

## Original Research Article

# Management of displaced transverse fractures of the patella using tension band wiring with or without augmented circumferential cerclage wiring: a comparative study

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## ABSTRACT

**Background:** Transverse fractures of body of the patella are by far the most common fractures of this bone. Surgical fixation is the recommended treatment in displaced fractures with extensor lag. Although, tension band wiring (TBW) technique is the gold standard for these fractures, few surgeons recommend augmentation with circumferential cerclage wiring to improve the strength of the fixation. Author compared the results of the internal fixation of displaced transverse fractures of the patella using TBW and circumferential cerclage wiring with those treated with TBW alone.

**Methods:** Authors treated 54 displaced transverse fractures of the patella at their institution. Authors segregated the patients into two groups: Group 1 (n=23) included fractures treated with tension band wiring (TBW) along with augmented circumferential cerclage wiring while as Group 2 (n=31) included fractures treated by TBW alone. Outcome was studied, graded and compared on the basis of knee pain, knee stiffness, quadriceps wasting, loss of flexion and loss of extension.

**Results:** 73.90% patients among group 1 and 70.96% among group 2 showed excellent to good results (P value <0.1). Fixation failure and need for revision surgery among group 1 and group 2 was found to be 8.69% and 9.67%, respectively (P value < 0.6). Infections and non-union occurred among 4.34% patients in group 1 whereas in group 2 it was 6.45% of the patients who encountered the same (P value <0.6).

**Conclusions:** The use of circumferential cerclage wiring along with tension band wiring for displaced transverse fractures of patella seems to have no added advantage over fixation with tension band wiring alone.

**Keywords:** Cerclage wiring, Patella fracture, Tension band wiring

## INTRODUCTION

Fractures of patella are very much common in adults. Transverse fractures of this bone account for most of the fractures.<sup>1-4</sup> Most of these transverse fractures are displaced and associated with failure of extensor mechanism at knee. In such cases, open reduction and

internal fixation (ORIF) is the recommended treatment to restore the extensor mechanism and augment fracture healing to ascertain early knee movements.<sup>5,6</sup> Among the various methods employed for the ORIF of these fractures tension band wiring (TBW) technique using K-wires and stainless steel wires is the most commonly used.<sup>7-10</sup> TBW works by converting the tensile forces into

compressive forces when movements occur at the knee joint.<sup>11-13</sup> Secure fixation using TBW allows early mobilization, hence preventing stiffness at knee.<sup>14,15</sup> Not many instances of any serious complications and fixation failure have been witnessed.<sup>16</sup> Although, TBW is the current gold standard for the displaced transverse patella fractures, few surgeons recommend augmentation of TBW with circumferential cerclage wiring to enhance the strength of the fixation.<sup>17-19</sup> Authors planned present study to compare the results of the displaced transverse patella fractures managed using TBW and circumferential cerclage wiring with the ones treated by TBW alone.

## METHODS

Author conducted a prospective and retrospective, comparative study in which authors included 54 displaced transverse fractures of the body of patella. Authors segregated the patients into two groups: group 1 (n=23) included fractures treated with tension band wiring (TBW) along with augmented circumferential cerclage wiring while as group 2 (n=31) included fractures treated by TBW alone. The patients were chosen from among those attending the emergency and outpatient care of the Orthopaedics department.

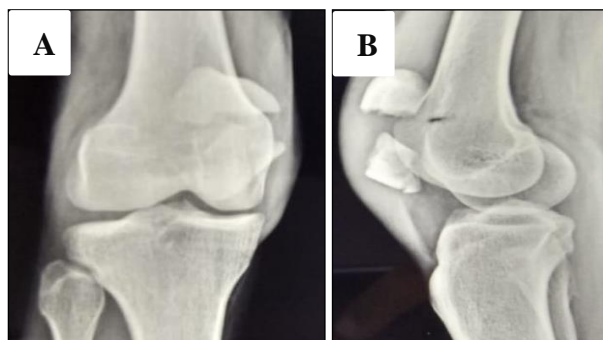
### Inclusion criteria

- Age > 18 years,
- Transverse (two part) fractures of the body of patella,
- Extensor mechanism lag at knee,
- Closed injury.

