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Results of non-surgical treatment of isolated closed tibial shaft fractures

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ABSTRACT

This Research aimed to see how well isolated closed tibial fractures retained their reduction after being immobilized in a cast. Medical data were gathered for all patients of identified solitary closed tibial shaft fractures treated non-surgically. Males were more typically impacted than females among the 32 individuals evaluated. The mean age was 27.68 years old (SD=7.06). Direct trauma with motorcycle was the most prevalent causes of injury. The average follow-up time for each patient was 9.1 months (SD=2.36). According to the AO/OTA classification, 34.4 % of the fractures are A1.1, 28.1% are A2.1, and 37.5 % are A3. The average time for all fractures to heal was 13.7 weeks (SD=3.24). In the 22nd week, there was one occurrence of delayed union. Shortening of bone was less than 1 cm in 93.75 % of patients and more than 1.5 cm in 6.25% of patients. In 2 (6.25%) of the patients, the anterior or posterior angulation was more than 10 degrees. Furthermore, even with uncomplicated tibial fractures, there appears to be a debate about therapy selection when considering long-term physical handicap and a longer follow-up time.

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INTRODUCTION

Tibia fractures are significant for two reasons. They are common in the first place, and they are controversial in the second. The tibial shaft is the most prevalent location for long bone fractures due to its location (Giannoudis *et al.*, 2006).

Tibial shaft fractures are notoriously difficult to treat, and opinions differ on the best course of action. Both conservative and surgical therapies have been developed to minimize the amount of time required for the union while at the same time decreasing the possibility of complications (Müller *et al.*, 2012). A cast and a closed reduction and fixation are often used for low-energy tibial shaft fractures (Hogue *et al.*, 2019). However, many studies have demonstrated that immobilization in a plaster cast does not provide enough stability for low-energy fractures (Quadlbauer *et al.*, 2020). The shape of the Fracture, soft tissue injury and an intact fibula are all factors that might affect the result (Casstevens *et al.*, 2012). Operative therapy is recommended for open tibial shaft frac-

tures according to current guidelines. Reamed and undreamed nailing has a significant preference in using intramedullary nailing for tibial shaft fractures with either open or closed therapy and with equal acceptance for both procedures (Mahendra and Singh, 2018; Sharr and Buckley, 2014). The most challenging approach to treating tibial fractures is through the use of plates (Prat-Fabregat and Camacho-Carrasco, 2016). However, in recent years, scientists have advocated percutaneous plating with promising outcomes (Ayoub *et al.*, 2016).

The purpose of this study was to look at how well simple isolated closed tibial fractures retained their reduction after being immobilized in a cast. Radiographs were evaluated from hospital records. The degree of displacement on the first radiographs was also looked at as a possible predictor of retention success.

METHODS

In the Orthopedic department of Liaquat University Of Medical and Health Science, Jamshoro, Pakistan, data was gathered for the patients between march 2020 to march 2021, medical data were gathered for all cases of solitary closed tibial shaft fracture in patients 16 years of age and older treated non-surgically. A total of 36 patients were hospitalized for non-operative therapy after being diagnosed with a two-fragment isolated closed tibial shaft fracture. We looked through medical records and radiographs. Two individuals, however, were omitted because their original radiographs were lacking. The following are the inclusion criteria: (a) fractures with a genuine diaphyseal location; hence, fractures affecting joints have been eliminated; (b) fractures in Tscherne's C0 (Typical fracture pattern: Spiral, Typical soft tissue damage: None to minimal) or C1 (Typical fracture pattern: Rotational ankle fracture-dislocations, Typical soft tissue damage: Superficial abrasion/contusion) categories of soft-tissue damage. (c) records of patients who have been hospitalized for closed reduction and cast immobilization therapy. We looked at 32 patients who met these criteria. The fractures were diagnosed using the AO classification and radiographs from the patients. Our patients were typed A (AO/OTA categorization), which comprises A1.1 spiral fracture-intact fibula, A2.1 oblique fractures-intact fibula (30° inclination or more), and A3.1 transverse fractures-intact fibula (less than 30° inclination), according to criteria. Inclusion with diaphyseal fractures, the proximal, middle, or distal third of the tibia has been designated as the Fracture site.

