CARDIOLOGY

The common anatomical site/s where diseases occur are listed in a box and so are the common etiologies of disease and the pathophysiological syndromes encountered.

SITE OF DISEASE

1. Pericardium

2. Myocardium

3. Endocardium: Valvular

4. Pancardium: Rheumatic Fever, Trauma

5. Vascular : *Artery*
: *Vein*
: *Lymphatic*

6. Electrical Pathways

SYNDROMES OF DYSFUNCTION

When the heart is not working properly it can result in the following pathophysiological syndromes:

1. Congestive Heart Failure
2. Cardiac Asthma
3. Low output Syndrome or Shock
4. Arrhythmia
5. Bacterial Endocarditis supervening on diseased Valves/ Shunt/ Artificial valves

ETIOLOGY OF CARDIAC DISEASE

(Note must be made of the common ones linked to a sub-site listed in the first box)

COMMON

1. Congenital
2. Rheumatic
3. Hypertensive
4. Infectious
: *Pericardial ~ Tuberculosis, Viral*
: *Myocardial ~ Virus, Rickettsia*
: *Endocardial ~ Subacute bacterial endocarditis*
5. Atherosclerotic

UNCOMMON

1. Collagen
2. Endocrinal
3. Immune Disease
4. Others

CARDIOLOGY – THE COMMON PLAN

A. HISTORY: As in the common, this part will answer questions A1-5.

A.1 SYMPTOMS SUGGESTING CARDIO VASCULAR INVOLVEMENT

-- Central chest pain esp. on exertion
-- Dyspnea on exertion
-- Nocturnal Dyspnea
-- Palpitation
-- Swelling over dependent parts

A.2 Symptoms suggesting PATHOPHYSIOLOGICAL EFFECTS

Most of the above symptoms occur because of the effects of primary disease on circulation. The symptoms of the disease per se may be few or none and the symptoms due to the consequent pathophysiological changes predominate or even predate.

A.3 CAUSE OF DISEASE

One has to consider the onset, course duration and the response to treatment in totality to reach the probable cause of disease. A chart depicting these will help as a guideline in the history. It needs to be re-emphasized that all these points have to be taken together to arrive at a decision.

CAUSE	ONSET	COURSE	DURATION	OUTCOME
VASCULAR	*Sudden*	*Rapidly Progressive or regressive*	*Few days*	*Good/ Bad*
RHEUMATIC	*Acute*	*Episodes of fever + Prophylaxis*	*Years*	*Variable*
TUBERCULAR	*Sub- Acute*	*Progressive*	*Months*	*Good with treatment*
CARDIOMYOPA - THY	*Sub- Acute*	*Slowly Progressive*	*Months/ years*	*Bad*
CONGENITAL	*Since birth*	*Progressive*	*Variable*	*Good in milder forms*
ARRYTHMIA	*Acute*	*Episodic*	*Years*	*Variable*
JOINT DISEASE	*Sub- Acute*	*Slowly Progressive*	*Years*	*Acute exacerbation problematic*

A.4BACKGROUND HISTORY: NATURE OF DISEASE CAN BE ELUCIDATED

- Congenital disease : There may be an antenatal history of
  - -- Disease in the mother like Rubella
  - -- Birth trauma
  - -- Delayed milestones
  - -- Squatting, crying spells
  - -- History of other anomalies

- Rheumatic disease
  - -- Chorea
  - -- Fleeting arthritis

- Atherosclerosis
  - -- Family history of diabetes, premature deaths in the family
  - -- Past history of other organ involvement by atherosclerosis
  - -- Diabetes mellitus
  - -- Smoking
  - -- Blood pressure

- Syphilis
  - -- Past, family or personal history pointers to syphilis
  - -- Present history of primary chancre
  - -- Past history of primary chancre or signs of secondary syphilis
  - -- Signs of Syphilis in the sexual partner and in congenital syphilishistory of still births/abortions of siblings
- Tuberculosis
  - -- Family history of Tuberculosis

- Hypertension
  - -- Past history of other organ involvement
  - -- Family history
  - -- History of renal diseases
  - -- History of Endocrinal diseases

