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Antegrade Rush nailing for fractures of humeral shaft– an analysis of 200 cases with an average follow up of 1 year

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Background: The incidence of humeral fracture has significantly increased during the recent times due to the rising age of the population and the number of automobile accidents. In order to achieve a stable fixation and early mobilization, numerous surgical implants have been devised.

Method: We carried out a prospective analysis of the data of 200 consecutive patients who had closed fractures of the humeral shaft treated with ante-grade closed Rush nails at our institute. Patients with preoperative radial nerve injury were excluded from this study. In 186 patients we achieved close to anatomic reduction of the fracture fragments. In 14 patients we had to resort to limited open reduction.

Results: Fracture united in 186 of 188 patient followed up for one year. Complications occurred in 26 patients. We strongly advise a careful surgical technique and modification as per the individual fracture pattern to reduce the complications.

Conclusion: Osteosynthesis with multiple Rush nails features the advantages of rotational stability of the head–neck fragment to the diaphysis, an unreamed implantation technique without any special instruments, the speed of execution and minimal economic burden so important for the developing country like ours.

Key-words: Osteosynthesis; fractures of the Humeral shaft; Rush nails.

Introduction

The humeral fractures account for 3% -5% of the skeletal injuries. The treatment modalities are varied. There have been proponents of closed reduction and casting claiming equally good functional results over the operative means. However with the advent tools and techniques the armamentarium of a trauma surgeon is enriched with a wide array of implants such as nails and plates. Open reduction and internal fixation with plate gives good radiological reduction but are fraught with complications like infection and radial nerve palsy. In today's era of closed technique of fracture fixation various nails are described with very promising results and early recovery.

The aim of our study was to evaluate the simple, cost effective, closed intramedullary technique of Rush nails capable of being undertaken at a District level Hospital without expensive instrumentation and providing results comparable to the standard existing interlocking systems.

Materials and Methods

From January 2000 to January 2006 we treated 200 patients with stable and unstable humeral fractures with multiple Rush nails. The mean age was 37 years (30-78 years). One hundred and seventy four males and 26 females were enrolled for this study. Three fourth of them had sustained a domestic fall while the rest had a vehicular accident.

The fractures were classified according the fracture pattern. Surgery was performed within 48 to 72 hours, on a standard operation table under the guidance of image intensifier. One hundred and sixty five cases were operated under supra clavicular block and only 35 were given a general anesthesia. Closed reduction was carried out and ascertained by image intensifier on anteroposterior and lateral views. A 4 cms incision was taken after palpating the acromion and the greater tuberosity. The anterior part of rotator cuff was dissected to enable a placement of curved awl at the proposed site of entry. A 4 mm reduction nail was passed to confirm reduction. The medullary cavity was filled with Rush nails of calculated length in the sizes ranging from 2 mm to 4 mm. A minimum of two and maximum of four Rush nails could be negotiated within the medullary canal. The proximal end was buried into the humeral head by gentle hammering. The shoulder was moved in all the direction to check the possible obstruction by the Rush nails. Care was taken to avoid distraction at the fracture site. Fractures in 186 patients were reduced by closed means whereas 14 patients needed limited open reduction. The mean duration for the surgery was 28 minutes (20-45 min). Postoperatively a strapping was given

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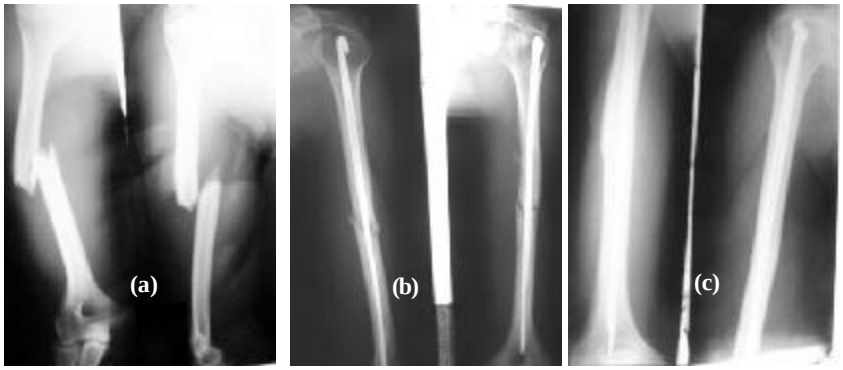

Fig. 1. (a) ***Fracture of the shaft of the humerous,*** **(b)** ***Fixed with Rush nails,*** **(c)** ***Six month follow up showing good union.***

for a period of three weeks. Active and passive exercises were initiated as soon as the pain tolerance of the patient improved.

Results

Postoperative radiographs showed a near anatomical fracture reduction in 186 patients. The patients were followed up at three, six and twelve months. The fracture consolidated in 4 months. No perceptible shortening was noted. Fourteen had superficial infection which was controlled with motion. Two patients died due to medical reasons within twelve months of surgery. One hundred twenty four patients had full range of shoulder and elbow motion. Sixty four patients had full range of elbow movement but limited terminal restriction of shoulder abduction. Sixteen patients had limitation of shoulder and elbow function. Twelve patients were lost to follow up after eight months. We had non union in two cases which was due to the primary distraction and implant breakage. Four patients had radial nerve neuropraxia which recovered eventually without any complications.

