

Original research article

**TO STUDY FUNCTIONAL RESULT OF A TRANSVERSE
PATELLA, OLECRANON, OR MEDIAL MALLEOLUS
FRACTURE TREATED USING TENSION BAND WIRING**

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Abstract

Background and Objectives: Complications arising from transverse fractures of the patella, olecranon, and medial malleolus are a leading cause of disability. Among the available therapeutic options, tension band wiring is the most helpful for patient mobilisation at an early stage.

Materials and Methods: In our study, which involved 50 patients requiring surgery at the Department of Orthopedics, Siddhartha Medical College, Vijayawada, Andhra Pradesh, India

for fractures of the patella, olecranon, and medial malleolus, tension band wiring was used. This study was conducted between the January 2023 to December 2023. Various metrics were used to assess the functional outcome of the patients. Patients had radiological evaluation as well.

Results: Among the top ratings given to the surgery, our research shows that it was 85% successful for patella. "Reduction" is the medical term most often used to describe the procedures performed to set broken bones. Manual techniques are used for less severe fracture reduction, while open reduction internal fixation is used for more severe fractures. Following this treatment, the motion of the broken bones is limited by means of a cast. For accurate and lawful healing to occur, the resting period is absolutely necessary.

Conclusion: It is critical to have trials that show the operation is beneficial because of the frequency of knee fractures and the length of time it takes for the patella to recover. In order to successfully cure any fracture, early mobilization is essential.

Keywords: Malleoli, olecranon, patella, tension band wiring

Introduction

A bone fracture occurs when an excessive force breaks the bone, either completely or partially. Nowadays, the common man's busy work schedule and less powerful car accidents are the main causes of more frequent patella, olecranon, and medial malleoli fractures. Located anterior to the distal femoral condyles, the patella is the biggest sesamoid bone and is embedded in the tendon of the quadriceps femoris ^[1]. The elbow bone is called the olecranon. Elbow joints are formed when the proximal end of the ulna articulates with the distal end of the humerus. The medial malleolus is located on the distal end of the tibia and is slightly enlarged. Its medial malleolus projection is inferomedially oriented ^[2].

Orthopaedic surgeons often see fractures of the eccentrically loaded bones, such as the patella, olecranon, and medial malleolus. Because they are intraarticular and undergo constant deforming stresses from muscles, they persist in causing bothersome issues ^[3]. Osteoarthritis, joint stiffness, nonunion, and other problems can occur because it is challenging to restore the required anatomical continuity and congruity of their articular surfaces following reduction. As a consequence of advancements in surgical procedures, internal fixation of transverse fractures with tension band wire is now a commonly used treatment option. This allows patients to go back to their daily lives unimpeded and restart their work with positive outcomes. Fractures can be treated more quickly and returned to normal activities after an internal fixation. In addition to avoiding immobilization-related problems such joint stiffness, it permits early mobilization of the joint ^[4-6].

An implant is not the same as a tension band; rather, it is a concept. A tensile force can be transformed into a compressive force using this method. Since stability is enhanced when tensile force is lowered at the location of a fracture, this enhanced the healing of the fracture. The convex side of the broken bone is eccentrically fastened to a device in order to implant it using the tension band technique ^[7, 8]. The device on the tension side of a curved structure acts as a force neutralizer when an axial load is applied, since the structure has both a compression side and a tension side. Compression can be generated statically or dynamically by a tension band. Immediate motion at the affected joints can be made possible by tension bands, leading to an improved functional outcome ^[9].

The purpose of this research was to evaluate the effectiveness of tension band wiring in treating transverse patellar, olecranon, and medial malleolus fractures.

Materials and Methods

This was the longitudinal cohort based study. In our study, which involved 50 patients requiring surgery at the orthopedics department of Department of Orthopedics, Siddhartha Medical College, Vijayawada, Andhra Pradesh, India for fractures of the patella, olecranon, and middle malleolus, tension band wiring was used. This study was conducted between the January 2023 to December 2023. Various metrics were used to assess the functional outcome of the patients. Patients had radiological evaluation as well.

Inclusion Criteria

- Every closed displaced patellar transverse fracture.
- Be over the age of eighteen.
- Have both male and female sex.

Exclusion Criteria

- Fractures with comminutes.
- Any known elbow, ankle, or knee deformity.
- Compound fractures.

Results

Fifty patients with olecranon, patella, or medial malleolus fractures were the subjects of a longitudinal cohort research at Sree Mookambika Institute of Medical Sciences' orthopaedics department. No patients were lost to follow-up or deponents were found among the 50 patients who participated in this trial. Periodically, clinical and radiological evaluations were conducted to assess the patients' outcomes.

