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The Lateral Trochanteric Wall

A Key Element in the Reconstruction of Unstable Pertrochanteric Hip Fractures

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Pertrochanteric hip fractures still are a major orthopaedic challenge, and those that are unstable have the poorest prognosis. Fracture collapse is one of the postoperative complications reported in association with these fractures. My objective was to evaluate possible causes for pertrochanteric hip fracture collapse. Twenty-four patients with documented postoperative fracture collapse were evaluated retrospectively. The findings showed unequivocally that in all patients, this complication followed fracture of the lateral wall and resulted in protracted period of disability until fracture healing. The importance of the integrity of the lateral wall for event-free fracture healing clearly is indicated, and fracture of the lateral wall should be avoided in any fixation procedure. The presence of the lateral wall on the preoperative radiograph should be a major factor in determining the internal fixation device used for fracture stabilization. In unstable pertrochanteric hip fractures, the traditional description of the posteromedial fracture part as the most important prognostic factor should be revised to include the structural description of the lateral wall. Special caution should be taken when drilling at the base of this often delicate structure.

Despite the fact that union rates are high in intertrochanteric hip fractures,[9] functional outcomes tend to be disappointing.[1,7] Members of the American Academy of Orthopaedic Surgeons (AAOS) have expressed concern for hip fracture patients, because approximately 50% of 350,000 patients treated annually in the United States do not regain their prefracture level of mobility.[11] A 60% loss of preoperative independent mobility (or the use of one cane) has been reported in patients with intertrochanteric hip fractures treated with either a gamma nail or a compression hip screw.[1] A combination of factors, such as poorly controlled systemic illnesses, psychiatric illness, and environmental factors are thought to be responsible for this poor result.[7] Many of these factors cannot be addressed at the time of fracture presentation. Because the operative procedure is a major component in the treatment of patients with hip fractures, understanding the causes of failure is integral to any attempt to achieve an improved functional outcome. Fracture collapse is one of the major reasons for failure of fixation of these fractures.[14,2] Defining fracture collapse, in contrast to fracture impaction and controlled fracture impaction, is a first step in understanding the contribution of collapse to failure of fixation after pertrochanteric hip fracture.

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MATERIALS AND METHODS

This retrospective study included all patients seen at a followup clinic during a 12-month period whose pertrochanteric fracture had been treated with a compression hip screw or a dynamic hip screw and had healed with collapse and/or an uneven lateral wall. In addition, patients admitted to my ward for an unrelated orthopaedic condition, but who fulfilled these same criteria in association with an earlier pertrochanteric hip fracture, also were included in the study.

Evaluation included meticulous assessment, by one observer, of preoperative and postoperative radiographs and of radiographs taken at an outpatient followup clinic. Fracture compression was defined in the study as the maneuver done by the surgeon during surgery to compress the fracture site. Fracture impaction was defined as the postsurgical compression provided by a fixation device with a sliding capability, in association with patient weightbearing. Controlled fracture impaction was defined as when, in addition to a sliding capability, torsional stability also was conferred by the fixation device. Therefore, rotational stability was the factor that differentiated between fracture impaction and controlled fracture impaction. Controlled fracture impaction particularly is important for the maintenance of stable reduction during fracture healing, and is compatible with the subsequent dynamic events of cyclic loading and remodeling across the fracture line. Fracture collapse, in contrast, was defined as fracture impaction—displacement, also termed uncontrolled fracture impaction, with loss of reduction and/or additional fracture in the subtrochanteric region or the lateral wall.[6]

RESULTS

Twenty-four patients were included in the study: 22 women and two men, with a median age of 74 years (range, 56–92 years). All patients had a period of severe postoperative disability until fracture healing.

