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Ender Nail versus Dynamic Compression Plating For Humeral Shaft Fractures

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Abstract
Aim: To compare ender nail with dynamic compression plating for humeral shaft fractures in terms of functional outcomes, union and complication rates.
Methods: 30 men and 20 women aged >18 years with fresh humeral shaft fractures without neurological deficits underwent either ender nail (n=30) or dynamic compression plating (n=20). Functional outcome of the upper limbs, pain, rates of union, and complications in the 2 groups were compared.
Results: Respectively in the nailing and plating groups, mean operating times were 65 and 112 minutes, mean blood loss volumes were 20 and 232 ml, complication rates were 20% and 24%, non-union rates were 13% and 8%, and delayed union rates were 7% and 4%.
Conclusion: Both techniques were equally appropriate for treating humeral shaft fractures.

Keywords: dynamic compression plates; enders nail; humeral fractures

Introduction
Humeral shaft fractures account 3 to 5% of all fractures [1]. Function not affected even when there is up to 20º of anterior, 30º of varus angulation, and 3 cm of shortening of the humeral shaft. [2] Conservative treatment using braces enabled early restoration of joint motion and alignment with minimal morbidity in humeral shaft fractures [3]. The humerus is difficult to immobilise rigidly, because of its articulation with scapula, as scapulohumeral joint [4]. Constant contraction of the surrounding muscles and the pull of gravity tend to distract the fracture. Other disadvantages of conservative treatment are joint stiffness, muscleatrophy, oedema and osteoporosis. Inadequate immobilisation lead to delayed union and non-union, whereas prolonged immobilisation lead to stiffness of elbow and shoulder joint [5]. Rigid plate fixation osteosynthesis widely used for humeral diaphyseal fractures [6, 7] but is associated with large incisions, stripping off of soft tissues and periosteum from the bone which leads to increases in the risk of non-union or delayed union, radial nerve damage, infection [8] less secure fixation in osteopenic bone, and delayed mobilisation of shoulder and elbow. There is stress of the bone by the plate and reduced strength of union, owing to primary opposed to callus healing. Intramedullary nailing avoids all these problems and is biomechanically stronger. The common indication for operative treatment is the presence of associated multiple injuries [9, 10] Other indications include vascular injury, open or segmental fractures, and failed conservative management [11, 12] We compared enders nailing with dynamic compression plating for humeral shaft fractures in terms of union, functional outcomes, and complication rates.

Materials and Methods
Patient with age group above eighteen years with fresh humeral shaft fractures without neurological deficits underwent either nailing (n=30) or dynamic compression plating (n=20) were selected. Patients withgrade IIIb and IIIc compound fractures, pathological fractures, malunited fractures, non-unions, or osteoporotic bones were excluded. Other associated morbidities included, femoral shaft fractures of the patellar, both forearm bones etc. For Antegrade nailing patient was made supine and from the most lateral point of the acromion,

center over the tip of the greater tuberosity. The entry portal was made at a point just medial to the tip of greater tuberosity and 0.5 cm posterior to the bicipetal groove by small curved bone awl. Its position in the centre of the canal using an image intensifier. For Retrograde nailing Patient kept in supine position with arm over the chest a straight 2 inch incision was made over the distal aspect of humerus posteriorly. The triceps fascia was split towards the olecranon, and triceps muscle was dissected bluntly, for the exploration of the distal humerus. Two to three holes were made 1 to 1.5 inch. Above the olecranon fossa near each other and bridge of bone between them was broken with a diamond tipped awl to create an elliptical opening over the posterior part of the cortex. For the plating pt., the patient placed in a lateral position for posterior approach and a supine position for anterolateral approach with the arm on a sidetable. Soft-tissue and periosteal stripping was minimised to avoid disturbance of blood supply to the bone. The fracturehaematoma was removed, and the medullary canal opened. Anatomic reduction achieved, and a dynamic compression plate of adequate size fixed with at least 3 to 4 cortical holds on each side. Active and active-assisted ROM of the elbow and pendulum exercises of the shoulder were started as early as possible. Patients followed up at weeks 6, 10, and 16, and monthly thereafter. Lifting of weights and heavy work was not allowed before fracture healing. Functional outcome of the upper limb was assessed using the American Shoulder and Elbow Surgeons (ASES) score.

