Vascular injuries in conjunction with low-energy geriatric hip fractures, although uncommon, can be life-threatening. Furthermore, vascular injuries are usually iatrogenic, related to malpositioning of percutaneous reduction aids, aberrant drilling, or poorly sized implants. The authors describe an older woman who had a low-energy pertrochanteric hip fracture. She was noted preoperatively to have an isolated decrease in hemoglobin of 4.7 g/dL in the 2.5 days before surgery. Fracture reduction was performed with closed and percutaneous techniques with the limb free-legged on a radiolucent flat-top table. On reduction of the distal fragment (which was translated proximal and medial), extremely brisk bleeding was noted from the fracture site. Vascular control was obtained with subvastus exposure through the fracture site to gain access to the medial aspect of the thigh. A pulsatile traumatic laceration in the profunda femoral artery was identified, and the ends were ligated. The fracture was then fixated internally. Careful analysis of preoperative imaging showed the distal fracture fragment in immediate proximity to the calcified profunda femoral artery, transecting it at the time of injury and resulting in the significant increase in hemoglobin noted preoperatively. This case is an unusual vascular injury associated with a very common geriatric fracture pattern. To the authors’ knowledge, there are only 2 cases in the English language literature of acute vascular injury as a result of a proximal femur fracture fragment. Given the routine nature of geriatric hip fractures, the orthopedic surgeon must be familiar with the appropriate diagnosis and management of this major complication. [Orthopedics. 2015; 38(1):e75-e79.]
Geriatric hip fractures are among the most common injuries treated by orthopedic surgeons.\(^1\)\(^2\) Typically, these are low-energy injuries with well-described risk factors, such as low bone mineral density, history of falls and fragility fractures, low body mass, and northern European descent.\(^3\)\(^5\) Understanding these injuries is critical for orthopedic surgeons with on-call responsibilities. Further, the Accreditation Council for Graduate Medical Education recently published minimum graduation requirements for hip fracture procedures. All residents are required to perform a minimum of 30 hip fracture surgeries before completion of an orthopedic residency accredited by the Accreditation Council for Graduate Medical Education.

Geriatric hip fractures are life-altering injuries for many patients and carry an associated 1-year mortality rate of 20% to 30%.\(^1\)\(^6\)\(^7\) They are also highly associated with postoperative morbidity, including urinary tract infection, venous thromboembolism, pneumonia, and acute renal dysfunction.\(^8\)\(^11\) The morbidity and mortality rates of geriatric hip fractures are well defined in the literature. A PubMed search using the MeSH terms “hip fracture” and “morbidity” and “hip fracture” and “mortality” returned more than 1800 indexed articles. This extensive body of literature is countered by relatively few reports of intraoperative complications of hip fracture surgery, most of which described iatrogenic vascular injuries related to malpositioning of retractors and percutaneous reduction aids, aberrant drilling, and poorly sized implants.\(^12\)\(^13\) Furthermore, nearly 75% of these reported vascular injuries occurred when arthroplasty was the treatment modality.\(^18\) Considerably fewer reported complications were attributed to displaced fracture fragments. Mauerhan et al\(^19\) and Yang et al\(^20\) reported acute vascular injuries by displaced hip fracture fragments, and Keel and Eyres\(^21\) and Tomcovic\’\’\’\’\’k et al\(^22\) reported delayed vascular injuries that were noted postoperatively by the finding of displaced lesser trochanter fracture fragments.

The authors describe a 79-year-old woman who presented to their institution with an AO/Orthopedic Trauma Association 31-A3.3 pertrochanteric hip fracture. During reduction, substantial bleeding and hemodynamic instability occurred. Careful analysis of preoperative images showed traumatic laceration of the atherosclerotic deep femoral artery that only became life-threatening intraoperatively when fresh clot and tamponading hematoma were disrupted.

Given the routine nature and extremely high frequency of these fractures, the authors believe that it is important to recognize this associated complication because a profound femoral artery laceration is truly a life-threatening intraoperative condition. The authors also describe the approach they used to achieve vascular control.

**CASE REPORT**

A 79-year-old woman with a history of coronary artery disease, hypertension, and osteoporosis presented to the authors’ hospital after a fall with an isolated injury to the right proximal femur. Injury radiographs (Figure 1) showed an apex anterior pertrochanteric hip fracture with significant medial displacement and comminution of the posteromedial cortex. Operative management was delayed until hospital day 3 because of ongoing medical clearance. Hemoglobin on admission was 13.4 g/dL. Repeat hemoglobin 2.5 days later, on the morning of surgery, was 8.7 g/dL (decrease of 4.7 g/dL). This decrease did not appear to be dilutional because the patient did not require aggressive hydration on admission and showed no concomitant drop in electrolytes or other blood fractions. Physical examination preoperatively showed an expected amount of diffuse thigh swelling; however, there was no evidence of a tense or expanding thigh hematoma or compromising vascular injury.

