

# Outcome of Patients with Comminuted Fractures of Patella Treated with Claw Shape Plate, a case Series at a Tertiary Care Hospital

SAIFULLAH SOOMRO<sup>1</sup>, ASIF ALI SHAIKH<sup>2</sup>, ZAMIR AHMED SOOMRO<sup>3</sup>, JAGDESH KUMAR AHUJA<sup>4</sup>

<sup>1</sup>Senior Registrar Orthopaedics, Department of orthopaedic, Chandka medical college (SMBBMU) Larkana

<sup>2</sup>Registrar Orthopaedics, Department of orthopaedic, Chandka medical college (SMBBMU) Larkana

<sup>3</sup>Professor of orthopaedics, Department of orthopaedic, Chandka medical college (SMBBMU) Larkana

<sup>4</sup>Professor of orthopaedics, Department of orthopaedic, Chandka medical college (SMBBMU) Larkana

Corresponding Author: Saifullah Soomro, Email: [saifullahsoomro8585@yahoo.com](mailto:saifullahsoomro8585@yahoo.com), Cell: 03422864474

## ABSTRACT

**Introduction:** Comminuted fractures of patella are usually dealt with partial or complete patellectomy which compromise the extensor mechanism. Claw plate is newly introduced device to fix comminuted fractures, which provide easy and efficacious method of preserving patella and is used in selected cases.

**Methods:** This prospective observational case series was conducted at orthopaedic department Chandka Medical College (SMBBMU) Larkana from March 2020 to May 2021.

Twenty one cases were selected via consecutive sampling with comminuted fracture of patella who were treated with newly introduced claw shape patellar plate. Age of patients was ranging from 18 years to 70 years. All patients were admitted in tertiary care hospital and were operated by senior surgeon. During procedure patella was approached through anterior mid line incision over knee, fracture reduced and fixed with claw shape patella plate. Post operatively patients were assessed on subsequent follow up visits and outcome of procedure was observed on the basis of functional (Clinical) and radiological results. The functional (clinical) outcome was measured on basis of Lysholm knee score and radiologically x-rays of knee were done to see union pattern. Final outcome of procedure was concluded after 6 month of operation.

Results of all patients were compiled and analysed by using statistical package for Social Sciences (SPSS) Version 21

**Results:** Twenty one patients were enrolled in our study, among them 15(71.4%) were male and six (28.6) were female; the mean age of patients was 42.52 years. The mean length of operation was 55 minutes (40 to 72 minutes). Bone union on radiograph was observed at 20th weeks after surgery in all patients, mean age of fracture healing was 11.5 weeks, (Ranges from 6th to 20th week). At final evaluation found excellent results in 12 (71%) patients, five (29%) patients obtain good results, while four patients lost follow up.

**Conclusions:** Partial or complete patellectomy can be avoided in comminuted patella fractures and patella can be preserved in these fractures by using claw shape patella plate.

**Keywords:** Comminuted fractures, Patella, Claw plate.

## INTRODUCTION

The patella is largest sesamoid bone and is involved in extensor mechanism of lower limb. Fracture of patella breaks the extensor mechanism and needs surgical treatment. Comminuted patella fractures are common and are usually dealt with partial or complete patellectomy which compromise the extensor mechanism [1-2]. Fixation of comminuted fractures of patella with newly introduced claw shape plate is alternative treatment method through which excellent results can be achieved and extensor mechanism of leg can be restored by preserving comminuted patella [3].

Claw plate is designed in triangular shape with base facing proximally and tips distally and has five claps making the shape of claw. These claps hold the reduced fragments of fractured patella in place and provide support for union of the bone so that removal of partial or complete patella can be avoided [4-5].

Rational for case series and need of this study was to experience the outcome and results of newly introduced implant in a small group of patients so that I can be used on usual basis as used in other countries.

The aim of study was to analyze functional out of patients with comminuted patella fracture treated with claw plate.

