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Acute deep venous thrombosis induced by May-Thurner syndrome after spondylolisthesis surgery: A case report and review of literature

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Abstract

BACKGROUND

Deep venous thrombosis (DVT) is a serious complication of lumbar spine surgery. Current guidelines recommend pharmacomechanical prophylaxis for patients at high risk of DVT after spine surgery. May-Thurner syndrome (MTS), a venous anatomical variation that may require invasive intervention, is an often overlooked cause of DVT. To date, no case reports of symptomatic MTS caused by isthmic spondylolisthesis or subsequent acute DVT after posterior lumbar surgery have been published.

CASE SUMMARY

We here present a case of a patient who developed acute DVT 4 h after spondylolisthesis surgery, and MTS was only considered after surgery, during a review of a gynecological enhanced computed tomography image taken before the procedure.

CONCLUSION

In conclusion, clinicians should consider MTS in the presence of a dangerous triad: spondylolisthesis, elevated D-dimer levels, and sonographically indicated unilateral deep vein dilation. Consultation with a vascular surgeon is also essential to MTS management.

Key Words: Spondylolisthesis; Spine surgery; Deep venous thrombosis; May-Thurner syndrome; Complication; Case report

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Core Tip: The overall prevalence of May-Thurner syndrome (MTS) and its contribution to deep venous thrombosis (DVT) are currently underestimated. We here present a case of acute DVT induced by MTS after lumbar surgery. MTS should be considered in the presence of a dangerous triad (spondylolisthesis, elevated D-dimer levels, and sonographically indicated unilateral deep vein dilation). Consultation with a vascular surgeon is essential to MTS management. A literature review of MTS in spinal settings was also performed.

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INTRODUCTION

Venous thromboembolism (VTE), which includes deep vein thrombosis (DVT) and pulmonary embolism (PE), is one of the most serious complications of spine surgery, with an incidence of 0.1% to 2.09% [1-3]. There are multiple quantitative VTE risk assessment models (RAMs) available for use in clinical practice. The one that is most widely validated in surgery populations is the Caprini score (version 2005). Despite their comprehensiveness, the RAMs used might not account for additional VTE risk factors such as potential anatomical variations [4]. May-Thurner syndrome (MTS), also known as iliac vein compression syndrome, is a rare vascular condition in which the left common iliac vein (LCIV) is mechanically compressed by the overriding right common iliac artery (RCIA), leading to venous congestion. MTS can be asymptomatic with partial venous obstruction, but progression with symptoms related to chronic venous hypertension or acute DVT can occur [5]. Although MTS accounts for only 2% to 5% of all DVT patients, multiple cadaveric and radiographic studies have shown that the actual prevalence in the general population is as high as 14% to 32% [6,7]. The present study reports a patient with MTS induced by isthmic spondylolisthesis who developed subsequent acute DVT after posterior spine surgery.

CASE PRESENTATION

Chief complaints

A 40-year-old Chinese woman was hospitalized with a chief complaint of severe back pain without neurological symptoms for 3 mo. She had exhausted conservative measures and elected to proceed with surgery. Her baseline pain severity was 90 mm on a 100-mm visual analogue scale (VAS).

History of present illness

The patient had a past history of cervical squamous cell carcinoma with metastasis to T10 vertebrae and the lung. She had undergone chemoradiation but not surgery, and her most recent radiotherapy and chemotherapy were 6 mo and 5 mo prior to admission, respectively. She denied any recent travel, surgeries, or immobilization. Her body mass index was 27.3 kg/m².

History of past illness

There was no other obvious abnormality or any past illness other than cervical cancer.

Personal and family history

There was no special history or personal history. The patient had no known family history of DVT.

Physical examination

No abnormality other than low-back tenderness were noticed on physical exam-

ination. No sign of swollen lower limbs was noticed.

Laboratory examinations

The routine blood and blood biochemical parameters of the patient were within normal limits. Her D-dimer level was 0.55 mg/mL, and her fibrinogen degradation product (FDP) level was 4.5 mg/mL.

Imaging examinations

X-ray and computed tomography (CT) showed grade 1 bilateral isthmic L5 spondylolisthesis. Dura sac/nerve root compression was not found on magnetic resonance imaging (Figure 1). Doppler ultrasound indicated mild left femoral vein dilatation and detectable blood flow in the distal part of the leg without thrombosis (Figure 2).

