Case report

Multifragmentary proximal humerus fracture successfully treated with k-wire fixation: A case report

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ABSTRACT

Introduction and importance: The ideal treatment of proximal humerus fracture remains a controversial topic, especially in the case of complex multi-fragmentary fractures. However, in limited resource settings, alternative less complicated fixation may be considered in highly selected patients without compromising the functional outcome. We report a case of successful treatment with k-wire fixation with satisfactory functional outcome.

Case presentation: A 22-year-old female presenting with a right-sided closed multi-fragmentary proximal humerus fracture following a motor vehicle collision. A complex multi-fragmentary right-sided proximal humerus fracture (AO 11C3, Codman-Hertel type 12) was diagnosed based on the shoulder x-ray and computed tomography 3-dimensional reconstruction. She underwent an open reduction and k-wire fixation under image guidance. She had satisfactory functional outcome 6 months after surgery with painless near-total range of motion.

Clinical discussion: The ongoing debate of the optimal surgical management for complex proximal humerus fractures implies that the best treatment should be made on an individual basis. The probable reason for the good outcome in our patient may be the combination of intact blood supply and periosteum, intact rotator cuff mechanism, young patient with healthy bone metabolism and achievement of good reduction with restoration of the articular surface and calcar.

Conclusion: Although this successful case of k-wire fixation is not sufficient to challenge the option of primary arthroplasty, this low cost, readily available simple strategy may be useful in highly selective instances.
another with sutures. Intraoperatively, there was no apparent rotator cuff defect. Post-operatively the limb was immobilized for 6 weeks using a shoulder immobilizer and she was closely followed up through routine clinic visits. She had an uneventful post-operative recovery.

At 4 weeks, X-ray showed possible early evidence of osteonecrosis (Fig. 4). However, subsequent X-rays showed satisfactory bone healing. After 8 weeks, the k-wires were removed and she was started on physiotherapy with muscle strengthening and range of motion exercises for which she was satisfactorily compliant. At 6 months, she had near total range of motion with satisfactory functional outcome (Fig. 5). On patient’s point of view, she was very satisfied with the outcome and she had near normal functional capacity and quality of life.

3. Discussion

The proximal humerus fracture occurs commonly in post-menopausal females and accounts for 6% of all fractures [3]. Although there are randomized controlled studies for management of proximal humerus fractures, these include mainly Neer II and III fractures [4]. The evidence for the ideal management of Neer IV type complex fractures are lacking and remains a matter of debate. However, the evidence currently favours endoprosthetic treatment which is a costly and invasive management option [1]. Furthermore, such options are limited in resource limited settings in developing countries. We describe the fixation using k-wires for a complex multi-fragmentary proximal humerus fracture with satisfactory outcome.

K-wire fixation for a multi-fragmentary proximal humerus fracture is not a biomechanically stable construct. However, we used a combination of principles to aim for a successful fixation. Open reduction was necessary to restore the anatomy. Meticulous care was taken during dissection to prevent the devascularisation of the fragments. K-wires were used to achieve partial stability and the suturing of fracture fragments added to the stability. Post-operative immobilization was needed for fracture healing. The basic biomechanical principles for k-wire fixation for proximal humerus fracture were followed [5]. The k-wires were passed in oblique fashion, in two planes, from the shaft of the humerus at the deltoid insertion aiming towards the medial calcar of the head. This allowed the whole of the proximal humerus to move as one
unit to achieve early range of motion.

Several prognostic factors have been described in literature for good functional outcomes. In all cases, restoration of the articular surface and the calcar is the most essential surgical measure to achieve good outcome [6]. An intact rotator cuff is important for functional outcome as there is associated good osteosynthesis and fracture healing [7]. The prevalence of rotator cuff defects range from 5% to 50% after the initial injury [3,7]. Careful dissection during surgery while preserving the rotator cuff mechanism is essential to achieve good outcome. Hertel et al. defined several characteristics associated with avascular necrosis [6]. The combination of a small calcar beak (<8 mm), medial hinge destruction and a displaced anatomical humeral neck fracture predict a very high risk (97%) of osteonecrosis [6]. However, this criteria alone cannot be used for prognostication as bone healing depends on several other factors such as intact blood supply and the state of surrounding soft tissues [8]. There is considerable individual variations in the blood

Fig. 2. Computed tomography 3-dimensional reconstruction image.
supply of the head of the humerus limiting the ability to predict the outcome [3].

Furthermore, the state of the bone architecture and metabolism are also important in healing [9]. Thus outcomes are worse in the elderly with osteoporosis leading to increased risk of osteonecrosis [9]. Difficulty in assessing all these individual factors limits the ability to predict good bone healing.

In the event of treatment failure and avascular necrosis, secondary endoprosthetic treatment is a useful rescue option [10]. There is lack of consistent data regarding the outcomes of primary hemiarthroplasty versus secondary hemiarthroplasty after avascular necrosis [10]. In the event of avascular necrosis after k-wire fixation, a reverse shoulder arthroplasty or a hemiarthroplasty may be considered as a salvage procedure [3,11].

Although the k-wire fixation was successful, routine use in complex fractures cannot be recommended due to the risk of avascular necrosis. The probable reason for the good outcome in our patient may be the combination of intact blood supply and periosteum, intact rotator cuff mechanism, young patient with healthy bone metabolism and achievement of good reduction with restoration of the articular surface and calcar. Immobilization was maintained for a longer duration and the patient was closely monitored for avascular necrosis. In older patients, these factors will not be favourable and longer immobilization will lead to poorer outcomes.

Fig. 3. Post-reduction X-ray on day 1.
4. Conclusion

The ongoing debate of the optimal surgical management for complex proximal humerus fractures implies that the best treatment should be made on an individual basis. Restoration of the articular surface and the calcar is essential for functional outcome. Although, this successful case of k-wire fixation is not sufficient to challenge the option of primary arthroplasty, this low cost, readily, available simple strategy may be useful in highly selective instances.

Fig. 4. X-ray after 4 weeks showing possible early evidence of osteonecrosis.

Abbreviations

None.

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Ethical approval

Ethical approval is not required for publishing case reports in our institution.
Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

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CRediT authorship contribution statement

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Declaration of competing interest

The authors declare that they have no competing interests.

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Fig. 5. X-rays at 6 months showing satisfactory bone consolidation and range of motion.