A.5 PATHOPHYSIOLOGICAL ABNORMALITIES AND DYSFUNCTION MEASUREMENT

~ Edema may suggest CHF
~ Nocturnal dyspnea suggests cardiac asthma
~ Episodes of unconsciousness may suggest arrythymias
~ Prolonged fever may indicate bacterial endocarditis
~ Cold extremities and muscle fatigue may suggest low output syndrome

In assessing dysfunction, the degree of breathlessness is to be noted, keeping in mind his job requirement and personal situation which includes details of his residence,how many stairs he has to climb, what are his hobbies & other recreational activities and the disturbance of function should be measured against these parameters.
The NYHA grade of dyspnoea must be recorded.

B. GENERAL EXAMINATION: This part will provide answers to B1-3.

B.1 VITAL SIGNS AND OBVIOUS ABNORMALITY

A measure of the vital signs including pulse, blood pressure, respiration and temperature has to be made.

Any remarkable abnormal facies recorded. This may include mitral facies or Pixie like facies in pulmonary stenosis etc.

It should be highlighted that the arterial pulse and blood pressure reflect hemodynamic changes of the left side of the heart especially aortic valve, left ventricle and to lesser extent the mitral valve.

The neck veins reflect right sided heart hemodynamics including tricuspid valve, right ventricle and to the lesser extent the pulmonary valve and pulmonary artery pressures.

B.2 ETIOLOGICAL SIGNS

~Congenital anomalies of the fingers, eyes, cleft lip, webbing of the neck etc.

~Signs of Rheumatic fever

~Evidence of other joint diseases like rheumatoid arthritis, ankylosing spondylitis, syphlis

~Pre-mature atherosclerosis in the form of thickened arteries and other ophthalmic fundus abnormalities
~Renal and endocrinal diseases

B.3 PATHOPHYSIOLOGICAL ABNORMALTIES AND MEASURING DYSFUNCTION

-- The grade of dyspnoea should be measured on an NYHA scale of 1 to 4.
-- CHF (including tricuspid regurgitation)
-- Left ventricle failure
-- Low output syndrome/shock
-- Arrhythmia and fainting
-- Bacterial endocarditis

C. SYSTEMIC EXAMINATION OF OTHER SYSTEMS (EXTRA-CARDIAC)
Should provide information regarding the Cause (etiology C1) and Effect (pathophysiology C2)

C.1 CAUSE OF DISEASE

Cardiac diseases may develop after diseases of other organs and as an example, efforts should be made to look for tuberculosis in the other systems, as well as Rheumatic fever and Rheumatoid arthritis have to be looked for.

C.2 EFFECTS ON OTHER SYSTEMS

-- Lung: basal crepts in heart failure
-- Kidneys: microscopic haematuria
-- Spleen: enlargement in CHF and SBE

D. SYSTEM EXAMINATION – CARDIAC: Should give us information as to what anatomical structures (Site and Sub-sites) are affected by the disease.

D.1 SITE OF INCOLVEMENT IN CARDIO-VASCULAR SYSTEM

(a) Pericardial involvement:
-- Rub
-- Signs of effusion
(b) Myocardial diseases
-- Usually silent
-- Arrhythmia
-- CHF/LVF
-- Mitral/Tricuspid Regurgitation
(c) Endocardial diseases
-- Murmurs
-- Stenosis/regurgitation
-- Congenital shunt
-- Cyanotic/acyanotic
(d) Peripheral vascular diseases

D.2 NATURE INDICATORS

The site of involvement sometimes guides us to the cause of diseases.

~Pure M.S. is rheumatic
~Multiple valve involvements usually rheumatic
~Pure A.R. is often due to connective tissue disorder

E. INVESTIGATIONS

An investigation may give us structural as well as functional information however radiology usually gives us structural information (site).

Functional information is often obtained from dynamic studies including Echocardiography, Radioactive scanning and Angiography.

