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Poliomyelitis-Related Deformities Successfully Treated with Reconstructing and Lengthening Lower Limb Surgeries and Followed Up 11 Years: Challenging Approaches in A Limited-Resources Country.

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Abstract

Poliomyelitis is a viral infection that may lead to paralysis or death. Paralysis can lead to skeletal and joint deformities. Typical manifestations include equinos cavus and tibial shortening. We report a polio case presented with right equinus foot, clawing in the right great toe, and shortening in the right tibia.

Keywords: *External fixation; Foot deformities; limb-length discrepancy; Poliomyelitis, Surgical techniques*

Background

Poliomyelitis or Polio is an acute infection caused by variant strains of poliovirus. It can affect the respiratory, gastrointestinal, and central nervous systems **[**1**]**. In the majority of cases, the infection is asymptomatic; however, symptoms may include headache, sore throat, nausea, vomiting, severe muscle weakness, muscle contracture, and flaccid paralysis. Paralysis usually affects the lower limb more than the upper limb. Patients may complain of muscle weakness associated with pain and decreased or absent reflexes **[**2**]**. Muscle weakness and contractures may lead to abnormal limb development and limb-length discrepancy **[**3**]**. Deformities are managed according to the stage, severity, and extent of paralysis and may require multiple corrective surgeries. In Syria, cases with old polio infection are still encountered with a variety of post-polio complications. Herein, we report a case of a 24- year old patient who presented with multiple polio-related musculoskeletal deformities. We also illustrate in detail the surgical work and the techniques applied to manage this case efficiently.

Case Presentation

A 24-year-old female presented to the Department of Orthopedic Surgery complaining of low back pain and motion restrictions due to limb weakness, foot deformities, and lower limb-length discrepancy. Clinical examination revealed polio-related deformities of the right lower limb and tiptoe gait with equinus foot. It also demonstrated a 4 cm shorter right limb with apparent right leg dystrophy, in comparison to the left one at the level of mid-gastrocnemius. Flexor muscle movement was better than the extensors. Clawing in the right great toe, equinus foot, and plantar flexion deformity caused by the imbalance between extensors and flexors of the foot and ankle were also observed (Fig.1 A, B). No further deformities were noted. Spina bifida, Marie Tooth disease, and other familial histories were excluded. Three consecutive surgeries were performed over five years to correct the foot deformities and lengthen the lower limb by 3 centimeters.

During the first surgery, in February 2006, correcting the foot and the great toe deformities were accomplished. The tibialis posterior tendon was transferred from its insertion at the dorsal foot, specifically the cuboid bone, across the interosseous membrane to rectify the equinus foot and the bending while retaining the muscular strength of the foot and ankle extension. The Jones surgical procedure was used: arthrodesis and toe k-wire fixation were used to repair the great toe's interphalangeal joint. The long extensor of the great toe was transferred from its insertion to the first metatarsal neck through a formed canal, and the tendon was sutured on itself to rectify the clawing of the great toe, placing it in a functional position, and retaining muscular strength while in motion (Fig.2 A, B). In August 2008, the second procedure entailed the placement of the axial dynamic external fixator on the medial side of the tibia (Fig.3), cutting 2 cm from the middle of the fibula, and fixing the distal portion with a cortical screw to avoid syndesmosis sliding. The proximal portion of the tibial cortex was osteotomized to establish an appropriate region for lower limb lengthening (Fig.4). The Achilles tendon was lengthened percutaneously using three small incisions and a temporary splint. During follow-up, the selected region for tibial osteotomy seemed to be inappropriate for sufficient callus formation and led to delayed consolidation (Fig.5), which necessitated a 6-week limb brace putting (Fig.6). After the removal of the axial dynamic external fixator and the cortical screw, the third surgery was performed in January 2010. The lengthening region of the proximal portion of the tibia was fixed with an intramedullary nail, and grafted with an iliac cancellous bone graft to maintain successful engraftment without damaging the callus. The lengthening amount and callus formation were preserved. Complete engraftment and callus formation were completed in the spring of 2010 (Fig.7). Eleven years Follow-up revealed equal leg-length on both sides. Muscular strength, excellent plantar flexion and dorsal motion in the right foot, a functional great toe, and excellent ability of prolonged walking were also recorded Fig.8 (A, B, C, D).

Fig.1 (A, B): Foot deformities caused by poliomyelitis, foot equinus and bowing, & clawing of the great toe.

