Early physiotherapy rehabilitation approach enhances recovery in rare acute tibial osteomyelitis post-operative in a 9 year old child

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ABSTRACT

Introduction: Osteomyelitis is an acute or chronic inflammatory process of bone, bone marrow and its structures secondary to infection with microorganisms. An immediate treatment module of osteomyelitis for preventing bone destruction and deformity is
early detection and diagnostic accuracy. Immediate rehabilitation in post-surgical patients has been beneficial for recovery to functional concerns. **Patient main concerns** were pain, inability to move right knee, painful weight bearing. **Diagnosis** was confirmed acute right tibial osteomyelitis with necessary investigations X-ray, MRI and blood work and patient underwent surgical treatment followed by IV antibiotics and rehabilitation. Early therapeutic exercises are found to be beneficial in achieving functional goals in the early post-operative phase. **Conclusions:** The above study concludes that definitive surgical approach and early physiotherapy rehabilitation led to enhancement in functional goals of the patient which stands a major understanding towards a successful recovery.

**Keywords:** Osteomyelitis, Rehabilitation, Autism spectrum disorder, Sickle cell Anemia, Physiotherapy.

### 1. INTRODUCTION

Nelaton (1834) was first to coin the term osteomyelitis. The root words osteon and myelo are combined with it that is inflammation, where in the bone is infected with microorganisms. Osteomyelitis is an acute or chronic inflammatory process of bone, bone marrow and its structures secondary to infection with microorganisms. Pathophysiology proceeds by beginning of infection in metaphysis, formation of subperiosteal abscess, formation of discharging sinus and sequestrum. It is a commonly seen infection affecting the tibia, diaphysis of femur and humerus. Due to its delayed onset the infection becomes hematogenous in nature. The most common organism is Salmonella (*Salmonella enteritidis, Salmonella typhimurium, Salmonella paratyphi* B, *Salmonella choleraesuis* and *Salmonella aureus*) which is responsible for osteomyelitis followed by *Staphylococcus aureus*, which is only seen in 10% of patients suffering from sickle cell-related osteomyelitis (Pande, 2015).

Cardinal clinical features involve bony tenderness, limp or muscle spasm which should raise red flags for osteomyelitis, mostly with pyrexia and malaise. Lack of appropriate treatment for acute osteomyelitis may lead to chronic, serious and life threatening condition (Ariffin et al., 2011). Treatment option is typically Sequestrectomy, Saucerization, Curettage, and Excision of an infected bone and finally Amputation for long standing discharging sinus. Physiotherapy has been shown to be effective in the post-surgery treatment of patients. Therapeutic measures involve passive movement to active assisted movements to active movements, progressive resisted exercises, muscle energy technique, cryotherapy and electrotherapy for pain relief. In this case, patient experienced pain, fever, swelling, tenderness and redness over right leg below knee which was gradually progressive one month back. Patient got initial investigation at arvi town and for definitive treatment was treated at AVBRH, Sawangi (M) Wardha and subsequently treated under physiotherapy department at academic hospital in Sawangi (M) Wardha with proper rehabilitation protocol.

### 2. PATIENT INFORMATION

A patient 9 years old male who lives in arvi town is a student in 4th standard. Hand dominance right hand, experienced pain, fever, swelling, tenderness and redness over right leg below knee which was gradually progressive. After initial investigation in Arvi town he was diagnosed for infection in the right leg, his parents were advised to take him to AVBRH Sawangi (M) Wardha by the physician. He came to AVBRH Orthopedic department on date 21/01/2020 with a complaint of pain, fever, swelling, tenderness, & redness over right leg below knee which was gradually progressive. His medical history was significant for ASD and Sickle cell anemia. He was non-verbal till age of 4 years and seen delayed developmental milestones. There was no history of previous fracture and or any invasive treatment for infection. His mother’s history was significant for sickle cell anemia. Consulted orthopaedic surgeon advised X-ray, MRI and laboratory tests, which were carried out. X-ray of his right leg interpreted increase in periosteal tissue and cortical destruction in the proximal aspect of right tibia (Figure 1), MRI showed bone marrow edema along the right tibia, and collection of purulent debris in the metaphysis and bone marrow. His laboratory investigations revealed WBC count of 15,740/mm³, CRP of 6.22 μg/mL and ESR of 61mm/h and was diagnosed with acute right tibial osteomyelitis with sickle cell anemia.

Further on 23/01/2020 patient underwent open irrigation and surgical drainage, followed by the medullary canal curettage in the right leg. Purulent fluid of approximately 170cc was drained out from the right tibia. Tissue biopsy samples were collected for acid-resistant bacilli staining, gram staining, blood and bone culture and TB culture, which resulted negative. Post-operation patient was treated with IV antibiotics, antiplatelet, analgesics. Later physiotherapy consultation accompanied the surgery patient four days later post-surgery that is 27/01/2020. Post-operatively patient had chief complaints of pain in right leg, which patient described as dull-aching with intensity of 6/10 at rest and 8/10 with activity on NPRS, aggravated on activities, also unable to perform range of motion (ROM) at knee due to the plaster slab and difficulty in performing activities of daily living such as self-hygiene.
3. CLINICAL FINDINGS
Patient was examined in long sitting position with both shoulder at same level and right lower limb covered in plaster slab with slight knee flexion supported on pillow with hip externally rotated (no ROM possible at right knee). On physical examination, vital signs including temperature were normal, pulse rate 90 beats/min, RR-24 breaths/min, BP-100/70mmhg. The knee was unable to palpate due to presence of plaster cast and dressings (Figure 2). Repeat blood work revealed hemoglobin 94g/l, TLC-4100/ml, platelets-2.3%. Patient was advised for not bearing weight on the operated right leg.