E.1 CONFIRMATION OF SITE OF DISEASE

(a) Pericardial diseases:
--Skiagram may show calcification
-- Catheterization can show thickness of walls
-- Echocardiography helps in diagnosis of effusion

-- Biopsy and aspiration give us etiological information

(b) Myocardial disease

-- EKG shows us the pattern of myocardial ischemia
-- Coronary angiography rules out Ischemic narrowing
-- Endocardial biopsy is helpful in etiology

(c) Endocardial disease (valves)

-- Chest skiagram
-- Barium swallow
-- Echocardiography
-- Catheterization and angiography
-- EKG for various chamber hypertrophies

(d) Blood vessels

-- Doppler studies
-- Angiography
-- Venography
-- Carotid Intima-Media thickness- this quantifies risk of both ischemic heart events and cerebral ischemic events
-- Testing for Endothelial Dysfunction

E.2 ETIOLOGICAL CONFIRMATION

- Rheumatic -- ASO titres
  -- C-reacting proteins
  -- Throat swab and culture

- Tuberculosis -- Pericardial biopsy and fluid testing
  -- Tuberculosis elsewhere

- Joint diseases -- Rheumatoid factor
  -- Anti nuclear antibodies
  -- Other antibodies
  -- Skiagram of joints

- Congenital diseases -- Chromosomes studies
  -- Biochemical enzyme estimation
  -- Skiagram of joints

E.3 PATHOPHYSIOLOGY AND DYSFUNCTION MEASUREMENT

-- Treadmill exercise testing
-- Systolic time intervals
-- Echo cardiography

-- Catheterisation
-- Radio nuclide assessment of ventricle function

These can be done before and after exercise or certain drugs.

E.4 MISCELLANEOUS

Risk factors assessment for pre-mature Coronary Artery Heart Disease

-- Lipids
-- Blood sugar
-- Serum uric acid
-- Lipoprotein A levels
-- Homocysteine levels
-- hs CRP levels
-- Carotid Intima-Media thickness (CIMT)
-- Endothelial Dysfunction studies
-- Ankle Brachial Index
-- Coronary Artery calcium Scores
-- Intravascular Ultrasonography

-- Catheterisation
-- Radio nuclide assessment of ventricle function

These can be done before and after exercise or certain drugs.

E.4 MISCELLANEOUS

Risk factors assessment for pre-mature Coronary Artery Heart Disease

-- Lipids
-- Blood sugar
-- Serum uric acid
-- Lipoprotein A levels
-- Homocysteine levels
-- hCRP levels

SITE OF DISEASE

1. Upper Respiratory tract
2. Trachea
3. Bronchi
- Large
- Small
4. Alveoli
5. Interstitial Tissue
- Collagen
- Vessels
6.Pleura

SYNDROMES OF DYSFUNCTION

1. Respiratory Failure
- Hypoxemic
- Hypercapnic
2. Pulmonary hypertension and CHF
3. Cardiac Arrhythmias

ETIOLOGY OF RESPIRATORY DISEASES

1. Infections
2. Allergy
3. Malignancy
4. Occupational Diseases
5. Collagen diseases
6. Degenerative diseases
7. Congenital

DIAGNOSTIC WORKUP OF RESPIRATORY SYSTEM CASE ACCORDING TO THE COMMON PLAN

A. HISTORY

A.1 Symptoms suggesting respiratory involvement

1. Cough with expectoration
2. Breathlessness at rest (may increase on exercise)
3. Lateral chest pain
4. Hemoptysis
5. Audible wheeze

SYMPTOM ANALYSIS

1. COUGH:

~ In Upper respiratory tract involvement, cough is generally dry or with very sticky sputum which is difficult to bring out along with soreness and throat irritation.

~ Laryngeal paralysis if it is "Bovine" type and ineffectual
~ Tracheal cough is loud and brassy

~ Bronchial cough is a deep cough with expectoration (mucoid type)

~ Alveolar coughing is commonly associated with dyspnoea and has frothy sputum

~ Pleural cough is painful and suppressed without expectoration unless there is a bronchopleural fistula

TIMING OF COUGH:

~ Nocturnal Cough can be due to
- Post-nasal drip
- Gastro-esophageal Reflux Disease
- Bronchiectasis
- Cardiac failure

~ Morning cough is seen in
- Chronic bronchitis
- Bronchiectasis

~ Post-meal cough may be due to
- Tracheo-esophageal fistula
- Hiatus hernia
- Aspiration
- Esophageal diverticulum

