

# **POLIOMYELITIS**

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## **SYNOPSIS:**

- ❑ Definition
- ❑ Epidemiology
- ❑ Etiology
- ❑ Pathophysiology
- ❑ Stages of Poliomyelitis
- ❑ Clinical Manifestation
- ❑ Diagnosis
- ❑ Differential Diagnosis
- ❑ Medical Management

# DEFINITION

The term is derived from the Greek, **polio** meaning “**grey**”, **myelon** referring to the “**spinal cord**”, and **itis**, denotes **inflammation**.

Poliomyelitis (polio) is a **highly infectious viral disease** that largely affects **children under 5 years of age**. The virus is **transmitted by person-to-person** spread mainly through the **faecal-oral route** or, less frequently, by a common vehicle (e.g. **contaminated water or food**) and multiplies in the intestine, from where it can **invade the nervous system and cause paralysis**.

It is primarily an infection of the alimentary tract and causes an episode of **diarrhea** but in some cases the virus may affect the anterior horn cells of the spinal cord and the brain stem leading to **flaccid paralysis with sensation intact**.

The **lower limb** and that to **extensor group of muscles are affected** more than the upper limb. In severe cases the **respiratory muscles** are involved.

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# EPIDEMIOLOGY

- One in 200 infections leads to irreversible paralysis. Among those paralysed, 5–10% die when their breathing muscles become immobilized.
- Cases due to wild poliovirus have decreased by over 99% since 1988, from an estimated 3,50,000 cases then, to 6 reported cases in 2021.
- India reported its last polio case in West Bengal on 13th January, 2011.

# ETIOLOGY

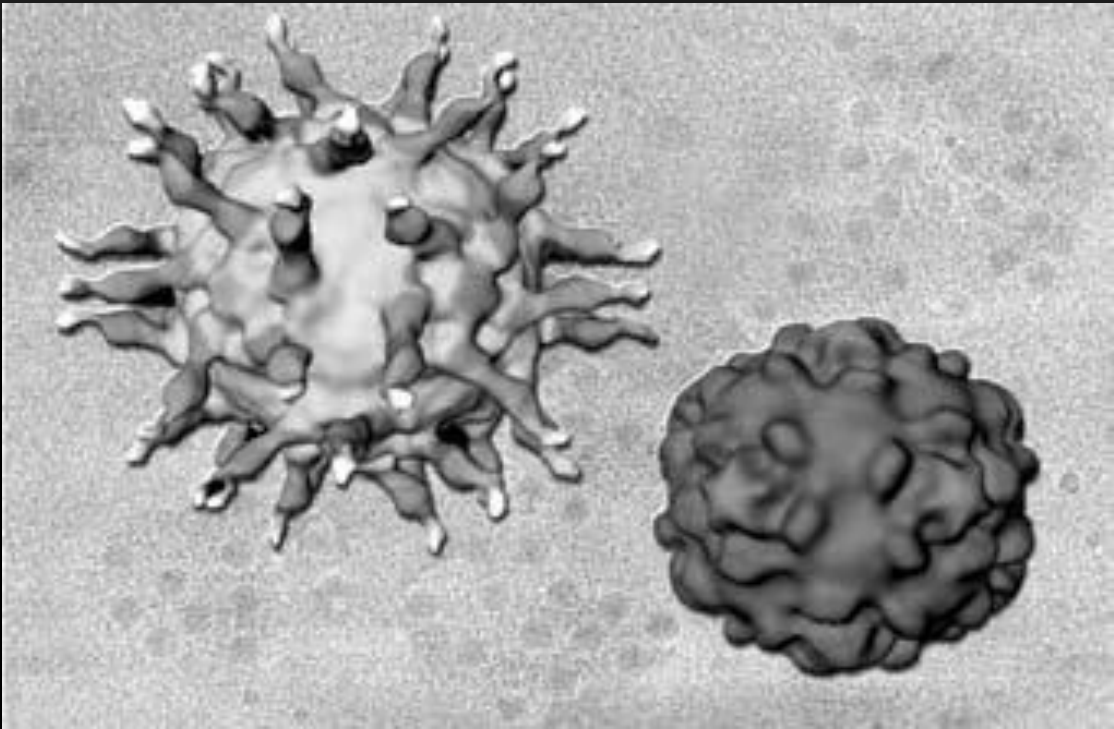
## CAUSATIVE AGENT:

The causative agent of polio is the **poliovirus** which has three serotypes 1, 2 and 3 namely:

- Type 1: Brunchilde
- Type 2: Leon
- Type 3: Lansing

**Mostly paralytic polio** is caused by **type-1 virus**.

Polio virus can survive in the external environment, commonly in cold weather 4 months in water and 6 months in feces.





