# Clinical Case Analysis of Iliopsoas Hematoma Causing with Femoral Nerve Compression

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# Abstract

**Background:** To investigate the clinical manifestation and prognosis of iliopsoas hematoma (IPH) associated with femoral nerve compression and enhance the current understanding of IPH.

**Methods:** Patients diagnosed with IPH from March 2014 to January 2023 at the Affiliated Hospital of Southwest Medical University were assessed. The main clinical indicator observed was visual analog scale (VAS) score before treatment as well as at 1 week and 1, 3, and 6 months after treatment. Secondary indicators included the degree of lower limb numbness before and after treatment, muscle strength, hip flexion degree, the distribution of affected nerves, hematoma size, and hematoma distribution.

**Results:** A total of 28 patients were included, among which 24 were men, and the average age (median [interquartile range]) was 48 (20.25, 63) years. The average duration of disease onset was 3 (1.25, 7) days, and 16 patients (57.14%) exhibited coagulation dysfunction.

After 1 week of treatment, a 50% reduction in the VAS score was noted in 18 patients (64.28%). Furthermore, VAS score at 1 week and 1, 3, and 6 months after treatment were significantly lower than the baseline VAS score ($P < 0.05$).

Baseline lower limb sensation was grade I in two patients, followed by grades II, III, and IV in five, 11, and 10 patients, respectively. After 6 months, 22 patients (78.57%) recovered to grade I. Baseline muscle strength of the lower limb was grade II in one patient, while grades III, IV, and V were in 10, eight, and nine patients, respectively. After 6 months, 19 patients (67.85%) exhibited improvement to grade V.

The baseline degree of hip flexion was graded I and II in 53.57% of the patients, with enhancement to grade III after 6 months in 25 (89.28%).

Hematoma distribution was localized in the mid-zone in 21% of the patients; upper-mid zone, 29%; mid-lower zone, 29%; and upper-mid-lower zone, 21%.

In terms of affected nerves, femoral nerve involvement was revealed in 25 patients (89.28%), whereas lateral femoral cutaneous nerve involvement in 15 (53.57%).

**Conclusions:** IPH is mainly caused by coagulation dysfunction and is often accompanied by pain and femoral nerve involvement that result in slow neurological recovery. Furthermore, the timely detection and causal treatment of IPH may help achieve a favorable prognosis.


# Background

Iliopsoas hematomas (IPHs) are spontaneous or traumatic hematomas involving the iliopsoas muscle [1]. Although IPH has a low morbidity rate, it is a major cause of lower back and leg pain. This hematoma develops beneath the iliac fascia, forming a closed compartment. This compartment can in turn

compress the lumbar plexus nerves, resulting in abdominal and leg pain as well as impaired lower limb sensation, movement, and joint function. Moreover, severe cases can lead to lower limb dysfunction, lifelong disabilities, and abscess formation with life-threatening implications[1, 2] .

A study by Decker et al[3] indicated that 77% of IPH cases were associated with anticoagulant use. However, the morbidity of it is low, often appearing in the literature as case reports. The primary cause of IPH is coagulation dysfunction, which is linked to anticoagulant medication use[4–6], patients with hemophilia[7], and the presence of secondary coagulation disorders [8, 9]. Furthermore, IPH is rarely observed in patients with normal coagulation function [10]. Previous literature has also reported IPH cases resulting from falls, accidents, collisions, and iatrogenic treatments [11].

Nevertheless, the etiology of IPH varies, often involving diverse precipitating factors. For example, patients with coagulation disorders regularly exhibit no apparent triggers or experience mild falls before the onset of lower back or hip pain[12]. However, in severe cases of this hematoma, lower limb neurological impairment, organ dysfunction, and even death can occur [5, 13]. Such patients and the primary attending medical personnel commonly overlook these symptoms initially, misidentifying them as lumbar strains or similar injuries. Additionally, IPH is routinely missed or misdiagnosed as other conditions during diagnosis because of its location deep within the pelvis and inconspicuous surface appearance. Subsequently, hematoma enlargement and femoral nerve paralysis develop, along with secondary symptoms, including lower abdominal pain, numbness, lower limb weakness, and restricted hip joint movement[5]. IPH diagnosis typically becomes apparent during further investigations.

The appropriate treatment methods for IPH remain debated, but they primarily involve surgical intervention and conservative medical treatment [14]. The associated factors generally include age, condition severity, disease progression, hematoma volume, the underlying causes of the hematoma, and the extent of nerve damage [7]. Individualized treatment approaches are selected based on these factors [15]. Currently, most IPH-related research consists of case reports, highlighting the scarcity of systematic clinical studies and research on treatment outcomes. Therefore, in this study, we enrolled patients diagnosed with IPH at our institution to summarize and analyze their clinical characteristics and neurological recovery, aiming to enhance the current understanding of the disease features and prognosis of IPH.

