MAK HILL Publications Research Journal of Medical Sciences

Research Article
doi: 10.36478/makrjms.2024.7.277.281

Functional Outcome of Tension Band Wiring in Transverse Patella Fractures

[1]N. Kattu Bava, [2]T.T. Annamalai, [3]Mohammed Sheriff and [4]Zakir Hussain Mohamed

[1-4]Department Of Orthopaedics, Sree Mookambika Institute of Medical Sciences, kulasekharam, Kanyakumari-629161,Tamil Nadu, India

OPEN ACCESS

Key Words
Transverse patella fractures, Tension Band Wiring (TBW), AO classification, Gaur's criteria for knee function evaluation

Corresponding Author
N. Kattu Bava,
Department Of Orthopaedics, Sree Mookambika Institute of Medical Sciences, kulasekharam, Kanyakumari-629161,Tamil Nadu. India
doctornkbava@gmail.com

Author Designation
[1]Final Year Postgraduate
[2,4]First Year Postgraduate
[3]Assistant Professor

Received: 25 April 2024
Accepted: 13 June 2024
Published: 14 June 2024

Citation: N. Kattu Bava, T.T Annamalai, Mohammed Sheriff and Zakir Hussain Mohamed, 2024. Functional Outcome of Tension Band Wiring in Transverse Patella Fractures. Res. J. Med. Sci., 18: 277-281, doi: 10.36478/makrjms. 2024.7.277.281

Abstract
If a fracture has to unite, it requires mechanical stability, which is obtained by compression of the fracture fragments. The principle of Tension band wiring is conversion of tensile forces into compressive forces. This improves the fracture healing and stability is improved when tensile force is reduced at the fracture site. Many treatment modalities are used for transverse patella fractures like tension band wiring, cannulated cancellous screws fixation, cannulated screws with tension band and other evolved techniques. In our study, we are going to determine whether the tension band wiring is still a gold standard treatment for transverse fractures patella even after evolution of various new fixation techniques. After getting institutional human ethical committee and research committee approval, This Prospective Study was conducted among 40 patients in Sree Mookambika Institute of Medical Sciences, Kulasekharam, who were diagnosed to have transverse fractures of patella. We included patients with age >18 years, both males and females with closed displaced transverse fractures of patella (AO classification C1.1). We excluded patients with age <18 years, open fractures, AO classification types A, B, C1.2, C1.3, C2 and C3 of patella fractures, any established deformity of knee prior to the fracture and ligament injuries associated with fracture. Functional outcome was measured using patella Gaur's criteria for knee function evaluation. In our study, the functional outcome was assessed for total 40 patients with patella fracture treated with TBW was evaluated using Gaur's Criteria for Knee Function Evaluation. Based on that Excellent outcome was observed in 22 (55%) patients, good outcome in 14 (35%) patients, Fair outcome in 2 (5%) patient and Poor outcome in 2 (5%) patients. Transverse fracture of patella can be effectively treated with Tension Band Wiring. It is relatively a simple, inexpensive procedure which gives excellent to good functional results. A good surgical technique, optimal operation room environment and judicious use of antibiotics will reduce the possibility of infection which intended results in excellent functional outcome.

INTRODUCTION

The patella is the largest sesamoid bone in the body[1]. Since it is subcutaneous, it is vulnerable to direct injuries and is about 1% of all the fractures in humans[2]. Approximately 50-80% of patellar fractures are transverse fractures, which is likely to disrupt the knee extensor mechanism. As these fractures are partially intra-articular, they are constantly being subjected to deforming forces from the extensor muscles, improper reduction may cause anatomical complications like Osteoarthritis, Stiffness of joints, Non-union etc.

Fredrick Pauwel stated the principle of Tension Band Wiring (TBW) in 1935, regarding treatment of avulsion fractures like Olecranon, Patella and Medial Malleolus. If a fracture has to unite, it requires mechanical stability, which is obtained by compression of the fracture fragments. The principle of Tension band wiring is conversion of tensile forces into compressive forces[3]. This improves the fracture healing and stability is improved when tensile force is reduced at the fracture site.

Many treatment modalities are used for transverse patella fractures like tension band wiring, cannulated cancellous screws fixation, cannulated screws with tension band and other evolved techniques.

In our study, we are going to determine whether the tension band wiring is still a gold standard treatment for transverse fractures patella even after evolution of various new fixation techniques. We are determining the functional outcome of TBW in transverse fractures of patella using Gaur's criteria for knee function evaluation[4].

