Case report

DOI 10.18019/1028-4427-2019-25-1-93-101

Pseudoaneurysm of the superior gluteal artery following iliosacral screw fixation – a case of non-operative treatment with spontaneous recovery

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We present a case of superior gluteal artery pseudoaneurysm following iliosacral screw placement into the posterior pelvis in a patient with vertically unstable pelvic fracture (OTA/AO 61C2.3(b,k)) who received anticoagulant therapy for deep venous thrombosis. The primary complaint was that of neuropathic pain the patient developed on the fourth postoperative day due to sciatic nerve irritated by a mass in the gluteal region. CT demonstrated intermuscular haematoma that was conservatively treated with analgesics, anticonvulsants, and antispasmodics. The therapy resulted in moderate positive effect. The gluteal mass was noted to grow at three months postsurgery. Ultrasonography showed turbulent blood flow inside the haematoma cavity and a diagnosis of pseudoaneurysm of the superior gluteal artery was made. Further observation revealed spontaneous decrease in the volume of pseudoaneurysm cavity and complete resolution at 5 months of surgery, and pain completely relieved at the time. No operative procedure was required for the pseudoaneurysm.

Keywords: unstable pelvic injury, iliosacral screw, superior gluteal artery, pseudoaneurysm, ultrasonography, turbulent blood flow, Yin-Yang sign, "to-and-fro" waveform, conservative treatment, spontaneous recovery

INTRODUCTION

Iliosacral screw fixation is a method of choice for unstable pelvic fractures to allow minimally invasive and less traumatic procedure. However, there is a risk of iatrogenic injury to the superior gluteal artery due to proximity of percutaneously inserted iliosacral screws to the superior gluteal nerve and vessels [1–7].

Clinical effects of injuries to the superior gluteal artery with inserted iliosacral screws are similar to those of other traumatic lesions. External bleeding from the superior gluteal artery is very rare due to the location in the depth of gluteal muscles [8, 9] and diagnosis of external bleeding is not difficult. An injury to the superior gluteal artery and the branches appears as an extensive hematoma and pseudoaneurysm. A constrained mass around a buttock is common for hematoma and pseudoaneurysm, the mass can grow continuously from several weeks to several years in case of pseudoaneurysm [9–13] and be hot to the touch with increased body temperature that would require abscess differential diagnosis [9, 13, 14] and palpable pulsation over the mass [10, 11, 13, 15, 16]. Injuries to the superior gluteal artery and a mass formed in the gluteal area in the most cases of pseudoaneurysm and extensive hematoma are primarily associated with symptoms of irritated and compressed sciatic nerve resulting in analgesic resistance and evident buttock pain irradiating to the posterior femur, posterior lateral tibia throughout the dorsal and plantar aspects of the foot with impaired sensitivity in the above sites, motor deficit of the anterior group of tibial muscles and positive stretch symptoms [1, 13, 17, 18, 19, 20]. Clinical manifestations of extensive intermuscular hematoma include symptoms of posthemorrhagic anemia, impaired hemodynamics with greater volume of blood loss [12, 17, 20] that are not typical for pseudoaneurysm due to the slow growth. Differential diagnosis of hematoma and pseudoaneurysm is important due to different tactics of treatment and diagnostic error can result in massive external bleeding from the exposed cavity of pseudoaneurysm [9, 10]. Ultrasound assessment can clearly identify pseudoaneurysm, hematoma or a mass using pathognomonic turbulent flow (Yin-Yang sign) and "to and fro" pattern of the waveform [11, 15, 21, 22, 23, 24].

