Clinical case
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Clinical development of ileofemoral thrombosis caused by malposition of the ileosacral screw

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Abstract

Introduction Treatment of unstable injuries of the pelvic bones is one of the unsolved problems in modern traumatology. The instability of the injuries is determined by the nature of the destruction of the posterior semi-ring of the pelvis. The most used technique for osteosynthesis of sacral fractures for unstable pelvic injuries is ileosacral screw fixation.

The purpose of the work was to demonstrate a clinical case of an iatrogenic complication: ileofemoral thrombosis caused by compression of the internal iliac vein due to malposition of the ileosacral screw.

Materials and methods Medical records of a 34-year-old patient injured in a traffic accident (front seat passenger) were studied, who was referred from a district hospital on the fourth day after the injury diagnosed with a fracture of the transverse process of L2 vertebra on the left, closed fracture of the pubic and ischial bones on the left, fracture of the lateral mass of the sacrum on the right. Alcohol intoxication. Traumatic shock stage 1. Treatment results were monitored throughout the inpatient and outpatient treatment periods. Long-term follow-up was 6 months.

Results Timely suspicion of the complication based on physical examination data with CT angiography that assisted to exclude internal bleeding and urgently carry out repeated surgical intervention to correct the implant malposition, reosteosynthesis of S1 body without loss of reduction, to achieve regression of the clinical picture of ileofemoral thrombosis, and also to mobilize the patient in the shortest possible time. During inpatient treatment, regression of the symptoms of the complication was achieved, the patient was fully activated, and was discharged for outpatient follow-ups.

Discussion Variability in the anatomy of the sacrum and the characteristics of fractures hinder the navigation while inserting iliosacral screws, which in some cases result in malposition. Compression of the common iliac vein without damaging it causes difficulty in blood outflow and the development of a clinical picture of ileofemoral thrombosis in the early postoperative period.

Conclusion This clinical case shows that X-ray images in standard views are not a reliable method for diagnosing sacral injuries and are not sufficient for preoperative planning. The use of standard C-arm did not provide sufficient intraoperative visualization to correctly assess the position of the iliosacral screw, especially in cases with sacral dysmorphia. The 3D volumetric image reconstruction significantly influenced the correct perception of the anatomical structure of the bony structures of the pelvis. Malposition of the screw and its exit to the anterior surface of the sacrum caused disruption of the iliac vein outflow and development of thrombosis in the early postoperative period.

Keywords: ileosacral blockage, malposition, ileofemoral thrombosis

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INTRODUCTION

Management of unstable injuries of the pelvic bones is one of the unsolved problems in modern traumatology. The instability of the injuries is determined by the nature of the destruction of the posterior semi-ring of the pelvis. Of all the possible variants of posterior pelvic fractures, the most common are sacral fractures [1, 2, 3]; they constitute 0.82–2.1 cases per 100 thousand people (about 3 % of all skeletal fractures) [4, 5, 6]. The most common technique for osteosynthesis of sacral fractures for unstable pelvic injuries is ileosacral screw fixation [4, 7, 8]. The technique has been quite well studied and has several variations depending on the characteristics of the fracture [3, 7, 9, 10, 11, 12]. It is demanding in terms of surgical skills, material and technical base of the medical institution.

The purpose of the work was to present a clinical case of an iatrogenic complication: ileofemoral thrombosis caused by compression of the internal iliac vein due to malposition of the ileosacral screw.

MATERIALS AND METHODS

All materials and methods are presented here with the informed consent of the patient's legal representative and in compliance with the ethical principles of the 2013 revision of the Declaration of Helsinki. The material was the medical records of a 34-year-old patient who was injured in a traffic accident (front seat passenger) and was referred to our institution from a district hospital on the fourth day after the injury with the diagnosis: fracture of the transverse process of L2 vertebra on the left; closed fracture of the pubic and ischial bones on the left, fracture of the lateral mass of the sacrum on the right. He was under alcoholic intoxication.

