

Thrombosis of the Superficial Femoral Artery following Fixation of Intertrochanteric Fracture of the Femur using a Dynamic Hip Screw

Sumedh D Chaudhary¹, Santosh D Ghoti¹

Learning Point of the Article:

Even seemingly simple trauma surgeries can land up in catastrophic vascular complications, if due care is not taken during patient positioning and instrumentation

Abstract

Introduction: Vascular injuries in orthopedic surgery are relatively rare but potentially limb and life threatening. They are most commonly encountered in knee and hip arthroplasty but also have been reported in trauma surgeries. Pertrochanteric fractures of proximal femur are among the most common fractures encountered in elderly osteoporotic patients. Positioning on fracture table, traction, and reduction maneuvers employed during fixation of these fractures, place the vessels at risk by bringing them closer to the bone. Iatrogenic vascular injuries can occur if adequate care is not taken during instrumentation for fracture fixation.

Case Report: We are reporting a case of 62 years female who underwent fixation of an intertrochanteric fracture of femur using a dynamic hip screw (DHS) and subsequently started developing ischemic changes in the operated lower limb on the 3rd post-operative day. Angiography revealed thrombosis of the superficial femoral artery at the level of the third screw of the DHS and the patient ultimately landed up with an amputation.

Conclusion: Operating surgeon should be aware of the risk of iatrogenic vascular injury during fixation of pertrochanteric fractures. Good surgical technique and simple precautionary measures can minimize the risk of this devastating complication.

Keywords: Vascular injury, pertrochanteric fractures, complication, dynamic hip screw, thrombosis.

Introduction

The incidence of vascular complications in orthopedic surgery has been reported to be between 0.005% and 0.5% [1, 2, 3]. They most commonly occur in the knee followed by hip arthroplasty, spinal surgery, knee arthroscopy, and fixation of long bone fractures and most commonly involve the popliteal, followed by the tibial, superficial femoral, iliac, common, and profunda femoris arteries. Vascular injuries usually include lacerations, pseudoaneurysms, thrombosis, and arteriovenous fistulae secondary to inappropriately placed retractors or direct vascular injury [1, 4].

With increasing life expectancy, incidence of pertrochanteric fractures is on the rise in elderly osteoporotic patients. Standard

treatment of these fractures consists of closed reduction on a traction table and fixation with either a dynamic hip screw (DHS) or a cephalomedullary nail (CMN). Close proximity of the vessels to the medial aspect of proximal femur, especially due to positioning on traction table and reduction maneuvers involving adduction and internal rotation, may predispose them to injury. Pre-existing atherosclerosis with thickened non-compliant vessel walls makes the arteries more prone to injuries. We are reporting a rare case of a 62 years female who developed thrombosis of the superficial femoral artery (SFA) following fixation of an intertrochanteric fracture of the femur using a DHS. We elaborate on the possible mechanisms which may lead to vascular injury during fixation of pertrochanteric fractures

Author's Photo Gallery



Dr. Sumedh D Chaudhary



Dr. Santosh D Ghoti

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¹Department of Orthopaedics, Indira Gandhi Government Medical College, Nagpur, Maharashtra, India

Address of Correspondence:

Dr. Sumedh D Chaudhary,
Department of Orthopaedics, Indira Gandhi Government Medical College, Nagpur, Maharashtra, India.
E-mail: sumedhchaudhary@yahoo.com





Figure 1: Clinical picture of the patient showing ischemic changes in distal part of operated lower limb.

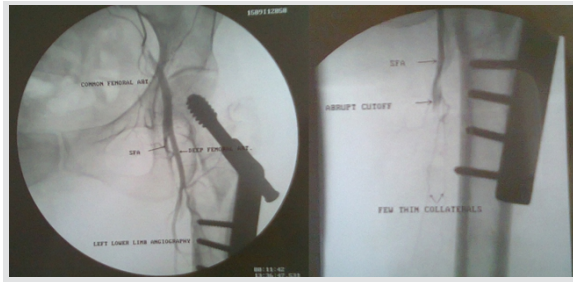


Figure 2: Computed tomography angiography films showing abrupt cutoff of blood flow in superficial femoral artery at level of the third screw of dynamic hip screw.

posterior tibial vessels. As there was no facility of vascular intervention where the patient was operated, it being a small nursing home at a remote place, the patient was referred to our tertiary care center. The patient came to our hospital on the 7th post-operative day. On examination, the patient had discoloration of skin over the left lower limb up to the mid-thigh

and suggest some measures which can be taken to minimize the risk of this dreaded complication.

