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Case Series

A case series of percutaneous tension band wiring technique for fixation of fractures of olecranon and patella

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ABSTRACT

There are several advantages in the treatment of fractures by means of closed reduction. Percutaneous fixation is a type of biological fixation. The aim and objectives of this study are to demonstrate the technique of percutaneous tension band wiring in cases of transverse, non- comminuted olecranon and patella fractures and to decrease the soft tissue dissection, blood loss, chances of infection and to ensure speedy mobilization using the innovative percutaneous fixation technique. This retrospective study includes ten patients of olecranon and ten patients of patella operated by the same surgeon. All patients were operated with percutaneous tension band wiring for olecranon and patella. There were six males and four females with olecranon fractures. There were seven males and three females who suffered patella fractures. The average duration of surgery was 55 minutes and average follow up was 24±6 weeks. The suture removal was done at 2 weeks. All patients had full range of movements at six weeks with significantly improved DASH score and Oxford knee score. None of the patients had any complications. Percutaneous fixation decreases the chances of bleeding secondary to unnecessary soft tissue dissection, thereby decreasing the post-operative morbidity. It also, convincingly, decreases the chances of post-operative infection and promotes early mobilization. Closed reduction with percutaneous fixation is believed to be an innovative, safe, reliable and efficient method of managing these difficult fractures.

Keywords: Olecranon, Patella, Tension band wiring, Jamshidi needle, Curvilinear wire passer

INTRODUCTION

Olecranon fractures constitute 10 percent of all upper extremity lesions. The lesion may be a result of direct or indirect trauma, especially forced hyperextension of the elbow joint.[1-4] The classification systems developed for olecranon fractures are descriptive and distinguish between the site of the mean fracture line and the morphological appearance. According to Mayo classification, olecranon fractures are classified according to the factors that influence treatment decisions-displacement, comminution, dislocation and subluxation of the articular joint surface.[5-8] Most olecranon fractures require operative management. However, fractures with displacement less than 2 mm when the elbow is flexed to 90 degrees can be managed conservatively. Transverse, non-comminuted fractures not associated with fracture-dislocation are treated with open reduction and tension band wiring. Transverse and non-comminuted fractures are not associated with fracture dislocation.[9] They may also be treated using percutaneous tension band wiring, with significant advantages over the conventional method

of open reduction and tension band wiring. Percutaneous tension band wiring in figure of eight configuration is newer technique which maintains the dynamic compression, converting tensile force into compressive force.

Patella, the largest sesamoid bone, is a key part of the knee extensor mechanism and provides leverage to the quadriceps mechanism. Fractures of the patella disrupt the articular surface. Management of patellar fractures must restore any disruption of the extensor mechanism while ensuring minimal disruption of the articular surface.[10-13] The major facets of the patella are medial, lateral and odd facets. The current methods of operative fixation of patella include open reduction and tension band wiring, circumferential cerclage wiring, both of which require extensive soft tissue dissection resulting in bleeding.[14-16] The aim of this study is to demonstrate the technique of percutaneous tension band wiring in cases of transverse, non- comminuted olecranon and patella fractures and to decrease the soft tissue dissection, blood loss, chances of infection and to ensure speedy mobilization using the innovative percutaneous fixation technique.

CASE SERIES

This retrospective study includes ten patients of olecranon and ten patients of patella operated by the same surgeon. A demonstrative preoperative X-ray of olecranon and patella fracture is done. Instruments needed are Jamshidi needle; wire passer, tension band wire, 2 mm K-wires, plier and cutter. A fresh pre-operative radiograph helps the surgeon to be familiar with the anatomy, anticipating problems and ensuring that all of the implants and equipment necessary are available.

