A STUDY OF ASSESSMENT OF SURGICAL CORRECTIONS DONE IN FRACTURE OF LOWER END OF TIBIA AND FIBULA USING SIMPLE RADIOGRAPH AND ITS IMPORTANCE IN RESTORATION OF NORMAL GAIT

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ABSTRACT

BACKGROUND

Bone crack mending impairment identified with mechanical issues has been to a great extent rectified by advances in break management. Better conventions, stricter controls of time and capacity, and equipment and surgical procedure advancement have added to better prognosis even in complex breaks.

SUBJECTS AND METHODS

The x-ray film was taken from the Department of Radiology. The fifty patients those who attended for x-ray scanning in the Department of Radiology between the year 2013 to 2014 were included in the study. The following parameters was assessed for this study: Talocrural angle, Tibial overlap, Tibiofibular distance, Joint space A, and Joint space B. All the parameters were measured by using Rhythm radiography software in the Department of Radiology. The total 50 study population were divided into two groups: 1) mean+/-<2SD whereas in group 2 mean+/->2SD.

RESULTS

The morphometry of radiograph such as Tibial overlap (4.25±1.76), Talocrural angle (26.6±1.23), Joint space A (7.21±0.23), Joint space B (6.54±0.56), and Tibiofibular distance space (9.18±0.12). The results of morphometry showed improvement in above parameters after surgery. However, even after three weeks of surgery, better improvement was observed in all the parameters. When compared between the group 1 and group 2 parameters, gait was normal in the group 1 (100%) and where as in the case of group 2 (23.08%), which was statistically significant. Pain was present in the group 1 (10.81%) and in group 2 (69.23%). 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 consideration indeed is useful in assessing the prognostic outcome in lower end of tibia and fibula fractures after surgery.

KEYWORDS

Tibia, Fibula, Fracture, Ligaments, Radiograph.

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INTRODUCTION: Man is a known obligate bipedal organism. The bipedalism is due to the strong bones of the lower limbs and the ligaments associated with it. The weight of the human is entirely balanced on his two limbs and is almost equally distributed among the two limbs. There are altogether four major long bones below the knee in two legs and majority of the balancing act has to be borne by these four bones. 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.

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The talocrural joint has indeed has powerful ligaments. The medial collateral ligaments also called as the deltoid ligament and the lateral collateral ligaments, which include the anterior talofibular and the posterior talofibular ligaments. 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 the two long bones in the lower leg. They are closely linked at the knee and ankle, but they are two separate bones.

The tibia is the bone that forms the shin and is the larger of the two lower leg bones.(1) The top of the tibia connects to the knee joint and the bottom of the tibia connects to the ankle joint. Although, this bone carries all the body's weight it needs support from the fibula. The fibula forms the calf bone. It is the smaller bone of the two lower leg bones and runs parallel to the tibia. The top end of the fibula is located below the knee joint, but is not part of the joint itself.(2) The lower end of the fibula forms the outer part of the ankle joint. The fibula doesn't carry much weight, but instead acts as a stabilizer for the tibia.

Fractures happen when more force applied to the bone than it can withstand. A lower leg fracture usually happens due to a high-energy force from falls, trauma, or a direct blow.[3] These are often caused by motor vehicle crashes or by direct contact or sudden twisting in sports. Whenever there is a trauma to the leg, the impact spreads between the tibia and fibula. Because both bones absorb the blow, the impact usually results in a combined tibia/fibula fracture.[4] A stress (Hairline) fracture may also occur in the fibula, although it is far less common than stress fractures to the tibia, which is a weight-bearing bone. Stress fractures in the tibia/fibula are likely to be caused by repetitive motion as in running, ballet, baseball, and basketball.[5] Certain risk factors in children includes, if the fracture involves the ends of the bone, it can affect the growth of the bone.

Generally, a 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 (may indicate damage to blood vessels). X-rays must show the whole length of the tibia and fibula. Check for associated injuries to the knee and ankle. CT scans maybe required if x-rays are inadequate to make a definitive assessment and for proximal tibial fractures.[6] The lateral and medial collateral ligaments maintain the integrity of the mortise. The integrity of the mortise is the most important requirement for a normal bipedal gait.[7] The fractures of lower end of tibia and fibula are invariably associated with ligamentous tears. The surgeon has to bear this in mind when the correction is done. Invariably in severe fractures, the structural abnormalities will be encountered in a massive scale and hence the correction may have to be taken in stages. This study puts in a sincere effort to know the condition of the patients after surgical correction and structural abnormalities been approximated to the nearest normal values. Hence, we conduct the study to assess parameters after surgical correction of tibia and fibula fractures.

