Implication of Internal Rotation Traction Radiography in Proximal Femoral Fracture Evaluation

Fernando M. Bidolegui, Sebastián Pereira, Gabriel Vindver
Orthopedics and Traumatology Service, Hospital Sirio Libanés, ECICARO (Buenos Aires, Argentina)

ABSTRACT

Introduction: The correct assessment of radiographs at the time of admission of a patient with proximal femoral fracture has a direct effect on the choice of treatment. **Materials and Method:** We consecutively evaluated 100 patients with a diagnosis of proximal femoral fracture. Antero-posterior pelvic radiographs (A-P), A-P radiographs of the affected hip, and internal rotation traction radiographs of the affected hip were taken. A comparison was made between the classifications made by residents and the classification of senior doctors, who used the 3 radiographs to classify all fractures. **Results:** The overall agreement score between the initial classification of residents and that of senior doctors was 68.9%. When the resident physicians used internal rotation traction radiography, agreement increased to 78.75%. 51 responses changed with respect to the initial classification. Of these, in 42 (82.4%) cases the initial classification was incorrect and changed to a correct classification. While in 9 (17.6%) cases the initial classification was correct and changed to an incorrect one. **Conclusion:** Internal rotation traction radiography is a simple, low-cost study that is well-tolerated by the patient and facilitates correct interpretation of proximal femoral fractures with a direct impact on the choice of treatment and its outcome.

Key words: Fractures; proximal femur; classification; traction radiography.
Level of Evidence: IV

Implicancia de la radiografía con tracción y rotación interna en la evaluación de las fracturas de fémur proximal

RESUMEN

Introducción: La correcta valoración de las radiografías cuando ingresa un paciente con una fractura de fémur proximal tiene una implicancia directa en el tratamiento propuesto. **Materiales y Métodos:** Se evaluó consecutivamente a 100 pacientes con diagnóstico de fractura de fémur proximal. Se tomaron radiografías de pelvis de frente, de la cadera afectada de frente y de la cadera afectada de frente con tracción y rotación interna. Se comparó la clasificación realizada por residentes con la clasificación de los médicos *senior*, todos utilizaron las tres radiografías para evaluar las fracturas. **Resultados:** El resultado global de concordancia entre la clasificación inicial de los residentes con la de los médicos *senior* fue del 68,9%. Cuando los médicos residentes utilizaron la radiografía con tracción y rotación interna, la concordancia aumentó al 78,75%. Cincuenta y una respuestas cambiaron con respecto a la clasificación inicial. De estas, en 42 (82,4%) casos, la clasificación inicial era incorrecta y cambió a una correcta. En 9 (17,6%) casos, la clasificación inicial era correcta y cambió a una incorrecta. **Conclusiones:** La radiografía con tracción y rotación interna es un estudio simple, de bajo costo y bien tolerado por el paciente que facilita la correcta interpretación de las fracturas de fémur proximal, lo que tiene un impacto directo en la indicación del tratamiento y su resultado final.

Palabras clave: Fracturas; fémur proximal; clasificación; radiografía con tracción.
Nivel de Evidencia: IV

Received on May 4th, 2020. Accepted after evaluation on July 6th, 2020 • FERNANDO M. BIDOLEGUI, MD • fbidolegui@gmail.com http://orcid.org/0000-0002-0502-2300

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INTRODUCTION

Proximal femoral fractures are common injuries in elderly patients and their incidence is on the rise.[1] Choosing the most appropriate treatment is fundamental in order to decrease the associated morbility and mortality rates, as well as to lower healthcare costs.[1] The correct assessment of radiographs upon admission of a patient with proximal femoral fracture has a direct impact on the indication of treatment. The objective of this study is to reveal the usefulness of internal rotation traction radiography taken upon the patient's admission in order to evaluate proximal femoral fractures.

MATERIALS Y METHODS

A consecutive series of patients aged over 65 with a diagnosis of proximal femoral fracture who had been operated by surgeons of the Traumatology Service of our Hospital between January 2018 and January 2020 was retrospectively assessed. Patients with subtrochanteric fractures and pathological fractures were excluded. The series consisted of 100 patients. Frontal radiographs of the pelvis, frontal radiographs of the affected hip and frontal internal rotation traction radiographs of the affected hip were taken. When deemed necessary, the assessment was complemented by computerized tomography. Traction radiographs are obtained by placing the patient in a supine decubitus position while the physician applies a gentle and progressive traction force from the ankle and, at the same time, brings the leg into an internal rotation with the patella pointing directly up. After taking the image, traction is gently released. At times, an assistant might be needed in order to perform countertraction.