VTE risk assessment

Preoperative thrombosis risk factor assessment indicated a high risk of DVT with a Caprini score of 6 because of obesity, history of chemoradiation, malignancy, and major surgery[8]. The thromboembolic prophylaxis plan was thrombosis prophylaxis hosiery immediately after the surgery and application of low-molecular-weight heparin (LMWH) as soon as the bleeding risk became low enough for that to be acceptable.

Surgical procedure

The procedure included L5-S1 decompression, lumbar spondylolisthesis reset, L5-S1 pedicle screw fixation, and posterior-lateral lumbar fusion. The entire surgery lasted 135 min, and the estimated blood loss was only 50 mL.

Postoperative DVT

Compression stockings were applied as planned. However, swelling and pain were noted in her left lower limb 4 h after the surgery. Laboratory tests and Doppler ultrasound were performed, and results showed elevated D-dimer level (2.15 mg/L), elevated FDP (12.5 mg/L) level, and left common femoral and deep femoral venous thrombosis. DVT was confirmed; the patient was immobilized and antithrombotic and thrombolytic therapy (LMWH and warfarin) were immediately administered. On review of preoperative examinations, an enhanced pelvis CT scan taken 2 wk before the operation for tumor follow-up showed that the LCIV was sandwiched between the RCIA and slipped vertebrae. MTS was therefore considered (Figure 2A-C).

FINAL DIAGNOSIS

The diagnosis was left common femoral and deep femoral venous thrombosis, MTS, isthmic spondylolisthesis, and metastatic cervical cancer.

TREATMENT

After a 2-wk immobilization and systemic anticoagulation, the left leg swelling gradually subsided, and embolism was undetectable on ultrasonography.

OUTCOME AND FOLLOW-UP

At the 1 mo postoperative follow-up, her VAS score of back pain decreased to 20 mm without further complications (Figure 1C). Neither DVT nor PE occurred during 1-year of follow-up. It should be noted that the patient also manifested acute progressive renal failure postoperatively because of bilateral radiotherapy-induced urethral stricture. The symptoms were relieved after percutaneous nephrostomy and insertion of two double-J tubes.