The patient underwent surgery 2.5 days after admission. Surgery was performed with the patient free-legged and supine on a radiolucent flat-top table. Before placement of a cephalomedullary device, mini-subvastus exposure to the proximal femur was made to perform open reduction. Once exposed, a medium Weber clamp was carefully placed on the proximal aspect of the distal fragment (Figure 2). Gentle lateral traction through the clamp was applied to approximate the fracture ends. Immediately, aggressive pulsatile bleeding from the fracture was noted. The lateral incision was extended proximally and distally, and a retractor was placed between the fracture ends to allow full access through the fracture to
the medial aspect of the proximal thigh. A significant amount of old clot was re-
moved, allowing visualization of 2 large pulsatile arterial ends. Provisional con-
trol was achieved with proximal and dis-
tal clamps, and the soft tissue bed was explored. The accompanying vein was
identified and determined to be intact. Finally, the lacerated arterial ends were
double ligated with heavy silk sutures,
and the clamps were removed. The femur
was expeditiously nailed in standard fash-
on, and the lateral wounds were closed.
During the aggressive bleeding episode,
the patient was hemodynamically unsta-
ble and had ventricular tachycardia with
hypotension. Distal flow was not pres-
et; however, once vascular control was
achieved and the patient was resuscitated,
triphasic Doppler flow signals were found
in both the dorsalis pedis and posterior
tibial arteries. Intraoperative angiogram
of the involved extremity was performed
after fixation of the femur and showed a
profunda femoral artery flow void with in-
tact 3-vessel distal circulation. The patient
was fully resuscitated in the intensive care
unit and had adequate distal vascular flow
throughout the hospitalization. She was
discharged on postoperative day 10. Post-
operative plain radiograph showed accept-
able reduction (Figure 3).

DISCUSSION
To the authors’ knowledge, this is one
of only 3 reported case series describ-
ing acute vascular injury as a result of
a displaced pertrochanteric hip fracture
fragment. Mauerhan et al described
a 54-year-old man who had an inter-
trochanteric hip fracture. During operative
reduction of the fracture, brisk bleeding
was noted. A separate anterior groin inci-
sion was made, and a profunda femoral
artery laceration was identified and sub-
sequently repaired with end-to-end anas-
tomosis. Yang et al similarly described
an 82-year-old woman who had a sub-
trochanteric femur fracture. On reduction
of the fracture with a reduction clamp,
brisk bleeding was noted. The bleeding
vessel could not be identified through
the lateral incision. The wound was ulti-
mately packed and closed, and the patient
subsequently underwent embolization of
a small branch of the profunda femoral
artery.

This report is unique because of the
preoperative history and novel emergent
management of an unstable vascular inju-
ry. Careful evaluation of the radiographs
showed a profunda femoral artery tran-
section at the level of the fracture (Figure
4). Additionally, retrospective analysis of
the preoperative images clearly showed
an extremely sharp and jagged proximal
medial spike in the immediate proximity
of the calcified profunda femoral artery
(Figure 5). This preoperative radiograph-
ic finding, in conjunction with a massive

Figure 2: Intraoperative anteroposterior fluro-
scopic image showing the reduction maneuver in
which a medium Weber clamp is carefully placed
around the medial aspect of the fracture. Vascular
instability occurred at this moment, in which there
was reduction of the fracture and disruption of the
tamponading fracture hematoma.

Figure 3: Postoperative anteroposterior plain ra-
diograph showing acceptable fracture reduction
and placement of a cephalomedullary device.

Figure 4: Magnified anteroposterior view of the
postoperative plain radiograph showing vascular
clips (arrows) above and below the transected seg-
ment of the profunda femoral artery at the level of
the fracture.
(4.7 g/dL) decrease in hemoglobin, pointed toward an acute arterial injury at the time of proximal femur fracture. Physical examination preoperatively showed swelling of the thigh; however, given the massive fluid volume that can be distributed in the thigh and the patient’s redundant soft tissue, physical examination findings did not suggest a significant vascular injury. Had this constellation of findings been appreciated preoperatively, the patient may have undergone embolization before open reduction, perhaps preventing an unstable intraoperative event.

To the authors’ knowledge, the unique approach to managing the intraoperative complication is not described in the English literature. To gain control medial to the proximal femur fracture, the authors retracted the proximal and distal fracture ends to gain a transfracture view of the medial thigh, rather than creating a separate incision anteriorly in an area, which is generally foreign to orthopedic surgeons. In the emergent situation, this exposure afforded full access to the transected vessel, allowing for rapid vascular control and definitive stabilization. The morbidity associated with this approach was minimal because the fracture previously had been displaced by the initial injury. A larger than typical skin incision was used, but was tolerated extremely well.

The authors’ decision to definitively ligate rather than reconstruct the profunda femoral artery was based on the well-perfused limb, diagnosed both clinically and angiographically, as well as an intraoperative vascular consultation. Had the limb been dysvascular, arterial reconstruction would have been indicated. Expendable vessels of the lower extremity include the superior gluteal artery, inferior gluteal artery, lateral femoral circumflex artery, and muscular branches of the profunda femoral artery.

In several situations, vascular injury occurs in conjunction with a hip fracture. Most commonly, the vascular injury takes place during arthroplasty for fracture and is related to aberrant retractor placement, cement spiculae, and thermal injury as a result of hardening cement or aggressive reaming. The subsequent amputation rate in these patients is approximately 7%. This is followed by iatrogenic injury because of overdrilling and excessively long screw placement, with a slightly higher amputation rate of 12%. Delayed vascular injury has also been described as resulting from a migrating lesser trochanter fragment that either lacerates or compresses the profunda femoral artery, although delayed presentation can also result from imprecise drilling. Tomcovic et al described a similar case in which the displaced lesser trochanter perforated the superficial femoral artery, ultimately resulting in a dysvascular limb requiring amputation. A recurring theme in many reported cases is atherosclerosis and its likely important role in affecting vessel compliance, resulting in traumatic injury.

**CONCLUSION**

Given the frequency with which hip fractures are seen and managed operatively by residents and attending surgeons, orthopedic surgeons must be able to recognize and appropriately manage vascular injuries in both acute and delayed settings. The authors present an unusual case of a vascular injury caused by a fracture fragment that occurred at the time of injury but only became obvious during operative reduction and was emergently and effectively managed with a transfracture approach to the medial thigh.

**REFERENCES**