For olecranon fixation under general anesthesia, above elbow tourniquet is applied to the affected arm. The patient is operated in lateral position with affected elbow kept over a side post. After checking all instruments and implants, painting and draping is to be done. Elbow joint is to be kept in full extension. This facilitates reduction of olecranon fracture. 5 mm incision is to be taken on the upper 1/4th of the posterior aspect of the ulna. Retraction is done using two Dura retractors, commonly used in spine surgery. 3.2 mm drill bit has to be used to make a drill hole (tunnel) in the proximal one fourth of the olecranon process. Make a 1 cm loop out of 0.8mm stainless steel wire spool 20 inch long. Pass the wire loop through the tunnel made in the proximal ulna. Insert a 2 mm Kirschner wire 9 inch long superior to olecranon under the triceps tendon from lateral to medial. Care should be taken to perform this step only in extended elbow. This step helps to protect the ulnar nerve from damage. Insert a 2 mm k wire from the incision site on proximal ulna to the site of exit of the horizontal k wire. Pass a Jamshidi needle or curvilinear wire passer over the k wire in the direction superior to inferior. The lateral end of the stainless steel (SS) wire is to be passed through the J needle and taken out superomedially. The wire loop has to be passed in a similar manner from the superomedial portal to the superolateral portal. J needle is passed over the K wire from the superolateral portal to the superomedial portal. Pass the wire loop in a similar manner from the superolateral portal to the incision site using K wire and J needle. Reduction is attempted by pushing the fragment downwards and by flexion and extension at the elbow joint. Both the ends of the SS wire loop are tied around by the pliers. Flex and extend the elbow. Check the reduction under image intensifier. Post-operative radiograph of olecranon is done. Mobilization is started from second post-operative day as per the pain endurance of the patient. Sutures are removed after 2 weeks. Regular follow up is done at 1 month, 2 months and 3 months.

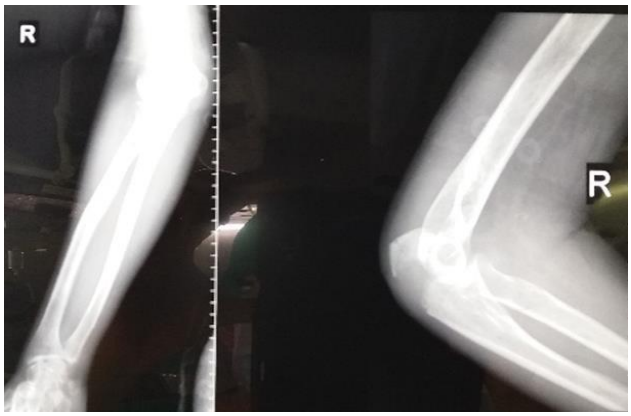

Figure 1: Pre-operative radiograph of olecranon fracture.

Figure 2: Passing of SS wire through Jamshidi needle in the olecranon percutaneously with patient's elbow on arm board in lateral decubitus position.

For fixation of fractures of patella under spinal anaesthesia and torniquet, in supine position, the boundaries of patella and tibial tuberosity are marked. Pass a Kirschner wire above the tibial tuberosity under ligamentum patellae below inferior pole of patella. Pass the Jamshidi needle or a curvilinear wire passer through K wire from medial to lateral. Pass through the J needle approximately 25-30-inch-long double flexible pre-tensioned SS wire from lateral to medial under the ligamentum patellae. After taking a stab incision over superolateral angle of the patella, pass thick 2 mm 9-inch k wire from lateral to

