

Early Complications of Modified Tension-Band Wiring (MTBW) in the Treatment of Close Patellar Fractures

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ABSTRACT

Introduction: Patella fracture account for 1 Percent of all skeletal fracture. Patella fractures are problematic because the loss of the extensor mechanism of the knee, loss of articular congruity and stiffness of the knee joint. The surgical goals are anatomic reconstruction of the articular surface and stable fixation to allow early motion. Modified tension band wiring MTBW (MTBW) is the procedure of choice for patellar fracture these days because of the dramatic decrease in post-operative complications with this procedure. The complications noted in the early post-operative period are infection, loss of reduction, prominence of hardware, and knee stiffness.

Objective: To determine the frequency of early post-operative complications following modified tension band wiring MTBW for closed patellar fractures.

Methods: This study was conducted in the department of orthopedic surgery, Lady Reading Hospital, Peshawar from June 2010-september 2011. Through a descriptive cross sectional study, a total of hundred patients of closed patellar fractures were selected in a consecutive manner from the OPD and ER department. All patients were subjected to modified tension band wiring MTBW under G/A by an expert orthopedic surgeon and data was also collected at 1st week, 1st month, 3 months and 6 months regarding early post-operative complications like loss of reduction, infection, prominence of hardware and stiffness.

Results: Total patients were hundred. There were 60 (60 Percent) males and 40 (40 Percent) were females. Mean age of the patients was 43.82 years + 14.3SD years (range 20-85 years). 74 (74 Percent) were presented with history of road traffic accident. Overall complication rate by the end of 6 months was a total of 25 Percent with of 21 Percent patients with infection, 11 Percent had developed stiffness, 6 Percent with hardware prominence and only 4 Percent with loss of reduction.

Conclusion: The frequency of early post-operative complication following modified tension band wiring MTBW for closed patellar fractures was higher than previously reported and further research work should be carried out to identify the factors responsible for it.

Keywords: Developed Stiffness, Closed Fracture Patella, Modified Tension Band Wiring MTBW, Early Post-Operative Complications, Hardware Prominence,

INTRODUCTION

Patella fracture account for 1 Percent of all skeletal fracture. They are caused by either direct injuries such as falling on the knee or road traffic accident RTA or by indirect injuries from sudden contraction of the quadriceps muscles¹.

Patella fractures are problematic because the loss of the extensor mechanism of the knee, loss of articular congruity and stiffness of the knee joint². In order to avoid this problem, the surgical goals are anatomic reconstruction of the articular surface and stable fixation to allow early motion³.

Contemporary methods of operative treatment for patellar fracture includes, modified tension band wiring MTBW, screw fixation, partial patellectomy and patellectomy. Modified tension band wiring MTBW is the procedure of choice for patellar fracture these days because of the dramatic decrease in post-operative complications with this procedure⁴.

Post-operative complications attributes to tension band wiring MTBW for patellar fractures includes, loss of reduction, prominence of hardware, infection, stiffness of knee joint, nonunion, vascular necrosis and post traumatic arthritis⁵.

The prevalence of post-operative complications with tension band wiring MTBW reported in previous studies and literature is 22 Percent for loss of reduction, 15 Percent hardware prominence, 18 Percent infection and more than 20 Percent for knee joint stiffness⁶. The rationale of the study is that, not many studies from this region have focused on the early outcome following this surgical intervention for the treatment of patellar fracture. From this study the post-operative care will be provided to reduce these complications and will help to improve the overall management of our patients⁷.

The aim of our study is to determine the frequency of early pre-operative complication following modified tension band wiring MTBW for closed patellar fractures.



MATERIALS AND METHODS

It was a Cross sectional study. Conducted in Orthopaedic department of LRH Peshawar. The data was collected from June 2010 to September 2011.

The sample size was hundred patients, using 15 Percent prevalence, 95 Percent confidence level and 7 Percent margin of error, using WHO software for sample size calculation. Samples were collected by non-probability consecutive method.

Inclusion Criteria

- 1- Patient aged 16 years are above
- 2- Closed patellar fracture: displaced, un-displaced or comminuted.
- 3- Both sexes.

Exclusion Criteria

- 1- Evidence of previous knees surgery, because this will affect knee stiffness and infection rate.