Fracturing of the lateral wall resulted in collapse in all cases. Radiologically, before the operation all fractures had an intact lateral wall (Fig 1A). However, at followup. The lateral wall was broken at the barrel drilling site of the compression hip screw/dynamic hip screw (Fig 1B), and had migrated proximally. The femoral head and neck had collapsed, and the lag screw protruded laterally (Fig 1C–D). A similar sequence of failure is illustrated in Figure 2. The three-part or four-part fracture had been converted to a four-part or five-part fracture, respectively, in which all regions of the trochanteric area were broken. Hence, fracturing the lateral wall resulted in collapse and deterioration in the nature of the fracture. This apparent vulnerability of the lateral wall was the outstanding feature common to all the patients. In all 24 patients, a similar radiologic and clinical pattern was observed.

DISCUSSION

Several characteristics make lateral wall fracture a distinct entity: it is a complication caused by a surgical procedure, resulting in a deterioration in the pattern of the fracture. My study unequivocally showed that large diameter (barrel) drilling fractures the lateral wall, resulting in fracture collapse. This complication should be acknowledged and avoided. Preoperative 31-A2 fractures were converted to 31-A3 pertrochanteric fractures in which all trochanteric parts are broken.[12]

This extremely unstable fracture results in a severe and prolonged period of postoperative disability (Fig 1). If this complication is not recognized, all patients with healed 31-A2 fractures would be regarded as having optimal results, although some results clearly are suboptimal because patients had an exceptionally extended, painful healing process.

This study involved a relatively small number of patients, but uniform clinical and radiologic picture in all the patients provides valuable information and identifies a possible surgical complication that may occur in some unstable pertrochanteric fractures. After reduction has been achieved, it is important not to impair or jeopardize this delicate situation by the introduction of potentially damaging surgical tools or implants. If additional fractures occur after internal fixation of a pertrochanteric hip fracture, the prospects for the patient are worsened. Subtrochanteric fractures have been reported after intramedullary nailing.[3,13,15] Fracture of the lateral wall as described in this study has similar consequences.

Traditionally, the medial and posteromedial fracture fragments have been considered to be the important ele-