Bliznets D.G., Runkov A.V., Zyrianov M.N., Shlykov I.L. Pseudoaneurysm of the superior gluteal artery following iliosacral screw fixation – a case of non-operative treatment with spontaneous recovery. *Genij Ortopedii*, 2019, T. 25, No 1, pp. 93-101. DOI 10.18019/1028-4427-2019-25-1-93-101. (In Russian)

Pseudoaneurysm of the superior gluteal artery is normally treated surgically to discontinue bloodstream in the cavity of pseudoaneurysm and eliminate pressure of pseudoaneurysm against sciatic nerve. Uni- and bilateral internal iliac artery ligation was accepted as a classical means of controlling haemorrhaging from the superior gluteal artery since the repair and ligation of the superior gluteal artery can fail due to the deep location and proximity to the bony wall of the greater sciatic notch [5, 8, 9, 10]. Selective endovascular embolization of the afferent artery is used to close the cavity of pseudoaneurysm [3, 12, 15, 19, 20, 25, 26]. Decompression of the sciatic nerve is produced by opening up the cavity of pseudoaneurysm and removing thrombotic masses [9, 10, 11, 16, 25, 27]. There is an evidence of successful conservative treatment of extensive hematoma caused by an injury to the superior gluteal artery with confirmed absence of continuous bleeding [17]. No reports of conservative treatment and spontaneous closure of pseudoaneurysm of the superior gluteal artery could be found in the available literature.

CASE REPORT

We present a case of superior gluteal artery pseudoaneurysm following iliosacral screw placement into the posterior pelvis in a 40-year-old patient B. who sustained workplace injury from a 10 m fall. He was admitted to a local hospital on the day of trauma and diagnosed with a fracture of a lateral mass of the sacrum on the right, fracture of the right pubic bone, left pubic and ischial bones, cervical fracture of the right femur, fracture of the distal epimetaphysis of the right radius and fracture of the IIId metatarsal bone on the right. Proximal tibial skeletal traction was applied on the right side, the right radius reduced and fixed with the cast, non-operative treatment including analgesics, anticoagulants, infusion therapy, antibiotics, vascular and sedation medications administered, and the patient was referred to the Ural Chaklin Institute of Traumatology and Orthopaedics (UCITO) for definitive treatment after 13 days. Multispiral computed tomography (MSCT) of pelvis, right radiocarpal joint and the right foot revealed vertically unstable pelvis fracture, transforaminal fracture of the lateral mass of the sacrum on the right, extraforaminal fracture of the lateral mass of the sacrum on the left due to bilateral seronegative sacroiliitis and ankyloses of the left sacroiliac junction (Bekhterev's disease), bilateral fractures of pubic and ischial bones, transcervical fractures of the right femur (**Fig. 1**), comminuted fracture of the distal epimetaphysis of the right radius, subcapital fracture of the IInd metatarsal of the right foot, fracture at the base of IInd, IIId and IVth metatarsals of the right foot, fracture of the cuboid on the right, dorsal dislocation of the IVthe and Vth metatarsals on the right.

Ultrasound examination of veins of lower limbs showed bilateral occlusion soleus thrombosis. The neck of the right femur was fixed with screws next day of admission to UCITO. Antithrombotic therapy with Ribaroxaban 15 mg × 2 times/day was administered next day postsurgery. The next stage of surgical treatment performed 8 days later included fixation of the fractured lateral masses of the sacrum with transverse iliosacral full threaded cannulated screws placed percutaneously by guide wire through the right iliac bone, the right lateral mass of the sacrum, the body of the IInd sacral vertebra and the left lateral mass of the sacrum (**Fig. 2**). The level of the screw placement – the IInd sacral vertebra – was chosen due to sacral dysmorphism (**Fig. 1**) with no safe corridor for the transverse screw at the level of the Ist sacral vertebra to provide fixation for the fractures of both lateral masses. There were total 15 attempts made to place the tip of the guide wire on the lateral iliac surface and 2 attempts to insert the wire in the iliac bone and the sacrum to provide wire positioning as wanted. There was a decision to neglect persisting vertical displacement of the right half of the pelvis being not more than 1 cm, no reduction manoeuvres were produced for the pelvis with no need of anterior pelvis fixation. The surgical session included open reduction, fixation of metatarsal fractures and dislocations with wires and radius fracture was repaired conservatively using plaster cast.

