-ray: Erect chest film reveals costophrenic angle obliteration if more than 500 ml blood exists. Lateral decubitus film can demonstrate as small as 250 ml of blood. Subpulmonic trapping can mask as much as 1000ml of blood on erect film.

Ultrasonography can reveal a small amount of fluid in the pleural recess.

TREATMENT: Chest tube insertion if sign of collection is visible on erect chest x-ray.

TUBE THORACOSTOMY (CHEST TUBE)

DEFINITION

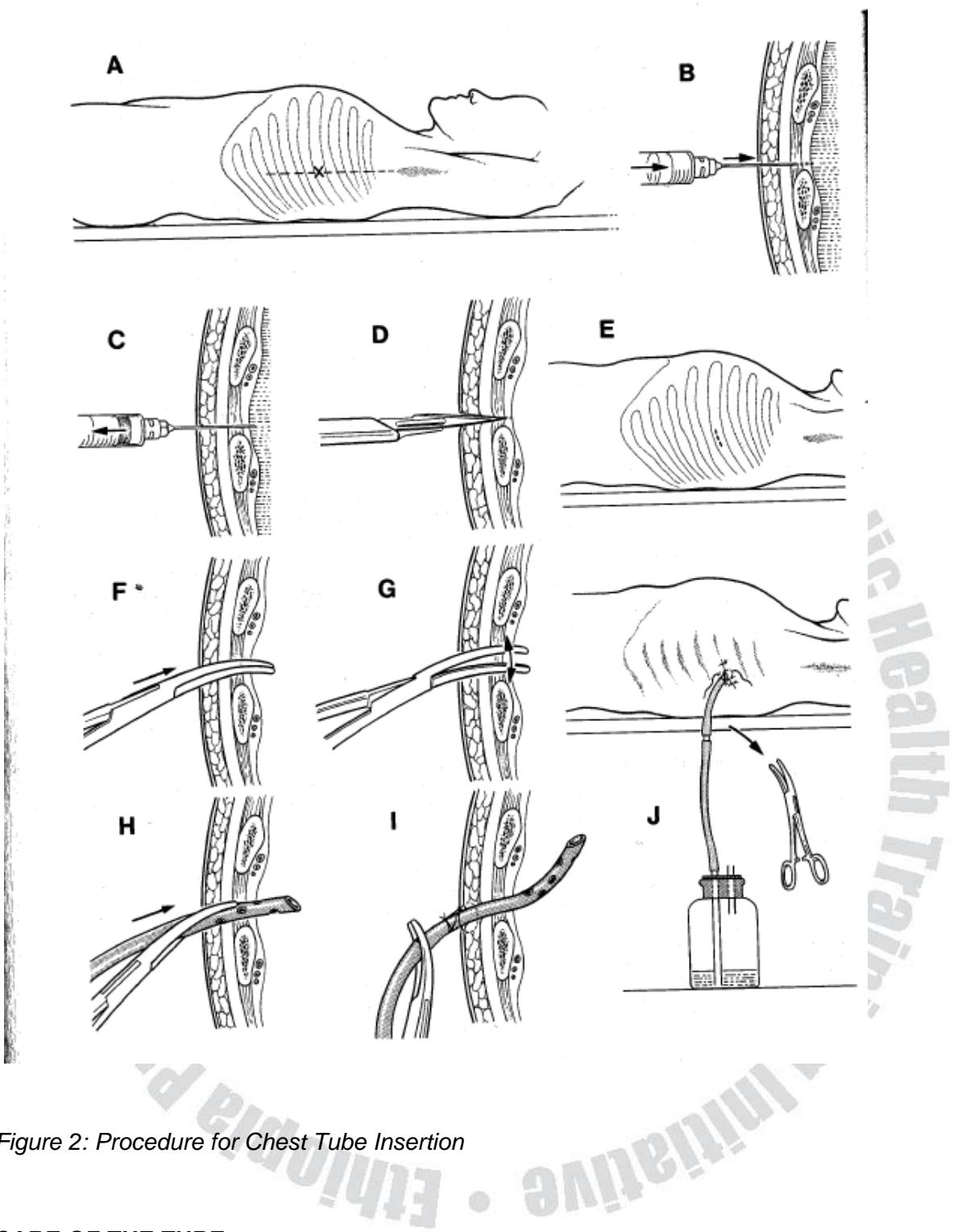
Tube thoracostomy is the process of inserting a tube into the pleural cavity. The purpose is to maintain the negative intrapleural pressure and allow complete re-expansion of underlying lung. This is achieved by connecting the tube to underwater seal drainage bottle with or without suction.

SITE (see figure 2 on next page)

The safe site to insert a chest tube is at the *triangle of safety* which is a triangle bordered by fifth or sixth rib, mid axillary line and the lateral border of the pectoralis major. Skin incision is placed one interspace below the site of pleural penetration.

PROCEDURE (STEPS) FOR CHEST TUBE INSERTION:

- A Positioning of the patient and marking the site
- B Infiltration of local anesthetic agent above the inferior rib
- C Aspiration of fluid
- D / E Making an incision and stabbing with a knife
- F / G Splitting the overlying muscles and widening incision using a hemostat
- H Inserting the tube along the direction of the hemostat
- I Clumping the tube until it gets connected (to prevent air getting in)
- J Releasing clump after connecting tube to underwater bottle



Ethiopian Health Train

Figure 2: Procedure for Chest Tube Insertion

CARE OF THE TUBE

- ◆ Immediate control chest x-ray for confirming position of the tube.
- ◆ Check patency of the tube by presence of air bubble and fluid oscillation.
- ◆ Always keep the bottle below the heart level. Clump it whenever moved.
- ◆ Record daily drainage
- ◆ Daily clinical assessment and x-ray if available

INDICATION FOR REMOVAL

Generally, a tube should be removed as soon as it finishes its purpose, i.e. when there is:

- Clinical evidence of complete lung expansion
- No more air leak and
- Less than 50 - 100ml of drainage in 24 hours
- Radiological evidence of complete expansion of the lung

N.B: Remove the chest tube while patient is in full inspiration and tightly close the insertion site by gauze soaked with a lubricant.

EMPYEMA AND LUNG ABSCESS

EMPYEMA THORACIS

DEFINITION

Empyema is a collection of purulent fluid in the pleural space.

AETIOLOGY

- Pulmonary *Infection* (unresolved pneumonia most common cause - 50%)
- *Trauma*: penetrating injury, thoracic surgery, esophageal perforation etc.
- *Aspiration* of pleural effusion of any source
- Extra pulmonary *spread*: from subphrenic abscess, retropharyngeal infection, mediastinal infection, etc.
- *Bone infection*: osteomyelitis of ribs and vertebra

CLASSIFICATION

- Depending on the pathological reaction, empyema is classified as follows:
 - Early (*acute or exudative*) phase: Thin fluid differentiated as pus, with PH less than 7, Glucose less than 40 mg/dl and LDH more than 1000 IU/litre.
 - Established (*sub acute or fibro-purulent*) phase: characterized by thicker pus with fibrin deposition and loculation of the pleural exudates.
 - *Chronic* or organization phase: characterized by fibroblast proliferation and scar formation causing lung entrapment. It forms more than 75% sediment when fluid is allowed to precipitate.

Factors contributing to chronicity

- Delay in antibiotic treatment
- Inappropriate choice of antibiotics

- Failure of early intervention
- Presence of foreign body
- Failure to detect underlying lung pathology

MICROBIAL PATHOGENS

In adults: Usually monomicrobial. *Staphylococcus aureus*, *Streptococcus pneumoniae* and *Streptococcus pyogenes* most common causes in healthy adult. Immunocompromised patients are prone to Aerobic gram negative bacilli and fungal infection.

Children: less than 6 month of age: *Staphylococcus aureus* most common pathogen

6 month-2 years of age: *Staphylococcus aureus*, *Streptococci pneumoniae* and *H.influenza* are common pathogens.

2 years- 5 years of age: *H. influenza* is the commonest pathogenic agent.

Fungal or tuberculous foci may be reactivated in patient with malignancy, transplant recipient and AIDS to cause empyema.

DIAGNOSIS

History and Physical Examination:

History of predisposing factors, fever, pleuritic chest pain.

Signs of pleural effusion and signs of chronicity (chachexia, finger clubbing and discharging sinus) can be detected.

Investigation:

1. Routine: haemoglobin, WBC, ESR
2. Chest film: shows fluid level, meniscus sign and underlying lung pathology
3. Needle aspiration and analysis:
 - a) Cloudy or purulent fluid suggestive of pus.
 - b) Gram stain and culture.
 - c) Acid Fast Staining if tuberculosis is suspected. Yield is less than 25%.
4. Ultrasonography: detects loculation and septation.

TREATMENT

The treatment depends on the stage, nature of primary infection and source of contamination. The principle of treatment includes control of infection by appropriate *antimicrobials* and *drainage* of pus to achieve full lung expansion.

The following procedures are options for drainage:

1. **Thoracentesis:** This is aspiration of fluid from the pleural cavity by a surgical puncture. If fluid analysis shows non loculated fluid without organism and serial x-ray demonstrates lung expansion, this procedure is adequate with appropriate antibiotics for 10% of patients.
2. Closed tube **thoracostomy:** A procedure of inserting tube into the pleural cavity and connecting it to underwater seal bottle with or without suction. It is indicated for patients with loculated fluid and gross pus on aspiration.
3. **Open tube drainage:** Drainage procedure by cutting the tube from under water seal to convert it to open one and follow the progressive obliteration of cavity. It is done if empyema fails to resolve in two weeks time.
4. **Rib resection** and **open drainage:** Is a drainage procedure by resecting the rib and break all loculation. It is done for chronic mature empyema with thick fibrous capsule.
5. Thoracotomy and **decortication:** A procedure of removing fibrous peel, which entraps the lung. It is major undertaking and should be left for experienced surgeon.

N.B: Tuberculous empyema needs drainage only if super infected, a bronchopleural fistula occurs or the patient is distressed.

PROGNOSIS

The prognosis depends on the nature of microbial agent, host defense, severity of the disease, and duration as well as adequacy of antibiotics and drainage. The mortality rate in healthy young patients is 5%. It can reach up to 40-70% in immunocompromised and debilitated patients.

LUNG ABSCESS

DEFINITION: Lung abscess is a localized area of suppuration and cavitation in the lung with parenchymal necrosis.

ETIOLOGY: Common etiologic mechanisms for lung abscess include:

1. Aspiration pneumonia (commonest cause)
2. Primary necrotizing pneumonia
3. Bronchial obstruction from neoplasm or foreign body
4. Complication of pulmonary trauma
5. Complication of systemic sepsis
6. Direct extension from extra parenchymal infection

MICROBIOLOGY:

Usually mixed aerobic and anaerobic bacteria and sometimes parasites are involved as pathogenic agents.

DIAGNOSIS

It presents with a history of a sudden onset of cough, productive of purulent sputum, fever with or without hemoptysis. On examination, patients appear chronically sick, febrile with coexisting effusive finding.

INVESTIGATION

- Sputum for Gram Stain, culture and sensitivity.
- Chest x-ray: consolidation with or without cavitation and air fluid level. A chest Wall or parenchymal pathology can also be demonstrated.

TREATMENT

1. **Conservative:** Includes use of antibiotics, penicillin and metronidazole for up to six weeks in most case, periodic sputum bacteriology, and internal drainage (postural, percussion, coughing). It is effective in 85% of cases.
2. **Operative:** Surgical treatment is indicated in case of failure of conservative approach, massive hemoptysis, thick or large cavity which is unlikely to collapse and in case of suspected malignancy.

COMPLICATIONS

1. Bronchogenic spread
2. Empyema
3. Cerebral abscess
4. Chronicity
5. Septicemia

PROGNOSIS

In primary, uncomplicated lung abscess, the mortality rate is less than 5% with prolonged and adequate antibiotics. However, when complicated with some other systemic illness, the mortality rate reaches 75-90%.

Review Questions

1. Outline the management of a two-year old male child who presented to emergency OPD with a sudden onset of high-grade fever, cough and inspiratory stridor.
2. A 45-year old male patient involved in a motor vehicle accident presents with severe respiratory distress. On examination, he is found to have tachypnea, hypotension and distended neck veins. What possible causes do you consider? Brief their management.
3. A 30-year old lady who was on antibiotic therapy for severe pneumonia started to shoot fever on the third day. She was found to be in respiratory distress and examination revealed evidence of fluid in left hemi thorax. Outline the management of this patient.

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CHAPTER FOUR

GASTROINTESTINAL TRACT

Learning Objectives

At the end of this unit the student is expected to:

- Evaluate urgently and institute resuscitation measures promptly on acutely bleeding patients
- Identify the common causes of gastrointestinal bleeding
- Assess the extent of bleeding
- Discuss the approach to the management of the patient with GI bleeding

Introduction

Gastrointestinal bleeding has high mortality and morbidity rates, particularly in the elderly. Bleeding is an alarming symptom and represents the initial presenting complaint in a significant proportion of patients. Although majority of gastrointestinal bleeding will stop spontaneously or with conservative management, persistent bleeding and/or recurrence carries worse outcomes without immediate intervention.

DEFINITIONS

Upper Gastrointestinal Bleeding (UGIB) is defined as blood loss originating from a site in the GIT which is proximal to the ligament of Treitz.

Lower Gastrointestinal Bleeding (LGIB) refers to blood loss arising from a site distal to the ligament of Treitz.

Hematemesis is the vomiting of blood, which may be a coffee ground material, fresh blood or blood clots. Often it indicates upper GI bleeding.

Melena is the passage of black tar-like stool due to mixing with altered blood. Melena without Hematemesis usually indicates a lesion distal to the ligament of Treitz. However, it can also occur from upper GI-bleeding without history of hematemesis.

Hematochezia is the passage of liquid blood or blood clots of varied brightness in color per rectum. It usually indicates lower GI bleeding, but it can be seen with massive upper GI bleeding.

