



Reconstruction of lateral humerus condylar defect using tricortical iliac crest graft: A case report

Sameer Rathore¹, Quadri Vasil^{1,*} and Sanjay Tapadia¹

¹ Department of Orthopaedics, Krishna Institute of Medical Sciences, Minister Road, Secunderabad-500003, Telangana, India

Abstract

Comminuted fractures of distal humerus are most commonly the result of high energy trauma. There is an extensive damage to soft tissues along with articular cartilage fragmentation and many a time associated with bone loss. Traditionally such bone voids are filled using a fibular strut graft. In this case report, reconstruction of lateral condyle of humerus, using a tricortical iliac crest graft has been described. A 37-year-old male sustained fracture of distal end of humerus with articular involvement of multifragmentary nature. There was severe comminution of the articular surface especially that of the lateral humerus condyle with bone void. To fill the bone void in the lateral column, tricortical iliac-crest graft was harvested from the ipsilateral iliac crest. Locking plates were applied medially and laterally, and fixation was done. After 6 months of follow-up, the patient showed good elbow range of motion (30 to 80 degrees) and the radiographs showed satisfactory union of the fracture with stable implants. There is also no significant graft donor site co-morbidity. For reconstruction of complex distal humerus fractures with bone void, tricortical iliac crest autologous bone graft can be considered as a feasible option apart from vascularised autologous bone graft and allograft.

Keywords: tricortical iliac; bony defect; humerus fracture; autologous bone grafting

***Corresponding author:** Dr. Vasil Quadri, Department of Orthopaedics, Krishna Institute of Medical Sciences, Minister Road, Secunderabad-500003, Telangana, India. Email: vasilquadri2704@gmail.com

Received 24 December 2015; Revised 25 February 2016; Accepted 1 March 2016; Published 11 March 2016

Citation: Rathore S, Quadri V, Tapadia S. Reconstruction of lateral humerus condylar defect using tricortical iliac crest graft: A case report. *J Med Sci Res.* 2016; 4(2):72-75. DOI: <http://dx.doi.org/10.17727/JMSR.2016/4-017>

Copyright: © 2016 Rathore S, et al. Published by KIMS Foundation and Research Centre. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution and reproduction in any medium, provided the original author and source are credited.

Introduction

The most common cause of comminuted fractures of distal humerus is high energy trauma. In adults, fracture of distal humerus is almost always associated with articular involvement. There is an extensive damage to soft tissues, articular cartilage fragmentation and many a times bone loss. Injury to neurovascular structures is not an uncommon association thereby further jeopardizing the chances of limb survival. Surgical reconstruction in such cases is a challenge [1, 2]. The goals of treatment would include thorough debridement of the wound (in case of compound fractures), anatomic reduction especially of the articular surface, rigid internal fixation, proper soft tissue cover and finally early post-operative joint mobilization. One of the hurdles, a surgeon comes across in reconstruction is

reduction of the fragments especially in the setting of major bone loss.

Traditionally such bone voids are filled using a fibular strut graft. In this case lateral condyle of humerus has been reconstructed using a tricortical iliac crest graft and is presented below.

Presentation of case

A 37-year-old male, known diabetic and hypertensive presented in the emergency department following a road traffic accident on a two wheeler 2 days ago. The patient was conscious and coherent and hemodynamically stable. On examination there was a swelling of the left elbow, the overlying skin was normal and the movements were painfully restricted. There were no distal neurovascular deficits nor were there any other associated injuries. Radiograph of the elbow joint revealed fracture of distal end of humerus with articular involvement of multifragmentary nature (Figure 1). The fracture was classified as Arbeitsgemeinschaft fur Osteosynthesefragen (AO) [3] type 13-C3. 3D CT scan of the elbow was done for better understanding of anatomy of the fracture (Figure 2).



Figure 1: Preoperative radiograph of left elbow antero-posterior and lateral views.

After relevant investigations patient was mobilized to the operation theatre and open reduction and internal fixation of the fracture was planned. Under brachial plexus block, the fracture site was opened through Chevron osteotomy approach. There was severe comminution of the articular surface especially that of the lateral humerus condyle with bone void (Figure 3). Medial and lateral condyle fragments were reduced and held provisionally with K-wires. The articular component in turn was fixed to humerus shaft with K-wires. To fill the bone void



Figure 2: 3D CT scan of the elbow showing the pathological anatomy.