Fig. 1 MSCT of the pelvis of patient B. showing (a) a similar-to-coronal view of 3D reconstruction of pelvis; (b) a similar-to-inlet view of 3D reconstruction of pelvis; (c) a similar-to-outlet view of 3D reconstruction of pelvis

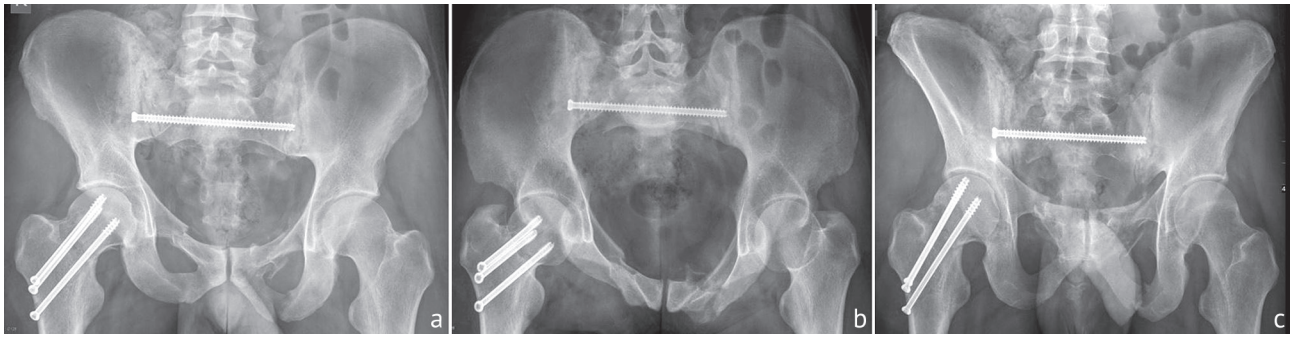

Fig. 2 Postoperative radiographs of two-staged treatment showing (a) AP view of pelvis, (b) AP inlet view, (c) AP outlet view

Postoperative computed tomography performed on day of surgery showed the sacral screw being in the osseous tissue with no sacral wall penetration revealed. Ribaroxaban administration discontinued on the day before the surgery and the day of surgery, and the patient received Nadroparin Calcium 40 mg once a day and returned to Ribaroxaban 15 mg × 2 times/day from the second postoperative day. The patient was encouraged to activities by sitting in bed getting his feet down to the floor. Postoperative CBC showed decrease in RBC measuring $2.77 \cdot 10^3$/μL compared to preoperative $3.34 \cdot 10^3$/μL, Hb of 91 g/L compared to pre-op of 106 g/L, RBC plasma ration of 23.7 % compared to pre-op of 29.1 %. No disorders in hemodynamic parameters were observed. Pain was not severe on the day of surgery and during the first postoperative days, Tramadol 100 mg × 3 times/day was administered for pain relief. He developed evident pain in the right buttock on the fourth postoperative day. The pain irradiated to the posterior femur, posterior lateral surface of the right tibia and lateral portion of the right foot. Edema was noted in the right buttock with sharp pain at palpation and positive stretch symptom. Computed tomography revealed hematoma of about 30 mL in the lateral aspect of the right iliac wing descending to the greater sciatic notch from iliosacral screw (**Fig. 3, a, b**). Retrospective analysis showed the hematoma of nearly the same size on postoperative CT scans performed on the day of surgery with no clinical manifestations observed at the time. Puncture aspiration was rejected due the small size of hematoma and the deep location. Administration of Tramadol of the same dose continued for the next 3 days and Diclofenac intramuscular injection of 75 mg administered for three days in a row, then two times every other day. The patient had to stay in bed due to expressed pain. Pain management was ineffective after 5 postoperative days with pain persisting in the right lower limb. Lidocaine injection 1 % – 50 mL into the right piriform muscle failed to obtain better effects and Gabapentin was prescribed with the dose gradually increasing from 300 mg on the first day to 1800 mg/day on day 6. Rain intensity of improved and the patient could sit on bed getting feet down to the floor. However, he resumed evident pain in the right lower limb after 10 postoperative days and CT scan showed hematoma in the right buttock increased to 50 mL. He was additionally administered intramuscular injection of Drotaverine 80 ml × 3 times/day, Meloxicam 15 mg × once per day during 14 days and driven to bed. Pain persisted during the next two weeks with the tendency to slow improvement although he occasionally experienced aggravated pain and constrained swelling in the right buttock. The patient could sit up in bed on postoperative day 12, and Drotaverine was replaced with Tolperisone 150 mg × 3 times/day

after 17 postoperative days. The patient developed no fever with occasional body temperature of 37.2 ºC. Postoperative wounds healed by primary intention and were removed on day 14 postsurgery. Flupirtine 100 mg × 3 times/day was prescribed on postoperative day 28. CT scan performed on day 32 showed hematoma increased to 330 mL having heterogeneous structure with ossification areas (**Fig. 3 c, d, e, f**).

