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REVIEW ARTICLE

POLIOMYELITIS*

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Poliomyelitis is an acute viral infection, the virus having a predilection for the grey matter of the spinal cord and brain-stem, damage to which explains the paralysis of muscles observed in this disease.

Etiology

The virus of poliomyelitis is one of the smallest viruses, the size ranging from 8-30 millimicrons in diameter. Three serologically distinct types have been described, type I (Brunchilde) type II (Lansing) and type III (Leon). In India, type I infection is believed to be commoner than others.

Epidemiology

Poliomyelitis is a widely distributed infection, once prevalent all over the world. It is endemic in India with occasional outbreaks in some places. The old nomenclature for this disease 'infantile paralysis' still holds true for India and by far the majority of cases are seen under the age of six years. The disease occurs throughout the year but shows a higher incidence between May to September.

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Pathogenesis and Pathology

The disease is mainly transmitted by healthy carriers of infected contacts. People with inapparent infection are believed to be specially important in this regard. The virus can be demonstrated in the faeces for a few weeks, and as in enteric fever, the oral-faecal circuit is believed to be the common mode of transmission. The virus multiplies in the tonsillo-pharyngeal tissues and the intestinal tract, and then passes into the blood stream. After a phase of viremia, the virus tends to become localised in the grey matter of the central nervous system. The anterior horn cells in the spinal cord and the brain-stem nuclei in severe cases undergo chromatolysis and destruction resulting in paralysis of the muscles supplied by them. The grey matter as a whole is congested and there is a perivascular cuffing with polymorphs and lymphocytes. Motor neurones which are affected by edema rapidly regain their function.

Clinical Features

The incubation period of the disease is usually 7-14 days. The infection by the virus of poliomyelitis may

assume one of the following presentations.

Inapparent infection

By far the majority (approximately 95 per cent) develop this type which can only be diagnosed by the recovery of virus from the stools or the demonstration of serum antibody. It is likely that most of the adult population in India have had this type of infection in childhood.

Abortive poliomyelitis

Clinical manifestations of this type include fever, sore throat, headache, malaise, nausea, vomiting, anorexia generalized pains in the muscles and joints. Clinically this type is often passed off as "influenza." The diagnosis rests upon the isolation of the virus and demonstration of a progressive rise in the type-specific neutralising and complement-fixing antibodies.

Non-paralytic poliomyelitis

In this type, the symptomatology is more severe than that in the abortive type and there are, in addition, definite manifestations of involvement of the central nervous system such as stiffness of the neck and back, positive Kernig's and Brudzinski's signs, C.S.F. changes such as an increase in cell count and proteins. The cells may vary from 100 to over 500 per cmm. In the early stages, a majority of the cells may be neutrophils and with the progress of illness, the cell count falls and lymphocytes dominate.

Paralytic poliomyelitis

Paralysis is the major event in this type. Three phases have been described in the development of paralysis in poliomyelitis.

Incubation phase. Minor symptoms such as transient fever, sore throat, nausea, vomiting, constipation, etc, may be noticed in this phase.

Invasive phase or major illness. Fever is almost a constant symptom and lasts usually less than a week. Often it is accompanied by vomiting, headache, restlessness and muscle pains. Stiffness and pain in the back and neck are fairly common. Tendon reflexes are normal or rather brisk in this phase.

Paralytic phase. The onset of paralysis is usually abrupt. Sometimes the paralysis may be the first symptom. All the muscles are usually affected simultaneously. The general symptomatology including fever may persist for a few days even after the onset of paralysis. The meningeal symptoms disappear within a few days. Retention of urine if present does not last for more than a week. Clinically, paralytic poliomyelitis may be described as being one of the following types—spinal type, brain-stem or bulbar type, encephalitic type and a combination of them.

Spinal type of paralytic poliomyelitis.

This is the commonest type. Any one or all of the four limbs may be affected with or without involvement of the abdominal or spinal muscles. The lower limbs are more frequently affected than the upper. The paralysis is of the lower motor neurone type characterized by flaccidity, loss or decrease of deep reflexes and an absence of sensory changes. Vasomotor disturbances such as a change of temperature and colour and some amount of swelling of the affected part may be present. Characteristically, the distribution of paralysis in

poliomyelitis is asymmetrical and patchy. Almost all the patients show features of improvement and a variable recovery is the rule.