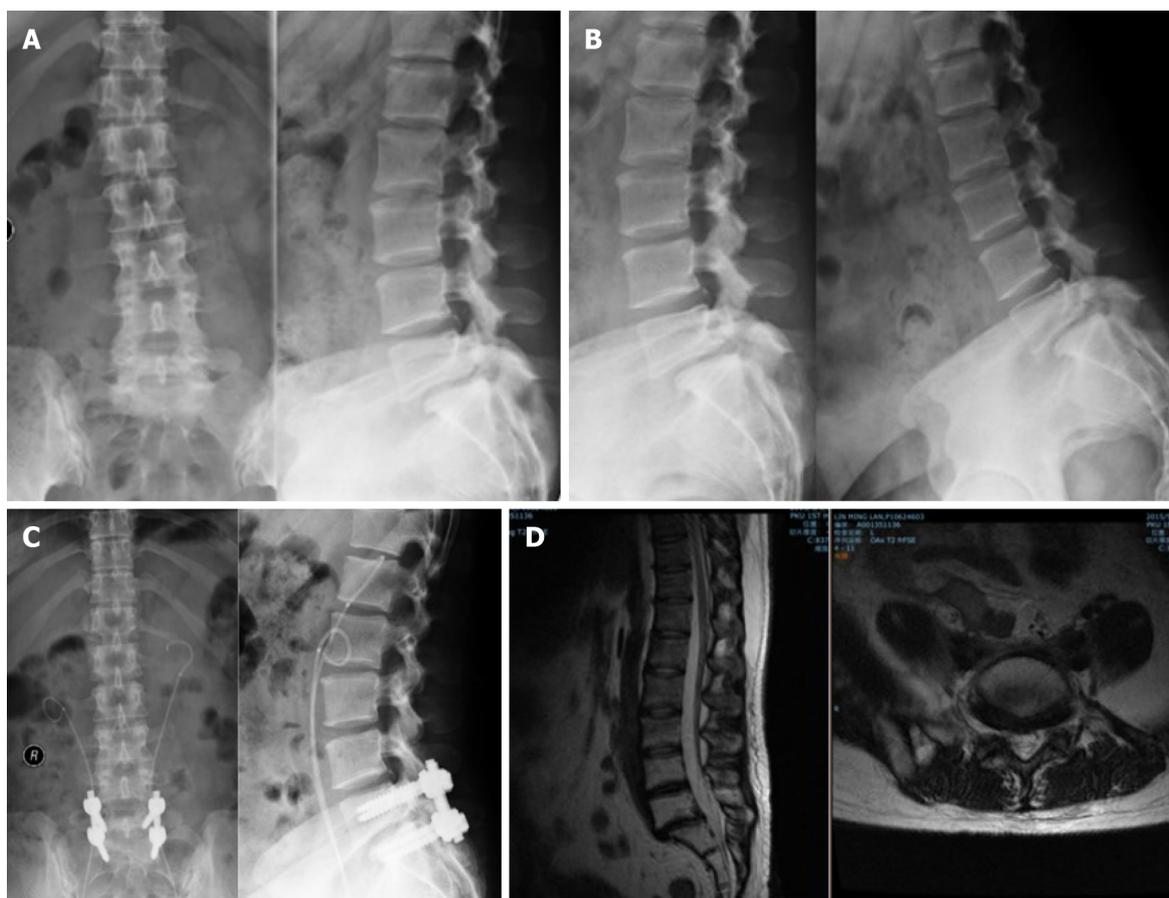


Figure 1 Peri-operative radiography. A: Preoperative anteroposterior and lateral radiographs; B: Preoperative flexion-extension radiographs; C: Postoperative anteroposterior and lateral radiographs; D: Preoperative magnetic resonance imaging on sagittal and L5/S1 axial planes.

DISCUSSION

MTS is described as venous compression by the iliac artery against the spine that may or may not present with symptoms of venous obstruction. This syndrome was first described in 1908 when McMurrich[9] noted that the incidence of congenital adhesions in the common iliac veins contributed to DVTs. In 1957, May and Thurner[10] reported that the presence of intraluminal fibrous bands, caused by external compression by the RCIA, directly led to extensive DVT of the left lower extremity in 22% of 430 cadavers, and they named the condition MTS. Although most cases of MTS follow the classic left-sided description (Figure 2E), right-sided MTS has also been reported[11,12]. Risk factors for MTS include female gender, scoliosis, dehydration, hypercoagulable disorders, and radiation exposure[5].

To the best of our knowledge, this is the first case report of MTS secondary to isthmic spondylolisthesis, and it highlights the need to suspect this variant of MTS under certain conditions. MTS is mostly asymptomatic for partial venous obstruction, but progression may present acutely as DVT/PE or chronically as varicose veins, venous ulcerations, or recurrent superficial venous thrombophlebitis[13,14]. Awareness of MTS should be raised especially among neurosurgeons, because spinal diseases or procedures can be responsible for MTS, while MTS can also manifest as sciatic neuralgia or cauda equina syndrome[15-19] (Table 1).

The overall prevalence of MTS and its contribution to DVT have been underestimated, as cadaveric studies have shown that venous spurs on the LCIV were present in 50% to 66.7% patients with left-sided iliofemoral DVT[20,21]. MTS typically progresses in three stages, asymptomatic iliac vein compression, development of venous spurs, and thrombus formation[15,22]. Timely diagnosis of MTS is challenging because MTS is usually overshadowed by other more easily recognized risk factors of DVT[7]. Despite its superior accuracy in diagnosing MTS, the use of contrast venography is usually limited in disease screening by its invasive nature. Although CT, magnetic resonance venography, and intravascular ultrasound (IVUS) have also been proven to be effective, they cannot be used for routine preoperative examinations