### Exclusion criteria

- Comminuted fractures of patella,
- Longitudinal fracture of patella,
- Open injury,
- Poly-trauma patients.

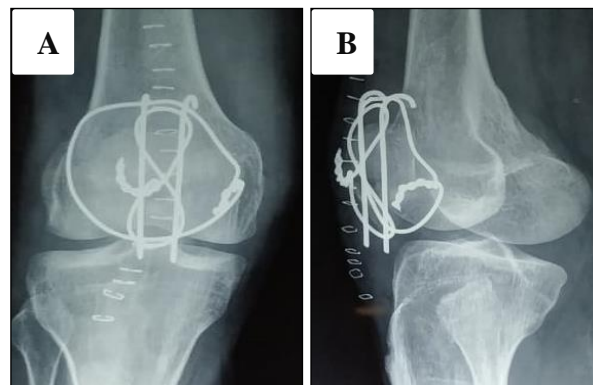
All the patients were properly examined to rule out any other associated injuries. Initial splintage was done and analgesia provided. X-rays of the effected knee (Anterior posterior and lateral views) were done along with all the necessary blood workup (Figure 1A and 1B).



**Figure 1:**(A) Pre-operative radiograph (AP view). (B) Pre-operative radiograph (lateral view).

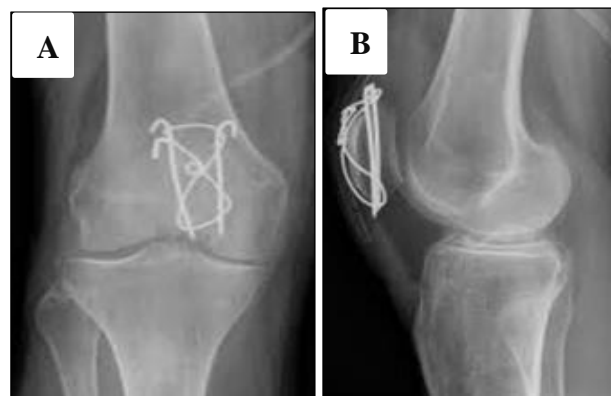
All the patients were operated in the emergency department at the 1<sup>st</sup> day of admission.

Surgery was performed under spinal anaesthesia. In all cases a tourniquet was used. The surgery was performed using a midline longitudinal incision over anterior aspect of the knee.



**Figure 2:** (A) Post-operative radiograph in group 1 (AP view). (B) Post-operative radiograph in group 1 (lateral view).

Open reduction and internal fixation were done using tension band wiring with or without augmented cerclage with stainless steel wire. Tension band wiring was done using two K wires and stainless-steel wire. A long knee brace was given post-operatively for as long as the patient could start range of motion at knee without pain. Post-operative radiographs were done to ensure that proper fixation was in place (Figure 2A, 2B, 3A and 3B).



**Figure 3:**(A) Post-operative radiograph in group 2 (AP view). (B) Post-operative radiograph in group 2 (lateral view).

Post-operatively, quadriceps exercise and knee movements were started as soon as possible. Walking was started as pain allowed. Antiseptic dressings were done at 2<sup>nd</sup> and 7<sup>th</sup> post-operative days. The sutures were removed at 2 weeks. The patients were followed every monthly for 6 months post-operatively. Outcome was studied, graded and compared on the basis of knee pain,

knee stiffness, quadriceps wasting, loss of flexion and loss of extension (Tables 1 and 2).

**Table 1: Scoring for outcome.**

Score	4	3	2	1
Knee pain	No pain	Mild	Moderate	Severe
Knee stiffness	No Stiffness	Mild	Moderate	Severe
Quadriceps wasting	0-1.5 cm	1.6-2.5 cm	2.6-3.5cm	>3.5 cm
Knee extension loss	0°- 5°	6°- 10°	11°- 20°	>20°
Knee flexion loss	0°- 10°	11°- 20°	21°- 30°	>30°

Authors proposed a null hypothesis claiming that the augmentation of the tension band wiring with circumferential cerclage has no added advantage over TBW alone when used for displaced transverse fractures of the patella as far as the clinical outcome and complication profile is concerned.