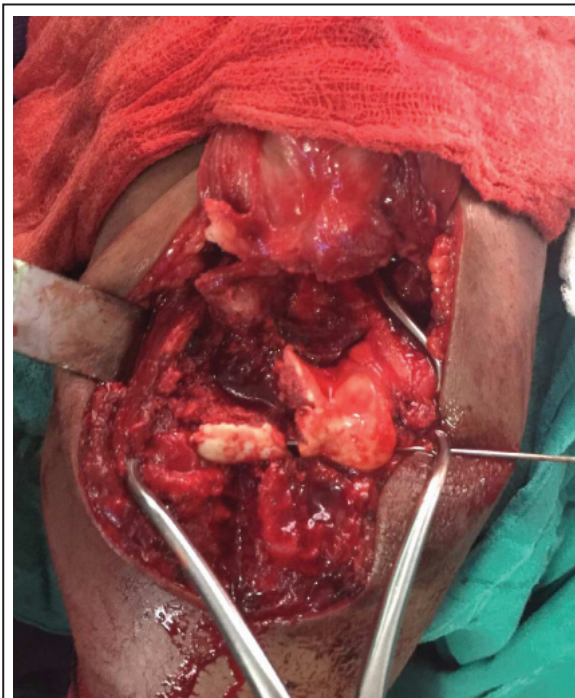


Figure 3: Intra-operatively bone void seen in the lateral condyle of humerus.

in the lateral column, tricortical iliac crest graft was harvested from the ipsilateral iliac crest and placed accordingly. Locking plates were applied medially and laterally and fixed (Figure 4). The joint was found stable and the olecranon osteotomy was fixed using tension band wiring.

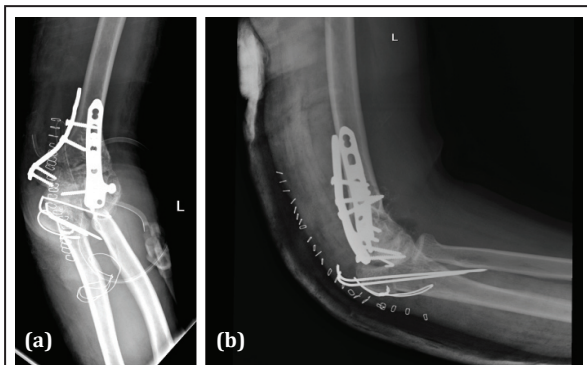


Figure 4a,b: Immediate postoperative radiography of left elbow antero-posterior and lateral views.

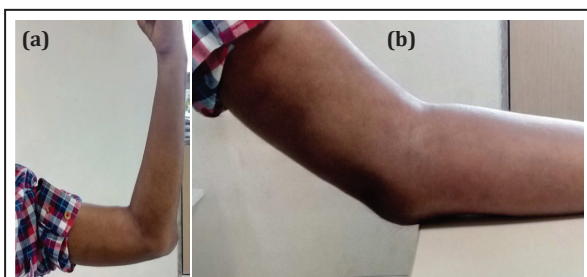


Figure 5a, b: Elbow showing 30-80 degrees of range of movements at 6 months follow-up.

On 6 months of follow-up, the patient showed good elbow range of motion (30 to 80 degrees) (Figure 5a,b) and the radiographs showed satisfactory union of the fracture with stable implants (Figure 6a,b).

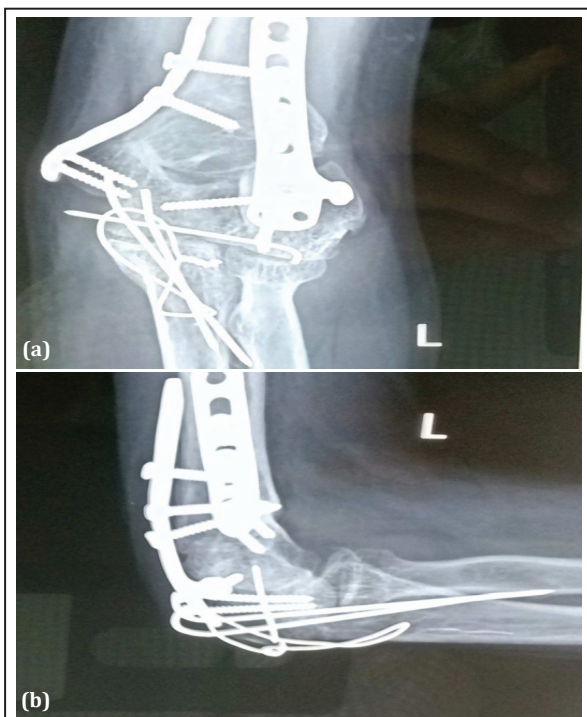


Figure 6a,b: Radiographs of left elbow antero-posterior and lateral views at 6 months follow-up.

The skin condition is good with the surgical wound healing with primary intention. The patient is able to carry out his activities of daily living without much difficulty. There is also no significant graft donor site co-morbidity.

Discussion

In cases of distal humerus fractures with significant bone void, autologous bone grafting more often than not becomes a necessity to achieve fracture healing [4]. Vascularised bone transfers are good option in treating such bone defects as they retain their intrinsic blood supply and healing occurs by fracture union rather than creeping substitution [5]. Non-vascularised bone autografts on the other hand do not require any technical expertise and have an added advantage of shorter duration of surgery. Such avascular grafts, however, possess a risk of non-union as they continue to exist as a mixture of viable and necrotic cells and thereby reducing the strength of the graft [5, 6].

