



Nailing vs. Plating for Humeral Shaft Fractures: A Comprehensive Review

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Editorial

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Abstract

Humeral shaft fractures require surgical intervention for optimal functional recovery. This review compares intramedullary nailing (IMN) and open reduction internal fixation (ORIF) with plating, focusing on their biomechanical advantages, healing timelines, complication profiles, and cost-effectiveness. IMN provides central bone support, promoting faster recovery through minimal soft tissue disruption, though it may result in rotator cuff complications and higher radiation exposure. Plating, despite requiring more invasive techniques, offers precise alignment in complex fractures. Both methods show comparable union rates, with treatment choice depending on fracture characteristics and patient factors. This review aims to guide clinical decision-making in humeral shaft fracture management.

Keywords: Humeral Shaft Fracture; Intramedullary Nailing; Open Reduction Internal Fixation; Plating, Biomechanical Stability

Abbreviations

IMN: Intramedullary Nailing; ORIF: Open Reduction Internal Fixation; MIPO: Minimally Invasive Plate Osteosynthesis

Introduction

Humeral shaft fractures, accounting for 1-3% of all fractures, often require surgical intervention to restore function and stability. Two primary fixation techniques are intramedullary nailing (IMN) and open reduction internal fixation (ORIF) with plating. Each approach has distinct biomechanical, functional, and complication profiles that influence treatment outcomes. This review examines IMN and plating concerning biomechanics, healing, complications, and cost-effectiveness to aid clinical decision-making [1].

Biomechanical Considerations and Stability

The humeral shaft's biomechanics necessitate fixation methods capable of handling rotational and axial loads. IMN, with its intramedullary placement, offers central support, which preserves the periosteum and promotes faster healing [2]. Selecting the appropriate nail length and diameter is crucial to avoiding instability and ensuring adequate bone contact without over-reaming, particularly in patients with smaller or shorter humeri, such as many Indian women [3,4]. Plating, by contrast, allows for precise alignment, especially in complex or comminuted fractures, though it requires more extensive soft tissue dissection [5].

Types of Nails and Associated Risks

Various humeral nails, including antegrade and retrograde designs, are tailored to anatomical and procedural

needs. Antegrade nailing through the shoulder can lead to rotator cuff injuries due to the proximal entry point, resulting in shoulder pain and functional impairment in up to 30% of cases [6,7].

Retrograde nails offer an alternative but carry a risk of neurovascular complications, including radial nerve palsy and possible arterial injury, particularly with excessive reaming [8,9].

Healing and Functional Recovery

IMN is generally associated with shorter healing times and less soft tissue disruption, promoting early mobilization. Studies indicate that patients treated with IMN report quicker functional recovery due to minimal periosteal stripping [10]. ORIF, while achieving rigid fixation and accurate reduction, may require a longer recovery period in patients with comorbidities affecting bone health [11]. Additionally, IMN often results in higher radiation exposure due to the need for fluoroscopic guidance, whereas plating involves less radiation during surgery [12].

Complications and Revision Surgeries

Complications differ between IMN and plating. IMN can cause rotator cuff injury, nerve injuries, and even iatrogenic fractures at the nail entry site. Selecting an appropriate nail size and insertion angle is critical to avoiding these complications [13,14]. Plating is more commonly associated with radial nerve injury due to dissection near the radial groove, leading to prolonged recovery and occasional need for revision surgery [15,16]. Although both IMN and ORIF have comparable union rates, IMN may reduce non-union risk by providing intramedullary support, which enhances callus formation [17].

Infection and Radiation Exposure Risks

ORIF, involving larger incisions, generally presents a higher infection risk than IMN. Studies report infection rates of up to 5% with ORIF, attributed to greater soft tissue handling, whereas IMN has infection rates closer to 2% due to less exposure [18]. IMN does, however, increase radiation exposure due to the frequent fluoroscopic checks required for nail alignment, especially in comminuted fractures, whereas plating generally requires less intraoperative radiation [19].

Cost-Effectiveness and Resource Utilization

Cost considerations are essential in managing humeral shaft fractures. IMN typically has lower costs due to shorter hospital stays, quicker recovery, and reduced need for physical therapy. However, fracture characteristics should guide fixation choice, with plating often preferred in fractures

requiring precise alignment, such as proximal or distal shaft fractures [20,21].

Current Recommendations and Future Directions

Choosing between IMN and plating should be based on patient profiles and fracture characteristics. IMN benefits mid-shaft fractures by reducing operative time, infection rates, and promoting quicker recovery. Plating remains a valuable choice for complex fractures requiring precise alignment. The evolution of IMN techniques, including improved nail designs and minimally invasive plating methods, continues to refine surgical outcomes.

Conclusion

IMN and plating each provide valuable, evidence-based options for managing humeral shaft fractures, each with distinct advantages and limitations. The decision-making process should carefully weigh fracture location, patient health status, and specific functional demands. As orthopedic surgical techniques evolve, individualized patient care remains central to optimizing outcomes in humeral shaft fracture management.

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