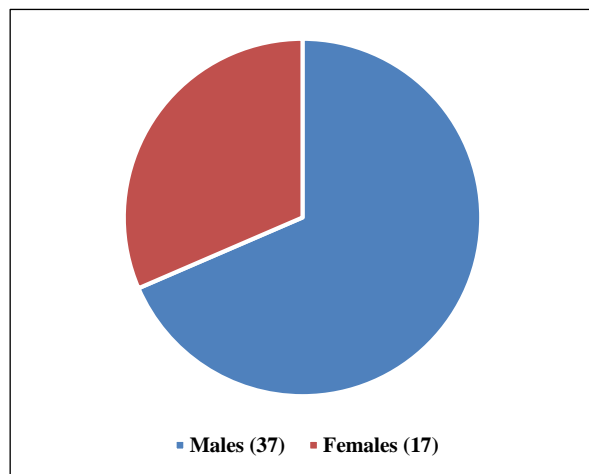
**Table 2: Grading of outcome.**

Result	Overall score
Excellent	16-20
Good	12-15
Fair	08-11
Poor	04 -07

Authors tested the null hypothesis using t test. Significance was set at a P value of <0.05.

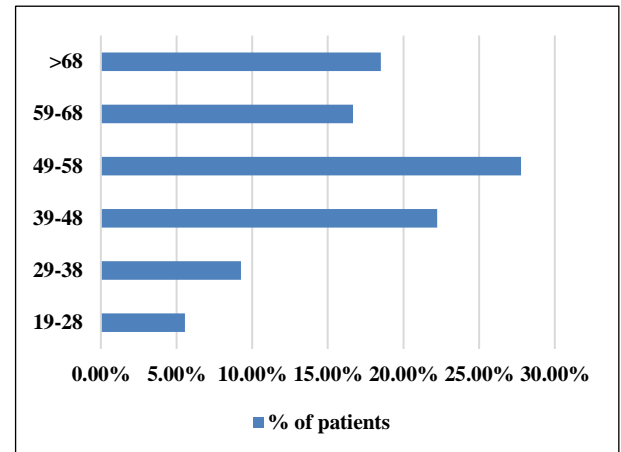
## RESULTS

In present study, authors included 37 male (68.51%) and 17 female (31.48%) patients (Figure 4).



**Figure 4: Gender involvement.**

The age of the patients ranged from 19 to 82 years. The age distribution of the patients has been depicted in (Figure 5).



**Figure 5: Age distribution (in years).**

More than 80% of the patients were aged more than 40 years.

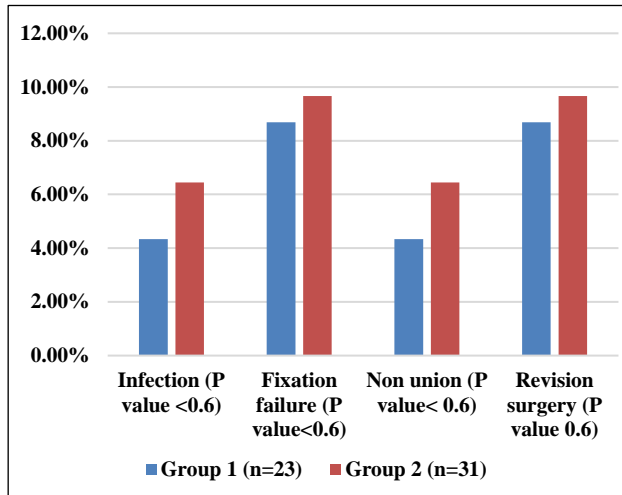
The results in group 1 were excellent in 13.04% (3 patients), good in 60.86% (14 patients), fair in 21.73% (5 patients) and poor in 4.34% (1 patient). The results in group 2 were excellent in 12.90% (4 patients), good in 58.06% (18 patients), fair in 22.58% (7 patients) and poor in 6.45% (2 patients). The results were marginally better among group 1 with excellent to good results among 73.90% as compared to group 2 with excellent to good results among 70.96%, which was tested using t test and found to be non-significant (P value<0.1). The results studied are summarized in (Table 3).

