



A Simple and Safe Technique of Olecranon Osteotomy

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Abstract

Chevron osteotomy of the olecranon during the posterior approach of the elbow joint has become universally common. We modified the technique to see if it is better than the standard technique to perform, reconstruct and finally evaluate the results. A prospective study was done in 17 cases of comminuted distal humeral intercondylar fractures. A modified osteotomy was done using a Gigli saw instead of a power saw. The indications remained the same. After fixing the distal humerus fracture, the olecranon fragment was stabilised with tension band wire technique. The post-operative management was similar to that of standard AO technique. There were no per-operative difficulties with the new technique. The osteotomy was easy to do with no risk of damage to the distal humeral cartilage, as the direction of the osteotomy was away from the joint. Gigli saw produced congruent antero-posterior chevron surfaces which helped the fragment to sit well in its trough with good bony apposition. Stable reduction of the olecranon facilitated easy fixation. In this series, all osteotomies united well. There were no osteotomy-related complications. Two cases had prominent wires which were removed after the union of the osteotomy. We feel that this osteotomy is easy to perform, safe and takes less time than the standard technique, though a comparative study in a large number of cases by different surgeons needs to confirm the benefits.

Keywords Olecranon chevron osteotomy · Tension band wiring of olecranon · Distal humeral fractures · Modified chevron osteotomy of olecranon · Olecranon osteotomy with gigli saw

Introduction

Olecranon osteotomy is a well-established technique during the posterior approach of the elbow joint. Though ‘non-articular’ olecranon osteotomies are commonly used for non-articular fractures of the distal humerus, ‘trans articular’ osteotomy makes fixation of condylar and intercondylar fractures of the humerus, much easier [1–3]. There is a small bare area on the articular side of the olecranon through which osteotomy is generally made [4, 5]. A chevron osteotomy is well established by the AO foundation and has stood the test of time. Normally, a ‘V’-shaped osteotomy is

made with the apex distal and the chevron in a medio-lateral direction in the coronal plane (Fig. 1) [6]. This study aims to present a safe and easy technique of olecranon osteotomy, where the apex of the ‘V’ is still distal but the chevron is in an antero-posterior direction in the sagittal plane and is performed using a Gigli saw (Fig. 2).

Materials and Methods

In a prospective series of 17 cases, modified chevron olecranon osteotomy was done to expose comminuted intercondylar fracture of the distal humerus from September 2013 to April 2017. There were 12 men and 5 women in this series, age ranging from 19 to 54 years. The average age of male patients was 34 years and it was 27 years in female patients (Table 1). Uniform technique as described below was followed for olecranon osteotomies and all were fixed with tension band wire (TBW) technique after completion of internal fixation of distal humeral fractures.

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Fig. 1 Standard chevron osteotomy (medio-lateral direction in the coronal plane)



Technique of Osteotomy

Patient selection, Indications for osteotomy and preparation were the same as for standard chevron osteotomy [1, 6]. The patient was positioned on the side with the arm placed over an armrest, leaving the forearm free to move. Under a tourniquet control, a midline incision was made on the posterior aspect of the elbow. The ulnar nerve was dissected free and protected. Insertion of the triceps tendon over the olecranon was protected and the muscle is elevated from the medial and lateral inter-muscular septae. The sides of the olecranon were exposed. A curved artery forceps was passed anterior to the olecranon transversely through the joint to check the space and ease of passing. Then a Gigli saw was passed through the joint by holding

Fig. 2 Modified chevron osteotomy (antero-posterior direction in the sagittal plane)

Table 1 Age and sex distribution of the cases

Age (Yrs)	Male	Female
20–29	2	3
30–39	5	2
40–49	4	
50–59	1	

it with the same artery forceps and retrieved from the other side, taking care that it lies close to the olecranon (Fig. 3). The wire usually sits in the bare area of the olecranon as there is an anatomical notch, which is devoid of articular cartilage [4, 5]. The osteotomy is performed under direct vision, the direction, force and the speed of osteotomy being fully under the control of the surgeon. The initial direction of ‘sawing’ movement was perpendicular to the axis of the ulna with ‘pull’ in a posterior direction. Once the Gigli saw got a purchase in the bone, the direction of pull on the Gigli saw was changed towards the wrist joint, i.e. posterior and inferior direction till the Gigli saw wire reached half the thickness of the olecranon under our direct vision (Fig. 4). Then the direction of pull was changed postero-superiorly until the remaining half of the ulna was cut (Fig. 5). This resulted in a ‘V’ osteotomy in an antero-posterior direction. This would be at 90° to the procedure done using a power saw in a medio-lateral direction. The average time to complete the osteotomy with a power saw and Gigli saw was not compared. But the first author took less than 2 min to complete the osteotomy with Gigli saw and about 5 min with an oscillating saw. Since the positioning of the wire and osteotomy is done under direct vision, there would be no need to check

