

OSTEOMYELITIS

Infection of the bone and bone marrow by pyogenic organism is called osteomyelitis. Osteomyelitis can be acute or chronic.

Osteomyelitis can be classified in different ways as following-

On the basis of duration:

- Acute (<2 weeks)
- Subacute (2-3 weeks)
- Chronic (>3 weeks)

On the basis of route of infection:

- Primary- Hematogenous route
- Secondary- Due to open fracture, Postoperative etc.

On the basis of existing organism:

- Pyogenic- Staphylococci, Straptococcus, Pneumococci, gonococci, H. influenzae, E.coli etc.
- Non Pyogenic- For example- Tuberculous, Syphillis, fungal, Virus etc.

EPIDEMIOLOGY:

Osteomyelitis can occur at any age it is common between age group of 2-12 and is more common in males, probably because they are more prone to injury.

AETIOLOGY:

Common causative organisms are;

- Staphylococcus aureus (60-85%) - this is the most common organism causing acute osteomyelitis.
- Streptococcus hemolyticus (8-10%).
- Salmonella- Osteomyelitis is relatively rare.

ACUTE OSTEOMYELITIS

This can be primary (haematogenous) or secondary (following an open # or bone operation). Acute osteomyelitis generally follows a history of trauma. It occurs most commonly during the period of active growth i.e. between 3 and 16 years of age. The causative organism spread through the blood stream from the original focus such as tonsils, respiratory tract and intestines to the bone.

- In children metaphysis of long bone (usually lower end of femur & upper of end tibia) is earliest and most commonly involved.
- In adults commonest site of infection is thoracolumbar spine.
- The initial focus of the infection is usually the metaphysis because of the following reasons;
 1. It is highly vascular.
 2. Hair pin arrangement of vessels resulting blood stasis.
 3. Metaphyseal hemorrhage due to frequent fall in children

PATHOLOGY:

The infection results in the formation of abscess at the region of metaphysis. Once the sufficient pus forms in the medullary cavity it spreads in the following directions;

1. **Along the medullary cavity:** The blood trickles along the medullary cavity & causes thrombosis of the venous & arterial medullary vessels. The blood supply to a segment of the bone is thus cut off.
2. **Out of the cortex:** The pus travels along Volkmann's canals & comes to lie subperiosteally. This result in the lifting the periosteum there by cutting of the blood supply to the underlying bone and resulting in its death (necrosis) and formation of sequestrum. Eventually the periosteum is perforated letting the pus out into the muscle where it can be felt as an abscess & if unattended the abscess bursts out of the skin forming a sinus.
3. **In the other direction:** The epiphyseal plate is resistant to the spread of pus but it may be affected by the inflammatory process. The capsular attachment at the epiphysis-metaphysis junction prevent the pus from entering the nearby joint. In joint with intra-articular metaphysis the pus can spread to the joint and cause acute pyogenic arthritis e.g. in the hip, shoulder etc.

CLINICAL FEATURES:

- In acute stage the child present with high fever, headache, irritability and mild swelling.
- On examination signs of dehydration may be found. The affected limb is in a position of slight flexion. This position relax the joint capsule and increase its capacity to accommodate the effusion.
- Tenderness and signs of inflammation present over the metaphysis.

- Swelling may become apparent when the pus comes into muscular or subcutaneous plane.
- The child restricts any examination because of severe pain. In rare cases there may be signs of toxæmia.

DIAGNOSIS: It is a disease of childhood more common in boys probably because they are more prone to injuries.

Presenting complaints:

- The child presents with an acute onset of pain & swelling at the end of a bone associated with fever.
- On examination: The child is febrile & dehydrated with signs of inflammation over metaphyseal area
- In later stages there is an abscess in the muscle & subcutaneous plane.
- Swelling of the joint.

