Failure of the Vari-Angle Hip Screw System: Two Cases

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Peritrochanteric hip fractures are among the more common fractures treated by orthopedic surgeons. The compression hip screw (CHS) was a significant advance in the treatment of these injuries. However, this classic implant now has several modifications,[1] including the Vari-Angle Hip Screw System (VHS®; Biomet Trauma, Warsaw, Ind). The CHS and the VHS are based on the same principles, but with the VHS the neck-shaft angle of the side plate can be varied during surgery, which means that not as much inventory is required.[2]

The literature includes few reports on the VHS, and the manufacturer asserted that its biomechanical studies have failed to show any failures of the variable-angle side-plate mechanism.[2] Here we report 2 cases in which the VHS failed by varus angulation of the side plate after insertion.

Case Reports

Case 1

A woman in her mid-80s sustained a left peritrochanteric hip fracture after a slip and a fall. After appropriate medical clearance, she was treated with reduction on a fracture table and insertion of a VHS. Her original postoperative radiographs were felt to show satisfactory fracture reduction and implant position (Figure 1). She tolerated the procedure well and without complications and was allowed to weight-bear as tolerated after surgery. Although her initial recovery progressed without event, 4-month follow-up radiographs showed varus collapse of the side plate without change in the femoral head or shaft fixation (Figure 2). The patient healed with a varus malunion and had shortening of the involved leg. She was treated with a shoe lift and ambulated with a cane 21 months after injury.

Case 2

A woman in her early 70s sustained a right peritrochanteric hip fracture after a slip and a fall. She was initially stabilized with a CHS, but this device failed. The treatment was revised with an open medial displacement osteotomy, autogenous bone grafting, and insertion of a VHS device (Figure 3). The patient returned 2 years later with complaints of increased shortening of the right leg and progressive hip pain. Radiographs at that time, compared with original radiographs, showed some controlled collapse of the lag screw as well as varus collapse of the barrel–side-plate angle (Figure 4). The radiographs also showed femoral head changes consistent with avascular necrosis. The treatment was subsequently revised to a calcar-replacing total hip arthroplasty. Gross inspection of the retrieved implant revealed no obvious deformation or damage, and the barrel–side-plate mechanism was still adjustable.

Discussion

It is estimated that up to 500,000 hip fractures occur annually in the United States.[3] This number can be expected to increase as the US population ages. Intertrochanteric fractures may constitute up to half of these injuries.[3] Prompt surgical treatment has been recommended to decrease morbidity and mortality in these patients.[4]

The CHS remains a popular treatment for many intertrochanteric hip fractures.[1,5-8] However, it is a construct best suited for treatment of stable fractures that do not have posteromedial comminution, reverse obliquity, or subtrochanteric extension. Unstable fracture patterns are

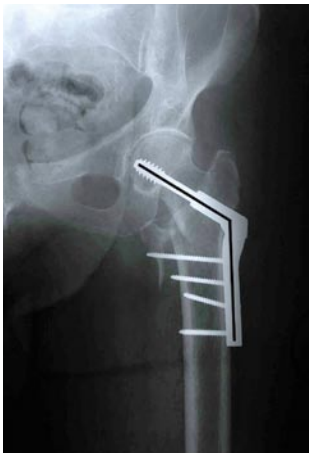

Figure 1. Case 1—Immediate postoperative radiograph of Vari-Angle Hip Screw System (VHS®; Biomet Trauma, Warsaw, Ind) hip screw for treatment of left hip peritrochanteric fracture. Measured implant angle is 120°.

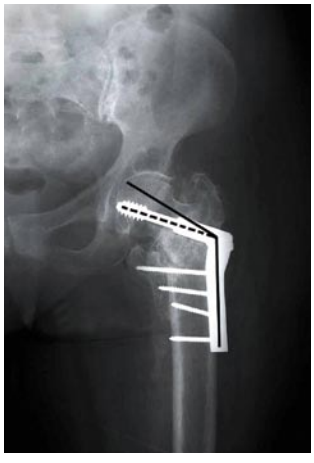

Figure 2. Case 1—VHS at 4-month follow-up showed varus collapse of variable-angle side-plate mechanism without loss of fixation in femoral head or shaft. New angle is 109°.