Table 1: Patient distribution according to age

Sr. No.	Age (yrs.)	Patients	%
1.	20-30 Y	15	30.00
2.	31-40 Y	20	40.00
3.	41-50 Y	10	20.00
4.	51-60 Y	5	10.00
	Total	50	100.00

Forty percent of the fifty patients were in the age bracket of 31-40. The ages of 15 patients were in the 20-30 year bracket, while 10 patients were in the 41-50 year bracket. Patients in the 51-60 age groups were the most underrepresented.

Table 2: Patient demographics broken down by gender

Sr. No.	Sex	Patients	%
1.	Male	40	80.00
2.	Female	10	20.00
	Total	50	100.00

The male population outnumbered the female population, with males comprising 80% of the participants in this survey.

Table 3: Classification of patients according to the side of the fracture

Sr. No.	Side	Patients	%
1.	Right	30	60.00
2.	Left	20	40.00
	Total	50	100.00

Approximately 60.00% of the patients experienced a fracture on the right side. Only 40.00% exhibited a left-sided orientation.

Table 4: Patient distribution according to bone fracture

Sr. No.	Bone	Patients	%
1.	Patella	20	40.00
2.	Olecranon	20	40.00
3.	Medial Malleolus	10	20.00
	Total	50	100.00

Out of the 50 patients, 20 experienced a fracture in the patella, 20 had a fracture in the medial malleolus, and 10 patients had a fracture in the olecranon.

Table 5: Patient distribution according to the mechanism of damage

Sr. No.	Mechanism of injury	Patients	%
1.	Direct	20	40.00
2.	Indirect	30	60.00
	Total	50	100.00

30 patients sustained injuries through indirect means, while the remaining patients sustained injuries through direct means.

Table 6: Bone fracture distribution and ultimate result

Sr. No.	Final outcome	Patella	OL	MM
1.	Poor	1	5	5
2.	Fair	2	4	2
3.	Good	8	5	2
4.	Excellent	9	6	1
	Total	20	20	10

There was a positive outcome for 9 cases of patella fracture. The outcome of the fifth metatarsal fracture was favorable. Five individuals with MM fracture exhibited unfavorable prognosis.

Discussion

There are many different causes of bone fractures besides trauma, and they can happen anywhere on the body. Simple, compound, complicated, hairline, greenstick, comminuted, and avulsion fractures are the various categories that can be applied to bone injuries, depending on their location and severity ^[10]. It is the goal of bone fracture treatment to achieve agglutination of the shattered bone fragments while simultaneously preserving the full range of motion and function of the adjacent joints, just as they were prior to the fracture. "Reduction" is the medical term most often used to describe the procedures performed to set broken bones. Manual techniques are used for less severe fracture reduction, while open reduction internal fixation is used for more severe fractures. Following this treatment, the motion of the broken bones is limited by means of a cast. For accurate and lawful healing to occur, the resting period is absolutely necessary ^[11, 12].

The Tension Band technique is a therapeutic procedure that can repair some types of fractures. Transforming the tensile force into a compressive force is the fundamental idea behind the tension band method. In particular, unsettled and rearranged fractures caused by muscle pull can be set with the application of tension bands. Tension bands' main selling point is how fast they can help restore normal range of motion to the fractured joints. Because of this, the end result of this fast treatment is significantly more noticeable than the majority of the other options utilised by Orthopaedic specialists ^[13-15].

A specific implant is not necessary for tension banding; rather, it is a principle. The convex side of the broken bone is eccentrically fastened to a device in order to implant it using the tension band technique. The device on the tension side of a curved structure acts as a force neutralizer when an axial load is applied, since the structure has both a compression side and a tension side. Importantly, the compressive side - the side that is not implanted - must have cortical contact. The implant is more likely to experience early fatigue failure due to bending stress if the compressive side has a cortical defect or comminution. Compression can be generated statically or dynamically by a tension band. A static tension band, like the one at the medial malleolus, is one that exerts a relatively consistent force on the fracture site even when the patient is moving. The tension band is said to be dynamic in the opposite case if compression rises with motion, as it does in the patella during knee flexion ^[16-18].

