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Comparitive study between antegrade and retrograde humerus nailing in diaphyseal fracture of humerus

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Abstract
With the advances in mechanization, increasing speed of life and increased life expectancy in the swarming population, the humerus fractures are increasingly seen. The purpose of this study was to evaluate the outcomes of antegrade and retrograde humerus nailing in terms of fracture union, functional outcomes, Complications.
Materials and Methods: 40 patients with fracture shaft humerus was treated with closed intramedullary interlocking nailing over a period of 5 years i.e, from June 2011 to June 2016 at tertiary care hospital. The inclusion criteria were closed fracture shaft humerus in skeletally matured patient. Patients with compound fractures shaft humerus, skeletally immature and fracture proximal and distal humerus were excluded from study.
Results: The mean age of patient was 39.25 years. Majority of patient were males (75%). Road traffic injury was the commonest mode of injury accounting for 36 patients. Radiological union was seen at 10wks to 16 wks. In our study of 40 patients shoulder function was excellent in 34 (85%) patients, good in 2 (5%) patient and fair in 4 (10 %) patient. Elbow function was excellent in 36 (90%) patients and good in 2 (5%) and fair in 2 (5%). 1 (2.5%) patients suffered posterior cortex comminution at fracture site while nail insertion in retrograde technique. 4 (10%) patients had nail impingement of proximal end who were operated by antegrade technique.
Conclusion: As compare to antegrade nailing we found retrograde nailing had fewer complications and better results including healing rate and eventual functional recovery of the patient though retrograde nailing is time consuming and techniqually more demanding procedure.

Keywords: Fracture shaft Humerus, Antegrade nailing, retrograde nailing

Introduction
Humerus shaft fractures represent between 3% to 5 % of all fractures (Brinker 2004), with a bimodal age distribution of young patients involved in high energy trauma or elderly patients with osteopenic bone with low energy injuries.
The two modalities of internal fixation in fracture shaft of humerus are plate osteosynthesis and intramedullary nailing. Fixation with plates requires extensive dissection and is complicated by the proximity of the radial nerve and the riionsk of mechanical failure in osteopenic bones. Biomechanically, intramedullary nail is a better implant as closed reduction and nailing preserves the fracture haematoma, which is essential for early fracture consolidation. Intramedullary nail can be done by two method, retrograde and antegrade, but still there are controversies which one is better.
So we conduct this study to evaluate the results of fixation of the shaft of humerus by Interlocking intramedullary nailing with both Antegrade and Retrograde method in respect to shoulder and elbow joint function and complications.

Materials and Methods
This was a prospective longitudinal study of 40 cases of humeral shaft fractures treated with closed intramedullary interlocking nailing over a period of 5 years i.e, from June 2011 to June 2016. Study Includes the patient age more than 19 years, closed fractures of mid shaft humerus with simple, segmental, comminuted and pathological fractures. Patients with age less than 19 years, open and comminuted fractures, fractures involving the proximal and distal ends of the humerus are excluded.

The operative procedure, its advantages and likely complications were explained to the patient and informed consent was obtained. The follow-up of the patient has been taken up to 6 months.

Results

End results were evaluated at the end of 6 months using modified criteria of Stewart and Hundley [1]. Assessment of the patient was done on the basis of time taken for clinical and radiological union, range of motion at shoulder and elbow joints and subjective complaints like pain in shoulder and elbow joints.

Table 1: It shows clinical and radiological union, range of motion at shoulder and elbow joints and subjective complaints like pain in shoulder and elbow joints

Excellent	Good	Fair	Poor
Solid Bony Union	Solid Bony Union	Solid Bony Union	Non-Union
No Pain/ Impairment of function	No Pain/ Impairment of function	Mild pain, satisfactory function for light duties	Persistent pain & impairment of function.
No Loss of ROM at shoulder & Elbow	Limitation of ROM at elbow or shoulder of <20°	Limitation of ROM at elbow or shoulder of >20° <40°	Limitation of ROM at elbow or shoulder of >40°

Total of 40 patients were included in our study. The average age was 39.25 yrs. Majority of patient were males (75%). Road traffic injury was the commonest mode of injury accounting for 36 patients. The period of fracture union ranged from 10wks to 16 wks

Table 2: Fracture union

Radiological Union		
Antegrade Technique		
Weeks	**Number**	**Perentage**
10-12 weeks	4	20
12-14weeks	10	50
14-16 weeks	6	30
16-18 weeks	0	0
Retrograde Technique	Column l	Column 2
Weeks	Number	Percentage
10-12 weeks	4	20
12-14weeks	8	40
14-16 weeks	6	30
16-18weeks	2	10

With an average period of 13 wks. In our study of 40 patients shoulder function was excellent in 34 (85%) patients, good in 2 (5%) patient and fair in 4 (10 %) patient. Elbow function was excellent in 36 (90%) patients and good in 2 (5%) and fair in 2 (5%).

