

# Pseudo-aneurysm after fixation of intertrochanteric femur fracture: literature review and report of two cases

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## Abstract

Fracture of Intertrochanteric region has been successfully fixed since years with the use of dynamic hip screw and proximal femoral nail, however life-threatening complications associated with these methods are not unknown to the orthopaedic fraternity. We present a report of two cases of pseudoaneurysm of profunda femoris artery which were operated for intertrochanteric fracture elsewhere and then referred to our hospital when during follow up for the index surgery, the course got complicated.

**Keywords:** Dynamic hip screw complications, Proximal femoral nail complications, Pseudoaneurysm of profunda femoris artery

## Introduction

Petrochanteric fractures are one of the commonest fractures of the geriatric age group. Various complications have been reported in literature including mal-union, non-union, mal-rotation, heterotopic ossification. One rare complication reported in the literature is pseudoaneurysm formation. We present a report of two cases of pseudoaneurysm of profunda femoris artery which were operated for intertrochanteric fracture elsewhere and then referred to our hospital when during follow up for the index surgery, the course got complicated.

**Case report 1:** A 78 year old male patient was referred to our hospital with pain and swelling left thigh two weeks after fixation for left side intertrochanteric fracture with dynamic hip screw at some other hospital. He had severe pain in the post-operative period with gradual increase in swelling in the thigh that was first ignored as a hematoma. The patient was mobilized non-weight bearing after surgery and was discharged from the hospital one week later. The patient reported with an increased swelling and pain and was then referred to our hospital. On examination the patient presented with a swelling over the proximal left thigh. There was thrill and bruit over the swelling. Plain X-rays showed good alignment

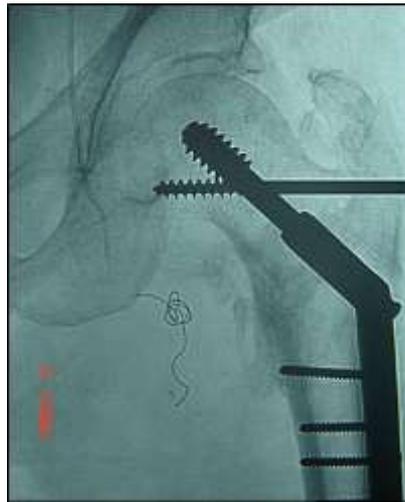
and fixation of the dynamic hip screw with an improperly placed anti-rotation screw in-situ. Ultrasonography revealed a vascular lesion over the thigh which on CT angiography turned out to be a 5x4 cm vascular mass originating from the medial circumflex branch of the profunda femoris artery. Embolization of the feeding vessel originating from the medial circumflex branch of the profunda femoris artery was done. Embolization was successful in occlusion of feeding vessels without complication. The thigh swelling and pain decreased gradually over one week. Patient was asymptomatic during subsequent follow up and the fracture healed.