Investigation:

- **Blood:** There may be leukocytosis & elevated ESR. A blood culture may show the causative organism.
- **X-rays:** It shows periosteal new bone deposition at the metaphysis.
- **Bone scan:** It may show increased uptake of by the bone in the metaphysis. This may be required in the early case where the diagnosis is in doubt.
- **Aspiration** of the bone using a thick needle: It is useful to confirm the presence of pus within the bone.

Differential diagnosis:

- Acute septic arthritis
- Scurvy
- Cellulitis

MANAGEMENT:

General management- Conservative management is the main stay of treatment.

The mnemonic REST sums up the conservative line of treatment.

- 1) **Rest** in bed protect affect parts with splints to alleviate pain and spasm.
- 2) **Elevation** of the part, warm and moist packs to reduce the swelling.

- 3) **Systemic treatment-** IV fluids are administered in case of marked dehydration or blood transfusion if the patient is anaemic.
- 4) **Treatment-** Appropriate antibiotic are administered intravenously after determining the severity of the organism from the blood or pus for the first 7-10 days. Oral administration is continued further for at least 8-12 weeks.
- 5) Adequately balanced diet and fluid intake have to be ensured.
- 6) Regular monitoring of general condition like fever, pulse, and the state of dehydration etc.
- 7) Observation-the affected area should be observed for soft tissue oedema, redness of skin, warmth, soft tissue abscess and discharge etc.

Local management:

The focus here is on well timed surgery –if any one of the following indication is present. Nade’s indication for surgery-

- Abscess formation
- Severely ill and moribund child.
- Failure to respond to intravenous antibiotics for more than 48 hours.

Surgical management: Depending upon the situation any of the following surgical methods could be employed:

- **Aspiration-** It helps in decompression and may be used to identify the organism & check the antibiotic sensitivity.
- **Incision and drainage-** helps to drain the subcutaneous abscess.
- **Multiple drill holes-** If the abscess is sub-periosteal this technique helps to drain the pus by making multiple holes in the cortex.
- **Small window bone-** if the multiple drill holes do not drain the pus a small window of bone is removed from the cortex and pus is evacuated.

PHYSIOTHERAPY MANAGEMENT:

- Pain and muscular spasm should be controlled by cryotherapy with icepack or ice water packs.
- Splinting of the affected joint in functional position should be done. Guide mother in changing posture and repetitive toe movements.
- Periodic, frequent isometric exercises.

- Muscle strengthening exercises.
- Joint mobility exercises

Later stage:

The joint stiffness and muscular weakness which have occurred during immobilization are major problems that needs concentrated efforts to improve.

- Initiate high rhythmic relaxed active movements within the pain free ROM.
- Whenever possible educate mother to encourage the child to do active exercises in a gradual mode.
- Encourage maximally the self stretching hold technique to improve the ROM of the post immobilization joint stiffness.
- Provide proper orthosis if needed and initiate ambulation in a parallel bar.
- The mother should be taught the technique of friction massage in the event of formation of an adherent scar.
- ROM at the hip and knee towards functional ambulation with the limit of the process of recovery of the disease.

Complications:

- Chronic osteomyelitis
- Acute pyogenic arthritis
- Septicemia
- Pathological fractures
- Growth plate disturbance

CHRONIC OSTEOMYELITIS

The term chronic osteomyelitis is used for chronic pyogenic osteomyelitis. The other causes are tuberculosis, fungal etc. There are 3 types of chronic Osteomyelitis:

1. **Chronic osteomyelitis** secondary to acute osteomyelitis.
2. **Garre's osteomyelitis:** It is a chronic non suppurative sclerotic bone inflammation characterized by a rigid bony swelling at the periphery of jaw. Commonly seen in men aged below 30 years.
3. **Brodie's abscess:** It is a special type of osteomyelitis in which the body defence mechanisms have been able to contain the infection so as to create a chronic bone

abscess containing pus or jelly-like granulation tissue surrounded by a zone of sclerosis.