## MATERIAL AND METHOD

**Registration and ethics:** All patients enrolled in this study were registered and their bio data was saved in electronic medical record of the hospital. All patients were counselled regarding the nature of study and nature of procedure, all treatment option, pre operative and post operative protocols were discussed with them. Informed and written consent were taken from every patient. Before conducting this study, it was presented before institutional review board and ethical committee of hospital, an IRB no: #246-1066-2016 was allotted after approval by IRB.

**Study design and setting:** This case series of prospective design was conducted from March 2020 to May 2021 at orthopaedic department of Chandka medical college Larkana, Sindh, Pakistan, which is a tertiary care hospital and level 1 trauma centre. This is single centre study and cases were consecutive.

**Participants:** All Participants with comminuted fracture of patella were selected consecutively who fulfilled the inclusion criteria of our study. Inclusion criteria were patients with either gender, age ranging from 18 years to 70 years, with comminuted patella fracture classified as AO 34-C2 (transverse plus second segment) and 34-C3 (complex), isolated fracture of patella and patients with disturbed extensor mechanism. Patients below 18 years

and above 70 years of age, with intact extensor mechanism of knee and open patella fractures, with knee ligamentous injuries were excluded from study. These all patients were followed up to 6 months post-operatively and were evaluated in out patients department for clinical and radiological results.

Sample size was calculated using WHO sample size calculator using following parameters

1. Confidence level 95%
2. Anticipated population portion (prevalence) 0.20
3. Absolut precision required 0.10

Pre intervention consideration: All patients with history of trauma to knee were presented to emergency room of the hospital where they were initially managed according to advanced trauma and life sport (ATLS) protocols, x-rays trauma series and x-rays of affected knee were done. Comminuted fracture of the patella was diagnosed on the basis of history of trauma to knee, clinical examination of knee and radiograph anteroposterior and lateral views of knee. On clinical examination there was swelling on anterior aspect of knee and lack of straight leg raise which confirmed injury to extensor mechanism of knee. Intravenous analgesia, muscle relaxants were given for pain relief and long leg back slab was applied. After management in emergency room all patients were admitted in orthopaedic ward and scheduled for intervention on next day.

Type of intervention: open reduction and internal fixation of comminuted fracture of patella with claw shape patella plate. This plate is made up of Titanium –nickel shape memory alloy (Ti-Ni SMA) and manufactured by Changzhou Waston Medical Appliances Co Ltd China with model number 10234.

Peri intervention consideration: Intervention was done in spinal anaesthesia, patients were supine on table, under pneumatic tourniquet control and injured limb was prepared and draped in usual manner. To expose the patella, anterior midline approach was selected; midline incision of about 15cm, starting proximally about 5 cm from upper pole of patella and extending up to tibial tuberosity was made in midline over anterior aspect of knee. Lateral and medial skin flaps were raised. After that fracture hematoma was cleaned, fracture was reduced under C-arm fluoroscopy and was fixed with claw shape patellar plate. After fixation accuracy of fracture reduction and plate position was confirmed in fluoroscopy. Wound was closed in layers and above knee cylindrical back slab was applied for two weeks.

All these procedures were done by same consultant orthopaedic surgeon, who is professor of orthopaedic surgery having experience of more than 25 years in orthopaedic surgeries.

Quality control: Each case was put first on list in early morning, all patients operated by single surgeon, pre and post-operative data collection was done by senior orthopaedic resident and all patients were followed in same interval duration, these all measures were taken to reduce inter and intra-operative variation.

Post – operative consideration: after procedure patients were shifted to general orthopaedic ward. Prophylactic antibiotic Inj: cefuroxime 50mg/kg 8 hourly intravenously was given for 24 hours and analgesics were

given for pain control. Post- operative x-ray knee anteroposterior and lateral views were done on same day. Physiotherapy straight leg raise and full weight bearing was started on next day. On second day wound dressing was changed, patient was discharged and called for follow up after two weeks for removal of stiches and removal of black slab.

