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Conservative Treatment of Closed and Gustilo Type-I Tibial Shaft Fracture

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Abstract **Original Research Article**

Background: As the tibia is a subcutaneous bone tibial shaft fractures are the common long-bone fractures, mostly closed and Gustilo Type-I. Various treatment methods including conservative treatment external fixation, intramedullary nailing and plate fixation have been suggested but none of these is considered the "gold slandered" for these injuries. ***Objective:*** The objective of this study is to evaluate the outcome of conservative treatment of closed and Gustilo Type-I tibial shaft fractures. ***Methods:*** A total of 43 fractures of the shaft of the tibia were treated with closed reduction and a long leg cast for eight to ten weeks followed by a PTB cast for another six to eight weeks from July 2018 to June 2021. One year follow up was done with 33 patients, ten months follow up with seven patients and three patients were lost to follow up. ***Results:*** All fractures united within six months of duration. Immediate post-reduction angulation was 2.52 degrees in the sagittal plane and 3.12 degrees in the coronal plane. The average final angulation was 4.45 degrees in the sagittal plane and 3.85 degrees in the coronal plane. The average limb length shortening was 5.4 mm. A full range of motion was gained compared to the normal side by six months of follow up. ***Conclusion:*** Closed Tibial shaft fractures can be treated conservatively with closed reduction and cast immobilization with many advantages over operative methods.

Keywords: Conservative, midshaft, fracture, tibia.

INTRODUCTION

Because of its subcutaneous position, the tibia is more commonly fractured, and more often sustains closed fracture, than any other long bone [1]. Tibial fractures are more often closed and associated with skin lesions. Skin lesion classified by Tscherne is Grade IC1- no skin lesion, Grade 1C2 – no skin laceration but contusion, Grade IC3- circumscribed degloving, Grade IC4 – Extensive, closed degloving, Grade 1C5 – necrosis from contusion, But there also open fracture, classified by Gustilo- Grade- 1 wound <1cm long, Grade-11->1 cm long, grade-IIIA usually >1 cm long, comminuted fracture, Grade-III B- usually >10 cm long with severe loss of soft tissue, Grade IIIC > 10 cm long with a need for vascular repair [2, 3]. Treatment of tibial shaft fractures is very difficult. Many options of treatment such as conservative treatment, external fixation, intramedullary nailing, and plate fixation have been described, but none of these is the gold standard [4]. Conservative treatment may result in loss of reduction and subsequent mal-union or non-union. External fixation may result in reduction failure, malunion and pin tract infection. Intramedullary nail fixation has become the mainstay of treating the tibial shaft fracture. Because of its success, the indications have been extended to the proximal and distal metaphyseal fractures. Intramedullary nailing may result in malunion or nonunion due to non-compliance to patients, comorbidities, frailty, BMI, pre-morbid level of function, smoking status, long oblique and butterfly fragment [5]. Plate fixation may result in wound complications and infections due to massive soft tissue dissection during operation. Most closed and Gustilo Type-I fractures can be treated successfully with conservative treatment that avoids the potential complications of surgical intervention.

METHODOLOGY & MATERIALS

This is a prospective study carried out in rural and tertiary level hospitals due to a lack of modern operative facilities, trained manpower and socioeconomic problems from July 2018 to June 2021. All the closed and Type-I open tibial or tibial and

fibular stable fractures, at the mid-shaft, were included in this study, severely contaminated open fractures, intraarticular fractures, and severely comminuted fractures involving more than 50% of the circumference, pathological fractures and patients with polytrauma were excluded from this study. A total of 43 patients were eligible three patients were lost to follow up, and 40 patients were included in this study. The mean age at the time of injury was 30 years (Range 19-50 years). There were 28 males and 12 females. The mechanisms of injury included fall on the ground in 7 patients, motor vehicle accident (MVA) in 15 patients, fall from height e.g. tree or roof in 20 patients and direct blow in 8 patients, twenty-four patients right and sixteen had left-sided fractures. Twenty-nine fractures were short oblique and four were transverse in the pattern. Thirty-two were closed and 8 patients were Type-I open tibial shaft fractures.

