

Salvage in hip inter-trochanteric fractures with AO/ASIF 95°-nail plate

LUIS S. RUCHELLI, MARTÍN M. MANGUPLI, JOSÉ M. GÓMEZ, BARTOLOMÉ LUIS ALLENDE

*Department of Orthopedics, Hip and Knee Section,
Sanatorio Allende, Córdoba*

Received on January 20th, 2016; accepted after evaluation on May 16th, 2016 • LUIS S. RUCHELLI, MD • luisruchelli@gmail.com

Abstract

Introduction: With contemporary techniques of reduction and osteosynthesis, most hip inter-trochanteric and neck fractures usually heal. Most of these fractures are treated with closed reduction and internal fixation with optimal results. In general, therapeutic failure leads to pain and functional impairment. In these cases, possible treatments are boiled down to two options, set aside conservative management in critical patients—either new osteosynthesis or hip total arthroplasty. Valgus surgery in fracture failure has the aim of converting shearing forces in the area of non-union into compressive forces, thus stimulating bone healing.

Materials and Methods: We evaluated retrospectively 14 patients with non-union in hip inter-trochanteric fracture between January 2010 and February 2014; all of them had been operated on at the institution we work at. All the patients were subject to revision with the aim of getting valgus in the proximal fragment using 95° nail plate (AO/ASIF) for fixation systematically. The aim of this study was to assess medical and radiologic results in non-union in hip inter-trochanteric fracture.

Results: We got bone healing in the 14 patients. Average time for bone healing varied between three and six months. The average Harris score for subjective assessment was 82.65. In no patient did we remove the surgical material after bone healing. **Conclusion:** AO/ASIF 95°-nail plate is still a very good option in proximal femur non-union, as long as pre-operative planning and surgical technique are correct, and the post-operative management is adequate.

Key words: Proximal femur; non-union; 95°-nail plate.

Level of evidence: IV

SALVATAJE DE FRACTURAS LATERALES DE CADERA CON CLAVO-PLACA DE 95° (AO/ASIF)

Resumen

Introducción: Con las técnicas contemporáneas de reducción y osteosíntesis, la mayoría de las fracturas intertrocantericas de cadera y de cuello femoral suelen consolidar sin problemas. La mayoría de estas fracturas se tratan mediante reducción cerrada y fijación interna con excelentes resultados. El fracaso terapéutico, por lo general, conduce a dolor y discapacidad funcional. En estos casos, los posibles tratamientos se reducen a dos, si se exceptúa el manejo conservador para pacientes críticos, una opción es una nueva osteosíntesis o la artroplastia total de cadera. La valguización de la falla de las fracturas tiene como objetivo transformar las fuerzas de cizallamiento de la zona de pseudoartrosis en fuerzas compresivas, estimulando así la consolidación de las fracturas.

Conflict of interests: The authors have reported none

Materiales y Métodos: Se evaluó retrospectivamente a 14 pacientes con pseudoartrosis de fracturas intertrocantericas de cadera, entre enero de 2010 y febrero de 2014, operados en nuestra institución. Todos fueron sometidos a una revisión con el objetivo de lograr una posición en valgo del fragmento proximal fijado siempre con clavo-placa de 95° (AO/ASIF). El objetivo de este estudio fue evaluar los resultados clínicos y radiológicos de pseudoartrosis de fracturas intertrocantericas de cadera.

Resultados: Se logró la consolidación de la fractura en los 14 pacientes. El tiempo de consolidación promedio varió de tres a seis meses. El puntaje de Harris promedio para la valoración subjetiva fue de 82,65. En ningún caso, se extrajo el material luego de la consolidación de la fractura.

Conclusión: El clavo-placa de 95° (AO/ASIF) sigue siendo una muy buena opción en los casos de pseudoartrosis de fémur proximal, siempre que la planificación preoperatoria y la técnica quirúrgica sean correctas, y el posoperatorio sea adecuado.

Palabras clave: Fémur proximal; pseudoartrosis; clavo-placa de 95°.

Nivel de Evidencia: IV

Introduction

With contemporary techniques of reduction and osteosynthesis, most hip inter-trochanteric and neck fractures usually heal. However, the number of hip fractures is continuously on the increase. A small percentage of patients usually suffer non-union or fixation failure.^{1,2} Most of these fractures should be treated by closed reduction and internal fixation with excellent results; however, this type of treatments does not result in bone healing in 8-13% of the cases.^{3,4} The possible reasons for failure in inter-trochanteric bone fracture that have been suggested are fracture unstable pattern, comminution or involvement of the posterior-medial cortex, sub-optimal reduction or fixation, and poor bone quality.^{1,4}

In general, failure in hip fracture treatment leads to pain and functional impairment.⁵ In these cases, therapeutic options boil down to two possibilities (set aside conservative management in critical patients)—new osteosynthesis or total hip replacement.⁶

In 1927, Pauwels⁷ introduced the concept of valgus inter-trochanteric osteotomy. This technique is used to treat a great deal of hip conditions^{8,9} and it was successful for avoiding or delaying total hip replacement in young patients. It converts shearing forces in the area of non-union into compressive forces that stimulate bone healing.^{10,11}

In our series, we used the aforementioned concept of valgus transformation but without osteotomy, so as to convert shearing forces into compressive forces, and thus increase the chances of bone healing.