Case Report

A 62-year-old female had a low-energy fall at home, with trauma to the left hip region followed by inability to stand or walk. She was taken to a nursing home at her native place and X-rays done there, revealed an intertrochanteric fracture of neck of the left femur. There were no other skeletal injuries. The patient was a known case of hypertension, on medication for the past 7 years. She did not have any other medical comorbidity. She was not receiving any blood thinners. The patient was investigated and operated the next day by an orthopedic surgeon. The patient underwent fracture fixation using a DHS, on fracture table under spinal anesthesia. As per the information mentioned in the discharge card, intraoperative period was uneventful. The patient was transfused two units of packed red cells in post-operative period. On the 3rd post-operative day, the patient started developing discoloration of the toes and foot of the operated lower limb. Color Doppler done the following day revealed the absence of flow in popliteal, anterior tibial, and

with evidence of dry gangrene up to middle third leg (Fig. 1). Peripheral pulses were not palpable on the affected lower limb and the patient had absence of sensation over the foot and leg. Vascular surgeon was consulted; he advised a computed tomography (CT) angiography which revealed abrupt cutoff of flow in SFA (Fig. 2). The level of cutoff was corresponding to the level of the third cortical screw of the DHS plate. There was no significant collateral circulation. As the patient presented late with changes of gangrene already set in, the limb could not be salvaged and the patient landed up having to undergo an amputation.

Discussion

Incidence of arterial injury during fixation of proximal femoral fractures has been reported to be from 0.21% to 0.49% [5, 6]. Although injury may be due to non-iatrogenic causes such as displaced lesser trochanter or other bone fragments, majority are iatrogenic presenting as either pseudoaneurysm or acute hemorrhage and rarely leading to thrombosis. Mostly extrapelvic vessels are involved with high prevalence of injury to

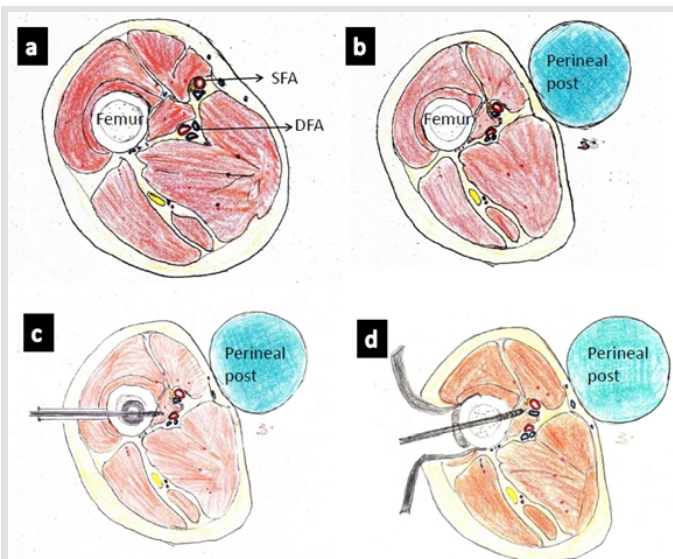


Figure 3: Cross-section of upper thigh showing. (a) Superficial femoral artery (SFA) and DFA in close relation to medial aspect of femur. (b) Reduction maneuvers with adduction and internal rotation bringing SFA in a more medial position and very close to medial aspect of femur due to being pushed by perineal post. (c) Drilling for distal screw of short cephalomedullary nail through distal targeting device, more likely to injure DFA. (d) Cortical screw for DHS plate if drilled in slightly anterior direction may injure the SFA instead of DFA.

