Introduction:

Polio myelitis is an infectious disease, epidemic and endemic throughout the world caused by ultra-microscopic virus. It is transmitted by droplet infection or oral ingestion. The incubation period varies from 3 to 30 days.

Polio myelitis is a generalised disease which can be divided into three phases. (1) Initial incubation phase (occurring between the movement of infection and the definite onset of the disease), (2) The invasion phase (pre-paralytic phase) occurring between the first clinical sign of the disease and the appearance of paralysis and (3) Paralytic phase.

The paralysis is made worse by injections or exercise in the prodromal phase. The residual effects of polio are due to destruction of the anterior horn cells of the spinal cord and the brain stem.

Pathology:

Polio myelitis is a disease by which the degeneration of the anterior horn cells resulting paralysis of a lower motor neuron type. A symmetrical flaccid paralysis with normal sensation will be seen in acute condition. Usually one or two limbs are affected and the lower limbs are much more often involved than the upper limbs.
In chronic stage, the paralysed muscles show atrophy and contractions. Imbalance of muscles leads to deformities, due to the excessive pull of the stronger group of muscles. Fibrosis is the main cause for contractions in paralysed muscles. The effect of paralysis on a growing limb results in shortening of the bone due to lack of muscle pull with added vascular and neurological causes. Long standing contractions of the joint surfaces may lead to flattened, deformed and occasionally subluxed or dislocated.

Virology:

In the year 1951, A.B. Sabin isolated and identified three types of polio virus namely, type I (Brunhilde), type 2 (Lansing) and type 3 (Leon). The polio virus is an ultra microscopic virus measuring 8-12 m/u in diameter. Theiler et al. (1934), and Elford et al. (1935) have mentioned before Sabin polio virus is resistant to many physical and chemical agents and in infected stools these virus may survive months together and can be destroyed at 55°C for 30 minutes.

Modes of spread:

Polio virus is mainly spread by faecal contamination, where hygiene is poor, and by droplet infection where sanitation is good.

Mouth is the usual portal entry of polio myelitis.
Environmental factors:

Gear (1952) has found polio myelitis virus not only in faeces but under natural circumstances in urban sewage. Environment as well as season may give some support to this virus, specially in autumn and summer.

Insects:

The insects arthropods have been suspected from time to time for spreading polio myelitis. Flies, cockroaches and also so many faecal feeding species carry this virus (Gear, 1952).

Climate and Season:

Polio myelitis is also a 'time disease', summer is more favourable season for polio than winter. Melnick, J.L. (1947) and Rhodes, A.J. et al. (1950) have collected the samples of sewage for six years every month of New York city and in Toronto, Canada for a period of 12 months respectively and revealed that polio myelitis virus have been isolated in the late summer and autumn of the year but not during the rest of the seasons of the year.

Turner's serological studies (1950) in Baltimore U.S.A. revealed that during summer the children blood showed antibodies 2 type polio myelitis virus.

Gear (1952) has expressed that modern hygiene and sanitation and good standards of living shall greatly
diminish the chances of infants being infected with the virus of polio myelitis. As a result, the lack of early immunization for infections in advanced communities are liable to epidemics.

The virus can be isolated from the pharyngeal secretions for one week before and two weeks after the onset of clinical infection. It can also be isolated from the faeces, even after one month of infection. The polio virus can survive for a considerable period in the gastro intestinal tract.

**Incubation period:**

Incubation period of polio myelitis observed by Robert Debre (1955) was 40 days, and 35 days by Casey (1942).

**Clinical Diagnosis:**

In pre-paralytic stage of polio, illness is usually of vague and variable duration. It may last from few hours to few days, but one to three days is the usual duration. In some patients, it may be very severe or so mild; it is too difficult to notice and more over many patients never progress beyond this stage. First remarkable description of pre-paralytic stage, by Peabody et al. (1912) has given a great deal of attention. Later on Wright (1936), Grules et al. (1947) have mentioned the clinical symptoms of this stage in the epidemics of California (1934) and Minnesota (1947).
Importance of this stage is that, exercise, injections, operations like tonsilectomy, appendectomy etc. may precipitate severe paralysis in the limbs exercised or traumatized.

**Signs and symptoms:**

1. Head-ache and malaise.
2. Sore throat and infection of upper respiratory tract.
4. Diarrohoea or constipation.
6. Fever with variable duration and severity.
7. Mild neck stiff.

**Paralytic stage:**

Signs and symptoms of this paralytic stage are very variable in both duration and severity. The common signs and symptoms are as follows:

1. **Peripheral Paralysis**

   To reach its maximum symptoms, it may take from few hours to three days and affect one muscle group or the entire body, i.e. arms, legs, trunk etc. It is also known as lower motor neurone type of flaccid paralysis. In addition bladder may be involved with urinary retention which always improves.
2. **BULBAR PARALYSIS**

The most important sign of the Bulbar paralysis is the inability to swallow due to pharyngeal paralysis. Sometimes, patients cannot swallow their own saliva. As a result, the patient may drown in his own secretion. Due to paralysis of the larynx, the patient cannot cough properly and also experiences difficulty in speaking due to paralysis of palats.

