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Spontaneous psoas hematoma following posterior lumbar fusion surgery: a mini literature review

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Abstract

Background Spontaneous psoas hematoma is a very rare clinical entity, and the pathogenesis and pathologic mechanisms of spontaneous psoas hematoma remain unclear, thus, it is of great value to explore.

Case presentation We encountered a patient who developed femoral nerve paralysis due to psoas muscle hematoma following posterior lumbar fusion surgery. A 69-year-old female with lumbar spinal canal stenosis underwent posterior lumbar fusion at the L3-4 and L4-5 levels. On the 7th postoperative day, the patient complained of severe abdominal pain along with right limb pain and weakness. A computed tomography image showed a large acute psoas muscle hematoma on the right side. After conservative treatment, the psoas hematoma was resolved and the patient's femoral nerve paralysis gradually recovered.

Conclusions Spontaneous psoas hematoma is a rare and extremely dangerous complication after lumbar spine surgery. For high - risk patients who have taken anticoagulants before the operation, we must be vigilant against the occurrence of this complication.

Keywords Femoral nerve palsy, Psoas hematoma, Therapy

Background

Spontaneous psoas hematoma is an extremely rare clinical entity, with an incidence rate of approximately 0.1% [1]. The clinical manifestations of patients are different, such as lumbago, inguinal pain, abdominal pain, lumbar plexus neuralgia, and acute massive hemorrhage [2]. However, these manifestations lack specificity, and some patients may not even have any clinical symptoms. Psoas hematoma is prone to occur in patients with vascular diseases or vascular malformations as well as in those undergoing hemodialysis. However, in patients undergoing anticoagulation therapy, such as with warfarin, aspirin, and low molecular heparin, the incidence of psoas hematoma can be as high as 6.6% [3].

The pathogenesis and pathologic mechanisms of spontaneous psoas hematoma remain unclear, however, it has potential bleeding tendencies, which can lead to hemorrhagic shock and become life-threatening in severe cases. Furthermore, after the formation of a major psoas hematoma, it can stimulate and exert pressure on the femoral nerve, resulting in paralysis of the femoral nerve, which

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Table 1 The anticoagulation protocol for the patient during hospitalization

Time	Anticoagulation treatment
Prior to admission	Clopidogrel, 75 mg/day
After admission ~ Postoperative Day 6	Low-molecular-weight heparin 2500IU/Q12H
Postoperative Day 7	Psoas hematoma,
Postoperative Day 7 ~ Postoperative Day 11	Non-anticoagulant
Postoperative Day 12	D-dimer 7.99 mg/L
Postoperative Day 12 ~ Postoperative Day 17	Clopidogrel, 75 mg/day
Postoperative Day 18	Occult blood test (++)
Postoperative Day 18 ~ Postoperative Day 19	Non-anticoagulant
Postoperative Day 20	Occult blood test (-)
Postoperative Day 20 ~ discharge from hospital	Clopidogrel, 75 mg/day

is a rare complication of lumbar surgery. In addition, due to the low incidence of psoas hematoma and the lack of specificity in clinical and imaging features, it is easy to misdiagnose, making early detection and prevention challenging. Therefore, accurate and timely diagnosis remains a significant challenge. Hence why, awareness is essential for early detection and prevention, especially in patients on anticoagulation therapy.

Case report

The patient, a 69-year-old female, complained of lumbar and leg pain for more than 10 years, with right lower limb pain aggravated for weeks. The Visual Analogue Scale (VAS) of right lower limb pain is 6 scores. Additional symptoms included difficulty in walking up to 300–500 m. She had a history of hypertension and coronary heart disease for more than 10 years, and two stents were implanted in the left coronary artery 5 years ago, and she was given 75 mg of clopidogrel daily for long-term oral treatment (Table 1). Physical examination revealed a decrease in the motor functions of the lower limbs. The X-ray of the global spine and Magnetic Resonance Imaging (MRI) showed lumbar spinal canal stenosis at the L3-4 and L4-5 levels (Fig. 1). After hospital admission, cardiologists were consulted to adjust the perioperative medications. Antiplatelet drugs were discontinued and low-molecular-weight heparin 2500IU/Q12H was given as an alternative therapy (Table 1). The preoperative blood parameters, including hematological, biochemical, and coagulation profiles, were within the normal range. After the completion of the preoperative examination, the patient underwent posterior lumbar fusion (L3/4, L4/5 PLF). There were no intraoperative complications. The operation proceeded smoothly, with a blood loss of 300 ml during the operation.