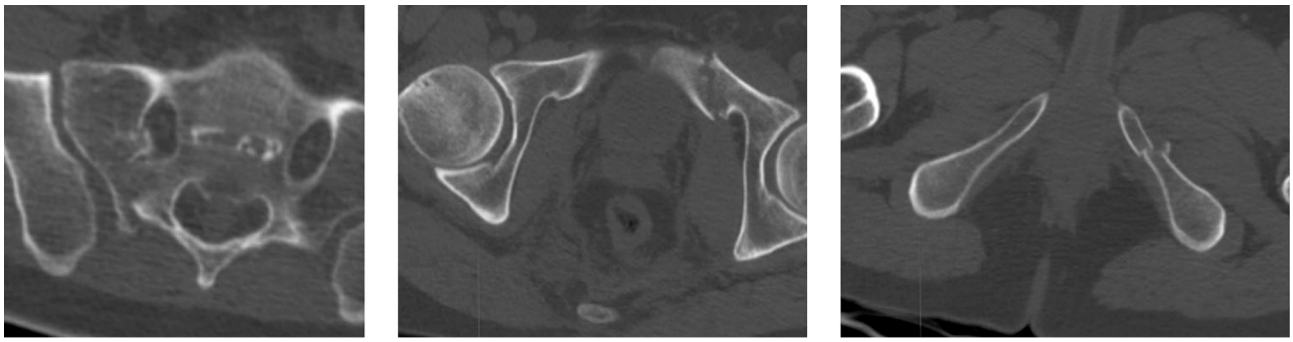
Patient's results were monitored throughout inpatient and outpatient management. The follow-up was 6 months.

RESULTS

The patient was hospitalized at the trauma department of the National Ilizarov Medical Research Center on the fourth day after the injury. Upon admission, according to ultrasound scanning of the vessels of the lower extremities and physical examination, there were no signs of thrombosis of the lower extremity vessels. Admission X-rays of the pelvis in three projections revealed a double fracture of the left pubic bone and left ischium without displacement of bone fragments (Fig. 1). Computed tomography (CT) scans confirmed injuries to the pubic and ischial bones, and additionally detected a fracture of the lateral mass of the sacrum on the contralateral side (Fig. 2).

a b c

Fig. 1 Radiographs of the pelvis upon admission: *a* — plain view; *b* — inlet projection; *c* — outlet projection



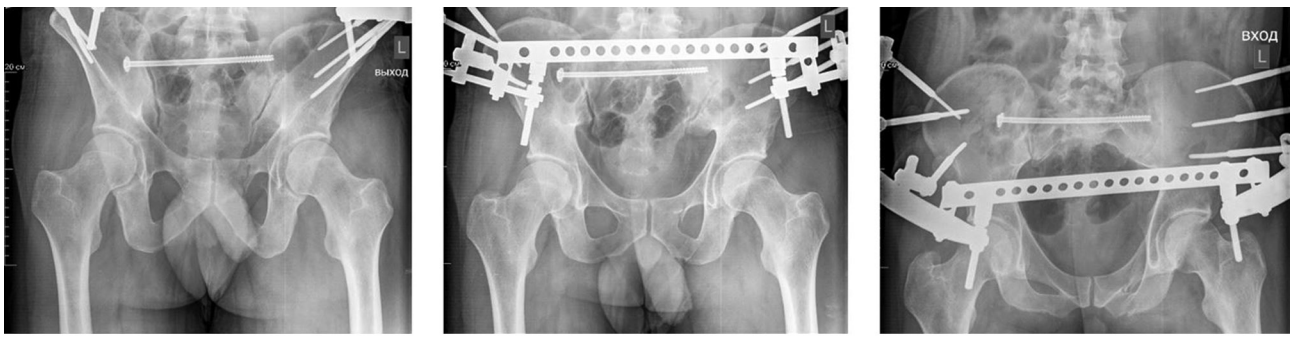
a b c

Fig. 2 CT sections with visualization: *a* — fracture of the right lateral mass of the sacrum; *b* — fracture of the left pubic bone; c — fracture of the left ischium