Fig.2 (A, B): Surgical incisions for transferring of the posterior tibial tendon to the dorsum of the foot and attachment to the lower foot button and Jones procedure: arthrodesis of the interphalangeal joint of the great toe and fixation with Kirschner wire and extensor hallucis longus transfer to the first metatarsal neck.

Fig.3 (A, B): Image of the lower limb on the day after the second surgery, showing the dynamic axial external fixator.

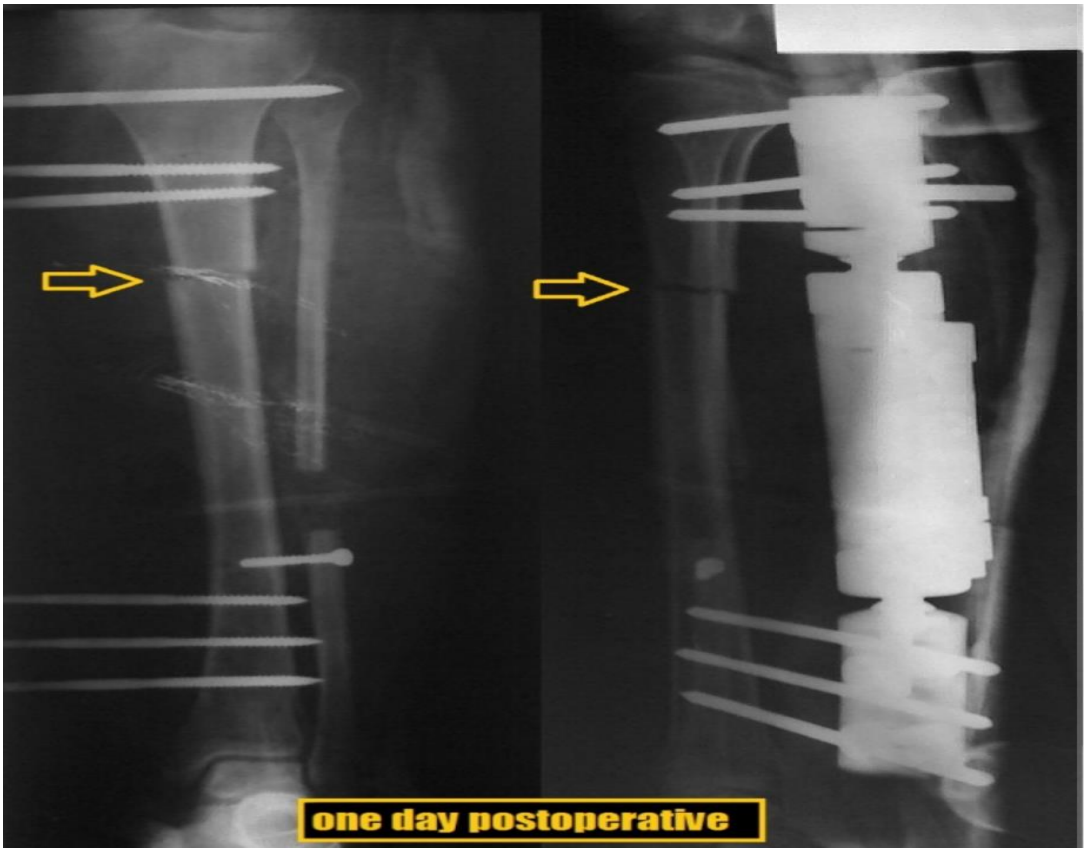

Fig.4: A radiograph of the leg bone on the day after lengthening surgery.

