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CHALLENGES ASSOCIATED WITH MANAGEMENT OF LOWER LIMB FRACTURES IN POST POLIO RESIDUAL PALSY

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INTRODUCTION:

Poliomyelitis is a viral disease that mostly impacts the central nervous system and causes uneven flaccid paralysis. [(1)] The WHO's continuous immunisation campaigns have significantly reduced the prevalence of the disease in recent decades to the extent of eradication. [(2)] However, the neurological and muscular complications of the sickness continue to provide a significant healthcare challenge, particularly in developing nations. Polio virus mainly targets the anterior horn cells, resulting in inadequate development of the musculoskeletal system, leading to weakness, wasting, and deformity of the affected limb. [(3)] Post-polio syndrome, according to the March of Dimes criteria, includes muscle atrophy, gait abnormalities, osteopenia, bone deformities, diminished joint stability, mobility and contractures, and functional disability that impacts everyday activities. All of these factors predispose individuals to a higher likelihood of falling and thus experiencing a fracture. The surgeons face a technical hurdle when operating on limbs that are lean and slender, with malformed bones and joint contractures. [(4,5)] Long bones are mainly afflicted, with the femur being a prominent site of involvement. Regional osteoporosis occurs due to underdeveloped surrounding muscles and soft tissues, leading to bone weakening. Osteoporosis, together with an increased risk of falling and neuro-muscular imbalance, significantly increases the likelihood of sustaining a femur fracture even after minor trauma. [(5,6)] In individuals with PPPS, there is typically a modified osseous anatomy with usually increase bowing narrow canal that leads to a unique and intricate fracture pattern. [(7,8)] Fractures can happen in any part of the lower extremity of the pelvis, but low-energy fractures in the proximal and distal shaft of the femur are most frequently observed. [(9)] Comprehensive clinical assessment and meticulous pre-operative planning are essential for surgical treatment of these fractures.Here we present a series of 9 cases of lower limb fractures in patients with post polio paralysis, the challenges associated with them and methods to overcome them

Matherials and Methods:
The Study was conducted in SRM Medical College Hospital and Research Centre between Janurary 2023 to January 2024. Total 9 patients were included who had fractures with post polio residual paralysis. Only fractures of femur and tibia were included and only the patients willing to participate in the study were involved. Fractures other than that of femur and tibia and patients managed non-surgically were excluded.

The demographics, mechanism of injury, challenges in fracture fixation, implant used,complication, their follow-ups. Complications and results were analysed. There were total of 4 females and 5 Male patients. Only two patients had low velocity injury(fall from bed, slip and fall from stairs). The remaining had history of RTA.

CASES:

A 45-year-old male, with a history of left lower limb poliomyelitis since the age of 6, presented with left hip injury following a slip and fall on stairs. The patient was brought to ER and local examination at the hospital revealed significant pain,tenderness, swelling around the hip, and an inability to bear weight. The limb with apparently shortened adducted and in internal rotation.The limb had obvious signs of disuse atropy with visible muscle wasting. Diagnostic imaging with plain radiographs confirmed a spiral fracture of the subtrochanteric region of the femur. The patient was initially stabilized and planned for surgical fixation.

Following consultation and informed consent, the patient underwent surgery the next day. Usually fixation of such fractures would involve closed reduction with iintramedullary nail. Here we observed narrow canal diameter which would not provide the environment suitable for nail insertion.Hence we decided to opt for open redicution with plate osteosynthesis using DCP. Surgical challenges encompassed the patient's narrow canal diameter, failure for closed reduction, abnormal countour of the bone. The operation, performed under spinal and epidural anaesthesia and proved successful.The patient was compliant with follow ups. After four months of postoperative recovery, the fracture united well the patient has resumed normal activities as he did before the fracture, demonstrating a positive outcome in the management of this complex orthopaedic condition.


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Similarly, a 55-year-old female with analogous clinical presentations was admitted to the hospital. Following diagnosis, she was managed using the same surgical approach and fixation with. The fixation was in varus but yielded successful outcome.

Case 2

A 38-year-old female, with a history of left lower limb poliomyelitis since the age of 5, presented with a left knee injury following a road traffic accident(skid and fall from two wheeler. The was tenderness and visible deformity of the left leg. Diagnostic imaging confirmed a transverse fracture of the shaft of tibia(AO). The patient, initially stabilized at the local hospital with above knee slab and now had come to our hospital for further managent. The patient had a history of right shaft of femur fracture 2 years ago which was addressed with closed reduction and internal fixation with nailing.