~ Precipitated by change in posture in
- Lung abscess
- Bronchiectasis

EXPECTORATION:

- Mucoid in Upper respiratory tract or tracheo-bronchial tree

- Frothy in Alveolar disease, especially in cardiac asthma

- Dry cough in Pleural diseases, early disease, upper respiratory tract disease and people who swallow sputum (like children)

- *Purulent* in Lung abscess, bronchiectasis and bronchopleural fistula
- *Rusty* as in Pneumonia
- *Foul odour* in Anaerobic infection
- *Bronchial casts* can be seen in Chronic bronchitis and bronchial asthma

2. DYSPNOEA

This can be respiratory, cardiac or psychological. Respiratory mechanisms can be:-

~ Inspiratory obstruction
~ Bronchospasm
~ Consolidation
~ Emphysema
~ Pleural effusion
~ Pneumothorax

The site of disease in respiratory system can often be told by associated symptoms/signs.

- Dyspnoea with inspiratory stridor occurs in Foreign body
- Wheeze is audible in Bronchitis and Asthma
- Nocturnal increase in dyspnoea is Cardiac (due to alveolar congestion)
- Shallow breathing is seen in Neuromuscular paralysis

3. LATERAL CHEST PAIN

This is the hallmark of pleural disease.
It has to be differentiated from musculoskeletal pain by the absence of other respiratory symptoms in the latter. Diaphragmatic pleurisy may be referred to the tip of shoulder and maybe associated with an increase during deep breathing and coughing.
Tracheitis may also be painful but the pain is in the front of neck and retrosternal.

4. HEMOPTYSIS

This symptom gives a lot of information about the site of involvement and sometimes helps in the etiological diagnosis as the causes of hemoptysis at each sub-site of the respiratory system are few and many diseases have their distinctive characteristics.

~ Upper Respiratory Tract often gives a Streaky hemoptysis

~ Alveolar origin of hemoptysis is often Frothy and is a hallmark of pulmonary edema

~ *Frank* blood can be seen in tuberculosis, mitral stenosis and bronchial adenoma

~ *Mucopurulent* hemoptysis is seen in bronchiectasis and lung abscess

~ *Rusty* hemoptysis is seen in early pneumonia

~ *Sudden* onset suggests pulmonary embolism and infarction

~ *Recurrent* hemoptysis occurs in hemosiderosis, Goodpasture's syndrome and bronchial adenoma

~ *Continuous* bleeding can be seen in malignancy

A.2 Are there any symptoms suggestive of pathophysiological effects of the disease?

- Tremulousness, drowsiness and coma in Respiratory Failure
- Pitting edema, right upper abdominal discomfort in CHF
- Palpitations in arrhythmias

A.3 Cause of Respiratory Diseases

The common causes are:
- Acute infections
- Chronic infections
- Malignancy
- Degenerative diseases (like Emphysema)
- Immunological diseases, common being asthma

Less common ones being
- Trauma
- Congenital
- Occupational and dust diseases-
- Vascular diseases (pulmonary embolism)

DISEASE	ONSET	COURSE	DURATION	TREATMENT RESPONSE
ASTHMA	*Acute / Chronic*	*Episodic*	*Years*	*Good for acute attack*
ACUTE INFECTION	*Acute*	*Progressive then Regressive*	*Days/ Weeks*	*Good*
CHRONIC INFECTION	*Sub-Acute*	*Slowly progressive*	*Months/ Years*	*Fair*
MALIGNANCY	*Sub-Acute*	*Rapidly Progressive*	*Months*	*Bad*
DEGENERATI - VE	*Insidious*	*Very Slowly Progressive*	*Years*	*Poor in long term*

As in all systems differentiation between these possibilities lies in analyzing the mode of onset, course, duration and response to treatment, if any. The table below highlights these for the common ones:

A.4 BACKGROUND HISTORY

~ Acute infections
- Present in others in family
- Endemic/epidemic in community

~ Tuberculosis
- Family history + debilitating disease
- Overcrowding
- Undernutrition

~ Malignancy
- Personal history of smoking
- Occupational history of exposure to asbestos or Polyvinyl chloride

~ Degenerative
- Family history of similar illness

~ Bronchial asthma
- Past history of atopy, eczema, rhinitis
- Family history of atopy, eczema, rhinitis, allergic pharyngitis, hay fever

A.5 What is the disturbance of function?