## **AGE OF ONSET:**

In India polio is the disease of infancy and childhood. About 50 percentage of cases are reported in infancy, between **6 months and 3 years**.

## **SEX AFFECTED MOST:**

It is usually in the ratio of **3 males to 1 female**.

## **INCUBATION PERIOD:**

It is usually **7 to 14 days**.

## **ENVIRONMENTAL FACTOR:**

Polio is most likely to occur during the rainy season. In India June to September is the month in which about 60 percent of cases are reported of polio.

The environmental sources of infection are contaminated water, food and flies. Polio virus survive for a long time in a cold environment.

Also overcrowding and poor sanitation provide exposure to infection.

## **MODE OF TRANSMISSION:**

Polio is transmitted mainly by two routes:

*Fecal-oral route:* This is the main route of infection. The infection may spread directly through contaminated fingers where the hygiene is poor or indirectly through contaminated water, milk, food, flies.

*Droplet infection:* This usually occurs in the acute phase of disease when the virus occurs in the throat. Close personal contact with the infected person may facilitate droplet spread.

## **RISK FACTORS**

Factors that increase the risk of polio infection include:

- Immune deficiency,

- Malnutrition,

- Tonsillectomy.

- Although the virus can cross the placenta during pregnancy.

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# PATHOPHYSIOLOGY

Virus enters the body through feco-oral route



Reaches digestive tract and attaches to the specific receptors



Replicates in the intestinal mucosa



Enters into the blood streams



Virus enters into the nervous system through blood circulation



Spreads along with the axons of the peripheral nerves to the CNS



Progress along with the fibers of motor neuron of brain and spinal cord



Destroys the anterior horn cells of spinal cord



Nerve cell death results in failure of contraction of the  
muscles



Muscle dysfunction results in paralysis of muscle of the  
extremity (In some cases it may affects the respiratory  
muscle and leads to death)



Virus may excreted through feces of affected person and  
leads to further contamination and spread

# STAGES OF POLIOMYELITIS

According to the severity of the disease, poliomyelitis can be divided into three phases:

1. Acute Phase
2. Convalescent or recovery phase
3. Chronic or Residual phase

## **1. Acute Phase:**

During this phase the child is restless and irritable due to pain and muscular tenderness together with spasm, joints are also involved.



General malaise, headache and bowel upset may be present with low grade fever and sore throat. In this phase of the disease, the involvement of brain is very little, almost absent.

## **2. Convalescent or recovery phase:**

This phase follows the acute phase, where the damage to the neurons is less resulting either in spontaneous recovery of the affected muscles or causes various degree of paralysis.

### **3. Chronic of Residual phase:**

This is the phase where there is no hope of recovery. Damage is done to the anterior horn cell of spinal cord or the brain stem leading to paralysis ranging from minimal degree to complete paralysis. Usually lower limb is affected more than the upper limb.

