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MANAGEMENT OF POST-TRAUMATIC CHRONIC OSTEOMYELITIS USING ILIZAROV'S TECHNIQUE- OGHARA EXPERIENCE

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ABSTRACT
Background: The treatment of chronic osteomyelitis has been a big challenge to orthopaedic surgeons till date because of the difficulty of eradicating infection. The use of Ilizarov technique has made this possible and is changing the outcome of management of this condition.
Objective: To report the outcome of management of post-traumatic chronic osteomyelitis using Ilizarov technique in DELSUTH, Oghara.
Results: A total of 8 patients were seen in this study, 7 males and 1 female with a M:F ratio of 7:1. The age range was 18-52 years (mean=36.1+11.6). All were victims of road traffic accident(RTA) with a Cierny and Mader type IVA chronic osteomyelitis. Linear rail system was used in 7 patients and Ilizarov device was used in one. The range of bone length excised was 6-12cm (mean=9.1cm). The average duration of external fixator was 10months, with a range of 8-14months. 7 of the patients had initial in-hospital treatment before developing osteomyelitis while one was treated by traditional bone setter (TBS). The outcome of treatment was excellent in 6 and good in 2 using Dror Paley's criteria. The complications seen were pin tract infection, muscle spasms, loss of regenerate, joint stiffness and pains.
Conclusion: The use of Ilizarov technique in the treatment of chronic osteomyelitis has been successful. It has brought hope and relieves to both orthopaedic surgeon and patients and also reduced the rate of amputations and complication of squamous cell carcinoma and renal failure from secondary amyloidosis previously associated with the disease.

Key words: chronic osteomyelitis, Ilizarov technique, debridement, distraction osteogenesis.

1. INTRODUCTION

Chronic osteomyelitis previously used to be a common complication of acute osteomyelitis but nowadays frequently complicates open fractures and operations on bones[1]. Bone is destroyed at a localized area of infection or extends along the surface of foreign body or implant[2,3]. Unlike hematogenous spread which starts from the marrow and metaphysis, post-traumatic chronic osteomyelitis starts from the surface, where the trauma occurs or the implant makes direct contact with the bone[2,3]. Sometimes infection may involve the whole bone if the patient's immunity is depressed, the organism is very virulent or the operation or trauma affects the whole length of the bone[2,3]. Cavities containing pus and sequestra are surrounded by poor vascular tissues[3,4]. Antibiotic may not reach the infected site because of poor blood supply of surrounding soft tissue envelop[3,4]. The sequestra act similarly like foreign body ensuring the sustenance of infection until they are removed.

Treatment of chronic osteomyelitis entails removal of the focus of infection (sequestra, poorly vascularized infected soft tissues and foreign body) and encouraging formation of involucrum and managing the defect created[4]. Historically, saucerization and sequestrectomy are done. This is followed by systemic and local antibiotic treatment. An example of the local method is the irrigation method by Lautenbach technique[5]. This helps to eradicate residual infection in the bone. Bone defects created by sequestrectomy have been managed by different methods. These include bone graft[5], vascularized local muscle flaps[6,7] and more recently the use Ilizarov technique for osteogenesis and histiogenesis[8-10].

In this study, the outcome of the use of Ilizarov technique in the management of chronic osteomyelitis in Delta State University Teaching Hospital (DELSUTH), Oghara is presented.

2. PATIENTS AND METHOD

All patients with traumatic chronic osteomyelitis managed with the use of Ilizarov technique in DELSUTH, Oghara from January 2011 to December 2014 were evaluated. Information obtained from case notes include demographics, aetiology, site of infection, length of sequestrum and device used. The bone infection was staged using Cierny and Mader classification[11] and the outcome was determined by using Dror Paley[12] criteria. Patients who could not complete the treatment or lost to follow-up were excluded from the study.

Pre-operatively, the following investigations were done to determine the state of the patient; full blood count and erythrocyte sedimentation rate to assess for anemia and infection, urinalysis and random blood sugar (RBS) test to rule out diabetic mellitus, X-ray to determine the site and size of the sequestrum and wound swab microscopy, culture and sensitivity for local infection and antibiotic sensitivity. Patients were placed on a course of antibiotic treatment for two weeks before admission for surgery.

At operation, all lower limb surgeries were done under spinal anaesthesia. For leg operations, tourniquet was used to reduce blood loss. Following exposure of the infected bone, sequestrum was properly identified by sound technique and paprika sign[4] and excised along with surrounding infected soft tissue as much as possible. The foreign body like implant was also removed. The wound was irrigated with diluted hydrogen peroxide and later copiously with normal saline. The linear rail system (LRS) to be used for the distraction osteogenesis was inserted on the bone. Corticotomy was done at a virgin area likely free of infection at the metaphyseal end of the bone. In some of the patients, the wound could not be closed. The defect was dressed with povidone iodine-soaked gauze and this was covered with several layers of gauze and bandage.