UPPER GASTROINTESTINAL BLEEDING

(Asrat Sime, M.D)

Etiology

The causes of upper GI bleeding include:

- **Peptic ulcer.** Peptic ulceration is the commonest cause of upper GI bleeding with duodenal ulcer (DU) bleeding four times more common than gastric ulcer (GU) which correlates to higher incidence of duodenal ulcer.
- **Varices.** Bleeding from esophageal or gastric varices is another common cause of upper GI bleeding in patients with cirrhosis and portal hypertension
- **Gastritis.** Acute gastritis (acute mucosal erosions) causes frequent and possibly massive bleeding and is usually associated with ingestion of substances such as NSAID, alcohol, corticosteroids, anticoagulants etc.
- **Gastric Neoplasms.** Carcinoma of the stomach is the commonest neoplastic cause of bleeding. Other less common neoplasms include: Adenoma, Angioma, and Lymphoma etc.
- **Stress ulcer-** refers to acute gastro duodenal lesions that arise in association with (risk factors): Multiple system trauma, Hypotension/shock, sepsis, Major burns, etc.
- **Mallory-Weiss tears** are longitudinal mucosal tears extending across the esophagogastric junction and follow prolonged violent vomiting, often after a binge of alcohol. Bleeding may be profuse, but in over 90 % of cases, it stops spontaneously without specific therapy and responds to conservative measures such as sedation and volume replacement.
- **Others:** Esophagitis, Vascular malformations, Systemic diseases leading to bleeding and coagulation abnormalities, etc.

WORK-UP AND MANAGEMENT

The initial evaluation involves assessment of the clinical features with inquiries and examinations aimed at:

- Identifying patients who need immediate intervention
- Having a clinical suspicion of the possible site of bleeding and the cause.

History

Features suggestive of significant upper GI bleeding include

- Collapse

- Sweating
- Anxiety, restlessness
- Large amount of bloody vomitus
- Hematochezia/melena

Inquiries should also include about

- Sociodemographic variables (e.g. Age)
- PUD history- past or present
- Ingestion of drugs implicated as causes of GI bleeding
- Liver diseases (past, present, complications)
- Co-morbid diseases
- Symptoms of bleeding diathesis, etc.

Urgent examination aims to pick up signs suggestive of seriously depleted blood volume and probably continuing blood loss which include:

- Rising pulse rate and respiratory rate
- Decreasing blood pressure and pulse pressure
- Restlessness
- Increasing pallor
- Cold nose and extremities
- Sweating (beads of sweat on the forehead)
- Decreased urine output

Also look for:

- palpable glands, e.g. left supraclavicular lymph nodes (Virchow's nodes)
- Signs of co-morbid and systemic diseases
- Signs of chronic liver disease and portal hypertension

Management

Resuscitation

For patients in need of immediate resuscitation and hospitalization:

- Insert large bore intravenous cannula (preferably two)
 - Restoration of blood volume is the initial priority which is started with rapid crystalloid infusion until blood is available (refer to the treatment of shock)
 - Blood is taken at this time for necessary investigations including blood count, blood grouping and cross matching, blood chemistry, etc. (but resuscitation is started and continued without waiting for results which can be reviewed later).

- Monitor response to resuscitation measures with:
 - Clinical monitoring (frequent evaluation), e.g. vital signs, urine output, etc.
- Alleviate anxiety and pain, e.g. diazepam, analgesics
- Place nasogastric tube in all patients with significant GI bleeding to monitor rate of bleeding and for saline lavage.
- Once the patient is stabilized review pertinent laboratory data and decide on further treatment in conjunction with the clinical setup of the patient
 - e.g. need for transfusion
- Monitoring needs to be continued (e.g. frequent vital signs) for at least 3 days after apparent cessation of hemorrhage.

Diagnostic evaluation and further management

- Once the patient with suspected upper GI bleeding is stabilized, the diagnostic evaluation, in a hospital setup, in addition to more detailed history and physical examination, involves investigations like:
 - Emergency esophago-gastro-duodenoscopy
 - Other studies performed based on the findings on endoscopy and availability of facilities
- After establishing the cause, further management is undertaken depending on the underlying cause. (Refer to the appropriate sections for diagnostic studies and treatment modalities on the specific causes of GI bleeding).
 - Medical therapy
 - Endoscopic therapy
 - Surgical (operative) - the primary goal in acute significant hemorrhage is to control the bleeding.

LOWER GI BLEEDING

Lower gastrointestinal bleeding (LGIB) can be:

- Small intestinal bleeding
- Colorectal bleeding
- Anorectal bleeding

Small intestinal bleeding: Is uncommon, rarely is massive, difficult to diagnose and usually a diagnosis of exclusion after other sources of bleeding have been ruled out.

Colonic bleeding: Can be acute and massive or chronic presenting with occult blood positive stool and anemia. The causes include:

- Neoplasms and polyps
- Diverticulosis/ diverticulitis
- Vascular malformations
- Inflammatory causes e.g. intestinal tuberculosis, inflammatory bowel diseases

Anorectal bleeding: Causes include:

- Hemorrhoids
- Anal fissure
- Tumors /polyps
- Proctitis

Clinical evaluation

This depends mainly on the history and physical examination. Assess for the hemodynamic status of the patient and clinical diagnosis of the possible underlying cause and site of bleeding.

History -Note that:

- LGIB is usually suspected when patient presents with Hematochezia
- Although usually helpful, the distinction based on stool color is not absolute.
Bright red blood per rectum can be seen with massive UGIB and bleeding from the right colon.
- Chronic bleeding may present with
 - Unexplained anemia
 - Orthostatic hypotension
 - Fatigue and weight loss
- Though visible bleeding is the most alarming symptom it is commonly associated with symptoms such as:
 - Pain
 - Change in bowel habits: - Stool frequency
 - Stool consistency
 - Excessive mucus discharge per rectum - Mixed with stool/blood in proximal lesions, covering the stool (with blood)/sloughs in distal lesion
 - Tenesmus
 - Sense of incomplete defecation

- Pruritus - ani common with local lesions

Also inquire for

Symptoms related to causes of UGIB

Symptoms related to manifestation of associated diseases e.g.-STI, AIDS

Physical examination: Vital signs and other indices of tissue perfusion and signs of chronic blood loss should be looked for. Do complete abdominal examination including digital rectal examination, and pelvic examination in female patients

Treatment: Patients who are low risk (e.g. - a young, otherwise healthy patient with self-limited rectal bleeding secondary to hemorrhoid) may be evaluated as an outpatient.

Resuscitation: Resuscitation is the first priority initiated while the patient is being assessed and its progress should be monitored closely (refer to the management of hypovolemic shock).

Diagnostic evaluation: With further clinical assessment and investigations performed after the patient is hemodynamically stable .Based on the patient's clinical setting and availability investigations could be performed which include:

- NG tube lavage to exclude UGIB
- CBC (WBC, HCT/Hb, platelet count...)
- Emergency esophago-gastro-duodenoscopy (EGD) may be needed
- Blood chemistry
- Coagulation profile
- Stool examination for- parasites, blood cells, Occult blood in chronic occult cases
- Lower GI Endoscopy: procto-sigmoidoscopy: Valuable for visualization biopsy taking and endoscopic treatment.
- Contrast studies- useful in chronic GI bleeding

Specific treatment:

The treatment depends on the underlying cause. It can be medical, operative or endoscopic.

Follow up of management:

Correction of anemia and malnutrition

Pain management

COLORECTAL TUMORS

Learning Objectives

At the end of this unit the student is expected to:

- Understand the importance of early diagnosis and treatment of colorectal tumors.
- Discuss the clinical features of colorectal carcinoma in relation to pathologic types, site and extent of spread.
- List the differential diagnoses of carcinoma of the colon.
- Mention investigations needed for the diagnosis of colorectal carcinoma.

Introduction

Colorectal malignant tumors (Particularly colorectal carcinoma) are among the common causes of death due to malignant diseases. However, early diagnosis is less likely as the symptoms are largely nonspecific early in the course of the diseases and likely to confuse with a number of other diseases. They also add to the mortality and morbidity of patients by causing acute complications such as GI bleeding & acute abdomen.

The effects of these diseases are made worse in places where health service availability is minimal, and the available ones commonly lack adequate diagnostic and therapeutic facilities. As a practitioner under these situations you will have to rely on your clinical assessment, aided by high index of suspicion, to reach at the diagnosis of these diseases and refer timely, patients for further workup and treatment to where the appropriate facilities are available.

COLORECTAL CARCINOMA

Large bowel carcinoma is common and it is the second commonest cause of death from malignant diseases in males. Usually, it occurs in patients over 50 years of age, but may occur at any age. Females are affected more often than males and the sigmoid, along with the rectum, is the most frequent site of cancers (and polyps) in the gastrointestinal tract.

Pathology: *Macroscopic varieties (forms) include*

- Polypoid
- Malignant ulcer
- Annular
- Tubular

Microscopically, it is a columnar cell carcinoma originating in the colon (adenocarcinoma)

Predisposing factors

- pre-existing polyps
- Familial adenomatous polyposis
- Ulcerative colitis

Spread

- Generally the growth is comparatively slow
- Local spread-
- Lymphatic spread- to the regional lymph nodes
- Blood stream spread- to the liver and then to the lungs, skin, bone.
- Trans-coelomic spread -malignant deposits throughout the peritoneal cavity and to non-adjacent organs.

Clinical features: The local effects of the tumor depend on the site and macroscopic variety of the primary tumor.

Tumors in the right colon commonly present with:

- Anemia
- Loss of appetite, weight and generalized body weakness
- Palpable lump on abdominal, rectal or bimanual palpation
 - e.g. in the RLQ of the abdomen, cecal carcinoma, carcinoma of the ascending colon
- Features of appendiceal mass

Tumors in the left colon usually present with:

- Change in bowel habit: constipation, diarrhea, or alternating
- Passage of mucus
- Tenesmus and sense of incomplete defecation (rectosigmoid tumors)
- Rectal bleeding (bright, mixed or occult)
- Features of intestinal obstruction (acute, chronic or acute on chronic)
- Pain usually a late manifestation
- Bladder symptoms (urinary symptoms): due to pressure /invasion

Investigations: These are based on mode of presentation and availability and include:

Diagnostic investigations:

- Stool examination - parasites, WBC, occult blood, culture
- Sigmoidoscopy, colonoscopy
- Barium enema
- Biopsy under endoscopic guide

Staging investigations:

Ultrasonography, Chest x-ray, Liver function tests etc.

Management: The management depends on mode of presentation, stage of the disease, the site of the primary lesion and presence or absence of multiple lesions. Modalities include:

- **Surgery** (curative or palliative)
 - *Emergency* laparotomy- for acute significant bleeding and/or acute abdomen with the primary aim of treating the acute complication followed by elective surgery.
 - *Elective* surgery
 - After pre-operative colon preparation
 - Resection for resectable tumors (curative)
- **Palliative:** palliative surgery, Cytotoxic chemo therapy, Radiotherapy for advanced malignancy.

COMMON PERIANAL CONDITIONS

Learning Objectives

At the end of this unit, the student is expected to:

- Perform clinical evaluation for early diagnosis of a patient with an Anorectal abscess and identification of underlying/associated diseases
- Discuss the management of a patient with Anorectal abscess
- Define anal fissure and discuss conservative and operative management of anal fissures.

Introduction

Anorectal diseases can occur at any age and in many of them, symptoms are non-specific. Generally the inflammatory ones are common in younger patients and tumors in the middle-aged and the elderly. It is worth remembering that common distal lesions can present with proximal ones and they may be manifestations of proximal diseases for which the patients need full evaluation.

The surgically important rectal, anorectal and perianal diseases, which will be dealt with in this unit, are, anorectal abscesses, perianal fistulas, anal fissures and Hemorrhoids.

ANORECTAL ABSCESSES

Patients with anorectal abscesses need a thorough evaluation and early and adequate surgical management. Because, an abscess:

- May be the presenting manifestation of an underlying systemic or local diseases (e.g.
 - AIDS, Diabetes mellitus, rectal tumors, inflammatory bowel diseases...)
- May be found in association with other diseases
- Leads to complication such as fistula in ano, sepsis (perianal sepsis), etc unless treated early and adequately.

Pathogenesis

In many cases the infection is caused by mixed micro organisms. Infection of anal gland is the initiating factor in the majority of cases, which spreads along tissue planes. An abscess can also develop following infection of a Perianal hematoma, infection following Perianal injuries, extension from cutaneous boils etc.

Classification

Based on their anatomical location, anorectal abscesses are classified into four main varieties:

Perianal(subcutaneous) abscess:-

This is the commonest type and can affect people of all age groups.

Ischiorectal abscess:-

Is also common and is located in the ischiorectal fossa

Sub mucous abscess:-

This an abscess located under the mucous membrane

Pelvirectal abscess:-

This is an abscess located above levator ani and follows spread from pelvic abscess

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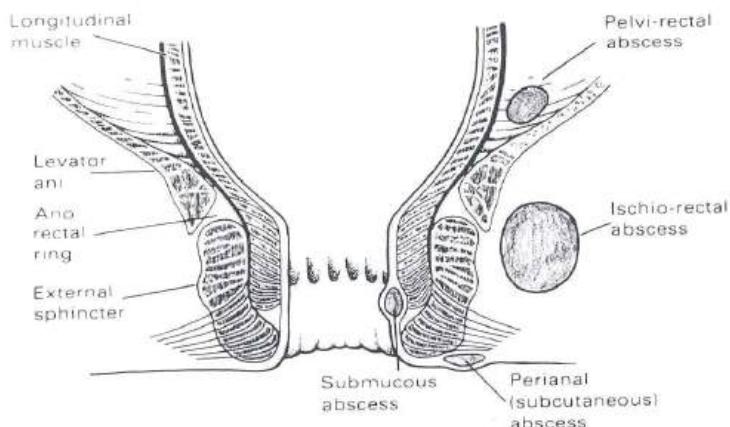


FIG. 35. The anatomy of peri-anal abscesses.

