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Role of Minimal Invasive Plate Osteosynthesis in Complex humeral Shaft Fractures

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Abstract : *Humeral fractures are one of the common fractures. There are various methods to treat humeral fractures. High energy fractures result in increased damage to soft tissues and thus requiring long union time. Minimal invasive plate osteosynthesis is a very handy procedure where biologic fixation can be offered to the patient with minimal complications. It has a learning curve but can be done without any special instrument requirement.*

Keywords - *Minimal Invasive Plate Osteosynthesis, Humeral Shaft, AO C3 Fractures, Anterior Approach.*

I. Introduction

Humeral shaft fractures account for 1 to 3% of all fractures in adults.[1] Humeral shaft fractures have been treated with almost every method of fracture treatment known to mankind. Conservative management still holds a place in humeral fracture treatment. Isolated low energy humeral shaft fractures can be treated conservatively.[3,11,12,13] Civilization has paid a price with increased incidence of road traffic accidents and resultant high energy fractures. Conservative treatment of these high energy complex fractures means increased period of immobilization and bracing with attending risks of nonunion, fragment displacement and joint stiffness. Patients with failed conservative treatment, open fractures and fractures with complex deformity are better managed surgically.[2,4] Surgical methods include plate screw fixation, intramedullary nailing and external fixation. External fixation has limited indications in open fractures and certain failed nonunions. Intramedullary nailing has its own problems with rotator cuff, decreased rotational stability in complex fractures and limited useulness in distal and proximal fractures.[5,6] Plate osteosynthesis remains the gold standard for treatment of humeral shaft fracture.[7] It is associated with a high union rate, low complication rate and rapid return to function. It has essentially no shoulder or elbow problems and is stable enough to allow early upper extremity weight bearing.[8] For optimal clinical result disruption of bone blood supply by the plate screw construct should be minimized.[9] Advances in surgical techniques have led to development of minimal invasive plate osteosynthesis. Its advantages are preservation of blood supply and providing a biologic environment for fracture healing and at the same time facilitating function of the injured extremity.

II. Material & Methods

Between 2011 and 2014, fifteen patients with complex humeral shaft fractures (C3 fractures) were operated by minimal invasive plate osteosynthesis. Patients with associated injuries in the same extremity were excluded from the study. Other exclusion criteria were open fractures, radial nerve palsies where upon an open approach was resorted to. There were 11 males and 4 females. In eight patients right limb was involved while in seven left extremity was injured. Average age was 28 years, range 20 to 55 years. Patients were posted for surgery as early as possible as this helps good reduction due to ligamentotaxis. We adapted the technique devised by Livani and Belangero[14] for MIPO of humeral fractures. They utilised the anterior approach in humeral shaft fractures. This MIPO technique avoids the problems related to the neural and vascular structures of the arm and especially to the radial nerve. For proximal and middle shaft fractures they have used a proximal limited approach (between biceps – medially and deltoid muscle - laterally) and a distal approach between biceps and brachialis muscle.

II.1 Surgical Technique: The procedure was done in the supine position under general anaesthesia, with the arm abducted to 60° and the forearm in full supination to prevent radial nerve coming into the field.[15] We used a narrow LCP in all of our patients. The image intensifier was positioned on the same side of the operating table as the arm to be operated. A 3 cm incision between the proximal biceps and the medial border of deltoid, 6 cm distal to the anterior part of the acromion process was made. Dissection was carried to the humerus. Distally, a 3-cm incision was made along the lateral border of the biceps, approximately 5 cms proximal to the flexion crease. The site of incision was confirmed under the image intensifier and altered, if necessary, to be as far as away as possible from the fracture site. The biceps was retracted medially to expose the musculocutaneous nerve, which overlies the brachialis muscle. The brachialis muscle was split and the musculocutaneous nerve retracted medially, and the radial nerve was protected by the lateral half of the brachialis muscle. A sub-brachialis, extra-periosteal tunnel was created by passing an periosteal elevator, used as a tunneling instrument, deep to the brachialis muscle from the distal to the proximal incision. Care was taken to pass the tunneling instruments anteriorly or anteromedially to avoid the chances of injury to the radial nerve. After creating the tunnel, the LCP of the template length was passed through the tunnel. The plate position and reduction was visualized on the image intensifier. Manual traction was applied to restore length and correct varus/valgus angulation and rotation. The plate was temporally fixed to the bone with 2.0-mm K-wires. Ensuring that the position of the plate on the distal fragment was central, it was fixed with a locking screw and, similarly, the proximal fragment was also fixed. After confirmation of the reduction alignment, the fixation was completed with a minimum of three screws in both fragments. Care was taken to pass the tunneling instruments anteriorly or anteromedially to avoid the chances of injury to the radial nerve. Deciding the appropriate amount of force to be used for manual traction to achieve adaptation of the fragments was not easy at first; this was something we had to slowly master as the study progressed. The rotational deformity was minimized using the 'cortical step sign' and the 'diameter difference sign' described by Krettek.[17] None of the patients required bone grafting or bone substitute at primary surgery. The operative time (defined as the time, from the skin incision to wound closure) and duration of radiation exposure (in seconds) was recorded though the doses were not calculated. Postoperatively, arm was immobilized in a neck-wrist sling. The standard protocol of mobilization exercises were started from day 2, as far as the patient's pain permitted. The time to union, the need for secondary procedure, and complications were noted. Results were evaluated by Constant Shoulder score[10],Oxford elbow score and time to union post operatively.