Radiographs were used to classify the fractures and determine their displacement and angulation. When measured on the radiographic image displaying the most significant displacement, displacement was expressed as a percentage of the diaphyseal width at the fracture site. On the radiographic image revealing the most prominent angulation, the initial angulation was measured. On the final radiographs collected during the follow-up examinations, the end outcome in terms of rotation and angulation was measured. General anaesthesia was administered to patients with fractured bones, and those with required fractures were immobilized with a long-leg cushioned plaster cast. The first radiographs in the cast were then obtained. If there was at least 25% cortical apposition, angulation of 5° varus or valgus or 10° anteroposterior on the lateral film, and no more than 1.5 cm of shortening, the reduction was judged satisfactory. For an average of 8.7 weeks, the above-the-knee cast was worn (range, 6 to 14 weeks). Additional radiographic tests were performed at regular intervals (1–2 weeks) until the alignment was achieved if the fracture location was satisfactory. Cast wedging was used to rectify angulation on occasion (2 patients). At around 4–6 weeks following the injury, the patients were allowed to partially bear weight in some more stable fractures. The knee casts were modified to below-knee patellar bearing casts in these patients.

The presence of bridging callus on both anteroposterior and lateral radiographs was used to characterize radiographic healing. Clinically and using radiographs of the knee and ankle, rotational alignment was examined. A normal union was described as one that occurred within 20 weeks, whereas a delayed union was described as one that occurred after 20 weeks. A non-union was defined as a fracture that had not united after 9 months or had exhibited no apparent signs of healing for 3 months.

Statistical Analysis

The statistical analyses are done using the Microsoft Excel program. To characterize the continuously measured data, means and standard deviations (SD) are calculated, whereas frequency and percentage are employed to characterize the qualitative variables of the research.

RESULTS

Out of the 32 patients that were evaluated, 23 (71.88 %) were male and 9 (28.12 %) were women. Therefore, it was more frequent for males to be impacted than females. The mean age of our patients was 27.68 (SD = 7.06 and ranged from 17 to 47 years). Our selected patients sustained the most prevalent types of damage in terms of mechanism of dam-

Table 1: Patients' information with various types of fractures and related parameters

Case	Sex	Age (Yrs)	AO/OTA classification	Location of tibia fracture	Initial displacement	Follow-up (months)	Deformity
1	F	29	A2.1	Mid. third	< 25%	7	Varus=6°
2	M	20	A3.1	Dist. Third	< 25%	13	-
3	M	28	A2.1	Dist. third	< 25%	9	-
4	F	30	A1.1	Mid. third	> 25%	8	Ant. angulation=12°
5	M	25	A2.1	Dist. third	< 25%	9	-
6	F	24	A1.1	Mid. third	< 25%	7	Varus = 7°
7	M	20	A3.1	Dist. third	> 25%	9	Post. angulation=11°
8	M	19	A3.1	Dist. third	< 25%	8	Varus = 10°
9	M	28	A1.1	Mid. third	> 25%	8	Varus = 9°
10	M	22	A3.1	Dist. third	< 25%	6	-
11	M	47	A1.1	Dist. third	> 25%	10	-
12	F	32	A1.1	Mid. third	< 25%	11	-
13	F	22	A2.1	Dist. third	> 25%	10	Shortening = 1.8 cm
14	M	30	A3.1	Prox. third	> 25%	12	-
15	M	20	A3.1	Mid. third	< 25%	9	-
16	F	25	A1.1	Dist. third	< 25%	12	-
17	M	22	A3.1	Dist. third	> 25%	9	Varus = 7°
18	M	23	A1.1	Mid. third	< 25%	10	-
19	M	32	A1.1	Mid. third	> 25%	11	-
20	M	17	A2.1	Dist. third	< 25%	12	-
21	M	47	A1.1	Dist. third	> 25%	6	-
22	M	42	A3.1	Dist. third	< 25%	7	-
23	M	30	A2.1	Mid. third	< 25%	9	-
24	M	24	A3.1	Prox. third	< 25%	6	-
25	F	26	A1.1	Dist. third	< 25%	12	-
26	M	30	A2.1	Mid. third	> 25%	11	Shortening = 2.6 cm
27	M	31	A3.1	Mid third	> 25%	10	-
28	M	30	A2.1	Dist. Third	< 25%	6	-
29	M	26	A2.1	Prox. Third	> 25%	9	-
30	F	24	A3.1	Mid third	< 25%	7	-
31	M	32	A1.1	Mid third	> 25%	11	Varus=7°
32	F	29	A3.1	Dist. third	< 25%	7	-

