Original Research Article

A Study of Assessment of Surgical Corrections Done in Fracture of Lower End of Tibia and Fibula

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Abstract

Background: The weight of the human is completely balanced on his two limbs and is almost equally dispersed among the two limbs. Bone crack mending damage identified with mechanical issues has been to a great degree rectified by improvements in break management. **Objectives:**To assess parameters after surgical correction of tibia and fibula fractures and to know the condition of the patient after surgical corrections.**Methods:**An interventional study was conducted among fifty patients who attended for x-ray scanning in the Department of Radiology between January 2020 to August 2020 was included in the study. Divided in 2 groups. The following parameters were assessed for this study: Talocrural angle, Tibial overlap, Tibiofibular distance, Joint space A, and Joint space B. SPSS software was used for data analysis.**Results:**The morphometry of radiograph such as Tibial overlap (4.10 ± 1.54), Talocrural angle (25.54 ± 1.13), Joint space A (6.89 ± 0.19), Joint space B (6.22 ± 0.10), and Tibiofibular distance space (9.10 ± 0.14). The results of morphometry showed improvement in above parameters after surgery. Pain was present in the group 1 (12.43%) and in group 2 (70%). Morbidity rate was nil in the case of group 1 and not in group 2.**Conclusion:**The study concludes that the five morphometric points taken into deliberation indeed are useful in evaluating the prognostic outcome in lower end of tibia and fibula fractures after surgery.

Key words: Tibia, Fibula, Radiograph, Articulation, Open reduction.

Introduction

The weight of the human is entirely balanced on his two limbs and almost equally distributed among the two limbs. The ligaments which connect the lower end of the tibia and the fibula are the anterior and the posterior tibiofibular ligaments and the lower part of the interosseous ligaments. The talocrural joint is formed by the thus formed mortise, which articulates with the talus. Fractures of the distal tibia have been treated in the past using various modalities. Rüedi and Allgöwer presented good results with open reduction and stable internal fixation using plates and screws[1].With the increasing incidence of high-energy injuries, however, a rise in complications when using such treatment has been observed including soft tissue dehiscence, infection, osteomyelitis, delayed union or non-unions[2]. All these structures in their own way support each other so that the humans can maintain the weight of their body on their toes. The tibia and fibula are long bones. They are closely linked at the knee and ankle, but they are two separate bones. The thin soft tissue that surrounds the distal tibia makes these fractures difficult. These fractures are often referred to as ‘‘pilon’’ fractures[1] or ‘‘plafond’’ fractures’’[2] if the articular surface of the tibia is involved; in such cases an anatomic realignment of the involved articular fracture in conjunction with a stable fixation is crucial[3]. The main mechanisms of injury for pilon fractures are two: (1) low-energy types, secondary to rotational forces (sporting accidents) and (2) high-energy types from axial loading of the distal articular surface against the talus causing multifragmental implosion of cartilage. Circular frames with tension wires, like the classic Ilizarov fixator, provide better stabilisation especially in comminuted lesions and control the fracture in all three

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planes of the reduction[4].Tibia/fibula fracture is associated with pain and swelling in the lower leg area, an obvious deformity, uneven leg lengths, inability to stand or walk, limited range of motion in the knee or ankle, bruising or discoloration (mayindicate damage to blood vessels). The whole length of the tibia and fibula shown by X-rays. Check for associated injuries to the knee and ankle. CT scans may be required if x-rays are inadequate to make a definitive assessment and for proximal tibial fractures[5]. In severe fractures, the structural abnormalities will be encountered on a massive scale and hence the correction may have to be taken in stages. The rationale behind this study is to know the condition of the patients after surgical correction and structural abnormalities had been approximated to the nearest normal values.

Materials and Methods

An Interventional study was conducted among fifty patients who attended for x-ray scanning in the Department of Radiology between January 2020 to August 2020. The radiograph was taken in anteroposterior view making sure all the identifying points are seen.
The following parameters was assessed for this study as shown in figure

- Talocrural angle.
- Tibial overlap.
- Tibiofibular distance.
- Joint space A.
- Joint space B.

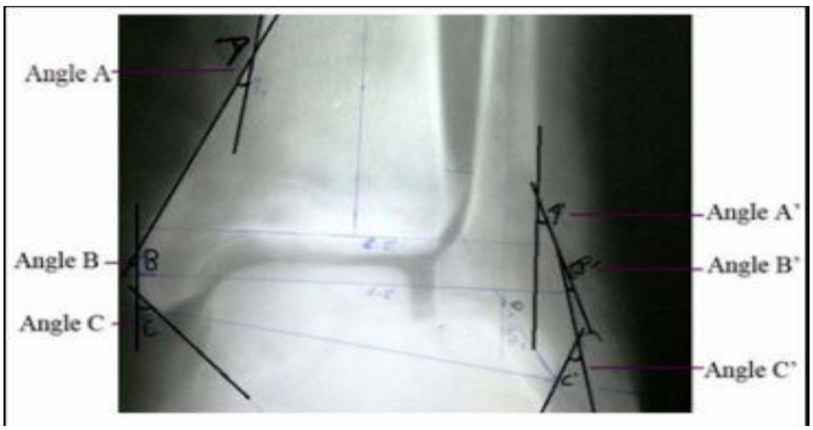

Fig 1:Parameters assessed for the study

All the parameters were measured by using Rhythm radiography software in the Department of Radiology and then was analysed by the Department of Orthopedics. The total 50 study population were divided into two groups: In group 1 (mean ±< 2SD) whereas in group 2 (mean >± 2SD).

Statistical Analysis: Recorded data were analysed using SPSS software. Unpaired student t-test was used for quantitative variables while the Chi- square test was used as a significance test. P-value < 0.05 is considered statistically significant.