**Fig 1:** Postoperative image showing fixation with DHS and de-rotation screw



**Fig 2:** Image showing the level of injury, pseudoaneurysm sac and the inadvertent screw position

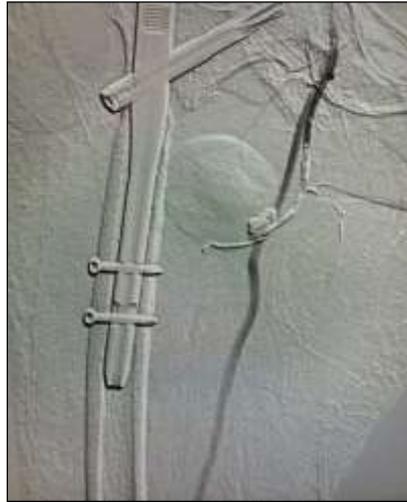


**Fig 3:** Image showing embolization of the feeding vessel and disappearance of the pseudo aneurysmal sac

**Case report 2:** A 69 year old female presented to our hospital with swelling over right hip and proximal thigh four months after she had been operated elsewhere for intertrochanteric fracture right hip with a proximal femoral nail. The patient presented with pain and developed swelling over the proximal thigh for which she visited the index hospital and was referred to our centre. The patient was investigated and ultrasonography and CT angiography were done which revealed a pseudoaneurysm with feeding distal branches of profunda femoris artery. There was no protruding implant or free fragment adjacent to the pseudoaneurysm, so it can be presumed that during surgical procedure, guide wire might have slipped medially to cause the injury of above-mentioned vessel resulting in pseudoaneurysm in post-operative period. The mass was excised and coil embolization done. In the follow up there was problem of superficial surgical site infection which was successfully treated with debridement and Vacuum Assisted Closure (VAC therapy) one month after the angioembolization procedure and further follow up was uneventful.



**Fig 4:** Image showing fixation with PFN and pseudoaneurysmal sac



**Fig 5:** Image showing coil embolization of the feeding vessel of the pseudo-aneurysm



**Fig 6:** Image showing excised sac material

**Discussion with literature review:** Pterochanteric fractures are one of the commonest fractures of the geriatric age group. Various complications have been reported in literature including mal-union, non-union, mal-rotation, heterotopic ossification. One rare complication reported in the literature is pseudoaneurysm formation [1-13, 17-20, 22, 24, 25, 27, 28, 38, 39, 44-48, 50-57]. Although uncommon, pseudoaneurysms have been reported to occur in all spectrum of orthopaedic injuries like closed reductions, interlocking nails [6, 28, 37], arthroplasty [42, 49], external fixators [27] and even with loose unfixed fracture fragments [17, 22, 27, 31, 38, 40, 51]. A pseudoaneurysm results due to tangential laceration through the arterial wall mainly because of a penetrating trauma resulting in a hematoma formation which re-canalizes into a sac contained by fibrous capsule, the sac communicating with the main arterial trunk via a neck [10, 27, 43]. The walls of pseudoaneurysms consist of fibrous capsule unlike true aneurysms that consist of true layers of the arterial wall. Dameron *et al.*, Basset and Hook, Maeyer and Slager were among the first to report pseudoaneurysms associated with intertrochanteric fractures in 1964 in different case reports [1, 2, 3]. Wolfgang *et al.*, in 1974 [10] reported a case of pseudoaneurysm of profunda femoris artery with nail plate fixation of intertrochanteric fracture, they also in a review of literature [1-5, 7-9] reported a total of eight cases of pseudoaneurysm after intertrochanteric or subtrochanteric fractures fixation (Dameron, 1964; Fordyce, 1968; Saletta and Freeark, 1970; Bergquist *et al.*, 1972; Horton, 1972), after neck of femur fixation (Lewin, 1966) and after subtrochanteric osteotomy (Bassett and Houck, 1964; Meyer and Slager, 1964). A similar case of profunda femoris artery pseudoaneurysm was reported by Wang *et al.*, in 1975 as a complication of fixation of intertrochanteric fracture with a nail blade plate [11]. Abraham E *et al.*, in 1975 reported a case fatality due to delayed diagnosis of pseudoaneurysm of profunda femoris artery in a patient who was admitted with profuse swelling and unexplained anaemia. Intertrochanteric fracture was diagnosed on work up, the patient was managed conservatively with skeletal traction and the