Post-operatively, the wound was cleaned on alternate days with normal saline and povidone iodine and dressed with honey-soaked gauze. Distraction of the device was commenced after a latency period of one week. The rate of the distraction was 1mm/day. Patient is taught how to care for the device and wound. Patient was discharged after two weeks on admission after he has mastered the procedure and seen in outpatient clinic initially on weekly basis for one month to ensure he is doing everything right. Thereafter the visit is two weekly until distraction is complete, when the transported segment docks. This is ascertained by x-ray. By this time, the defect is filled up with regenerate that is surrounded by healthy granulation tissue and overlying tissue scar. Before distraction is complete, patient is on non-weight bearing ambulation. When distraction is complete, partial weight ambulation is commenced. To further protect the regenerate from collapsing during ambulation after completion of distraction, the leg was incorporated into a protective scotch cast together with the pins of the LRS/Ilizarov device. Outpatient visit was now monthly and x-ray was done at each visit to monitor the consolidation of the regenerate. After consolidation has been fully achieved as determined by the x-ray, the cast and LRS or Ilizarov device are removed.

3. RESULTS

A total of 8 patients were seen in this study. 7 males and 1female with a M:F ratio of 7:1. The age range was 18-52years with a mean of 36.1±11.6. All the patients were involved in road traffic accidents. Two were pedestrians knocked down by vehicles that lost control while the rest were passengers of motor cycles that were knocked down by vehicles. All the patients had Cierny and Mader type IVA chronic osteomyelitis. Linear rail system (LRS) was used in 7 of 8 patients while one used Ilizarov device. The range of length of the bone excised was 6-12cm with a mean of 9.1cm. The average duration of external fixator was 10 months with a range of 8-14months. 7 of the patients presented first in the hospital and had surgical intervention that included implant surgery for fracture fixation, debridement, external fixation and multiple skin grafting. Only one patient had the intervention of traditional bone before presenting to us for treatment. Wound swab m/c/s yielded growth of staphylococcus aureus and pseudomonas aeruginosa that were sensitive to rifampicin and ciprofloxacin. Outcome of treatment was excellent in 6 and good in 2 using Dror Paley criteria. The complications seen were pin tract infection, muscle spasm, loss of some regenerate, joint stiffness and pains.

S/N	AGE	SEX	LBE	DOD	DEVICE	OUTCOME
1.	32yrs	M	12cm	14months	Ilizarov	excellent
2.	46yrs	M	6cm	8months	LRS	good
3.	18yrs	M	8cm	10months	LRS	excellent
4.	28yrs	M	10cm	12months	LRS	excellent
5.	30yrs	M	6cm	8months	LRS	excellent
6.	48yrs	M	10cm	12months	LRS	excellent
7.	52yrs	M	10cm	12months	LRS	good
8.	35yrs	F	12cm	14months	LRS	excellent

LBE=Length of bone excised, DOD= Duration of device

Fig 1: Pre-op picture showing sequestrum and implant

Fig 2: Intra –op debridement

Fig 3: Same limb with LRS in-situ

Fig 4& 5: Limb in cast during consolidation and check x-ray

Fig 6 & 7: showing limb and x-ray of a patient before procedure

Fig 8: After procedure

4. DISCUSSION

Treatment of chronic osteomyelitis is a big challenge to every orthopaedic surgeon. This is because it is difficult to completely eradicate infection in the bone except the leg or limb containing the infected bone is amputated[13]. Another challenge has been the management of the defect created following radical excision of the infected bone segment. Once complete excision is achieved and viable bone and soft tissues are left behind as evidenced by a positive paprika sign, then it will be very easy to contain the residual infection left with antibiotics determined by the wound swab m/c/s result.

Several methods have been used to adequately identify viable bone and soft tissue from sequestra and poorly perfused soft tissues. These include the use sulphan blue that stains normal tissues green but does not stain dead[5]. Others are the use of computerized scan[14] of the bone and paprika sign[4]. Paprika sign, the colour of the bone and the sound produced by the bone when struck by a metal were used during the radical debridement of the patients in this study to identify the necrotic bone.

Barbarossa et al[15] reported a case of a 26years old woman with post-traumatic chronic osteomyelitis caused by vibrio alginolyticus following contamination of an open tibial fracture with sea water. The patient had bone resection and bi-focal osteosynthesis by Ilizarov technique and treatment with a combination of tetracycline and ciprofloxacin. The patient had a good outcome.