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# TYPES OF PARALYTIC POLIO

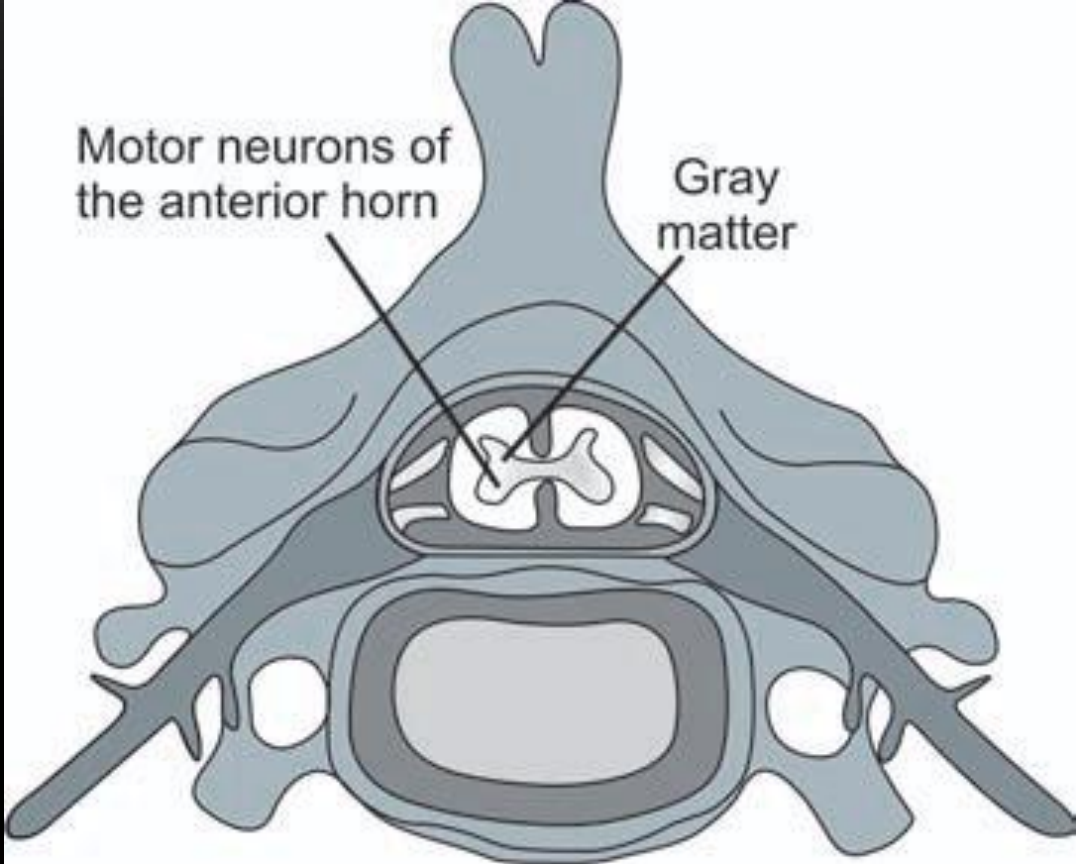
## SPINAL POLIO:

Spinal polio is the most common form of paralytic poliomyelitis, it occurs due to viral infection of the **motor neurons of the anterior horn cells**, or the **ventral (front) grey matter section in the spinal column**, which causes movements of the muscles, including those of the trunk, limbs and the intercostal muscles.

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Virus invasion causes inflammation of the nerve cells which lead to damage or destruction of motor neuron ganglia. The clinical features of spinal polio is as follows:

- Fever
  - Myalgia
  - Muscle weakness and atrophy
  - Poor muscular control
  - Diminished or absent of DTR
  - Normal sensation in paralyzed extremity
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## **BULBAR POLIO:**

Comprising about 2 percent of cases of paralytic polio, bulbar polio occurs when poliovirus invades and destroys nerves within the **bulbar region of the brain stem**.

The bulbar region is a white matter pathway that connects the cerebral cortex to the brain stem. The destruction of these nerves weakens the muscles supplied by the cranial nerves, producing symptoms of encephalitis, and causes difficulty in breathing, speaking and swallowing.

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The signs and symptoms includes:

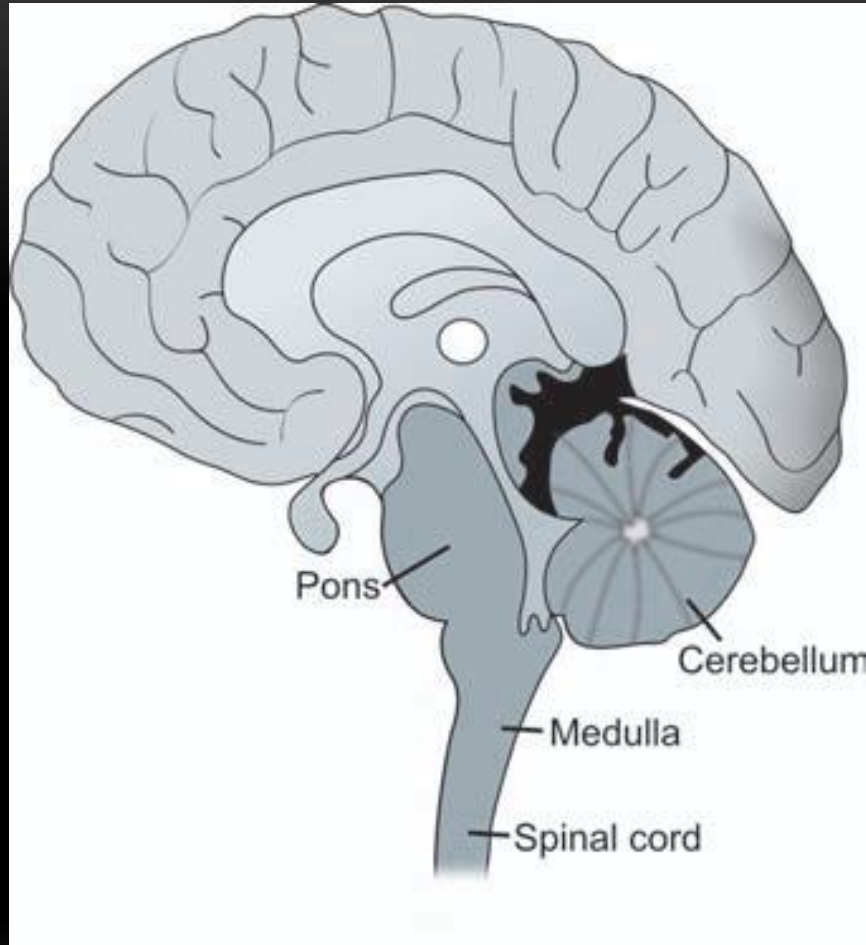
- Facial weakness, caused by destruction of the trigeminal nerve and facial nerve, which innervate the cheeks, tear ducts, gums, and muscles of the face.

- Double vision;

- Difficulty in chewing;

- Abnormal respiratory rate, depth, and rhythm, which may lead to respiratory arrest.

- Pulmonary edema and shock.





## **BULBOSPINAL POLIO:**

Approximately 19 percent of all paralytic polio cases have both bulbar and spinal symptoms; this subtype is called respiratory polio or bulbospinal polio. Here the virus affects the upper part of the cervical spinal cord (C3 through C5), and paralysis of the diaphragm occurs.

The critical nerves affected are the phrenic nerve, which drives the diaphragm to inflate the lungs.

# CLINICAL MANIFESTATION

## ○ MINOR ILLNESS

This is seen in 4 to 8 percent of polio infection.

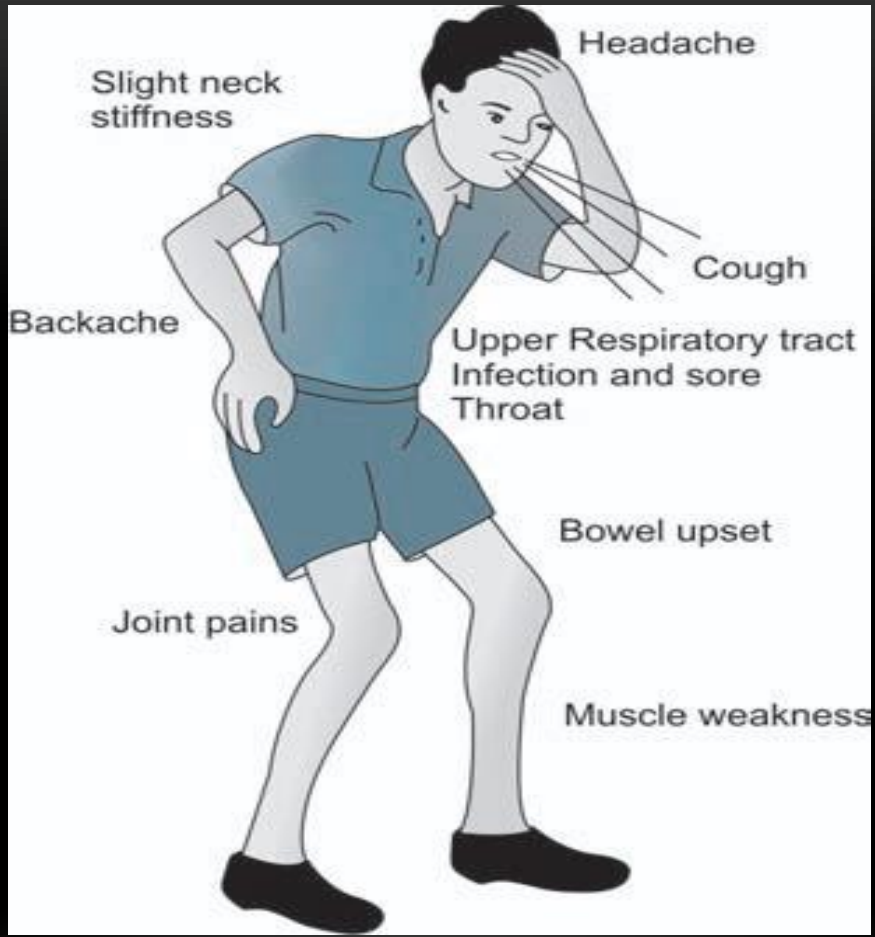
Minor symptoms include:

- Sore throat
- Malaise
- Headache
- Gastrointestinal upset (diarrhea)
- Low grade fever
- Muscular pain and tenderness

## ○ **NON-PARALYTIC POLIO**

Occurs in only 2 to 3 percent cases of polio. Here the damaged neurons undergo regeneration and the recovery occurs. The symptoms include:

- Stiffness, pain in neck & back
  - High grade fever
  - Muscle weakness
  - Upper respiratory tract infection
  - Diarrhea or constipation
  - Malaise
  - Nausea
  - Vomiting
  - Joint pain
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Headache

Slight neck stiffness

Cough

Backache

Upper Respiratory tract Infection and sore Throat

Bowel upset

Joint pains

Muscle weakness

## ○ **PARALYTIC POLIO:**

Occurs in less than 1 percent cases. Here the virus enters the central nervous system and spreads along certain nerve fiber pathways, preferentially replicating in and destroying motor neurons within the spinal cord, brain stem, or motor cortex.

The sign and symptoms vary according to the duration and severity. It include –

- Asymmetrical flaccid paralysis

- Associated symptoms include: Malaise, Anorexia, Nausea, Vomiting, Headache, Sore throat, Constipation, Abdominal pain

- There is meningeal irritation i.e. stiffness of neck and back muscles

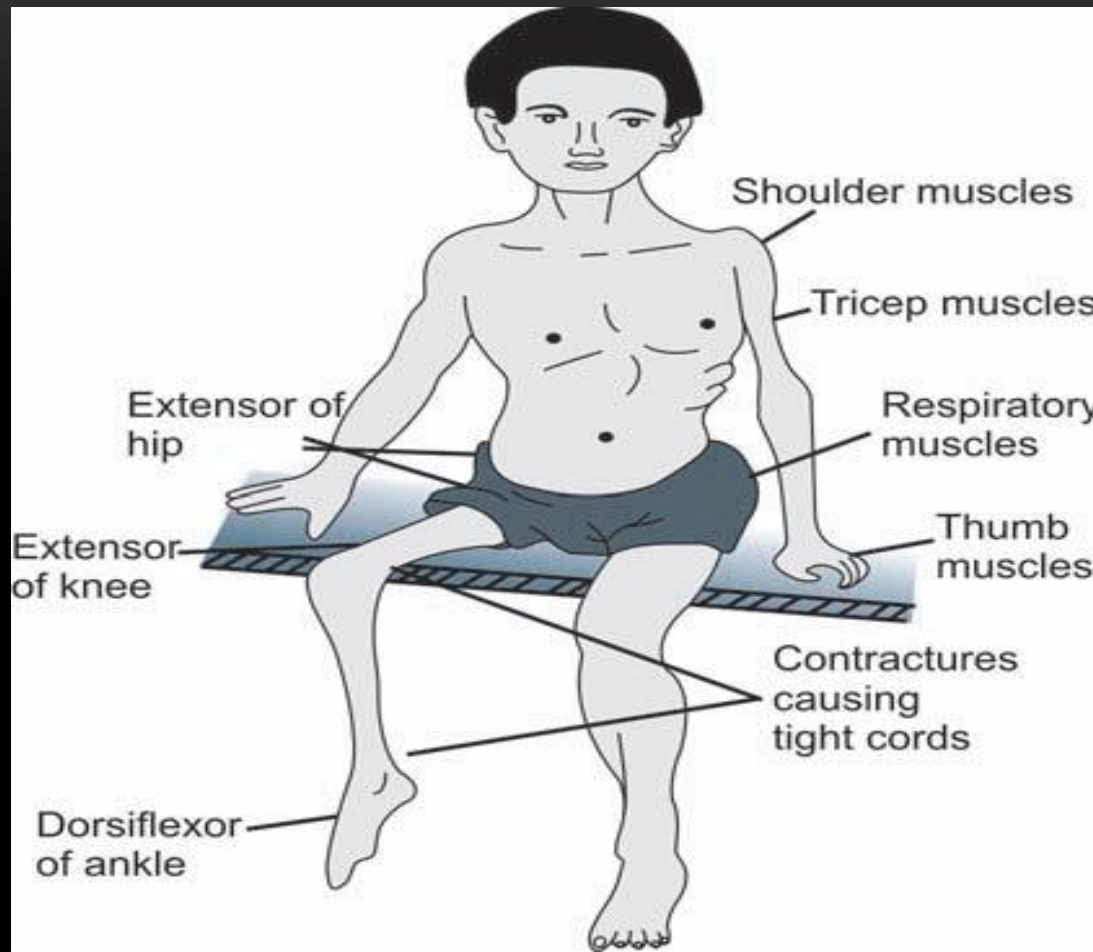
- Tripod sign is the peculiar feature of polio i.e, the child finds difficulty in sitting and sits by supporting hands at the back and by partially flexing the hips and knees