Once again this is considered in context of a patient's daily activities, occupation and recreational pursuits.
- Coughing can interfere with these
- Breathlessness can cause problems and depending on its severity can cause variable degree of problems.
- Hoarseness may cause untold misery in a professional singer or teacher

B. GENERAL EXAMINATION

B.1 What is the grade of dyspnoea 1-4 (MMRC grade)

- Is there Respiratory Failure?
- Presence of Cyanosis, clubbing, flapping tremors, drowsiness or papilledema
- Is there Cor pulmonale?
- Chest expansion must be measured

B.2 Any evidence of etiology

- Lymph nodes: size, feel, fixity, matting, warmth
- Clubbing: signifying suppuration
- Skin/joint affection in collagenoses

B.3 General parameters

- Respiratory rate, depth, nature and pattern
- Pulse and blood pressure
- Level of consciousness

C. EXAMINATION OF OTHER SYSTEMS

C.1 Cause of respiratory disease is in other organ/s such as-

~ Primary cancer elsewhere causing secondaries in lung
~ Tuberculosis elsewhere
~ Multisystem involvement in collagen disorders, sarcoidosis

C.2 Affect of lung disease on other system (CONCEPT OF LUNG-HEART-BLOOD AXIS)

~ Cor pulmonale: Right Ventricular hypertrophy and/or failure
~ Polycythemia

D. EXAMINATION OF RESPIRATORY SYSTEM

D.1 This examination should be able to tell us which part/s of the lungs is/are involved and how. SUMMATION of the physical signs in the lung tells the ALTERED PHYSICAL STATE and the common ones (in alphabetical order) are :-

a. Atelectasis, Asthma
b. Bronchitis, Bronchiectasis
c. Cavity, Collapse, Consolidation
d. Emphysema, Empyema*
e. Fibrosis: Interstitial as well as Replacement
f. Hydrothorax*, Haemothorax*, Hydropneumothorax
g. Pulmonary edema
h. Pneumothorax, Pleural effusion(*similar signs)

AS THESE ALTERED PHYSICAL STATES DO NOT TELL US THE ETIOLOGICAL DIAGNOSIS

TWO IMPORTANT FACTS MUST BE REMEMBERED

- ONE :- Any respiratory disease can give rise to different signs (altered physical states) in the lung e.g. T.B. can cause cavity, collapse, effusion

- **TWO :-** Many different diseases can give rise to the same physical signs (altered physical states) e.g. Consolidation can be due to Pneumococci, Mycobacteria, Fungi, or Malignancy

D.2 DISTRIBUTION OF ALTERED PHYSICAL STATES

UNILATERAL

1. APICAL
(a) Tuberculosis
(b) Bacterial (Others)
(c) Fungal
(d) Malignancy

2. BASAL
(a) Bacterial Pneumonia
(b) Malignancy
(c) Fungal
(d) Tuberculosis

3. WHOLE LUNG
(Various causes)
(a) Pleural effusion
(b) Collapse
(c) Consolidation
(d)Fibrosis
(e)Pneumothorax

BILATERAL

1. APICAL
Tuberculosis

2. BASAL
(a) Pulmonary edema
(b) Bronchiectasis
(c) Interstitial fibrosis

3. UNIVERSAL
(a) Bronchitis
(b) Emphysema
(c) Asthma
(d)Tropical Pulmonary Eosinophilia
(e) Interstitial fibrosis
(f) Occupational diseases
(g) Allergic alveolitis

Hence, in lung diseases the two points to be determined are what is the altered physical state and where is it. This would give us the probable etiological causes.

E. INVESTIGATIONS

E.1 For SITE and confirmation of the Altered Physical State

- Various Skiagrams help (PA View, AP View, Laterals, Lordotic Views and Tomograms)
- Bronchography for the distal smaller bronchi
- Bronchoscopy* for trachea and larger proximal bronchi
- CT Scan (with high resolution- HRCT)

E.2 Etiological confirmation needs a specimen from the affected site. All this material is subjected to gram stain, AFB smear, culture, PCR, BACTEC, Pap stain, fungal elements, eosinophils, asbestos bodies.