Table 2: Duration periods for the union of fractures

Weeks to union	Number of patients (percentage)
< 14 weeks	26 (81.25%)
14-20 weeks	4 (12.5%)
> 20 weeks	2 (6.25%)

age resulting from a direct blow, motorbike, and pedestrian accident. The follow-up period on average was 9.1 months (with a standard deviation of 2.02), which varied from 5 to 12 months. In all, 32 patients were given the following fracture type classifications: 11 (34.4 %) A1.1, 9 (28.1 %) A2.1, and 12 (37.5 %) A3.1 fractures. Thus, the most commonly used value was A3.1. More fractures were experienced in the lower part of the tibia (50 %) and the middle third included 40.6 %, while only 9.4 % of the fractures included the proximal third (Table 1 lists the patients' information). The injuries all recovered in an average of 13.6 weeks (standard deviation [SD] = 3.23) (see Table 2).

Table 2 shows the duration of union in patients. Union took more than 14 weeks in three patients,

with fractures in the middle third in two and the distal third in one. These patients' fractures were finally repaired with conservative therapy and a functioning brace. Shortening was less than 1 cm in 30 (93.75%) of our patients and greater than 1.5 cm in 2 (6.25%). (One with 1.8 cm and the other one with 2.6 cm). Two patients (6.25%) had an anterior or posterior angulation greater than 10°, one with an anterior angulation of 12° and the other with a posterior angulation of 11°. Furthermore, we discovered varus angulation > 5° in 6 (18.75%) patients (with specific values of 6°, 7°, 9° and 10°). As a result, the ultimate deformity was seen in 10 (31.25%) of the patients. Refracture happened in one patient three months after he was released from plaster (because he was united) and required surgery. There were no patients in our study who had no non-union, rotational malalignment, infection or partial syndrome.

DISCUSSION

The results of this study showed that men were more commonly affected compared to women. This result has been reported by Jones (2010), where the male incidence was reported 41 per 100,000 per year whereas female incidence was 12 per 100,000 per year. We found 27.68 years for the mean age in our patients. In the literature, the average age of a tibial fracture population was about 37 years (Liu *et al.*, 2015). However, this age variation depends highly on the mechanism of injury. For example, it was 23.5 years for sports injuries and 57.4 years for fallings. Our patients' distribution in A1.1, A1.2 and A1.3 types are approximately similar to the result which was obtained (Hsu *et al.*, 2015). Moreover, the fracture level distribution of our work agrees with the results in the literature (Ferguson *et al.*, 2008).

The average time to the union for the closed fractures varies in the previous studies. It was reported as 16.8 weeks by Bhat *et al.* (2015), while Gaebler *et al.* (2011) achieved union in 16 weeks. Therefore, our derived 13.7 weeks for the average time to union conforms to the previous results. In 13 (40.62 %) patients, the initial displacement was greater than 25% of the shaft diameter, while in 19 patients, it was less than 25% of the diameter (59.38 %). Despite using all conservative therapy methods and selecting patients who met tight criteria, such as isolated closed tibial shaft fractures with low-grade soft-tissue damage, the results of our non-surgical treatment were not adequate (e.g., the final deformity was observed in 31.25 % of patients).

CONCLUSIONS

Isolated tibial shaft fractures are complicated injuries that need lengthy recuperation times and are linked with a high prevalence of complications and additional treatments. Treatment of tibial shaft fractures with a plaster cast can be technically challenging and takes great skill, especially when reduction is required. Since most patients were young, active, and healthy before their injury, long-term physical handicaps caused by cast therapy and extended follow-up periods may preclude them from returning to physically demanding jobs. As a result, patients must be educated before treatment decisions. Furthermore, even for uncomplicated tibial fractures, there appears to be a debate in treatment selection, especially when considering long-term physical handicap and a longer follow-up time. We note that owing to the few subjects in our research, more extensive research is required to make the findings of this paper credible for treatment recommendations.

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Conflict of Interest

The authors declare that they have no conflict of interest.

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