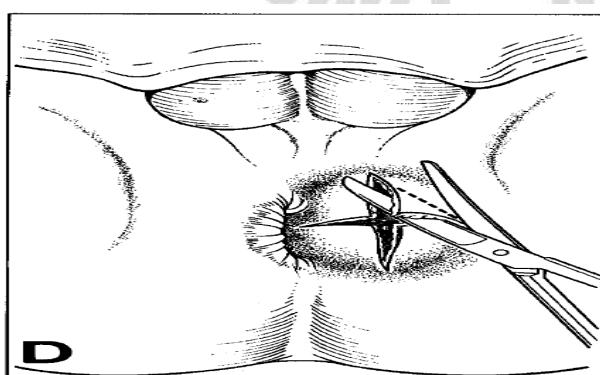
Clinical features: Patient complaints include pain (usually severe), fever, constitutional symptoms such as sweating and anorexia, features of proctitis and constipation

Physical findings (rectal examination) include

- A lump visible and palpable at the anal margin/anal canal or ischiorectal fossa which is tender brownish induration palpable on the affected side
- Rectal tenderness, rectal tender mass

Management of anorectal abscess: The abscess needs drainage as soon as it is diagnosed followed by irrigation, packing with saline soaked gauze and Sitz bath twice daily till wound healing. Antibiotics should be used together with surgical treatment. They are needed when there are systemic manifestations and in immunocompromised patients. Analgesics and mild laxatives

Fig. Drainage of perianal abscess



PERIANAL FISTULAS (FISTULA IN ANO)

Definition: A fistula in ano is a track, lined by granulation tissue, which connects the anal canal or rectum internally with the skin around the anus externally.

Causes (risk factors) - It results from:

- Usually an untreated or inadequately treated anorectal abscess (see also causes and risk factors for anorectal abscesses)
- Granulomatous infections and inflammatory bowel diseases
- May give rise to multiple external openings and include
 - e.g. Tuberculous proctitis Crohn's disease

Classification: It can be grouped into two according to the level of the internal opening:

- Low level: with an internal opening below the anorectal ring
- High level: with an internal opening at or above the anorectal ring.

Clinical features

- Seropurulent discharge with perianal irritation
- An external opening (frequently single) seen as a small elevated opening on the skin around the anus with a granulation
- An internal opening may be felt as a nodule on digital rectal examination (almost always single) irrespective of the number of external openings)
- Signs of underlying/associated diseases

Management

- Emergency treatment for abscesses
- Treatment of underlying cause
- Surgery for fistula in ano
- Preceded by
 - Preoperative bowel cleansing (enema)
 - Examination under anesthesia

Low level fistula

- Laying open the entire fistulous tract, fistulotomy.
- Wound care

High level fistulas

- Protective colostomy to prevent infection and facilitate healing
- Staged operation that has to be performed by an expert and the patient needs referral to hospital.

ANAL FISSURE (FISSURE IN ANO)

Definition: Anal fissure is an elongated tear (ulcer) in the lower anal canal, which lies along the long axis of the canal. The upper end stops at the dentate line. It is located commonly in the posterior midline, occasionally along the anterior midline and rarely at multiple sites.

Etiology: The cause of anal fissure is not completely understood. Passage of hard fecal mass precipitates and aggravates the condition.

Classification: Anal fissure can be classified as acute or chronic based on its pathologic features.

- *Acute fissure*: is a deep skin tear at the anal margin extending into the anal canal with edges showing little inflammatory indurations or edema .It is accompanied with spasm of the anal sphincter muscle.
- *Chronic fissure*: is characterized by Inflamed and indurated margins as a result of inflammatory fibrosis and contracture of the internal sphincter in long standing cases

NB: specific causes are much more common with a chronic fissure (e.g. syphilis, tuberculosis, Crohn's disease, and carcinoma).

Clinical features: A patient with anal fissure presents with:

- Pain is the commonest feature
- Characteristic sharp, severe pain starting during defecation and lasting an hour or more and ceases suddenly to reappear during the next bowel motion.
- Constipation: the patient tends to be constipated for fear of the pain on defecation.
- Bleeding: usually appearing as bright streaks on the stool surface or the toilet paper
- Discharge: common with chronic cases
- Manifestations related to underlying diseases and/or complications

Examination may reveal:

- Tightly closed anus due to the sphincter spasm
- Sentinel pile (skin tag) visible at the anal verge
- Lower end of the fissure on gentle parting of the buttocks
 - Digital examination
- Should be done using local anesthetic gel, a cotton wool soaked in local anesthetic.
- Fissure may not be palpable in early cases.
- In fully established cases the fissure may be felt as a vertical crack in the anal canal.

NB:- Big ulcers and fissures can be found in patients with HIV and other viral infections.

Management

Conservative management: This is recommended especially for a small acute and superficial fissure, which may heal spontaneously. It includes:

- A high fiber diet and high fluid intake with a mild laxative, such as liquid paraffin, to encourage passing of soft, bulky stools
- Administration of a local anesthetic ointment or suppository

Surgical Measures:

Surgical measures are needed when the above measures fail, in chronic fissures with fibrosis, a skin tag or a mucous polyp or recurrent anal fissures. Procedures include:

- Lateral anal sphincterotomy
- fissurectomy and
- sphincterotomy

This procedure can be used for cases with a chronic fissure. It needs an experienced operator to reduce complications, which include hematoma formation, incontinence and mucosal prolapse.

After care: This consists of bowel care, daily bath and softening the stool till wound healing.

HEMORRHOIDS (PILES)

Definition: Hemorrhoids are dilated sub mucosal veins in the anus. They may be classified into:

- Internal hemorrhoids (Internal to the anal orifice)
- External hemorrhoids (External to the anal orifice)
- Interoexternal hemorrhoids (Prolapsing internal hemorrhoids)

INTERNAL HEMORRHOIDS

Internal hemorrhoids refer to dilatation of the sub mucosal internal venous plexus and draining superior hemorrhoidal veins. They develop within areas of enlarged anal lining ('anal cushions') as they slide downwards during straining. Since the internal and external (subcutaneous perianal) venous plexus communicate (Porto-systemic anastomosis) engorgement of the internal plexus is likely to lead to involvement of the latter.

With the patient in the lithotomy position, internal hemorrhoids are frequently arranged in three groups at 3, 7 and 11 o'clock positions. This arrangement corresponds to the distribution of the superior hemorrhoidal vessels (2 on the right, one on the left) but there can be smaller hemorrhoids in between the three groups.

Etiology: Though most hemorrhoids are idiopathic, they may also be secondary to underlying causes, which include:

- Straining accompanying constipation
- Straining at micturition
- Recto Sigmoid mass

Clinical features: Hemorrhoids are usually asymptomatic but can present with:

- *Rectal bleeding:* is the main and earliest symptom which is usually slight painless bright red occurring on passing stool as a splash into the toilet or toilet papers or covering the stool at the end of defecation.
- *Prolapse* of the varicose masses is a late manifestation. Hemorrhoids are graded based on the degree of prolapse and reducibility in to:
 - ⇒ First degree hemorrhoids: those confined to the anal canal (do not prolapse outside the anal canal)
 - ⇒ Second degree hemorrhoids: prolapse on defecation but reduce spontaneously or are replaced manually and stay reduced.
 - ⇒ Third degree hemorrhoids: prolapse, even apart from defecation, and remain permanently prolapsed outside the anal margin. These give rise to a feeling of heaviness in the rectum
- A mucoid *discharge* frequently accompanies prolapsed hemorrhoids and is due to mucus secretion from the engorged mucus membrane.
- *Pruritus ani*-due to the discharge and perianal soiling accompanying prolapsed hemorrhoids.
- *Pain-* is not a significant feature of uncomplicated internal hemorrhoids.
- *Anemia*-due to persistent/profuse bleeding
- On examination every patient should undergo at least:
 - Complete abdominal and pelvic examination looking for underlying causes or aggravating factors.
 - Rectal examination: Inspection may show prolapsing hemorrhoids (piles) with or without straining and/or redundant skin folds or skin tags. Digital rectal examination may show prolapsing or thrombosed hemorrhoids. Internal hemorrhoids are not felt unless they prolapse.

Investigations

Proctoscopy- to visualize internal hemorrhoids and exclude other lesions

Complications: Complications of hemorrhoids include profuse hematochezia, strangulation which leads to an acute pain, thrombosis, which makes the mass swollen, dark, tense and feel solid and tender on examination. Unrelieved strangulation/thrombosis may lead to ulceration of the exposed mucus membrane. Gangrene- may lead to spreading infection/sepsis and Abscess formation.

Management: Any underlying or associated more important condition or disease should be excluded or treated accordingly before commencing specific treatment for hemorrhoids. Hemorrhoids can be managed with:

▪ **Conservative measures** which include:

- High fiber-diet for a regular soft and bulky motion
- Hydrophilic creams or suppositories
- Local application of analgesic ointment /suppository.

This is recommended and usually effective for many patients with early hemorrhoids particularly those secondary to other conditions and likely to regress with removal of the underlying conditions (e.g. pregnancy and post partum hemorrhoids)

The following procedures need to be performed by expert hands to avoid /reduce complications

▪ **operative treatment** , hemorrhoidectomy indicated for:

- Third degree hemorrhoids
- Failure of non-operative treatment of second degree hemorrhoids
- Fibrosed hemorrhoids
- Interoexternal hemorrhoids with well defined external hemorrhoid

Treatment of complications

Strangulation, thrombosis and gangrene

- Immediate surgery under adequate antibiotic cover or
- adequate pain relief,
- bed rest, frequent hot sitz bath,
- warm saline compress with firm pressure followed by
- ligation or excision or anal dilation.

- Severe hemorrhage
 - Resuscitation with IV fluids
 - Local compression with adrenaline solution
 - Pain relief when present
 - Blood transfusion when needed

All these are followed by definitive therapy

EXTERNAL HEMORRHOIDS

A thrombosed external hemorrhoid (perianal hematoma), is usually associated with considerable pain. It appears as an inflamed tense tender and easily visible on inspection of the anal verge.

Treatment

Relieving pain by local or oral analgesics and avoid constipation. Surgical evacuation of the clot can be done under local anesthesia.

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ACUTE ABDOMEN

DEFINITION: The term acute abdomen denotes any sudden condition with chief manifestation of pain of recent onset in the abdominal area which may require urgent surgical intervention.

CLASSIFICATION: The pathologic cause for acute abdomen can be grouped into *obstruction, inflammation, hemorrhage, infarction or perforation.*

CLINICAL FEATURES

Symptoms:

- Colicky and Intermittent pain (visceral)
- Continuous pain (somatic)
- Vomiting
- Fever
- Tachycardia
- Constipation

Colic pain indicates obstruction to a hollow viscus due to stretch and contraction of smooth muscles. Continuous pain, on the other hand, signifies infection, inflammation or ischemia.

Signs: Acute abdomen may present with one or combination of the following clinical signs

- Abdominal distention, visible peristalsis
- Direct and rebound tenderness, guarding
- Anemia, hypotension
- Toxic with Hippocratic faces
- Absence of bowel sound (peritonitis)
- Special tests (for signs) are possible
 - e.g. Psoas sign in appendicitis
 - Murphy's sign in acute cholecystitis
- Dehydration with sunken eyeballs (fluid loss)

DIFFERENTIAL DIAGNOSIS

- Surgical causes, e.g. Intestinal obstruction
- Gynecologic and obstetric causes, e.g. Ectopic ruptured pregnancy
- Medical causes not amenable to surgery, e.g. enteritis. A surgical cause has however to be ruled out

Surgical causes

- A. Inflammation: e.g. Acute appendicitis, cholecystitis
- B. Obstruction: e.g. Acute intestinal obstruction
- C. Infarction: e.g. Mesenteric ischemia
- D. Strangulation: e.g. volvulus
- E. Perforation: e.g. perforated peptic ulcer

DIAGNOSIS

Clinical: History and physical examination

Laboratory: Complete blood count, cross match, urine analysis, serum amylase and electrolytes

Radiology: Ultrasound and plain film of abdomen

MANAGEMENT

- A. Preoperative preparation
 - Resuscitation with IV fluids
 - Antibiotics, if indicated
 - Catheterization and NGT insertion
 - Analgesics after confirming the diagnosis
- B. Surgery: Definitive laparotomy according to the cause
- C. Patient monitoring and Post operative follow up

INTESTINAL OBSTRUCTION

DEFINITION

Intestinal obstruction is partial or complete blockage of the intestine producing symptoms of vomiting, constipation, distension and abdominal pain.

CLASSIFICATION

- Mechanical (dynamic): due to physical barrier blocks
- Paralytic ileus (adynamic): due to disordered propulsive motility
- High Intestinal obstruction (small bowel)
- Low intestinal obstruction (Large bowel)
- Simple: has adequate blood supply
- Strangulated: Mesenteric vessels occluded

Classification of mechanical obstruction

a. Luminai

- Gallstone Ileus
- Food bolus
- Meconium Ileus
- Malignancy or inflammatory mass
- Ascaris bolus

b. Mural

- Stricture
- Congenital
- Inflammatory
- Ischemic
- Neoplastic
- Intussusceptions

c. Extra mural

- Adhesions: Congenital, inflammatory or malignant
- Hernia(as cause of intestinal obstruction): External or internal hernias
- Volvulus: small bowel, large bowel etc. E.g. Sigmoid volvulus.

PATOPHYSIOLOGY

Obstruction leads to proximal dilatation of the bowel and disrupts peristalsis. Bowel above the obstruction becomes distended with fluid and gas. This stimulates excessive peristalsis producing colicky pain. As distension increases with time, blood vessels in the bowel will be stretched and narrowed impairing blood flow and leading to ischemia. Absorptive capacity of the gut decreases with a net increase of water and electrolytes secretion into the lumen. There will be increased vomiting which leads to depletion of extra cellular fluid which eventually leads to hypovolemia and dehydration.

A strangulated loop dies and perforates to produce severe bacterial peritonitis which is often fatal. Grossly distended abdomen restricts diaphragmatic movement and interferes with respiration. A multiple organ failure will subsequently result if the strangulated loop is not removed.