Paralysis of the respiratory muscles such as the intercostals, diaphragm and the abdominal muscles causes difficulty in breathing and requires skilled management in well-equipped centres.

Brain-stem or bulbar type.

This type comprises paralysis of any of the cranial nerves or of the medullary vital centres or both. The prognosis is usually good if only the upper cranial nerves are affected. The clinical findings of paralysis of the soft palate, pharynx and larynx include nasal intonation of the voice, regurgitation of fluids through the nose, inability to swallow, refusal of feeds and collection of secretions in the throat which often produces a rattling sound.

Encephalitic type (polio-encephalitis).

This type is characterised by confusion, agitation, somnolence, trembling, twitchings, restlessness and even convulsions. The diagnosis of this type should be based on the presence of the spinal or brain-stem type, C.S.F. changes and virological investigations.

Differential Diagnosis

1. *Painful conditions* causing a paralysis, e.g. osteomyelitis, rheumatic fever, scurvy, etc. A painful swelling of the big joints, specially when migratory, associated with tachycardia with or without cardiac signs, would suggest rheumatic fever. In osteomyelitis there is usually high fever, painful swelling of the bony part, subperiosteal abscess and later a sinus discharging bony spicules. In scurvy other scorbutic manifestations like spongy bleeding gums, R.B.C. in the urine, etc. are present.

2. *Conditions causing true muscular weakness.* Polyradiculo-neuropathy (Landry-Guillain-Barre-Strohl syndrome) may have to be differentiated. Usually fever, headache and meningeal symptoms are less marked and there is a characteristic albuminocytologic dissociation in the cerebrospinal fluid in polyradiculo-neuropathy. Moreover, the paralysis is usually symmetrical and sensory symptoms and signs may be present in this condition.

Polyneuritis or polyneuropathy of any other etiology should be differentiated by history, sensory disturbances and related findings.

The bulbar and encephalitic type of poliomyelitis may have to be differentiated from various other causes of encephalitis and encephalomyelitis. In encephalomyelitis complicating exanthemata, the primary cause may be evident and features of pyramidal tract involvemet would be seen.

Other central nervous system disorders such as familial periodic paralysis, myasthenia gravis and acute porphyria should also be kept in mind.

3. *Laryngeal diphtheria.* The bulbar or brain-stem type of poliomyelitis may be confused with laryngeal diphtheria. The absence of a patch over the tonsils or the pharyngeal wall would be against the diagnosis of diphtheria.

Prophylaxis

Isolation of the patients for six weeks is advisable. All excreta of the patients should be disposed off as in enteric fever.

Known contacts and children, during outbreaks of poliomyelitis, should avoid undue exertion, vigorous games, sports, etc. Tonsillectomy, dental extractions and other operative procedures should be avoided during outbreaks of poliomyelitis.

Immunisation against poliomyelitis is the best way of prevention of the disease. Oral (Sabin) live virus vaccine is cheaper, easier to administer and more effective than the parenteral Salk vaccine. The live virus colonises in the gut, increases local resistance and is excreted in the stools and thus helps to eradicate the wild virus from the community. Usually a three dosage schedule at an interval of 4-6 weeks is preferred.

When exposed to known cases, personal prophylaxis with gamma globulin may be attempted but gamma globulin is costly and may not be available.

Management

General management

In all cases immediate and complete rest in bed should be enforced as soon as poliomyelitis is suspected. Trauma of all kinds including injections should preferably be avoided. Whenever possible, a close consultation between the pediatrician, physiotherapist and the orthopaedic surgeon is highly desirable.

Treatment of uncomplicated spinal type of poliomyelitis

For the purpose of treatment, it is customary to divide the course of the disease into three stages.