2- Open fractures, because in these cases the infection rate is high.

3- Any other debilitating disease, in which patient fitness for anesthesia is at high risk.

All those patients presented to the accident and emergency department with history of trauma to knee and confirmation of patellar fracture by radiology, fulfilling the inclusion criteria.

Modified tension band wiring MTBW surgical procedure was applied on these patients. Post-operatively all patients were advised a check X-ray after recovery from anesthesia. Following a hospital stay of few days, patients were discharged on decision of the attending surgeon. Follow up visits were conducted in the out-patient department at 10 days; 1 month, 3 months and 6 months post operatively. The check list Performa containing the entire necessary variable (complication) was followed upon advising investigations as depicted by the operational definitions mentioned.

The data was analyzed using SPSS version 11. Variables under study for descriptive statistics were age, sex, and loss of reduction, prominence of hardware, infection and stiffness. Frequency and percentages was calculated for categorical variable like sex, loss of reduction, prominence of hardware, infection and stiffness. Mean \pm standard deviation was used for numerical variables like age.

RESULTS

In this study, hundred patients with closed patellar fractures had dealt, in which 40(40 Percent) were female and 60(60 Percent) were male patients. Male to female ratio was 1.5:1. As in figure below.

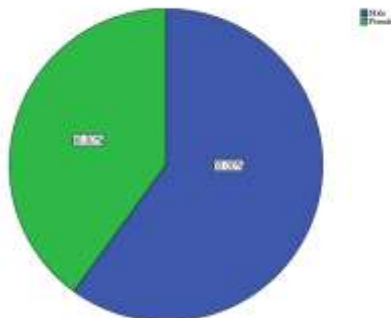


Figure 1: Gender Wise Distribution of the Patients

Patients age was divided in four categories, patients presented in age i.e less than or equal to 30 years which were 16(16 Percent) while 42(42 Percent) patients were in the age range of 31-45 years, 28(28 Percent) were of age range 46-60 years and 14(14 Percent) presented at age more than 60 years. The study included age ranged from 20 up to 85 years. Average age was 43.82 years + 14.3SD. (Table 1)

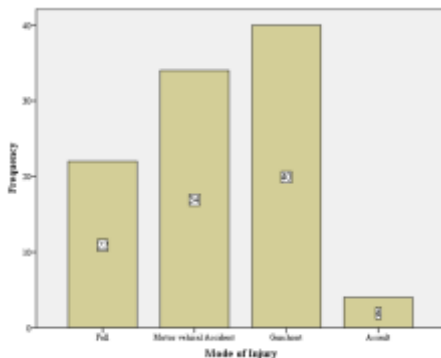


Figure 2: Mode of Injury

Mode wise presentation of the patients' shows that majority of the patients were presented with gunshot i.e 40 Percent followed by motor vehical accident 34 Percent, motor vehicles accident i.e. 74 Percent, 22 Percent were presented with fall history and 4 Percent were suffered of assault.

Early complication at 1st week shows that there were 35 Percent of complications. In which loss of reduction was 6 Percent, hardware prominence 10 Percent, infection 12 Percent, stiffness 7 Percent noted.

Table 1: Early Complications at 1st Week

	Frequency	Percent
Loss of Reduction	6	6.0
Hardware Prominence	10	10.0
Infection	12	12.0
Stiffness'	7	7.0
No Complication	65	65.0

Table 2: Age Wise Distribution of the Patients

	Frequency	Percent	Cumulative Percent
<= 30.00	16	16.0	16.0
31.00 - 45.00	42	42.0	58.0
46.00 - 60.00	28	28.0	86.0
61.00+	14	14.0	100.0
Total	100	100.0	

Early complication at 1st month shows that there were 31 Percent of complications. In which loss of reduction was 6 Percent, hardware prominence 7 Percent, infection 13 Percent, stiffness 5 Percent.

Table 3: Early Complications at 1st Month

	Frequency	Percent
Loss of Reduction	6	6.0
Hardware Prominence	7	7.0
Infection	13	13.0
Stiffness	5	5.0
No Complication	69	69.0

Early complication at 3rd month shows that there were 28 Percent of complications. In which loss of reduction was reduced to 4 Percent, hardware prominence 7 Percent, infection 7 Percent, stiffness 5 Percent and no complication rate was 72 Percent observed.