CLINICAL FEATURES

Symptoms: The commonest presenting symptoms are:

- Abdominal pain (colic)
- Vomiting (frequent in high obstruction)

- Constipation (partial or absolute)

Signs: The commonest signs (physical findings) are:

- Abdominal distension with visible bowel loops
- High pitched and tinkling bowel sounds
- Abdominal tenderness and guarding
- Signs of dehydration and hypotension
- Empty rectum on digital rectal examination (Large bowel obstruction)

DIAGNOSIS

- *Clinical:* history and physical examination
- *Laboratory:* complete blood count, electrolytes, etc
- *Plain film* of the abdomen:
 - Gaseous distension of the bowel with fluid level (general)
 - Central located distended loops with multiple air fluid level (small bowel)
 - Peripherally located distended bowel with haustral marks (Large bowel)

MANAGEMENT

- Fluids resuscitation to restore the circulatory state
- Early preoperative preparation
- Attempt rectal tube deflation in assumed viable large bowel obstruction
- Other supportive measures
- Early operation (Laparotomy)
- Post operative care

SIGMOID VOLVULUS

The sigmoid colon is the most frequent site of volvulus in the large bowel. The following are believed to be the predisposing factors:

- A long redundant sigmoid with a narrow pedicle of the mesocolon
- High fiber diet
- Chronic constipation in the elderly and among chronic mental patients

PATOPHYSIOLOGY

The sigmoid is grossly redundant and twists on its base in a clockwise direction. The mesocolic veins then become occluded and the arterial inflow into the twisted loop perpetuates the volvulus until it becomes irreversible.

The twisted loop distends grossly and passes up under the right side of the diaphragm. Unless the situation is relieved, perforation may occur due to either pressure necrosis at the base of the twist or to avascular necrosis at the apex.

DIAGNOSIS

CLINICAL

- Abdominal cramp and distension
- Constipation (early) and vomiting (late)
- Empty rectum on digital rectal examination

RADIOLOGIC FINDINGS

- Two long fluid levels in the lower quadrant
- Inverted U shape of the sigmoid lumen
- "Coffee bean" appearance or the 'Omega sign'

MANAGEMENT

Conservative:

The uncomplicated, simple volvulus without signs of peritonitis can be deflated with a well greased large bore rectal tube under the guide of a sigmoidoscope if available. If the deflation fails, laparotomy and derotation of the loop has to be done followed by elective resection to prevent recurrent attacks.

Intravenous fluid should be given to rehydrate the patient if there is a sign of dehydration.

Emergency Surgery:

In case of complicated volvulus with signs of peritonitis, the patient has to be prepared following resuscitative measures and giving antibiotics. Resection of the gangrenous segment with Hartman's colostomy is done which has to be closed at a later stage.

APPENDICITIS

Appendicitis is an inflammation of the appendix that results from bacterial invasion usually distal to an obstruction of the lumen.

PATOPHYSIOLOGY

Appendicitis begins with obstruction of the narrow lumen by lymphoid hyperplasia, fecal material (fecolith), foreign body (seeds or worms) etc. Following obstruction of the lumen, a continued secretion of mucus produces distension of the distal end. The distension results in

ischemia of the wall with bacterial proliferation. Subsequently, a patchy necrosis, gangrene and perforation develop resulting in peritonitis and sepsis and finally death.

CLINICAL PRESENTATION

Symptoms

- Central abdominal colic which shifts to a pain in the right Iliac fossa.
- Anorexia, nausea, episodes of vomiting and low grade fever. High grade fever usually indicates perforation and peritonitis.

Signs

- *Tenderness* and localized *rigidity* in the right lower quadrant over, MC Burney's point, 2 inches from the anterior superior iliac spine on a line drawn to the umbilicus.
- *Rovsing's sign*: Pain in right lower quadrant on pressing in the left lower quadrant
- *Psoas sign*: Pain on extension of the right flexed hip
- *Obturator sign*: Pain on passive internal or external rotation of the flexed right hip.
- Right sided tenderness on rectal examination.
- Diminished bowel sounds indicating peritonitis

DIFFERENTIAL DIAGNOSIS

IN CHILDREN

- Intussusceptions
- Mesenteric adenitis

THE FEMALE PATIENTS

- Pelvic inflammatory disease (right salpingitis)
- Ruptured ectopic pregnancy
- Twisted ovarian cyst(torsion), ruptured ovarian follicle

THE GENERAL POPULATION

- Acute cholecystitis
- Perforated peptic ulcer disease
- Renal or ureteric calculi, urinary tract infection
- Early small bowel obstruction (volvulus)
- Gastroenteritis
- Referred pain from the pleura (basal pneumonia)

MANAGEMENT

PREOPERATIVE PREPARATION

- Resuscitation of the patient with fluids and other supportive treatment.

- Appropriate antibiotics (combination for coverage of gram positive, gram negative and anaerobes)
- Correct all deficits (dehydration)

SURGERY

- Surgical removal of the appendix is the definitive treatment.

N.B: Close follow up of surgical patient is very important post operatively to identify complications as early as possible and correct in time.

COMPLICATIONS

Complications of acute appendicitis include perforation with local or generalized peritonitis, appendiceal mass and abscess formation. Delayed diagnosis and treatment may lead to complications and death.

MANAGEMENT OF APPENDICIAL MASS

If appendicitis is not recognized and treated early, it may progress in one of two ways:

1. Perforation and peritonitis
2. Organized appendiceal mass or progress to appendiceal abscess

The inflammatory process may become walled off in the right iliac fossa by omentum and loops of bowel to form a mass.

The management of appendix mass is conservatively with combined antibiotics for anaerobes, aerobes and gram negative bacterial and fluids. The drug of choice is a combination of metronidazole and ceftriaxone if available. If this combination is not available, use ampicilline, chloramphenicol and gentamycin instead.

Patient should be followed up, strictly monitoring

- The vital signs every 4 hours
- The mass size and consistency 12 hourly
- Patient's condition and laboratory every other day

If the mass settles on conservative management, the patient can be discharged and readmitted for interval appendectomy 6 weeks later. Otherwise, if there is any sign suggestive of progression to an abscess (Increasing mass size, fluctuation, persistence of systemic signs), emergency laparotomy has to be done for drainage of the abscess and appendectomy if the appendix is easily found. If the appendix is imbedded in the conglomerated mass, one should not struggle to deliver it for fear of damage to surrounding structures. Interval appendectomy after emergency drainage is preferred in this case.

PERITONITIS

DEFINITION: Peritonitis is an inflammation of the peritoneum. It is an acute life threatening condition caused by bacterial or chemical contamination of the peritoneal cavity. The major causes of peritonitis include:

- Perforated appendix
- Perforated peptic ulcer disease
- Anastomotic leak following surgery
- Strangulated bowel
- Pancreatitis
- Cholecystitis
- Intra abdominal abscess
- Haematogenous spread of infective agent such as typhoid or tuberculosis
- Typhoid perforation
- Ascending infection (e.g. salpingitis) etc.

CLASSIFICATION

Primary peritonitis: caused by bacterial spread via the blood stream.

Secondary peritonitis: caused during perforation or rupture of abdominal organ allowing access of bacteria and irritant digestive Juices to the peritoneum.

Acute peritonitis: rapid onset or brief duration with several symptoms

Chronic peritonitis: long duration since the onset involving very slow changes.

Localized peritonitis: peritonitis confined to a limited space e.g. pelvis.

Generalized peritonitis: the whole peritoneal cavity involved.

ROUTES OF BACTERIAL INVASION

1. Direct: contamination via perforation, a penetrating wound or during surgery

2. Local Extension: contamination by migration from an infected organ

e.g. -through gut wall, via the fallopian tubes

3. Blood stream: via the blood as consequence of general septicemia.

Bacteria or other pathogenic agents can gain access to the peritoneum by the above mentioned routes. The infection can remain limited to a local area of the peritoneum or become generalized. Factors which favor localization of the infection include:

- Anatomical factors (e.g. subphrenic spaces)
- Pathological factors (e.g. adhesions)

- Surgical factors (e.g. drains) Etc.

ETIOLOGY: The commonest bacterial invaders in peritonitis are :-

- Escherichia coli
- Streptococci
- Bacteroids
- Etc.

CLINICAL FEATURES: Commonest manifestations (presentation) of peritonitis are:

- Sharp pain which is worse on movement
- Fever and tachycardia
- Abdominal distension
- Tenderness and guarding
- Diminished or absent bowel sounds
- Shoulder pain due to referred pain from diaphragmatic irritation
- Tenderness on rectal examination (pelvic peritonitis)
- Abdominal distension and vomiting, etc.

DIAGNOSIS

The diagnosis of acute peritonitis is mainly made by the clinical findings i.e. suggestive history and physical examination. Base line laboratory investigations like WBC count may be indicative. Plain film of the abdomen can also be diagnostic with findings related to underlying pathology e.g. air under the diaphragm in perforated viscus. Ultrasound is also useful to detect abscess collection.

MANAGEMENT

The management of patients with peritonitis should be started immediately. It includes various aspects of approaching the patient. Attention should be given to the following conditions:

- Resuscitation: general patient care with intravenous fluids
- Analgesia
- Naso-gastric tube insertion (NGT)
- Triple antibiotics (ampicilline , gentamycin and metronidazole or chloramphenicol)
- Monitoring in put and out put by catheterization
- Surgery to control source of infection and do drainage and peritoneal lavage
- Supportive treatment and close follow up etc.

HEPATO BILIARY DISEASES

Learning objectives

After reading through this topic the students are expected to:

1. Discuss the common pathologies of hepato biliary trees
2. Describe the risk factors to different hepato biliary diseases
3. Describe the clinical features of each disease entity
4. List the most pertinent investigation to reach to the diagnosis
5. Enumerate the possible complications of these diseases
6. Discuss the treatment options
7. Early diagnosis & referral when indicated

Introduction

Hepatobiliary structures have significant surgical importance not only in abdominal surgery but also in general outcome of surgical management on any other sites of human body. They are common sites of different surgical diseases due to their big size and very large and double blood supply.

LIVER

Anatomy

The liver is the largest solid viscus in the abdomen. Anatomically it is divided into two lobes, the right and left lobes. The right lobe is the larger, and gall bladder is attached to its inferior surface. The left lobe stretches across the epigastrium towards the left hypochondrium. Hepatic artery, portal vein, and the hepatic duct together with lymphatic vessels and nerves enters and leave the liver at the area called porta hepatis ,which is found at the interior and posterior aspect of right lobe.

Functions

The liver has two functional components (cells)

1. *Hepatocytes*
2. *Reticuloendothelial cells (Kupffer cells)*

Function of hepatocytes

1. *Metabolic* (carbohydrate, protein and fat)
2. *Storage-* glycogen, vitamins, minerals, intrinsic factors
3. *Synthesis* (plasma protein, fibrinogen, protrombin...)

4. *RBC production* and destruction of the old RBC,s
5. *Conjugation* of circulating bilirubin
6. *Detoxification* of drugs and certain toxic substances

Function of Kupffer cells

Phagocytosis - defense against infections

AMOEBIC LIVER ABSCESS

Amebic liver abscess is a complication of amoebic dysentery.

Incidence

The disease occurs approximately in 3% of patients with intestinal amoebiasis. It is more common in middle aged male (M:F = 9:1)

Etiology

E. histolytica - intestinal protozoal parasite

Pathology and pathogenesis

Amoeba reaches the liver by way of the portal vein from the focus of ulceration in the bowel wall. Hepatic lesion usually occurs in the right lobe and has the following characters:

- Is large, single abscess
- Contains characteristic liquid material which is reddish brown *anchovy paste* fluid
- Has thin wall with little or no fibrosis

Clinical manifestation

History:

Chief complaints are fever, chills, right upper quadrant pain which may radiate to right shoulder area. There could also be a history of:

- Cough, pleuritic chest pain or dyspnea
- Painful epigastric swelling if left lobe is involved
- History of antecedent diarrhea
- Weight loss

Physical examination:

Physical examination can reveal the following findings:

- Tender hepatomegaly : almost constant feature
- Tenderness over lower intercostal spaces with /without swelling and skin edema.
- Abnormal finding over the base of the lung

Investigations

Stool examination: cysts or trophozoites of E. histolytica

WBC: leukocytosis

Hemoglobin: anemia in prolonged illness

CXR: elevated right diaphragm, right side pleural effusion, obliteration of costophrenic or cardio phrenic angle

Ultrasound: localizes the abscess

Aspiration:- anchovy paste aspirate is considered pathognomonic

- amoebic trophozoite can be seen from the aspirated fluid

Complications

1. Secondary infection – the most common complication
 - ⇒ pyogenic abscess
2. Rupture: direction of rupture can be into plural cavity, lung, pericardium or peritoneum.
3. Shock (due to rupture)

Treatment: Can be medical or surgical

1. *Medical (main modality of treatment)*
 - Oral metronidazol 750mg TID for 10 days is effective in more than 90%
 - Analgesics (paracetamol)
 - Rehydration and nutritional support
 - Correct anemia
2. *Surgical drainage*
 - When there are complications like rupture or sign of imminent rupture
 - When there is no response to medical treatment within 48 to 72 hrs

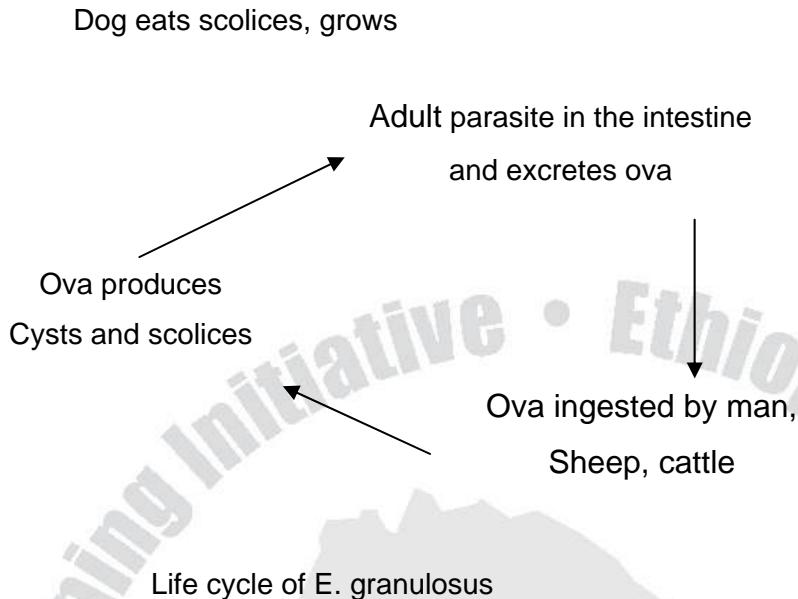
HYDATID CYST OF THE LIVER

This is a parasitic disease caused by infestation with the *Echinococcus granulosus*.