The patient started using a wheelchair on postoperative day 38 with the cast removed from his right upper limb. He started walking with crutches on postoperative day 42 maintaining no weight-bearing on his right lower limb. Although the pain persisted, the patient could tolerate pain with Gabapentin 1800 mg/day and Flupirtine 100 mg × 3 times/day. He was discharged from the hospital after 49 days to continue treatment as an outpatient and was recommended to take Flupirtine with persisted pain and Ribaroxaban 15 mg × 2 times/day during the next 6 weeks. The patient was seen at 12 weeks postsurgery presenting with pain in the right buttock irradiating to the femur and posterior aspect of tibia down to the foot, swelling in the right buttock and palpable tight mass increased in volume as compared to the previous follow-up visit. Ultrasound examination of the right buttock revealed intermuscular hematoma of about 13 cm in diameter with a cavity in the centre featuring turbulent blood flow (Yin-Yang sign) (**Fig. 4**, video 1A – http://ilizarov-journal.com/files/2019_1_15.mp4), and the diagnosis of pseudoaneurysm of presumably the superior gluteal artery was made.

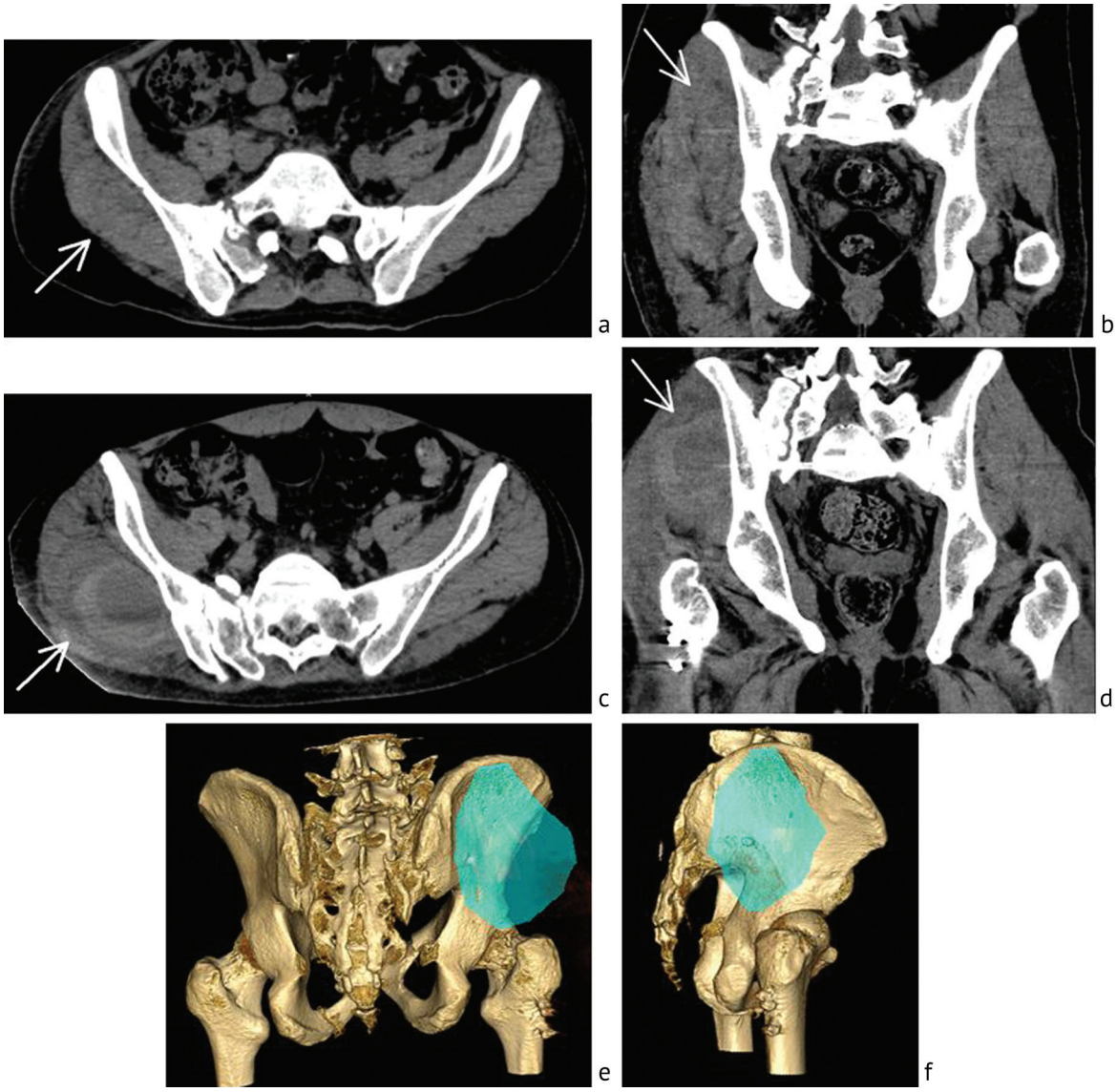