pseudoaneurysm was excised at 7<sup>th</sup> week with repair of defect but the patient developed deep infection and died of pneumonia and heart failure 5 months after admission <sup>[12]</sup>. Ebong *et al.*, in 1978 reported a case of a 49 year old male with pseudoaneurysm of profunda femoris artery in an intertrochanteric fracture 2 weeks after fixation with Mclaughlin plate, as a result of loosening of the nut at the nail plate junction. These authors concluded that the insult to the vessel would have been due to a protruding screw or the loose lesser trochanter fragment because of the loss of fixation and displacement of fracture. However, they did not rule out the possibility of a slipping of a drill bit during surgery. They managed the patient in Thomas splint followed by spica cast but the patient required exploration after two and a half months and the sac was excised and vessel defect sutured <sup>[13]</sup>. Keel *et al.*, in 1993 reported a case of pseudoaneurysm of profunda femoris artery in an 81 year old woman fixed with dynamic hip screw 2 days after surgery, caused by a free lesser trochanter fragment which was later excised and the arterial defect closed <sup>[17]</sup>. Karnikas *et al.*, in 1993 over a period of 5 years reviewed total of 1417 patients who were treated for hip fractures with different procedures and reported an incidence of 0.21%, a total of 3 cases, 2 of profunda femoris and one of femoral artery. One case was due to protruding screw, one due to bone spicule and one due to free lesser trochanter fragment <sup>[18]</sup>. O'Donoghue *et al.*, in 1994 reported a case of pseudoaneurysm of the profunda femoris artery in an 89 years old male treated with dynamic hip screw for intertrochanteric fracture 2 months after fixation, the aneurysm was adherent to the free lesser trochanter fragment which had displaced anteriorly <sup>[19]</sup>. Hanna GB *et al.*, in 1995 published a report of two cases, one of an 89 years old female who was treated with a pugh nail for intertrochanteric fracture of right femur and developed a pseudoaneurysm of the first perforating branch of the profunda femoris artery which was treated with embolization. The other patient they reported was a 22 year old male treated with interlocking nail for open comminuted femur fracture. They concluded that the insult to the vessel would have happened while readjusting the distal locking screws by the screw itself or the drill bit during drilling which was done to correct distraction during primary surgery. In this patient superficial femoral vein was also penetrated. The arterial defect was managed by suturing and the femoral vein repaired using a saphenous vein patch <sup>[20]</sup>. Fernandez *et al.*, in 1995 reported a case of a 78 year old female who was treated with ender nails and presented with pseudoaneurysm of superficial femoral artery one month after surgery which had been caused by a spike of bone from the displaced lesser trochanter fragment and was managed by suturing and excision of bony spike <sup>[22]</sup>. Murphy *et al.*, in 1999 reported a case of pseudoaneurysm of profunda femoris artery 8cm distal to its origin in a 70 years old women treated with dynamic hip screw for intertrochanteric fracture, four weeks after fixation. It was treated with ligation <sup>[24]</sup>. Dhal *et al.*, in 2001 published a series of 13 cases of pseudoaneurysms over a period of 8 years, the commonest vessel involved was the deep femoral artery (five cases) and one case each of the internal iliac, profunda femoris, common femoral, popliteal, posterior tibial, peroneal, anterior tibial and brachial arteries. The commonest cause implicated was pin placement during external fixation (5 cases), followed by bony fragments (4 cases), penetrating injuries (3 cases) and one from blunt trauma without fracture. Two of their patients had pre-operative foot drop as a result of pressure symptoms. All the cases were treated surgically by either ligation or end to end anastomosis or suturing except one who recovered spontaneously <sup>[27]</sup>. Yang *et al.*, in 2002 reported a case of pseudoaneurysm of the femoral artery in a case of trochanteric fracture fixed with a gamma nail during distal locking with limb in adduction and internal rotation. They recommended that the limb should be placed in a neutral position during interlocking as adduction and internal rotation abuts the superficial femoral artery to the femur and this position should be avoided during distal locking <sup>[28]</sup>. Canbaz *et al.*, in 2002 in a 39 year old male reported a pseudoaneurysm of the perforating branch of the profunda femoris artery following an external fixation for a complicated femur fracture which was treated by ligation of the perforating branch of the profunda femoris artery and excision of the aneurysmal sac <sup>[29]</sup>. Maheshwari *et al.*, in 2004 reported a case of a 78 year old male patient treated with dynamic hip screw for intertrochanteric fracture who presented with a groin swelling 12 weeks after the index surgery. On exploration a free sharp lesser trochanter fragment was found and removed and vessels found patent, five days after the second surgery, pseudoaneurysm was diagnosed along with thrombus in mid femoral and popliteal veins with partial recanalization and treated with embolization of the neck of pseudoaneurysm and inferior vena cava filter for vein thrombosis