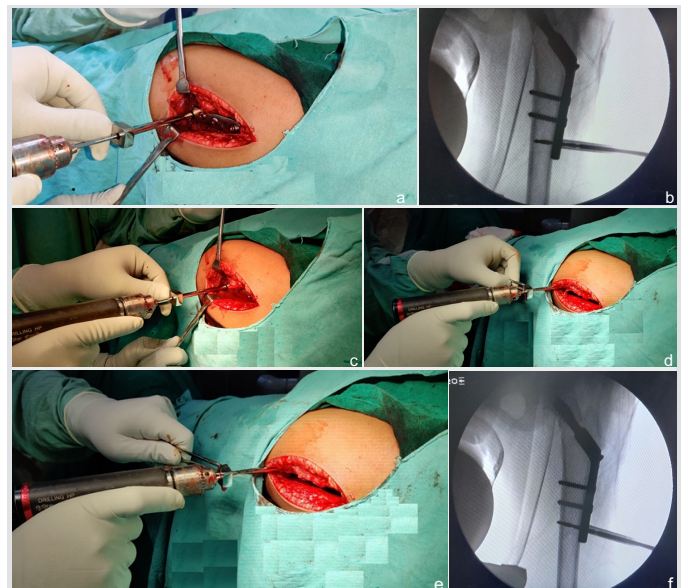


Figure 4: Using drill sleeve as a stopper to prevent overpenetration of medial cortex. (a) Clinical picture of drilling of lateral cortex. (b) IITV image on drill bit reaching medial cortex. (c) Clinical picture showing length of drill bit on reaching medial cortex. (d) Readjusting length of drill bit to 7-8 mm from drill sleeve. (e) Drill sleeve acting as stopper to prevent overpenetration. (f) IITV image showing appropriate length of drilling without any medial overpenetration.



the deep femoral artery and its branches (78.31%) and less commonly involving the superficial femoral vessels (10.84%) and other arteries of the thigh. Intrapelvic vessel injury may be seen with intrapelvic protrusion of guide wires or post-operative migration of implants [6].

The femoral artery and its branches run close to the medial aspect of femur and maneuvers for closed reduction of pertrochanteric fractures make them more vulnerable to injury (Fig. 3a). Traction potentially fixes these arteries because of elongation and also compresses them between the perineal post and the bone [6]. Adduction and internal rotation bring the SFA within 5 mm of medial cortex of subtrochanteric femur as opposed to 14 mm when limb is in neutral position [7]. Oversized perineal post also pushes the medial soft tissues to the shaft and may reduce the distance between the vessels and the medial cortex (Fig. 3b). Manipulation of fracture fragments, incorrect placement of retractors, clamps, cerclage wires, or inadvertent over penetration of medial cortex of femur by drill bits and too long screws may injure the vessels. These injuries are usually seen corresponding to the third or fourth hole of the DHS plate or the hole for the locking screw of a short CMN [6]. When using a CMN, the trajectory of distal screw is fixed and determined by the distal targeting device and the direction of drilling is more likely to injure the DFA (Fig. 3c). When using a DHS, the surgeon can pass the cortical screws angled slightly anteriorly or posteriorly. An overshoot drill bit while drilling in an anteriorly directed trajectory may injure the SFA, rather than the DFA (Fig. 3d). Anatomical variations of intra- and extra-pelvic arteries may pose further risk for this complication [8].

Elderly patients with atherosclerotic vessels are more prone to these injuries because the rigid arterial wall does not yield and compression or stretching of atherosclerotic arteries may lead to injury to the brittle endothelium, rupture of plaques, and dislodgement of emboli leading to arterial thrombosis [6,9].

Clinical presentation of vascular injury depends on mode of injury. Even in high-volume orthopedic centers, these injuries are frequently not recognized until after the day of surgery [1, 2, 3]. Laceration or transection presents as severe hemorrhage either intraoperatively or in post-operative period, leading to hypotension or even shock. Compression or arterial thrombosis or thromboembolism presents as acute ischemic syndrome [6]. A pseudoaneurysm usually presents as enlarging and painful swelling in post-operative period with a falling hematocrit and hemoglobin levels [10, 11]. The swelling may be pulsatile, with bruit on auscultation and distal pulsations are usually present [6, 12]. An arteriovenous fistula usually presents as a pulsating mass with a continuous murmur [6].

This particular patient which we are reporting was an elderly female, hypertensive and may be having atherosclerotic vessels.

Since there is no mention in the operative notes of the index surgery regarding any intraoperative hemorrhage, the patient started developing skin color changes on the 3rd post-operative day and the CT angiography showing a complete occlusion of blood flow in SFA at level corresponding to the third screw of DHS plate, most probably there was an intimal injury to the SFA due to an overshoot drill bit which led to thrombosis ultimately resulting into gangrene. In this part of the world, many surgeons, especially those working in smaller nursing home setups, do not have their own instrument sets and use loaner instrument sets supplied by the implant manufacturer. The drill bits in these loaner sets may have been reused many times and may not be sharp. Surgeon inadvertently uses more force to drill with these blunt drill bits and this can cause overpenetration of medial cortex, leading to a vascular injury.