Fig. 3 Evolution of pseudoaneurysm (arrow) of the right superior gluteal artery seen in MSCT of pelvic in patient B. showing (a) rounded buildup in the right buttock in the horizontal plane of MPR-reconstruction produced on postoperative day 4; (b) coronal plane of MPR-reconstruction produced on postoperative day 4; (c) buildup partitioned into nucleus and multilayer capsule in the horizontal plane of MPR-reconstruction produced on postoperative day 32; (d) coronal plane of MPR-reconstruction produced on postoperative day 32; (e) posterior aspect of 3D-reconstruction of a mass in the right buttock (stained with blue) on postoperative day 32; (f) lateral view of 3D-reconstruction of a mass in the right buttock on postoperative day 32

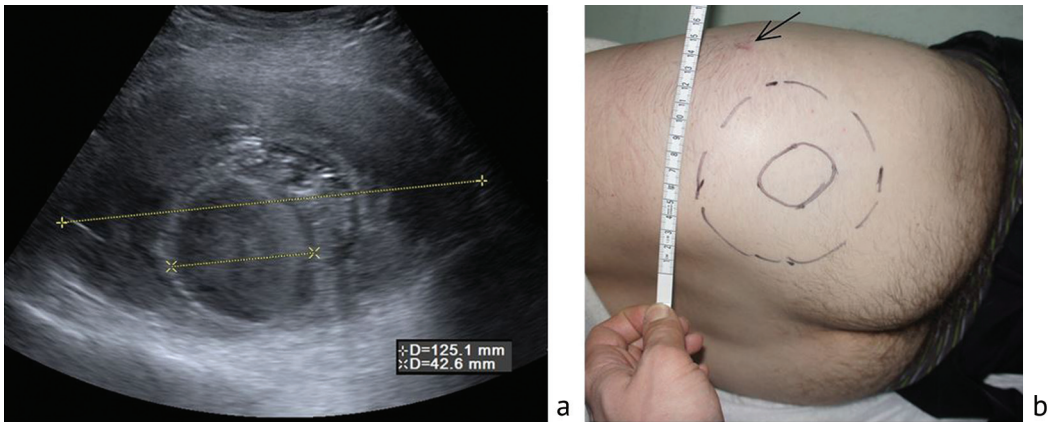

Fig. 4 Ultrasound assessment of the size and layout of pseudoaneurysm (a) measuring nucleus and membrane of pseudoaneurysm; (b) tracking pseudoaneurysm on the skin of the right buttock showing nucleus with continuous line and capsule with interrupted line. Postoperative scar of iliosacral screw is shown with an arrow

Multislice CT angiography with 3D reconstruction produced at 12.5 weeks postsurgery demonstrated intermuscular buildup in the right buttock with one of the branches of the right gluteal artery, more likely the lower branch being contrasted, pulled by preudoaneurysm distally. The screw entry point was located close to anatomical site of anticipated course of the lower branch (by analogy with intact side) (**Fig. 5**).

