

Iatrogenic Venous Compression Syndrome due to Surgical Lumbar Hardware

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Abstract: Background: The Iliac vein compression syndrome (IVCS) is most commonly due to May-Thurner variant, an anatomic variant where in the right common iliac artery overlies the left common iliac vein and compresses it against the lumbar spine. The compression of the common venous outflow tract of the left lower extremity may cause discomfort, swelling, or deep vein thrombosis in the iliofemoral veins. The role of the pelvic surgery particularly the lumbar hardware in the development of symptomatic Venous compression syndrome in patients with May-Thurner syndrome is not well understood. The incidence is presumably very low. Herein, we present six patients who developed IVCS after Lumbar hardware.

Method: The cases were diagnosed between Nov. 2016 to Oct. 2019 in the Outpatient Cath Lab of McKinney, TX. The patient's medical records were retrospectively analyzed looking for risk factors, clinical features, venogram findings, and post venogram. The evaluation of each case was described, and common trends were later presented in a cross-case analysis.

Conclusion: The cases presented in this report suggest that the hardware used in lumbar/spinal surgery could lead to an IVCS. Patient's symptoms are unspecific. Venogram/venoplasty is the gold standard for diagnosis and treatment. It is imperative having a high level of suspicion and familiarizing with the natural history of IVCS due to the invasive nature of venogram and the relevance of an early diagnosis to reduce the occurrences of complications.

Keywords: Venous disease, Iliac vein compression, May-Thurner syndrome, Lumbar surgery complications, Unexplained edema of left leg, May-Thurner Syndrome, Lumbar hardware, Venous compression, IVUS, Venogram, Angioplasty.

INTRODUCTION

The Iliac vein compression syndrome (IVCS) is most commonly due to May-Thurner variant, an anatomic variant where in the right common iliac artery (RCIA) overlies the left common iliac vein (LCIV) and compresses it against the lumbar spine [1, 2]. The compression of the common venous outflow tract of the left lower extremity causes discomfort, swelling, or deep vein thrombosis in the iliofemoral veins. The prevalence of IVCS is approximately 20%. Asymptomatic cases occur in 15–30% of the population [2]. Symptomatic patients typically present with acute or chronic edema of the lower limb, most often after surgery, pregnancy, travel, or prolonged immobility. The role of the pelvic surgery particularly the lumbar hardware in the development of symptomatic Venous compression syndrome in patients with May Thurner syndrome is not well understood. Iatrogenic causes of venous compression are rarely reported [3, 4]. The incidence is presumably very low. Herein, we present six patients who developed IVCS after lumbar hardware.

METHODS

In a period between Nov. 2016 to Oct. 2019, six patients with history of surgical intervention of the lumbar spine were diagnosed with May-Thurner Syndrome in the Outpatient

Cath Lab of McKinney, TX. The patient's medical records were retrospectively analyzed looking for risk factors, clinical features, venogram finding, and post venogram course in order to understand and describe the possible connections between the occurrence of the IVCS and the patient's risk factors. Each case was evaluated separately, and a cross case analysis was later performed to find common trends.

MULTIPLE CASE REPORT

Case 1 (c1). This patient was a 58-year-old female, obese, with past medical history (PMH) of hypertension (HTN), hyperlipidemia (HLD) and rheumatoid arthritis (RA) without history of deep venous thrombosis (DVT), coagulation disorders, use of oral contraceptive pills (OCP), or immobilizations. Because of her PMH of degenerative disc disease, she underwent spine surgery where lumbar hardware was used six months earlier. The initial physical examination (PE) showed bilateral lower extremities swelling, with predominance in the left leg.

Case 2 (c2). This 77-year-old female patient was a former smoker, with PMH of HTN, HLD, hypothyroidism, non-Hodgkin's lymphoma, abdominal aortic aneurysm, and peripheral vascular disease but without PMH of coagulation disorders, immobilization, or previous DVT. She underwent lumbar spinal surgery for her spinal stenosis with the use of hardware in March 2012. The subsequent exam showed intermittent

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swelling in both lower extremities.

Case 3 (c3). A 40-year-old female patient reported being a former smoker, without PMH of coagulation disorders, long term immobilization, OCP use, abortions, but with superficial phlebitis and previous DVT on the left leg, and peripheral neuropathy. Because of her PMH of spinal stenosis, she underwent a lumbar spinal surgery with hardware use in November 2012. Even though the initial patient physical exam showed no swelling on the lower extremities, she reported constant dull pain in the left lower leg.