Incidence

It occurs wherever a large number of sheep are raised.

Life cycle



Pathology

The liver is the most commonly affected organ in the body. The right lobe is affected in 85% usually in a unilocular appearance.

The hepatic hydatid cyst is usually superficial and composed of two layers laminated wall.

- An inner *germinative* membrane and
- An outer *adventitia*

Inside the main hydrated vesicle, daughter cysts are usually found that are pathognomonic to the disease.

Clinical manifestation

- Usually asymptomatic
- Symptom of pressure on adjacent organs
- Upper abdominal pain and tenderness
- Palpable mass or diffuse liver enlargement
- weight loss
- Jaundice and ascites: uncommon
- With secondary infection: fever, chills and tender hepatomegaly
- Urticaria and erythema

Complications

1. *Rupture* can be into biliary tree ,thoracic or peritoneal cavity-
2. *Suppuration* - death of the parasite and conversion in to pyogenic abscess
3. *anaphylactic shock*

4. Penetration (stomach, colon, pancreas, kidney)
5. Broncho-pleural and hepato-bronchial fistulas

Investigations

- U/S of the abdomen :- cyst and daughter cysts
- Casoni skin test: if reagents are available.
- Chest X-ray - to rule out concomitant lung infection or pulmonary complication.

Treatment

Expectant: small/dead calcified cyst

Medical: Albendazol/mebendazol for 2- 4 weeks for multilocular disease or patients unfit for surgery.

Surgical: Definitive treatment

Differential diagnosis

- Amoebic liver abscess
- Non parasitic liver cysts
- Tumor
- Pyogenic liver abscess

DISEASES OF GALL BLADDER AND BILIARY TREE

Anatomy and physiology

Gall bladder

The gall bladder is a pear shaped organ of 7.5 – 12.5 cm length and capacity of 50cc. It has three parts: *fundus, body and neck*.

The cystic duct (the duct which joins the GB with common hepatic duct together to form CBD (common bile duct)

Functions of Gall bladder: The main functions of the gall bladder is to serve as

- Reservoir for bile
- Organ for concentrating the bile
- Secretion of the mucus

GALL STONE DISEASE (cholelithiasis)

Gall stone disease is the most common pathology of the biliary tract.

Classification

1. Cholesterol stone (6%): usually solitary
2. Mixed stone (90%): cholesterol is the major component with others like calcium bilirubinate. These type of stones are multiple, faceted and usually associated with infection.
3. Pigment stone: mainly composed of calcium bilirubinate. They are usually small, multiple and black. Commonly associated with hemolytic disease.

Incidence

Female sex and old age are the common risk factors. But the condition can occur in both sexes and at any age.

Pathogenesis: Three important factors implicated in pathogenesis of cholelithiasis are:

1. **Metabolic:** cholesterol is soluble in bile salt and phospholipids. When bile salt is deficient or when the cholesterol level is in excess in relation to the bile salt, the bile formed is supersaturated or lithogenic
2. **Infection:** causes increased mucus plug formation and scarring which form a nidus for stone formation. Also many bacteria deconjugate bilirubin which will combine with calcium to form insoluble calcium bilirubinate.
3. **Stasis:** important for growth of stone. Progesterone in multiparous women is believed to be contributory.

Clinical Presentation

Most (90%) patients with gall stone diseases are asymptomatic. Symptomatic patients present with:

History:

- Right upper quadrant colicky pain (biliary colicky)
- Dyspepsia, fatty food intolerance, flatulence, abnormal post prandial bloating
- Symptoms of acute cholecystitis or other complications

Physical examination:

- right upper quadrant tenderness
- Risk factors can be identified

Complications of Gall bladder stone

1. *In the gall bladder:*

- chronic cholecystitis
- acute cholecystitis
- gangrene
- perforation
- empyema
- mucocele
- carcinoma

2. *In the bile duct:*

- obstructive jaundice
- cholangitis
- acute pancreatitis

3. *in intestine:*

- acute intestinal obstruction (Gall stone ileus)

Diagnostic workup

Ultrasound: detects stone in the gall bladder

Plain abdominal film: Only 10% of stones are radio opaque and visible on X-ray

Differential diagnosis

1. PUD
2. Hiatal Hernia
3. Carcinoma of stomach
4. Diverticular disease
5. Angina pectoris

Treatment

Surgery: Open or Laparoscopic

- 1) cholecystectomy. The main stay of treatment
- 2) cholecystostomy for bad risk patients with severe infection
(Severe Acute cholecystitis or gall bladder empyema)

Acute Cholecystitis

Definition

Acute cholecystitis is an acute inflammation of gall bladder due to obstruction of neck of gall bladder or cystic duct stone. Another rare form of acute cholecystitis which occurs in absence of stone is called acalculous cholecystitis.

Pathogenesis

Direct pressure of calculus on the mucosa results in ischemia, necrosis, and ulceration with swelling edema and impairment of venous return. This process increases and extends the extent of inflammation and favors bacterial multiplication. The end result may be:-

- Pericholecystic abscess
- Fistula formation between gall bladder and bowel
- Gall bladder empyema/mucocele
- Rarely, perforation of gall bladder and bile peritonitis

Commonly involved bacterial species in acute cholecystitis include *E. coli* *Klebsiella* species, *Streptococci* species, *Enterobacter* species and *Clostridial* species.

Clinical features

History:

- History of chronic cholecystitis or Cholelithiasis
- Women more affected than men
- Moderate to severe right upper quadrant and epigastric pain which may radiate to the back.
- Fever and vomiting

Physical examination:

- Right upper quadrant tenderness usually with rebound tenderness
- Gall bladder or inflammatory mass due to omentum wrapped around the GB may be palpable.
- *Murphy's Sign* may be positive: sudden arrest of inspiration due to tenderness of inflamed gall bladder which is palpated during deep inspiration.

Differential diagnosis

- Perforated or penetrated peptic ulcer disease
- Biliary colic
- Pneumonia
- Pancreatitis

- Hepatitis
- Pleurisy
- Appendicitis
- Myocardial ischemia or infarction.

Investigation:

WBC: Leucocytosis

Plain Chest or abdominal X-ray: to check for pneumonia or radio opaque stone

Ultrasound: detects calculi, gall bladder wall thickening and pericholecystic fluid

Treatment

1. *conservative*
 - Admit the patient
 - keep the patient NPO
 - Start on IV fluid
 - Insert NGT
 - Analgesics
 - Antibiotics to cover common causative bacteria: usually ampicillin and gentamycin are used.
 - Follow the response to medical treatment with clinical improvement (fever, abdominal findings) and WBC count reduction
 - Appoint the patient to undergo cholecystectomy after 6 weeks
2. *Surgical treatment:* Cholecystectomy

OBSTRUCTIVE JAUNDICE

Definition

Jaundice is a yellowish discolouration of the sclera, mucous membrane and skin. It becomes clinically evident when the level of serum bilirubin reaches 2.0 to 3.0 mg/dl

Classification

I Medical: This type of jaundice could be subdivided into

Pre hepatic: - when the cause is excessive destruction of RBC (hemolytic)

Hepatic: - when the cause is due to the liver problems.

II Surgical: when the cause is obstruction of biliary trees (obstructive jaundice)

Biochemical features of different types of jaundice.

Type of the test	Pre hepatic	hepatic	Post hepatic
Serum bilirubin:-			
Total	+	+++	+++
Direct	N	++	+++
Indirect	+++	++	N
Serum Alkaline phos	N	+	+++
Liver Enzymes	N	+++	+
Urine :			
billirubin	0	N	+++
urobilinogen	+++	N	0

Causes of extra hepatic biliary obstruction

Obstruction in the *lumen*

- Gall stone(the most common)
- Parasitic occlusion e.g. Ascaris, liver flukes
- Blood clot

Obstruction in the *wall*:

- Atresia (congenital)
- Stricture (post traumatic)
- Tumor of the bile duct

Extrinsic compression

- Carcinoma of head of pancreas(the second most common)
- Carcinoma of ampulla of vater
- Pancreatitis
- Lymph node around porta hepatis
- Choledochal cyst

Clinical manifestation

History: Helpful to differentiate surgical jaundice from medical jaundice for management decision

- Intermittent jaundice, if it is due to stone
- Progress of jaundice (progressively deepening or intermittent)
- +/- Pruritis

- Urine and stool (clay color) color change is indicative of obstruction
- RUQ abdominal pain
- Loss of appetite, weight loss
- History of abdominal trauma, surgery

Physical examination:

- General appearance: obesity, emaciation.
- Depth of jaundice/pallor
- Hepatomegaly, splenomegaly
- Ascitis
- Palpable gall bladder
- Liver mass.
- Skin scratch marks

Note the following distinctions of various causes of jaundice

- Surgical jaundice is characterized by
 - Yellow green icterus
 - Pruritus of the skin more during night time
 - Clay colored stool due to absent bile
 - Dark brown urine due to conjugated bilirubin in the urine
- Jaundice due to choledocholithiasis is characterized by
 - history of chronic colicky right upper quadrant pain
 - Intermittent jaundice
 - Risk factors for gall bladder stone formation or
 - History of gall bladder stone (Diagnosed)
 - Usually impalpable gall bladder
- Jaundice of Neoplastic cause is characterized by
 - Progressively deepening jaundice
 - Anorexia, weight loss, and pallor
 - Palpable gall bladder with mild or no pain

Courvoisier's Law:

If in presence of jaundice, the gall bladder is palpable, then the jaundice is unlikely to be due to stone (True in 60%of cases).

Investigations

- Hemoglobin: anemia suggests malignancy
- Urinalysis: bilirubin/urobilinogen
- Serum bilirubin: total and direct
- Serum alkaline phosphatase
- Ultrasound: gall stone, choledochal cyst, dilated bile duct, Neoplasm
- Liver function test
- Prothrombin time

Treatment

Surgical: The patient should be sent to a hospital for surgery.

Review Questions

1. Correct statement regarding Amoebic Liver Abscess is/are:
 - A. It is more common in males.
 - B. Right lobe is more commonly affected
 - C. Hepatic lesion is usually solitary.
 - D. 'Anchovy Paste' aspirate is pathognomonic
 - E. All of the above
2. Complications of hydatid diseases of the liver do not include
 - A. Rapture
 - B. Suppuration
 - C. Hypovolemic shock
 - D. Penetration
 - E. None
3. The commonest type gall bladder stone is
 - A. Cholesterol
 - B. Oxalate
 - C. Mixed
 - D. Pigment
 - E. None
4. The most important diagnostic work up in cholelithiasis is
 - A. ultrasound
 - B. plain abdominal X-Ray
 - C. Oral cholecystography
 - D. Serum cholesterol level
 - E. endoscopy
5. Stone in bile duct can cause
 - A. Obstructive Jaundice
 - B. Cholangitis
 - C. Acute Pancreatitis
 - D. All of the above
 - E. None

ABDOMINAL WALL HERNIAS

Learning Objectives

1. To discuss the common types of abdominal wall hernias
2. To enumerate the risk factors
3. To describe the clinical features of different abdominal wall hernias
4. To discuss the complications of abdominal wall hernias
5. To describe the modalities of treatment
6. To emphasize the importance of early diagnosis & intervention

Introduction

Abdominal wall hernias are common surgical problems encountered in all levels of health care facilities. Adequate knowledge to reach to the correct diagnosis and appropriate management plan help the care provider to prevent serious complications which could be fatal.

General consideration

Definitions – *Hernia* is a protrusion of a viscous through an opening in the wall of the cavity

Important terminologies

Hernial sac - is an out pouch of the peritoneum. It has four parts:
mouth, neck, body and fundus

Content- Is a viscous or any other organ inside a sac. It can be:

- Small bowel and omentum – the commonest
- Large bowel appendix
- The bladder

Reducible hernia- when the protruded viscous can be returned back to the abdomen

Irreducible hernia- when the contents can't be returned back

Obstructed hernia- the content of the hernia (intestine) is occluded but no impairment of vascular supply

Strangulated hernia- when the vascularity of protruded viscous is impaired

Richter's hernia- when only one side of the wall of the intestine is herniated. Here strangulation of the bowel can occur with out intestinal obstruction

Sliding hernia- when an extra peritoneal structure form part of the wall of the sac

Risk factors for abdominal wall Hernia development

Increased intra abdominal pressure resulting from:

- Chronic cough
- Straining at urination or defecation
- Heavy wt lifting
- Abdominal distension

Weakened abdominal wall

- Advanced age
- Malnutrition
- Congenital defect – ppv
- Trauma/surgery

Clinical features

History

- Lump which varies in size
- Pain, local aching, discomfort
- Factors predisposing to increased intra abdominal pressure
- Symptoms of int. obstruction/strangulation

Physical examination

- Patient is examined in standing and lying position.
- Lump – reducible, cough impulse with bowel sound
- May be reduced when patient is lying and increases in size when patient is coughing or straining
- Relation of the lump with the common references – pubic tubercle, inguinal ligament
- Signs of obstruction – tense, tender, irreducible with absent cough impulse
- Signs of strangulation – more tenderness, with warm indurated, and inflamed overlying skin.

Investigation: Hernia is a clinical diagnosis and investigation is rarely needed.

Complications of abdominal wall hernias:

1. Irreducibility
2. Obstruction
3. Strangulation is a surgical emergency

Risk of obstruction and strangulation is very high in femoral hernia, paraumbilical hernia and indirect inguinal hernia with narrow neck

Principles of management

- Spontaneous resolution is unlikely
- The risks of irreducibility, obstruction and strangulation increase with time. So surgical intervention is needed in most cases

Surgical treatment for abdominal wall hernias

1. Herniotomy - removal of the sac and closure of the neck: Done only in infants and children
2. Herniorrhaphy - Herniotomy and repair of the wall to prevent recurrence.

Obstruction and strangulation

This is one of the causes of intestinal obstruction (acute abdomen). Therefore, one shouldn't forget to examine the hernial sites during evaluation of the patient with intestinal obstruction.

Treatment options

Non operative treatment:

Gentle reduction (Taxis) can be indicated in obstructed hernia in infants but not advisable in adults due to the risk of mass reduction.