Ultrasound performed at 15 weeks showed spontaneous decrease in the nucleus of pseudoaneurysm in the right buttock to 1 cm, afferent vessel of the superior gluteal artery located (video 1B, 1C – http://ilizarov-journal.com/files/2019_1_15.mp4), no signs of thrombosis in the veins of lower limbs. The reduced dosage of Ribaroxaban 10 mg once a day was administered. Twenty-week follow-up showed pain and swelling improved in the right buttock, the right buttock volume decreased, tension relieved, soft buildup palpated between the muscles, no pain observed in the right foot with weak dorsal flexion of the Ist toe on the right and motion limited in toes IV and V on the right. Ultrasound of the right buttock demonstrated closure of pseudoaneurysm at 22 weeks, no cavity with blood flow revealed. The superior gluteal artery appeared normal in shape and size with maintained blood flow in the lumen (video 1D, 1E – http://ilizarov-journal.com/files/2019_1_15.mp4).

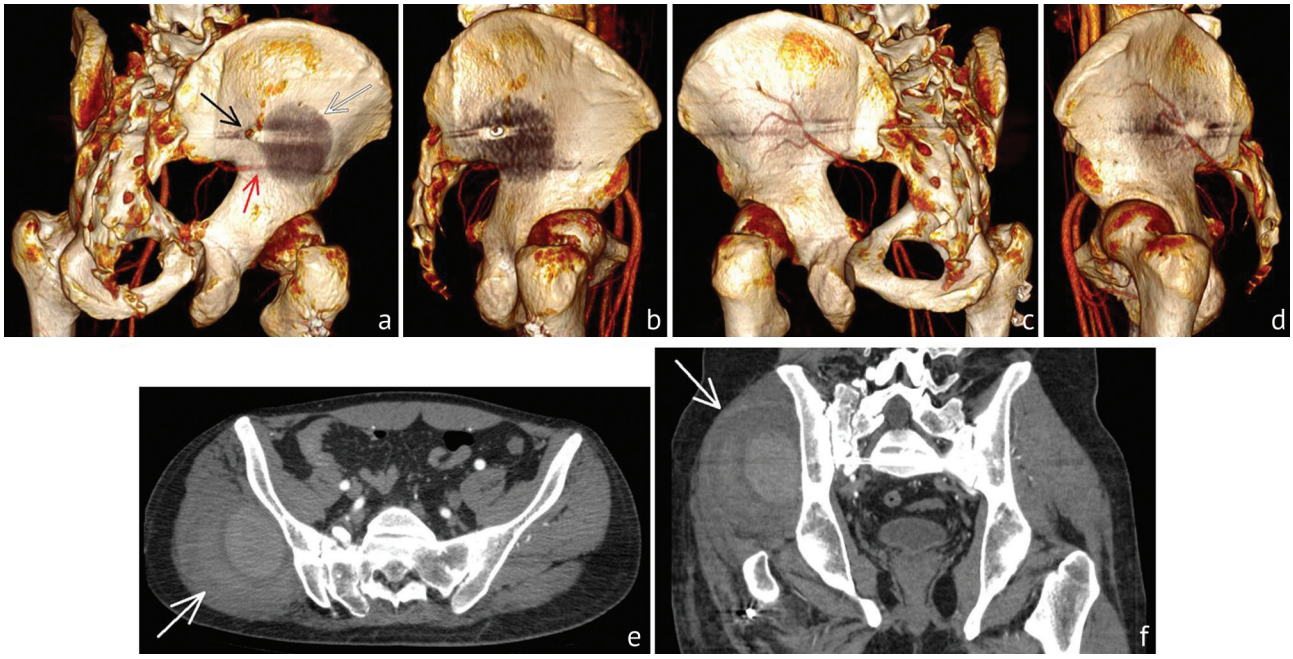

Fig. 5 MSCT angiography and 3D reconstruction performed at 12.5 weeks postsurgery showing (a) the lower branch of the deep division of the superior gluteal artery (red arrow), nucleus of pseudoaneurysm (white arrow) and iliosacral screw entry point (black arrow) on the posterior lateral aspect of the right iliac bone; (b) lateral aspect of the right iliac bone; (c) normal anatomy of the branches of the gluteal artery on the posterior lateral aspect of the left iliac bone; (d) lateral aspect of the left iliac bone; (e) MPR reconstruction at the level of pseudoaneurysm (white arrow) in the horizontal plane; (f) MPR reconstruction at the level of pseudoaneurysm in the coronal plane