[31]. Lahopoonrangse *et al.*, in 2005 reported two cases of pseudoaneurysm of profunda femoris artery who had been operated for intertrochanteric fracture with dynamic hip screw. The first case was a 71 year old female who had developed this complication two years after the index surgery and on exploration a screw was protruding and its level corresponded with the level of pseudoaneurysm. The second cases of a 78 years old male who had developed the complication three months after the surgery and the authors concluded that it might have been due to intraoperative trauma either by a drill bit or a retractor. Both cases were managed by embolization of the feeding vessels, however in the first case excision was also done to rule out any sarcomatous pathology [33]. Ritchie *et al.*, in 2007 reported a case of pseudoaneurysm of profunda femoris artery arising from its medial branch distal to its second bifurcation caused by a free fragment of lesser trochanter in a case of intertrochanteric fracture managed by dynamic hip screw in a 74 years old male patient. It was managed by ligation of the medial branch and excision of the lesser trochanter fragment [38]. Rajaesparan *et al.*, in 2008 reported a case of pseudoaneurysm arising from a branch of profunda femoris artery posterolaterally 4 weeks after fixation with intramedullary hip screw for an intertrochanteric fracture in an 81 year old female and they concluded that the injury might have happened during distal locking and these authors concluded that the limb be placed in neutral position during distal locking [39]. Unay *et al.*, in 2008 reported two cases of pseudoaneurysm of profunda femoris artery, one in a 32 years old female suffering from multiple sclerosis with avascular necrosis of both hips who was treated with core decompression but developed pseudoaneurysm on 4th postoperative day, which was embolized. The most probable cause cited by the authors was the lancet, which had gone deeper than expected during the fascial incision. The other patient was a 34 years old male treated for subtrochanteric fracture with a gamma nail, who developed this complication on 7<sup>th</sup> post-operative day and was treated with embolization. The cause implicated by the authors in this case was fracture fragments [40]. Navaratte *et al.*, in 2009 reported a 78 year old patient treated with PFNA for an unstable pertrochanteric fracture in the right hip who presented with a superficial femoral artery pseudoaneurysm on 7<sup>th</sup> post-operative day and was managed by a percutaneous trans luminal angioplasty in order to close the neck of pseudoaneurysm, which was excluded by implanting a coated stent. The authors concluded that it is imperative to rectify the abduction and internal rotation of the fractured limb once the implant has been inserted for safer placement of locking screw and thereby preventing a potential iatrogenic vascular lesion [44]. Grimaldi *et al.*, in 2009 reported an 89 year old woman who was managed by gamma nail for intertrochanteric fracture and developed a pseudoaneurysm of Superficial Femoral Artery within 24 hours after the procedure which was managed by suturing the defect. These authors recommended two manoeuvres to prevent this complication one by placing the limb in neutral rotation after inserting the nail and secondly by decreasing traction which reduces the compression between soft tissues and perineal post and also increases SFA mobility [45]. Lohmann H *et al.*, reported a case of an 89 years old male patient who developed pseudoaneurysm of deep femoral artery 3 weeks after fixation of intertrochanteric fracture with a gamma nail, the pseudoaneurysm was treated by a suture [46]. Hamoui *et al.*, 2009 reported a case of pseudoaneurysm in a perforating branch of superficial femoral artery treated with dynamic hip screw for intertrochanteric fracture. She was managed by coil embolization [47]. Chan *et al.*, reported a case of an 83 year old treated with dynamic hip screw for intertrochanteric fracture who presented with pseudoaneurysm 23<sup>rd</sup> day after the index surgery which was evacuated under emergency and the pseudoaneurysm excised [48]. Singh *et al.*, in 2013 reported a case of pseudoaneurysm of profunda femoris artery after internal fixation of intertrochanteric fracture with a dynamic hip screw which was treated by coil embolization [50]. Regus *et al.*, in 2015 reported an 85 years old female who was treated with gamma nail for intertrochanteric fracture of femur who developed pseudoaneurysm of the deep femoral artery 3 weeks after surgery caused by a displaced fragment of lesser trochanter. It was managed by excising the tip of the lesser trochanter fragment and vessel wall reconstruction by a vein patch [51]. De raffe *et al.*, in 2016 reported a case of 78 year old male with multiple comorbidities who was treated with a gamma nail for intertrochanteric fracture and presented with a pseudoaneurysm of the profunda femoris artery. The patient was treated with multiple thrombin injections and finally with an endovascular stent but landed in cardiopulmonary resuscitation setting and couldn't be reviewed [53]. Toyota *et al.*, in 2015 reported a case of pseudoaneurysm of deep femoral artery in a 76 year old female who was managed