Procedure (taxis):

- Put patient in head down position
- Sedative is given
- Gentle manipulation to reduce the hernia

NB: No place for vigorous manipulation and be ready to stop the procedure when any difficulty arises

Urgent surgery is indicated in

- Great majority of obstructed hernia and
- All strangulated hernia

Specific types of hernia

Anatomy of Inguinal and femoral canal

Inguinal canal Boundaries

Anteriorly: External oblique apponeurosis

Posteriorly: Fascia transversalis

Inferiorly: Inguinal ligament

Superiorly: Conjoined tendon and internal oblique muscle

This canal runs in antero inferior direction from internal to external ring. The internal ring lies 2cm above and 2cm medial to mid inguinal ligament. The external ring lies just above the pubic crest and tubercle

Contents of inguinal canal

In male: Spermatic vessels, Vas deference, Ilio inguinal nerve, Genito femoral nerve

In female: Round ligament

Anatomy of femoral canal

Is a narrow rigid space bounded by:

- Inguinal ligament, superiorly
- Pectineal part of inguinal ligament posterior
- Lacunar part of inguinal ligament medially, femoral vein laterally
- The narrow rigid space makes this types of hernia more prone to obstruction and strangulation.

Inguinal hernia

- accounts for 80% of all external abdominal wall hernia
- commonest is all ages and sexes
- 20 x more common in males than women
- more common on right side

Classification

1. Indirect type: passes through internal inguinal ring along the inguinal canal. May extend down to the scrotum.
2. Direct type : Bulges through the post wall of inguinal canal

Indirect inguinal hernia

- 60% on right, 40% Lt side and 20% bilateral
- Due to congenital defect or potential defect which is the remnant of processes vaginalis
- 20 times more common in men

Direct inguinal hernia

- due to wear and tear associated with advanced age and increased intra abdominal pressure

Femoral Hernia

- acquired downward protrusion of intestinal contents into the femoral canal
- 4 times more common in females (middle-aged multiparous)
- rare in children

Clinical features

History

- Elderly or middle aged woman with thin body build
- lump on anterior and upper thigh
- may present with complaints associated with int. obstruction or strangulation

Physical examination

- Small lump on lower groin, lateral and below pubic tubercle
- Reducible/irreducibility
- Bowel sound/cough impulse – usually absent

Management

- surgical repair without delay

Umbilical (Para umbilical) Hernia

Umbilicus is one of the weak sites of the abdomen. A hernia can occur at this potential site.

Risk factors

- Female sex
- Multiple parities
- Obesity
- Ascites

Complications

- Obstruction
- Strangulation
- Rupture

Treatment

Expectant: - Spontaneous closure is expected in 80% cases of umbilical hernia in under five children.

Surgery: - Beyond five years

Incisional Hernia

Risk Factors

- Wound infection
- Poor surgical technique (improper fascial repair)
- Chronic cough or straining
- Obesity

Clinical features

- Risk of obstruction and strangulation is very rare.
- Local discomfort
- Cosmetic problems
- Difficulties with micturition and bowel movement when very large

Treatment

Hernioplasty

Review Questions

1. False statement regarding abdominal wall hernia is/are
 - A. Indirect inguinal hernia is the commonest type
 - B. Femoral hernia is the commonest type in females
 - C. Strangulation can occur without obstruction
 - D. Direct inguinal hernia is common in old age
 - E. A & D
2. Conservative management is indicated in Obstructed hernia in
 - A. Obstructed inguinal hernia in infant
 - B. Femora hernia
 - C. Strangulated hernia
 - D. Umbilical hernia in under five children
 - E. None
3. Incidence of obstruction is higher in which one of the following hernial type?
 - A. Femoral
 - B. Direct inguinal
 - C. Paraumbilical I adult
 - D. Incisional
 - E. A and C
4. Options of management of abdominal well hernia
 - A. Herniotomy
 - B. Herniorrhaphy
 - C. Expectant
 - D. All
 - E. None

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STOMACH AND DUODENUM

Learning Objective

The student should be able to:

- enumerate the associated risk factors for Peptic ulcer disease (PUD) and gastric cancer
- describe the clinical features and investigation modalities pertinent to PUD and gastric cancer
- discuss the complications of peptic ulcer disease
- describe the treatment of peptic ulcer disease and gastric cancer

Introduction

Peptic ulcer disease is a common problem all over the world including Ethiopia. It had been one of the intersecting points for the discipline of internal medicine and surgery. The recent finding suggesting infection with Helicobacter pylori (H. pylori) as an important associated risk factor is shifting the treatment of peptic ulcer disease from surgery to medical modalities.

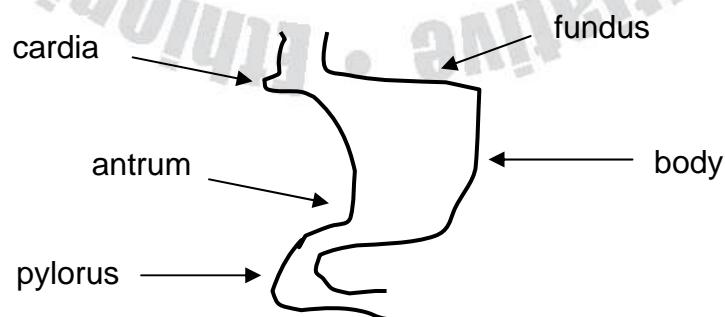
Gastric cancer is one of the top five cancers in frequency, however, it is one of the disease entities with the worst prognosis because of the difficulty to diagnose it early. Therefore one has to have a high index of suspicion to diagnose the disease early for the outcome of treatment heavily depends on the stage of the disease at the time of diagnosis.

Peptic ulcer disease

Anatomy and physiology of the stomach and duodenum

The stomach is an asymmetric dilation of the proximal gastro intestinal tract. The adult capacity is 1.5 to 2.0 liters. Anatomically, it is divided into the following parts:

Cardia, Fundus, Body, Antrum and Pylorus



The pyloric sphincter regulates gastric emptying and prevents reflux of duodenal content.

The wall of the stomach has four layers mucosa, submucosa, muscularis and serosa.

Region	Mucosa cells	Secretion
Cardia	goblet cell	mucus
fundus and body	parietal cells	acid
	chief cells	pepsinogen
Antrum and pylorus	goblet cells	mucus
	G. cells	gastrin

Table: Types of cells in the stomach and their secretion.

The stomach performs two interrelated functions in the initial phase of digestion

- a. Food breakdown to form chyme through
 - mechanical digestion and
 - acid and pepsin action
- b. Reservoir through receptive relaxation, i.e. the stomach increases its size as the amount of food in it increases.

Phases of gastric secretion

There are three phases of gastric secretion

Cephalic - mediated by acetylcholin secreted by the vagus nerve.

Gastric - mediated by the hormone gastrin (by G cells)

Intestinal - mainly inhibitory through peptides like secretin

Pathogenesis

The pathogenesis of peptic ulcer is an imbalance in the aggressive activity of acid and pepsin and the defensive mechanisms that resist mucosal digestion.

Factors contributing to the pathogenesis of peptic ulcer include:

1. Helicobacter pylori
2. Non steroidal anti-inflammatory drugs (e.g. aspirin)
3. Acid hypersecretion (e.g. Zollinger Ellison syndrome)
4. Rapid gastric emptying
5. Impaired duodenal acid disposal
6. Impaired gastric mucosal defense
7. Duodenogastric reflux

The most convincing evidence for *H. pylori* infection as a cause is that eradication of *H. pylori* infection is associated with a near elimination of recurrence of peptic ulcer following treatment. However, only a minority (10% over a life time) of people harboring *H. pylori* develop ulcers.

Classification

Acid peptic disease of the stomach and duodenum includes

Erosive gastritis (inflammation confined to the mucosa of the stomach)

Acute gastritis - occur after major trauma, shock, sepsis, head Injury and ingestion of aspirin and alcohol. It is generally classified as "Stress erosion".

Chronic gastritis

Peptic ulcers - extend through the mucosa into the submucosa and muscularis. Chronic gastric and duodenal ulcers are distinguished by the presence of an established inflammatory reaction. Duodenal ulcer usually occurs in the proximal duodenum within 1 to 2 cm of the pylorus, the portion of intestine first exposed to gastric secretion. In duodenal ulcer there is acid hyper secretion while in gastric ulcer acid secretion is either normal or decreased.

Clinical manifestation

The clinical presentation is non-specific and the following features may not always be found.

Table 1: Summary of clinical features of gastric and duodenal ulcers

	Gastric ulcer	Duodenal ulcer
Periodicity	present	Well marked
Pain	Soon after eating but not when lying down	Two hours after food Night pain
Vomiting	Considerable vomiting	No vomiting
Hemorrhage	Hematemesis more frequent than melena	Melena more frequent than hematemesis
Appetite	Afraid to eat	Good
Diet	Lives on milk and fish	Eats almost anything
Weight	Loses weight	No loss in weight

On examination it is not unusual to find localized deep tenderness in the right hypochondrium.

Investigations

- a. Gastroduodenoscopy and biopsy
- b. Barium meal
- c. Blood studies ↓ hemoglobin (Hgb) shows chronic blood loss
- d. H.pylori test

Treatment

Medical treatment

- Acid reduction
 - H₂ – receptor antagonists– cimetidine 800 mg/night for six weeks
 - Proton pump inhibitor – omeprazole 20 mg/d
 - Irritants should be avoided
 - Anti H. pylori treatment is given in the following manner if positive for H.pylori test
- Bismuth tablets }
Amoxicillin } for 2 – 4 weeks
Metronidazole }

Relapses are treated with the standard treatment in cases of duodenal ulcer. However gastric ulcers need endoscopic evaluation and biopsy to rule out malignancy

Surgical treatment

The patient is referred for surgery in the following conditions:

- a. Complications – obstruction, perforation or bleeding
- b. Intractability (failure of medical treatment)

Complications

Overall, in men, there is a 5 percent risk of perforation. About 10 percent of patients will have significant bleeding.

Perforated peptic ulcer

- Sex ratio 2:1 , age 45-55 years
- Anterior surface of duodenum (location)
- Past history of PUD is common
- Gastric contents spill over the peritoneum and bring about peritonism which will be followed by bacterial peritonitis after 6 hours

Clinical features

- Sudden onset of abdominal pain
- Pale, anxious
- Raised pulse rate
- Abdomen still, not moving with respiration tender, board like rigidity, liver dullness may be absent
- After 6 hrs peritonitis issue with silent abdominal distention and patient progressively deteriorates to death
- If the perforation occurs slowly the presentation may be less dramatic
- Erect plain abdominal x-ray, preferably a chest X- ray may show air under the diaphragm

Treatment

- Patient is resuscitated
- Antibiotic therapy, continuous gastric aspiration and breathing exercise are also important
- Urgent laparotomy done to do peritoneal toilet and closure of perforation with omental patch
- Anti H-pylori treatment started to avoid recurrence
- Definitive surgical treatment if symptoms persist

Bleeding Peptic Ulcer

- Slight bleeding frequently occurs following trauma from solid food
- Severe hemorrhage is due to erosion of an artery at the base of the ulcer located posteriorly (gastroduodenal, splenic)
- Patient presents with hematemesis and/or melena

Management

- Conservative
 - IV fluid resuscitation
 - Blood transfusion if indicated
 - Naso gastric tube insertion and saline lavage
 - H₂ receptor antagonist
 - Endoscopic evaluation
 - Serial hematocrite determination
- The patient should be referred for possible operation.

Gastric Outlet Obstruction (G.O.O)

This is a state that results from cicatrisation and fibrosis due to long standing duodenal or juxtapyloric ulcer.

Clinical feature

- Patient presents with pain, fullness, vomiting of large foul smelling vomit and on examination a peristaltic wave from left to right and succession splash can be elicited. There could also be signs of electrolyte disturbance and metabolic alkalosis
- Barium meal shows large stomach full of food residue with delay in evacuation

Treatment

Surgery – truncal vagotomy and bypass operation after preliminary gastric lavage with saline for 4-5 days and Correction of fluid and electrolytes using crystalloid fluids

Gastric Cancer

Epidemiology

- Age 40-60 years
- Sex M:F 3:1

More common in Far East – Japan

Etiology

Premalignant conditions and risk factors:

Gastric polyp, pernicious anemia, post gastrectomy stomach, gastritis, cigarette smoking and genetic makeup

Pathology

Prepyloric region is the most common site

Microscopic - Adenocarcinoma

Spread

Direct, lymphatic, transperitoneal, blood stream

Clinical features

- New onset dyspepsia in patients above the age of 40 years
- Anorexia and loss of weight
- Anemia, tiredness, weakness, pallor
- Persistent pain with no response to medical treatment

- Gastric distention
- Dysphagia or fullness, belching and vomiting
- Other signs
 - Virchow's nodes on the neck, Krukenberg tumor in the pelvis, etc.
 - Abdominal mass
 - Ascites

Investigations

- Gastroscopy and biopsy
- Hgb
- Barium meal shows filling defect
- Laparotomy (diagnostic)

Treatment

- Gastrectomy when possible
- Palliative bypass surgery

Prognosis

Over all 5 years survival is about 10 -20%

Review Questions

1. What are the three phases of gastric secretion?
2. Compare and contrast the clinical presentation of gastric and duodenal ulcers.
3. Mention the treatment of uncomplicated chronic duodenal ulcer.
4. Enumerate the complications of peptic ulcer disease.
5. How would you manage a perforated peptic ulcer disease?
6. Mention the premalignant conditions for gastric cancer.
7. What are the clinical features of gastric cancer and how do you reach the diagnosis?
8. What is the overall five year survival rate of gastric cancer?

DYSPHAGIA

Learning Objectives

The student is expected to know:

- Common causes which bring about dysphagia.
- Clinical features and investigations which help to reach to a specific diagnosis.
- Treatment options for the common conditions which cause dysphagia.

Introduction

Dysphagia, though an infrequent occurrence in clinical practice, is a very serious problem which makes the patient miserable for he/she can't swallow food, fluids and even saliva. The causes differ according to the age of the patient and the history may clearly suggest the diagnosis in some cases like foreign body swallowing and corrosive ingestion as in achalasia and cancer. One has to have a high index of suspicion and the help of special investigations. Most cases need a higher level of treatment, thus one should have a tentative diagnosis and convince the patient for early management at a hospital.