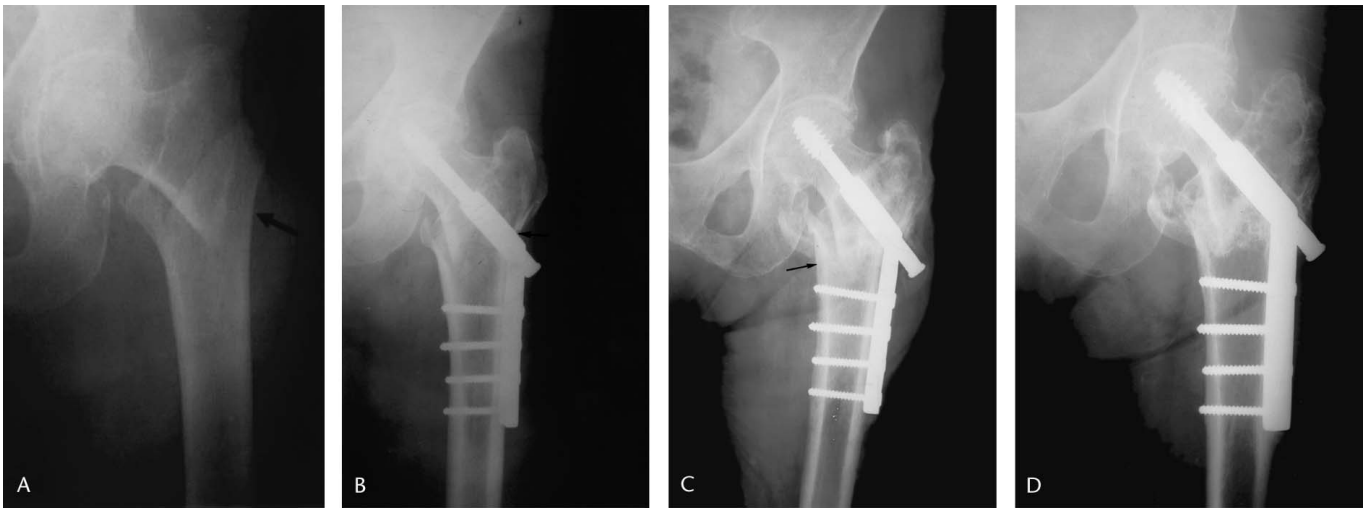

Fig 1A–D. These radiographs show an unstable pertrochanteric fracture treated with a compression hip screw, where after surgery the fracture has collapsed. (A) A preoperative radiograph shows a sound lateral wall (black arrow). (B) An anteroposterior image shows a fracture of the lateral wall at the compression hip screw drilling site (arrow), caused fracture collapse after the patient started walking. The fracture pattern has deteriorated, resulting in marked instability. (C) An anteroposterior image taken 3 months after surgery shows that persistent instability has caused additional fracture collapse with increased medialization (arrow) and additional lag screw protrusion laterally, with marked soft tissue swelling. (D) Fracture healing is shown 9 months after surgery. The patient had an exceptionally long period of disability.