The radiographs were assessed by senior doctors (S.P., F.B. and G.V.), who classified the fractures based on the three types of radiographs and on tomographic images, if needed. Garden[2] classification was used for femoral neck fractures and Evans[3] instability criteria (comminution, posteromedial wall compromise, subtrochanteric extension and verticality of fracture line) for intertrochanteric fractures. The possible answers were: 1) undisplaced femoral neck fracture (Garden types I and II), 2) displaced femoral neck fracture (Garden types III and IV), 3) stable intertrochanteric fracture and 4) unstable intertrochanteric fracture (at least, a criterion of instability). The answers given by the senior doctors served as reference. Then, they were compared with the answers given by four beginner residents who, independently and blinded to clinical information of the patient, classified the fractures into the four possible groups. In a first round (400 answers), they used the frontal radiographs of the pelvis and frontal radiographs of the affected hip. In a second round (400 answers), two weeks after the first one, under the same conditions, the same four residents classified the same fractures into the four possible groups, by observing the frontal internal rotation traction radiographs of the affected hip.

RESULTS

The distribution of the 100 fractures according to the senior doctors was the following: undisplaced femoral neck fractures (8 cases), displaced femoral neck fractures (24 cases), stable intertrochanteric fractures (25 cases) and unstable intertrochanteric fractures (43 cases).

Agreement between the residents' initial classification (round 1) and the senior doctors' answers was of 68.75% (275 right answers). When the residents used the internal rotation traction radiographs (round 2), global agreement increased to a 78.75% (315 right answers) (Table 1).

Table 1. Effect of internal rotation traction radiograph on the classification made by residents.

	Anteroposterior radiograph	Anteroposterior internal rotation traction radiograph
Correct classification	275	326
Incorrect classification	125	74
Total answers	400	400

A total of 51 answers changed from their initial classification when internal rotation traction radiography was used. In 42 of the 51 answers (82.4%), the initial classification was incorrect and it changed to a correct one. The right changes were the following: from a stable intertrochanteric fracture to an unstable intertrochanteric fracture (24 cases); from a displaced femoral neck fracture to a stable intertrochanteric fracture (12 cases) and from a stable intertrochanteric fracture to a displaced femoral neck fracture (6 cases) (Table 2).

Table 2. Correct changes in the classification made by residents using internal rotation traction radiograph

Change in the classification	Number of answers
From stable intertrochanteric fracture to unstable intertrochanteric fracture	24
From displaced femoral neck fracture to stable intertrochanteric fracture	12
From stable intertrochanteric fracture to displaced femoral neck fracture	6
Total correct changes	42

On the other hand, nine (17.6%) of the 51 answers changed from a correct initial classification to an incorrect classification after assessing the internal rotation traction radiograph: seven cases of unstable intertrochanteric fracture changed to stable intertrochanteric fracture, one case of stable intertrochanteric fracture changed to displaced femoral neck fracture (Figure) and one case of displaced femoral neck fracture changed to undisplaced femoral neck fracture (Table 3).

Table 3. Incorrect changes in the classification with internal rotation traction radiograph

Change in the classification	Number of answers
From unstable intertrochanteric fracture to stable intertrochanteric fracture	7
From displaced femoral neck fracture to undisplaced femoral neck fracture	1
From stable intertrochanteric fracture to displaced femoral neck fracture	1
Total incorrect changes	9

DISCUSSION

Assessing radiographs correctly upon admission of a patient with proximal femoral fracture has a direct effect on the choice of treatment. Generally, when a patient with hip fracture is admitted, he or she experiences pain and presents a shorter and outwardly rotated leg on the injured side. This, together with the natural anteversion of the femoral neck, hinders the correct evaluation of the fracture. Internal rotation traction radiography extends the femoral neck and prevents the fragments from overlapping, facilitating its interpretation.[8] When performed gently and progressively, this simple maneuver of traction and internal rotation is well-tolerated by the patient and does not require sedation.

Femoral neck fractures are usually classified according to Garden's classification.[2] However, some authors have documented poor interobserver reliability with this classification.[3] Likewise, various authors highlight the same difficulty in the initial classification of intertrochanteric hip fractures.[4-7] The results of our study highlight the interobserver variability in the classification of proximal femoral fractures. Agreement between the classification made by the residents using routine radiographs and the classification made by the senior doctors was of 68.75%. But when residents used internal rotation traction radiography, agreement increased to 78.75%.

If changes in the answers are analyzed, in 18 of the 42 cases in which the answer changed to a correct one, this would have meant a modification in surgical management. Twelve of these 18 cases were initially classified as displaced femoral neck fractures, which then changed to stable intertrochanteric fractures. Considering the age of our series, this would have meant treating a stable intertrochanteric fracture with a hip arthroplasty. In the six remaining cases, a stable intertrochanteric fracture changed into a displaced femoral neck fracture, which would have meant treating a femoral neck fracture in an elderly patient with reduction and osteosynthesis. In 24 of the 42 remaining cases, changing the classification of a stable fracture into an unstable fracture would not have had an effect on the choice of the implant due to the fact that, in our Service, the implant of choice for intertrochanteric hip fractures is the proximal femoral nail, regardless of whether the fracture is stable or unstable. However, in Services where a dynamic hip screw (DHS) is used for stable fractures and a proximal femoral nail is used for unstable fractures, this change would have implied a modification in the choice of the implant.