Materials and methods

We evaluated retrospectively 14 patients with non-union of hip inter-trochanteric fracture which, according to the AO classification, were: 31A3 (9 cases), 31A2 (4 cases), and 31A1 (1 case), and which had been operated on at the institution we work at between January 2010 and February 2014. Seven of them had been treated with the DHS system; six, with cephalo-medullary nailing,

and one with no surgery at all. We defined non-union as lack of bone healing after nine month-treatment or as the presence of a radiolucent gap between the sclerous bone ends,¹² accompanied by pain and walk impairment.

All the patients were subject to revision with the aim of getting valgus in the proximal fragment which, in all cases, was fixed with a 95°-nail plate (AO/ASIF).

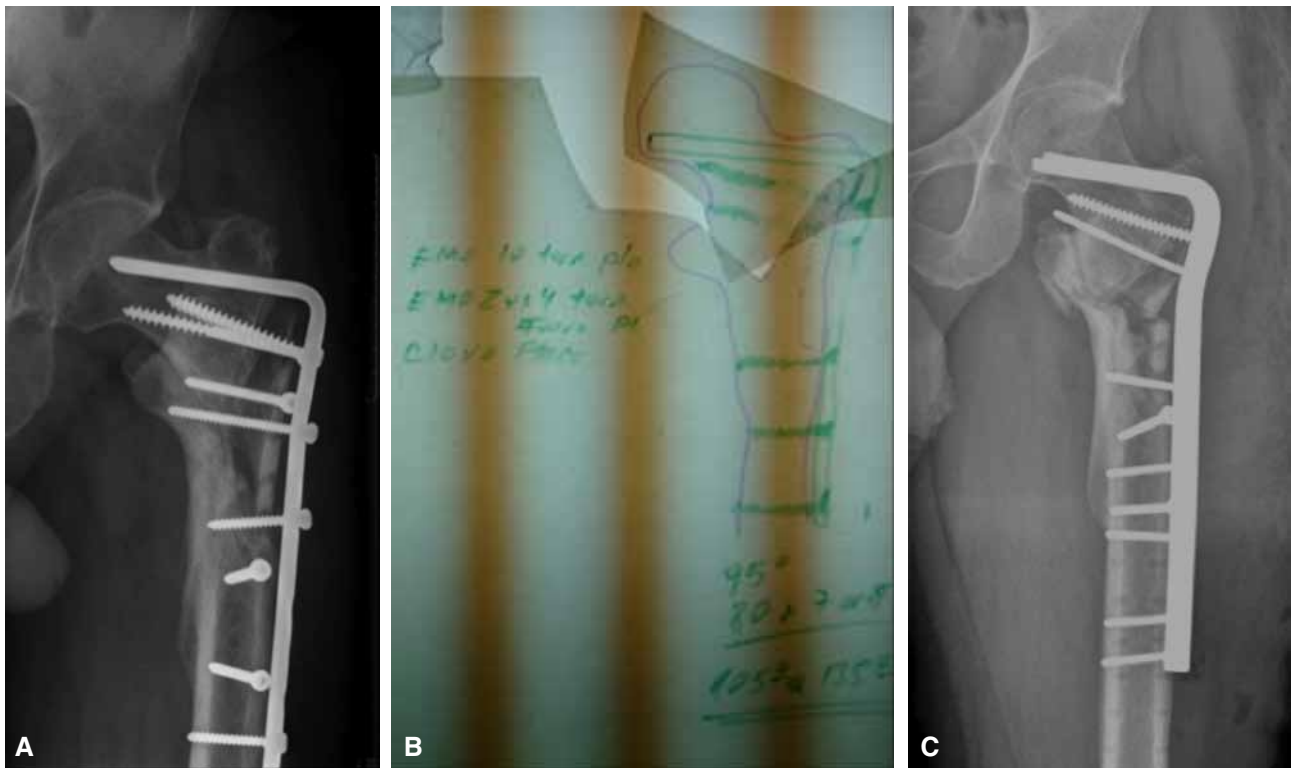
Patients averaged 58.2 years old (ranging from 33 to 82); eight (58.3%) were females and six, men (41.66%). We excluded pathologic fractures, the ones caused by alendronate, and infected non-union.