Regression of pain in the right buttock and the right lower limb was noted at 24 weeks with asymmetric buttocks visualized (**Fig. 6**) and neurological deficit persisted in the form of weak dorsal flexion of the Ist toe on the right. CT scans showed rounded buildup in the right buttock measuring 77 × 57 × 71 mm and presenting intermuscular hematoma (**Fig. 7**). Consolidation of cervical fracture of the right femur and restoration of pelvic ring stability were identified with computed tomography, and weight-bearing of the body weight was allowed on the right limb.

Neurological symptoms completely resolved at one-year follow-up, and the patient could return to pre-injury level of functional activity with 100 scores on the Majeed Outcome Scale. An asymmetry persisted in the right buttock objectively compared to the left side, an intermuscular buildup visualized on CT scans was palpated in the upper lateral quadrant (**Fig. 8**) and decrease to 49 × 28 × 48 mm in comparison to the last US examination. Radiographs and computed tomography confirmed complete consolidation of pelvis fracture and ankyloses of the right sacroiliac joint.

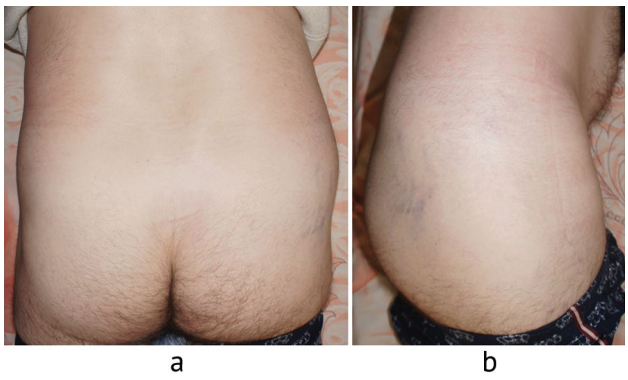

Fig. 6 Appearance of the right buttock at 24 weeks postsurgery showing (a) asymmetric right side as compared to the intact side in the back view; (b) percutaneous hemorrhage in the projection of pseudoaneurysm in the lateral view

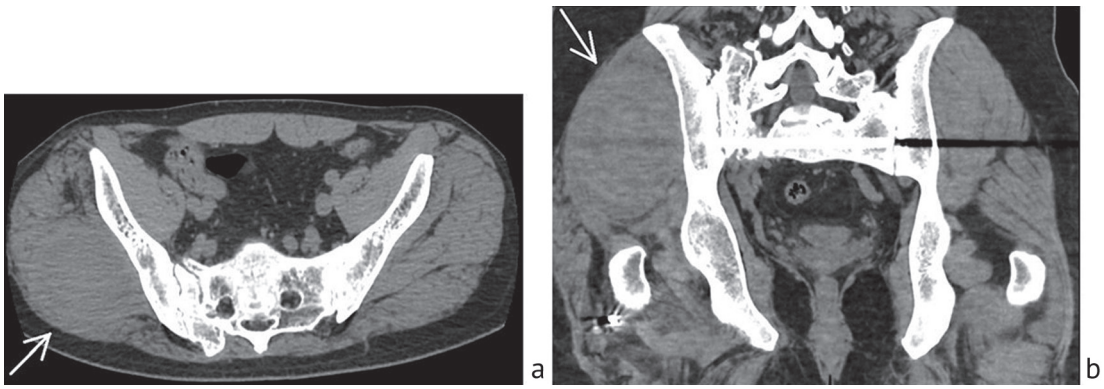

Fig. 7 MSCT scans of pelvis of patient B. ф̈t 24 weeks postsurgery showing (a) MPR reconstruction at the level of intermuscular hematoma (white arrow) in the horizontal plane; (b) MPR reconstruction at the level of intermuscular hematoma in the coronal plane