1. Management in the acute stage. In addition to complete rest in bed, symptomatic relief of muscle pain and headache by aspirin, paracetamol, etc. and of restlessness by phenobarbitone is necessary. Muscle spasm may be relieved by warm compresses or dry heat. The affected limbs may be kept warm by loose woollen stockings epecially in winter. An important measure, unfortunately often neglected, is the prevention of over-stretching of the paralysed muscles and contracture of their antagonists. A neutral position with the foot at a right angle with the hips and the spine straight is ideal. In paralysis of the upper limbs, the shoulder should be kept abducted preferably at a right angle. These positions may be maintained by pillows, sand bags or light splints. Rigid splinting is to be avoided. Almost from the very beginning, active movements may be encouraged. Gentle passive movement through the full range should be practised once or twice a day. Injections of all kinds should be avoided. Towards the end of the first month, when the muscle spasm subsides, an assessment of the muscle power by the Medical Research Council method is done and active physiotherapy is started.

2. *Convalescent stage.* The improvement of muscle power and the prevention of deformities form the basis of treatment in this stage. The following simplified procedures may be adopted :—

(a) *Muscle re-education*

Active movements or assisted active movements are to be practised twice or thrice a day.

(b) *Prevention and correction of contractures and deformities*

As stated earlier, the maintenance of a neutral position of the foot by light posterior splints and gentle stretching of the tendo-achilles should prevent and correct contracture of this muscle. A flexion deformity of the knee is prevented by keeping the knee more or less straight and passive movements once or twice a day. Flexion or flexion-abduction contractures of the hip may be prevented by maintaining the lower limbs in apposition, encouraging prone lying posture and stretching, when a contracture develops. In case of affection of the spinal and trunk muscles, prolonged recumbency may be necessary to prevent deformities of the spine.

(c) *Progressive resistance exercise*

This is an extremely valuable procedure to improve the muscle power. Various equipments as the Cuthrie-smith sling suspension apparatus have been devised. One should start with the minimum weight and end with the maximum which the patient can lift. Coloured weights in different designs, encouragement, and team exercises etc. will make this a pleasant procedure for children.

(d) *Massage*

Massage with different oils has been in vogue since ancient times but a gentle massage with talcum powder in the direction of blood flow will be good enough and may be carried out once or twice a day.

(e) *Practice of walking*

The patient may be taught to start walking between parallel bars or with the help of walkers, which infuses confidence in the patient. Gradually the child may be allowed to walk without support.

(f) *Fitting of appliances*

Various appliances such as braces, corrective shoes, etc. may have to be given depending on the assessment of the muscle power and deformities in individual cases.

(g) *Electrical stimulation of paralysed muscles*

In some cases, stimulation of the paralysed muscles by a galvanic current is practised, though its role is not firmly established.

Residual stage.

This stage is mostly managed by the orthopaedic surgeons. Usually the following procedures are adopted:—

(a) Correction of contractures and deformities by surface traction, plastering, tenotomy, fasciotomy, etc.

(b) Muscle transferance. The stronger muscles of one group are transferred to improve the power of another group, e.g. transferance of hamstrings to improve the knee extensors. Post-operative physiotherapy including muscle re-eduction is essential in these cases.

(c) Operation on joints: arthrodesis of flail joints by triple arthodesis (Dunn's operation) in flail foot.

(d) Correction of limb length in equality: either by retarding the growth on the healthy side by stapling the epiphysis or stimulating the growth on the affected side by complex procedures.

Education and rehabilitation

The education of these children might pose a problem. Ideally these children should continue their studies even while in hospital. The general education should be followed by vocational training and guidance

depending on their aptitude and placement in suitable jobs.

Treatment of the brain-stem type (bulbar poliomyelitis)

The patient may be put in a prone position with the face turned to one side. The foot end of the bed may be raised to help drainage. The mouth and throat must be kept clean preferably by a mechanical sucker. The sheet anchor of treatment is to maintain a free air-way. The fluid and electrolyte balance should be maintained by the parenteral route. A cabinet type respirator might be extremely dangerous. In some cases, a tracheostomy and intermittent positive pressure respiration may be necessary.

Treatment of respiratory type

All cases with respiratory paralysis require artificial respiration, occasionally for weeks or even months. For uncomplicated paralysis of the respiratory muscles, a cabinet or tank respirator is usually preferred. The use of these respirators requires considerable experience and skill.

Treatment of combined respiratory and bulbar paralysis

This is the most difficult problem to tackle and the mortality is high. Three possible methods have been suggested : to maintain postural drainage while the patient is in the respirator, to continue respirator treatment with tracheostomy, and to treat the patients by tracheostomy and intermittent positive pressure respiration.