Case Report

Trauma-associated left renal vein thrombosis with nutcracker syndrome

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Background: Nutcracker syndrome is a compression of the left renal vein between the superior mesenteric artery and aorta, resulting in thrombogenesis. While renal vein thrombosis caused by renal disease is more common, solitary left renal vein thrombosis with nutcracker syndrome is rare.

Case Presentation: We present the case of a patient with trauma-associated left renal vein thrombosis with nutcracker syndrome. A 24-year-old woman with low body mass index taking oral contraceptives was admitted for trauma. She had multiple injuries, including thoracolumbar fractures, for which elective spinal fusion surgery was scheduled. As the D-dimer level elevated to 82.5 μg/dL preoperatively, enhanced computed tomography was performed, which revealed a solitary left renal vein thrombus.

Conclusion: This is the report of solitary left renal vein thrombosis in a patient with nutcracker syndrome after trauma. Patients with low body mass index and coagulopathy might have solitary left renal vein thrombosis associated with nutcracker syndrome.

Key words: Body mass index, nutcracker syndrome, renal vein, thrombus, trauma

INTRODUCTION

NUTCRACKER SYNDROME (NCS) is a compression of the left renal vein (LRV) between the superior mesenteric artery (SMA) and abdominal aorta, resulting in blood flow stagnation. Although the prevalence of NCS is unknown, it is more common in women with low body mass index (BMI) and is often asymptomatic (hereafter, the nutcracker phenomenon).[1] However, it can cause symptoms such as left flank pain, hematuria, proteinuria, varicose veins in the spermatic cord, and pelvic congestion syndrome.[2] Although various factors cause renal vein thrombosis, solitary LRV thrombosis associated with NCS is extremely rare, with only five cases reported previously.[3–7] Herein, we describe the case of NCS with trauma-associated solitary LRV thrombosis.

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CASE REPORT

Case presentation

A 24-year-old Japanese woman who fell from a height of 10 m was taken to the emergency room. She was very thin, 150 cm tall, weighed 29.9 kg, and had a low BMI of 13.3 kg/m^2. She was also taking oral contraceptives and denied any medical history, including thrombosis.

Investigation

Initial full-body enhanced computed tomography (CT) revealed thoracolumbar burst, sternal, multiple rib, and sacral fractures, and bilateral pneumothorax. It also revealed distal dilatation of the LRV, suggesting blood flow stagnation, called beak sign; however, no thrombus was found (Fig. 1A). Laboratory findings on admission were as follows: leukocytes 16,900/μL, hemoglobin 11.6 g/dL, platelets 214,000/μL, activated partial thromboplastin time 21.7 s, prothrombin time (international normalized ratio) 1.07, fibrinogen 246.0 mg/dL, and D-dimer 52.0 μg/dL. Urinalysis revealed the presence of urine protein 2+ and

occult blood 3+. Antithrombin III, protein C, protein S, and antiphospholipid antibody levels were normal.

Diagnosis

The patient had a burst fracture of the thoracolumbar vertebrae and had to rest on a bed in a supine position until spinal fusion. Five days after admission, D-dimer level elevated from 52.0 to 82.5 μg/dL, and enhanced CT was performed again to detect the presence of a thrombus preoperatively. Computed tomography revealed a solitary LRV thrombus that was not noted on the prior CT (Fig. 1); there were no physical complaints, such as left flank pain. Furthermore, the angle between the SMA and abdominal aorta in the sagittal section narrowed to 25° (Fig. 2), which is usually greater than 35°, revealing NCS with beak sign (Fig. 1). Furthermore, there was no occupying lesion around the LRV. Based on the above findings, the patient was diagnosed with trauma-associated solitary LRV thrombosis with NCS.

Treatment and outcome

An inferior vena cava filter was implanted preoperatively. Spinal fusion was performed on day 9 postadmission, and edoxaban was given for anticoagulation; the postoperative course was uneventful. On day 33 postadmission, ultrasonography revealed LRV thrombus shrinkage. The patient was discharged from the hospital on day 36 postadmission, but anticoagulation therapy was continued for 3 months.

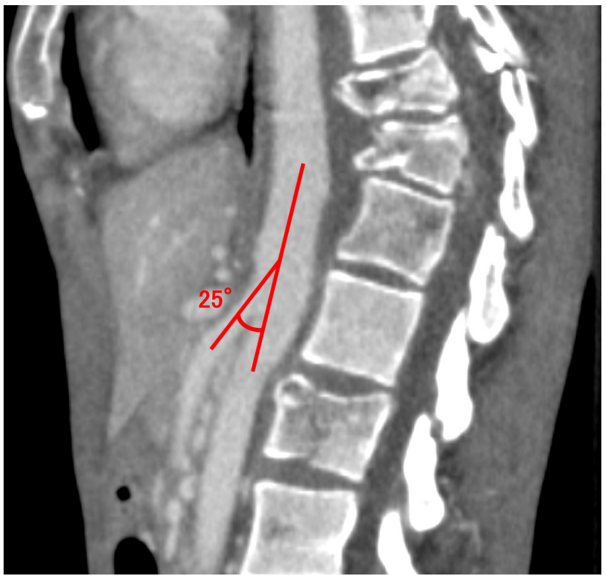

Fig. 2. Computed tomography scan of a 24-year-old woman with trauma-associated left renal vein thrombosis with nutcracker syndrome. The sagittal section shows the angle between the superior mesenteric artery and abdominal aorta, which had narrowed to 25°.