The surgical intervention plan was as follows. Due to the damage to the lateral mass of the sacrum on the right and a rupture of the anterior parts of the SIL on the left, it was decided to insert two iliosacral screws and fix the anterior semi-ring of the pelvis with the Ilizarov apparatus. The patient was prescribed anticoagulants in a prophylactic dosage (Enoxparin 0.4 subcutaneously once a day). Significant laboratory tests data at the time of admission: PTI — 106 %; hemoglobin — 107 g/l; erythrocytes — 3.52×10^{12}/l; hematocrit — 32.7 %; platelets — 181×10^{9}/l; leukocytes — 6.5×10^{9}/l; ESR — 35 mm/h.

Description of surgical intervention On 10.05.23, under the control of the image intensifier, a wire was passed through the ilium into the body of S1 on the left. A 7/80-mm cannulated screw was inserted along the wire. The screw deviated inwards into the pelvic cavity; it was not possible to change the screw direction. A decision was made to place one screw transsacral on the right. Under the control of the image intensifier, a wire was passed through the ilium into the body of S1 transsacrally. A 7.0-mm cannulated screw with a washer was inserted along the wire. The X-ray checks showed that the position of the screw was satisfactory in all projections. Three half-pins were inserted into the iliac crests. The front frame of the external fixation device was assembled. Due to the difficulties in screw insertion and the staged surgical intervention, the duration of the operation was three hours. Blood loss was approximately 150 ml.

First postsurgical day The patient was verticalized, moved within the ward independently using crutches. He complained of moderate pain in the area of surgical intervention (iliac crests). Control radiographs showed the results of the surgical intervention, the positioning of the elements of the external fixation apparatus and the iliosacral screw in three projections (Fig. 3). A control CT check of the pelvic bones was not available on the first day after surgery due to the operating regime at the institution on that day. Laboratory tests: hemoglobin — 84 g/l; erythrocytes — 2.67×10^{12}/l; hematocrit — 25.4 %; platelets — 442×10^{9}/l; leukocytes — 10×10^{9}/l. The patient was somatically stable, there was no tachycardia, blood pressure did not drop.



a b c

Fig. 3 Checking radiographs after surgery: *a* — outlet projection; *b* — overview projection; *c* — inlet projection

Second postsurgical day Examination of the patient did not detect negative changes in the somatic condition; blood test control: hemoglobin — 80 g/l; erythrocytes — 2.67×10^{12}/l; hematocrit — 24.8 %; platelets — 412×10^{9}/l; leukocytes — 7.1×10^{9}/l. The patient had no complaints at the time of examination. Data for ongoing bleeding were not available. He received anticoagulant therapy at the same dosage (Enoxparin 0.4 subcutaneously once a day).

Fourth post-surgical day Physical examination revealed severe swelling of the left thigh (+6 cm). Ultrasound scanning of the vessels of the lower extremities was performed. Its findings were echo signs of ileofemoral thrombosis on the left, thrombophlebitis of the left GSV of the upper third of the thigh, lymphadenopathy of the inguinal node on the left. In the lumen of the left common femoral vein, echogenic thrombotic masses measuring 25.4×9.6 mm were visualized; thrombotic masses passed into the left GSV measuring 19.4×5.1 mm with preservation of weak parietal blood flow, compression of the veins was incomplete. The left superficial and deep veins of the thigh and the left popliteal vein were not visualized due to severe lymphostasis of the subcutaneous fat. LSV on the right was 2.0 mm, the course was straight, there were no blood clots; on the left, it was 2.1 mm, the course was straight, there were no blood clots. Severe lymphostasis of the SF at all levels of the left thigh and left popliteal fossa. Moderately pronounced lymphostasis of the SF at all levels of the lower leg. The iliac vessels (arteries and veins) were not visualized due to intestinal loops distended with gas. The left femoral artery and deep femoral artery were not visualized due to severe lymphostasis. The walls of the visible arteries of the lower extremities were smooth, the IMT was not thickened — up to 0.6 mm, the ASC was not visualized. The blood flow was of the main type at all levels of the lower extremities, the blood flow speed was not reduced. A previously planned CT scan of the pelvis was performed to assess the position of the iliosacral screw. The CT scan (Fig. 4) showed that the end of the screw protruded to the anterior surface of the sacrum on the left by up to 1.5 cm.