Dysphagia

Definition: Difficulty in swallowing

Classification: According to the site and cause

1. Oropharyngeal dysphagia
 - Causes – Local pain due to trauma, oral candida, tonsillitis etc
 - Neuromuscular disorders, e.g. Parkinson's disease,
 - Mechanical causes, e.g. Tumor
2. Esophageal dysphagia
 - Causes - Mechanical, e.g. - foreign body, tumor (esophageal cancer, Goiter)
 - Dysmotility, e.g. - achalasia

Diagnosis

History

- Dysphagia to solids or liquids
- Progressive, static or intermittent
- Duration
- Associated pain, heart burn or weight loss

Examination: Usually less revealing - weight loss, emaciation, chest findings due to aspiration pneumonia

Investigations

- Barium swallow radiography
- Esophagoscopy
- Endoscopic ultrasound
- Manometry

Common surgical causes of Dysphagia

Achalasia of the esophagus (cardiospasm)

Etiology - motility disorder of the esophagus due to loss of ganglion cells in auerbach's plexus.

Pathophysiology - Incomplete relaxation of lower oesophageal sphinctor (LES)

- Stasis esophageal dilatation (functional obstruction)
- Risk for cancer (Ca), in long standing cases

clinical feature

- Age 20-40 years
- Progressive dysphagia (insidious onset) regurgitation
- Retrosternal discomfort, fetid flatulence and aspiration pneumonitis

Diagnosis – Barium swallow: rat tail tapering, dilated esophagus, no gas in stomach

- Esophagoscopy
- manometry

Treatment: Disruption of the lower circular muscles- Heller's cardiomyotomy.

Carcinoma of the esophagus

Epidemiology

- > 60 years M > F
- 5% of all cancers

Predisposing factors

Ingestion of hot meal, smoking, alcohol intake, etc

Pathology

Microscopic: squamous cell carcinoma, Adeno carcinoma

Macroscopically: Annular stenosing, ulcer, fungating, cauli flower like

Spread

Direct, lymphatic and blood stream to liver and bone

Clinical feature

Dysphagia, regurgitation, anorexia, weight loss

Diagnosis

- Barium swallow - Irregular, ragged pattern of mucosa with narrow lumen
- Esophagoscopy and biopsy
- Bronchoscopy - to see bronchial involvement
- Endoluminal Ultrasonography(U/S)
- U/S - liver secondaries
- Hgb, plasma proteins, blood chemistry

Treatment

Curative - surgery

- Radiotherapy

Palliative - Intubation with specially designed tubes

- Radiotherapy

Foreign bodies

Coins, pins, dentures, etc

Diagnosis

- Radiography (neck and chest x-ray)
- Esophagoscopy

Treatment

Removal by rigid esophagoscope

Oesophagitis

Acute - burns or scalds

- Infective (spreading from the pharynx), e.g. candidiasis
- Peptic

Chronic - reflux due to hiatus hernia or previous surgery

Pathology

Bleeding granulation tissue replaces epithelium- upward displacement of the cardia

Clinical features

Pain, heart burn, dysphagia, occult blood, secondary anemia

Diagnosis - Barium swallow, esophagoscopy

Treatment - treat the cause, H₂ blockers, omeprazole – reflux (peptic)
- surgery for sliding hernia

Caustic strictures

Treatment - acute inflammatory stage - NPO, antibiotics and cortisone
- stricture – dilation, esophageal replacement

Review Questions

1. Classify dysphagia according to the cause and site and give examples for each.
2. What are the investigations which are important in the differential diagnosis of dysphagia?
3. Compare and contrast a patient with achalasia with another patient having esophageal cancer (clinical presentation, diagnosis, treatment and prognosis).

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CHAPTER FIVE

UROLOGY

Learning Objectives

The student is expected to know:

- 1- Common symptoms and signs of urinary tract disorders
- 2- Routine and special investigations of urinary tract
- 3- Treatment of most of the conditions associated with these pathologies

Introduction

The urinary tract is a system for various pathologies, as it is lined by urothelium it is the origin of transitional carcinomas. It also communicates with the external environment and exposed to microbes causing diseases. Moreover, as in many organ systems, the urinary tract is liable to trauma. Hence the student must be very well versed about the practice of the common urological problems.

Urinary symptoms and Investigations of Urinary Tract problems:

Introduction

Urinary pathologies are fairly common problems that health workers encounter in his/her daily activities. The symptoms are not always specific to urinary tract diseases; some of these symptoms are merely feature of generalized illness. The following symptoms are commonly related to urinary tract disease:

- A. Pain:** Pain in the urinary tract can arise from the kidneys (renal colic), which is due to obstruction of one of the calyces by stone. Infection due to obstruction of other causes could also cause a renal colic. Such patient may exhibit costovertebral angle tenderness on examination.

If pain is sudden in onset and severe radiating to the groin from the flank, it is most likely due to passage of stone in the ureter. Pain arising from bladder pathologies is located in the suprapubic region, the cause of which maybe urinary retention or cystitis.

- B. Hematuria:** is blood in urine. It can be divided as initial hematuria, terminal hematuria and bloody urine throughout. It may be associated with pain, and described as painful or without pain (painless hematuria). Microscopic hematuria is only evident when we see red blood cells in the urine under the microscope.

- C. **Frequency:** it is an increased number of voiding urine; it is due to incomplete emptying and/or irritability of the bladder.
- D. **Dysuria** (painful micturition)
- E. **Dribbling:** drops of urine continues to flow even after micturition
- F. **Urgency:** the feeling to void is very high urging the patient to void now and then
- G. **Hesitancy.** Patient hesitates void, when he reaches to toilet though he had great feeling to void.

Investigations

Urinalysis:

- *Presence of protein, blood, glucose, ketones and PH in urine can all be determined.*
- *Electrolytes and chemical in the urine are measured e.g. bilirubin bacteria*

Bacteriology

- *Urine culture and their susceptibility pattern from urine culture.*

Renal function Test:

- Estimates the capacity of the kidneys to excrete waste products and capacity of concentrating the urine.
- It is measured by assessing Blood Urea nitrogen (BUN) (normal value 20-40) and creatinine level (normal value 0.5-1.5) in the blood.

Radiology

Plain film (KUB) is the initial film that should be taken in cases suspected to have presence of stones along the urinary tract projections.

Intravenous Urogram (IVU, IVP):-

patient is given a contrast material intravenously. Anatomy and physiology of the Kidneys, ureters and bladder are demonstrated.

Other investigations modalities are listed below

Modality	Advantages
Ultrasonography	<ul style="list-style-type: none"> - Shows the size of renal parenchyma - Hydronephrosis and stone, mass lesions
Cystoscopy	<ul style="list-style-type: none"> - Visualizes the bladder for tumor, and the prostate for enlargement
Urethrocystogram	<ul style="list-style-type: none"> - Delineates the location and length of urethral stricture
Retrograde Ureteropyelography	<ul style="list-style-type: none"> - Displays the ureter and pelvis e.g.- PUJ obstruction

Acute Renal Failure (Anuria/Oliguria)

Acute renal failure is said to happen when

- Oliguria (<400 ml of urine in 24 hours) or
- Anuria (no urine excretion at all). Kidneys fail to produce adequate urine output to wash out all harmful toxic products such as nitrogen products.
- Hyperkalemia

Causes

The following table illustrates the common causes of acute renal failure

Level	Common condition
Pre renal ARF	<ul style="list-style-type: none"> - Dehydration - Shock
Renal (intrinsic renal diseases)	<ul style="list-style-type: none"> - Glomerulonephritis - Drugs, poisons - Myoglobinuria - Incompatible blood transfusion
Post renal (obstructive)	<ul style="list-style-type: none"> - Calculi, pelvic malignancy - Iatrogenic, retroperitoneal fibrosis - Bilharzias , BPH ,etc

Management of acute renal failure

Treatment of acute renal failure depends on the causes.

1. Treat the cause

- If hypotension, administer fluids and correct hypotension, then most of the cases could be reversed, urine output is monitored hourly.
- Adequate urine output is 0.5 – 1.5ml/Kg/hr.
- Diuretic challenge
- In established cases: fluid restriction, and fluid administration based on replacement of the ongoing losses.

2. Renal supportive methods, such as dialysis (peritoneal and hemodialysis) performed to remove toxic chemicals and decrease the potassium level (K^+) level in the blood to normal.

3. If the cause is post renal obstruction, e.g. ureteric stone, BOO, remove or bypass obstruction by the following means:

Catheterization

Open Surgery

Disorder of the kidneys and ureters

Hydronephrosis

Definition:

Hydronephrosis is defined as an aseptic dilatation of the pelvicalyceal system as a consequence of a partial or complete obstruction. It can be unilateral or bilateral based on the level of obstruction. The following table lists some causes of hydronephrosis.

Congenital	Acquired
- Congenital stricture of external urethral meatus, phymosis	- Benign prostatic enlargement
- Congenital valves of the posterior male urethra	- Urethral stricture
- Idiopathic pelvi-ureteric junction obstruction	- Post- circumcision phymosis - Stone diseases

Pathophysiology

When obstruction of urine flow is not relieved the following conditions happen:

The pelvis will be dilated, and more and more urine is collected.



Then calyces and pelvis become dilated, and pressure develops in the pelvicalyceal system



Then renal parenchyma undergoes pressure atrophy and even chronic renal failure could develop in bilateral obstructions

Clinical features

- Right side and males are commonly affected
- Insidious onset of mild pain or dull aching pain in the loin
- Sensation of drugging and heaviness
- Enlargement of kidney may be evident on palpation
- Attacks of acute renal colic may occur
- Features of chronic renal failure in untreated cases.

Diagnosis

- Based on History and physical examination.
- IVP/IVU
- Ultrasonography:- Accumulation of urine in the pelvis , stones, thickness of the kidney parenchyma are all visualized.

Treatment

Remove the obstructing element: e.g.

- | | | |
|-----------------|---|--|
| PUJ obstruction | → | Pyeloplasty |
| Ureteric stone | → | Ureterolithotomy |
| BPH and BOO | → | Bladder catheterization, prostatectomy |

Urinary Tract infection (UTI)

Upper urinary tract infections

Infection of the kidney: the source of pathogenic organisms in infection of the kidneys either from distant affected organ such as boils furuncles from which the organisms reach the kidneys or ascending infections from lower urinary tract infection. E.coli, other gram negative organisms and proteus species are the causative organisms.

Classification of Kidney infections

- Acute pyelonephritis
- Chronic pyelonephritis
- Pyonephrosis
- Renal abscess
- Perinephric abscess

Acute pyelonephritis:

It commonly occurs in females, in reproductive age group, childhood and pregnancy. The reason behind the increased prevalence of acute pyelonephritis is due to high incidence of lower UTI, which can ascend to upper tract.

Clinical features

- General nonspecific such as headache, lassitude and nausea may occur. Later sudden onset of pain, rigors and vomiting follows.
- Pain is localized in the flank and hypochondrium.
- When the source is lower UTI, frequency and dysuria are evident.

Diagnosis:

- Mid stream urine (MSU) is taken for culture and sensitivity
- Urinalysis yields few pus cells and many bacteria
- Blood culture
- In children, cloudy and offensive urine may be the only representative, and about 50% of the children with UTI have underlying abnormality

Treatment:

- Prompt antibiotic treatment. Choice should be based on clinical and epidemiological evidences, and then tailored by the results of culture and sensitivity. Exclude any anatomical abnormality.
- Initiate treatment with combination of amino glycoside and penicillin

Chronic pyelonephritis

Chronic pyelonephritis is associated mainly with vesico-ureteric reflux resulting in nephropathy and scarring of the renal parenchyma. Women and younger age groups are commonly affected.

Clinical feature

- Flank pain, frequency and dysuria, hypertension, pyrexia, anemia

Diagnosis

- U/A - white cells are seen in great number
- Culture may grow E.coli, proteus species or any other organism listed above
- Ultrasonography:- may show scarred small kidney in late cases.

Treatment

- Remove the predisposing element e.g. Vesico-ureteric reflux
- Repeated courses of antibiotic treatment may be necessary

Perinephric abscess

Definition

Perinephric abscess is an infection of the perinephric fat resulting in pus collection. The source unlike pyelonephritis can be from extension of cortical abscess. It could also result from a distant source such as from appendix abscess.

Clinical feature

- Swinging high grade fever
- Abdominal and loin tenderness
- Flank mass

Diagnosis

Elevated WBC count,

Low or no pus cells or bacteria in urine

Ultrasound is usually diagnostic. KUB may help

Treatment

Drainage of abscess, intravenous antibiotics and fluid administration

Renal tuberculosis

Renal tuberculosis is not an uncommon condition. It is hematogenous in origin.

Pathogenesis

- The infection, once established in the kidney, tuberculous granuloma is formed.
- The granulomas are changed to ulcers and several ulcers coalesce to form an abscess.
- Healing of the inflammatory processes lead to extensive fibrosis and then to Tb pyonephroses.
- The ultimate result is calcified or cement kidney.

Clinical feature

- painful micturition
- Minimal flank pain

- Bloody urine
- urinary frequency

Investigation

- Sterile urine (routine culture is negative)
- Plain film of the abdomen shows calcified lesion (pseudo calculi)
- IVU shows loss of outline of renal papilla, hydronephrosis , and abscess
- Chest X-ray may show lung lesions

Treatment

- Anti-Tb chemotherapy administration
Reconstructive surgery

Renal Stone Disease (Nephrolithiasis)

Renal stone disease is common in areas where the temperature is hot, and people are likely to be dehydrated. Etiology of stone formation in the urinary tract is not very clear. Proposed etiologies include:-

- Urinary stasis
- Infections
- Lack of inhibitors

Types of renal calculi

Calcium oxalate	Triple phosphate	Urate stone	Cystine stone
<ul style="list-style-type: none"> - They are irregular with sharp projection - Radio opaque - Cause bleeding (hematuria) 	<ul style="list-style-type: none"> - Formed by ammonium magnesium and calcium phosphate (struvite) - Grows in infected alkaline urine - Tends to be very large (stag horn) - Dirty, radio opaque 	<ul style="list-style-type: none"> - Multiple - hard, smooth - Radiolucent 	<ul style="list-style-type: none"> - congenital error of metabolism - cystinuria - Contain sulfur - Radio-opaque

Clinical feature

- Symptoms are variable
- Silent calculi, may cause no symptoms but progressive destruction of the renal parenchyma
- Bilateral stones may cause uremia before dilatation
- Pain(75%) located in the renal angle

- Stone in the ureter manifests with severe pain radiating from loin to groin, attacks may not last longer than 8 hours
- Hematuria
- No tenderness, rebound tenderness or guarding
- Pyuria if complicated with infection
- Septicemia and urosepsis

Diagnosis and diagnostic modalities

Urinalysis: - Presence of RBC, Pus cells, calcium oxalate

Radiology: - KUB opacity in the UT projection

IVU- establish presence of stone

Ultrasonography: -

- locates stone in the kidney
- detects hydronephrosis

N.B- all opacities are not necessarily kidney stones.