3. **RESPIRATORY PARALYSIS**

This may be caused by involvement of respiratory centre, intercostal muscles and diaphragm. Involvement of respiratory centre is very rare. In this, stopping of respiration for a few seconds at a time and irregularity of breathing may be seen. Paralysis of intercostal muscles may be asymmetrical and may be complete or incomplete. If respiratory system is involved the signs include breathlessness, suffocation, slight cyanosis etc.

4. **POLIO ENCEPHALITIS**

This type is very rare and is usually associated with bulbar paralysis. Always all facial muscles will be affected with mental disturbances and even coma may occur. In some cases muscles are very painful and tender. The back and limb muscles which are not paralysed are both tender and spasm.
Laboratory diagnosis:

The laboratory diagnosis can give comparatively little help in polio myelitis except to confirm the diagnosis.

The important laboratory investigations are as follows:

1) **E.S.R.** : Slight or moderate increase of the E.S.R. will be seen in polio.

2) **White blood count** : Slight or moderate leucocytosis may be seen.

3) **Cerebrospinal fluid** : Cerebrospinal fluid is normal in the pre-paralytic phase whereas in paralytic phase there is often raised pressure with an increase of neutrophils and proteins.

4) **Culture of the polio virus** :-

   **Throat** : It may be cultured from the throat one week before and one week after the onset of paralysis.

   **Faeces** : Cultured from faeces even after one month or even some times longer periods.

Differential diagnosis:

**Acute polio myelitis** :

In the pre-paralytic stage the diagnosis can be confirmed by culture of the virus. The important differential
diagnosis in the paralytic and pseudo paralytic stages are as follows:

1. **Acute infective polyneuritis**:

   Some times acute infective polyneuritis may be confused with polio myelitis. In polyneuritis, the paralysis is symmetrical and affects all the four limbs and trunk associated with sensory loss. Cerebro spinal fluid shows high protein content but no cells. Usually acute infective polyneuritis is recovered completely.

2. **Meningitis and Encephalitis**:

   Polio encephalitis is very rare and meningitis can be differentiated from lumber puncture. Without laboratory help it is very difficult to diagnose virus encephalitis. Neck pain is common in polio, flaccid paralysis also occurs in polio myelitis but not in meningitis or encephalitis.

3. **Pseudo paralysis**:

   Arthritis, osteomyelitis and trauma in children may cause apparent paralysis of a limb due to the child's unwillingness to move it. A thorough clinical examination can be ruled out very easily.

**CHRONIC POLIOMYELITIS**

**Spinal condition**:

The back should always be examined in all paralysis cases for differential diagnosis of polio myelitis.
Tuberculosis and infection of spine may cause either a spastic or flaccid paralysis of limbs and usually we will get Kyphosis as well as sensory and bladder disturbances. In Transverse myelitis, the spastic type of paralysis is usually caused with sensory loss.

Spastic hemiplegia and diplegia usually give the history from birth or in some cases from early childhood. In most cases either left side or right side limbs are involved, but some times even all the limbs or one limb may be paralysed. To some extent, the child is usually affected mentally but not always. The limbs are always spastic and muscles look normal. Contractures are usually much less than in polio which is not treated.

\textbf{Deformities :}

In polio myelitis, initial cause of deformities may be due to muscle spasm followed by interstitial fibrosis. The exact cause of muscle spasm is unknown. However, basically we presume that may be due to incoordinated involuntary contractions of surviving fibres in partly paralysed muscle.

In acute polio the important cause of deformities in muscle spasm whereas the growth of the limb is most important factor in almost all deformities in chronic polio. Therefore, the deformities are much worst in children than in the adults.
The important deformities which are seen in Polio myelitis at the chronic stage are as follows:

1) **Hip deformities**:

Hip deformities in Polio consists usually of a flexion-adduction deformity due to weakness of abduction and expansions. Some times abduction deformity may lead to subluxation or dislocation of the hip.

2) **Knee deformities**:

Flexion deformity is the most commonest in knee due to imbalance between flexors and extensors. Mild valgus deformity in knee is also common in Polio. Genu recurvatum, which is caused by the lateral rotation of the tibia as the femur, and lateral subluxation of the knee. This deformity is more often due to early weight bearing on weak knee.

3) **Ankle deformities**:

Equinus deformity is the most commonest in ankle due to weak dorsiflexors and a relatively stronger calf muscles.

Valgus deformity and Varus deformity are due to imbalance of invertors and evertors.

Cavus foot is due to weak intrinsic muscles and strong flexors of the toes. Due to weak calf muscles calcaneal deformity may occur, but this is not common.
A short leg, or a flexed hip, knee, or ankle may cause the pelvis to tilt and a compensatory scoliosis may develop in the spine. If it is not treated severe scoliosis associated with apparent kyphosis may occur.

**Prophylactic measures**

There are two main types of vaccines: Salk, a killed vaccine given by injection and Sabin, a live attenuated vaccine given by mouth. In recent years, it has been shown that the live attenuated vaccine is not only much cheaper but also extremely safest and the chances of causing paralysis are less than one in million.

The vaccine can be stored for several weeks in a refrigerator between +2°C and +10°C. The vaccine can be transported in ordinary 'picnic' cold bags with cold packs or tins.

**Dose:**

Three drops of vaccine should be given with plastic dropper. Dosage should start at the age of two to three months and three doses are given at approximately 4-6 week intervals. A booster dose at the age of 18 months and another at the school entry is advisable. At present, instead of 3 doses at the beginning, many doctors give 5 doses.