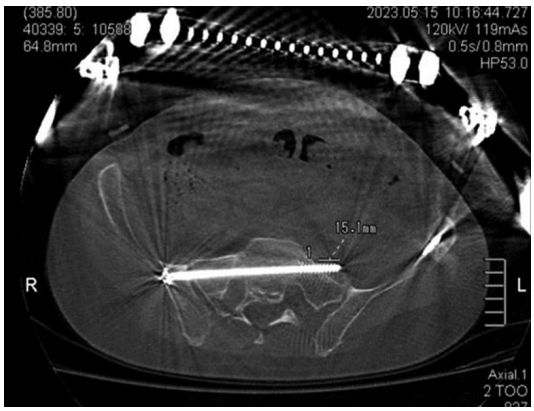


Fig. 4 CT section shows the screw protruding on the anterior surface of the sacrum

To exclude the damage to the iliac vessels with the screw, contrast CT angiography was performed (Fig. 5). It found that contrast enhancement of the arteries was not impaired; expansion, decreased contrast, blurred contours of the left external iliac vein (up to 1.8 cm on the left, up to 1.3 cm on the right), and the common femoral vein. Swelling of the soft tissues of the left thigh. The ileosacral screw on the left protruded into the pelvic cavity up to 2 cm. There were no obvious signs of compression of the vascular structures (pronounced artifacts from the metal structure). Despite the absence of obvious signs of compression, due to artifacts from metal structures, the presence of compression was indirectly suspected by the expansion of the left iliac vein distal to the place where the screw protrudes into the pelvic cavity. There was no evidence of vascular damage or ongoing bleeding; the frequency of anticoagulant therapy was increased to 2 times a day.

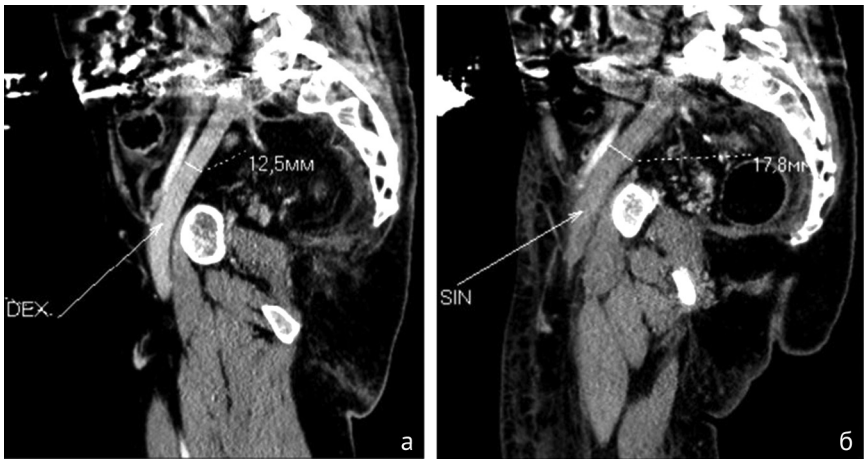


Fig. 5 CT sections with contrast, displaying: *a* — diameter of the iliac vein on the right; *b* — diameter of the iliac vein on the left

Based on the data of instrumental and physical examinations, indications were given for repeated surgical intervention: removal of the iliosacral screw, reosteosynthesis of the lateral mass of the sacrum with insertion of the screw through the corridor in S2. Considering the high risks of intraoperative bleeding from the iliac vessels and initial anemia (hemoglobin — 80 g/l; red blood cells — 2.67 × 10^{12}/l; hematocrit — 24.8 %), a preventive blood transfusion of 2 units of compatible red blood mass was performed. The next day the patient was taken to the operating room. The implant position was controlled in the operating room using a C-arm. In the postoperative period, to assess the positioning of the screw, radiographs in four projections (Fig. 6) and computed tomography (Fig. 7) were performed.