Case 4 (c4). A 69-year-old female and obese patient reported being a former smoker, with PMH of coagulation disorders, factor VIII deficiency, with previous DVT and pulmonary embolism. Patient has history of HLD and coronary artery disease (CAD) for which she underwent heart bypass surgery in 1999. The patient denied OCP use, abortions, or long-term immobilizations. She had a lumbar spinal surgery with hardware use in 2012 due to her PMH of degenerative disc disease. The initial PE revealed swelling in both lower extremities accompanied by numbness and pain.

Case 5 (c5). This case is a 67-year-old male patient, obese, a former smoker with PMH of Diabetes mellitus, Hypertension, peripheral neuropathy, and degenerative disc disease. He did not have a history of immobilization but has protein C deficiency. This patient had one event of DVT and an inferior vena cava filter placement in 2010. In December 2016, he had a lumbar spinal surgery with hardware use. The subsequent physical examination revealed a remarkable swelling in the left leg accompanied by skin discoloration.

Case 6 (c6). This patient was a normal weight 68-year-old female with a PMH of Systemic Lupus Erythematosus (SLE), HLD and thyroid disorders, without history of DVT, coagulation disorders, OCP, or immobilizations. Because of her PMH of degenerative disc disease, she underwent spine surgery on august and December 2018, where lumbar hardware was used. Immediately after the second surgery she had a DVT on the left lower extremity after the acute management for the vein thrombosis she came to our clinic for the post-thrombotic

syndrome management. The patient was also complaining of recurrent left leg edema.

CASE DIAGNOSIS AND MANAGEMENT

To diagnose the cases a venogram was completed with intravascular ultrasound (IVUS) in each case. Left common iliac vein (LCIV) stenosis of 80 % (c1), 90 % (c2), 99 % (c3), 50 % (c4), 99 % (c5), and 100 % (c6) were confirmed (*Appendix A*). An iliac vein venoplasty and stenting was performed for *case 1-5*. For case 6, the revascularization was possible to cross the total occlusion but was not done due to the extensive presence of collateral circulation and a normal right iliac vein. The residual stenosis was considered 5, 20, 0, 20 and 100 % (c1-6 correspondingly). After the procedure, the patients reported a significant improvement in symptoms and no recurrences have been registered in a period of 32, 22, 18, 12, 27, and 2 months (c1-6 respectively).

CROSS-CASE DISCUSSION

IVCS is an underreported cause of DVT. May-Thurner syndrome is one of the most frequent causes of IVCS, and the most common scenario of the pathogenesis is LCIV at confluence crossed by RCIA which compress the vein against lumbar vertebrae [1]. In the trapped vein, the intimal hypertrophy within the wall of the vessel causes endothelial changes and thrombus formation [2]. Many factors can contribute to the development of mechanical compression in susceptible individuals. Orthopedic surgery is a field commonly associated with complications like DVT formation or acute vascular damage; most of them venous injuries in nature [5-7]. However, there are only a few reports about Iatrogenic IVCS after lumbar surgery with hardware placement, which have similar findings in the multiple case report presented in this article [8-10].

The cross-case analysis presented here reports about six patients diagnosed with May-Thurner syndrome in the period between November 2016 to July 2018.

Findings are shown in Table 1.

APPENDIX A



Fig. (1). Left Iliac Vein Compression, Shown is Balloon Dilatation Over the Wire. Stenting of the Vein with Post Stenting Stenosis of 5%.



Fig. (2). Wire Shown in the Left Iliac Vein. Angiogram with Bilateral Stenosis with Subsequent Stent Placement.

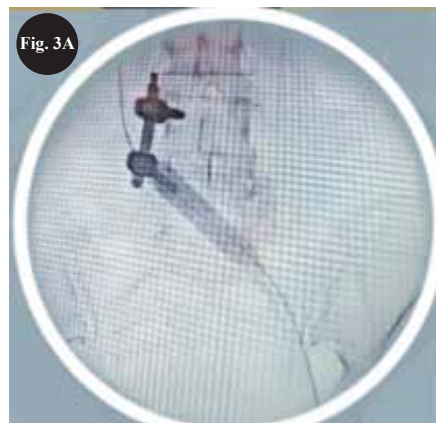


Fig. (3A). The Angiogram Findings of Left Iliac Vein Stenosis with Subsequent Balloon Dilatation and Stenting.

