Non Union of Diaphysial Humeral Fractures

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ABSTRACT:

BACKGROUND:

Humeral shaft fractures represent 3-5% 0f all fractures mostly heal by conservative methods ,frequently few fractures fail to unite , several fixation modalities have been used with types of bone graft .

OBJECTIVE:

To analyze the local and environmental factors of 44 patients having non union of diaphysial humeral fractures and the result of treatments by open reduction and fixation with plate and screws and autogenous bone graft application .

METHODS:

Retrospective and prospective study of forty four patients had non union of the daiphysis of the humerus, 34 males ,10 females, age ranged from 18-61, 29 had open injuries , 15 had closed injuries . All patients treated by rigid fixation with plate and screws and ample amount of autogenous bone graft. Follow up from 6-24 months .

RESULTS:

40 patients had good results in clinical and radiological union of their humeri , in four patients the bone fail to unite ,graft resorbed with or without plate failure.

CONCLUSION :

Sever injuries with soft tissue damage is a major cause of nonunion and rigid fixation by plate and screws with autogenous bone graft is a good optional method of treatment when other modalities are not available .

KEY WORDS: humerus nonunion ,bone graft .

INTRODUCTION:

Humeral shaft fractures are common and constitute 3-5% of all fractures[1,2]. While anatomical reduction is usually not achieved with non operative treatment, it is rarely necessary to regain perfect alignment because of the wide range of movement of the shoulder ,humeral fractures mostly heal by conservative treatment [1].In certain circumstances the fracture fails to unite with in the expected period of t time (4-6) months; then labeled non union [3].

The causes of non union are initial injury severity ,distraction of fracture fragments, soft tissue interposition ,and inadequate immobilization methods. Other contributory factors are smoking ,obesity, diabetes, poor nutrition ,steroid intake ,non steroidal and anti inflammatory drugs(NSAID)and infection[3,4,5].

According to criteria of Weber and Cech[6],non union of bones is classified into hypertrophic and atrophic according to the viability of the bone ends, non union of humeral diaphysis has been reduced by application of different modalities of treatment; conservative like hanging cast by Calwell[7] and functional brace by Sarmiento and associates[8],the incidence of nonunion has dropped to 5% or less in non pathological fractures [9,10],operative modalities like Kuntscher nails, other intramedullary devices ,compression plates and external fixation with or without bone graft [11,12,13,14,15,16].Bone graft can be autologous graft,allograft,demineralized bone matrix, bone morphogenic proteins(BMP)and pharmacological agents like parathhormon [17,18,19]; the choice depends on the preference of the surgeon considering the nature of the non union bone ends, the size of gab, availability of the substitute and cost .

This study was carried out to analyze the local and environmental factors in forty four patients with non union of humeral diaphysis treated by fixation by plates and screws with autogenous bone graft application.

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MATERIALS AND METHODS:

This is a prospective and retrospective study of forty four patients had non union of the diaphysis of their humeri treated during the period from June 2006 to June 2011 by internal fixation with plates and screws and autogenous bone graft from the iliac crest.

Thirty four males and ten females, their age ranged from 18- 61 years, 29 patients had open injury while 15 had closed injury. Of the 29 patients with open injury four had one or more major nerve injury in the arm, one had brachial artery injury and one had severe injury of the hand. Of the 15 patients with closed injury two had radial nerve injury.

All patients were assessed clinically and radiologicaly and labeled non union when the bone was not united six months post injury, of the 29 patients who had open injury 20 were treated primarily by external fixation and 9 treated by plaster of Paris(POP) cast. Fifteen patients had closed injury 8 were treated by POP cast, 4 by intramedullary rush nail and 3 by external fixation.

Of the 29 patients with open injury 21 were fractured by bullet or blast explosion of civil violence causing comminuted or fragmented open fracture humerus,5 had open injury due to road traffic accidents and 3 fall from high; all had type C fracture .Of the 15 patients had closed injury 8 had fragmented fractures(type C) and 7 had transverse or short spiral fractures type(A&B). Eighteen male patients were smoking more than 20 cigarettes per day.

All patients were labeled free of infection before starting the treatment; all treated by open reduction through antero lateral skin incision and fixation of bone by long plate with 6-8 screws on the anterior or medial surface of the humerus underneath the brachialis muscle and application of ample amount of cortico- cancellous bone graft from the iliac crest .Vacum drain used in both wounds, broad spectrum antibiotic used for 15 days. All fixations were considered rigid; so no external splint was used post operatively and early joint movements of the extremity were advised.