Table 4: Early Complications at 3rd Month

	Frequency	Percent
Loss of Reduction	4	4.0
Hardware Prominence	7	7.0
Infection	7	7.0
Stiffness'	3	3.0
No Complication	72	72.0

Table 5: Early Complications at 6th Month

	Frequency	Percent
Loss of Reduction	4	4.0
Hardware Prominence	6	6.0
Infection	21	21.0
Stiffness	11	11.0
No Complication	75	75.0

Similarly Early complication at 6th month shows that there was decrease in complication rate i.e. 25 Percent. In which loss of

reduction was reduced to 4 Percent, hardware prominence 6 Percent, infection 21 Percent, stiffness 11 Percent and no complication rate was 75 Percent observed.

Fracture type distribution shows that there were 49 Percent patients have left side fracture, 33 Percent have right side fracture and 18 Percent patients have presented with both side of fracture.

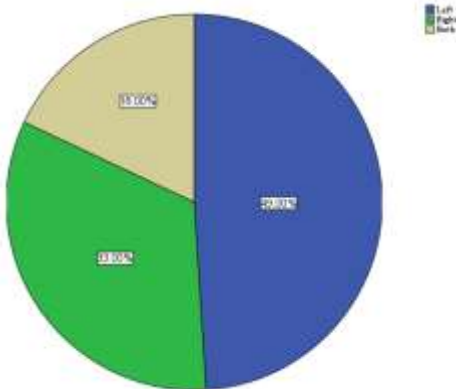


Figure 3: Fracture Type

DISCUSSION

Patellar fracture is a serious injury with the poor functional outcome. Because of conflicting report of postoperative morbidity, it is important to study the result of patellar treatment⁸. It is well known that the course of fracture healing and functional outcome is closely related to the method of treatment and the results generally vary with the method of fixation on which is directed the principle of postoperative rehabilitation. Mechanical factors produced at the fracture site involve many components, of which muscle action internally and the mode of fixation externally is most important⁹.

The concept of more rigid fixation in patellar fractures is controversial. Yet there are high complication rates with the tension band technique and early mobilization requires more rigid fixation methods¹⁰.

It is a fact that the expected result of the tension band techniques is affected by many factors such as variety of patellae, surgical practice and traumatic damage. But the Kirschner wire for tension band was placed deeply in some practices so that more interposed tendinous tissue can diminish stability. Many treatment methods are discussed in the literature with clinical results and biomechanical studies, and numerous results indicate the importance of the relationship between tension band and soft tissue¹¹.

Several biomechanical studies and several modifications of the tension band technique indicate that the relationship between the tension band and soft tissue around the patella can affect the outcome in terms of complications¹².

One Hundred patients were included in the study. Patients' age ranged from 20 to 85 years which was consistent with many other studies in the literature like 18-83 years by Mehdi et al, mean age of 45 years by Ndiaye A et al but somewhat different in study conducted by Shay Shabat reporting age range of 65-88 years. Majority of the injuries were in the 4th and 5th decade of life, which means working individuals who were more outgoing suffered the most. The male dominance (60 out of hundred making it 60 Percent) in the injuries also verified the similar interpretation of male dominance and proved in the literature too like 73.5 Percent by Mehdi et al¹³.

The most common mode of injury was road traffic accidents accounting for 74 Percent of cases (74 out of hundred). It signifies that high incidence of patellar fracture in high impact trauma and the same is reported by Torchia et al who reported 90 Percent cases of patella fracture had history of road traffic accidents and same reported by Mehdi et al and 92.3 Percent by

Ndiaye A et al. Other common mode of injury was fall from height (22 Percent) and fight/physical assault 4 Percent. In majority of cases, left side was involved (49 out of hundred) and there were 18 Percent cases of bilateral knee involvement.

Operative treatment of displaced patellar fracture using modified tension band technique has generally been associated with few short term complications. The complication rate in our study was little bit higher after 6th month of follow-up for what was previously reported. The overall rate of complications as reported in previous literature ranged from 0 Percent to 15 Percent: which in our study was found to be a total of 25 Percent (16 out of hundred). This was very much higher from what was previously reported by Lotke 16 Percent, Chen A et al reported 5.2 Percent and less than 5 Percent by Bostman¹⁴.

