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Original Article

To evaluate the functional and radiological outcome of LRS in fractures of Tibia with or without bone loss and to compare it with simple external fixator.

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Abstract

Background & Methods: The aim of the study is to evaluate the functional & radiological outcome of LRS in fractures of Tibia with or without bone loss & to compare it with simple external fixator. The patients of all age groups were included. Majorities were male & predominant mode of injury was Road Traffic Accidents.

Results: Majority of cases (22) underwent a rigid external fixation & 4 of them underwent flap rotation, 8 of them underwent skin grafting, bone grafting in 2 patients, plating in 1 patient & interlock nailing in 1 patient.

Conclusion: With the excellent results we recommend this technique for the above mentioned indications. This monolateral rail fixator has the further advantages of dynamization to facilitate fractures union & lengthen limbs. In addition it has sufficient stability for lower extremity fractures & can improve patient's daily functions, such as walking, squatting, or even sitting with legs crossed. It can be concluded that, the LRS external fixator is simple, stable, rigid & safe device in trauma management with excellent results.

Keywords: radiological, LRS, fractures, Tibia & fixator.

Study Design: Observational Study.

Introduction

Tibia is the medial & larger bone of the leg. It is subjected to load many times the body weight during normal physiological activity. It is exposed to frequent injury & it is the most commonly fractured long bone[1]. Open fractures are more common in the tibia than any other major long bone as one third of tibial surface is subcutaneous throughout most of its length .High velocity tibial fractures may be associated with compartment syndrome or neural or vascular injury. Delayed union, nonunion & infections are relatively common complications of tibial shaft fractures.

The tibia is situated at the medial side of the leg, and, excepting the femur, is the longest bone of the skeleton[2]. It is prismoid in form, expanded above, where it enters into the knee-

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joint, contracted in the lower third, & again enlarged but to a lesser extent below. In the male, its direction is vertical, & parallel with the bone of the opposite side; but in the female it has a slightly oblique direction downward & lateralward, to compensate for the greater obliquity of the femur[3].

The lateral surface is narrower than the medial; its upper two-thirds present a shallow groove for the origin of the Tibialis anterior; its lower third is smooth, convex, curves gradually forward to the anterior aspect of the bone, & is covered by the tendons of the Tibialis anterior, Extensor hallucis longus, & Extensor digitorum longus, arranged in this order from the medial side[4].

The posterior surface presents, at its upper part, a prominent ridge, the popliteal line, which extends obliquely downward from the back part of the articular facet for the fibula to the medial border, at the junction of its upper & middle thirds; it marks the lower limit of the insertion of the Popliteus, serves for the attachment of the fascia covering this muscle, & gives origin to part of the Soleus, Flexor digitorum longus, & Tibialis posterior. The triangular area, above this line, gives insertion to the Popliteus[5-6]. The middle third of the posterior surface is divided by a vertical ridge into two parts; the ridge begins at the popliteal line & is well-marked above, but indistinct below; the medial & broader portion gives origin to the Flexor digitorum longus, the lateral & narrower to part of the Tibialis posterior. The remaining part of the posterior surface is smooth & covered by the Tibialis posterior, Flexor digitorum longus, & Flexor hallucis longus.

Material & Methods

Study of 30 cases of fractures of tibia with bone loss (primary or secondary) performed at Department of Orthopaedics at Amaltas Institute of Medical Sciences, Dewas, M.P., for 01 Year. These cases included fresh trauma of tibia with severe soft tissue injury with bone loss/ without bone loss, infected non-union of tibia, aseptic nonunion of fractures of tibia, gap nonunion & shortening.

22 cases were applied external fixator primarily (in 20 cases with bone loss & in 2 cases without bone loss) & in 8 cases LRS was applied primarily (in 5 cases with bone loss & in 3 cases without bone loss). Most of the cases were compound comminuted fracture of tibia with bone loss.

A radiolucent table is used & the Image Intensifier placed at right angles to the table on the opposite side of the patient to the surgeon. A sandbag is placed under the lower back & buttock to bring the leg from its normal externally rotated position to neutral, making sure that the image of the hip will not be obscured.

Where there is an unstable segment, care must be taken when handling the limb. The skin of the whole limb should now be prepared, from the toes to the lower abdomen. A disposable U-drape should be used to isolate the perineum. The U-drape should be applied in such a way that the leg can be moved freely.

Inclusion criteria

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE4, 2024

1. Without any associated neurovascular injury

2. Compound segmental fractures of tibia

Exclusion criteria

1. Pathological fractures

2. Fractures from metabolic bone diseases

3. Patients not fulfilling above inclusion criteria

Result

Table No. 1: Age Group

Age Group	No. of Patients	Percentage
2 – 10 Years	01	03%
11 - 20 Years	02	07%
21 - 30 Years	04	13%
31-40 Years	**21**	**70%**
41 - 50 Years	02	07%
50 ≥ Years	00	00%
Total	30	100%

The observations were made after studying 30 cases of lower extremity trauma treated with Limb Reconstruction System. Most of the patients (70%) belonged to 3rd & 4th decades of life. The mean age was 31.9 years.

Table No. 2: Mode of Injury

Mode of Injury	No. of Patients	Percentage
Road Traffic accident	27	**90%**
Railway Accident	02	07%
Accidental Fall	00	00
Assault	01	03%
Others	00	00%
Total	25	100%

Majority of fractures of lower extremity resulted from road traffic accidents.

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE4, 2024

Table No. 3: Knee range of motion.