Table 1 Literature review of May-Thurner syndrome in spinal settings

Ref.	Country	Study type	Number of patients	Gender/age in yr	Length of onset	Means of diagnosis	Cause of MTS/MTS consequences	Treatment
Delera <i>et al</i> [30], 2021	United States	Case report	1	Female/60	8 mo	CT, Venogram and IVUS	Spondylolisthesis	Wait and see strategy
Kim <i>et al</i> [15], 2020	Korea	Case report	1	Female/28	15 d	CT	Spinal heterotopic ossification	Wait and see strategy
Diaz <i>et al</i> [31], 2019	Spain	Case report	1	Female/40	6 h	MRI, venography	MTS induced back pain and radicular pain	Catheter-directed thrombolysis, cava venal filter and stenting
Khalid <i>et al</i> [32], 2019	United States	Case report	1	Female/66	3 mo	CT, Venogram, IVUS	Degenerative disc	Ballooning and stenting
Xu <i>et al</i> [16], 2019	China	Case report	1	Female/59	1 mo	CT, MRI and venography	lumbar disc anterior herniation	Disc radiofrequency thermocoagulation
Yamamoto <i>et al</i> [18], 2018	Japan	Case report	1	Male/53	3 mo	CT, MRI and venography	MTS induced sciatic neuralgia	Stenting
McKean <i>et al</i> [33], 2017	UK	Case report	1	Female/64	Several wk	CT	Degenerative spondylolisthesis	Anticoagulation therapy
Rachaiyah <i>et al</i> [17], 2016	India	Case report	1	Female/63	3 d	Venogram	Vertebral transpedicular screw	Catheter-directed thrombolysis and oral anticoagulation therapy
Ou-Yang and Lu[34], 2016	China	Cross-sectional study	33	NM/61.5 ± 10.6	22.5 ± 7.6 d	CT	Intervertebral discs (17/33), osteophytes (16/33), and degenerative lumbar spondylolisthesis (8/33)	Catheter-directed thrombolysis, thrombolytic aspiration, ballooning and stenting
Woo <i>et al</i> [35], 2016	United States	Case report	1	Female/65	NM	MRA, venography	Pedicle screw perforation	Ballooning and stenting
Reddy <i>et al</i> [36], 2015	United States	Case report	1	Female/33	8 d after spine surgery	CT, venography	NM	Catheter-directed thrombolysis, stenting and oral anticoagulation therapy
Oteros <i>et al</i> [37], 2008	Spain	Case report	1	Female/13	During scoliosis surgery	CT, venography	Scoliosis	Wait and see strategy

CT: Computed tomography; IVUS: Intravenous ultrasound; MRA: Magnetic resonance angiography; MRI: Magnetic resonance imaging; NM: Not mentioned.

in practice[23]. Doppler ultrasound is convenient and is useful in the detection of lower limb DVT but not MTS because of technological challenges. In our case, although preoperative ultrasound of the lower limb showed mild dilation of the left femoral vein, MTS was only confirmed by enhanced pelvic CT. As suggested by Harbin and Lutsey[7], the patient’s preoperative elevation of D-dimer could have indicated hypercoagulability and possible MTS. Therefore, based on this case, we conclude that MTS should be suspected when the following dangerous triad is observable: spondylolisthesis, elevated D-dimer levels, and unilateral deep vein dilation on sonography. The specific risks of thrombosis in this patient were obesity, history of chemoradiation, malignancy, and major surgery. All the factors could have been responsible for the thrombosis event, and MTS would have gone undetected if not for the review of the patient’s gynecological CT imaging.

Several RAMs have been developed for postoperative VTE estimation and prevention, and the Caprini risk score is the one that has been the most extensively used and validated[8,24-26]. However, the commonly used RAMs do not take such variant factors as MTS into account and may cause clinicians to underestimate the risk of venous thrombosis complications. Bartlett *et al*[4] recommended exercising caution in relying on RAMs to determine the optimal prophylaxis strategy. The Caprini score of this patient was 6 with recommended prevention of pharmacological and mechanical prophylaxis, which is clearly inappropriate in the setting of MTS because it does not address the underlying pathology. Standard care for MTS is endovascular