MATERIALS AND METHODS

After getting institutional human ethical committee and research committee approval, This Prospective Study was conducted among 40 patients in Sree Mookambika Institute of Medical Sciences, Kulasekharam, who were diagnosed to have transverse fractures of patella. We included patients with age >18 years, both males and females with closed displaced transverse fractures of patella (AO classification[5] C1.1). We excluded patients with age <18 years, open fractures, AO classification types A, B, C1.2, C1.3, C2 and C3 of patella fractures, any established deformity of knee prior to the fracture and ligament injuries associated with fracture. In our study of 40 patients patella fractures, most of the patients were in the age group of 31-50 years which constitutes about 50% of study population i.e. 20 patients. However, 32.5% i.e.13 patients were in the age group of 18-30 years and remaining 17.5% i.e. 7 patients were of age >50 years. In our study of 40 patients there were 31 males and 9 females with Male predominance owing to more incidence of Road traffic accidents among males. All the patients involved in the study were explained in detail and informed consent forms were obtained. All required investigations were done including X-Ray and blood investigations. All patients were treated with Open Reduction and Internal Fixation with Tension Band Wiring. The patients were regularly followed up for a period of 6 months in regular intervals at 4, 8, 12 and 24 weeks. Functional outcome was measured using Gaur's criteria for knee function evaluation[4]. Patients were evaluated for complications such as infection, skin necrosis, k-wire migration, stiffness. The data collected was subjected to data entry in MS Excel. The data was analyzed using SPSS (SPSS inc IBM Chicago city, Illinois state, USA) Version 20.0 using Chi square test.

Operative technique: In our study for patients with displaced transverse olecranon fractures, spinal anaesthesia was used. A midline longitudinal incision approximately 12.5 cm long was used. TBW is done with 2 K-wires of sizes 1.5-2mm and 18-gauge stainless steel wire. The limb was placed in extension in a knee brace. Isometric exercises and full weight bearing was allowed with a straight knee using walker, from first postoperative day. Check dressing was done on 2nd postoperative day. Following routine dressing, repeat x-ray AP and lateral views of affected knee was done. Sutures were removed on 14th post-operative day and active knee range of movements were started.

RESULTS AND DISCUSSIONS

In our study of 40 patients with patella transverse fractures, the most common mode of injury was found to be Road Traffic Accident (RTA) in 13 patients (65%). Domestic in nature in about 9 patients (22.5%), Sports injury and Assault type in around 3 patients (7.5%), which were the least common mode of injury [Fig. 1].

Out of 40 patients, 21 (52.5%) patients had direct mechanism of injury and remaining 19 (47.5%) patients had indirect mechanism of injury. 38 (95%) patients did not have any associated injuries whereas 2 (5%) patients had associated injuries in which 1 (2.5%) patient had proximal tibia fracture and 1 (2.5%) patella fracture patient had femur shaft fracture.

In our study, among 40 patients with patella fracture, 20 (50%) patients had union time in around 10-12 weeks, 14 (35%) patients had union time in 13-18 weeks and 6 (15%) patients had union time in 8-9 weeks (Fig. 2).

Based on Gaurs criteria of knee function evaluation[4], the knee pain score is evaluated. There was no pain in 22(55%) patients, minimum pain in 14(35%) patients, moderate pain in 2(5%) patients and severe pain in 2(5%) patients.

Out of 40 patients with patella fracture, 22 (55%) patients had full knee range of motion, 14 (35%)

patients had 0-110° knee range of motion, 2 (5%) patient had up to 90° knee range of motion and 2 (5%) patient had <90° knee range of motion based on Gaur's Criteria For Knee Function Evaluation[4] (Figure 4).

In our study, the functional outcome was assessed for total 40 patients with patella fracture treated with TBW was evaluated using Gaur's Criteria for Knee Function Evaluation[4]. Based on that Excellent outcome was observed in 22 (55%) patients, good outcome in 14 (35%) patients, Fair outcome in 2 (5%) patient and Poor outcome in 2 (5%) patient (Fig. 5).

In our study population, we had nil complication in 32 (80%) patients, 2 (5%) patients had K-wire migration, 2 (5%) patients had skin necrosis, 2 (5%) patients had infection, 2 (5%) patient had Knee stiffness. (Fig. 6).

In our study, Tension band wiring was used for patella transverse fractures of total 40 cases. It has given favorable results. The results will be analyzed and compared in the following discussion.

In our study population, the age group of patients who sustained transverse fracture of patella ranges from 20-65 years. The mean age of the study was 42.5 years. The majority of patients were between the age