# Methods

This study was a single-center, retrospective investigation. Here, we included patients diagnosed with IPH treated at the Affiliated Hospital of Southwest Medical University between March 2014 and January 2023. The Clinical Trial Ethics Committee of the Affiliated Hospital of Southwest Medical University (KY2021148) approved this study, and the patients or their close relatives provided informed consent. This study adheres to the relevant requirements of the World Medical Association's Declaration of Helsinki. All data included in the analysis have been de-identified.

# Study Design and Patients

Patients were included in this study if they met the following criteria: (1) age > 14 years, (2) computed tomography (CT) scans displaying hematoma characteristics, (3) magnetic resonance imaging (MRI) findings indicating hematoma characteristics, and (4) hematoma confirmation via surgical exploration.

Patient exclusion criteria were as follows: (1) incomplete medical records, (2) hematoma involving other areas, (3) retroperitoneal hematoma not causing femoral nerve compression, (4) hematoma accompanied by lesions such as iliopsoas cysts, infections, or tumors, (5) isolated lower limb neuropathic pain without hematoma, (6) admitted without CT or MRI scans or unavailable imaging examinations, or (7) lost to follow-up.

A total of 4,251 medical records were entered into the electronic medical record system for diagnoses including hematoma, femoral nerve injury, IPH, iliac fossa hematoma, muscle hematoma, retroperitoneal hematoma, muscular hematoma organization, traumatic iliac hematoma, traumatic retroperitoneal hematoma, traumatic IPH, coagulation dysfunction, and hemophilia. After the screening process based on the previously mentioned inclusion and exclusion criteria, 28 patients were found to meet the criteria for study selection.

# Procedures

Patients with coagulation dysfunction received different treatment approaches according to the underlying causes. Specifically, patients with hemophilia (n = 7) were administered factor VIII supplementation and fresh frozen plasma, with treatment adjusted to achieve normal clotting factor levels. In the case of patients on oral warfarin (n = 9) due to cardiovascular diseases, warfarin dosages were modified, and treatment included fresh frozen plasma transfusion and intramuscular vitamin $K_1$ injection, wherein the modifications were guided by the clotting tests to achieve normal levels. Similarly, in patients with coagulation dysfunction caused by rodenticide exposure (n = 2), treatment included fresh frozen plasma transfusion and intramuscular vitamin $K_1$ injection, accompanied by treatment alterations to achieve normal levels using clotting test results.

Additionally, two patients with normal coagulation function underwent internal iliac artery embolization, while surgical hematoma evacuation, rehabilitation therapy after transfer from another medical institution, and cranial surgery after a high-level fall injury were performed for one patient each. Furthermore, IPH treatment, including pain management (tramadol hydrochloride injection) and hemostasis (etamsylate injection), was required in four patients. Finally, based on their complete blood count results, all patients with hematoma occurring with anemia were administered concentrated red blood cell transfusion to elevate hemoglobin levels to the normal range.

# Data Collection

Data including baseline demographic data as well as post-treatment and post-discharge follow-up information were obtained from the medical record system of the East China Hospital Information

System and routine follow-up databases. Baseline demographic data included patients' gender, age, affected side, symptom duration, location of pain, VAS score, level of lower limb numbness, lower limb muscle strength level, hip joint flexion level, hematoma location on imaging, the extent of nerve compression, and time for muscle strength recovery. Routine follow-up assessments were conducted at 1 week and 1, 3, and 6 months after treatment as well as 1 year post-treatment.

The degree of lower limb numbness was assessed using the Barrow Neurological Institute Numbness Scale[16], wherein grade  corresponds to no numbness; grade , mild numbness (no major impact on daily life); grade , moderate numbness (some influence on daily life); and grade , severe numbness (substantial effect on daily life).

Further, the anterior thigh muscle strength was evaluated based on a grading system from 0 to V. In this system, grade 0: no muscle contraction, and the limb is fully paralyzed; grade : slight muscle contraction and slight movement in a single muscle are possible, but the limb is paralyzed; grade : horizontal muscle movement is possible, and the limb exhibits muscle contraction during movement but cannot resist gravity when lifted; grade : slight resistance against gravity and short movement duration, while the limb can be raised but cannot resist gravity; grade : moderate resistance against gravity and weaker than normal muscle strength, while the limb can move in a limited range against some resistance; and grade : normal muscle strength and joint function, and the limb and joint can move freely.

Lastly, hip joint flexion was measured using the Harris hip score, in which grade  represents 0°–45° flexion; grade , 45°–90° flexion; and grade , 90°–110° flexion.

# Statistical Analysis

Statistical analysis was conducted using SPSS (version 26, IBM, USA), and GraphPad Prism 9.0 was employed for graphical data visualization. Normally distributed continuous data are presented as mean ± standard deviation, while non-normally distributed quantitative data are expressed as median (interquartile range), i.e., M (Q1, Q3).

VAS score at different time points were analyzed using the non-parametric Kruskal–Wallis test, with the Bonferroni method for between-group comparisons. Survival analysis was conducted using the Kaplan–Meier method, and the differences were assessed using the log-rank analysis. Categorical data were described via frequencies and percentages. $P < 0.05$ was considered statistically significant.