Closed fractures with limb swelling were kept in a long leg posterior slab with the limb elevated for up to a maximum of 14 days. Type-I open fractures have closed the wound primarily after proper surgical toileting and antibiotics coverage for a maximum of 16 days. Closed reduction was done with the patient lying supine hanging the leg vertically from the edge of the operation table. General or regional anaesthesia was given where needed. A long leg cast was applied. An X-ray of the leg was done to assess the reduction. The acceptable reduction was considered up to 5 degrees of medial or lateral angulation, 8 degrees of anterior or posterior angulation, 5 degrees of rotation, and 15 mm of shortening. Wedging of the cast was done to correct unacceptable angulation. Isometric quadriceps strengthening exercise started immediately after the application of a cast. A long leg cast was retained for eight to ten weeks depending upon radiological callus formation and comminution of the fractures. After removal of the long leg cast, PTB (Patellar tendon bearing) cast was applied. Then gradual partial and then full weight-bearing ambulation and knee and ankle mobilization exercises started. PTB cast was continued for six to eight weeks. X-ray evaluation was done in three months, six months, nine months and one year follow up. Immediate post-reduction angulation, rotation and shortening were recorded. Duration of fracture union was noted. Final angulation and limb length shortening were recorded after achieving fracture union. Knee and ankle range of motion were compared with normal limbs. Data were analyzed manually and then rechecked with SPSS (Statistic package for social science) computer package programme. Ethical clearance was taken individually from the patient and the ethical review committee of Khulna Medical College Hospital.

RESULTS

Forty-three patients were treated at our institution over three years from July 2018 to June 2021, but three patients were lost to follow-up before the radiographic bone union was achieved. As a result, 40 patients were evaluated in terms of union rate, time is taken to achieve union. Post reduction and final angulation in sagittal and coronal planes, limb length discrepancy and joint stiffness clinical and radiological union in all fractures were achieved within 6-8 months. Post reduction average medical/lateral angulation was 2.5 degrees (2^0-4^0). Final angulation in same plane 4^0 (3^0-8^0). In 34 patients it was 5^0 or below. In six (15%) cases it was 7^0. Anterior/posterior angulation at lateral view x-ray at post-reduction was 3^0 (2^0-5^0) and the outcome was 3.8^0 (2^0-7^0). In seven cases it was more than 6^0. None of the patients had recurvatum. The average limb length shortening was 5.4 mm (4-10mm). By eight months all the patients had a full range of motion of knee and ankle joints compared to the normal side. Eight patients required extensive physiotherapy for regaining full range of motion. There was no infection in Type-I open fracture and no plaster related complication. A long leg cast was softened and broken in six patients. All of them needed reinforcement or reapplication of the cast.

Table-1: Post reduction and final angulation.

Angulation		Post reduction	Final
Media/Lateral	Min	2^0	3^0
	Max	4^0	8^0
	Average	2.5^0 (±1)	4^0 (±1.1)
Anterior/Posterior	Min	2^0	2^0
	Max	5^0	7^0
	Average	3 (±1.02)	3.8 (±1.28)

Figure-1: Pre-operative status

Figure-2: Post-operative status after 3 months

Figure-3: Post-operative status after 6 months

DISCUSSION

Closed and Type-I open isolated tibial or tibial and fibular fractures are difficult to manage. Treatment selection depends on the proximity of the fracture to the plafond, fracture displacement, comminution and injury to soft tissue. Conservative treatment is possible for stable fractures with minimal shortening [6]. Intramedullary nailing allows atraumatic, closed stabilization with preservation of vascularity and integrity of the soft tissue coverage. Plate fixation is effective but extensive dissection and periosteal stripping increase the risk of infection and non-union [7]. In our study, all the fractures united within 6-8 months. Sarmiento *et al*., In a study of 1000 closed fractures of the tibial shaft reported that conservative treatment with the use of a functional below-knee cast-brace was effective [8]. Nicoli did not find the patient's age or the presence of an intact fibula to be associated with delayed or non-union [9]. Zelle conducted conservative treatment, non-union was 1.3%, and malunion was 15% [10]. Non-union very less with conservative treatment if there is proper immobilization and the advantages are more biological, negligible risk of infection and no need for hardware removal [11]. In our study, post-reduction mean lateral angulation was 2.5^0 and the final follow up angulation was 4^0. Antero-posterior angulation was 3^0 and finally follow up 3.8^0. Sarmiento and Latta reported less than 5^0 in 67% of cases with conservative treatment [12]. Limb length shortening was 5.4mm. Sarmiento and Latta reported a shortening of less than 12mm in 94% of patients treated conservatively. In our study, all the patients had full range of motion (ROM) of ankle and knee joints compared to normal side by six months [12-15]. There were no infection and cast related complications in our study. For cast immobilization, the surgeon must be skilled in cast technique and the patient must be committed to returning frequently for follow up and making adjustments during treatment.

CONCLUSIONS

Patients with closed, and Type-I open, stable tibial fractures can be treated successfully with a cast and has acceptable loss of reduction during treatment. There is less chance of non-union and no chance of infection. Hence these fractures can be treated conservatively with closed reduction and cast immobilization with numerous advantages over surgical treatment.

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