DISCUSSION

HERE, WE PRESENT the case of a patient with trauma-associated solitary LRV thrombosis with NCS. To the best of our knowledge, there have been only five previously published reports of solitary LRV thrombosis with NCS,[3–7] and this is the first report of a solitary LRV thrombosis that occurred after trauma.

Factors that lead to thrombus formation are described by Virchow's triad of endothelial damage, hypercoagulability, and blood flow stasis. Renal vein thrombosis is relatively rare. Asghar *et al*. reported that nephrotic syndrome is the most common cause; other causes include blunt trauma, renal transplantation, cancer invasion, vasculitis, decreased circulating plasma volume, retroperitoneal tumors, sepsis,

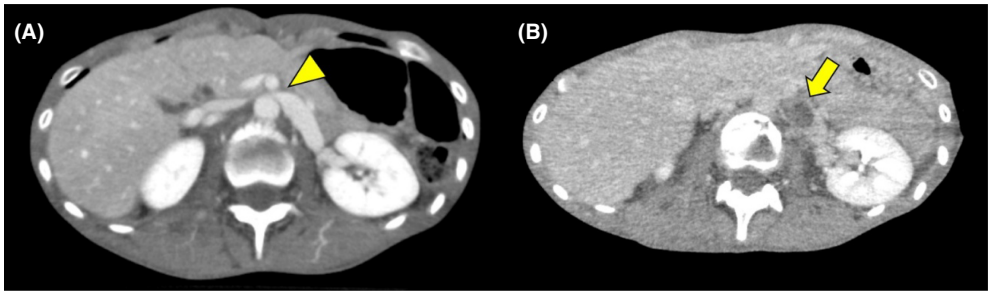

Fig. 1. Computed tomography (CT) scans of a 24-year-old woman with trauma-associated left renal vein thrombosis with nutcracker syndrome. (A) Enhanced CT of the abdomen showing a dilated left renal vein (LRV), compressed between the superior mesenteric artery and the abdominal aorta (yellow arrowhead). (B) Enhanced CT of the abdomen showing a solitary LRV thrombus (yellow arrow), not present at the time of admission, formed during the course of treatment.

Table 1. Published reports of patients with nutcracker syndrome complicated by left renal vein thrombosis and disease features

Case	Study	Age (years)	Sex	Body mass index (kg/m^2)	Symptoms	Other thrombogenic factors
1	Cakir *et al*.	36	Male	Not available	Left flank pain	Membranous glomerulonephritis
2	Mahmood *et al*.	27	Female	Not available	Left flank pain	Oral contraceptives
3	Mallat *et al*.	24	Female	17.2	Left flank pain	None
4	Nakashima *et al*.	43	Female	20.3	None	Cancer
5	Peces *et al*.	24	Female	19.3	Left flank pain	Oral contraceptives Thalassemia minor Heterozygous factor V Leiden
Present case		24	Female	13.3	None	Oral contraceptives Trauma

malignant dissemination, oral contraceptives, and congenital endogenous thrombotic predisposition. Nutcracker syndrome was not mentioned.[8]

In this case, a solitary LRV thrombus, not present at initial diagnosis, formed during the treatment course due to addition of new triggers, such as trauma and bed rest, and a background of thrombogenesis tendency due to NCS and oral contraceptive use. In general, the angle between the SMA and the abdominal aorta narrows in the upright position than in the supine position, resulting in blood flow stasis.[9,10] However, considering that no thrombi were found in other parts of the body despite the presence of multiple thrombogenic predispositions, NCS, even in the supine position, was believed to have contributed to the formation of a solitary LRV thrombus, as well as other factors. Thus, a combination of factors resulted in thrombosis, but we could have lowered the risk of thrombosis by scheduling early fusion surgery to avoid the bed rest, which is one of the thrombogenic predispositions.

Furthermore, among reported cases of solitary LRV thrombosis associated with NCS, including the present case,[3–7] patients were women, of whom four had a relatively low BMI, and all were diagnosed with NCS by CT scan. Except for one report, all patients had other thrombotic predispositions. In all patients, NCS, which causes blood flow stagnation in the LRV, might have contributed to the formation of the LRV thrombus (Table 1).

D-dimer levels prompted the screening CT scan, which revealed a solitary LRV thrombus. Therefore, given that NCS is more common in thin women with low BMI,[1] the possibility of LRV thrombosis should be considered when coagulation abnormalities, such as high D-dimer levels and low BMI, are observed.

CONCLUSION

THIS IS A rare case report of a patient with trauma-associated solitary LRV thrombosis with NCS. In general, a combination of multiple thrombogenic predisposing factors promotes thrombus formation, and thin patients with low BMI may have a history of NCS. In addition, patients with coagulation abnormalities, such as high D-dimer levels, should be aware of the risk of LRV thrombosis, and prolonged bed rest should also be avoided if possible.

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DISCLOSURE

APPROVAL OF RESEARCH protocol: N/A.
Informed consent: Written informed consent was obtained from the patient for publication.
Registry and registration no. of the study/trial: N/A.
Animal studies: N/A.
Conflict of interest: None.

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