# Results

In this retrospective investigation, 31 patients with IPH were initially identified. After applying the study's inclusion and exclusion criteria, three patients were excluded (one had retroperitoneal hematoma, and two were lost to follow-up). Ultimately, 28 patients with IPH were included, and their clinical data were collected and analyzed.

# 1. Baseline Characteristics

Table 1 summarizes the baseline characteristics of the patients at admission, including age, gender, affected side, symptom duration, pain location, hemoglobin and coagulation function, VAS pain scores, the extent of lower limb numbness, lower limb muscle strength level, hip joint mobility, hematoma location on imaging, hematoma size, and treatment methods. Table 2 displays the coagulation function of the patients on admission, wherein nine underwent testing for factors VIII, IX, and XI activity.

Table 1
Patient Characteristics

| **Patients** | **Total (n = 28)** |
|---|---|
| Age[year, M(Q1, Q3)] | 48(20.25, 63) |
| Gender, male, n(%) | 24, 46.15% |
| Diseasedparts, right, n(%) | 13, 46.42% |
| Course of disease[day, M(Q1, Q3)] | 3(1.25, 7) |
| hemoglobin(g/L, ) | 110.57 ± 26.17 |
| thrombocyte [M(Q1, Q3)] | 207(180.50, 286.25) |
| VAS score[M(Q1, Q3)] | 7(6, 8) |
| Abnormal coagulation function, n(%) | 18(64.28%) |
| complication | |
| hemophilia, n(%) | 7 (25.00%) |
| Stent placement or heart valve replacement, n(%) | 6 (21.41%) |
| coronary heart disease, n(%) | 3, 10.71% |
| other, n(%) | 12, 42.85% |

Table 2
coagulation function

| **Item** | **PT** | **PT-INR** | **APTT** | **TT** | **FiB** | **Ⅸ(n = 9)** | **Ⅺ(n = 9)** | **Ⅷ(n = 9)** |
|---|---|---|---|---|---|---|---|---|
| / M(Q1, Q3) | 21.55 ± 15.31 | 1.92 ± 1.59 | 43.3(34.20, 61.3) | 16.31 ± 1.45 | 3.68 ± 1.15 | 16.20(3.5,178.05) | 93.14 ± 75.83 | 83.73 ± 41.80 |

# 2. VAS score

All patients experienced a rapid reduction in VAS scores after treatment owing to interventions, such as medication, intervention procedures, and surgery. Moreover, pain intensity and extent, as well as lower limb nerve function were re-evaluated before discharge. Among the 28 patients, 17 (60.71%) exhibited a > 50% decrease in VAS scores after 1 week of treatment. At the 6-month follow-up, 18 patients (64.28%) achieved a VAS score of 0, with 10 (35.71%) reporting mild pain and none presenting with moderate to severe pain (Fig. 1).

# 3. Grading of Lower Limb Sensation, Muscle Strength, and Hip Joint Flexion

The varying degrees of nerve compression have distinct effects on lower limb sensation, motor function, and hip joint flexion. Based on the extent of lower limb numbness, patients were categorized into four levels. On admission, two patients were classified as level I; five as level II; 11 as level III; and 10 as level IV, with levels III and IV accounting for 75% of the patients. At the 6-month follow-up, 22 patients (78.57%) recovered to level I, while 95.45% (n = 22) improved to level I at the 1-year follow-up (Fig. 2). The patients were categorized into six levels according to their thigh muscle strength. During admission, one patient was identified as level II; 10 as level III; eight as level IV; and nine as level V, with levels III and IV including 64.28% of the patients (Fig. 3). At the 6-month follow-up, 19 patients (67.85%) resolved to level V, while four remained at level IV at the 1-year follow-up.

The compression of the hematoma on the iliopsoas muscle affects the hip flexion function. The hip joint flexion was categorized into three levels. On admission, 15 patients (53.57%) exhibited hip joint flexion of levels I and II (Table 3). At the 6-month follow-up, 25 patients (89.28%) progressed to level III, with only one remaining at level II with a mild restriction at the 1-year follow-up.

Table 3
Hip flexion

| bend | baseline | at discharge | 6 months after treatment | 1 year after treatment |
|---|---|---|---|---|
| | 10, 35.71% | 1, 3.57% | 0 | 0 |
| | 5, 17.85% | 13, 46.42% | 3, 10.71% | 1, 4.54% |
| | 13, 46.42% | 14, 50% | 25, 89.28% | 21, 95.45% |

# 4. Hematoma Distribution and Nerve Involvement

The location of the hematoma (Fig. 3a-b). All hematomas were unilateral, with hematomas in the middle region in 21% of the patients, upper-middle region in 29%, middle-lower region in 29%, and upper-middle-lower region in 21%. Additionally, no patients exhibited hematomas in the unilateral upper or lower regions (Fig. 3c). Furthermore, the size of the IPH positively correlates with the width of the involved area and the number of branches of the affected lumbar plexus nerves. Among the various lumbar plexus

nerves, the femoral and lateral cutaneous nerves of the thigh are most susceptible to hematoma compression, associated with 25 (89.28%) and 15 patients (53.57%), respectively, in this study (Fig. 3d).