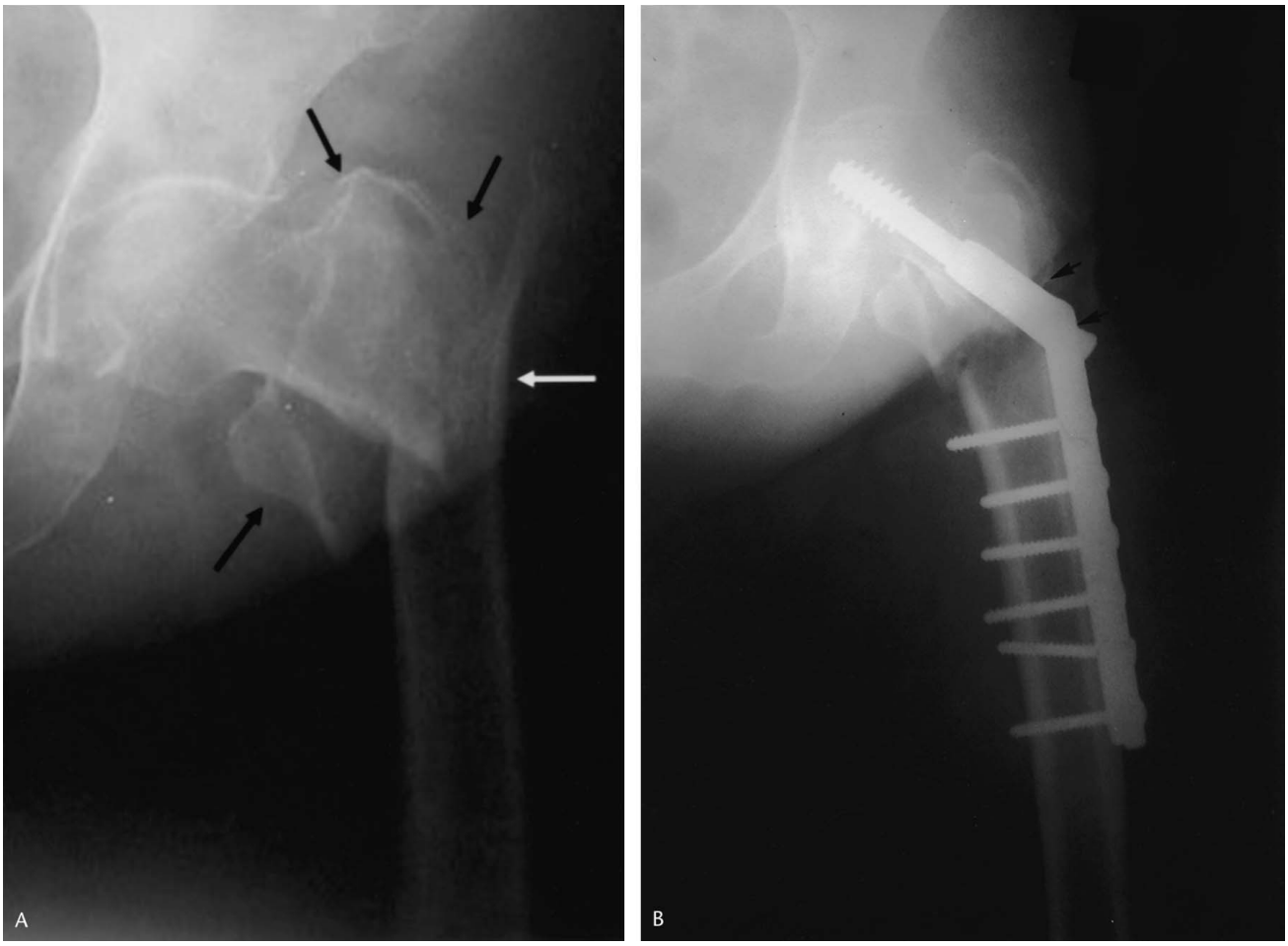

Fig 2A–B. These radiographs show an unstable four-part pertrochanteric fracture. (A) Preoperative radiograph shows displaced posteromedial fragments (black arrows). Traditionally, these fragments have been considered to be the most important prognostic factor. However, the lateral wall (white arrow) is the only (and therefore the most important) structure left for reconstruction. (B) An immediate postoperative radiograph shows the fractured lateral wall at the compression hip screw barrel drilling site (arrows). This additional, surgical, damage resulted in deterioration of the fracture pattern. The lateral wall, therefore, is more important in a reconstructive context than the posteromedial fragment, and should be preserved carefully to avoid jeopardizing the stability of the reduced fracture.

ments in determining the severity of the intertrochanteric hip fracture.[4] This is true, but only in assessing the extent of the bony damage. The trochanteric portion that is not broken, and is retained for fracture reconstruction, namely, the lateral wall, also is important. The lateral wall is the proximal extension of the femoral shaft. In an unstable three-part or four-part pertrochanteric hip fracture, the lateral wall is a fragile bony structure. It is this region that provides the best opportunity for osteosynthesis with the proximal part of the fracture complex (Figs 1, 2). It cannot be overemphasized that fracture of this delicate structure will convert a pertrochanteric fracture into a subtrochanteric fracture equivalent, which is a more severe problem, and therefore should be avoided.

An intact lateral wall plays a key role in the stabilization and fixation of unstable pertrochanteric hip fractures. By providing a lateral buttress for the proximal fragment, fracture impaction is facilitated, and followed by rotational and varus stability after fracture spike impaction occurs. If the lateral wall is broken, there is no lateral buttress for the proximal neck fragment and collapse will occur. Lateral wall fracture may occur during surgery[5,10] or after surgery.[10] Collapse has been reported to be a major contributor to postoperative morbidity because it is followed by a long period of disability[2,14] (Fig 1). Because of the nature of this complication, it has been considered to be a distinct entity: the pantrochanteric fracture.[5] The characteristics of this condition are: an intact lateral wall that is fractured at