Differential diagnoses of opacity in X-ray film are: - calcified mesenteric lymph node

- Gall stones or concretion in appendix
- Phlebolith or any calcified lesion

Treatment:

Most small ureteric stones and non-obstructive kidney stones can be managed conservatively by treating the pain and any underlying infection with analgesics and antibiotics and then expecting the stone to be washed out by the urine and following the patient taking a follow up x-ray. Big stones, obstructing the urine outflow, and failure of expectant treatment are the indication for the following.

- Open surgery (nephrolithotomy , pyelolithotomy or ureterolithotomy)
- Minimal access and non invasive techniques/percutaneous nephrolithotomy, extra corporal shock wave lithotripsy (ESWL)

Renal Tumors

Renal tumors are not common. Renal malignancy is in fact a very rare tumor. Benign tumors of the kidney vary greatly, and have little significance most of the time.

Malignant Renal Tumors

Wilms tumor : it occurs in children

Renal Cell Carcinoma /hypernephroma, Grawitz tumor/

Clinical Feature of Renal cell carcinoma

- relatively rare tumor , occurs in adults
- Most frequent findings are pain or hematuria alone

- Symptoms of metastatic disease occur more frequently such as varicolele and
- Hypertension

Diagnosis

- Ultrasonography shows space occupying lesion
- IVU shows space occupying lesion with destroyed and deformed pelvi-calyceal system
- computer tomography

Treatment

The treatment depends entirely on surgical excision. It is not sensitive to radiotherapy and chemotherapy.

Renal injuries

Renal injuries are relatively uncommon injuries partly due to the inaccessible location of the kidneys in the retroperitoneum. Injuries to ureters are extremely rare in traumas; however ureteric injuries are fairly common in endoscopic ureteric procedures.

Renal injuries can be divided as mild, moderate severe or first, second and third degree renal injuries respectively.

First degree renal injury is an injury limited to the kidney parenchyma resulting in only subcapsular hematoma, hematuria may not be there.

Second-degree renal injury is said to happen when the injury involved the pelvicalyceal system but not the renal major vessels, hematuria is evident

Third degree renal injury is characterized by renal artery or renal vein involvement

Clinical features

Hematuria: - the most important symptom in renal injuries, extent and duration of hematuria determines the severity

Pain in the flank area and hypochondrium

Fullness, tenderness and bruises in the flanks may be detected

Hypotension and shock in third degree injuries are seen

Treatment

Conservative: - first degree and some second degree renal injuries replacement of fluid and blood transfusion if needed catheterization and follow up

Surgery: - severe forms of renal injury

Urinary Bladder

Bladder Injuries

The bladder is one of the visceral organs that are commonly involved in either blunt or penetrating injuries. Bladder rupture can be either intra peritoneal where urine peritonitis occurs and needs laparotomy and closure , While extra peritoneal rupture can be managed conservatively by passing an indwelling catheter.

Bladder outlet obstruction

This is the commonest presentation of all urologic problems and quite diverse disorders produce bladder outlet obstruction. The following table describes some of the long list of causes.

Males	Females
-BPH	- Retroverted gravid uterus
-Urethral stricture	- Multiple sclerosis
-Prostatitis	- Hysteria
- Rupture of Urethra	- Neurogenic bladder
- Meatal ulcer	- Certain drugs
- Phimosis	
- Neurogenic bladder	

Treatment

Acute urinary retention in most cases is relieved by passing a fine urethral catheter. If the cause is urethral stricture, suprapubic cystostomy is done to relieve the acute retention.

Bladder Stones

Stones are also formed in the bladder, and if stone is formed without any predisposing factor it is called primary vesical calculus. Whereas, a stone formed in the presence of distal obstruction or foreign body acting as a nidus, is called secondary vesical calculus.

Clinical Feature

- Males are more effected than females
- Pain characteristically occurs at the end of micturition
- The pain is referred at the end of the penis or labia majora
- In young boys, screaming and pulling of the penis with hand at the end of micturition
- Interruption of urinary stream and changing of body position to resume micturition.

Diagnosis

Radio opaque stone or filling defect in X-ray film

Treatment

Cystolithotomy (Open surgical removal)

Bladder Cancer

Bladder tumor is common in people exposed to chemical carcinogens. Occupational exposure to chemicals such as dye factory workers and cigarette smoking are considered to be strongly associated with bladder cancer. More than 80% of bladder cancer is transitional cell origin and only 25% of the tumors are muscle invasive.

Superficial bladder cancers are typically exophytic growth or papillary tumors. They account for 70% of the cases. Treatment is endoscopic resection and recurrence afterwards is common. Cystoscopic check up is necessary at regular intervals.

Muscle invasive transitional cell Carcinoma is solid tumor, large based and possesses potential of distant metastasis to the lungs, bones and liver.

Clinical feature

- Urinary retention from blood clot
- Pain, deep in the pelvis, indicating spread out of bladder territory
- Painless hematuria
- Recurrent UTI

Investigation

- Urine for white cell and RBC
- Blood BUN, Creatinine
- IVU shows filling defect, irregular out line of the bladder wall and hydronephrosis
- Cystoscopy

Treatment

Non- invasive tumors are treated with transurethral resection and followed with check cystoscopies.

- Intravesical chemotherapy and
- BCG is also effective in prevention of recurrence.
- Invasive tumors are very aggressive. Possible treatment is radical surgery, removing the bladder and lymph nodes around it, then urinary diversion.

Benign prostatic Hyperplasia (BPH)

Surgical Anatomy

These are three zones in the prostate gland

- Peripheral zone: mainly the posterior aspect of the gland

- Central zone: the gland posterior to urethral lumen above the ejaculation duct.
- Periurethral zone: this part is on which most of benign enlargement of the prostate arises.

Benign prostatic Hyperplasia starts in the periurethral zone and as it increases in size it compresses the outer peripheral zone. This zone finally becomes the false capsule. The gland is acted upon by testosterone, male hormone, incriminated to cause the enlargement.

Clinical Feature

- acute urinary obstruction
- Symptoms of prostatism (frequency , dysuria, urgency, dribbling, hesitancy)
- Chronic retention, overflow incontinence, and renal insufficiency.

Investigation and assessments

- Digital rectal examination
- Serum PSA(Prostatic specific antigen)
- Ultrasonography and IVU
- Cystoscopy
- Transrectal Ultrasonography

Management of BPH:-

- If associated with BOO → Pass a catheter and allow drainage, then prostatectomy.
- In cases only with symptoms of prostatism, other conservative measures can be tried.

Prostatic carcinoma

Prostatic cancer is most common malignant tumor in men over the age of 65 years.

Clinical Feature

Advanced disease gives rise to symptoms including

- Bladder out let obstruction
- Pelvic pain and hematuria
- Bone pain , renal failure

Diagnosis and assessment

- Rectal examination – stony hard gland with obliteration of the median sulcus.
- Blood tests- Hgb, PSA level, Liver function test, BUN and creatinine.
- PSA level $> 10\text{nl}$ is suggestive $> 30\text{nl}$ is diagnostic

N.B: PSA level is not specific. It can be affected by other conditions as BPH, UTI, etc.

Treatment

Based on the stages of the disease and the life expectancy of the patient, treatment is selected. The modalities available are:

- Surgery
- Radiotherapy
- Hormonal therapy, e.g. Bilateral orchidectomy

The urethra and penis

The urethra

Congenital abnormalities

Meatal stenosis

This is a condition which usually follows fibrosis after circumcision and if left untreated leads to chronic retention then chronic renal failure

Clinical Feature

Spraying and dribbling in lesser degree of stenosis

Urinary retention

Treatment

Meatotomy/meatoplasty (Plastic reconstruction of the meatus)

Congenital valves of the posterior urethra

This is a condition with presence of symmetrical of valves. It can cause obstruction to the urethra of boys and is not visualized on urethroscope. Voiding urethrocystogram (VCUG) is diagnostic

Treatment

Treatment is by initial decompression by catheterization followed by transurethral resection of the valves.

Hypospadias

This is the most common congenital malformation where meatus open onto the under side of the penis, perineum or prepuce. It has associated deformity called chordee (fibrous cord deforms the penis).

Treatment

Surgical repair

Urethral Injuries

There are two types

- Rupture of the membranous urethra

- Rupture of the bulbar urethra: blow to the perineum is the mechanism of injury

Clinical Features

- Retention of urine
- Perineal hematoma
- Bleeding from the external meatus

Treatment

- No attempts to catheterize should be made before urethroscopy or urethrogram
- Suprapubic catheter insertion then surgery (urethroplasty) after 3 months.

Rupture of the membranous urethra: most commonly due to pelvic fracture or can also be due to penetrating injuries.

- Road traffic accidents, severe crush injuries and falls all can cause this injury
- Pain, bruising and dullness to percussion above the umbilicus

Treatment

Initial suprapubic catheter can be put to relieve urinary obstruction followed by urethroplasty

Complication

- Urethral stricture
- Urinary incontinence

Urethral Stricture

Causes

- Traumatic → Road traffic accident, falls, penetrating injuries
- Inflammatory → Gonococcus, Mycobacterium tuberculosis
- Latrogenic → Catheterization, instrumentation

Clinical Features

Bladder outlet obstruction, younger age than the prostate Patients

Diagnosis

- Urethroscopy
- Urethrogram

Treatment

- Dilation with elastic or metallic boogie
- Urethrotomy , internal visual incision of stricture
- Urethroplasty, Excision and end to end anastomosis, patch urethroplasty

The Penis

Phymosis: Is an adhesion of the foreskin. It can be congenital or post-circumcision and results in urinary retention.

Treatment: is circumcision

Paraphymosis: Is a condition in which tight foreskin is retracted and causes constriction to the penis.

Treatment is dorsal incision over the constricting ring.

The Testis and Scrotum

The Testis

Incomplete Descent

This is a condition in which the testis is arrested in some part of its path to the scrotum.

Ectopic testis

Is abnormally placed outside its path, e.g. perineum. The testis located out of the scrotum is usually atrophic, grossly immature. If not treated early irreversible destruction will occur.

Clinical Features

- Right side in 50% of the cases
- Left 30%,
- bilateral in 20%

The position of the undescended testis is intra abdominal or inguinal canal or in the superficial inguinal pouch.

Hazards

The risks of incomplete descent of the testes include

- Sterility in bilateral cases
- Pain due to trauma
- Associated inguinal hernia
- Torsion
- Epididymo-orchitis
- Atrophy
- Increased liability to malignant diseases

Treatment: Orchidopexy

Testicular Torsion

Torsion of the spermatic cord may cause ischemia and necrosis of the testis

Predisposing conditions

- Inversion of the testis (rotated testes, upside down, or transverse lie)
- High investment of the tunica vaginalis (clapper-bell deformity)
- Separation of epididymis from the body of testis

Clinical Features

Most common between 10-25 years of age. It presents with sudden agonizing pain in the groin and the lower abdomen. Vomiting is also common

Treatment

- emergency exploration is mandatory
- orchidectomy if necrotic testis is found, orchidopexy if viable
- orchiopexy is advised on the unaffected side

Hydrocele

Hydrocele is an abnormal collection of serous fluid in the tunica. Types include:-

- Primary
- Secondary

Etiology: - excessive production and defective absorption

Treatment: - Hydrocelectomy

Malignant tumors of the Testis

1-2% of all malignant tumors are Testicular Carcinoma. Malignant tumors of the testis are common in young male adults. Mal descent predisposes to malignancy.

Classification

Tumors are classified based on Histologic predominant cells

- Seminoma (40%)
- Teratoma (32%)
- Combined seminoma and teratoma (14%)
- Lymphoma (7%)
- Other (7%)

Seminoma

- Occurs in age range between 35-45 years
- Extremely rare in children before puberty
- Tumor compresses the neighboring structure as it grows
- In rapidly growing tumors there may be areas of necrosis
- Spread is via the lymphatics, blood born is rare.

Teratomas

Teratomas arise from Totipotent cells, contain variety of cell types. They occur in relatively younger patients compared to seminomas.

Clinical features: - Testicular tumors may be asymptomatic for several months except lump in the testis

- Sensation of heaviness
- Pain in one - third of the cases
- On examination, the testis is enlarged, smooth, firm, and heavy.
- Testicular sensation is lost.
- Secondary Hydrocele in 10%

Diagnosis

- Blood for tumor markers such as HCG, Alpha FP
- CXR for secondary deposit

Treatment

Orchidectomy: removes primary tumor

Seminoma: - *Radiotherapy* after orchidectomy

Chemotherapy

Teratomas: - *Chemotherapy* is the treatment of choice

Follow up by serum tumor markers

Prognosis

Excellent

Seminoma, 95% 5 years survival

Teratoma, 85% 5 year survival

Review Questions

1. Outline the important steps of investigating a patient with right flank mass and hematuria.
2. Discuss the management of a 13 year-old patient with intermittent urinary retention and initial hematuria.
3. Outline common causes of acute urinary retention and indicate the recommended treatment.
4. Describe the clinical feature and treatment of benign hyperplasia.
5. List common problems associated with painful, sudden swelling of the scrotum.
6. A 40 year-old male presented with difficulty in urination of 1 year duration. How do you work him up? (Start from clinical evaluation)

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