All patients were followed at 2nd, 6th, 12th, 16th, 20th and 24th weeks of surgery. On subsequent visits patients were assessed clinically by using Lysholm knee Scoring scale and anteroposterior and lateral radiographs of the knee for bone union. Lysholm knee scoring scale is based on enquiring some common complaints regarding knee from patients. These are limp, using support for walking, locking sensation in knee, giving way sensation from knee, participation in daily activities, pain, swelling, climbing stairs and squatting. Total score is one hundred points. Lysholm knee scoring scale indicates good outcome at 80-90 points and excellent outcome above 90 points. [6]

All collected data regarding patients was handed over to department of statistics and was interpreted and analyzed by senior statistician. Patients were divided in four groups on basis of outcome (excellent, good, fair and poor).

## RESULTS

Participants: Total twenty one patients were enrolled in our study, among them 15(71.4%) were male and six (28.6) were female; the mean age of patients was 42.52 years. Seven patients were diabetic and 3 were smoker. The mean length of operation was 55 minutes (40 to 72 minutes).

No change in intervention during the course of this case series done.

Table 1: knee function on basis of lysholm knee score at various follow up visits

Case	(6 weeks)	(12 weeks)	(24 weeks)
1	53	91	99
2	56	72	82
3	51	89	100
4	56	84	96
5	57	80	85
6	51	90	Lost follow up
7	53	91	100
8	49	70	78
9	51	83	95
10	49	76	84
11	53	89	97
12	53	87	Lost follow up
13	52	82	96
14	58	87	99
15	51	88	Lost follow up
16	57	84	100
17	58	74	80
18	58	89	99
19	51	82	99
20	56	84	100
21	51	88	Lost follow up

Bone union on radiograph was observed at 20<sup>th</sup> weeks after surgery in all patients, mean age of fracture healing was 11.5 weeks (Ranges from 6<sup>th</sup> to 20<sup>th</sup> week). Splint was removed at first follow up visit and knee ranges of motion exercises were advised. At final evaluation four

patients (19.04%) lost their follow up and remaining 17 patients were assessed. 12 patients (71%) had excellent outcome, five patients (29%) had good result.

Few patients had symptoms related to skin irritation, foreign body sensation and pain but those resolved with time. No complications like blood loss, wound dehiscence, delayed union, nonunion, infection, dislocation of claw plate, cut through of cortex or bone fracture around plate were observed in any patient. One patient presented with broken implant in which redo fixation was done with TBW.

## DISCUSSION

Good to excellent results can be obtained by using claw shape patella plate in patients with comminuted patella fractures. Patella acts as a lever to participate in the extension mechanism of knee joint. Tensile and compressive forces are acting upon the patella. Tensile forces are produced in quadriceps and patellar tendons across patella when quadriceps musculature is contracted. Compressive forces also appear in the patellofemoral joint at the same time. These forces increase greatly in daily activities and may amount to manifold of body weight [7]. Therefore, the implants used for the fixation of patella fracture also face such high forces and should be well designed to meet those demanding circumstances.

Considering the forces acting on patella during normal knee function, tension band wiring (TBW) technique is designed and recommended for the internal fixation of patella fracture by Arbeitsgemeinschaft für Osteosynthesefragen (AO) group [8]. Biomechanics behind tension band clarify that tensile forces at nonarticular surfaces are neutralized by TBW and converted into the compressive forces at patellofemoral articular surfaces which allowed early knee mobilization.

Detailed follow up indicated that the incidence of reduction loss and fracture opening using traditional TBW technique with two parallel K-wires accounted for up to 22% of total patients [9].

Comminuted and displaced fractures of patella are difficult to reduce and fix firmly enough to allow early movement of the knee. The inherent weakness of the bone and the size of the fragments prevent firm stabilization by ordinary wiring or screws. Tightening of the cerclage wire often decreases the length of the patella tendon and may injure the soft tissue in front of the tendon and tibial tuberosity causing scarring and subsequent patellar baja. A low lying patella may disrupt the normal physiology of patellofemoral joint [10].