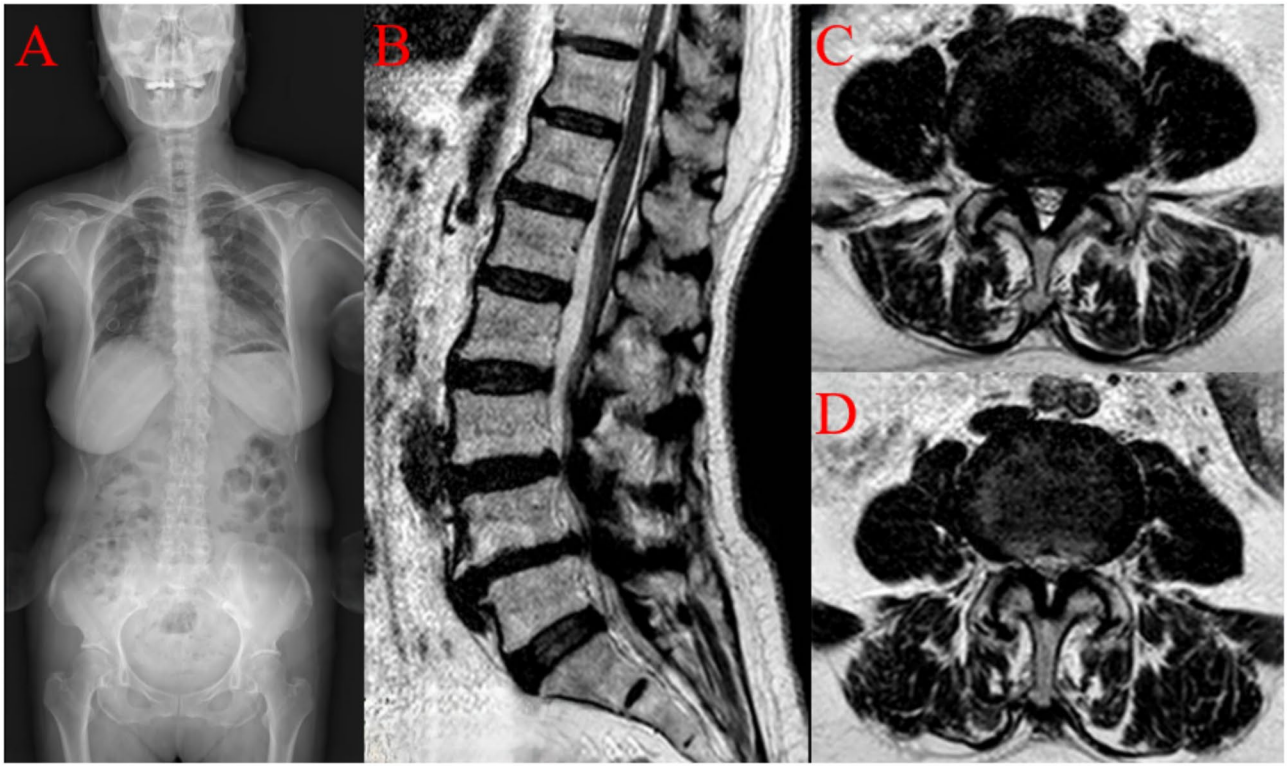

Fig. 1 The preoperative X-ray and MRI images of the patient. (**A**) The anteroposterior radiographs of the global spine (**B**) The sagittal MRI image of the lumbar spine. (**C**) The MRI image in the axial plane of L3/4. (**D**) The MRI image in the axial plane of L4/5

Four days after the operation, the patient complained of abdominal pain accompanied by lower back pain and right leg pain in the early morning, and the pain VAS score was 10 points. The patient's pain was not relieved after oral administration of 100 mg of tramadol sustained-release tablets. The pain was alleviated after intramuscular injection of 5 mg of morphine hydrochloride again. Seven days after the operation, the patient presented again with abdominal and right leg pain, accompanied by nausea and an elevated temperature, which reached as high as 38.1℃. Physical examination revealed decreased sensation over L4 and 5 dermatomes and a motor power of Medical Research Council (MRC) grade 4 on the right L4 and L5 myotomes. There was a marked decrease in sensation in the femoral (including saphenous) and the lateral femoral cutaneous nerve distributions.