- Sputum
- Swab (thru Bronchoscope)*
- Trans-tracheal aspirate
- Pleural aspirate
- Scalene/other node biopsy
- ENE Expert

} *All this material is subjected to gram stain, AFB smear, culture, PCR, BACTEC, Pap stain, fungal elements, eosinophils, asbestos bodies and sensitivity tasting*

E.3

- Is there corpulmonale present : Right Ventricular Hypertrophy or strains on ECG Chest skiagram showing right ventricular hypertrophy pattern
- Is there respiratory failure : Blood gases in the arterial sample
- Occasionally cardiac arrhythmias and polycythemia can occur consequent to respiratory illness and this need to be investigated.

E.4 Timed walking capacity is a measure of respiratory function. A 12 minute walking distance has often been used for this purpose and serially performing such a test can be an assessment tool for disease progression.

- **Sleep Studies**

NEUROLOGY

Site of Disease in the Nervous System

INTRACRANIAL

SUPRATENTORIAL	INFRATENTORIAL
1. Frontal Lobe	8. Mid Brain
2. Temporal Lobe	9. Pons
3. Parietal Lobe	10. Medulla
4. Occipital Lobe	11.Cerebellum
5. Basal Ganglia	
6. Thalamus	
7. Internal Capsule	

EXTRACRANIAL

1. Motor: Upper motor Neuron: (a) Pyramidal
   (b) Extrapyramidal
   Lower Motor Neuron
2. Sensory: (a) Posterior Columns
   (b) Lateral Columns
3. Cerebellar connections
4. Autonomic function: Lateral horns

COMMON ETIOLOGIES OF DISEASE IN NEUROLOGY

1. Trauma
2. Vascular diseases: Hemorrhage
   Thrombosis
   Embolism
3. Acute Infections
4. Chronic Infections
5. Malignancy
6. Benign Tumors
7. Degenerative/ Metabolic/Hereditary/ Genetic Diseases
8. Congenital diseases
9. Immunologically Mediated Diseases

COMMON PATHOPHYSIOLOGICAL ABNORMALITIES

NOTE: These are closely linked to the Sites mentioned in Box 1. and will not be described separately.

In the Nervous System each structure has a well defined function and indeed it is this loss of function which tells the site of disease. The Nervous system is not amenable to direct Examination by Inspection, Palpation, Percussion and Auscultation as the other Systems are.

COMMON PLAN AS APPLIED TO NERVOUS SYSTEM DISEASES

A. HISTORY

A.1 SYMPTOMS SUGGESTING C.N.S. INVOLVEMENT

- Motor -- Weakness
  -- Abnormal movements
  -- Wasting of muscle
- Sensory -- Tingling
  -- Numbness, hyperesthesia
- Special -- Fits
  -- Speech and gait disorders
  -- Coma

Miscellaneous -- Endocrinal manifestations like Cushings and Acromegaly

A.2 HISTORY: CAUSE OF DISEASE ONSET

1. Sudden onset -- Trauma/vascular*
2. Acute onset -- Acute infections
3. Sub-acute onset -- Chronic infections/ malignancy
4. Insidious onset -- Degenerative disorders

*Other causes may also lead to sudden onset through vascular involvement like in malignancy or infections, and the development of arteritis.

COURSE

- Progressive -- Chronic infections/ malignancy
- Slowly progressive -- Degenerative
- Regressive -- Acute infections

- Stationary -- After trauma/residual damage of infections
- Episodic -- Epilepsy/T.I.A.

DURATION

Malignant tumors do not last for more than 2 years despite all treatment. Duration is fairly established for various degenerative diseases. The common age of onset of various degenerative disorders is also known.