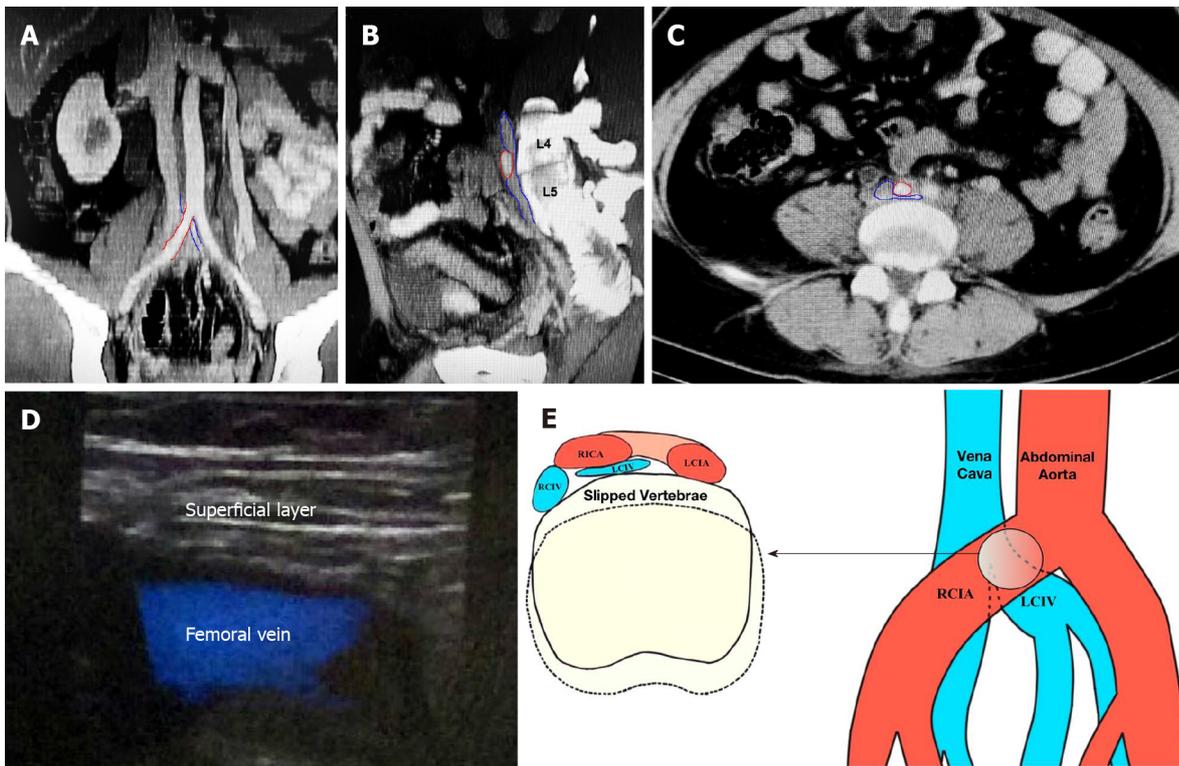


Figure 2 Preoperative May-Thurner syndrome radiography and mechanisms. A: Coronal plane of computed tomography (CT) showing the right common iliac artery (RCIA, red outline), and left common iliac vein (LCIV, blue outline); B: Adjusted plane of CT shows the RCIA (red outline) and the vena cava and LCIV (blue outline). The RCIA compresses the adjoining part of the vena cava and LCIV against the vertebrae; C: Axial plane of CT showing the RCIA (red outline) and the LCIV (blue outline); D: Preoperative ultrasonography shows dilation of femoral vein without thrombus; E: Mechanisms of May-Thurner syndrome. LCIA: Left common iliac artery; RCIV: Right common iliac vein.

treatment, which involves catheter-directed pharmacological thrombolysis, mechanical thrombectomy, and stenting of the iliac vein with or without a caval filter. Recanalization in difficult cases can be performed under IVUS guidance[27]. Surgery, including vein repair with thrombus removal, relocation of the artery, and placement of a venous bypass graft, are only indicated when endovascular approaches have failed[28]. However, invasive intervention is not always necessary when MTS is asymptomatic[29]. For this patient, endovascular intervention was not suitable because of the accompanying acute progressive renal failure and hyperkalemia. Antithrombotic and thrombolytic therapy were effective for her. We here further presume the repair of the spondylolisthesis anatomically addressed the compression of left common femoral vein and indirectly relieved MTS.

CONCLUSION

In summary, our case showed that MTS may occur in patients with isthmic spondylolisthesis. MTS should be suspected if the patient shows a dangerous triad. Besides, consultation with a vascular surgeon is essential to MTS management in patients undergoing spine surgery.

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