Results

Table 1: Radiographical Morphometry of Study Participants (N = 50)

Parameters	Mean (mm)	SD
Tibial Overlap	4.10	1.54
Talocrural Angle	25.54	1.13
Tibiofibular Distance Space	9.10	0.14
Joint space A	6.89	0.19
Joint space B	6.22	0.10

As per table 1 morphometry of parameters in terms of mean and standard deviation was seen before surgery. The morphometry of radiograph such as Tibial overlap (4.10 ± 1.54), Talocrural angle (25.54 ± 1.13), Joint space A (6.89 ± 0.19), Joint space B (6.22 ± 0.10), and Tibiofibular distance space (9.10 ± 0.14).

Table 2: Morphometry after Surgery

Parameters	Group 1 (N = 27)	Group 2 (N = 23)	p-value
Tibial Overlap	11.20	8.10	0.04*
Talocrural Angle	15.40	18.20	0.03*
Tibiofibular Distance Space	4.10	5.82	0.001*
Joint space A	3.92	4.44	0.02*
Joint space B	3.80	4.10	0.002*

*p<0.05 is considered statistically significant

As per table 2 morphometry after surgery was significantly changed (p<0.05). Higher mean length after surgery seen only under one parameter which is tibial overlap. Which was statistically significant (p<0.05), other parameters like talocrural angle, tibiofibular distance space, joint space A and B were higher in group 2 and was statistically significant. (p<0.05)

Table 3: Morphometry three weeks after surgery

Parameters	Group 1 (N = 27)	Group 2 (N = 23)	p-value
Tibial Overlap	10.78	9.33	0.01*
Talocrural Angle	13.48	14.20	0.02*
Tibiofibular Distance Space	3.88	4.82	0.02*
Joint space A	3.72	4.54	0.001*
Joint space B	2.68	4.48	0.001*

*p<0.05 is considered statistically significant

As per table 3 morphometry after three weeks of surgery another radiograph shows significant changes the mean length was hanged but the higher mean length was seen only in Group 1 in Tibial overlap (10.33,9.33). Which was statistically significant (p<0.05), other parameters like talocrural angle, tibiofibular distance space, joint space A and B were higher in group 2 and was statistically significant. (p<0.05). This concludes that even after 3 weeks of surgery the mean length changes significantly but parameters difference in both groups remains the same.

Table 4: Comparison of Complication in Both Groups

Complications	Group 1 (N = 27)	Group 2 (N = 23)	p-value
Gait (Abnormal)	0%	67%	0.001*
Pain (Present)	12.43%	70%	0.001*
Morbidity	0	64%	0.01*

*p<0.05 is considered statistically significant

As per table 4 all the twenty-seven patients who belonged to the first group attained normal gait. Pain was complained in 12.43 percent of the patients and morbidity was not seen in any of the patients. In group two, the gait was normal only in 33 percent of the patients. Pain was complained in 70 percent of the patients and morbidity was observed in 64 percent of the patients. There was a significant difference in the two groups in attaining normal gait, the pain, and the morbidity (p<0.05).

Discussion

In the present study, the five morphometric factors were taken into deliberation. The five factors that were studied comprised tibial overlap over the fibula, talocrural angle, joint spaces at two different points, and the tibiofibular distance space. At first, the morphometry of the five points were considered in patients who were expected to be operated. The ankle joint is an essential weight bearing joint, being exposed, and having no musculature to protect it. It is imperilled to lot of stress with increase in mechanisation and sporting activities, ankle fracture has shown rapid increase in incidence[6].The average tibiofibular overlap in anteroposterior view was found to be 11.2mm (range 6-23mm); in mortise view was found to be 4.2mm (range 1-7mm). In the anteroposterior radiograph the overlap in our study was found to have a range of 7mm to 19mm[7].Most of workers have commented that overlap of less than 10mm denotes diastasis[6,7]. We recommend that there may be normal variations of less degree of tibiofibular overlap. In all such situation preoperative lateral stress testing should be undertaken to confirm instability. Isman and Inam mentioned the talocrural angle as being important to indicate changes in fibular length[8]. Sarkisian and Cody defined the measurements of talocrural angle and proposed comparison of talocrural angle on injured with that on normal side. The normal talocrural angle in adults is 83 ±4[9].The difference in the angles of the two ankles of any individual is normally less than 2. Phillips et al took the difference of more than 5 to be abnormal[10]. In their study of various criteria for predictions of results, the difference in talocrural angle was the only statistically significant radiograph, indication of good prognosis[10]. In 15° of internal rotation radiograph the values were 79.9° ±5° . We agree with Sarkisian and Codi that the talocrural angle of two ankles of a given individual does not vary by more than 2[9].Phillips et al. defined tibiofibular clear space as a horizontal distance from lateral border of the posterior tibial malleolus to the medial border of fibula measured on anteroposterior radiograph. Subsequent authors have used this criterion for the assessment of syndesmotic diastasis[10] Jenkinson et al. used a 1mm increase in tibiofibular clear space on external rotation stress radiograph as an indication for syndesmotic stabilization[11].Leeds et al. suggested 2mm as an unacceptable increase in tibiofibular clear space[12]. Stoffer et al. showed that syndesmotic injuries correlate with relatively small increase in the measurements on stressradiograph[13]. The maximum normal range of clear space in our study was 6mm in Anteroposterior view and 8mm in 15° internal rotation view. Hence these may be taken as the upper limit of normal. Conversely ankles with value beyond 5 mm may be subjected to lateral stretch radiograph for confirmation of diastasis[14,15].

Conclusion

The study concludes that the five morphometric points taken into significance indeed are useful in evaluating the prognostic outcome in the lower end of tibial and fibular fractures after surgery.

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