A.3 BACKGROUND HISTORY :

1. Congenital diseases
   - Presence of defect since birth
   - Congenital adverse factors during early pregnancy
   - Similar problems in siblings and other family members

2. Acute infections
   - Previous history of ear, nose and throat disease
   - Previous history of debilitating diseases like diabetes, cancer.
   - Epidemic/endemic diseases prevalent

3. Chronic infections
   - Past history of other organ involvement
   - H/o debilitating diseases and diminished immunity

4. Malignancy -- Nothing specific, but in secondary malignancy history of primary may be there

5. Degenerative disease

   - Family history is significant
   - Exposure to toxic material, occupational or environmental

6. Epilepsy
   - Trauma during childbirth
   - Family history positive
   - Personal history of stress precipitating it
   - Past history of parasitic diseases ENT diseases

7. Vascular
   - Previous history of heart diseases, Diabetes, Hypertension
   - Previous history of smoking
   - Oral contraceptive use in females
   - Family history of vascular events

A.4 HISTORY: DYSFUNCTION

- Disturbance of function: The patient himself (or family members) reports it
- Motor involvement : Paraplegia, Hemiplegia, Quadriplegia, Diplegia, Cranial nerve involvements
- Sensory involvement: Various modalities
- Specially coordinated functions: Gait, Speech, Abnormalities of consciousness
- Epilepsy

B. GENERAL EXAMINATION

B.1 APPEARANCE AND VITAL SIGNS

- Level of consciousness can be judged objectively and graded.
- Look for -- Hypertension, Fever, Respiratory rate and abnormality of its pattern

B.2 ETIOLOGICAL SIGNS

- Other congenital anomaly/anomalies
- Macro/micro cephaly
- Other skull deformities
- Lymphadenopathy / Subcutaneous masses
- Spinal bifida
- Neurofibromata
- Meningomyelocele
- Skin lesions -- Measles, Mumps, Chicken pox etc. Café-au-lait spots, skin lesions of secondary syphilis

B.3 Grading:

- Grading of muscle power
- Grading of coma - Will be covered in CNS examination

C. SYSTEMIC EXAMINATIONS OF OTHER SYSTEMS

C.1 EVIDENCE OF ETIOLOGY

-- Tuberculosis
-- Primary tumors
-- Secondaries in bones
-- Congenital anomaly of other organs
-- Metabolic disorder of spleen an liver
-- Premature atherosclerosis
-- Diabetes, Hypertension, Heart disease
-- Teeth and ENT for pyogenic focus

C.2 EFFECT OF NERVOUS SYSTEM DISEASE ON OTHER SYSTEMS

-- Cardiac arrhythmia
-- Gastric hemorrhage

D. EXAMINATION OF NERVOUS SYSTEM

This aims to find site, sub-site and sub-sub sites of lesions. Also primary and secondary sites, e.g. Mitral stenosis with Atrial fibrillation leading to embolism and syndrome of Middle Cerebral Arterial Occlusion.

Physical examination only indirectly reveals site as what we examine is dysfunction in a highly specialized organ and dysfunction is unlikely to pinpoint the site affected. (The actual change in respiratory system, for example, a consolidated lung can be diagnosed by physical examination but except for the peripheral nerves and retina, rest of the central nervous system is enclosed in membrano-fibro-boney chamber and cannot be directly examined.)

The study of dysfunction which is the only method for assessing site of disease is divided into the higher functions and spinal functions.

In examination of those functions which do not depend upon the integrity of a single modality alone like gait, speech, consciousness, localization is less precise; but if found normal does rule out significant disease of most of the nervous system.
Cranial nerve involvement is more specific but supranuclear VII, XII & III, IV & VI can be affected through indirect mechanisms and does not necessarily indicate the brain stem as the site of disease.

- Spinal functions including:
  - UMN
    - Pyramidal
    - Extrapyramidal
  - LMN
    - Anterior Horn Cell
    - Nerve
  - Sensory
    - Lateral column
    - Posterior column
- Cerebellar
- Autonomic Nervous System

These modalities can be affected "Vertically" from cerebral cortex down to the lowest spinal segment and then along the peripheral nerve up to the myoneural junction. In this regard, localization of the vertical site is most definite if there is involvement of LMN > UMN > Sensory.