Plain radiographs taken also revealed narrow canal diameter with abnormal anterior bowing of the tibia. This would have prevented the nailing which would have been the usual method of management of such a fracture. Hence the patient underwent open reduction and plate osteosynthesis with 4.5 narrow DCP with 8 point cortical purchase through routine anterio-lateral approach. Post operatively a below knee slab was applied for dorsal reinforcement. The patient was discharged after 12 days post suture removal to be next seen after 3 months. New radiographs taken at this follow up revealed fracture to be united with no visible complications.


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Similarly, a 49-year-old male with analogous clinical presentations of the left tibial shaft was admitted to the hospital. Following diagnosis, he underwent the same surgical approach, leading to a favourable outcome.

Case 3:

A 42-year-old male, with a history of right lower limb poliomyelitis since the age of 4, presented with a left leg injury following a road accident. Radiographs revealed a comminuted fracture of shaft of the tibia with fibular neck head fracture. After stabilization the patient was planned for surgery.

Unlike the previous case, the tibia did not show significant narrowing with possibly sufficient canal diameter. Hence the patient was planned for CRIF+IMIL nailing. During the procedure, various challenges were faced. There was difficultly in reaming the canal and further forced reaming with a flexible automatic reamer caused splinting. Hence the fracture site was opened and canal was reamed using a rigid reamer through the fracture site and a nail of 8mm diameter was inserted and locked.

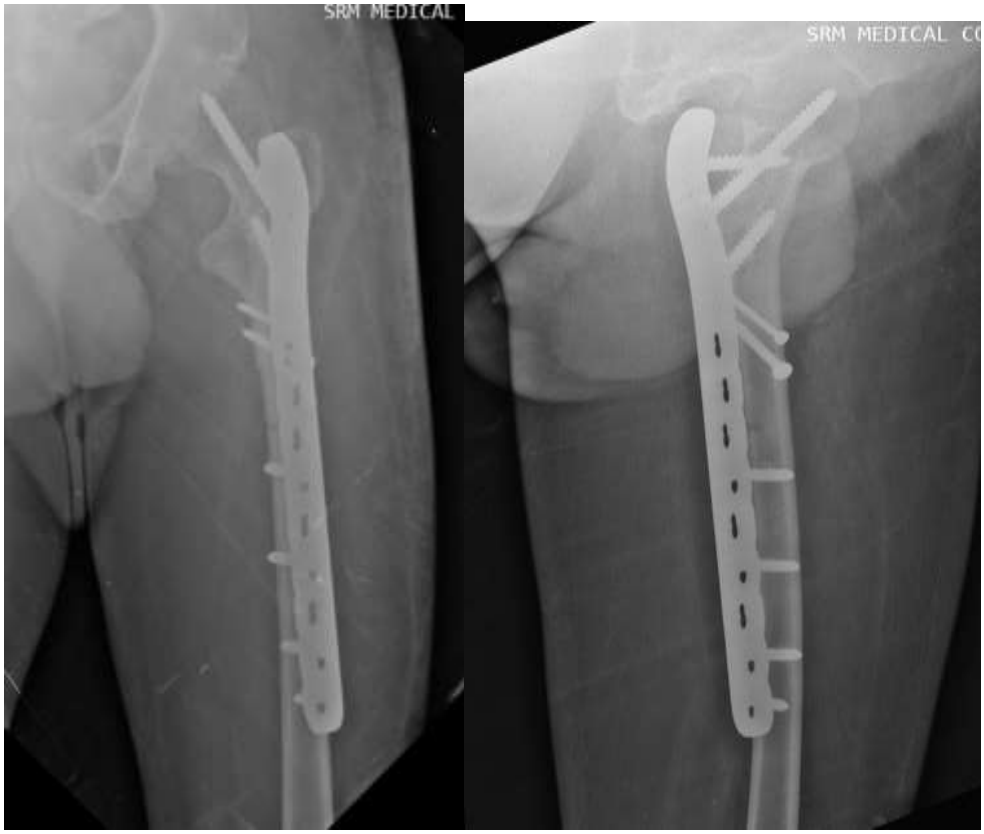
After around 4 months of postoperative recovery, the fracture united and the patient was without any complications.

Similarly, a 54-year-old female with analogous clinical presentations was admitted to the hospital, where she underwent open reduction without any attemnpt at closed reduction with imil nailing

. The consistent success of these surgical interventions underscores their effectiveness in addressing diverse cases of complex orthopaedic conditions.