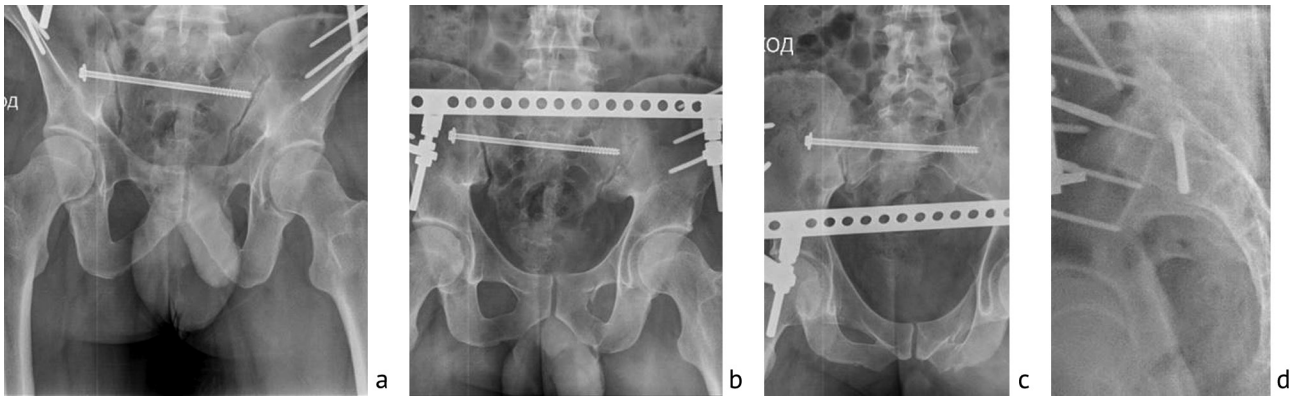


Fig. 6 Radiographs of the pelvis in 4 projections after repeated surgery: *a* — outlet projection; *b* — overview projection; *c* — inlet projection; *d* — sacrum in lateral projection

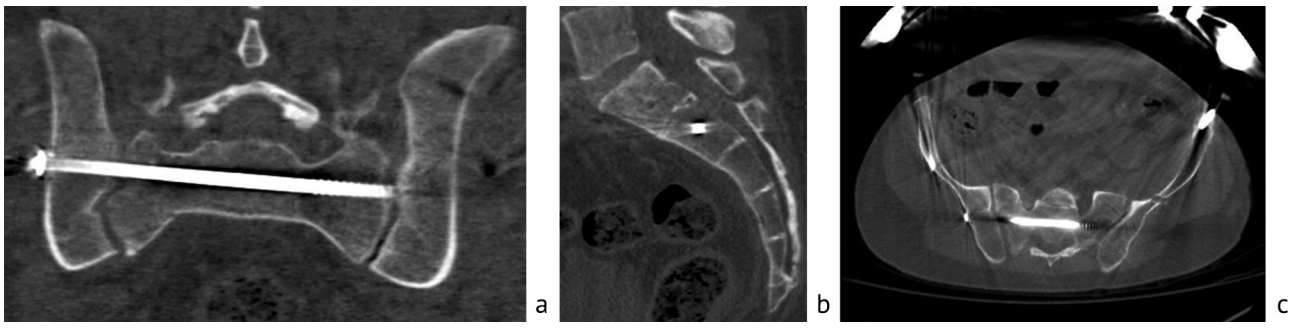


Fig. 7 Sections of multiplanar CT reconstruction of the pelvis, displaying the position of the screw: *a* — frontal plane; *b* — sagittal plane; *c* — horizontal plane

Monitored blood tests after repeated surgery were: hemoglobin — 99 g/l; erythrocytes — 3.34×10^{12}/l; hematocrit — 31 %; platelets — 435×10^{9}/l; leukocytes — 9×10^{9}/l. In the postoperative period, the patient was verticalized the following day but axial load on the left limb was excluded. He continued to receive anticoagulants in the same dosage. Clinical manifestations of phlebothrombosis regressed during the first week. A control ultrasound study of the vessels of the lower extremities was carried out on the seventh day after reintervention. The findings were echo signs of ileofemoral thrombosis on the left, phlebothrombosis of the left superficial vein of the thigh, popliteal vein in weak recanalization, thrombophlebitis of the left GSV of the upper third of the thigh in the stage of weak recanalization, lymphadenopathy of the inguinal node on the left.