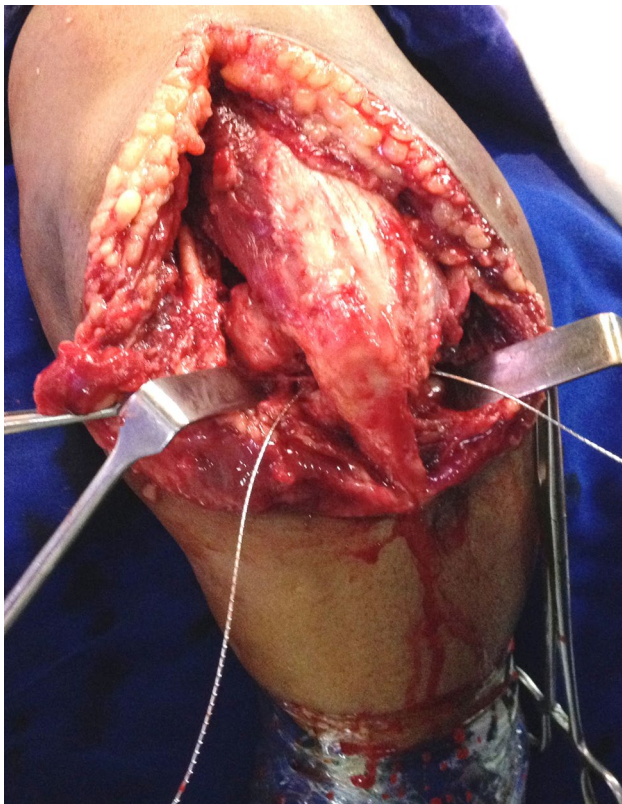


Fig. 3 Passage of the Gigli saw through the joint anterior to the olecranon

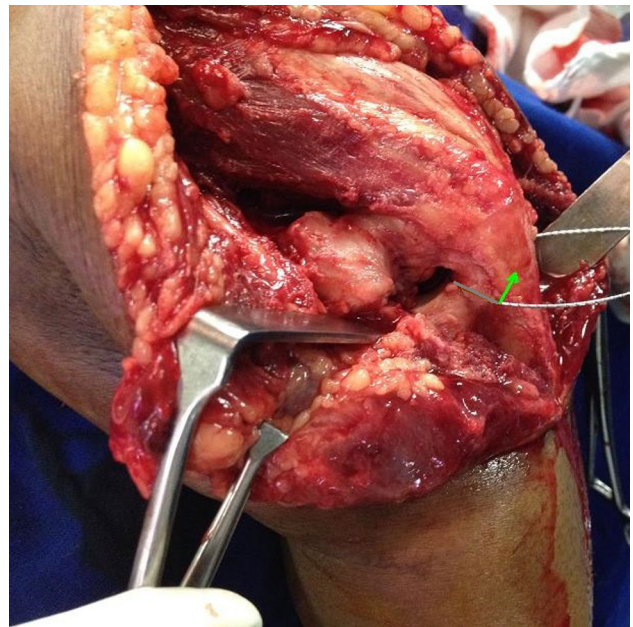


Fig. 4 Gigli saw reached half the AP width of the proximal Ulna

with the C-arm. Once the exposure of the elbow joint was complete, the distal humeral fracture was fixed appropriately with plates, screws and wires as necessary. Then the

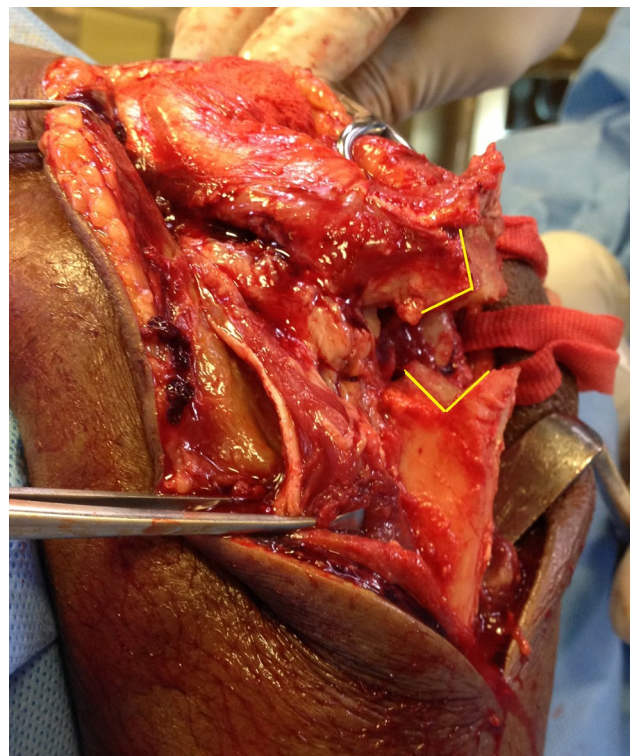


Fig. 5 Osteotomy is complete with Chevron in the sagittal plane



Fig. 6 X-ray of the elbow, AP/Lat views showing healing distal humerus fracture and olecranon osteotomy (6 wks post-op)

olecranon was fixed to the ulna by the tension band wire technique (Fig. 6). The post-operative protocol was same as in standard osteotomy cases, dictated largely by the primary distal humeral fractures.