III. Results

All fifteen fractures united within 14 weeks (Range 12 to 20). There were two patients which required bone marrow injection at the fracture site since the callus was scanty even after 12 weeks of follow up. There was no neurological injury except in one patient who complained of numbness in musculocutaneous nerve distribution. The mean surgical time was 108 minutes (range: 90–120 minutes). As we gained confidence in the procedure and ease of doing it the radiation exposure required also decreased. Shoulder function was excellent in 14 cases (93%) and good in remaining 1 case (7%) on the Constant Shoulder score. Elbow function was excellent in 13 cases (87%), good in 2 cases (13%). Our post operative protocol was active movement of the shoulder and elbow joints as per pain tolerance of the patient without need of any immobilization.

IV. Discussion

Humeral fractures can be managed by various methods, including conservative treatment, external fixation, intramedullary nailing, conventional plating, and MIPO. Indications for surgical treatment of humeral shaft fractures have been well documented by McKee and widely accepted.[17] Plate and screw fixation has always been the more common surgical treatment.[16] Recently, surgical treatment with the use of relative stability through the MIPO technique was recognized by its reproducibility and high rates of bone consolidation.[18] MIPO has been successful in managing various fractures of the distal tibia, supracondylar femur, proximal tibia, and humeral shaft[19,20]. During the MIPO technique for humeral shaft fracture, the radial nerve is a major concern in the middle and distal humerus. The occurrence of iatrogenic radial nerve injury may be affected by the surgical approach, forearm position, location of the plate, and shape or length of the plate. A cadaveric study demonstrated that in anterior plating, the radial nerve was safe in full supination of the forearm, with an average distance of 3.2 mm between the lateral border of the plate and the radial nerve.[15] The need for blood transfusions is also reduced when we are comtemplating Minimal invasive Plate Osteosynthesis.[21] MIPO becomes easier with the help of external fixator in place which holds the limb in some form of alignment.[22] As a check point if the plate is in centre of distal and proximal bone segment without any need of moulding the plate the alignment will be what is required for the final outcome. Various studies have reported similar results in terms of fracture healing, neurological complications, infections and functional outcomes. Shin SJ et al evaluated twenty one patients and found that no patient experienced a neurological complication. Bony union was obtained in 20/21 patients at a mean 17.5 weeks postoperatively. They had one nonunion and one malunion.[23] M Shantharam Shetty et al observed that Union occured at a mean period of 12.9 weeks (range: 10-20 weeks) and no nonunions were present.[24] Daniel Romano Zogbi et al reviewed seven patients and achieved union in every case but they had neuropraxia of Radial Nerve which eventually recovered. They followed a different approach by visualization of radial nerve.[25]

V. Conclusion

Minimal invasive Plate osteosynthesis is a safe and reproducible technique with very promisisng results. Fracture union in complex fractures is achieved easily and in shorter operative time with less risk of infection. Functional results are very good as there is no need of immobilization. Although there is a learning curve associated with it, it is a relatively easy to learn procedure.

References

[1]. JE. Emmette, LW.Breck, A review and analysis 0f 11000 fractures seen in private practice of orthopaedic surgery, Journal of Bone Joint Surg Am,40A(5), 1958, 1169-75. (8)

[2]. Sharma, B. Awasthy, S. Mehta, S. Babhulkar, Evaluation of results of different treatment modalities in the management of diaphyseal fractures of the humerus, The Internet Journal of Orthopaedic Surgery, Vol 16, No. 1, 2009.

[3]. Sarmiento et al, Functional braces for humeral shaft fractures, Journal Bone Joint Surg, 2000

[4]. Vander, Open reduction and Internal fixation of Humeral Shaft Fractures. Results using AO plating techniques. JBJS Am 2001.

[5]. Putti. AB, Uppin. RB, Putti. BB. Locked intramedullary nailing versus dynamic compression plating for humeral shaft fractures. J Orthop Surg(Hong Kong),2009Aug 17(2), 139-41

[6]. Bhandari. MI, Devereaux. PJ, Mckee. MD, Schemitsch. EH. Compression plating versus intramedullary nailing of humeral shaft fractures-a meta analysis. Acta Orthop.2006Apr77(2),279-84.