# 5. Effect of Coagulation Function on Muscle Strength Recovery

Based on the log-rank test results, no significant difference was observed between the two groups in terms of time for recovery of muscle strength to grade V ($P > 0.05$, Fig. 4).

# Discussion

IPH is a prominent cause of lower back and leg pain. Moreover, the incidence of spontaneous IPH in the general population is approximately 0.1%, which increases to 0.6% in older patients undergoing anticoagulant therapy or patients with coagulation disorders [12]. Most IPH cases occur within the iliac fossa and present with characteristic abdominal pain, along with inconspicuous surface manifestations that make its detection difficult. This under-recognition of the hematoma is an important factor in its misdiagnosis [3]. Furthermore, the hemorrhage can spread to upper or lower regions when it becomes severe. The spread to the lower regions is initially hindered by muscle compartments, which are eventually breached as the pressure increases. In particular, IPH exerts pronounced compression on the femoral and lateral femoral cutaneous nerves, potentially causing irreversible damage [2].

Hemorrhage in the psoas major muscle is a severe clinical condition with diverse and ambiguous presentations, encompassing femoral nerve compression, compartment syndrome in the abdominal cavity, and even fatal hypovolemic shock[17]. Additionally, spontaneous IPH commonly manifests as abdominal pain, along with pain in the lumbar, hip, thigh, and inguinal regions [11]. This hematoma is often mistaken for conditions such as lumbar disc herniation, lumbar myofascial pain syndrome, or third lumbar transverse process syndrome[11].

Our study identified coagulation disorders as the primary cause of IPH[5]. Furthermore, in the current study patients, common etiologies included anticoagulant medication use (32.14%), hemophilia (25%), and trauma from falls (21.42%). These findings aligned closely with the previous literature results. Based on our case analysis and the prior research findings, we summarize the causes of IPH as follows: 1: Coagulation disorders (warfarin[13, 18], heparin[5, 15], and edoxaban use); 2: Hemophilia[7, 10]; 3: Traumatic injury [2] (e.g., sports injuries, falls, high-impact trauma, and car accidents); 4: Other causes [10, 12, 19, 20] (including spontaneous bleeding due to Mediterranean anemia[21], cirrhosis [17], and splenomegaly-related bleeding [21])

Non-coagulation disorder-related causes comprise conditions such as thrombocytopenia, impaired platelet function, decreased coagulation factor levels, and excessive fibrinolysis. Shimazaki et al. [8] also reported a rare case of a patient with progressive myelitis and spasms who developed bilateral IPHs due to related muscle contractions.

In this study, we revealed that patients experienced rapid pain relief after interventions including coagulation function improvement, interventional procedures, and surgical methods. The baseline median VAS score for pain of 7 was reduced to 4 at 1 week and further decreased to 0 at 3 months after treatment, indicating marked pain relief by that time. However, the recovery of lower limb sensory function, motor function, and hip joint mobility was relatively gradual. At 6 months post-treatment, 78.57% of the patients had restored their sensory function to level I, 67.85% achieved muscle strength of level V, and 89.28% attained hip joint flexion of level III.

Guild et al[14] indicated that patients with IPH commonly experience long-term impairment of lower limb motor function, congruent with the current study findings. Several factors may contribute to this phenomenon, including the following:

1. Duration of medical intervention: A longer duration of hematoma compression is associated with an increased risk of irreversible nerve function impairment.

2. Hematoma size: Larger hematomas lead to wider compression areas and longer recovery times for hematoma absorption and nerve function restoration.
3. Hematoma distribution: Hematomas localized in the middle and lower segments are more likely to cause femoral nerve compression, leading to lower limb functional impairment. Conversely, hematomas presenting in the retroperitoneal space (Fig. 3D) and the lumbar region without compression at the site of nerve passage would not induce lower limb neurological issues.
4. Treatment approach: Patients with hemophilia are mainly treated with coagulation factor supplementation, focusing on improving coagulation function and adjusting relevant medications. In this condition, hematoma absorption is slow, resulting in the delayed recovery of nerve function. In contrast, patients with normal coagulation function can undergo surgical hematoma evacuation, leading to faster nerve function recovery.

Additionally, we revealed that the femoral nerve was the most susceptible among all lumbar plexus branches, exhibiting an involvement in this nerve in 25 (89.28%) study patients. This susceptibility may be attributed to the location of the hematoma within the mid-zone (as illustrated in Fig. 4), wherein the femoral nerve precisely traverses. This anatomical location explains the specific vulnerability of the femoral nerve. Conversely, the lateral femoral cutaneous, ilioinguinal, and iliohypogastric nerves that innervate areas at relatively higher positions might exhibit impairment only when the hematomas occur in the upper segment or upper zone of the psoas major.

We also conducted a comparative analysis to explore whether clotting function differences might have affected the time for muscle strength recovery. However, the analysis found no significant difference in the recovery time between the normal and abnormal clotting function groups. Nevertheless, attention should be given to the fact that this was a retrospective study without blinding and randomization in the grouping. Moreover, the normal clotting function group consisted of a relatively small sample size of only 10 patients. Additionally, the study included patients from various medical departments; therefore, the

rarity of this condition combined with the varying management approaches across departments might have introduced limitations in this study. Thus, more extensive case studies are warranted in the future to address this issue.