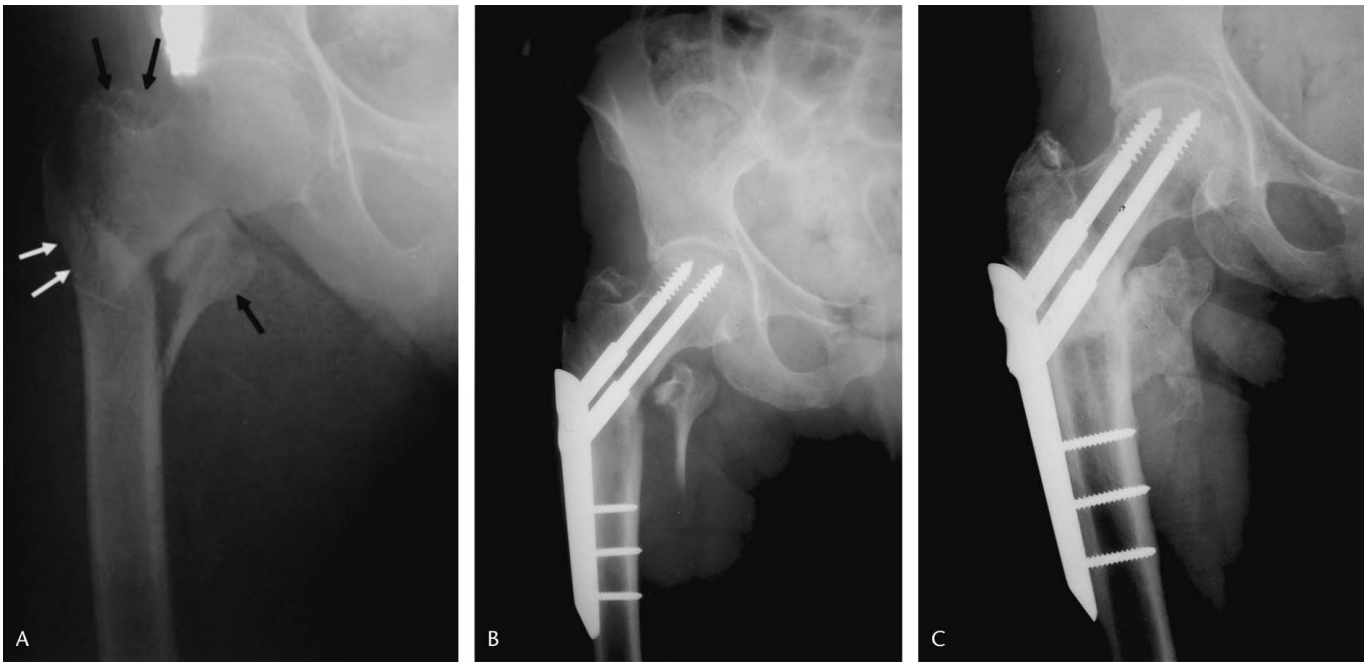

Fig 3A-C. These radiographs show a four-part unstable pertrochanteric hip fracture stabilized with the percutaneous compression plating. (A) A preoperative radiograph shows the delicate lateral wall (upper white arrow) and posteromedial comminution (black arrows). Large diameter drilling at the base of the lateral wall (lower white arrow) may jeopardize this structure. If fractured, the fracture will deteriorate to a subtrochanteric equivalent. (B) An immediate postoperative radiograph shows a well-preserved lateral wall. (C) Fracture union was achieved 4 months after surgery. The patient was allowed immediate full weightbearing postoperatively.

the drilling site of a compression hip screw/dynamic hip screw fixation device in an unstable pertrochanteric hip fracture. It is considered a complication of surgery; a lateral wall fracture is followed by collapse; a pertrochanteric fracture has deteriorated to a subtrochanteric fracture equivalent; these complications, occurring during or after surgery, result in a long period of disability.[6]

The pantrochanteric fracture may be responsible, in part, for the large number of patients who lose the ability to walk independently after surgery because of the long period of immobilization associated with it.[1,2] No lateral wall damage or fracture collapse were reported with the use of percutaneous compression plating in patients with pertrochanteric hip fractures[6,8] (Fig 3). This was attributed to the small diameter of the holes at the drilling site with percutaneous compression plating. In addition, incremental drilling from 7–9.3 mm, compared with the nonincremental drilling of 16 mm or as much as 32 mm drilling required for the screw barrel of the dynamic or compression hip screw, also were considered beneficial in minimizing trauma to the lateral wall.[5,8]

The results described in this retrospective study are important, and there clearly is a need for an additional prospective study to establish the precise relationship between dynamic hip screw/compression hip screw fixation of unstable pertrochanteric hip fractures, lateral wall damage, fracture collapse, and functional results.

Twenty-four patients with radiologic evidence of fracture collapse after unstable pertrochanteric fracture fixation with a compression hip screw/dynamic hip screw were evaluated retrospectively. In all patients, fracture of the lateral wall, which was intact preoperatively, was responsible for this complication. Therefore, maintaining the integrity of this structure should be a major objective in all surgical stabilization procedures for unstable pertrochanteric fractures.

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