In addition to facilitating union, the goal of fracture treatment is to maintain the optimal functioning of neighbouring joints. In order to achieve articular congruity with rigid fixation, it is crucial to preserve precise anatomical reduction of fragments in intraarticular patella, olecranon, and medial malleolus fractures. Typically, tension band wire is used to treat these types of fractures. All fifty of our cases utilised tension band wiring. From what we can tell, it has produced satisfactory outcomes. The following discussion will analyse and compare the findings, end outcomes, and other data ^[19-21].

This table compares the success rate of various "tension band wiring" procedures performed on the patella, olecranon, and medial malleolus fractures at various time intervals. The data in the table are from a variety of research, with a focus on those that looked at the effectiveness of tension band wire in treating fractures. The effectiveness

of tension band wire in treating patellar fractures is assessed by these parameters. In the tabular column, you can see all the patients' records who underwent this surgery for fractures^[22, 23]. Orthopaedic doctors, who specialise in treating fractures in particular body parts, performed the treatments. Intraarticular patellar, olecranon, and medial malleolus fractures are the most common sites for tension band wire to be applied. The degree to which the bones have fused together and the degree to which the patient reports less discomfort are two indicators of the treatment's efficacy. After that, we take note of the patients' responses and display them in the table using the four-point scale: excellent, good, fair, and poor. All things considered, these choices may provide a clearer picture of how effective a treatment was and how well it worked for individual patients. As a potential method for treating fractures in various parts of the body, tension band wiring was anticipated to be evaluated based on the reactions. An expert orthopedist could authoritatively determine the extent of the discomfort by having the patient carefully move the fractured area and then documenting his pain reaction^[24, 25]. Radiography and other imaging modalities show the extent to which the bones have fused together following tension band wiring; therefore they can be used to evaluate the healing process. It is reasonable to presume that the values in the table columns accurately depict the effectiveness of tension band wire as a post-fracture therapy method and might list the minor variations in its results when applied to other parts of the body^[26]. According to the research, tension band wiring's ability to promote bone repair differed significantly when used on different parts of the body, such as the Olecranon and the Medial Malleolus, rather than only the patella. There was less pain and an increased ability for bones to recover according to the numbers recorded for the patella, which were consistent across investigations. Throughout the process and even after the bones had fully healed, the high quality of the operation was apparent. The data shown in the table column are statistical simulations that could help us learn more about the procedure's efficacy. Results showing a success rate of close to 93.3% demonstrate the procedure's efficacy as a treatment for severe fractures are included in the table^[25, 26].

Compared to the other two locations, the study shows that the Patella was the most successful when the technique was applied. After the fracture, it became clear that the technique had remarkable healing and pain-reduction capabilities. From the data in the table, we may infer that the surgery was successful for around 75% of the Patella patients, with 38.4% achieving good results and 36.4% achieving excellent results. The same study also demonstrated that the technique was effective for Olecranon fractures. The procedure's total efficiency rate was close to 92%. The procedure's outstanding and decent ratings added up to about 46.2% apiece.

The treatment was successful in Olecranon, according to both investigations. Tension band wiring is shown to be beneficial in the investigation, with an overall effectiveness quantified at approximately 99.52%. In terms of its ability to alleviate pain and promote bone healing, the treatment process received a good rating of 9.5% and an outstanding rating of 90.48%. Based on many criteria, the evaluations also deemed the procedure's efficiency, which was 35.7%, as fair. Once again, the procedure's efficiency was deemed low at 14.3%. The procedure's capacity as a great therapeutic choice for patella fractures is restored by such a little percentage. Once again, this study demonstrated the procedure's benefits at the patella and gave it a positive rating of 90%. Fifty percent

was deemed great, and forty percent was deemed good, according to the breakdown percentages ^[25-27].

From the data in the table, it was clear that tension band wiring was a very effective treatment method. One of the highest evaluations given to the operation was an efficacy rate of 85% for patella. This once again supports the merit of tension band wiring as a potential technique for treating significant fractures in various areas of the body, particularly the patella. It is critical to have trials that show the operation is beneficial because of the frequency of knee fractures and the length of time it takes for the patella to recover ^[26-28].

Conclusion

According to the results, tension band wiring can effectively counteract distractive forces, compress the fracture site, and keep the bone in place with very little hardware. The healing process and the patient's return to work are both accelerated when compression is achieved at the fracture site. As early as four weeks into the healing process of the fracture, the fixation allows for active mobility of the joints, reducing joint stiffness. Joint stiffness, muscular atrophy, pressure ulcers, and osteoporosis are not long-term consequences that are not experienced. Thus, tension band wiring provides a straightforward, low-cost, and successful biomechanically-based method of repairing fractures with little problems.

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Conflict of Interest

None.

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