Extrapyramidal and cerebellar involvement is less helpful in localization of site. Absence of a single deep tendon reflex and wasting are really important LMN signs. Similarly, the association of a segmental or nerve distribution of sensory involvement is very helpful. UMN deficit has an indeterminate pattern. From T-1—L-1, sensory involvement may not match the site. They may also be affected horizontally (as in transeverse myelitis many modalities may be affected).

D.1 SITE LOCALISATION

A. What **higher functions** are involved? Can they help to localize the site of lesion?

- ✓ Vertical
- ✓ Horizontal
- ✓ Cranial nerve
- ✓ Specified speech & gait disorders

B. Which of the 6 spinal function is involved.(The signs of each are well known)

Is LMN involved -- Where is the wasting
-- Which particular deep reflex is lost

Is pyramidal involved
-- Deep reflex of highest root value involved gives the lowest possible location of disease but a drop level is possible and partial lesions cortex are also known to cause confusion.

Sensory involved -- lateral column upper level of involvement
-- posterior column upper level of involvement
-- Care has to be taken regarding multiple areas of loss, drop levels, skip areas, saddle anesthesia, dissociate loss of modalities, spinal versus vertebral level, difference due to secondary phenomenon (vascular) above or below the site of compression.

Sometimes the pattern of these losses and their permutation/combinations can tell us about the possible causes.

D.2 CAUSES ACCORDING TO SITE OF INVOLVEMENT

Non-selective diseases

Cranium and Vertebra
-- Multiple myeloma and secondaries
-- Osteomyelitis
-- Mastoiditis
-- Tuberculosis
-- Trauma

Meninges
-- Bacterial
-- Viral
-- Aseptic Meningitis
-- Trauma - Old minimal trauma can cause subdural hematoma
-- Meningioma of Falx, sphenoidal ridge, CP Angle

Cortex and Subcortical

-- Congenital mal development
-- Birth trauma
-- Encephalitis - Can also affect the sub-tentorial region
-- Malignancy -- Primary
-- Secondary
-- Tuberculoma (especially in the posterior-fosa)
-- Other granulomata and cysts
-- Vascular

Multiple causes -- Leading too old scars and Epilepsy

Spinal cord -- Disc,Vascular, Tumours, Infections, melitis etc.

Selective diseases (Degenerative/ Metabolic/ Herditary/Genetic)

-- Parkinsonism -- Extrapyramidal
-- Cerebellar -- Degenerative diseases
-- Pyramidal -- MND, selective vascular involvements
-- L.M.N. -- A.N.C., M.N.D. and Polio
-- Nerve -- Multiple causes
-- Post col-tabes dorsalis

Note : Degenerative diseases refer to those disease where only the clinical phenotype is known and as yet the biochemical disturbance or the chromosome/gene or heredity is not known. Metabolic is used when the underlying metabolic abnormality is known. Genetic is used when the gene/mode of inheritance has been identified

E. INVESTIGATION OF C.N.S.:

The site investigations are primarily directed towards

-- Site of lesion
-- Nature of lesion
-- Disturbance of function

E.1 SITE:

Radiology -- Plain skiagram in various views
Contrast -- Myelography
-- Carotid angiography
-- Basilar angiography
-- Ventriculography
-- Pneumoencephalography

These also tells definite structural phenomenon like atrophy of cerebral/cerebellar hemispheres.

-- CT Scan with or without contrast
-- M.R.I.

E.2 NATURE OF LESION

1. C.S.F. -- Routine
   -- Serology
   -- Smears/cultures
   -- Toxic products
   -- Special tests- trace elements, catecholomines
   -- Metabolities of fat metabolism

2. Nerve and muscle biopsy

3. Biopsy of tissue obtained at craniotomy

4. L.N. Biopsy

5. If secondaries suspected then search for primary site.

6. MRI and PET Scans

E.3 IDENTIFICATION OF PATHOPHYSIOLOGY AND MEASUREMENT OF DYSFUNCTION

1. Brain -- E.E.G.
   -- Evoked potentials

2. Peripheral Nerves
   -- N.C.V.- Motor and/or sensory

3. Myoneural Junction and Muscles
   -- E.M.G.

4. Muscle enzymes

5. C.S.F. pressure

6. MRI and PET Scans