MATERIAL AND METHODS: The x-ray film was taken from the Department of Radiology. The radiograph was taken in anteroposterior view making sure all the identifying points are seen. The fifty patients those who attended for x-ray in the Department of Radiology between the year 2013 to 2014 were included in the study.

The following parameters was assessed for this study:

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

Above all the parameters were measured by using Rhythm radiography software in the Department of Radiology. The total 50 study population were divided into two groups: 1) mean±<2SD whereas in group 2 mean>±2SD. The normal measurements were adopted by previous study.

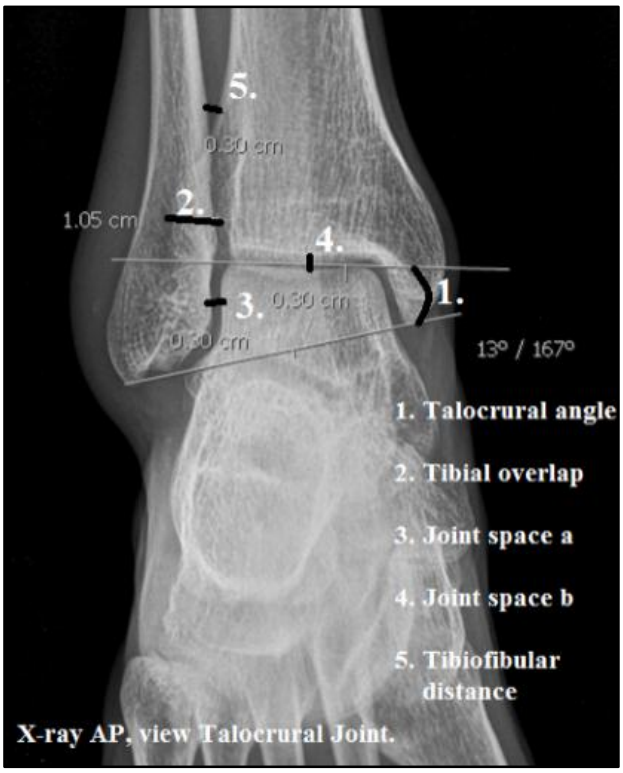

Image 1: Showing the Parameters Used in the Study

RESULTS:

	Mean	SD
Tibial Overlap	4.25	1.76
Talocrural Angle	26.64	1.23
Joint space A	7.21	0.23
Joint space B	6.54	0.56
Tibiofibular Distance Space	9.18	0.12

Table 1: Morphometry of Radiography in Total Study Population

	Group-1 n=37	Group-2 n=13
Tibial Overlap	11.25	8.35
Talocrural Angle	15.47	17.25
Joint space A	4.01	5.68
Joint space B	3.8	4.28
Tibiofibular Distance Space	4.13	5.79

Table 2: Morphometry of Radiography Showing After Surgery

	Group-1 n=37	Group-2 n=13
Tibial Overlap	10.35	9.58
Talocrural Angle	13.89	14.25
Joint space A	3.14	4.68
Joint space B	3.05	4.56
Tibiofibular Distance Space	3.56	4.83

Table 3: Morphometry of Radiography Showing Three weeks after Surgery

	Group-1 (n=37)	Group-2 (n=13)	P <valve
Gait (Normal)	100%	23.08%	0.001
Pain (Present)	10.81 %	69.23%	0.0016
Morbidity	NIL	92.30%	0.0014

Table 4: Comparison between Group 1 and Group 2

DISCUSSION: In the present study, the five morphometric factors were taken into consideration. The five morphometric factors were taken into consideration by following a study done by Shishir et al. The five factors that were considered included tibial overlap over the fibula, talocrural angle, joint spaces at two different points, and the tibiofibular distance space. In the initial level, the morphometry of the five points were considered in patients who were supposed to be operated. The following measurements were taken. The mean tibial overlap was found to be 4.25 mm and the standard deviation was found to be 1.76 mm. The mean talocrural angle was found to be 26.64 degrees with a standard deviation of 1.23 degrees. The mean joint space at point A was found to be 7.21 mm with a standard deviation of 0.23 mm.

The mean joint space at point B was found to be 6.54 mm with a standard deviation of 0.56 mm. The tibiofibular distance space was found to be 9.18 mm with a standard deviation of 0.12 mm. Postsurgery, one more radiograph of the corrected limb was taken and the patients were divided into two groups using the measurements conducted by Shishir et al. The group 1 included the patients whose measurements were within 2 standard deviation of that study and the group 2 included the patients whose measurements were beyond that of 2 standard deviation.