In this study, 89.28% (25/28) of the patients were treated conservatively. In particular, patients with hemophilia received clotting factor transfusions to improve their clotting function, whereas concentrated red blood cell transfusions were administered to manage those with anemia. Rodriguez-Merchan et al. [7] have emphasized that long-term replacement therapy with clotting factors is crucial for dealing with hemophilia-related IPHs. Meta-analysis studies [8, 14] have demonstrated that conservative treatment was administered in 57% of patients, including interventions based on blood products, analgesics, hemostatic drugs, hormones, and neurotrophic factors [15]. In contrast, the proportion of conservative treatment was higher in our study, possibly due to the prevalence of clotting disorders in 64.28% (18/28) of the patients.

In the case of surgical approaches for treating IPH, techniques including open surgery, interventional embolization, CT or ultrasound-guided puncture aspiration, and the injection of coagulation enzymes have been reported[10, 22]. However, hematoma recurrence is a possibility with this strategy. Consequently, the decision for surgical intervention should be according to a comprehensive assessment of the patient's etiology, condition, and other factors [21].

In summary, IPH is an important cause of lower back and leg pain. Considering the variety of initial admitting departments for patients with IPH, careful observation of those with trauma or clotting disorders is essential to prevent misdiagnosis or oversight. Further, the diagnosis of IPH should be followed by a comprehensive analysis of the underlying causes to guide the selection of an appropriate personalized treatment plan. Moreover, initiating early rehabilitation training of the lower limb is crucial after the selected treatment of hematoma evacuation or correction of clotting abnormalities has been performed. This rehabilitation measure should be focused on monitoring the progress of hematoma resolution and the recovery of neurological, joint, and muscular function.

# Conclusions

IPH is primarily caused by clotting disorders and is often accompanied by femoral nerve involvement that results in the slow recovery of neurological function. Furthermore, the timely identification of IPH is vital for facilitating etiological treatment and the early initiation of rehabilitation exercises.

# Abbreviations

IPH iliopsoas hematoma

CT Computed tomography

VAS visual analog scale

# Declarations

### Ethics approval and consent to participate

The study was clinically ethically registered in the University Medical Research Archive Registry and approved by the Clinical Trials Ethics Committee of the Affiliated Hospital of Southwestern Medical University (Grant No. KY2021184). All methods in the study were carried out in accordance with the Helsinki guidelines and declaration. Juveniles were obtained from a parent and/or legal guardian for study participation.

### Consent for publication

Not applicable.

### Availability of data and materials

The data used to support the findings of this study are available from the corresponding author upon request.

### Competing interests

The authors declare that they have no conflicts of interest in this work.


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### Authors' contributions

Fubo Li and Miao Peng: drafting and revision of the manuscript. Gege Gong and Changhe Ren : discussion and revision of the manuscript. Cehua Ou and Yue Zhang: final approval of the revised manuscript after correction based on several academic advices for submission.