Results

The authors had no per-operative problems with this procedure. Towards the end of the surgery, the fragment always sat well in its trough, as the osteotomy surface is uniformly congruent. It is easy to hold it reduced with the elbow held in about 30 degrees of flexion. A stable reduction made fixation easy. All Olecranon osteotomies united by 12–16 weeks (mean 14.8 weeks). There were no problems related to the osteotomy, but two cases had pain over the olecranon due to prominent metalwork. These two patients had removal of K-wires and wire loop, one after 11 months and the other, 14 months following surgery. In another case, TBW was removed when the surgery was done for removal of the distal humeral implants at 15 months following surgery. The results of this study were restricted to the technical aspects

of the osteotomy—ease of doing, reduction, fixation, time to union and any complications. The results of the union of the distal humerus fracture, range of movement and function of the elbow joint, which are primarily those of distal humerus fractures, were not included.

Discussion

A chevron osteotomy is preferred over a transverse osteotomy as it provides a large area of bony contact and also offers medio-lateral and rotational stability [6] (Table 2). A standard chevron osteotomy is done with a thin oscillating saw. To avoid damage to the humeral articular cartilage the saw cut is stopped short of the subchondral cortex and the final step of completing the osteotomy is done with an osteotome. Caution should be applied while using a power saw, as vigorous uncontrolled oscillations may result in loss of bone at the osteotomy, more so at the apex of the chevron where the saw cuts from medial and lateral directions converge. It is not always easy to judge the depth of the saw while it is entering the subchondral

Table 2 Salient features of three techniques of Olecranon osteotomies

	Modified osteotomy	Standard AO osteotomy	Ramsey DC Olecranon Osteotomy
Technique	Gigli saw	Oscillating saw	Gigli saw
Shape	Chevron	Chevron	Flat
Direction of chevron	Antero-posterior	Medio-lateral	
Ease of doing	Easy	Needs training	Easy
Safety of technique	Good	Needs additional care	Good
Osteotomy surface	Congruent chevron	Sometimes steps, more at the apex of chevron, irregular break of the sub articular bone	Horizontal flat surface
Ease of reduction	Easy	Easy	Easy
Stability	Stable	Stable	Unstable
Learning curve	Easy	Needs practice	Easy
Compression at the osteotomy site	Possible, can adjust	Possible, can adjust	Possible but limited, due to pre-drilled screw holes

area of the olecranon, as the articular surface is not flat. In one area the saw blade may still be in the subchondral bone while in another place it may have entered the joint damaging the humeral articular surface. Finishing the last part of the osteotomy with an osteotome, with tension break of the far cortex and articular cartilage may at times produce a bone spike and an irregular flap of articular cartilage [7]. This hinders accurate approximation of the olecranon fragment during fixation which tends to sit in slight extension due to a relatively wider gap posteriorly. Ramsey DC et al. recently described a technique of olecranon osteotomy using a Gigli saw [3]. However, they performed a transverse osteotomy which has the drawbacks of being inherently unstable. They fixed osteotomy with a plate and screws with pre-drilled holes prior to osteotomy. This may not allow adequate compression at the osteotomy site.

The technique described in this study avoids these complications. A Gigli saw is used instead of a power saw or an osteotome. We found this procedure simple, easy and safe. The humeral articular surface remains protected from any abrasion as the pull of the Gigli saw is away from it. The olecranon fragment always sits back in its trough without any step or angulations, as the chevron surfaces are fully congruent allowing stable reduction. Since there is no ‘play’, it is easy to hold it reduced with one hand and to pass wires with the other hand to fix it. In all cases included in this study, the elbow joint is mobilised after the change of the dressing on day 2 following surgery. In this series of 17 cases, there were no delayed unions or non-unions of the olecranon. However, the potential complications associated with prominent metalwork of TBW fixation may remain the same as in the other olecranon fixations which were reported to be about 8% [8].

Conclusion

This modified technique of olecranon osteotomy has all the advantages of the standard AO chevron technique. In addition, we found osteotomy with Gigli saw to be simple and easy to do, and it took less time in the hands of the first author compared to the procedure done with an oscillating saw. There is no chance of damaging the humeral articular cartilage as the direction of osteotomy is inside-out, and hence safe. It needs fewer inventories. Gigli saw produced minimum bone loss and gave a uniform cut surface with no steps at the apex of the chevron. It made the reduction of fragment easy and had good bony apposition. Hence it facilitated easy fixation. We had no complications during the procedure. It has a short learning curve. The authors found that it is safer even in the hands of surgeons in training. We do not claim that this technique is superior to the standard technique in terms of post-op complications and the rate of union of the osteotomy and accept that this is not a comparative study. The authors acknowledge a limited number of cases in this series and the findings needs to be validated with more number of cases by different surgeons.

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Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical Standard This article does not contain any studies with human or animal subjects performed by the any of the authors.

Informed Consent Appropriate informed consents have been taken as per the hospital policy on the prescribed format.

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