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- Paralysis in polio is characterized as descending i.e, starting at the hip and then moving down to the distal parts of the extremity

- There is loss of Deep Tendon Reflexes whereas the sensation is intact.

- Facial asymmetry,
  - Difficulty in swallowing,
  - Respiratory insufficiency
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# Peculiar Features seen in Polio

## IN THE EARLY STAGE:

The typical features seen in this stage are:

- The involvement of the affected muscle is asymmetrical
- It occurs commonly in the lower limbs
- The muscle affected most is the quadriceps, although in some cases it is partially paralysed

- The muscle which goes into complete paralysis is Tibialis anterior

- The muscle of the hand affected most is the Opponens pollicis

- Motor paralysis is not associated with sensory loss

- If motor neurons of the medulla are affected, it results in Bulbo-spinal polio which is the life threatening polio. It involves respiratory and cardiovascular centers and may cause death.

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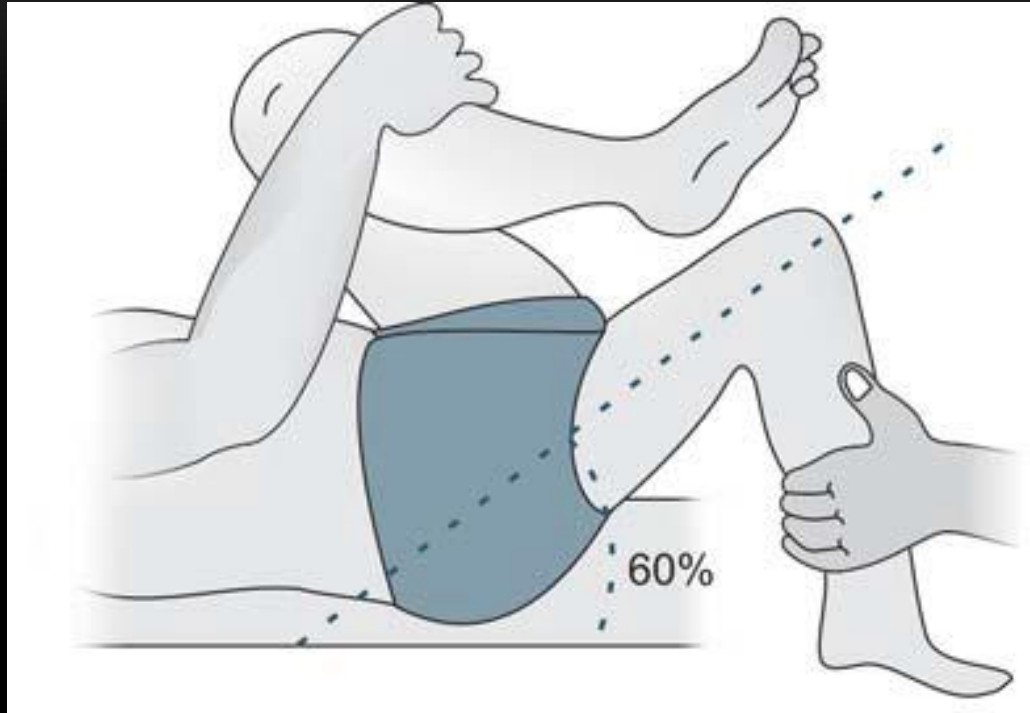
## **IN THE LATER STAGE:**