Lin et al[16] reviewed the treatment of 16 patients with chronic osteomyelitis of the tibia over a 14 year period and developed a staged treatment protocol. The stages were 1. radical debridement of infected bone and soft tissue; 2.immediate application of Ilizarov's apparatus for all patients except those needing delayed application; 3. osteotomy in healthy bone; 4. simultaneous distraction-compression osteogenesis and histiogenesis; 5. Additional docking-site bone grafting ; 6. changing the external fixator to locked nail when callus formation was visible at the distraction site. Union was achieved in 15 of 16 patients with an average eternal fixation time of 4.5 months (range of 3- months). No deformity or limb length discrepancy of >1cm was recorded. The concluded that this staged protocol was safe and successful. The technique provided a unique type of reconstructive closure for infected wound without the need of flap coverage. Almost the same approach was adopted in this study except that locked nail was used in only one of our study patients. It was not done for the rest patients because of the fear of infection. This possible complication was explained to the patient who had it and the need to remove the nail on time was advised.

El-Moatassem[17] managed tibial defect created after radical debridement in 16 patients with chronic osteomyelitis using distraction osteogenesis. He achieved excellent result in both anatomic and functional outcome in 11patients while the rest needed a repeat surgery to achieve satisfactory bone healing.

Papineau technique[5] is limited in the length of the defect it can manage, while the use of muscle flap, myocutaneous island flap and osteomyocutaneous island flap in areas devoid muscles like the distal leg require the expertise of experienced plastic surgeon that are often not readily available[18]. Sometimes these complex plastic surgical procedures fail because of infection resulting from inadequate debridement. This was the case in one of the patients in this study(Fig 7) who had extensive skin loss of the proximal third of the leg some days after surgery (open reduction and internal fixation). He was a victim of a road traffic accident in which he suffered a closed fracture of the proximal tibia and fibula. He had muscle flap coverage with the internal fixation converted to external fixation. Despite these interventions, the flap failed because of infection. Ilizarov bone transport was able to overcome this difficult challenge with relative ease without the help of a plastic surgeon after the infective focus had been eradicated. A sequestrated bone of about 11cm was excised and new bone regenerated as well as new soft tissue cover from the same process. Five of the patients in this study did not have any plastic surgical intervention in the course of their treatment. The sequestra and implants were removed and bone transport was done to achieve successful treatment in their cases.

Local antibiotic therapy with genticin-impregnated beads has raised a lot of controversies. The issues include the duration of implanted beads, the need for removal and the choice of non-absorbable versus bioabsorbable delivery vehicles[19]. The long stay of antibiotic beads and spacers remain controversial because of the risk of secondary infection and the development of resistant organisms[19]. Secondary infection results when the beads which act as foreign body remain after complete elution of the antibiotics.

Antibiotic management of the infection in the patients of this study was a big challenge. A lot of these patients had been on different types of antibiotics prior to presentation for treatment, sometimes exhausting all available options in the wound swab m/c/s test result. The culture results showed organisms resistant to the antibiotics used in the culture test. Combined empirical use of drugs like rifampicin with lincomycin and rifampicin with ciprofloxacin known to have good bone penetration and effective for bone infection were resorted to. These patients had not been exposed to them. This gave good outcomes as the infection was controlled. The wound discharge stopped and the wound eventually healed. Oral antibiotics proven to be effective in chronic osteomyelitis include clindamycin, rifampicin, trimethoprim sulfamethoxazole and fluoroquinolones. Studies have shown that after discontinuation of antibiotics, no recurrence of infection occurred in 67% of patients treated with trimethoprim-sulfamethoxazole, 55% of patients treated with rifampicin and fusidic acid and 50% of patients treated with rifampicin and ofloxacin[20]. Rifampicin must always be used in combination with other antibiotics for prosthesis infection because it acts on the biofilm and prevent recurrence [20].

In this study, it was observed that all the injuries resulted from road traffic accident; six of the patients were motor cycle passengers while 2 were pedestrians knocked down by vehicles that lost control. The need to stop the use of motor cycles as means of commercial transportation has been emphasized by relevant authorities and government in different states have been implementing it as motorcycles are being replaced by tricycle vans in different cities in the country. There is need to provide walk ways for pedestrian with adequate protection. This will go a long way to reduce the current accident rate. In addition, the statistic in this study indicates that men were

worse affected (87.5%). This is not good at all especially when they happen to be in working age group. This will deplete the workforce and adversely affect the economy of the nation. The man-hour of time lost and the money spent to treat these patients will be saved if these problems are prevented in the first place. Efforts should be channeled towards prevention by making our roads a safe place. Several authors have written a lot in this regards.