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# Figures

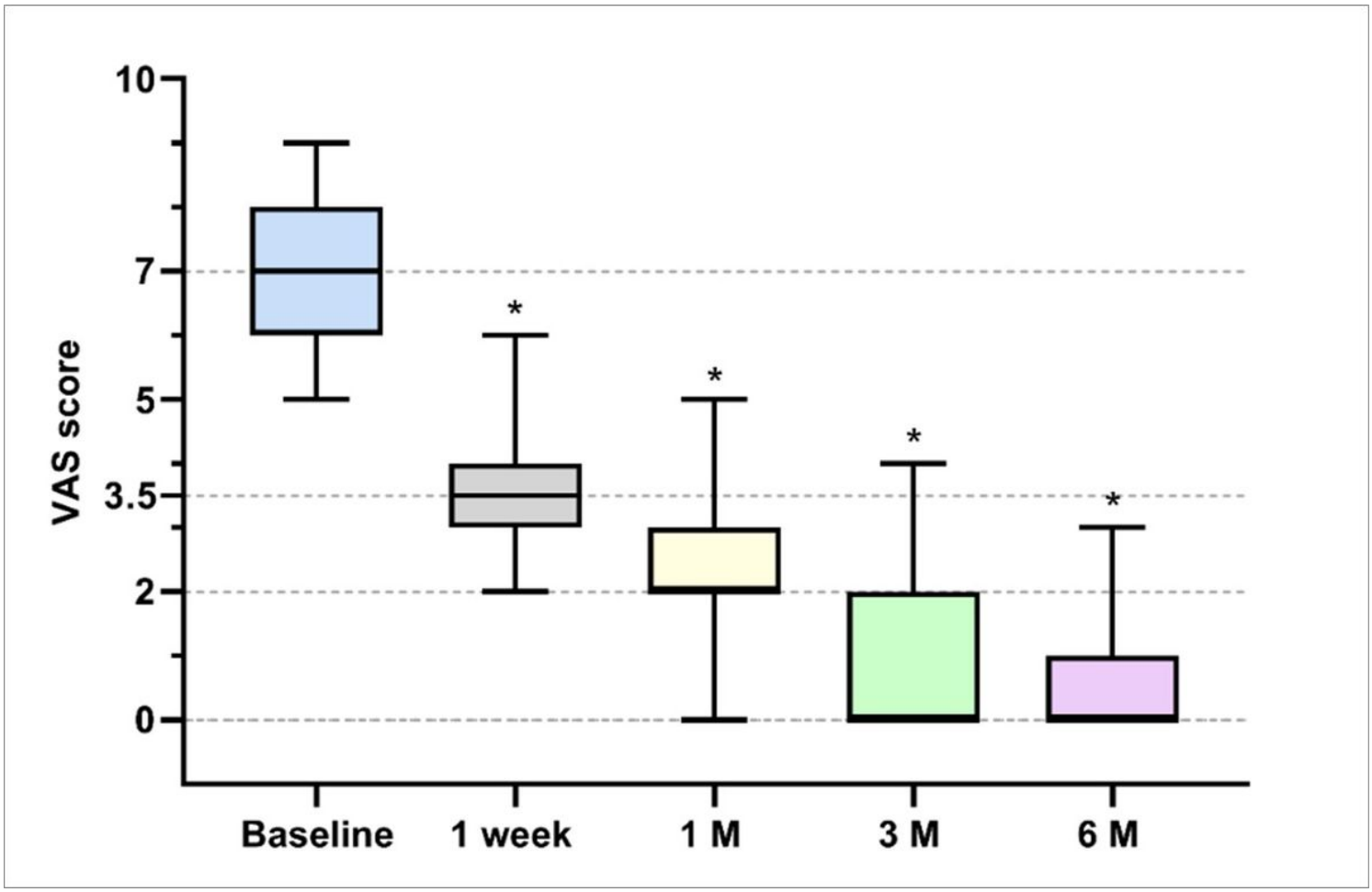
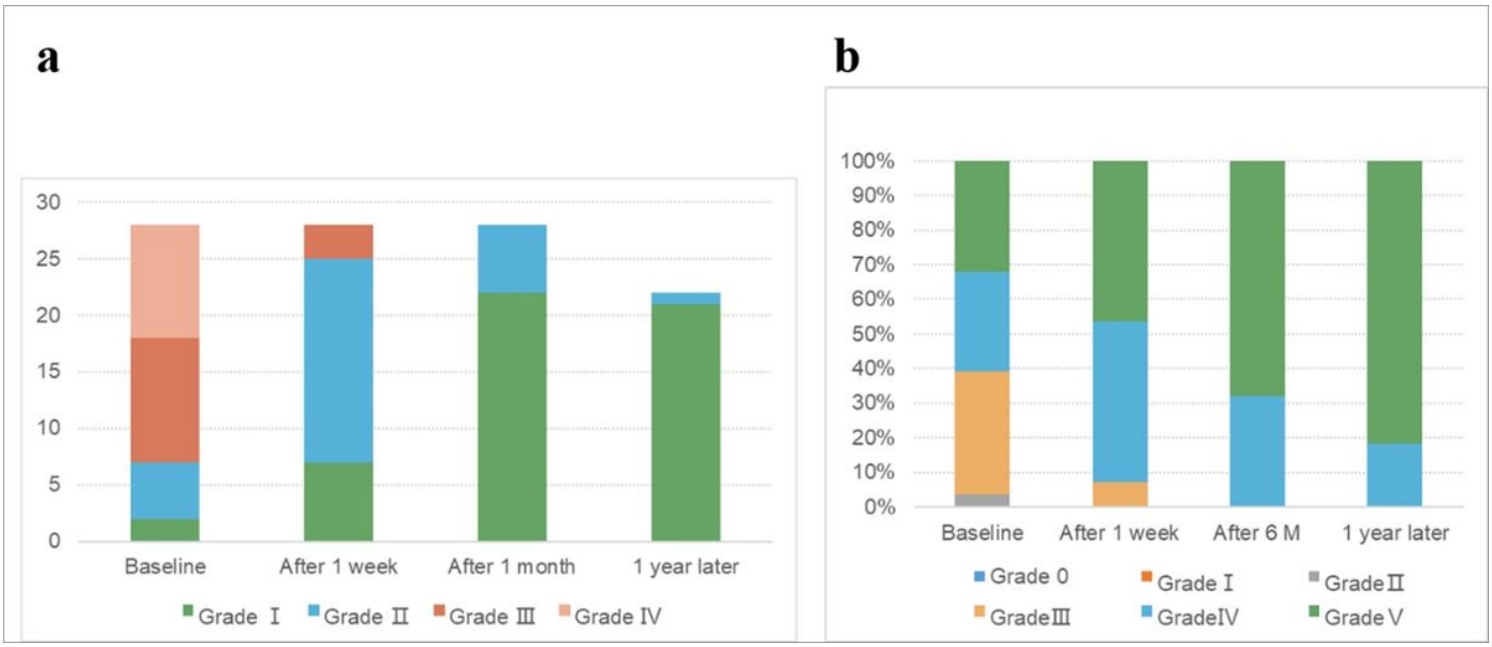



**Figure 1**

VAS score changes at various time points during the treatment process.