Her vital signs were unstable and her blood pressure was 96/48 mmHg. The blood routine examination (Table 2) indicated the following: red blood cell count: 1.39×10^{12}/L, hemoglobin: 44 g/L, white blood cell count: 17.12×10^{9}/L, neutrophil percentage: 13.17×10^{12}/L. A computed tomography (CT) scan of the abdomen was performed to rule out any retroperitoneal hematoma, deep infections, or screw misplacements. The CT scan revealed that the right psoas was swollen, presenting a round, irregular, and high-density shadow with an unclear boundary, and the gap between adjacent muscle and fat was narrowed (Fig. 2). MRI of the lumbar spine revealed a large collection measuring $6.6 \times 5.3 \times 5.6$ cm adjacent to the L4–S1 vertebral bodies (Fig. 3).

The patient was considered to have a psoas hematoma with femoral nerve injury and septic shock. 2 units of red blood cell suspension and 200 ml of plasma were transfused. Vancomycin and meropenem antibiotics were selected for anti-infection treatment and blood was collected for culture. After the blood transfusion, the hemoglobin level increased to 60 g/L (Table 2). Angiography indicated no significant active bleeding, so the patient opted for conservative treatment.

Table 2 The results of peripheral blood indicators of the patient during hospitalization

Time	WBC (10^9/L)	Neu (10^9/L)	RBC (10^9/L)	HB (g/L)
Before surgery	8.84	5.31	3.99	129
Postoperative Day 1	17.45	14.70	3.01	97
Postoperative Day 4	21.37	14.14	2.04	67
Postoperative Day 7	17.12	13.17	1.39	44
Postoperative Day 8	16.91	13.90	1.94	60
Postoperative Day 12	10.60	7.92	2.62	82
Postoperative Day 15	9.77	7.16	3.17	97
Postoperative Day 18	4.37	2.78	2.70	85
Postoperative Day 20	3.10	1.20	2.81	87

Interval of reference: White cell count, WBC:$3.5 \sim 9.5 \times 10^9$/L; Neutrophil, Neu: $1.8 \sim 6.3 \times 10^9$/L; Red cell count, RBC: $3.8 \sim 5.1 \times 10^9$/L; Hemoglobin, HB:115.0 ~ 150.0 g/L

Four days after discontinuation of anticoagulation treatment, the re-examination of the blood indicated that the D-dimer was 7.99 mg/L (Table 3), and reexamination by CT showed no significant active bleeding. Considering the condition of the patient after coronary artery stent implantation, 75 mg/day of clopidogrel antiplatelet therapy was continued to prevent the occurrence of adverse cardiovascular events (Table 1). Five days after the recovery, the patient presented with abdominal distension and diarrhea, with dark-brown stools and a positive fecal occult blood test (++). The gastroscopy suggested the possibility of gastric bleeding, so the antiplatelet drug was stopped again.

After the patient's condition stabilized, the rehabilitation physician used medium-frequency electrotherapy to restore skeletal muscle function and assisted the patient with rehabilitation exercises. One week after the hemorrhage, there was no significant change in the right hip flexion muscle strength of the patient, and the superficial sensation of the right lower limb remained impaired. Two weeks after the hemorrhage, the right hip flexion muscle strength of the patient recovered, and the patient could walk on the ground, while the superficial sensation of the right lower limb showed no significant change. After 3 months of conservative treatment, a review of lumbar CT indicated that the hematoma in the psoas major was basically resolved and the innervation function of the femoral nerve was basically restored to normal (Fig. 2).

Discussion

Hematomas on the psoas muscle occur secondary to trauma, iatrogenic etiology during lumbar surgery including endoscopic discectomy, use of anticoagulants, or coagulation disorders such as disseminated intravascular coagulation and hemophilia [4–6]. However, femoral nerve injury caused by significant psoas hematoma after lumbar internal fixation surgery is very rare [7, 8]. Patients with psoas hematoma exhibit a wide range of clinical manifestations, including low back, abdominal pain or inguinal pain, radiative pain involving the distribution of nerve roots, or persistent chronic blood loss [2, 7]. Physical examination of the patient in the acute hematoma stage revealed that the affected side had pain around the hip joint, limited movement, and a positive straight leg elevation test [9]. The occurrence of psoas hematoma was often accompanied by inguinal area enlargement, superficial skin hypoesthesia in the distribution area of compressed nerves, and even decreased muscle strength [6]. However, the aforementioned clinical signs were not specific and could be observed in various lumbar disorders such as lumbar disc herniation, lumbar spinal stenosis, lumbar tuberculosis, infection,