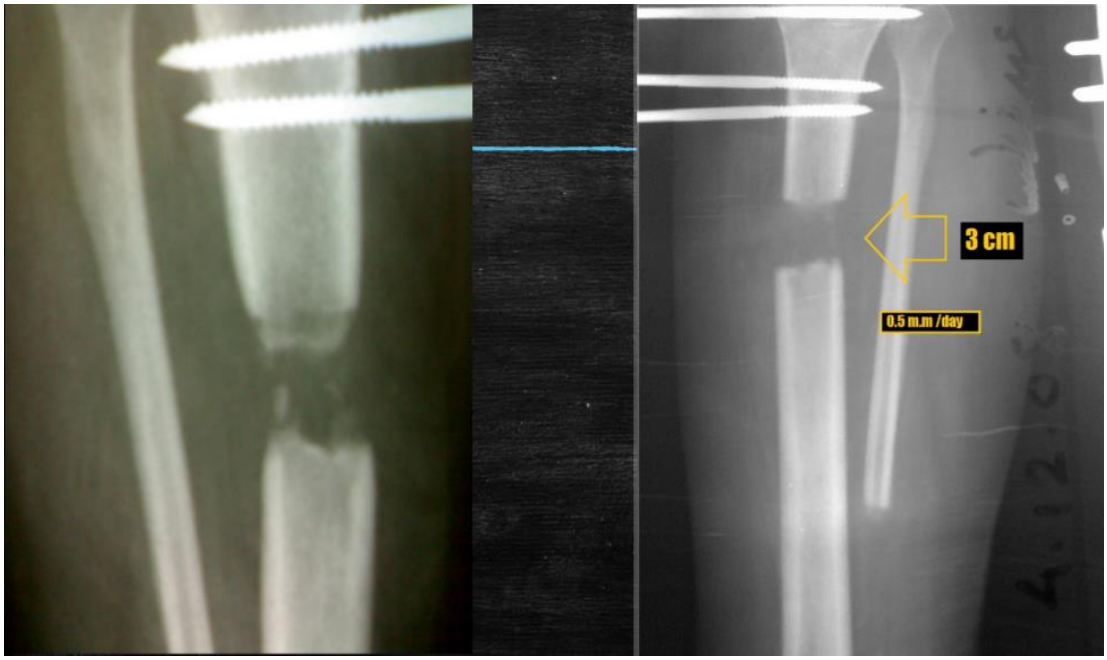

Fig.5: A radiograph at the end of the lengthening and weakness of the extension callus formed.

Fig.6: A radiograph after removing the dynamic axial external fixator and placing the limb in a plaster cast above the knee.

Fig.7: X-ray showing the complete fusion of the lengthening site two months after the third surgery, & fixation of the tibia with an intramedullary nail with grafting of the site of lengthening through the skin.

[A] **[B]**

[C] **[D]**

Fig.8 (A, B, C, D): The final clinical form of the foot in the plantar position and the lower limbs in the standing position.

Discussion and Conclusion

In the 1980s, the number of annual paralytic cases due to polio was > 350,000. Since then, the international vaccination campaigns have been successful in nearly eradicating the virus worldwide. In 2016, there were only 42 active cases **[**4**]**. In Syria, polio was totally eliminated in 1999. However, in 2013, 25 new polio cases were reported **[**5**]**. In Syria, Patients infected with polio before 1999 are still encountered in daily practice with a variety of limb deformities. Polio foot and ankle deformities include equinus foot, claw hallux, and contracted tendon **[**6**]**. Leg deformities include limb-length discrepancy **[**3**]**. Correction of these deformities requires multiple surgeries. Our patient underwent 3 consecutive surgeries. During the first surgery, the equinus foot and claw hallux were corrected, and a plantigrade foot was obtained. In the second surgery, the limb-length discrepancy and contracted tendon were lengthened concomitantly. The Ilizarov apparatus is typically used for tibial lengthening **[**7**]**.

However, in our case, the axial dynamic external fixator was selected (Fig.3 A, B). Tibial lengthening may be associated with several complications, including delayed consolidations, pin tract infections, and axial deviations **[**8**]**. The occurrence of delayed consolidations is attributed to many factors, including the osteotomy technique, fixation stability, and delayed bone healing due to co-existent muscular atrophy and bone hypoplasia **[**7**]**.

In our case, tibial lengthening was complicated by delayed consolidations of the callus. This necessitated another surgery. It is also thought that the osteotomy site, at the upper third of the tibial shaft, was not ideal for sufficient callus formation. According to the literature, one approach to managing delayed consolidations is through the transition from external fixation to internal fixation **[**9**]**. Internal fixation was performed by removing the axial dynamic external fixator, fixing the lengthening region with an intramedullary nail, and inserting a bone graft into the distraction callus. The Iliac crest was used for bone graft as it is proven to be an excellent grafting option **[**10**]**. The above-mentioned surgeries can usually be completed in less than 2 years. The harsh circumstances in Syria limited the performance of these surgeries within the expected timeline and led to an unanticipated delay. After 11 years of follow-up, the maximal tibial lengthening has been reached Fig.8 (A, B, C, D). In conclusion, post-polio sequelae remain a significant challenge in some countries, and extensive consultations should be considered to establish the finest management. Cases with post-polio sequelae exhibit significant challenges in Syria. Despite the extreme shortage of medical resources in the country, corrective, multi-step, and selective surgeries are still performed, and excellent outcomes are obtained.

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