Results

Respectively in the nailing and plating groups, mean patient ages were 39 (range, 20–60) and 39 (range, 22–77) years, mean follow up periods were 10 and 12 months, mean times to union were 16 and 17 weeks, mean operating times were 65 and 112 minutes, mean blood loss volumes were 20 and 232 ml, complication rates were 20% (6/31) and 24% (6/25),non-union rates were 13% (4/31) and 8% (2/25), and delayed union rates were 7% (2/31) and 4% (1/25). In the nailing group, 3 of the 7 patients with transverse fractures had non-union secondary to fracture site distraction (transverse fractures usually result from high-velocity trauma and tend to distract at the time of nail insertion15), whereas the 2 of the 9 patients with oblique fractures had delayed union secondary to decreased vascularity of the surrounding tissues after high-velocity trauma. In the plating group, one patient with an oblique fracture and another with a spiral fracture had non-union secondary to loss of fixation, whereas one patient with an oblique fracture had delayed union secondary to infection. ROM of in both method were comparable and satisfactory. Three patients in the plating group had postoperative radial nerve palsies.

Fig 1: Humeral shaft fractures treated with dynamic compression plating showing anatomic reduction and bone union.

Fig 2: Humeral shaft fractures treated with Enders nails showing sequential fellow up and after one year shows complete union.

Discussion

Enders nail is quite simple and needs very simple instrumentation. These nails have been designed to be used as simple nail or multiple nail without reaming. The nail is circular in cross section and malleable, so in long bones fracture they acquire the curvature of the long bones in which they are placed. If two nail are placed inside the marrow they cross each other during their journey from the portal of entry to the subchondral bone thereby giving dynamic fixation to the fractureImplant failure is rarely seen with Ender nailing because of its flexibility. Its flexibility induces micro motion at the fracture site and causes exuberant amount of callus to be formed around the fracture site, Ender nail does not hamper the endosteal callus formation. These factors are essential for fracture healing of the fractured bones. Dynamic compression plating is considered the gold standard of operative treatment [16] achieving high rates of union and good outcome [17] However, it is associated with extensive open surgery with periosteal stripping of soft tissues from bone [18] a longer operating time [11] and less secure fixation, especially in elderly patients with osteoporotic bone and if crutch walking is required [11, 18] Its common complications include infection, non-union, and radial nerve injury [12] Transverse fractures should be treated with a dynamic compression plate, as it aids achieving bone-to-bone contact, and dynamic compression screws can pull opposite fracture fragments together when tightened. Intramedullary nailing involves a simpler technique with minimal exposure [19] and shorter operating time and less blood loss [20-23] The preservation of fracture haematomas, soft tissues, and periosteum around the fracture enables higher rates of union and good results, [12, 20] with no risk of iatrogenic radial nerve palsy. [16] However, the anatomic configuration of the humeral shaft may lead to residual fracture site distraction [20, 22, 23] especially when the sagittal diameter of the distal humerus is small, and eventually delayed union and non-union may ensue. Unlike for more tubular bones like the femur and tibia. In addition, ante grade nailing may violate the rotator cuff. A medial starting point may avoid the avascular area of the cuff and give straight access to the medullary canal, without compromising rotator cuff healing [24] Adhesive capsulitis of the shoulder has also been reported after ante grade nailing.

Conclusion

Respectively in the nailing and plating groups, mean operating times were more in plating, mean blood loss volumes were more in plating but complication rates and union rate were same in both cases. And both techniques were equally appropriate for treating humeral shaft fractures.

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