Risk of vascular injury during fixation of pertrochanteric fractures can be minimized by following a few simple steps:

1. Careful placement of retractors, bone clamps, and cerclage wires
2. Prevent overshoot of drill bits medially by:
 - a. Use of sharp drill bits, preferably a new one for each surgery so that force is not applied during drilling
 - b. Use of stoppers over drill bits to prevent overpenetration of medial cortex
 - c. Using a drill sleeve and readjusting the length of drill bit on reaching medial cortex to within 7–8 mm of the drill sleeve so that the drill sleeve acts as a stopper (Fig. 4a-f).
3. Using oscillating mode while drilling the medial cortex so that medial soft tissues do not get entangled in case of inadvertent overpenetration
4. Using appropriate size perineal post so that the medial soft tissues and vessels are not pushed to the bone
5. Bringing the limb to neutral position from adduction, while passing the shaft screws in DHS or distal locking screws of short CMN, will move the SFA slightly away from medial cortex and reduce the chances of vascular injury in event of inadvertent overpenetration of drill bit [7]
6. Inadvertent intrapelvic advancement of guide wire may occur during use of triple reamer and this should be avoided by careful monitoring by image intensifier, to prevent intrapelvic vessel injury.

Vascular injuries if detected in time can be very well managed by

appropriate vascular intervention procedures. Since this particular patient whom we are reporting presented to us on the 7th post-operative day with already established changes of ischemia, her limb could not be salvaged.

Conclusion

Vascular injuries in pertrochanteric fracture fixation can be devastating. Its incidence can be minimized by being aware of the predisposing factors, proper patient positioning, good surgical technique, careful placement of retractors, and preventing over penetration of medial cortex while drilling. Early detection by watchful monitoring of the patient in post-

operative period and appropriate vascular intervention may help in limb salvage.

Clinical Message

Even seemingly simple trauma surgeries can land up in catastrophic vascular complications if due care is not taken during patient positioning and instrumentation, especially in cases operated on fracture table. Surgeon should be vigilant about the vascular anatomy around the operative site and reduce the risk of iatrogenic injury with use of good surgical technique.

References

1. Wilson JS, Miranda A, Johnson BL, Shames ML, Back MR, Bandyk DF. Vascular injuries associated with elective orthopedic procedures. *Ann Vasc Surg* 2003;17:641-4.
2. Calligaro KD, Dougherty MJ, Ryan S, Booth RE. Acute arterial complications associated with total hip and knee arthroplasty. *J Vasc Surg* 2003;38:1170-7.
3. Parvizi J, Pulido L, Purtill JJ, Sharkey PF, Hozack WJ, Rothman RH. Vascular injury following total joint arthroplasty. *J Arthroplasty* 2008;23:643.
4. Mavrogenis AF, Rossi G, Rimondi E, Ruggieri P, Mercuri M. Embolisation for vascular injuries complicating elective orthopaedic surgery. *Eur J Vasc Endovasc Surg* 2011;42:676-83.
5. Karanikas I, Lazarides M, Arvanitis D, Papayanopoulos G, Exarchou E, Dayantas J. Iatrogenic arterial trauma associated with hip fracture surgery. *Acta Chir Belg* 1993;93:284-6.
6. Barquet A, Gelink A, Giannoudis PV. Proximal femoral fractures and vascular injuries in adults: Incidence, aetiology and outcomes. *Injury* 2015;46:2297-313.
7. Yang KH, Yoon CS, Park HW, Won JH, Park SJ. Position of the superficial femoral artery in closed hip nailing. *Arch Orthop Trauma Surg* 2004;124:169-72.
8. Prakash, Kumari J, Bhardwaj AK, Jose BA, Yadav SK, Singh G. Variations in the origins of the profunda femoris, medial and lateral femoral circumflex arteries: A cadaver study in the Indian population. *Rom J Morphol Embryol* 2010;51:167-70.
9. Alshameeri Z, Bajekal R, Varty K, Khanduja V. Iatrogenic vascular injuries during arthroplasty of the hip. *Bone Joint J* 2015;97-B:1447-55.
10. Ortiz SP, Giner BA, Pérez CM, Cruz MG, Pérez JL. Pseudoaneurysm of the superficial femoral artery after cephalomedullary nailing in an intertrochanteric fracture. *Acta Sci Orthop* 2018;1:19-23.
11. Patelis N, Koutsoumpelis A, Papoutsis K, Kouvelos G, Vergadis C, Mourikis A, et al. Iatrogenic injury of profunda femoris artery branches after intertrochanteric hip screw fixation for intertrochanteric femoral fracture: A case report and literature review. *Case Rep Vasc Med* 2014;2014:694235.
12. Toyota T, Horiuchi H, Takizawa T, Yamazaki I, Matsunaga D, Nakamura Y, et al. A case of femoral pseudoaneurysm after surgery for intertrochanteric fracture, *J Orthop Sci* 2017;22:362-5.

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