Follow up was from 6 - 24 months, by successive visits clinical and radiological union of the bone was observed, presence of infection, elbow and shoulder range of movements and neurological condition of the limb.

Table 1:

Total No of Patients	44	100%
Male	34	77%
Female	10	23%
Average age	38.5	years
Open injury	29	66%
Closed injury	15	34%

RESULTS:

Forty four patients having non union of uni lateral humerus were admitted to this study, age range was from 18 -61, 34 males 10 females, 29 had open injuries 15 had closed injuries. Follow up was from 6-24 months.

Forty patients (90%) had good results; humeri united completely within 2-4 months and regained good range of joint movements.

Four patients fail to unite (10%), graft resorbed ,two had fixation implant failare after six months of follow up, three of them had primarily open blast injury resulted in comminuted (Type C) fracture with wide soft tissue damage of the arm and several foreign bodies retained in the arm ,one patient was female of 61 years old had primary closed injury with general osteoporosis of bones; all the three male patients who had poor results of nonunion after the treatment were smokers.

Complications:

Infection occurred in six patients all had primarily open injury ,treated by local debridement and antibiotics, four recovered and proceeded to union,2 (4.5%)fail to unite resulted in resorbtion of the graft and implant failure; removal of implant and application of external fixation in one and external brace to the other.

Post operative radial nerve paralysis resulted in five patients, it was neuropraxia in four recovered within 12-16 weeks completely, in one(2.7%) patient the nerve was injured during the process of exploration of the nerve because of sever dense adhesions to the fibrous union of the bone and was repaired after fixation and bone graft application

by direct suture with six zero prolene thread the nerve started to recover six months post operatively.

DISCUSSION:

Fractures of the humerus is not uncommon ,mostly unite by conservative treatment, high velocity injuries cause fragmentation of the bone and soft tissue damage which decrease the stability of the fracture , inadequate treatment methods also add to the factors that may lead to delay the process of healing[2,3].In our study most of the patients ,29(66%) 0f total 44 had high velocity open injuries with substantional soft tissue damage, this explains the local causes of nonunion. Inadequate methods of treatments like prolonged external fixation, Rush nails and POP casts obviously did not provide enough stability.

Our treatment policy was to provide rigid stability by broad long plates and ample amount of bone graft from the iliac crest to devlope better osteogenic power for union. This allowed the patients to start early joint movements to decrease the sequel of fracture disease.

Locked intramedullary nails of the humerus is another option of rigid fixation but it was not available in our hospitals. The use of dynamic compression plates and bone graft was also advocated by many authors to treat aseptic nonunion of the humeral shaft with success [11,12,,13,14,15,16] ; these plates are mostly suitable for transverse type A fracture.

Several types of bone substitutes are also advocated to provide local osteogenic power to decrease morbidity of autogenous bone graft operation ; their use was not practical in our environment because of the high cost of one cubic centimeter as osteoinductive agent and large amounts would be needed to full gabs of bones ; so autogenous bone graft used to act as osteoconductive and osteoinductive agent as well [17,18,19];other types of bone substitutes can be used to full gabs of bone to act as osteoconductive scaffold material ;prospective randomized, multicenter trial found the use of autogenous bone graft versus rh PDCF-BB (BMP) in foot and ankle fusion model found the results comparable[20],Yuan H,Fernandes H,et al successeded in manufacturing micro ceramics with varying physicochemical and structural charasterictcs to act as osteoconductive plus osteoinductive agent to full gab in bone in sheep called SMART biomaterials[21], having said that we believe that using autogenous bone graft is more practical and beneficial ,in addition the morbidity of this step is moderate ,temporay and tolerated by our patients peacefully .

The amount of complications we had were not significant and were controlled; infection was due to the potential hidden bacteria and presence of retained foreign bodies, radial nerve injury were minimized by exploration and protection [22,23,24].

Fig. 1: Nonunion communited fracture humerus

Fig. 2: Plated with bone graft united humerus

CONCLUSION:

Non union of humeral fractures can occur especially in high velocity injuries which cause cominution and soft tissue damage; treatment by rigid fixation by broad plates and at least 12-16 cortical fixation points with ample amount of autogenous bone graft from the iliac crest provides good opportunity for the bone to heal and minimize complications of fracture disease.

Declaration:

There is no conflict of interest in doing this study and no financial benefit to the authors.

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