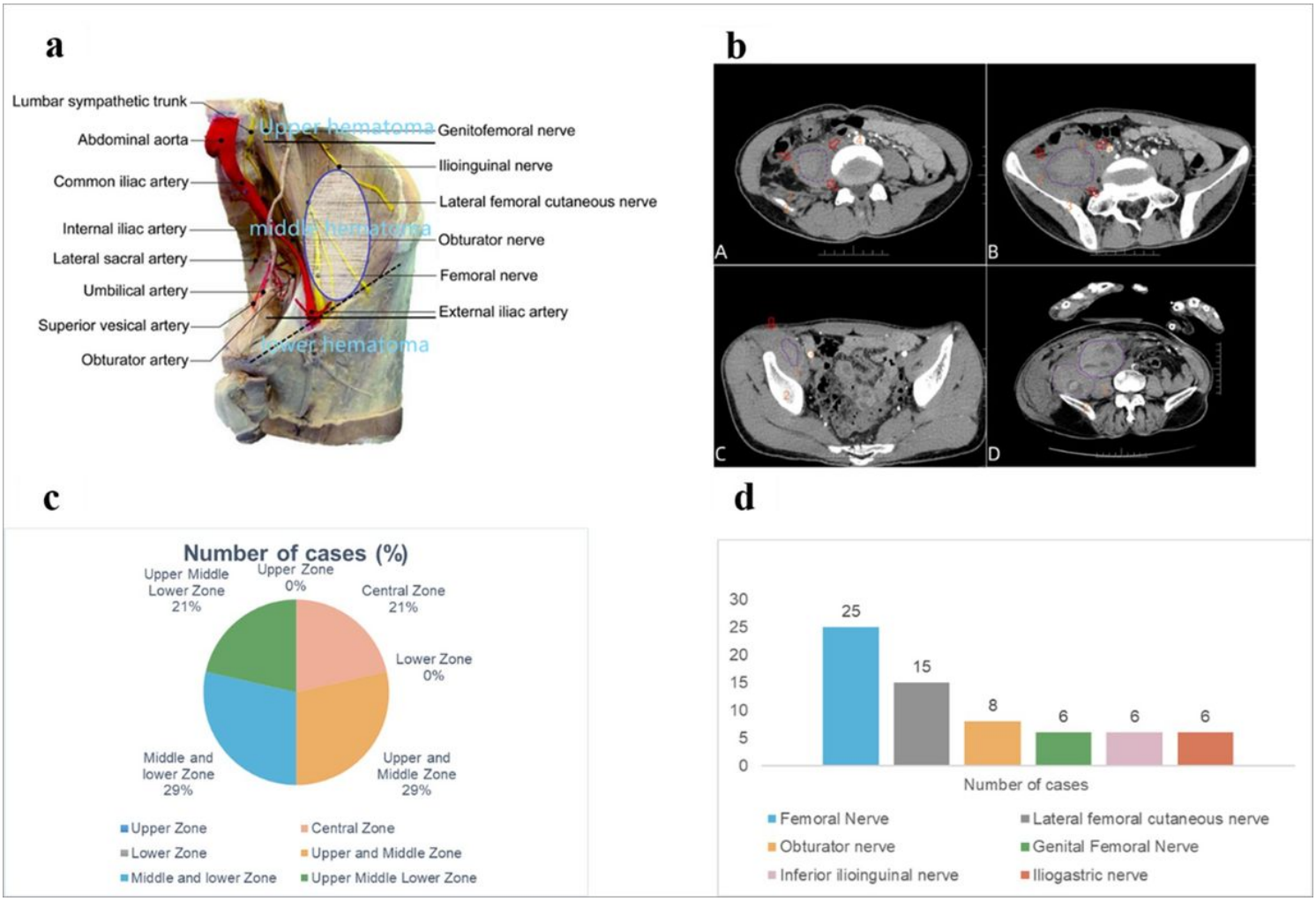
*Significant differences were observed between VAS scores at 1 week, 1 month, 3 months, and 6 months after treatment and those at baseline ($P < 0.05$).