An outpatient follow-up examination was carried out one month after surgery. The patient had no complaints, moved independently without additional means of support fully loading the limb. Ultrasound scanning of the vessels of the lower extremities was performed. At the time of the examination, there was no evidence of acute thrombosis of the veins of the lower extremities. Echo signs of incompetence of the left valves of the GSV were revealed. The external fixation device was removed after 1.5 months.

During inpatient treatment, regression of the symptoms of the complication was achieved; the patient was fully activated and discharged for outpatient observation.

The patient was interviewed at three and six months after the surgical intervention: he returned to work after the wounds had healed at the sites where the half-pins and screws were inserted, and had no complaints.

DISCUSSION

Variability in the anatomy of the sacrum and the characteristics of fractures make navigation difficult during insertion of iliosacral screws that may result in their malposition [11, 13, 14, 15]. Cases of neurological disorders associated with insertion of screws in the projection of the sacral foramina and sacral canal were described [6, 15, 16], and a case of damage to the superior gluteal artery from the side of screw insertion [17] as well as cases of malposition accompanied by the screw coming out on the inner surface of the sacrum were reported [17]. In the available literature, we have not found a description of the clinical picture of ileofemoral thrombosis associated with the mentioned above malposition of the ileosacral screw. In most cases of screw malposition, visual radiographic control using standard C-arm views satisfied the surgeons. The above clinical case confirms that radiological images in standard views are not a reliable method for diagnosing sacral injuries and are not sufficient for preoperative planning [9, 18]. The same applies to standard projections of multislice computed tomography (axial, coronal, sagittal). The combination of the imaging methods used in pelvic trauma is necessary to assess the nature of damage to the pelvic bones for planning reconstructive operations aimed at restoring normal anatomy and reliable fixation of injuries [7, 11, 19].

The 3D volumetric image reconstruction helps a lot to correctly perceive the anatomical structure of the bony structures of the pelvis. However, the need to standardize the imaging protocol for pelvic examination remains relevant [8]. The ability for a surgeon to study a 3D volumetric image in detail by changing its position in space can significantly increase the efficiency of its perception. Thus, careful preoperative planning with regard to the anatomy of each patient aimed at the acceptable corridors for the placement of iliosacral screws helps to avoid their incorrect placement. In order to prevent such complications, the use of non-standard X-ray views during surgery was proposed [17]. An alternative way to prevent such complications is the use of navigation systems [16, 20, 21, 22].

It is advisable to conduct a control MSCT study after such operations. Compression of the common iliac vein without damaging it causes difficulty in blood outflow and the development of a clinical picture of ileofemoral thrombosis in the early postoperative period. Timely suspicion based on physical examination data assisted with CT angiography enabled to exclude internal bleeding and urgently carry out repeated surgical intervention to eliminate implant malposition, reosteosynthesis of the S1 body without loss of reduction, to achieve regression of the clinical picture of ileofemoral thrombosis, and also to mobilize the patient in the shortest possible time .

CONCLUSION

The use of standard C-arm views did not provide sufficient intraoperative visualization to correctly assess the position of the iliosacral screw in the case with sacral dysmorphia. Malposition of the screw and its protrusion to the anterior surface of the sacrum, which was not detected intraoperatively, caused a disruption of the outflow of the iliac vein and promoted thrombosis in the early postoperative period. Patients after minimally invasive surgical interventions for sacral fractures require careful medical supervision. It is advisable to perform MSCT study as early as possible after such operations.

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