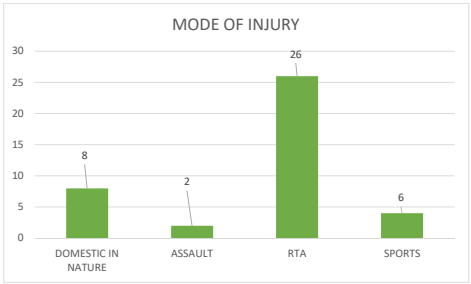

Fig. 1: Mode of injury in our study cases

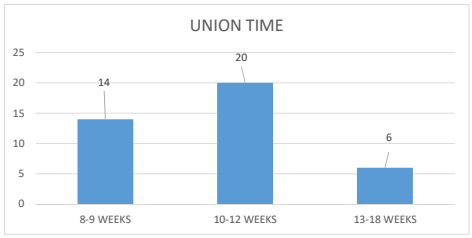

Fig. 2: Union time for TBW in transverse patella fractures in our study cases

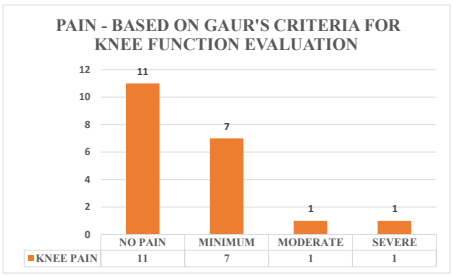

Fig. 3: Pain-based on Gaur's Criteria for Knee Function Evaluation[4]

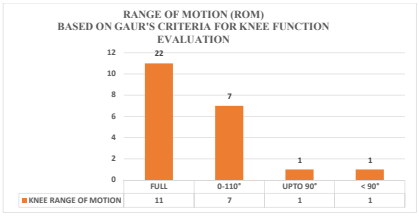

Fig. 4: ROM-based on Gaur's Criteria for Knee Function Evaluation[4]

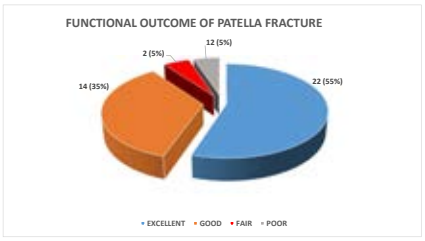

Fig. 5: Functional results of TBW in transverse Patella fracture cases

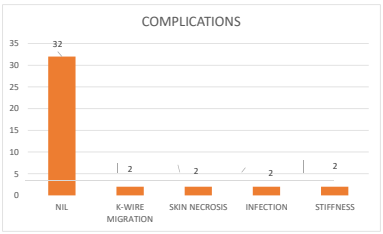

Fig. 6: Complications following TBW in patella fractures in our study cases

Fig. 7: (a) Preoperative X-Ray, (b) Immediate postoperative X-ray, (c) 12-week follow-up X-ray, (d) Intra-operative pictures, (e) Postoperative knee flexion (f) Postoperative knee extension

Fig. 8: Poor results and associated factors: Transverse patella fracture-with associated osteoarthritis knee

Table 1: Comparison of average union time for patella fracture.

Study	Average union time
Hung L.K *et al*[9]	12 weeks
Hanumantharaya GH[10]	12 weeks
Berg E E *et al*[11].	13 weeks
Prakash Ponnan *et.al*[6]	11-13 weeks
Present Study	10-12 weeks

Table 2: Comparison of functional outcome of TBW in patella

	Patella				
Studay	Excellent	Good	Fair	Poor	
Levack *et al*[12]			50	35.7	14.3
Mohammad Asimuddin *et al*[13]	65		15	15	5
Karra Bansilal *et al*[14]	50		40	10	-
Maini and Kochar *et al*[15]	36.6		38.4	15	10
Present Study	55		35	5	5

group of 30 and 50 years (60%). Prakash Ponnan[6] in his study, among 35 cases, age of patient ranges from 20-60 years with mean age of 43 years. Maximum patients were in the age group of 50-60 years (40%).

In our study, there was a male preponderance with 14 (70%) males and 6 (30%) females A study conducted by Nikhilesh[7] gender-wise distribution of his study subjects. It shows that majority of the patients were males with a male: female ratio of 1.7: 1.

In our study among 40 cases of transverse patella fracture, 24 (60%) were on right side and remaining 16 (40%) were left side. Samiullah[8] The right knee was involved in 20 (66.66%) cases, while the left knee was involved in 10 (33.33%) cases.

In our study of 40 cases with patella transverse fractures, the most common mode of injury was found to be Road Traffic Accident (RTA) in patella fractures 26 (65%). Domestic in nature was around 8 (22.5%), Sports injury and Assault type was around 6 (7.5%) each which were the least common mode of injury.

In various studies of Hung[9]. (1985), Hanumantharaya[10] Berg[11] and Prakash Ponnan[6] they had an average union time of 11-13 weeks. Whereas in our study among 40 patients with patella fracture, 20 (50%) patients had union time in around 10-12 weeks, 14 (35%) patients had union time in 13-18 weeks and 6 (15%) patients had union time in 8-9 weeks (Table 1).