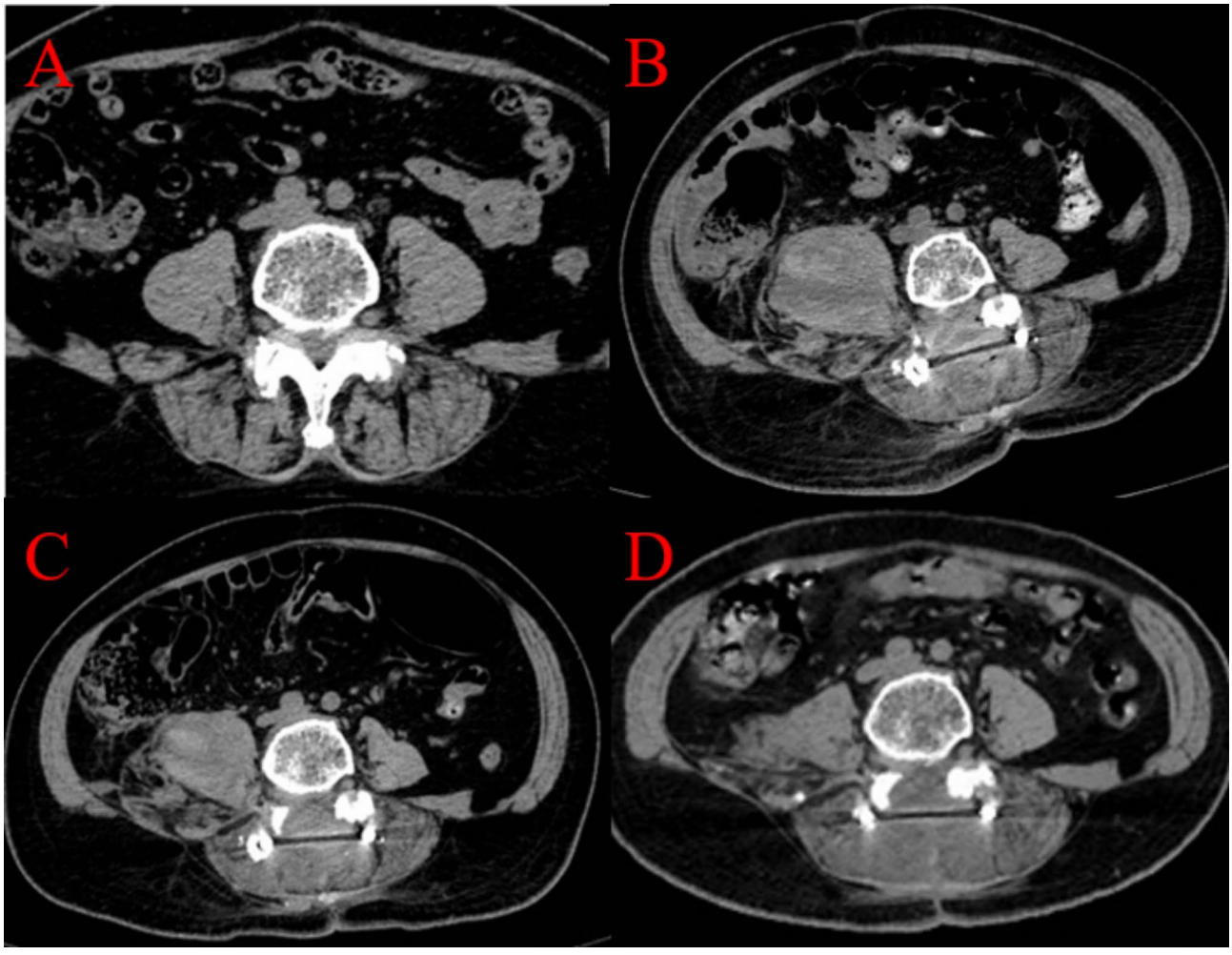

Fig. 2 The CT image of the patient's lumbar spine. (**A**) The preoperative CT images of the lumbar spine (**B**) The CT image of a primary psoas hematoma (**C**) The CT image of the psoas major hematoma 1 month after its occurrence (**D**) The CT image of the psoas major hematoma 3 months after its occurrence