Intra operative complication 1 (2.5%) patients suffered posterior cortex comminution at fracture site while nail insertion in retrograde technique, but this did not affect the fracture union.

Post-operative complication Infection: - There was no superficial or deep infection noted in our patients. Impingement: - 4 (10%) patients had nail impingement of proximal end, as it was not buried completely into the bone. They had occasional pain in the shoulder with restriction of terminal 20 and 15 of abduction respectively. They had moderate functional out come. Joint stiffness: - 4 (10%) patient ended up with shoulder stiffness mainly abduction was affected and range was up to 0-100. The patient was not following instructions of physiotherapy properly. The patient was complaining of mild pain, the cause of which was unknown. Radial Nerve palsy: we encounter post-operative radial nerve palsy in 1 patient treated with antegrade technique which gradually recovered with 4 months of physiotherapy. Elbow pain: 1 patient had elbow pain the cause of which was not known. Delayed Union: delayed union was seen in 1 patient treated with retrograde technique where radiological union was seen on 18th week

Discussion

Intramedullary nailing has the advantages over plating of less soft tissue trauma and less chances of radial nerve injury, but the use of unlocked flexible nails has been complicated by poor rotational stability and slipping out of the nails causing joint irritation. Locked nailing overcomes these deficiencies and has produced satisfactory clinical results. We evaluated our results and compared them with those obtained by various other studies opting different modalities of treatment for humeral shaft fractures.

Fractures of the humeral shaft are commonly seen in middle aged adults. Crates *et al.* [2]. Treated 73 acute humeral shaft fractures in 71 patients with intramedullary nailing. There were 43 male and 28 female patients with an average age of 32 years (range 13 to 75 years). Jinn Lin [3]. Treated 48 patients of acute humeral shaft fractures with humeral locked nails. There were 29 men and 19 women with a mean age of 48 years. (Range, 21 to 76 years). Rommens *et al.* [20]. Treated 39 patients with humeral shaft fractures with locked retrograde nailing. There were 20 males and 19 females with average age being 43.8 years. (Range, 15.5 to 97.3 years).

The average age in our study was 39.25 years. (Range 21 to 68 years). Out of 40 cases 30 were males and 10 were females.

In studies by Crates *et al.* [2], Rommens *et al.* [20], Jinn Lin [3]. Middle third of the shaft is "the most common location of the fracture. In the present study also, middle third fractures 20 (50%) was the commonest site. The right extremity was commonly involved.

Most of the operative methods for stabilization of humeral shaft fractures have acceptable rates of union. Vander Griend *et al.* [4], Bell *et al.* [5], Dabezies *et al.* [6]. All reported union in 97%, Tingstad [7]. Reported 94% union of humeral shaft fractures treated with AO plating techniques. As the flexible intramedullary nails lack rotational control, they are frequently associated with nonunions, Durbin *et al.* [8]. Reported union in 92% of 30 humeral fractures treated with hackethal nailing. Brumback *et al.* [10]. Obtained union in 94% of 58 fractures treated with Rush and Ender nails. More rigid locked intramedullary nails have better rotational control than flexible nails, which theoretically should decrease the frequency of nonunion. Riemer *et al.* [9]. Reported no nonunions in 28 acute humeral shaft fractures treated with seidel nails. Rommens *et al.* [20]. Reported union in 95% of fractures with a mean time for union of 13.7 weeks. Jensen *et al.* [11]. Reported 92% fracture union after seidel nailing in 16 patients. Jinn Lin [3] reported 100% union with a mean time to union of 8.6 weeks. Crates *et al.* [2]. Reported 97% union of fractures treated with antegrade Russell-Taylor nailing, with a mean time of 3.2 months.

In our series 40 (100%) out of 40 fractures united with a mean time for union of 13 weeks (range 10 to 16 weeks). This is comparable with the other series. We attribute, early mobilisation, fracture consolidation and higher union rates to

nailing technique, which preserves fracture hematoma and use of unreamed nailing which preserves the endosteal vascularity promoting early fracture union.

Because the radial nerve lies in close proximity to the humeral shaft, it may be injured by any operative approach to the humerus. Vander Griend *et al.* [4]. And Bell *et al.* [5]. Reported transient iatrogenic nerve palsies in 2.9% humeral fractures treated with plating. Henley *et al.* [5]. And Brumback *et al.* [10]. Reported 0%, Hall and Pankovich [12]. Reported 1.2% iatrogenic nerve palsies after fixing humeral shaft fractures with various flexible nails. Robinson *et al.* [13]. Reported 3.3% and Riemer *et al.* [9]. Reported no postoperative radial nerve palsies after seidel nailing. Rommens *et al.* [20]. Reported 2.6%, Crates *et al.* [2]. Reported 2.7%, Jinn Lin [3]. Reported iatrogenic radial nerve palsies after locked intramedullary nailing.