by intramedullary hip screw device four months after the index surgery. The deep femoral artery was ligated and the offending captured locking screw was removed. The authors concluded that the injury was caused by a malpositioned guide wire<sup>[52]</sup>. Kunwal *et al.*, in 2016 reported pseudoaneurysm of profunda femoris artery four days after fixation of intertrochanteric fracture with dynamic hip screw in a 55 years old female patient. Intra-operatively they reported an inadvertent over drilling of medial cortex with profuse bleeding which got controlled by packing but reappeared on fourth day, embolization using two coil wires was done<sup>[54]</sup>. Kim *et al.*, (2017) reported pseudoaneurysm of deep femoral artery in an 85 years old female who was treated with PFNA2 for intertrochanteric femur fracture within 12 hours after surgery and was treated by coil embolization<sup>[55]</sup>. Milady *et al.*, in 2019 reported two cases of pseudoaneurysm of profunda femoris artery after fixation with a dynamic hip screw. One patient was 67 years old male who presented three months after surgery and was managed by resection of aneurysm. The other patient was a 68 year old female who was treated for non-union trochanter after index surgery and developed the complication and was managed by stenting<sup>[56]</sup>. Vicky T. Jain *et al.*, in 2019 reported a case of pseudoaneurysm of profunda femoris artery in a 79 year old male treated with a trochanteric femoral nail for intertrochanteric fracture hip on 7<sup>th</sup> post-operative day which was treated by embolization<sup>[57]</sup>. Pseudoaneurysm is a rare but an important complication after fixation of intertrochanteric fractures and should be diagnosed properly and managed swiftly and appropriately. A number of risk factors can lead to the formation of pseudoaneurysm like poor technique during surgery, patient factors like obesity or anticoagulation therapy or calcified vessels<sup>[43]</sup>. A high index of suspicion along with radiological investigations are imperative for diagnosing the pseudoaneurysm<sup>[34, 41, 43]</sup>. If not diagnosed promptly, rupture of the aneurysm can occur leading to haemorrhage, compartment syndrome, infection, interference with fracture healing and even mortality<sup>[14, 25, 28, 30, 35, 53]</sup>, compressive symptoms like neuropathy<sup>[27]</sup>. The development of pseudoaneurysm should be considered in any patient who presents with pain associated with groin swelling and a palpable mass with a thrill or bruit over the swelling but thrill or bruit may be difficult to detect due to deep location<sup>[15, 16, 30, 35, 36, 48]</sup>. A fall in haemoglobin level and hemodynamic instability can be fatal<sup>[43]</sup>. Once suspected, radiological investigations like Doppler ultrasound typically shows the inflow-outflow pattern of blood, yin-yan sign<sup>[16]</sup>. In cases where ultrasound findings are equivocal multidetector CT angiography can be done to detect the pseudoaneurysm. Multidetector CT angiography is a quick and non-invasive method, with sensitivity of 90-95% and specificity of 98-100%<sup>[34]</sup>. Various treatments of pseudoaneurysm have been reported like ultrasound guided compression<sup>[23]</sup> percutaneous thrombin injection under ultrasound guidance<sup>[32]</sup>, transarterial embolization with coils<sup>[21]</sup> and stent grafts<sup>[26]</sup>. Surgery is indicated when there is rapid expansion of mass that can lead to compartment syndrome or pressure effects like neurovascular compromise<sup>[30, 35]</sup>.

**Summary:** Pseudoaneurysm of the femoral artery is a rare but an important complication which should be always kept in mind and care should be taken in adhering to a proper surgical technique while performing drilling and guide wire insertion during surgery as well as taking care of the position of the limb while distal locking. A high index of suspicion is required and once suspected prompt investigations and treatment should be ensued to ensure that both the limb and life of the patient is saved.

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