Surgical technique

After pre-operative planning (Figure 1), surgical procedures are due to start with the patient in supine position on operating traction-table and with spinal anesthesia. The surgical approach should be a proximal femur lateral one, for osteosynthesis material removal; then Kirschner pins should be inserted in the direction of the femoral neck and angulated as previously established in the pre-operative planning. The chisel should be maneuvered in the direction of the cephalic pin. What comes next is the insertion of the 95°-nail plate getting it next to the femoral shaft with a *davier* and fixing it with 4.5 mm-cortex screws, which vary depending on the plate length, and thus femoral neck valgus is achieved. The whole procedure should be guided by fluoroscopy (Figure 2).

We took immediately post-operative X-rays for check-up, and then X-rays at week 6, at months 3, 9 and 12 after the surgery, and at last follow-up before discharge. The objective analysis was carried out assessing the pre-operative and post-operative cervico-cephalic angles with goniometer. For subjective evaluation we used the Harris test.¹³ X-ray evaluation and questionnaires were left for the final follow-up.

The aim of this study was to evaluate medical and radiologic results in non-union of hip inter-trochanteric fractures using fixation with nail plate (AO/ASIF) combined with valgus in the proximal fragment with no autologous bone graft.



▲ **Figure 1.** A. Pre-operative hip X-ray. B. Pre-operative planning C. Post-operative X-ray showing hip valgus.



▲ **Figure 2.** Surgical technique. Photographs showing the sequence that leads the hip to the necessary valgus to get bone healing.

Results

We got bone healing in the 14 patients. Average time for bone healing varied between three and six months (4 months on average). The pre-operative femoral neck angle oscillated between 92° and 132° (114.53° on average). The post-operative femoral neck angle varied between 123.6° and 135.6° (128.52°). Therefore, final correction oscillated between 5.3° and 41.7° (15.07° on average) (Figures 3 and 4).

The average score in the Harris test¹³ for subjective evaluation was 82.65 (ranging from 68.1 to 97.8). There was neither infection nor avascular bone necrosis. In no patient did we remove the surgical material after bone healing. All the fractures healed with the same degree of correction we got at the initial surgery.

Discussion

So far, there have been just few reports on per-trochanteric non-union.^{14,15} Current bibliography suggests that, for hip non-union salvage, there is a wide range of implants that can be used as long as finally there is stable fixation of the proximal fragment. In this study we show salvage of hip non-union with a 95°-nail plate as a good option, not only for healing rates (14 out of 14 hips) but also because of good medical results.

Mariani et al¹⁶ published data about 11 patients (aged 53 years old on average) whose inter-throchanteric non-union was treated with new osteosynthesis using diverse types of implants. In nine of these 11 patients, they got bone healing after average six months.



▲ **Figure 3.** Eighty-two years old female. 118° pre-operative angle and 124° post-operative angle. Post-operative Harris test of 79.5



▲ **Figure 4.** Female patient. 100° pre-operative angle and 128° post-operative angle. Post-operative Harris test of 85.7.

Wu et al.¹⁷ published 14 inter-trochanteric fractures with protrusion of the dynamic compression screw; all of them were treated by reinsertion of the compression screw below within the femoral head, increasing fixation by cementation and valgus sub-trochanteric osteotomy, and they got bone healing in average five months in all cases. Sarathy et al.¹⁸ made a report on seven patients with inter-trochanteric non-union treated by valgus osteotomy and fixation with a 130°-nail plate. Six cases healed. Haidukewych and Berry¹⁹ published a series of 20 inter-trochanteric non-unions revised by open reduction and internal fixation plus bone graft. In 75% of the cases they use a fixed-angle device. Nineteen of the 20 non-unions healed.

All things considered, available bibliography seems to suggest that, for the salvage of inter-trochanteric non-union, it is possible to use a wide range of implants as long as finally there is stable fixation of the proximal fragment.

Haidukewych and Berry²⁰ recommend hip arthroplasty as an effective option following failure in the treatment of hip inter-trochanteric fracture in elder patients with bad bone quality or symptomatic osteoarthritis. In their series, they got good medical and functional results and, in spite of the technical challenges associated with hip ar-

throplasty in these patients, complications rates were low and prosthesis useful life was comparable to that of primary arthroplasty.

In our series, we evaluate retrospectively 14 patients with atrophic non-union in hip inter-trochanteric fractures treated with the same implant (AO/ASIF 95°-nail plate) with neither osteotomy nor bone graft, using the same surgical technique and the same protocol for post-operative management; we got predictable bone healing in cases.

The main limitations to this study are its retrospective nature and the lack of a control group.

Conclusions

We believe that, for these types of fractures, whose incidence is on the increase, what matters most are good pre-operative planning, adequate surgical technique and appropriate selection of both the implant and the patient, so as to guarantee the primary surgery success. If failing in bone healing, we consider salvage with a 95°-nail plate and no bone graft still a very good option in proximal femur non-union, as long as pre-operative planning and surgical technique are correct, and the post-operative management is adequate.

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