Twelve patients had a migration of nail proximally which we felt was due to inadequate impaction and 5 of which were due to severe osteoporosis. We had one patient where the nail penetrated into the elbow joint, which was subsequently revised. In 10 of our patients, we could see the malrotation of the fracture which did not affect the eventual functional outcome. In one patient there was ectopic new bone formation at the point of insertion of nail which was responsible for the limited mobility in one of the patients. One case of implant failure was noted.

The average elbow flexion movement was between 4 degree short of full extension to an average flexion of 130 degree. Shoulder abduction averaged 88 degrees, external rotation of 54 degrees and internal rotation of 68 degrees was noted.

Discussion

The humeral fractures account for 3% -5% of the skeletal injuries. The treatment modalities are varied. There have been proponents of closed reduction and casting claiming superiority over the operative means. The functional cast bracing yields good results. But conservative treatment for the obese patients and females with large breast pose difficulty for conservative management of these fractures. Patients who are not compliant with the conservative treatment can also be managed with surgery. The successful treatment of humeral fractures depends on many factors; the age of the patient ,the patients general health, the time from fractures to treatment, the adequacy of treatment, concurrent medical treatment, the adequacy of treatment and stability of fixation.

Amongst the various intramedullary devices used for the fixation of humeral fractures the Rush Nails, the Kuntcher nails, the Hackethal nails, the Ender nails, the interlocking nails, the Siedel Nail, the Cloverleaf Pohl nail, The AO interlocking nails find references in the vast literature. Intramedullary nailing of the humerus was advocated by the Rush Brothers[1,2] who initially used these elastic nails in the surgical treatment of the proximal diaphyseal fractures. The inherent stability achieved was based on the principle of "three point fixation". The flexibility of the nails and the crowding of the medullary canal with multiple nails provide stability at the narrowest part of the diaphysis. Distally the nails of unequal length fan out in different directions and gain anchorage in the distal metaphyseal region. This imparts fixity in the medulla and the solid portion of the lower humerus. At the proximal end the nail hooks are buried in the bones which prevent the proximal migration of the nails.

In a series of 81 fractures treated by the Eiffel tower technique, Zhingi et al[3] concluded that nailing the diaphyseal fractures of the humeral shaft always have the advantage of quick recovery which is not always the case with plating.

Similar view was also shared by Weseley et al[4] who concluded after treating 700 patients with Rush nail, that this method is suitable for treating the fractures of the surgical neck of humerus and also for the fractures involving the anatomical neck and /or greater tuberosities. Their results were comparable to those obtained by any other means.

Stern et al[5] in analyzing the 60 patients treated by Rush nail and Ender nails concluded that 56% adhesive capsulitis,15% delayed union and 5% deep infection could well be reduced if proper surgical technique is followed, stressing the importance of correct pin selection and placement to achieve a three point fixation.

The importance of maintaining the integrity of the rotator cuff was stressed by Brumback et al[6] who concluded that antegrade insertion to have a fewer problems than the retrograde technique. In case of the impingement of the nails proximally they advised early removal and replacement of the nails.

The Kuntscher nailing[7] for the fracture of humerus diaphysis could not achieve the popularity as that for femoral and tibial fractures. The nail, which resisted the elasticity did not fit easily within the medullary canal, needed a larger fenestration to accommodate the nail resulting in distraction and fracture. But favourable results were documented by Zanasi et al[8] in 130 cases observed for a period of more than 15 yrs stressing the surgical mechanical and biological advantages of the Kuntscher nails.

The Hackethal nails[9] inserted into the medullary cavity were more elastic and were inserted in the retrograde manner. These nails somehow could not afford adequate stability on loading, and peroperative radiation outweighed the advantages it had.

The unslotted Seidel nails designed to fit the humeral shaft was locked with a bolt proximally and distally the fins expanded using a spreading bolt. Widespread use of the nails[10] revealed the technical problems associated with its use namely the difficulty in proximal locking, proximal migration, and damage to the rotator cuff thereby affecting the shoulder function. Cadaveric study carried out by Evans et al[11] revealed the possible damage Seidel nails could cause to the axillary nerve and the biceps tendon.

In our series of 200 patients we feel that the problems with non union and the migrations of the nails could be prevented if postoperatively the fracture is not distracted. Equally important fact is the burying of the Rush nail hook into the proximal humerus and ascertaining the range of movement of the shoulder on the table. We feel this important to minimize the complications.

Antegrade Rush nailing for diaphyseal fractures of humeral shaft combines the advantages of the minimally invasive surgery, minimal instrumentation, cost efficient implants, a relatively safe leaning curve, minimum morbidity and significantly lower complications if the basic principles are adhered to. We agree with Confalonieri et al[12] that in antegrade Rush nailing for diaphyseal fractures of humeral shaft adequate reduction of the fractures, simplicity of execution good results and shorter periods of mobilization scores over the newer and costly intramedullary devices requiring extra instrumentation, reaching the markets .

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