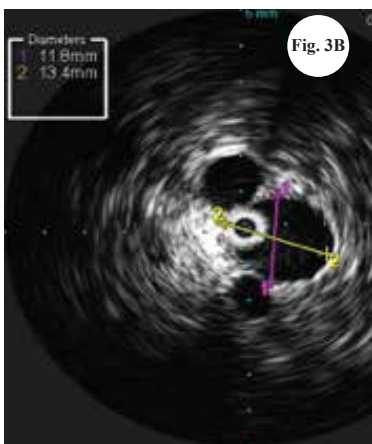


Fig. (3B). Demonstration of left iliac vein with luminal stenosis through IVUS.

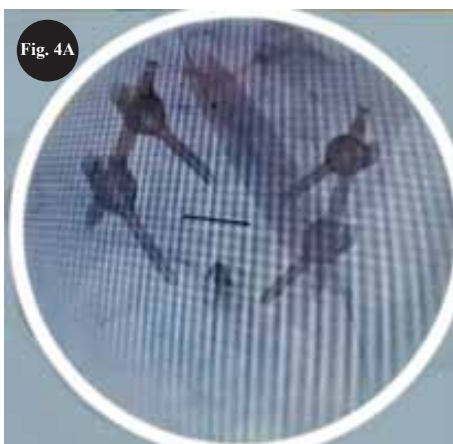


Fig. (4A). Right Iliac Vein Angiogram Finding of Dilation after Finding Stenosis.

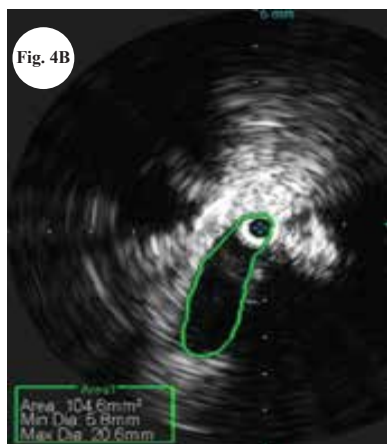


Fig. (4B). IVUS Demonstration of the Stenosis of the Iliac Vein



Fig. (5). Angiogram Findings of the Iliac Vein Stenosis.

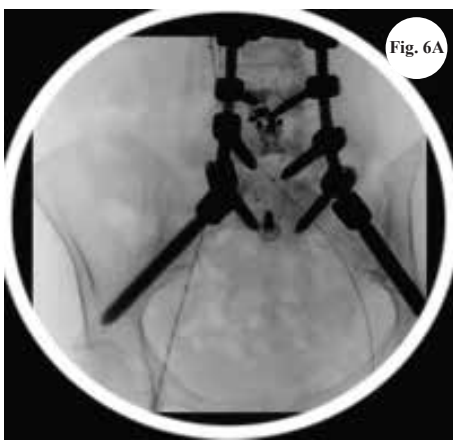


Fig. (6A). Angiogram Findings of the Left Vein Stenosis.

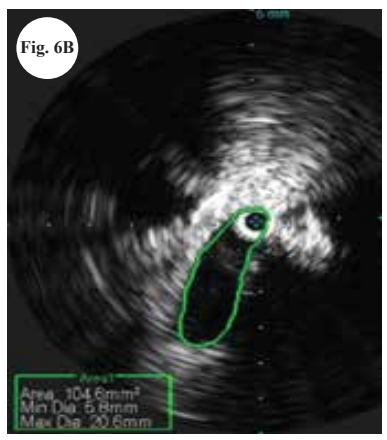


Fig. (6B). IVUS Finding of the Stenosis of the Left Iliac Vein.

Table 1. IVCS Syndrome Patients' Comparison.