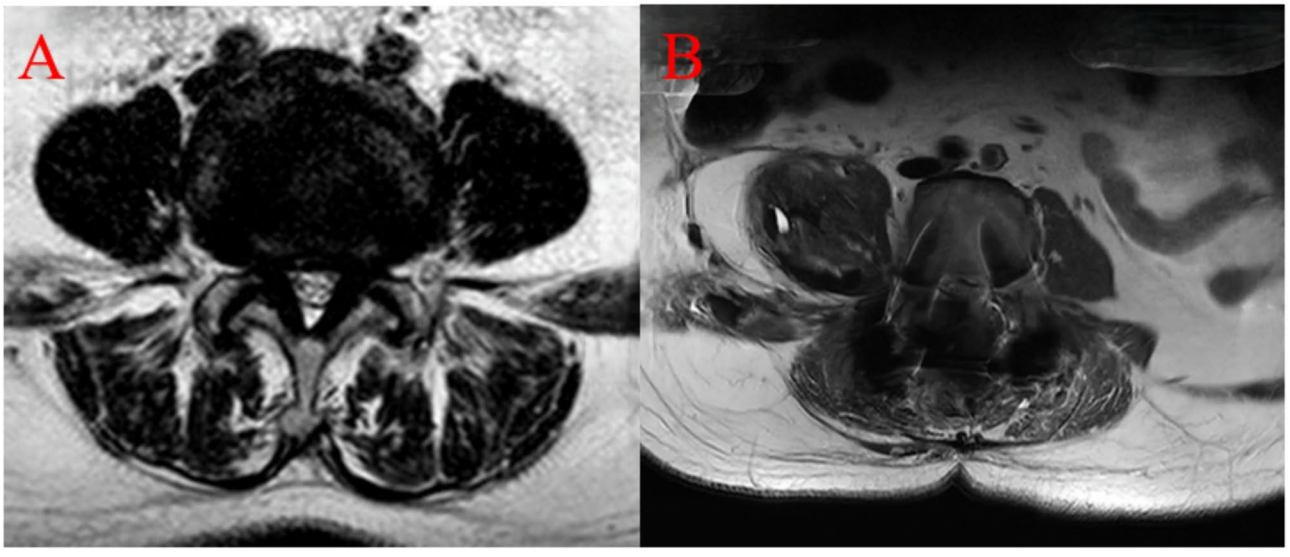

Fig. 3 The MRI image of the patient's lumbar spine. (**A**) The preoperative MRI images of the lumbar spine (**B**) The MRI image of a primary psoas hematoma

Table 3 The coagulation profiles in the patient during hospitalization

Time	INR	APTT(s)	D-dimer (mg/L FEU)
Before surgery	1.04	25.9	< 0.150
Postoperative Day 1	1.04	20.6	0.560
Postoperative Day 4	1.04	35.0	1.060
Postoperative Day 9	1.18	27.1	4.100
Postoperative Day 10	1.11	25.4	4.270
Postoperative Day 12	1.13	24.3	7.990
Postoperative Day 15	1.13	27.7	6.960
Postoperative Day 18	1.15	28.3	4.340
Postoperative Day 20	1.04	23.5	3.210

Interval of reference: international normalized ratio, INR (0.80 ~ 1.50); Activated partial thromboplastin time, APTT (25.0 ~ 31.3s); D-dimer (< 0.550 mg/L FEU)

tumor, etc. As a result, the clinical signs for the diagnosis and treatment of psoas hematoma were relatively limited.

In terms of imaging examination, the significance of X-ray examination is rather limited. The Computed Tomography (CT) images of hematomas demonstrate diffuse involvement of the muscles, and a hyperdense lesion in the muscle might be an early sign of hematoma [10]. Enhanced CT reveals that the hematoma of the psoas major presents as a round, oval, or irregular ring-shaped enhancement. Within the ring-shaped enhancement of the lumen, a high-density blood clot, known as the "island sign" can be observed, which is an important sign of great diagnostic value [11]. Despite the diagnostic advantages of CT, it is difficult to distinguish iliopsoas neoplasms, abscesses, and hematomas without knowledge of the clinical history [10]. Magnetic resonance (MRI) imaging is a more sensitive alternative to CT in diagnosing a hematoma, especially advantageous in demonstrating the deposition of the visible components of the blood within a hematoma [12]. Coronal T2-weighted images are more useful. A mosaic of various signal intensities, named the "mosaic sign," is useful in diagnosing hematoma on MR T2-weighted imaging [13].