Knee ROM	No. of patients	Percentage
< 90	06	24%
90 -100	0	00%
110 -120	0	00%
> 120 (full)	19	76%

Range of motion of the knee tested at the time of union gave the following results; Out of 25 patients, 76%of the patients have good range of motion. In 1 patient there is Fixed Flexion Deformity (FFD) of 20^0 at knee,

Table No. 4: No. of surgeries done before or after LRS frame fixation

Name of Surgery	No. of patients	Percentage
External Fixator	22	**73%**
Skin Grafting	08	27%
Flap rotation	04	13%
Bone Grafting	02	08%
Plating	01	03%
Interlock nailing	01	03%

Majority of cases (22) underwent a rigid external fixation & 4 of them underwent flap rotation, 8 of them underwent skin grafting, bone grafting in 2 patients, plating in 1 patient & interlock nailing in 1 patient.

Discussion

A study 16 cases, 4 cases developed pin tract infection, 5 required isolateral pin removal, 2 cases required entire frame removal. Hoffman et al, reported pin tract infection in 3%, skin reaction in 6%, similar to our study. Mohr et al; reported 50% pin tract reactions which is more than our results. 3 cases required readjustment of frame due to pin loosening[7].

The average union time in their study was 10.4 months (4-24). Rathacker & Cananela et al., reported a mean time for clinical union of 20.8 wks (7-60 wks) after knee arthrodesis. 27 cases & found a mean of 2. 2 months longer for fusion to heal in patient who had the arthrodesis at the site of infection. The limb length nearly equalized in most of the cases. Saleh & Hammer, suggested bifocal lengthening in cases of extreme shortening or shortening with metaphyseal deformity[8].

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE4, 2024

Management of infected non-union is aimed to control the infection & to promoteunion at the fracture site with a proper alignment of the fracture fragments along with the maintenance of normal length & restoration of movements at the adjacent joints & getting a fully functional & painless limb. The segment of infected bone was resected till the bleeding ends appear (paprika sign) [9]. Distraction osteogenesis was done at the rate of 1 mm / day in 4 steps to fill the gap. It took around 4 weeks to 17 weeks depending upon the length of excised bone.13 In our Study treatment of infected non-union of tibia 90% patient showed successful Union in 8 to 12weeks period which is comparable to other studies Garcia-Climbrelo et al,[10] Gajbhiye AI et al., [11] & Patil S et al. [12] In majority of the patients range of motion was not much impaired. Average follow-up was for the 18 months ranging from 12 to 24 months study is comparable to mean bone transport was 3 to 12 cm comparable to the other studies like Sen et al. [13-14] Mean duration of LRS application was 52.2 weeks. One patient had severe equines deformity at ankle joint as the patient did not comply with the ROM exercise.

Conclusion

With the excellent results we recommend this technique for the above mentioned indications. This monolateral rail fixator has the further advantages of dynamization to facilitate fractures union & lengthen limbs .In addition it has sufficient stability for lower extremity fractures & can improve patient's daily functions, such as walking, squatting, or even sitting with legs crossed. It can be concluded that, the LRS external fixator is simple, stable, rigid & safe device in trauma management with excellent results.

References

1. Mahajan NP, Mangukiya HJ. Extended use of limb reconstruction system in management of compound tibial diaphyseal fracture as primary & definitive tool. Int J Res Orthop. 2017;3(6):1157-64.

2. Gopal S, Majumder S. Fix & flap: The radical orthopaedic & plastic treatment of severe open fractures of the tibia. J Bone Joint Surg Br 2000;82:959-66.

3. Biasibetti A, Aloj D. Mechanical & biological treatment of long bone non-unions. Injury 2005;36:S45-50.

4. Sangkaew C. Distraction osteogenesis for the treatment of post traumatic complications using a conventional external fixator. A novel technique. Injury 2005;36:185-93.

5. Chahar HS, Gupta M, Kumar V, Yadav R, Patel J, Pal CP. Prospective evaluation of role of limb reconstruction system (Rail External Fixator) in open fractures & infected non-union of femur. Journal of Orthopaedic. 2021;11(1):5-11.

6. Ajmera A, Verma A, Agrawal M, Jain S, Mukherjee A. Outcome of limb reconstruction system in open tibial diaphyseal fractures. Indian J Orthop. 2015;49(4):429-35.

7. Singh P, Singh S K, Gill S P S. Management of compound fractures of tibia by limb reconstruction system (LRS). Journal of Bone & Joint Diseases. 2020;35:29-34.

8. Jain S, Mukherjee A, Ajmera A, Verma A, Agrawal M. Outcome of limb reconstruction system in open tibial diaphyseal fractures. Indian J Orthop. 2015;49(4):429–35.

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE4, 2024

9. Donnan LT, Saleh M, Rigby AS, McAndrew A. Radiographic Assessment of Bone Formation in Tibia During Distraction Osteogenesis. J Pediatr Orthop. 2002;22(5):645–51.

10. García-Cimbrelo E, Martí-González JC. Circular external fixation in tibial Nonunions. Clin Orthop Relat Res. 2004;419:65–70.

11. Gajbhiye AI, Goyal SS, Kumar MM. Dorai Kumar Outcomes of mono-lateral limb reconstruction system in infected non-union of long bonesInt. J Res Orthop. 2018;4(1):27–32.

12. Patil S, Montgomery R. Management of complex tibial & femoral nonunion using the Ilizarov technique, & its cost implication. J Bone Joint Surg Br. 2006;88:928–4.

13. Sen C, Kocaoglu M, Eralp L, Gulsen M, Cinar M. Bifocal Compression-Distraction in the Acute Treatment of Grade III Open Tibia Fractures With Bone & Soft-Tissue Loss. J Orthop Trauma. 2004;18(3):150–7.

14. Sharma B, Kumar Shakunt R, Patel J, et al. Outcome of limb reconstruction system in tibial infected non-union & open tibial diaphysial fracture with bone loss. Journal of Clinical Orthopaedics & Trauma. 2020;10:008.