Postoperative complications can be minimized by good attention to wound care, accurate fracture reduction, secure fracture fixation and an early range of motion. Despite the surgeon's best efforts, however, post-tension band complications can develop and may require additional treatment. The results of study by Baran O et al reported their results in somewhat of our study's favor concluding that there are high complication rates with the tension band technique and early mobilization requires more rigid fixation methods. However, Ha CW et al showed 0 Percent complication rate in their study.

Displacement of the hardware (leading to hardware prominence) has been attributed to errors in technique most commonly involving improper placement or insufficient tension in the tension band wire which may allow fracture displacement and hardware prominence¹⁵. The incidence of symptomatic hardware is difficult to report because it is rarely reported in previous studies, hung reported 10 Percent of patients in their series with hardware prominence within the first 12 months while Yum Tian reported it to be 15 Percent. Carpenter et al in their study that Fractures stabilized with a modified tension band were found to displace significantly more than those fixed with screws alone or screws plus a tension band in simulated knee extensions ($p < 0.05$)¹⁶. The total number of patients in our study with hardware prominence due to fracture displacement was observed to be 6 Percent (6 out of hundred) which was somewhat lower than previously reported like Smith et al reported only 13 Percent of patients who developed symptomatic hardware due to fracture displacement and required re surgery. Although few would consider symptomatic hardware a complication, it does require an additional operative procedure in a number of patients. This carries a small risk of further morbidity as well as an additional expense. The results of study by Mehdi et al also give good results for hardware prominence showing 0 to 10 Percent of patient developing hardware prominence and they concluded the tension band wiring MTBW to be good technique for early recovery for fractures patella¹⁷.

The rate of infection after tension band wiring MTBW in our study was also found to be somewhat higher in the previous studies; this might be due to the fact about poor socioeconomic status of our population with poor nutritional status and also not forgetting poor attitude toward follow up and wound care. In our study it was observed to be in around 21 Percent of patients which needs immediate considerations. The results of our study totally different from the study conducted by Shrestha B et al who showed that infection occurred only in 2.7 Percent of patients. The results of study conducted by Torchia et al also showed deep infection occurred in only 10.7 Percent of patients almost halfway from what was observed in our study while infection rate was totally 0 Percent in the study by Ha CW et al and somewhat closer to Ha CW, the CC Wu et al showed only 3 Percent infection rate in their study and Lotke reported only 3.1 Percent and 2.2 Percent reported by Smith et al and Mehdi et al showed only 5 Percent of patients who developed infection after tension wiring MTBW fixation for patella fracture. However the study reported by Hung showed somewhat closer to what we found in our study reporting 15 Percent of patients who developed infection after tension wiring MTBW fixation for patellar fractures¹⁸.

The loss of reduction was another early complication which was scrutinized in our study after fixing patellar fractures with tension wire bands. In our study the overall complication rate though high, but the loss of reduction was minimal as compared to other early complications. The same was reported in other studies (though rare) in the literature. Hang reported no patient with loss of reduction in his series of patellar fractures fixed with tension wiring MTBW technique as compared to results of our series where we reported 7 Percent of patients who developed loss of reduction in the follow up period. The results of study by Ha CW et al were consistent with the results of Hang et al who also didn't find a single patient with loss of reduction and also of that of Smith et al¹⁹.

The other complication studied in our series was stiffness of the knee joint. This complication is also very rarely reported in literature and most often associated with loss of mobility after the fracture fixation with tension wires. Regular physiotherapy with other exercises greatly reduces the incidence of knee joint stiffness. In our series it was reported in some 11 Percent of patients and very negligible data from literature is available for its comparison²⁰. The most obvious reason for such complication might be irregular follow up to the operating surgeon. The results of our study were comparable to the one conducted by Klessen et al who reported knee stiffness in 12 Percent of patients after fixing patellar fracture with tension wires.

CONCLUSION

The study was designed owing in view to the routine use of modified tension band wiring MTBW technique for closed fractures of patella. The overall early post-operative complication rate was found to be somewhat higher than previously reported and this issue must be addressed. The overall high complication rate may be due to various factors which must be studied and researched to bring the complication rate lower down.

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