The patients were very happy with the outcome of their treatment (Figs 4 and 8) and it encouraged them to continue the treatment in spite of the pains suffered during distraction and the high cost of treatment. It gave them hope after they had been offered amputation previously by other surgeons. The stigma caused by the continuous discharge and foul smell of the leg was now a thing of the past. This, in itself is an indication for amputation; a damn useless limb. Chronic osteomyelitis also has an associated risk of malignant transformation (squamous cell carcinoma)[21] and secondary amyloidosis[21] which can lead to renal failure. The patients were saved from all these potential future complications.

5. CONCLUSION

The use of Ilizarov bone lengthening technique has made treatment of chronic osteomyelitis a possible reality .This had hitherto been a night mare to orthopaedic surgeons and sorrow and death to the patients. The good outcomes have brought joy and hope to patients and relieve to the surgeons. All orthopaedic surgeons are encouraged to learn this technique to be able to manage this common problem in their practice.

6. REFERENCES

[1] Concia E, Prandini N, Massari L, Ghisellini F, Consoli V, Menichetti F. Osteomyelitis: clinical update for practical guidelines. *Nucl Med Commun*. Aug 2006;27(8):645-60.
[2] Böhm E, Josten C. What's new in exogenous osteomyelitis?. *Pathol Res Pract*. Feb 1992;188(1-2):254-8.
[3] Laughlin RT, Reeve F, Wright DG, Mader JT, Calhoun JH. Calcaneal osteomyelitis caused by nail puncture wounds. *Foot Ankle Int*. Sep 1997;18(9):575-7.
[4] Mader JT, Cripps MW, Calhoun JH. Adult posttraumatic osteomyelitis of the tibia. *Clin Orthop Relat Res*. Mar 1999;(360):14-21
[5] Solomon L, Warwick DJ, Nayagam S. Apley's system of orthopaedics and fractures.8th Edition. 2001; Chapter 2:38
[6] Weber EJ. Plantar puncture wounds: a survey to determine the incidence of infection. *J Accid Emerg Med*. Jul 1996;13(4):274-7.
[7] 3. Paluska SA. Osteomyelitis. *Clinics in Family Practice*. 2004;6:127-56.
[8] 4. Calhoun JH, Manring MM. Adult osteomyelitis. *Infect Dis Clin North Am*. Dec ;2005;19(4):765-86.
[9] Ger R. Muscle transposition for treatment and prevention of chronic post-traumatic osteomyelitis of the tibia. *J Bone Joint Surg Am*. Sep 1977;59(6):784-91.
[10] Weiland AJ, Moore JR, Daniel RK. The efficacy of free tissue transfer in the treatment of osteomyelitis. *J Bone Joint Surg Am*. Feb 1984;66(2):181-93.
[11] Rosenfeld SR. The Ilizarov method. *West J Med*. Dec 1995;163(6):568..
[12] Louie KW. Ilizarov method. *West J Med*. Aug 1991;155(2):170..
[13] Gateley DR, Irby SJ, Martin DL, Simonis RB. Ilizarov bone transport for the treatment of chronic osteomyelitis: a rare complication. *J R Soc Med*. Jun 1996;89(6):348P-50P.
[14] Dror P, Herzenberg JE, Paremain , Bhave A. Femoral lengthening over an intramedullary Nail. A Matched case comparison with Ilizarov femoral lengthening. J. Bone Joint Surg Am.1997;79:1464-80
[15] 14. Gross T, Kaim AH, Regazzoni P, Widmer AF. Current concepts in posttraumatic osteomyelitis: a diagnostic challenge with new imaging options. *J Trauma*. Jun 2002;52(6):1210-9.
[16] 15. Barbarossa V, Kucisec-Topes N, Aldova E, Matek D, Stipoliev F. Ilizarov technique in the treatment of chronic osteomyelitis caused by vibrio alginolyticus. Croat. Med. J.2002;43(3):364-9
[17] 16. Lin CC, hen CM, Chiu FY, Su YP, Liu CL,Chen TH. Staged protocol for the treatment of chronic tibial shaft osteomyelitis with ilizarov's technique followed by the application of intramedullary locked nail. Orthopedics. 2012;35(12):e1769-74
[18] 17. El-Moatassem EHM. A single-stage operation in the treatment of tibial chronic osteomyelitis with the use of the Ilizarov technique. Egyptian Orthop. Journal.2012; 47(3):296-304
[19] 19. Zalavras CG, Patzakis MJ, Holtom P. Local antibiotic therapy in the treatment of open fractures and osteomyelitis. *Clin Orthop Relat Res*. Oct 2004;(427):86-93.
[20] 20. Roesgen M, Hierholzer G, Hax PM. Post-traumatic osteomyelitis. Pathophysiology and management. *Arch Orthop Trauma Surg*. 1989;108(1):1-9.
[21] 21. Thio D et al. Malignant change after 18 months in a lower limb ulcer. Acute Marjolin's revisited. Br J Plast Surg. 2003; 56:825