CAUSES: The following reasons can lead to chronic osteomyelitis;

- 1) **Delayed & inadequate treatment:** This is the commonest cause which leads to spread of pus to medullary cavity & subperiosteally results in death of part of bone (sequestrum formation).
- 2) **Type & virulence of organism:** Sometimes despite adequate treatment the body defence mechanism may not be able to control the damaging influence of a highly virulent organism & the infection persists.
- 3) **Reduced host resistance:** Malnutrition compromises the body's defence mechanisms thus letting the infection persist.

Sequestrum: This is a piece of dead bone surrounded by granulation tissue trying to eat the sequestrum away. It is pale in colour & has a smooth inner & rough outer surface.

Involucrum: This is a dense sclerotic bone overlying the sequestrum. There may be some holes for pus to drain out. These holes are called cloacae.

CLINICAL FEATURES: The following are the characteristic features of chronic osteomyelitis:

- Discharging sinus which is usually fixed to the underlying bone.
- Irregular thickening of the bone.
- Irregular surface of the bone
- Deformity of the limb
- Shortening of the limb
- Joint stiffness
- Deformities and decreased movements develop due to scars and contractures.

DIAGNOSIS:

Radiological examination: Following are some radiological features seen in chronic osteomyelitis;

- Thickening & irregularity of cortices.
- Patchy sclerosis giving like honey-combed appearance.

- Sequestrum: The granulation tissue surrounding the sequestrum give rise to a radiolucent zone around it.
- Involucrum & cloace may be visible.

Blood: The ESR may be mildly raised. TLC are increased during exacerbation only.

Pus culture: This may grow the causative organism.

DIFFERENTIAL DIAGNOSIS:

- Tubercular osteomyelitis
- Soft tissue infection
- Ewing sarcoma

TREATMENT:

Antibiotics are given as per the pus culture and sensitivity reports.

Surgical methods:

Sequestrectomy: Removal of necrotic bone (sequestrum with curettage of the cavity is carried out. The infected granulation tissue is also exercised.

Curettage- The cavity of the bone allows accumulation of pus and bacteria inside it. The cavity is curetted and after a through curettage, it may be filled with cancellous bone grafts or a viable muscle.

3) **Saucerization:** Pus gets collected in the deep cavity in the bone. The cavity is therefore made shallow like a ‘saucer’, by removing its overhanging edges which prevents accumulation of pus. This procedure is called saucerization.

4) **Excision of the sinus tract:** The sinus tract is excised and the wound is allowed to heal slowly.

5) **Amputation:** It is indicated in very rare situations when a discharging sinus of longstanding duration undergoes a malignant change or when other organ of the body involved due to the infection.

PHYSIOTHERAPY MANAGEMENT:

When the active disease is controlled it leaves certain chronic musculoskeletal deficiencies. Therefore maximum efforts are introduced to restrict the residual disabilities to the minimum.

Limb length imbalance: There may be a limb shortening due to damage of growth plate by the disease where as limb lengthening may occur as a result of localized increased vascularity at the growth plate. This requires periodical checking of the leg length and providing correct raise in the affected or the contralateral limb.

Deformity:

- Initially by the passive stretching mode.
- Adjustable dynamic orthosis
- Wedge serial POP cast.

Adherent scar:

- Sustaining and gradually passive stretching combined with friction massage may be tried.
- Ultrasound exposure has been found to be effective.

Ambulatory assisted devices like LL braces, crutches, canes with gait training session may be required.

Resistance exercises and resisted functional movements are maximized to ease the stability as well as the freedom of movements and the ADL's

COMPLICATION:

Most common complication-

Pathological fracture is the most common complication.

Common complications-

Acute exacerbation of the existing chronic disease initiated by a change in bacterial flora or by decrease in the general resistance of the patient which flares up the dormant infection.

Limb length discrepancy

Deformity

Rare complication-

Amyloidosis due to long standing infection.

Epithelioma of the sinus tract due to chronic discharging sinus.

References:

Mheshwari, (2000). Essential Orthopaedics, Interprint.