Polioviruses, Poliomyelitis - Dr. Bakr

- Poliovirus is RNA virus belonging to the Picornaviriae family in the genus Enterovirus.
- There are 3 distinct serotypes 1, 2, 3.
- The polioviruses are extremely hard and can retain infectivity for several days at room temperature.
- Human are the only known reservoir.
- Route of transmission is feco-oral.
- Poliovirus has been isolated from feces for >2wk before paralysis to several weeks after the onset of symptoms.

PATHOGENESIS

- The wild type and vaccine strains of virus gain host entry via the GIT. The primary site of viral replication is the M cells lining the mucosa of small intestine, regional lymph nodes are involved and primary viremia occur within 2-3 days.
- The virus seeds multiple sites including the reticuloendothelial system, skeletal muscle, and the wild type access the CNS via the peripheral nerves, but the vaccine strains do not replicate in the CNS, which accounts for the safety of the life attenuated vaccine.
- Occasionally revertants of the vaccine strains occur and develop a neurovirulent phenotype and causes vaccine-associated paralytic poliomyelitis (VAPP).
- Enormous viral replication occur in the reticuloendothelial system occur which leads to secondary viremia.
- The exact mechanism of entry into the CNS is not known, but probably the virus gain entry via the peripheral nerves.
- The polio virus primarily infects motor neuron cells in the spinal cord (the anterior horn cells) and the medulla oblongata.
- Involvement of the reticular formation have catastrophic outcome because it contain vital centers that control respiration and cardiovascular system.

CLINICAL MANIFESTATION

- Infants in the first 4-6 months of life are protected due to transplacental transport of maternal antibodies.
- Active immunity after natural infection is lifelong but protects against the causative serotypes only, infections with other serotypes is possible.
- The incubation period is 8-12 days.
- Infection with wild poliovirus may follow one of several course.

1. **Inapparent infection:**
   - Which occur in 90-95% of cases and causes no disease and no sequelae provide immunity.
2. **Abortive poliomyelitis:**
   - In about 5% of patients a nonspecific influenza-like syndrome occurs 1-2wk after infection there is sore throat, fever, headache, nausea, vomiting with stiffness of posterior muscles of neck, back and limbs. Recovery is complete, and no neurological signs or sequelae occur.
3. **Nonparalytic poliomyelitis:**
   - In about 1% of patients infected with wild poliovirus signs of abortive poliomyelitis present but more severe, paralysis of bladder and constipation are frequent with signs of CNS involvement like nuchal and spinal rigidity, superficial and deep reflexes are diminished.
4. **Paralytic poliomyelitis:**
   - Paralytic poliomyelitis occur in about 0.1% of persons infected with poliovirus, causing 3 clinically recognized syndromes according to the portion of CNS that most severely involved:
a) Spinal paralytic poliomyelitis:
   - Starts with features of abortive poliomyelitis then appears to recover and feels better for 2-5 days, after which severe headache and fever occur with severe muscle pain.
   - Within 1-2 days asymmetric flaccid paralysis or paresis occurs. Involvement of one leg is most common followed by involvement of one arm. Proximal weakness is more than distal. Paralysis of lower limbs is often accompanied by bowel and bladder dysfunction. In developing countries history of intramuscular injections precedes paralytic poliomyelitis in about 50-60% of patients.
   - Once the temperature return to normal progression of paralytic manifestation stops. The return of strength and reflexes is slow and may continue to improve as long as 6 months after the acute disease. Atrophy of the limb and deformity occur in those with permanent paralysis.

b) Bulbar poliomyelitis:
   - May occur as a clinical entity without involvement of spinal cord, or rarely occur as an ascending paralysis from initial involvement of the lower extremities. Clinically there are manifestations of dysfunctions of the cranial nerves and medullary center like: nasal speech, inability to swallow, absent of effective coughing, nasal regurgitation, and deviation of the palate, uvula or tongue, vocal cord paralysis, irregular respiration with cardiovascular alteration as hypertension.
   - The course of bulbar disease is variable some patients die as result of extensive, severe involvement of the various centers in the medulla, others recover partially but require ongoing respiratory support, and others recover completely.

c) Polioencephalitis:
   - It is a rare form of poliomyelitis in which there is involvement of higher centers of the brain clinically there are seizure, coma, irritability, disorientation and spastic paralysis with increased reflexes.
   - The manifestations are common to encephalitis of any causes and can only be attributed to poliomyelitis by specific viral diagnosis or if accompanied by flaccid paralysis.