The results of TBW in our study were compared with Levack[12], Mohammad Asimuddin[13], Karra Bansilal[14], Maini and Kochar[15] for transverse fracture of Patella. In the study done by levack[12], good outcome was in 50% of patients, fair outcome was in 35.7% and poor outcome were 14.3% of patients. In Mohammad Asimuddin[13] series excellent outcome was in 65% of patients, good outcome was in 15%, fair outcome was in 15% and poor outcome were in 5% of patients. And similarly, Karra Bansilal[14] had excellent outcome in 50% of patients, good outcome in 40% of patients, fair outcome in 10 % and there are no poor outcome cases reported (Table 2). In our present study (Fig. 7), we found that the Tension band wiring procedure for patella fracture had excellent outcome in 11 (55%) of patients, good outcome in 7 (35%), fair outcome in 1 (5%) of patients and poor outcome in 1 (5%) of patients which is comparable with above mentioned studies. One patient with poor outcome had stiffness due to severe osteoarthritis (Fig. 8).

In our study population, out of 20 patients with patella fracture, nil complications in 16 (80%) patients, 1 (5%) patient had K-wire migration, 1 (5%) patient had skin necrosis, 1 (5%) patient had infection and 1 (5%) patient had stiffness (Fig 8). Prakash Ponnan[6] in his study about patella fracture, out of 35 patients, 7 (20%) had pain on squatting, 3 (8.57 %) had limitation of flexion, extensor lag was seen in 2 (5.71 %), superficial skin infection was seen in 2 (5.71 %). One patient had loss of fixation in the post-operative period.

CONCLUSION

Transverse fracture of patella can be effectively treated with Tension Band Wiring. It is relatively a simple, inexpensive procedure which gives excellent to good functional results. A good surgical technique, optimal operation room environment, and judicious use of antibiotics will reduce the possibility of infection which intended results in excellent functional outcome. Physiotherapy protocol also plays an important role to improve overall functional outcome to overcome the late complications However, a greater number of cases are needed to determine the long-term complications.

REFERENCE

1. Melvin, S.J. and S. Mehta, 2011. Patellar fractures in adults. Am. Acad. Orthop. Surgeon, 19: 198-207.
2. Boström, Å., 1972. Fracture of the patella: A study of 422 patellar fractures. Acta Orthop. Scand., 43: 1-80.
3. Fyfe, I., M. Mossad and B. Holdsworth, 1985. Methods of fixation of olecranon fractures. An experimental mechanical study. J. Bone Joint Surg.. Br., 67: 367-372.

4. Gaur, S.C., A.N. Verma, A.K. Kulshreshtha, R.K. Katiyar and N. Sinha, 1997. Late outcome of patellectomy. Ind. J. Orthop., 33: 422-426.
5. Müller, M.E., M. Allgower, R. Schneider and H. Willenegger , 1991. Manual of internal fixation: techniques recommended by the AO-ASIF group. 3rd Edn., Springer, Berlin, Germany, ISBN-17: 978-3-662-02695-3, Pages: 752.
6. Ponnan, P. and M.M. Kunjappan, 2021. Evaluation of functional outcome of patients with transverse fracture of patella treated with tension band wiring-a prospective study conducted at Trichur, Kerala. J. Evid. Based Med. Healthc., 8: 2757-2762.
7. Nikhilesh, P.S., H. Sivanandan, M. Anandanarayan and A.E. Manoharan, 2021. Functional outcome of surgical management in cases of fracture patella in a tertiary care hospital in salem. Int. J. Res. Orthop., 7: 507-512.
8. Samiullah, D.M. and D.A. KN, 2022. Functional outcome of tension band wiring in transverse patella fracture. Int. J. Orthop.s Sci., 8: 1-4.
9. Hung, L.K., K.M. Chan, Y.N. Chow and P.C. Leung, 1985. Fractured patella: Operative treatment using the tension band principle. Injury, 16: 343-347.
10. Hanumantharaya, H., 2017. Functional outcome with modified tension band wiring for patella fractures. Int. J. Orthop. Sci., 3: 455-457.
11. Berg, E.E., 1997. Open reduction internal fixation of displaced transverse patella fractures with figure-eight wiring through parallel cannulated compression screws. J. Orthop. Trauma, 11: 573-576.
12. Levack, B., J. Flannagan and S. Hobbs, 1985. Results of surgical treatment of patellar fractures. J. Bone Joint Surg.. Br., 67: 416-419.
13. Asimuddin, M., S. Shah and A. Fatima, 2021. A comparative study of tension band wiring versus circumferential wiring in the management of patellar fractures. Indian J. Orthop. Surg., 7: 118-122.
14. Bansilal, K. and S. Kommera, 2016. Management of fractures of patella olecranon, malleoli by tension band wiring method. Int. J. Med. Sci. Clin. Inv., 3: 1824-1836.
15. Maini, P.S., S.S. Sangwan, S. Sharma, P. Chawla and A. Kochar, 1986. Rigid fixation of various fractures by tension band wiring. I. J. Orthop., 20: 162-167.