## Figure 2

Condition of lower extremity

a. Extent of lower limb numbness; b. Degree of thigh muscle strength before and after treatment




## Figure 3

Hematoma Distribution and Nerve Involvement

a. Schematic diagram of iliopsoas muscle hematoma and compression of the lumbar plexus. The blue ellipse is a simulated hematoma. Above the upper black line is the upper area of the hematoma, and between the black lines is the middle area and the lower black line. The following is the area under the hematoma. Hematoma distribution in the iliopsoas muscle and retroperitoneal area.

b. CT image of a hematoma of the iliopsoas muscle :(A–C) Contrast-enhanced and (D) non-contrast abdominal CT scans. (A) The hematoma is located in the upper region within the psoas major muscle (purple dashed line), where a red arrow denotes the swollen psoas major muscle. 1 = psoas major muscle, 2 = iliacus muscle, 3 = iliac crest, and 4 = abdominal aorta. (B) The hematoma is localized in the middle region within the iliopsoas muscle (purple dashed line), while a red arrow indicates the swollen iliopsoas muscle. 1 = psoas major muscle, 2 = iliacus muscle, 3 = iliac bone, and 4 = external iliac artery. (C) The hematoma is observed in the lower region within the iliopsoas muscle (purple dashed line), with the swollen iliopsoas muscle shown by a red arrow. 1 = iliopsoas muscle, 2 = ischium, and 3 = external iliac artery. (D) A retroperitoneal hematoma (purple dashed line) is depicted, which is not classified as an IPH. 1 = psoas major muscle and 2 = iliac bone.

c. The distribution of hematoma in each segment of iliopsoas muscle.

d. Distribution of the hematoma in different segments of the iliopsoas muscle.

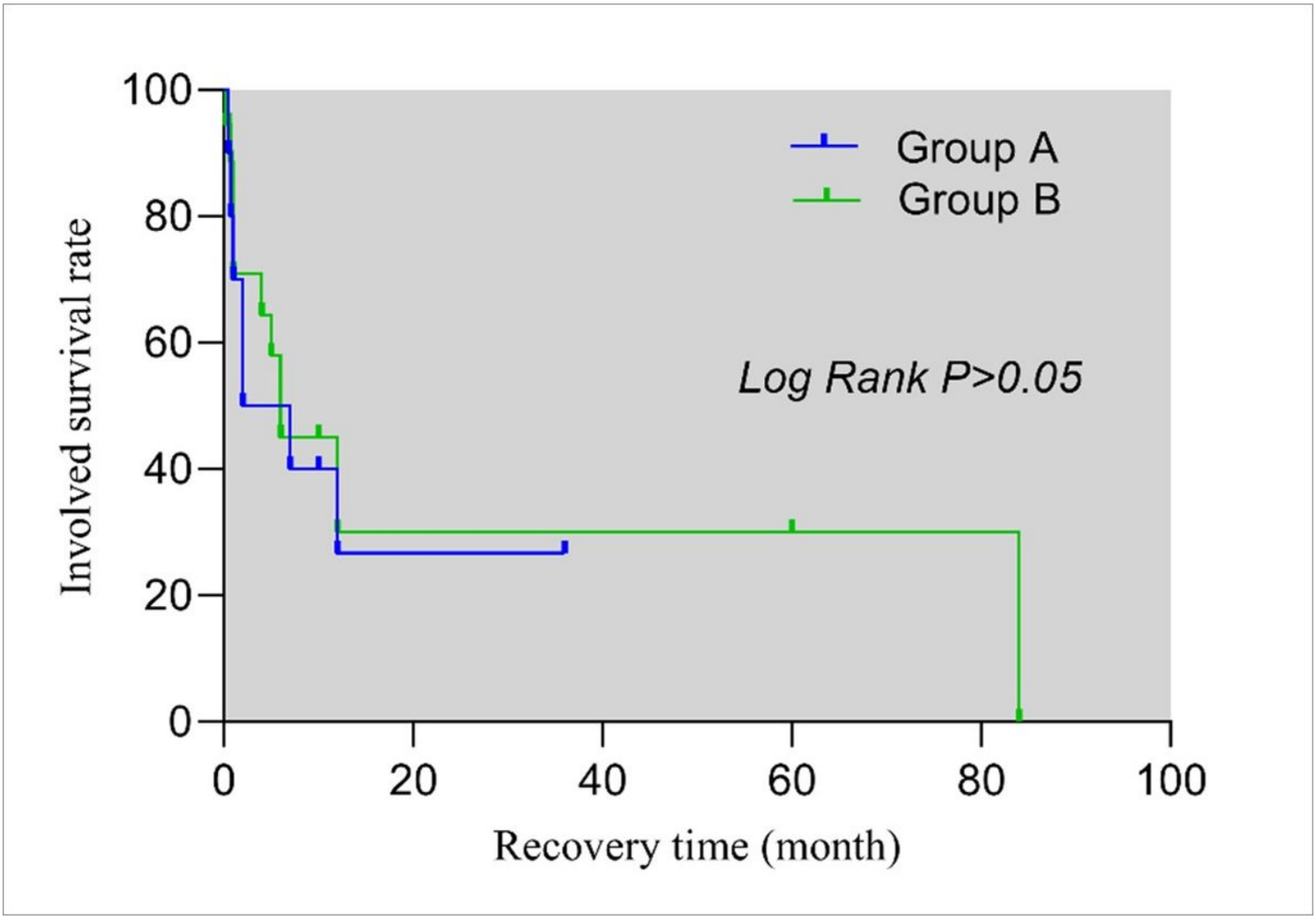



**Figure 4**

Effect of coagulation function on muscle strength recovery

Group A = normal coagulation function; Group B = coagulation dysfunction