Thirty seven were found to be in group 1 and the remaining were there in group 2. In group 1, the following measurements were taken. The mean tibial overlap was found to be 11.25 mm. The mean talocrural angle was found to be 15.47 degrees. The mean joint space at point A was found to be 4.01 mm. The mean joint space at point B was found to be 3.8 mm. The tibiofibular distance space was found to be 4.13 mm. In group 2, the following measurements were taken. The mean tibial overlap was found to be 8.35 mm. The mean talocrural angle was found to be 17.25 degrees. The mean joint space at point A was found to be 5.68 mm. The mean joint space at point B was found to be 4.28. The tibiofibular distance space was found to be 5.79 mm.

After three weeks, another radiograph was taken and the following measurements were taken in the two groups. The following measurements were taken in group 1. The mean tibial overlap was found to be 10.35 mm. The mean talocrural angle was found to be 13.89 degrees. The mean joint space at point A was found to be 3.14 mm. The mean joint space at point B was found to be 3.05 mm. The tibiofibular distance space was found to be 3.56 mm. The following measurements were taken in the group 2.

The mean tibial overlap was found to be 9.58 mm. The mean talocrural angle was found to be 14.42 degrees. The mean joint space at point A was found to be 4.68 mm. The mean joint space at point B was found to be 4.56 mm. The tibiofibular distance space was found to be 4.83 mm. Then, the group one results were compared with that of the group 2.

The Following Results were obtained: All the thirty seven patients who belonged to the first group attained normal gait. Pain was complained in 10.81 percent of the patients and morbidity was not seen in any of the patients. In group two, the gait was normal only in 23.08 percent of the patients. Pain was complained in 69.23 percent of the patients and morbidity was observed in 92.3 percent of the patients. There was a significant difference in the two groups in attaining normal gait, the pain, and the morbidity. In the study conducted by Shishir et al irrespective of the side and sex to which it belongs, the mean value of the talocrural angle is 13.23 degrees, tibial overlap 10.67 mm, tibiofibular distance is 3.58 mm, joint space A is 3.03 mm, joint space B is 3.06 mm, and joint space A equals joint space B.

The mean length values on the right side are 13.4 degrees, 10.85 mm, 3.56 mm, 2.98 mm, and 3.06 mm with a standard deviation of 1.59 degrees, 0.74 mm and 0.36 mm, 0.39 mm and 0.36 mm. Joint space A is almost equal to joint space B. The mean length values on the left side are 13.06 degrees, 10.5 mm, 3.6 mm, 3.08 mm, and 3.06 mm with a standard deviation of 1.57 degrees, 0.60 mm and 0.25 mm, 0.46 mm and 0.39 mm. Joint space A is almost equal to joint space B. The measurements are similar on both sides. The mean length in the males are 13.26 degrees, 10.5 mm, 3.64 mm, 3.03 mm, and 3.11 mm with a standard deviation of 1.62 degrees, 0.54 mm and 0.29 mm, 0.49 mm and 0.43 mm. Joint space A is almost equal to joint space B.

The mean length in the females are 13.2 degrees, 10.85 mm, 3.52 mm, 3.02 mm, and 3.01 mm with a standard deviation of 1.56 degrees, 0.79 mm and 0.32 mm, 0.36 mm and 0.32 mm. Joint space A is almost equal to joint space B. The measurements are similar in both sexes. M.S. Patil et al[8] in their study on anthropometric measurements of ankle mortise for evaluating mortise fracture reductions with an aim to develop contoured implants measured the talocrural angle, tibiofibular clear space, tibiofibular overlap, and compared joint clear space at two places. Anteroposterior radiographs of both ankles in 20 adult individuals formed the material. They agree with that the talocrural angle of two ankles of a given individual does not vary by more than 2 degrees. Tibiofibular clear space on anteroposterior radiographs measured a mean value of 2.4 mm with a standard deviation of 1.3 mm. Tibiofibular overlap on anteroposterior radiographs was measured as 11.2 mm with a standard deviation of 4.4 mm. Joint spaces at two levels were almost equal. The study on three-dimensional morphological characteristics measurement of ankle joint

based on computed-tomography image post processing by Chen Yan-Xi et al.[9]

The mean talocrural angle (10.01±0.38°) was measured to be 10.1 degrees with a standard deviation of 0.38 degrees. Tibiofibular clear space mean measurements were 2.78 mm with a standard deviation of 0.19 mm. They were not significance correlated with gender, height, and weight (P>0.05) in 100 cases in 50 males and 50 females. The study is in agreement with the other studies. The study is a boon to the developing society like ours because of its low cost. An MRI or a CT is both time consuming and is not easily available in the rural setup of India. This is an ideal method to study the outcome when these parts are involved.

CONCLUSION: The study concludes that the five morphometric points taken into consideration indeed is useful in assessing the prognostic outcome in lower end of tibial and fibular fractures after surgery. The ligaments and the bones involved in forming the mortise and its connexion with talus to form a talocrural joint should be within anatomical limits in order to carry out the successful obligate bipedalism.

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