Polio at the later stage involves various deformities:

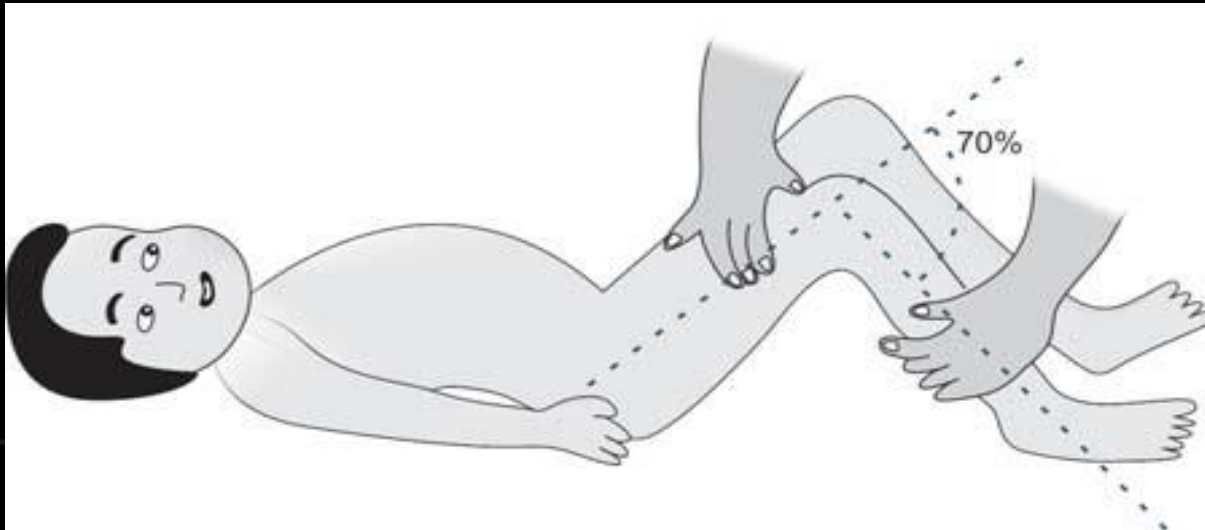
1. Hip is in flexion, abduction and external rotation:

This is due to weakness of the extensors, adductors and internal rotator muscles of the hip. In some cases adduction deformity is also seen in the form of flail hip, leading to subsequent subluxation or dislocation of the hip.

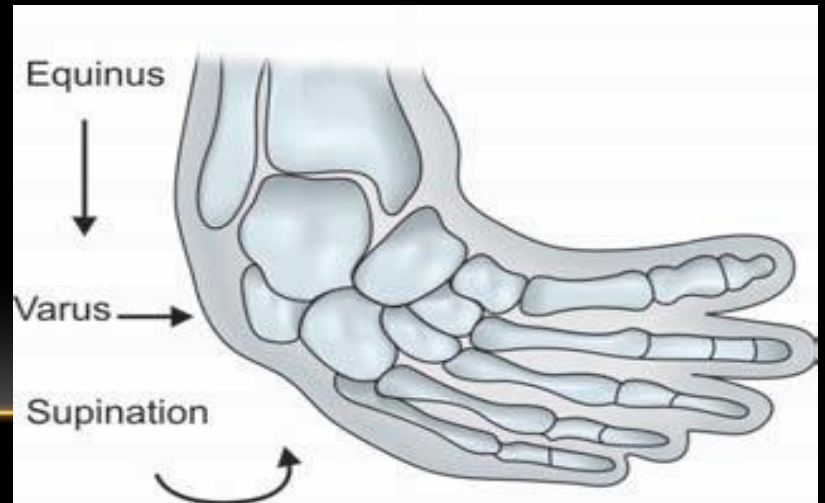
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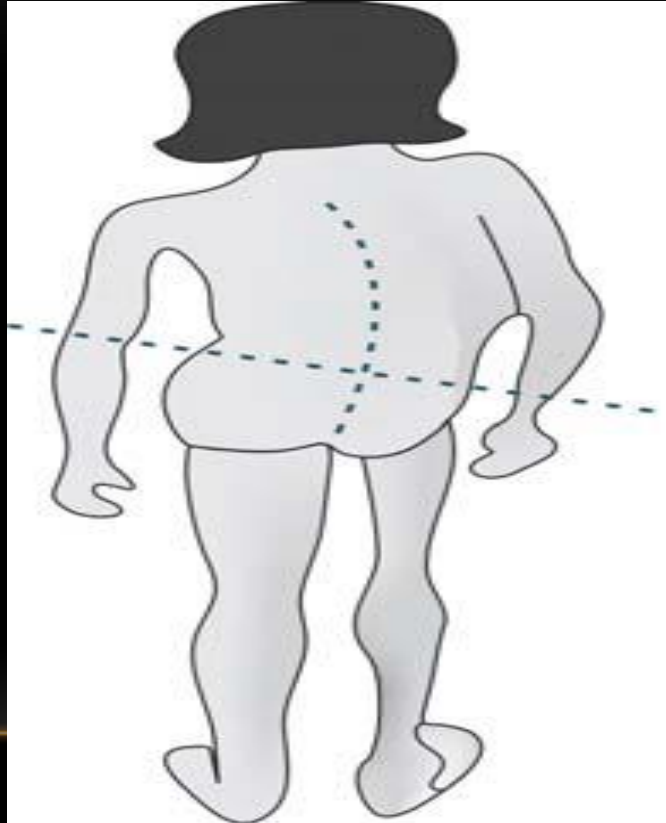
2. In knee common deformity seen is flexion deformity. Second common deformity of the knee is valgus deformity which is due to paralysis of semitendinosus and semi-membranosus. Next common deformity of the knee is the Genu-recurvatum.