**Table 3: Results based on clinical grading of the outcome (P value< 0.1).**

Result	Group 1		Group 2	
	Patients	%	Patients	%
Excellent	03	13.04%	04	12.90%
Good	14	60.86%	18	58.06%
Fair	05	21.73%	07	22.58%
Poor	01	04.34%	02	06.45%
Total	23		31	

Authors encountered few complications post operatively including infection, fixation failure and nonunion among both the groups.

Figure 6 shows the comparative complication profile of both the groups.



**Figure 6: Complication profile.**

Infection and nonunion occurred among 4.34% (1 patient) in group 1 and 6.45% (2 patients) in group 2. Fixation failure and need for revision surgery among group 1 and group 2 was found to be 8.69% (2 patients) and 9.67% (3 patients), respectively. Infections were managed with daily debridement and antiseptic dressings along with proper antibiotics. Fixation failure and nonunion were managed with revision surgery with bone grafting. Union was achieved in all the cases of fixation failure and nonunion, after revision surgery. The comparative complication profile was tested using t test and was found to be non-significant (P value <0.6).

## DISCUSSION

Displaced transverse fractures of the body of patella are currently managed with tension band wiring (TBW), which is considered as the gold standard. Circumferential cerclage wiring added to the TBW has been regarded to improve the strength of the construct by some researchers.<sup>17-19</sup> Curtis, in a cadaveric study, concluded that the addition of cerclage wiring to the TBW significantly adds to the strength of the construct.<sup>20</sup>

In present study, on the basis of inclusion and exclusion criteria, authors studied 54 cases of displaced transverse fractures of the body of patella from June 2017 to December 2018. All the fractures were closed injuries. The age of the patients in the study ranged from 19 to 82 years. Most of the patients involved in the study were aged more than 40 years (Figure 5). 37 males (68.51%) and 17 females (31.48%) were included in the study. The patients were divided into two groups: group 1 (n=23) included patients which were managed with TBW along

with circumferential cerclage wiring whereas group 2 (n=31) included patients which were managed with TBW alone. The patients were followed every monthly for a period of 6 months. Clinical outcome grading was done to compare the results in the two groups (Table 1 and 2).

There were 73.90% patients among group 1 and 70.96% among group who showed excellent to good results (Table 3). Fixation failure and need for revision surgery among group 1 and group 2 was found to be 8.69% and 9.67%, respectively (P value <0.6). Infections and nonunion occurred among 4.34% patients in group 1 and 6.45% in group 2 (P value <0.6). Infections were managed with daily debridement and antiseptic dressings along with proper antibiotics. Fixation failure and nonunion were managed with revision surgery with bone grafting. Union was achieved in all the cases of fixation failure and nonunion, after revision surgery.

Authors proposed a null hypothesis claiming that the augmentation of the tension band wiring with circumferential cerclage has no added advantage over TBW alone when used for displaced transverse fractures of the patella as far as the clinical outcome and complication profile is concerned. Authors tested the null hypothesis using t test. Significance was set at a P value of <0.05. In present study authors failed to reject the null hypothesis. Hence, authors do not have sufficient evidence to suggest that TBW with augmented cerclage can have any benefit over TBW alone in treating displaced transverse fractures of patella. Authors results were similar to the study conducted by Yang TY et al, who suggested that augmented circumferential cerclage wiring is needless in patients treated with modified TBW for displaced transverse fractures of the body of patella.<sup>21</sup>

## CONCLUSION

Authors concluded that the use of circumferential cerclage wiring along with tension band wiring for displaced transverse fractures of the body of patella has no added advantage over fixation with tension band wiring alone.

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