The Stability of Fixation of Proximal Femoral Fractures: A Radiostereometric Analysis

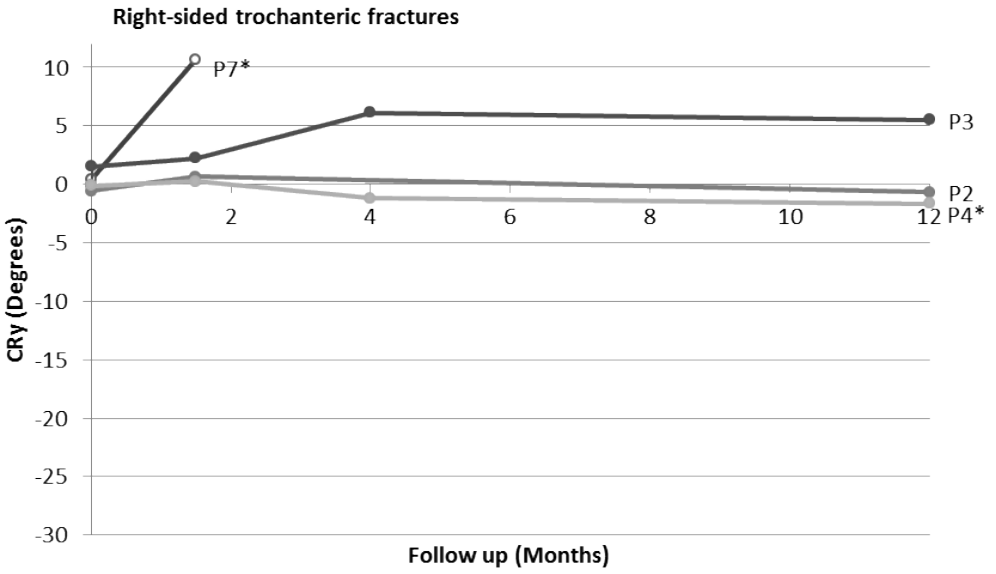
Daphne van Embden, MD[1]*; Guido Stollenwerck, MD*[2]*; Lennard Koster, BS*[3]*;*
Bart Kaptein, MD, PhD[3]*; Rob Nelissen, MD, PhD*[3]*; I.B. Schipper, MD, PhD*[3]*;*
[1]*Leiden University Medical Center / The Hague Medical Center, THE NETHERLANDS;*
[2]*Maastricht University Medical Center, THE NETHERLANDS;*
[3]*Leiden University Medical Center; THE NETHERLANDS*

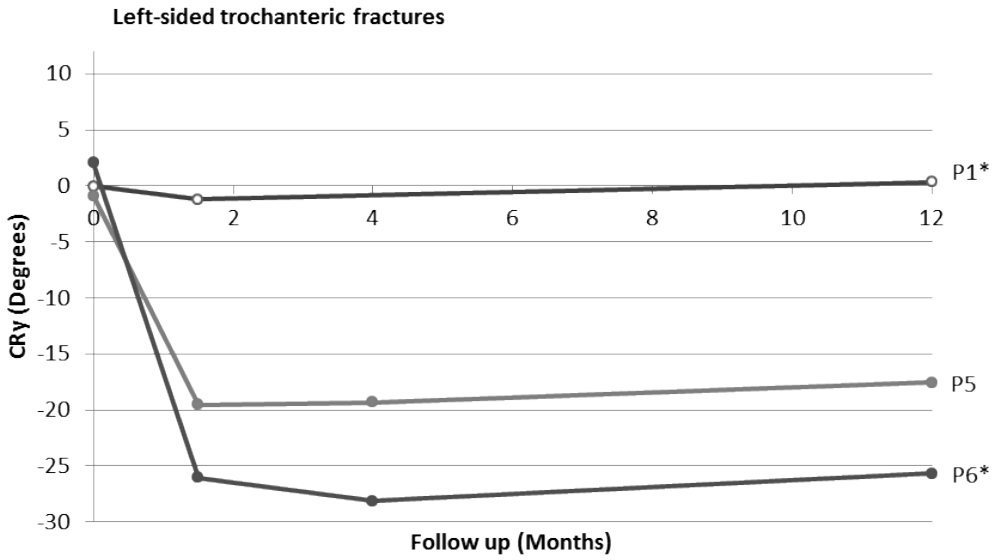
Background/Purpose: Rotational instability of the fracture-implant complex is thought to be a significant cause of fixation failure in proximal femoral fractures and may even be a key denominator and predictor of the most common fixation-related complications. However, the extent of rotational instability in hip fractures treated with modern implants has never been quantified in detail. Rotational instability is difficult to track using standard imaging techniques. However, segment motion (eg, motion between the fracture fragments) can be accurately measured by radiostereometric analysis (RSA). The aim of this study was to use RSA to quantify the movement of proximal femur fragments after fixation with the most commonly used methods of osteosynthesis (GN [Gamma nail], DHS [dynamic hip screw], and CS [cannulated screws]).

Methods: A total of 15 patients with an undisplaced femoral neck fracture (AO31-B1 and B2), treated with either a dynamic hip screw or three cannulated hip screws, and 16 patients with an AO31-A2 trochanteric fracture treated with a dynamic hip screw or a Gamma nail, were included. RSA was used at 6 weeks, 4 months, and 12 months postoperatively to evaluate shortening and rotation.

Results: Migration could be assessed in ten patients with a fracture of the femoral neck and seven with a trochanteric fracture. The RSA migration profiles showed that, until 4 months postoperatively, substantial translational instability is present in both fracture types. After this period stabilization occurs. By 4 months postoperatively, a mean shortening of 5.4 mm (range, -0.04 to 16.1) had occurred in the femoral neck fracture group and 5.0 mm (range, -0.13 to 12.9) in the trochanteric fracture group. A wide range of rotation occurred in both types of fracture. Right-sided trochanteric fractures seem more rotationally stable than left-sided fractures (Fig. 1).

Conclusion: The RSA migration profiles showed that, until 4 months postoperatively, substantial translational instability is present in both nondisplaced femoral neck fractures and AO31-A2 trochanteric fractures treated with the most commonly used implants. Left-sided trochanteric fractures treated by DHS or intramedullary fixation seem to be more rotational instable than right-sided fractures. Since rotation is most probably due to rotation of the medial fragment around the hip screw(s), rotation-preventing screw systems or cement augmentation of the hip screw may prove increasingly important in elderly hip fracture patients with poor bone stock. Future RSA hip fracture research may help develop risk profiles for adverse outcome and quality control tools for optimal fracture reduction and implant positioning.





See pages 47 - 108 for financial disclosure information.