3. In ankle, the commonest deformity is the equinus deformity which is due to weakness of dorsiflexors and the stronger calf muscles. Valgus deformity is associated with equinus. In some cases even cavus deformity of the foot is also seen due to weakness of the intrinsic muscles and strong flexors of the toes.



4. Pelvic tilting and compensatory scoliosis may develop in the spine.



# DIAGNOSIS

## ❑ **Viral Cultures:**

Presence of virus in specimens from pharynx, stool in patient with suspected poliomyelitis infection

## ❑ **IG titers:**

4 fold increase in the immunoglobulin G (IgG) antibody titers or a positive anti-immunoglobulin M (IgM).

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## □ CSF Examination:

- Increased number of white blood cells (10 to 200 cells/mm<sup>3</sup>, primarily lymphocytes).
  - Mildly elevated protein from 40 to 50 mg/100 ml.
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# DIFFERENTIAL DIAGNOSIS

- Cerebral Palsy
- Muscular Dystrophy
- Erb's Palsy
- Spina Bifida
- SCI
- TB Spine
- GBS

# PROGNOSIS

30% recover completely within few weeks or months



30% have mild paralysis



30% have moderate or severe paralysis



10% die (often because of difficulty breathing or swallowing)



# MANAGEMENT

## ❖ **Pharmacological treatment:**

No antiviral agents are effective against poliovirus.

## ❖ **Vaccination:**

Two type of vaccine used are:

- Inactivated (Salk) polio vaccine
- Oral (Sabin) polio vaccine

## **Salk Vaccine:**

This vaccine contains all the three types of polio virus which is inactivated by formalin. The primary dose of immunization consist of 4 inoculations.

The first three doses are given at the interval of 2 months and the fourth dose is given 6 to 12 months after the first dose.

Then additional doses are given before the child enters the school, also repeated in every 5 years until he is at the age of 18.

## **Sabin Vaccine:**

OPV or sabin vaccine is given to all the children under the age of 5. The dose is in the form of 3 drops.

## **Age-Vaccine:**

- At birth - BCG and OPV - 0 dose
- At 6 weeks - DPT 1 and OPV 1
- At 10 weeks - DPT 2 and OPV 2
- At 14 weeks - DPT 3 and OPV 3
- At 18 months - DPT and OPV boosters

## ❖ SURGICAL TREATMENT

When the paralysis due to polio virus is severe and had resulted in various forms of deformities, surgical procedures are necessary to correct and prevent the deformity.

- Tendon transplantation
- Release of contracture (Fasciotomy, Myotomy, tenotomy, Capsulotomy)
- Z – Plasty (Tendon lengthening)
- Osteotomy, arthrodesis