In this case, as the patient's pain was relieved after an intramuscular injection of morphine, the occurrence of psoas major hematoma was ignored. Therefore, in the process of diagnosing psoas muscle hematoma, patients should undergo a thorough physical examination, with the combined application of CT and MRI for diagnosis, to further improve the diagnostic accuracy of psoas muscle hematoma and the appropriate treatment.

The treatment of psoas hematoma remains controversial, including conservative treatment, interventional treatment, and surgical treatment [7, 9]. Given that the patient has the potential risk of developing massive hemorrhage and is prone to hemorrhagic shock, it is necessary to strictly monitor the patient's vital signs, hemoglobin level, coagulation function, and various blood flow indicators, blood transfusion should be carried out when necessary. In addition, the neurological status of the patient cannot be ignored. Since the occurrence of psoas hematoma in patients is related to the long-term oral administration of clopidogrel, once the patients' vital signs are stable, the first recommended treatment plan is bed rest along with close monitoring of vital signs and blood-flow indicators, and timely adjustment of anticoagulation plan, which usually can yield satisfactory efficacy [6]. Chan et al. reported that the majority of psoas hematoma can be absorbed spontaneously, and do not require any further intervention measures, against open surgery, as it can further aggravate bleeding [1].

Interventional therapy is increasingly utilized in the treatment of psoas major hematoma, including embolization and CT-guided hematoma drainage. Isokangas et al. reported 4 cases in which open surgery failed to control bleeding, followed by successful embolization [14]. The surgical indications must be clearly defined, and the hemoglobin and blood flow status of the patients must be maintained in a relatively stable state. CT-guided hematoma drainage can also be employed as another treatment option, with the advantages of rapid recovery and fewer complications, however, the treatment effect for intramural hematoma is relatively poor. Although open surgery has significant trauma and numerous complications, open surgery should be employed when the hematoma of the patient is large and there is an infection, deterioration of nerve function, a continuous decrease of hemoglobin level, and peritoneal irritation [15].

Hemorrhage is the most common complication during the utilization of anticoagulant drugs, encompassing gastrointestinal tract bleeding, respiratory tract bleeding, and subcutaneous mucosal muscle bleeding, with the most severe being intracranial hemorrhage. As morphine can delay gastric emptying, morphine might delay anti-platelet drug absorption, decrease peak plasma levels, and reduce its antiplatelet activity, suggesting that morphine should be used with caution in such patients [16] In addition, in this case, to avoid the occurrence of adverse cardiovascular events, clopidogrel was resumed after the patient's condition stabilized, however, gastrointestinal bleeding occurred. This process suggests that we should pay attention to the adjustment of anticoagulant regimens in patients with oral antiplatelet drugs during the perioperative period and be on high alert for hemorrhage-related complications.

In conclusion, Psoas hematoma is an infrequent complication observed in patients who undergo lumbar surgery. It is primarily associated with oral anticoagulants. It is of particular significance to diagnose psoas hematoma through detailed examinations of past medical history, meticulous physical examinations, and cognizant analysis of CT and MRI findings This case emphasizes that conservative treatment is an effective approach for psoas

hematoma. After a three-month course of complications, the hematoma of the psoas muscle can be spontaneously resolved, and the function of the femoral nerve can be restored.

Abbreviations

VAS	Visual analogue scale
PLF	Posterior lumbar fusion
MRC	Medical research council
CT	Computed tomography
MRI	Magnetic Resonance Imaging
WBC	White cell count
Neu	Neutrophil
RBC	Red cell count
HB	Hemoglobin
INR	International normalized ratio
APTT	Activated partial thromboplastin time

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Author contributions
TH and SHZ initiated the idea. HDG and HWX gathered the data. HHZ and YFG wrote the manuscript. BY and HS helped with the data analysis. DSW and SJW supervised and reviewed the manuscript. All authors read and approved the final manuscript.

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Data availability
The datasets generated and analyzed during the present study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate
The study was approved by the Shanghai East Hospital Ethics Committee and obtained the informed consent of the participant

Consent for publication
Consents for publication were obtained from the participant that data are included in this art.

Competing interests
The authors declare no competing interests.

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