Patella claw plate has been designed and produced according to the request of clinical practices and can achieve adequate compression and stability effects as expected. Compared with traditional TBW- based technique the intraoperative manipulation process of claw plate was simple and thus reduced operation time and blood loss. More importantly loosening or even failure of tension band due to atrophy of the inserted soft tissue can be avoided. Theoretically, the body of this kind of fixator has been put on the anterior aspect of patella, through which tensile forces has been converted into compressive forces hence claw plate also complies the working mechanism of TBW principle.

Liu XW et al [3] studied 25 patients retrospectively in which all patients had comminuted fractures of inferior pole of patella and were treated by using claw shape patella plate and he found excellent results using bostman score. Wei Hao et al [11] presented study on 29 patients with patella fracture treated by using claw like fixator and assessed outcome on basis of lysholm knee score. Our results are comparable with above mentioned studies.

Small number of participant, single centred study and few participant lost to follow up and these are limitations of this study.

## CONCLUSION

In conclusion, the fixation of comminuted fractures of patella via the claw plate can be expected to produce excellent results. The advantages of claw shape plate as we observed lie mainly in holding the multiple fragments at one place, in continuous compression of fracture and in creating stable biomechanical environment. Claw plate not only fix the fractures in anatomically position, but also decrease the risk of partial or complete patellectomy in comminuted fractures. Based the results of our clinical study, we believe that claw plate can serve as an effective means for management of comminuted fractures of patella.

Multicentric prospective observational studies need to be done further to establish the use of this specialized claw shape plate in the treatment of patients with comminuted and multifragment fractures of patella.

**Conflict of interest:** No conflicts of interest

**Source of funding:** No funding required in the study.

## REFERENCES

1. Neuman H.S, Winckler S, Strobel M, long term results of surgical management of patellar fractures. *Unfallchirurg*, 1993;96, p 305-310.
2. Scalero J, Bernstein J, Ahn J , in brief patellar fractures , *clin ortho relate res*(2011) 469:1213-1215 DOI 10.1007/s 11999-010-1537-8.
3. Liu XW, Shang HJ, Xu SG, Wang ZW, Zhang CC, Fu QG, patellar shape-memory fixator for treatment of comminuted fractures of inferior pole of patella *JMEPEG* (2011) 20:623-628 DOI: 10.1007/s 11665-011-9862-Y.
4. Bassani P, Panseri S, Ruffini A, Montesi M, Ghetti M, Zanotti C, Tampieri A, Tuissi A (2014) Porous NiTi shape memory alloys produced by SHS: microstructure and biocompatibility in comparison with Ti2Ni and TiNi 3. *J Mater Med Epub ahead of print*.
5. Wang Y, Zheng G, Zhang Y, Xiao S, Wang Z(2010) comparative analysis between shape memory alloy –based correction and traditional correction technique in pedicle screws constructs for treating sever scoliosis. *Eur Spine J* 19(3):394-399 [stfsportsmed.com/wp-content/uploads/Lysholm-Knee-Scale.pdf](http://stfsportsmed.com/wp-content/uploads/Lysholm-Knee-Scale.pdf)
6. Schindler OS (2012) Basic kinematics and biomechanics of the patellofemoral joint part 2: the patella in total knee arthroplasty. *Acta Orthop Belg* 78(1):11-29
7. Muller ME, Allgower, Robert Schneider M, Willenegger Hans, Perren SM (1991)Manual of INTERNAL FIXATION techniques recommended by the AO-ASIF Group, 3rd edn. Springer.
8. Smith ST, Cramer KE, Karges DE, Watson JT, Moed BR (1997) early complications in the operative treatment of patella fractures. *J Orthop Trauma* 11(3):183-187.
9. L.K. Hung, K.M. Chan, Y.N. Chow et al., Fractured patella: Operative treatment using the tension band principles. *Injury*, 1985;7. P343-347.
10. Wei Hao et al ,Treatment of patella fracture by claw-like shape memory alloy, *Arch orthop trauma surg*(2015) 135:943-951, DOI 10:1007/s 00402-015-2241-7