POLIOMYELITIS WITH VENTILATORY INSUFFICIENCY

- Ventilatory insufficiency in patient with polio results from several components acting together resulting in hypoxia and hypercapnia.
- Because respiratory insufficiency may develop rapidly, close continued clinical evaluation is essential.
- The cause of respiratory insufficiency is either because of weakness of respiratory muscles mainly diaphragm and intercostal muscles or because of involvement of cranial nerves and vital centers, involvement of 9th, 10th, and 12th cranial nerves results in paralysis of the pharynx, tongue, and larynx with consequent airway obstruction.
- The clinical finding associated with involvement of the respiratory muscles include: anxiety, inability to speak with frequent pauses, increased respiratory rate, movement of alae nasi and accessory muscle of respiration, paradoxical movement of abdomen.

DIAGNOSIS

- Poliomyelitis should be considered in any unimmunized or incompletely immunized child with paralysis.
- VAPP should be considered in any child with paralysis occurring 7-14 days after receiving the orally administered polio vaccine, but it can occur at later time after administration and should be considered in countries in which wild-type viruses has been eradicated.
- The WHO recommends that the laboratory diagnosis of poliomyelitis be confirmed by isolation and identification of poliovirus in the stool, with specific identification of wild-type and vaccine-type strains. In suspected cases of acute flaccid paralysis 2 stool specimens should be collected 24-48 hr. apart, as soon as possible.
- Serological test: demonstrate a seroconversion or a 4 fold or greater increase in antibody titers 3-6 wk. later.
- CSF analysis: in patient with CNS involvement there is pleocytosis in the early stages, and return to normal by second week, in contrast CSF protein initially is normal and increase to 50-100mg/dl in the second week of illness.
DIFFERENTIAL DIAGNOSIS

- There are many other causes of acute flaccid paralysis:
  2. Guillain-Barre syndrome.
  3. Acute traumatic sciatic neuritis.
  5. Spinal cord compression, trauma, epidural abscess.
  6. Neuropathies like diphtheria, botulism, tick bite.
  7. Myasthenia gravis.
  8. Viral myositis.

TREATMENT

- There is no specific antiviral treatment for poliomyelitis. The management is supportive.
- All intramuscular injections and surgical procedure are contraindicated in the first week, because these may result in progression of disease.
- Patient with paralytic form require hospitalization with complete physical rest in a calm atmosphere for 2-3 weeks.
- Suitable body alignment is necessary for comfort and to avoid skeletal deformities.
- Active and passive movement are indicated as soon as the pain has disappeared.
- Close monitoring of respiratory, cardiovascular GIT and urinary system is critical with interference when indicated.
- An orthopedist and physiotherapist should see these patients as soon as possible.
- Analgesia is indicated in cases of myalgia or headache.
- Mechanical ventilation is often needed in patients with bulbar paralysis.
- Tracheostomy care is often needed in patients who require long-term ventilatory support.

COMPLICATIONS

1. GIT complications like acute gastric dilatations GIT bleeding, perforation rarely may occur.
2. Cardiovascular: hypertension, pulmonary edema and arrhythmia may occur.
3. Hypercalcemia with nephrocalcinosis.

PREVENTION

- Vaccination is the only effective method of prevention.
- Two types of vaccine is available inactivated polio vaccine (IPV) which is giving by intramuscular injection, and live attenuated vaccine (OPV), which is giving by oral rout.
- Both vaccines induce production of antibodies against the 3 strains of poliovirus.
- IPV has no adverse effects, but OPV may cause VAPP, the overall risk is 1 case /6.2 million doses.
- Transmission to IPV in developed countries with high rates of immunization coverage is encouraged.