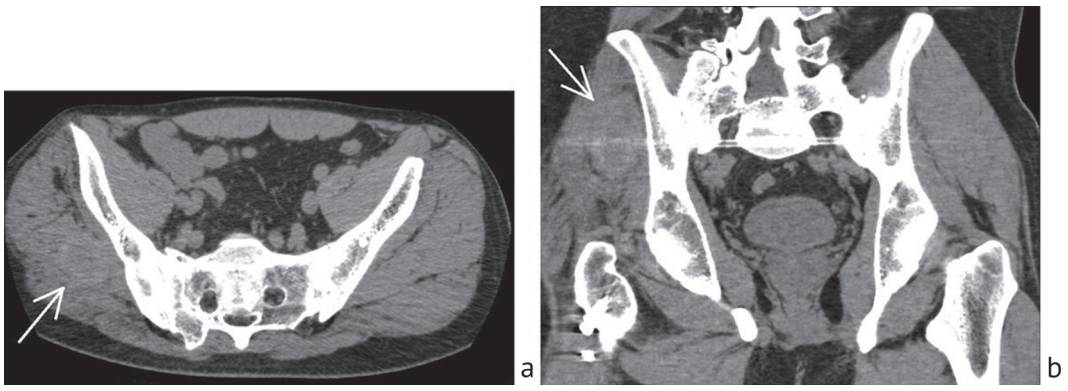

Fig. 8 MSCT of pelvis produced at 16 months postsurgery showing outcome of pseudoaneurysm of the right superior gluteal artery with intermuscular hematoma formed in the right buttock (an arrow) using (a) MPR reconstruction in the horizontal plane and (b) MPR reconstruction in the coronal plane

DISCUSSION

Risk factors for clinically meaningful injuries to the superior gluteal artery include anticoagulant therapy [1, 28], greater number of attempts placing the guide wire for proper screw insertion [1], absence of protector for the soft tissues [29] and proximity of the screw entry point to the superior gluteal artery [6]. Reduced number of traumatic manipulations produced close to the gluteal artery is likely to decrease risk of injury. In our opinion, the risks cannot be completely avoided due to the choice of a safe entry point in the iliac bone because a screw entry point is predetermined and limited by the width of bone corridors in I–II sacral vertebrae being applicable for iliosacral screw placement. The possibility of anatomical variance of the superior gluteal artery should be acknowledged when planning iliosacral screw insertion [2, 5, 30] and it can alert surgeons to risk factors for potential complications. A postoperative mass in the buttock, neurological symptoms at L5–S1 innervation zone with adequately placed iliosacral screws and administered anticoagulants, in particular, are most likely arouse suspicion of superior gluteal artery injury with hematoma or pseudoaneurysm in proximity to sciatic nerve that would require diagnosis to rule out a mass developed at the greater sciatic notch. Ultrasound examination is of greater diagnostic importance in comparison to CT or MRI since it allows differential diagnosis between pseudoaneurysm and hematoma using pathognomonic Yin-Yang sign and "to and fro" pattern of the waveform. In addition to that, ultrasound examination is technically simple and widely available for practical healthcare. In the case presented, timely ultrasound would have been helpful in making adequate diagnosis at early postoperative period, and endovascular operative intervention would have contributed to pain relief at early stage of pathological process and prevention of long-term sufferings. However, refusal from active surgical tactics associated with delayed diagnosis allowed us to observe the natural course of the development of pseudoaneurysm of the superior gluteal artery and identify the possibility of the spontaneous closure.

CONCLUSION

1. Symptoms of irritation and compression of the sciatic nerve following iliosacral screw placement should arouse suspicion of superior gluteal artery injury.

2. Anticoagulant therapy is a risk factor for hematoma and pseudoaneurysm of the superior gluteal artery.

3. Ultrasound is important due to the possibility of differential diagnosis between pseudoaneurysm and hematoma using turbulent blood flow in the cavity.

4. Nonoperative treatment can result in spontaneous closure of the cavity of the pseudoaneurysm.

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Received: 26.09.2018

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