Case	1	2	3	4	5	6
Date of Venogram	11/23/16	9/13/17	1/17/18	7/14/18	4/29/17	10/9/19
Sex	F	F	F	F	M	F
Age	58	77	40	69	67	68
Initial PE manifestations	Swelling in legs more in the left	Bilateral intermittent swelling in legs	Left lower leg pain	Swelling, pain and numbness on legs	Swelling left leg and skin discoloration	Left lower leg swelling, post-thrombotic syndrome
Past medical history	DM, HTN, HLD, RA.	HTN, HLD, hypothyroidism non-Hodgkin's lymphoma, mild mitral regurgitation, AAA, PVD.	Peripheral neuropathy, superficial phlebitis, DVT left leg	Iatrogenic DVT, pulmonary embolism, factor VIII deficiency HLD, CAD	DM, HTN, peripheral neuropathy, DVT, protein C deficiency	DVT, SLE, thyroid disorders, HLD
Past surgical history	Lumbar spine fusion (hardware)	Lumbar spine fusion (hardware)	Lumbar spine fusion (hardware)	Heart bypass, Lumbar spine fusion (hardware)	IVC filter, neck surgery Lumbar spine fusion	Lumbar spine fusion (hardware)
Reason for back surgery	Degenerative disc disease	Lumbar spinal Stenosis	Lumbar spinal stenosis	Degenerative disc disease	(hardware) Degenerative disc disease. Cervical and	Degenerative disc disease
Date of back surgery	6/2016	3/2012	11/2011	2012	lumbar disc prolapse 12/2016	08/2018 and 12/2018
Other Risk Factors of DVT						
Immobilization	No	No	No	No	No	No
OCPs use.	No	No	No	No	Not applicable	No
Obesity	Overweight	Normal Weight	Normal weight	Obese	Obese	Normal Weight
Familial hyper coagulopathy	No	No	No	No	No	No
First trimester abortion	No	No	No	No	Not applicable	No
Travel Habits						
Smoking	No	Yes	Yes	Yes	Yes	No
Alcohol abuse	No	No	No	No	No	Yes
Recreational drugs	No	No	No	No	No	No
Regular exercise	No	No	No	No	No	Yes
Findings on venogram	80 % stenosis	90 % Stenosis	99 % stenosis	>50 % stenosis	99% stenosis	100% stenosis
Stenting performed	Yes	Yes	Yes	Yes	Yes	No
Residual stenosis	< 5%	20%	0%	20%	30%	100%

The six cases presented in this report had a history of lumbar spinal fusion which was surgically treated with lumbar hardware. Two out of six patients had surgery due to spinal stenosis, three had surgery due to degenerative disc disease, and one of them had surgery due to cervical and lumbar disc prolapse. Five patients presented leg swelling and pain, with predominance in the left leg, in an elapse of six months to several years after spinal surgery but one patient suffered an acute DVT in the first 24 hours after lumbar surgery. None of them reported OCP use, first-trimester abortion, or recent travel. Three of the patients had documented hypercoagulability, patient 5 has protein C deficiency, patient 4 had history of DVT, pulmonary embolism with infarction, and patient 6 had SLE. Also, Patient 3 had history of three previous DVT on the distal left leg and superficial phlebitis. Case 1 and 5 are Diabetics and obesity or overweight was evident in three of them. Four patients had a history of heavy smoking. The labs performed showed unremarkable results at the time when the IVCS was diagnosed. Iliac vein ultrasound scan done on all the patient showed positive deep vein reflux followed by venogram/venoplasty. Acute DVT was ruled out in all patients.

Endovascular treatment, such as percutaneous angioplasty with stent placement is favored, and it has been used since 1995 [11]. Treatment depends on the severity and location of the vein compression. However, venogram and IVUS for diagnosis and therapeutic venoplasty with or without stenting have become the first choice for diagnosis and post stenting confirmation. In addition to IVUS being the gold standard for diagnosis it is currently the most used procedure to determine the severity of stenosis. For this reason, venogram and IVUS were used in all the cases reported above and venoplasty with stenting was done in five of them. All the patients reported significant improvement in symptoms after these procedures. No recurrences of the IVCS have been observed in the patients presented in this report.

CONCLUSION

The cases presented in this report suggest that the hardware used in lumbar/spinal surgery could lead to an iatrogenic compression of the left common iliac Vein. The natural evolution of the scaring process and the proximity between vascular structures in the pelvic region with the hardware placed in the lumbar spine surgery could produce a disturbance of the normal pelvic vascular anatomy and favor the compression of the iliac vein. This anatomic disturbance combined with a hypercoagulable state such as SLE, protein C deficiency, DM or surgery could promote the occurrence of an early symptomatic May-Thurner syndrome. Therefore, it is crucial to recognize the history of lumbar surgery with hardware as a potential contributing or causal factor in those patients who present with pain or swelling in the lower extremities or DVT. The presentation of IVCS after lumbar surgery could be unspecific, and event simulates other more common pathologies. Standard imaging techniques are not always reliable to detect the interference of orthopedic hardware with essential

internal structures. Our six patients were diagnosed by venogram and IVUS, which is the gold standard not only due to its high sensitivity and specificity for this entity but because it can be therapeutic through angioplasty and stenting. The angioplasty with or without stenting placed has achieved a low recurrence rate [8-11]. It is imperative having a high level of suspicion and familiarizing ourselves with the natural history of IVCS due to the invasive nature of venogram and the relevance of an early diagnosis to reduce the occurrences of complications of this not so rare disease that can lead to severe DVT, Pulmonary embolism or an uncomfortable and persistent discomfort in our patients.

AUTHORS' CONTRIBUTION

All authors have contributed equally.

CONFLICT OF INTEREST

Declared none.

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