<table>
<thead>
<tr>
<th>Timeline</th>
<th>Date</th>
</tr>
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<tbody>
<tr>
<td>Diagnosed with acute right tibial osteomyelitis with sickle cell anaemia.</td>
<td>21/01/2020</td>
</tr>
<tr>
<td>Open irrigation and surgical drainage</td>
<td>23/01/2020</td>
</tr>
<tr>
<td>Physiotherapy rehabilitation</td>
<td>27/01/2020</td>
</tr>
<tr>
<td>Discharge</td>
<td>11/02/2020</td>
</tr>
</tbody>
</table>

**Figure 1** X-ray cortical destruction of proximal right tibia

**Figure 2** Post-operative right limb in plaster slab, maintained in slight knee flexion
Physiotherapy Intervention

The patient received physiotherapy for 15 days on a regular basis in the orthopedic in patient ward by a skilled orthopedic physiotherapist. The sessions were started with the goal to develop independent non weight bearing walking with walker and minimal assistance for reminder daily activities. Cryotherapy with ice packs was given to control pain and muscular spasm for the right thigh pain and elevation with a pillow for positioning the right lower limb. Further rehabilitation exercises included were isometric contraction for right hamstrings, quadriceps, and gluteus muscles with ten second hold for ten repetitions each respectively. Active assisted movements for right hip flexion-extension and abduction-adduction and ankle finger toe movements were performed for ten repetitions. The physiotherapy sessions were designed to maintain the muscle integrity for the right lower limb and enhance left lower limb and both upper limbs to promote independent non weight bearing walking with walker and minimal assistance for daily activities. Active resisted exercises for upper limbs with weights and weight cuff for left lower limb were used progressively with proper safety measures. Child’s parents were instructed and educated to carry out home exercises program using a proper written protocol. Further progression in the rehabilitation was instructed after the first follow-up which would consists of plaster cast removal and initiation of range of motion to the right knee.

4. RESULTS

The NPRS score at rest pre surgery 6/10 to 5/10, at the initiation of physiotherapy four days after surgery and post 15 days with physiotherapy improvements in NPRS were seen 2/10 and on activity from 8/10 pre surgery to 3/10. Improvements were observed in the initiation to active assisted to active movements of right hip flexion-extension and abduction-adduction and also in independence of activities of daily living with minimal assistance or supervision. The improvement was observed gradually as the patient progressed from NWB walking with walker with minimal assistance to NWB walking with walker without any assistance and only supervised.

5. DISCUSSION

A review of incidence of radiologically and bacteriologically diagnosed acute haematogenous osteomyelitis in children under 13 years of age between 1990 to 1997 reported 44% fall of incidence of acute and sub-acute osteomyelitis. Bennet et al. in 2001 also confirmed osteomyelitis in children had become a rare disease with yearly incidence of 2.9 cases per one lac population (Blyth et al., 2001). Riise et al. in 2008 confirmed 43% increase in long bone osteomyelitis that is 13 per one lac population in children (Riise et al., 2008). A peak of incidence has been found in children aged between 5 and 15 years (Bajuri, 2018). Acute osteomyelitis occurring in children is often caused hematogenously. Usually in adults, osteomyelitis presentation is a sub-acute or chronic infection which develops secondary to an open injury to the surrounding soft tissues and bone (Panteli and Giannoudis, 2016). Most often the age of the patient and factors such as trauma or recent surgeries is associated with the specific organism isolated in bacterial osteomyelitis (Walter et al., 2012). In our case report, patient and his parents both confirmed of no injury to the patient right leg in recent timeline or any previous surgeries. The onset was insidious in our patient scenario with unknown cause. Involvement of pain hampered the patient’s right lower limb movements and activities of daily living, following surgery and antibiotic, analgesic administration with reduced pain; we could involve the patient actively in rehabilitation. The major goal of treatment must be fully understood by the parents, while caregivers should have a better understanding of the challenges along the process of a successful recovery.

Teresa pena fernandes et al. in their case report had a 14 year old boy with a minor trauma while playing football the previous day with no medical history and had presented with the tenderness of right knee, following surgical debridement, antibiotics were administered, but due to septic shock and respiratory failure the initiation to physiotherapy was delayed (Pena Fernandes et al., 2018). However in our case study the initiation to physiotherapy was early that is post-operative day four that led to early improvements in the patient activities of daily living. In the aspect of rehabilitation we intended more of the patient’s involvement to achieve most of the improvement in his pain free and voluntary action, which we succeeded within 15 days to improve his activities of daily living and supervised non-weight bearing walking. An adherence to the rehabilitation protocol was intended by educating the parents to carry out the exercises at home and a written protocol was provided. This case report intended to highlight the significance of prompt diagnosis; treatment and most importantly rehabilitation to get back the patient back to his functional state.

6. CONCLUSION

The above study concludes that definitive surgical approach and early physiotherapy rehabilitation led to enhancement in functional goals of the patient which stands a major understanding towards a successful recovery.
List of Abbreviation

MRI - Magnetic Resonance Imaging
ROM - Range of Motion
ASD - Autism spectrum disorder
TLC - Total Leucocyte Count
WBC - White Blood Cells
CRP - C-reactive protein
ESR - Erythrocyte sedimentation rate
TB - Tuberculosis
NPRS - Numerical Pain Rating Scale
IV - Intravenous

Author’s contribution
All author made best contribution for the concept, assessment and evaluation, data acquisition and analysis and interpretation of the data.

Informed Consent
Proper consent was taken from patient’s parents for writing case report.

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