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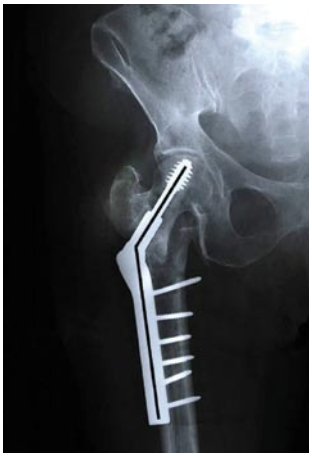

Figure 3. Case 2—Immediate postoperative radiograph of revision open reduction internal fixation with VHS for failed compression hip screw. Angle is 143°.

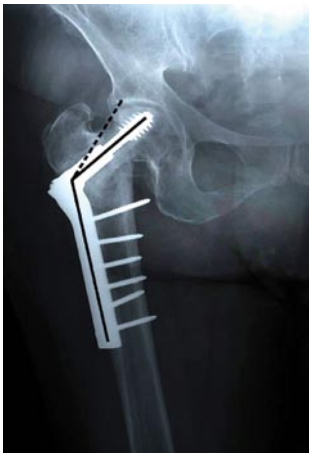

Figure 4. Case 2—At 2-year follow-up, lag screw showed collapse within barrel and clear change in neck-shaft angle of VHS. New angle is 120°.

best treated with either an intramedullary implant[1,3,7,9,10] or a 95° fixed-angle plate.[11]

The most common complication of CHS fixation, femoral head cut-out,[6,12] most often occurs with incomplete reduction of the fracture and malposition of the implant.[6,12] Femoral head lag screws are more likely to cut out if placed too far from a center-center position on both anteroposterior and lateral radiographs or if the tip apex distance is more than 25 mm.[12-14] Fracture instability, generalized osteoporosis of targeted bone, patient age, and a high-angle (≥150°) side plate are other important factors that may lead to fixation failure.[4,10]

The primary difference between the CHS and the VHS is that the latter allows for an adjustable angle between the barrel and the side plate and therefore allows the surgeon more versatility in accommodating a patient's specific anatomy and femoral shaft angle. As the side-plate angle can be adjusted after lag-screw placement, the VHS can allow for valgus angulation reduction of the fracture. Overall inventory is also reduced, as separate angled side plates become unnecessary.

According to the manufacturer's studies, the VHS has had no failures of its adjustable side plate.[2] To our knowledge, the literature includes few reports on use of this device. In a biomechanical study using the VHS, Chaim and colleagues[15] found that, with an applied load, more bending and shear occur at femoral head angles of 135°, and more fracture compression occurs at 150°.

In both our patients' cases, it could be argued that different implants should have been used for fracture fixation. Case 1 shows subtrochanteric involvement, and case 2 represents an attempt to salvage a failed CHS. Nevertheless, both cases clearly illustrate that, when used for unstable peritrochanteric fracture patterns, the barrel–side-plate angle of the VHS can collapse into significant varus. This outcome goes against the manufacturer's claims. The precise mechanism that allows for the angle to change without manual adjustment is unclear, but it may involve cyclic, in vivo forces focused at the internal adjustable ratchet mechanism of the implant. This phenomenon does not occur in standard CHS implants. Further study may elucidate a precise mechanism for this failure.

Conclusions

The 2 cases reported here show that the VHS may not be able to maintain a specific barrel–side-plate angle determined at time of surgery for peritrochanteric hip fractures, and it should be used with caution in unstable peritrochanteric fracture patterns.

Authors' Disclosure Statement

The authors report no actual or potential conflict of interest in relation to this article.

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This paper will be judged for the Resident Writer's Award.