



## Original Article

# Preliminary results from osteosynthesis using Ender nails by means of a percutaneous technique, in humeral diaphysis fractures in adults<sup>☆</sup>



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## ABSTRACT

**Objective:** To demonstrate the clinical and functional results from treatment of humeral diaphysis fractures using Ender nails.

**Methods:** Eighteen patients who underwent osteosynthesis of humeral diaphysis fractures using Ender nails were evaluated. In addition to the clinical and radiographic evaluations, patients with a minimum of one year of follow-up were assessed by means of the Constant, American Shoulder and Elbow Surgeons (ASES), Mayo Clinic and Simple Shoulder Value (SSV) functional scores, and in relation to the degree of satisfaction with the final result. The fixation technique used was by means of an anterograde percutaneous route.

**Results:** All the patients achieved fracture consolidation, after a mean of 2.9 months (ranging from 2 to 4 months). The mean Constant score was 85.7 (ranging from 54 to 100) and the mean ASES score was 95.9 (ranging from 76 to 100). All the patients achieved the maximum score on the Mayo Clinic scale.

**Conclusion:** Fixation of humeral diaphysis fractures using Ender nails by means of a percutaneous technique was shown to be a method with promising preliminary results.

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## Resultados preliminares da osteossíntese com haste de Ender, por meio da técnica percutânea nas fraturas diafisárias do úmero nos adultos

### R E S U M O

#### Palavras-chave:

Fraturas do úmero  
Fixação intramedular de fraturas  
Fixação interna de fraturas

**Objetivo:** Demonstrar os resultados clínicos e funcionais do tratamento da fratura diafisária de úmero com uso das hastes de Ender.

**Métodos:** Foram avaliados 18 pacientes submetidos à osteossíntese da fratura diafisária de úmero com uso da haste de Ender. Além das avaliações clínicas e radiográficas, os pacientes com no mínimo um ano de seguimento foram avaliados pelos escores funcionais de Constant, American Shoulder and Elbow Surgeons (Ases), Mayo Clinic, Simple Shoulder Value (SSV) e quanto ao grau de satisfação com o resultado final. A técnica de fixação usada foi por via anterógrada e percutânea.

**Resultados:** Todos os pacientes obtiveram consolidação da fratura, com média de 2,9 meses (variação de dois a quatro). A média do Score de Constant foi de 85,7 (variação de 54-100) e a do ASES de 95,9 (variação de 76-100) e todos obtiveram pontuação máxima pelo escore Mayo Clinic.

**Conclusão:** A fixação das fraturas diafisárias do úmero com o uso da haste de Ender pela técnica percutânea demonstrou ser um método com resultados preliminares promissores.

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## Introduction

The Ender nail, which is thin, flexible and premolded, was first described by Ender for treating intertrochanteric hip fractures.<sup>1</sup> The first study to evaluate the results from using Ender nails for treating closed humeral diaphysis fractures was published in 1987. In that study, osteosynthesis was performed using an Ender nail after closed reduction of fractures with angular displacements greater than 20 degrees.<sup>2</sup>

The majority of humeral diaphysis fractures can be treated conservatively with good clinical and functional results.<sup>3-5</sup> Surgical treatment is reserved for exposed segmental fractures, multiple trauma patients, cases of floating shoulder or elbow and failure of conservative treatment.<sup>6-8</sup>

Currently, the two types of implant for which there is the greatest amount of evidence regarding surgical treatment of humeral diaphysis fractures are dynamic compression plates and rigid intramedullary nails.

Anatomical reduction of the fragments, which is the objective when plates are used, tends to reduce the risks of poor consolidation. However, this requires greater perioperative exposure, with greater damage to the soft tissues and periosteal vascularization, which possibly can be correlated with a higher infection rate and pseudarthrosis.<sup>6-8</sup> On the other hand, rigid intramedullary nails give rise to less soft-tissue aggression. However, their use has been correlated with postoperative shoulder pain and high numbers of second interventions.<sup>7,9-11</sup>

Fixation using flexible intramedullary nails has been criticized because of the deficit of rotational control and instability during the fixation,<sup>7,10</sup> along with the possibility that the rotator cuff might be affected in cases of anterograde entry.<sup>2,12</sup> With modification to the technique originally described for introducing the nail, good results are expected.

The objective of the present study was to demonstrate the clinical and functional results from treating humeral diaphysis fractures using Ender nails and compare the financial costs of this implant in relation to those from other surgical techniques.

## Materials and methods

Twenty-six patients with closed humeral diaphysis fractures that had been treated surgically using Ender nails as the fixation method were selected. The operations were performed in our institution between July 1998 and August 2011. All of the patients were retrospectively evaluated regarding the neurological functioning of affected limb before the surgical procedure, and possible associated lesions were investigated. In addition, by means of orthogonal preoperative radiographs of the humerus, in anteroposterior (AP) and lateral views, the fractures were classified in accordance with the AO system.

The inclusion criteria were that the cases should comprise closed fractures that occurred not more than 7 days before the surgical procedure, in which the fracture displacement was more than 20 degrees in the sagittal or coronal plane, with shortening between the segments greater than 2 cm, classified as 12A, 12B, 12C1 or 12C2 fractures.

Cases were excluded if a minimum of one year of outpatient follow-up had not been concluded, including reviews conducted 1 week, 15 days and 1, 2, 3 and 6 months after the operation. Fractures of the type 12C3 were also excluded, as were pathological and exposed fractures. None of the patients presented a fracture of type 12B3. Among the 26 patients selected, eight were lost from the follow-up: one due to death and seven because it was impossible to contact them. Eighteen patients (12 women and 8 men) remained, and were all evaluated. Their mean age was 48 years (range: 24-72), and the

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