There was 1 transient iatrogenic radial nerve palsy in antegrade technique in the present study, this frequency is consistent with the above reports. Fernandez *et al.* [14]. Using unreamed humeral nail reported two cases of iatrogenic fracture comminution. Crates *et al.* [2]. Using Russell-Taylor nail reported no cases of iatrogenic fracture comminution. Jinn Lin [3]. Reported once case and Rommens *et al.* [20]. Reported three cases of additional fracture comminution. In our study we encountered 1 cases of intraoperative fracture comminution but this did not affect fracture healing and all the fractures united well within four months.

Because of the good vascular supply and large soft tissue surrounding the humerus, infection is relatively infrequent and seems to be more common after open techniques. Radrigues-Mechan [15]. Reported 5%, Bell *et al.* [5]. Reported 2.9%, Vander Griend *et al.* [4]. Reported 5.9% and Foster *et al.* [16]. Reported 7% infections after plate fixation of humeral shaft fractures. Stern *et al.* [17]. Reported 5%, Hall and Pankovich [12]. Reported 0%, Brumback *et al.* [I0]. Reported 1.7% infection after fixing humeral shaft fractures with various flexible nails. Most of them occured after open nailing and with nailing in open fractures. Riemer *et al.* [9]. Reported no infections but, Robinson *et al.* [13]. Reported 6.7% of infection in humeral shaft fractures treated with seidel nailing. In series of acute humeral fractures treated with Russell-Taylor nails, Rommens *et al.* [20]. Ikpeme *et al.* [18]. And Crates *et al.* [2]. Reported no infections. In our study we did not encounter any post-operative infection.

The most frequent criticism of antegrade humeral nailing has been its potentially deleterious effect on shoulder function. This can be due to impingement of proximal nail tip or proximal locking screw, due to adhesive capsulitis or due to rotator cuff tears. In most of the studies with antegrade nailing, 80 to 95% of patients regained their normal shoulder function. With Russell-Taylor antegrade nailing, Crates *et al.* [2]. Reported 90% of patients and Petsatodes *et al.* [14]. Reported 87.2% of patients regaining full shoulder function. Kropfl *et al.* [19]. Treated 111 fractures in 109 patients with unreamed antegrade interlocking nailing, 19 patients had limited shoulder motion, none had limitation of elbow motion. In our study of 40 patients shoulder function was excellent in 34 (85%) patients, good in 4 (10%) patients and fair in 2 (5%) patient. These patients had impingement of proximal end of the nail. One patient had severe shoulder stiffness and had significant restriction of shoulder motion.

Postoperative early mobilization of the shoulder and elbow was very critical in attaining full range of movements. It was observed that the movements and the functional ability of the shoulder depend upon the patient's adherence to rehabilitation programme and early intensive physiotherapy hastened the recovery of shoulder function.

Most of our findings, including period of fracture consolidation, union rates, complications and functional results are comparable with the studies where intramedullary nailing was used to treat humeral shaft fractures.

But as the study sample was small, for better conclusion it has to be repeated in a larger group of patients with longer follow up periods.

Limitations

Low sample size and short duration of follow-up remains the limitations of the present study.

Conclusion

Though it is a small series of 20 cases each by both the techniques, yet following conclusion can be derived - When indicated, internal fixation of fractures of the shaft of humerus with interlocked intramedullary nail gives goods results. The reliable secure fixation provided enables early post-operative rehabilitation. While the standard Intramedullary nailing with Antegrade technique has disadvantages like damage to rotator cuff & deltoid, shoulder pain, shoulder stiffness, impingement syndrome & proximal migration of nail, it is the method of choice in poly trauma patients being less time consuming and because of its ease. In addition, the retrograde method of nail insertion has following advantage over the conventional antegrade method: Avoids the above complications of antegrade technique and achieves high patient comfort and good functional result. Hence, Closed Intermedullary interlock nailing by retrograde technique is a safe and reliable way of stabilizing fractures of shaft of humerus allowing speedy recovery of the patients though it has complication like posterior cortex communition while making entry point which can be reduced by multiple drilling the posterior cortex while making entry point.

As compare to antegrade nailing we found retrograde nailing had fewer complications and better results including healing rate and eventual functional recovery of the patient though retrograde nailing is time consuming and techniqually more demanding procedure. Age, Condition of the patient, level of fracture and diameter of the medullary canal is the key for proper selection of the procedure.

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