medially under the quadriceps above the proximal pole of patella. Pass another 9-inch-long K wire obliquely through the existing lateral exit of the inferior pole over the patella to the superomedial existing medial exit of superior pole. Pass a J needle through the oblique K wire over the both fragments of patella. Pass lateral end of wire loop through J needle from inferolateral to superomedial. Again, pass a K wire from same previous exit superolateral to superomedial under the quadriceps (above proximal fragment of patella). Pass a 2.5 mm J needle from superolateral to superomedial through the K wire under the quadriceps. Pass lateral end of wire loop from superomedial to superolateral through J needle under the quadriceps tendon over the proximal fragment of patella. Pass a 9-inch K wire through existing superolateral exit to inferomedial exit and pass a J needle through the K wire. Pass medial end of wire loop through the J needle from inferomedial to superolateral (care must be taken to avoid kink formation in wire loop). Pull both the ends of the wire loop after closely reducing both the ends of the patella (one end of wire loop transversely coming under quadriceps and another end is obliquely coming over inferomedial to superolaterally over the both fragments of patella). Take two artery forceps to wind the two ends of the wire loop to achieve the better compression at the fracture ends of patella and make 2-3 turns and make temporary knot. After making temporary knots in both ends of wire loop, fully flex and extend the knee and check fracture reduction under C arm. After acceptable of the fracture reduction fully tighten both ends of the wire loop. Post-operative X-ray of patella is done on the same day. Mobilization is started from second post-operative day as per the pain endurance of the patient. Sutures are removed after 2 weeks. Regular follow up is done at 1 month, 2 months and 3 months.

Figure 3: Checking of tension band wire under image intensifier.

There are twenty patients taken for this study, ten each for fixation of fractures of olecranon and patella respectively. There were six males and four females with olecranon fractures. There were seven males and three females who suffered patella fractures. All fractures were closed fractures. Average time between injury and surgical procedure is 5±3.5 days. The average duration of surgery was 55 minutes and average follow up was 24±6 weeks. The suture removal was done at 2 weeks. The knee and elbow mobilization were started after two weeks. All patients had full range of movements at six weeks. None of the patients had any complications. The disability arm shoulder hand score (DASH) and Oxford knee score improved significantly from preoperative status of 56±9 and 19±8 to 93±5 and 36±7 at six weeks follow up with p value <0.05.

Figure 4: Union of olecranon fracture at two months with percutaneous tension band wire technique.

Figure 5: Pre-operative radiograph of patella fracture.

Figure 6: Passing of ss wire through Jamshidi needle in patella percutaneously with patient supine on radiolucent operating table.

DISCUSSION

There are several advantages of percutaneous tension band wiring over open reduction and tension band wiring. Percutaneous fixation preserves the soft tissue biology as there is no dissection of soft tissues. There is less morbidity due to minimal blood loss making it suitable for all patients including those having high risk of surgery. There are less chances of infection as there is no conventional skin incision. During open method as soft tissues are dissected it is difficult to align all fragments. Romero et al have described several complications related to olecranon fractures treated with tension band wiring. It includes wire breakage, skin impingement, wire back out, bursitis, ulcer formation and infection[6]. This leads to subsequent multiple surgeries either to revise the fixation, to modify the fixation or to remove the hardware in cases of severe infection.[7,8] Even olecranon anatomical plate is used for comminuted fractures of olecranon. However, it is also related to various such complications especially wound breakdown and screw impingement through the skin. As far as patella fractures are concerned, Hosino et al have described that repair of extensor retinaculum is important along with implant fixation. That may include k wires, encirclage with stainless steel wires, cannulated screws or plates.[14]

In percutaneous technique, as soft tissue is preserved it is easy to align the comminuted fragments. There is less duration of hospital stay. It lessens the cost of treatment proportional to the lesser duration of hospital stay. Immediate mobilization is done as per the principle of tension band wiring. Dynamic compression holds true for triceps muscle insertion over olecranon and quadriceps muscle insertion over tibial tuberosity. Closed reduction of olecranon and patella fractures requires a detailed knowledge of the morphological anatomy of olecranon and patella. As far as literature search is concerned, this is the first of its type case series which reports percutaneous fixation of olecranon and patella fractures. Percutaneous fixation decreases the chances of bleeding secondary to unnecessary soft tissue dissection, thereby decreasing the post-operative morbidity. It also, convincingly, decreases the chances of post-operative infection and promotes early mobilization. The limitation of our study is shorter follow up and small sample size. Yet it is interesting study as far as patient related outcome measures are concerned.

CONCLUSION

Closed reduction with percutaneous fixation is believed to be an innovative, safe, reliable and efficient method of managing olecranon and patella fractures. Further studies are required in future to validate our results.

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