[7]. Colton C. History of Osteosynthesis. 2nd Ed. In: AO/ASIF instruments and implants, Texhammer R, Colton C (eds). Berlin: Springer Verlag; 1994: 3-5

[8]. Chandler RW. Principle of Internal Fixation. 4th Ed. In/; Rockwood and Green's Fractures in Adults. Rockwood Cajr, Green DP, Bucholz RW, Heckman JD (eds). Philaldelphia: Lippincott- Raven; 1996:159-228

[9]. Kubiak EN, Fulkerson E, Straus E, Egol AK. The Evolution of Locked Plates. J Bone Joint Surg. Am. 88:189-200, 2006.

[10]. Constant CR, Murley AH. A clinical method of functional assessment of the shoulder. Clin Orthop Relat Res. 1987 Jan;(214):160-4

[11]. Camden P, Nade S. Fracture bracing of the humerus. Injury 1992;23:245—8.

[12]. Hunter SG. The closed treatment of fractures of the humeral shaft. Clin Orthop 1982;164:192—8

[13]. Sarmiento A, Kinman PB, Galvin EG, Schmitt RH, Phillips JG. Functional bracing of fractures of the shaft of the humerus. J Bone Joint Surg Am 1977;59-A:596—601.

[14]. Bruno Livani,corresponding author William Belangero, Giovanna Medina, Ciro Pimenta, Rodrigo Zogaib, Mauricio Mongon.: Anterior plating as a surgical alternative in the treatment of humeral shaft non-union. Int Orthop. Oct 2010; 34(7): 1025–1031.

[15]. Apivatthakakul T, Arpornchayanon O, Bavornratanavech S. Minimally invasive plate osteosynthesis (MIPO) of the humeral shaft fracture. Is it possible? A cadaveric study and preliminary report. Injury, Int.J. Care Injured (2005) 36, 530-38.

[16]. Crenshaw AH, Perez EA. In S. Canale T, Beaty jH, eds : Campbell's Operative Orthopaedics, 11ed, Mosby, Philadelphia, 2008.

[17]. McKee MD. Fractures of the shaft of the humerus.In: Bucholz RW, Heckman JD, CourtBrown CM, eds. Rockwood and Green's Fractures in Adults. 6th ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2006:1118.

[18]. Concha JM, Sandoval A, Streubel PN. Minimally invasive plate osteosynthesis for humeral shaft fractures: are results reproducible? Int Orthop. 2010;34(8):1297-305.

[19]. Cole PA, Miclau T 3rd, Ly TV, Switzer JA, Li M, Morgan RA, et al. What's new in orthopaedic trauma. J Bone Joint Surg Am 2008;90:2804–22.

[20]. Zhiqua A, Bingfang Z, Yeming W, Chi Z, Peiyan H. Minimally invasive plating osteosynthesis (MIPO) of middle and distal third humeral shaft fractures. J Orthop Trauma 2007;21:628–33.

[21]. Jiang R, Luo CF, Zeng BF, Mei GH. Minimally invasive plating of complex humeral shaft fractures. Arch Orthop Trauma Surg 2007;127:531–5.

[22]. Lee HJ, Oh CW, Oh JK, Apivatthakakul T, Kim JW, Yoon JP, Lee DJ, Jung JW.:Minimally invasive plate osteosynthesis for humeral shaft fracture: a reproducible technique with the assistance of an external fixator. Arch Orthop Trauma Surg. 2013 May; 133(5):649-57.

[23]. Shin SJ1, Sohn HS, Do NH. Minimally invasive plate osteosynthesis of humeral shaft fractures: a technique to aid fracture reduction and minimize complications. J Orthop Trauma. 2012 Oct;26(10):585-9.

[24]. M Shantharam Shetty, M Ajith Kumar, KT Sujay, Abhishek R Kini, Kiran G Kanthi. Minimally invasive plate osteosynthesis for humerus diaphyseal fractures IJO. Nov 2011, Vol 45, Issue 6. 520-26.

[25]. Daniel Romano Zogbi 1 , Alberto Maranon Terrivel 1 , Guilherme Grisi Mouraria 1 , Maurício Leal Dias Mongon 1 , Fernando Kenji Kikuta 1 , Américo Zoppi Filho.: Fracture of distal humerus: MIPO technique with visualization of the radial nerve. Acta ortop. bras. vol.22 no.6 São Paulo Nov./Dec. 2014.

Fig 1: Pre operative X Ray

Fig 2: Intra Operative Picture showing incision

Fig 3: Immediate Post Op

Fig 4: 3 Month follow up