In the nine cases (17.6%) where the internal rotation traction radiograph changed a correct answer into an incorrect answer, in only two patients this change would have had an effect on the choice of treatment: in one of the cases, because a stable intertrochanteric fracture changed into a displaced femoral neck fracture (Figure) and, in the other case, because a displaced femoral neck fracture changed into an undisplaced femoral neck fracture.

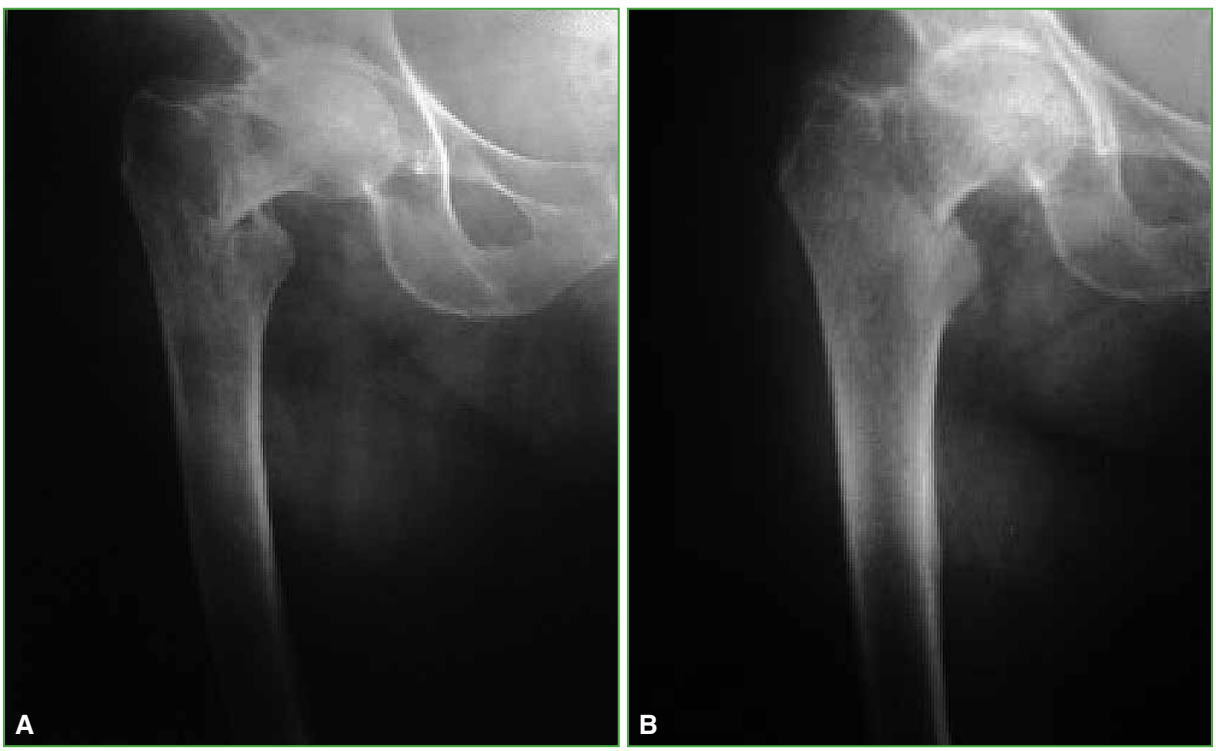

Figure. A. Anteroposterior radiograph without traction. An apparent displaced lateral fracture is observed. **B.** Internal rotation traction radiograph. Medial fracture is observed.

According to our knowledge, few studies analyze the usefulness of internal rotation traction radiograph in proximal femoral fractures. In 1976, Wiltse[9] was the first to mention the usefulness of internal rotation traction radiograph in order to increase detection sensitivity of hidden hip fractures.

In a more recent study, Koval et al.[10] evaluated the usefulness of traction radiograph comparing agreement in the classification of 47 radiographs of fractured hips between residents and senior doctors. There was a 71.9% of agreement without traction radiograph, whereas when internal rotation traction radiograph was used, it increased to 77.9% (p <0,01).

Lastly, in a consecutive series of 78 patients, Khurana et al.[11] proved that precision in classification of proximal femoral fractures increased from 44.9% to 72,4% when internal rotation traction radiograph was incorporated (p <0,001).

We highlight as the main weaknesses of this study the retrospective design and lack of a statistical analysis of the results.

CONCLUSIONS

According to the results obtained we have reached the conclusion that internal rotation traction radiography is a simple, low-cost study that is well-tolerated by the patient and should be performed routinely upon arrival of a patient with proximal femoral fracture, for it facilitates the correct interpretation of the fracture, which has a direct impact on the choice of treatment and implant, and on the potential outcome.

Conflict of interests: Authors claim they do not have any conflict of interest.

S. Pereira ORCID ID: http://orcid.org/0000-0001-9475-3158
G. Vindver ORCID ID: https://orcid.org/0000-0003-3858-6687

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