Case 4:

A 59-year-old male, with a longstanding history of right lower limb poliomyelitis dating back to the age of 5, presented with left hip pain following skid and fall from a two wheeler. Clinically the limb was shorted, abducted and externally rotated. A similar problem was encountered as seen in the above mentioned proximal femnoral fracture with canal being too narrow for intramedullary nailing. Hence an open reduction was done through lateral approach and fracture fixed using proximal femoral locking plates after lagging the fragments.



DISCUSSION:

The management of fractures in polio-affected limbs presents distinctive challenges that deviate from conventional protocols [(10)]. Proximal femur fractures, a common occurrence in these cases.

Long bone fractures are complicated by a small medullary canal and excessive anterior bowing, rendering traditional implants like PFN or IM nails impractical [(11)]. Alternative solutions such as elastic nails, customized designs, locking plates, and external fixators emerge, each with its advantages and drawbacks [(12)].

Recognizing that AO surgery principles may not align with the intricacies of polio-affected femoral fractures, trauma surgeons must navigate these complexities with a nuanced understanding [(13)]. This understanding is particularly crucial as the number of individuals with residual post-polio syndrome (PPS)

rises with age, resulting in progressive muscle weakness, joint malalignment, and skeletal deformities that severely impact daily activities [14].

The occurrence of poliotic fractures, while rare due to the near-eradication of poliomyelitis, is on the rise among aging polio survivors [15]. It leads to flaccid asymmetric paralysis and muscle asymmetry and muscle atrophy which reduces stability, and mobility and alters gait pattern, hence predisposing to falls These fractures can often result from low-energy trauma in day-to-day activities as the bone quality tends to be poor. [16].

The impediments to surgical management in these cases include deformity and osteopenia. [17].

Addressing these challenges requires careful pre-operative planning, including a detailed clinical examination and radiological work-up. Factors such as deformities of the hip, knee, and ankle must be considered, influencing patient positioning and altering the management plan accordingly [18]. Radiographic evaluation, measuring femoral canal diameter, assessing femoral bow, and evaluating greater trochanter and neck geometry, guides implant choices [19].

Despite intramedullary nailing being the gold standard for shaft femur fractures, cases with PPS demand a deviation from this norm due to factors such as deformed greater trochanter, varus or valgus neck in femoral fractures, and in long bones the presence of a narrow canal diameter [20]. Various alternatives, including elastic nails, customized designs, and locking plates, have been successfully employed, demonstrating favourable outcomes in terms of bone union and minimal complications [21].

Complications arising from surgical interventions, including plate application, necessitate careful soft-tissue handling and the use of minimally invasive techniques to minimize trauma and promote early healing [22].Careful planning is require with respect to plate application and insertion of screws due to increased bowing.In case of plating one should make sure adequate number of small size screws are available for fixation as the canal diameter asks for it. Preference to be given to stainless steel implants as they are easy to countour for often these fractures will ask for it. The functional outcome, measured in terms of postoperative ambulation, knee range of motion, and the use of walking aids, is reported to be favourable, with patients achieving a return to pre-injury status.

When it comes to fracture healing we did not see any difference with respect to bone healing of a normal individual. All fractures healing within as per the appropriate time without any complications.

However, the study has limitations, notably the small sample size of 9 patients and the use of various implant types, preventing a comparative analysis of bone healing. Additionally, bone mineral density was not evaluated, potentially limiting the comprehensive understanding of factors influencing post-implant fixation outcomes. Also the study period is of 1 years thereby masking the comprehension of the long term complications .

CONCLUSION

In conclusion, successful management of fractures in polio-affected limbs requires meticulous preoperative planning to address potential challenges associated with implant placement. Given the complexities often encountered, open reduction must be considered and prepared for as closed reduction is unfeasible or unsuccessful. The paramount importance of respecting soft tissues cannot be overstated, emphasizing the need for minimally invasive fixation techniques that involve minimal periosteal stripping and preserve blood supply. Maintaining a sterile and aseptic technique throughout the procedure is crucial to prevent complications.

Early postoperative rehabilitation is a key factor in achieving favourable surgical outcomes, promoting faster recovery, and minimizing complications. This underscores the importance of a comprehensive approach that extends beyond the surgical intervention itself.

To navigate the diverse scenarios encountered in these cases, having a diverse array of implants is imperative. From simple plates and nails to anatomical locking plates, a well-prepared surgeon should ensure the availability of various implant options as a backup. This approach ensures adaptability during surgery, allowing for the swift selection of an alternative implant if needed. In essence, the success of managing fractures in polio-affected limbs hinges on a strategic and flexible approach, prioritizing preoperative planning, soft tissue preservation, aseptic techniques, and a versatile implant arsenal.

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