On the other hand, cement spacer application has been regarded as an option for filling up of such bone voids [7, 8]. This option is not considered as it does not incorporate into the bone like bone graft, hence serving only as a temporary measure rather than a long term treatment option. For this particular case a tricortical iliac crest graft was preferred instead of the traditional fibular strut graft. For optimum osteoconductive, osteoinductive and osteogenic properties, cancellous bone from iliac crest is obtained especially when weight bearing at the recipient site is not required [9, 10]. Literature shows that less than 50ml of cancellous bone graft is needed from the donor site. Bone graft harvested from the anterior half of the iliac crest is preferred (Figure 7) [11-13]. As compared to allografts and other non-biologic bone substitutes (which have high costs), autologous cancellous bone grafts have superior osteogenic and osteoinductive properties and devoid of potential immune reactions which can lead to rapid resorption of the graft [14].

The most common complications of harvesting a tricortical iliac crest graft as reported in the literature are donor site pain, infection, hematoma formation, abdominal hernias, lateral femoral cutaneous nerve injury, and gait disturbances [15-18]. In this particular case using a tricortical iliac crest for the



Figure 7: The anterior half of iliac crest is preferred site for bone harvest.

reconstruction of the lateral pillar of lateral humerus condyle has resulted in good fracture union with minimal donor site co-morbidities.

Conclusion

Reconstruction of complex distal humerus fractures can pose a challenge especially in the presence of a significant amount of bone loss. Tricortical iliac crest autologous bone graft can be considered as good option for filling up the bony defect. It has the advantages of a less cumbersome surgical procedure and better incorporation of the graft as compared to vascularised autologous bone graft and allograft respectively.

Acknowledgement

The Department of Radiology & Imageology, Krishna Institute of Medical Sciences (KIMS), Secunderabad.

Conflicts of interest

Authors declare no conflicts of interest.

References

1. McKee MD, Kim J, Kebaish K, Stephen DJ, Kreder HJ, et al. Functional outcome after open supracondylar fractures of the humerus. The effect of the surgical approach. *J Bone Joint Surg Br.* 2000; 82(5):646-651.

2. Mostafavi HR, Tornetta P. Open fractures of the humerus treated with external fixation. *Clin Orthop. Relat Res.* 1997; 337:187-197.
3. Muller ME, Nazarian S, Koch P, Schaftzken J. *Comprehensive Classification of Fractures of Long Bones.* Springer. 1990.
4. Webb LX. Distal humeral fractures in adults. *J Am Acad Orthop Surg.* 1996; 4:336-344.
5. Weiland AJ, Phillips TW, Randolph MA. Bone grafts: a radiologic, histologic, and biomechanical model comparing autografts, allografts, and free vascularized bone grafts. *Plast Reconstr Surg.* 1984; 74(3):368-379.
6. Tu YK, Yen CY, Yeh WL, Wang IC, Wang KC, et al. Reconstruction of posttraumatic long bone defect with free vascularized bone graft: good outcome in 48 patients with 6 years' follow-up. *Acta Orthop Scand.* 2001; 72(4):359-364.
7. Chantelot C, Chantelot-Lahoude S, Masmajeun E, Eddine TA, Migaud H, et al. Reconstruction of the distal humeral metaphysis using free vascularized fibular autograft: a case report. *J Shoulder Elbow Surg.* 2005; 14(4):450-453.
8. Klauke K, Knothe U, Masquelet AC. Effet biologique des membranes à corps étranger induites in situ sur la consolidation de greffes d'os spongieux. *Rev Chir Orthop Reparatrice Appar Mot.* 1996; 87(suppl 2):109.
9. Enneking WF, Eady JL, Burchardt H. Autogenous cortical bone grafts in the reconstruction of segmental skeletal defects. *J Bone Joint Surg Am.* 1980; 62(7):1039-1058.
10. Finkemeier CG. Bone-grafting and bone graft substitutes. *J Bone Joint Surg Am.* 2002; 84-A(3):454-464
11. Marx RE. Philosophy and particulars of autogenous bone grafting. In: MacIntosh RB, editor. *Autogenous grafting in oral and maxillofacial surgery.* Atlas Oral Maxillofac Clin North Am. Philadelphia (PA): WB Saunders; 1993. p. 599-612.
12. Mrazik J, Amato C, Leban S, Leban S, Mashberg A. The ilium as a source of autogenous bone for grafting: clinical considerations. *J Oral Surg.* 1980; 38(1):29-32.
13. Gil-Albarova J, Gil-Albarova R. Donor site reconstruction in iliac crest tricortical bone graft: Surgical technique. *Injury. Int J Care Injured.* 2012; 43 (6):953-956.
14. Heiple KG, Goldberg VM, Powell AE, Bos GD, Zika JM. Biology of cancellous bone grafts. *Orthop Clin North Am.* 1987; 18(2):179-185.
15. Arrington ED, Smith WJ, Chambers HG, et al. Complications of the iliac bone graft harvesting. *Clin Orthop Relat Res.* 1996; 329:300-309.
16. Younger EM, Chapman MW. Morbidity at bone graft donor sites. *J Orthop Trauma.* 1989; 3(3):192-195.
17. Joshi A, Kostakis GC. An investigation of post-operative morbidity following iliac crest graft harvesting. *Br J Dent.* 2004; 196(3):167-171
18. Kurz LT, Garfin SR, Booth RE. Harvesting autogenous iliac bone grafts. A review of complications and techniques. *Spine.* 1989; 14(12):1324-1331.