

DVT with Pulmonary Embolism in Patient with Grade 2 Compound Tibia Shaft Fracture- Treated with Thrombolysis and Use of Prophylactic IVC Filter: Case Report

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Learning Point of the Article:

Importance of timely detection of symptoms and investigations, immediate appropriate treatment of DVT-PE with thrombolytics and anticoagulants also use of IVC Filter for conditions when anticoagulants are contraindicated.

Abstract

Introduction: Major orthopedic procedures place patients at risk for Deep venous thrombosis (DVT) and pulmonary embolism (PE). DVT has a 10–40% incidence after isolated fractures of the tibia and distal bones of the lower extremity. Diagnostic techniques are venous compression ultrasonography, venography, and pulmonary angiography. Prevention methods for venous thromboembolism (VTE) include mechanical prophylaxis and pharmacological prophylaxis. Inferior vena cava filter (IVCF) intercepts thrombus in inferior vena cava and prevents it from reaching the pulmonary artery.

Case Report: A 39-year-old female having compound Type 2 mid-shaft tibia fracture and operated with intramedullary nailing at a corporate hospital, Navi Mumbai in January 2024. Despite giving DVT prophylaxis, she developed shortness of breath on 3rd day. 2D echocardiogram (ECHO) showed dilated right atrium and right ventricular and computed tomography pulmonary angiography (CTPA) showed saddle embolism at the junction of pulmonary artery division. The cardiologist immediately advised intravenous (IV) thrombolysis (injection tenecteplase 30 mg stat) followed by IV anticoagulants (injection low molecular weight heparin 0.6) and oral (rivaroxaban 20 mg) for 15 days. However, she complained of high-grade fever, right leg persistent swelling, and per vaginal (PV) bleeding. Venous Doppler showed persistent thrombi. Hence oral rivaroxaban was stopped, and IVCF was inserted in February 2024 to prevent further embolization. After observing her menstrual cycles, she was resumed on oral rivaroxaban after 1 month. Follow-up after 3 months of surgery (April 2024) showed signs of healing of shaft tibia fracture. Follow-up after 3 months of IVCF placement (May 2024) showed no persistent thrombi in bilateral lower limb venous Doppler. Hence decision of F removal was made at 3 months.

Conclusion: Clinical evaluation of patients is important for the detection of DVT-PE. Complain of breathlessness on exertion suggested the diagnosis of PE, confirmed by 2D ECHO and CTPA, and immediately treated by the cardiac team with thrombolytics and anticoagulants. Since the patient developed bleeding PV, the insertion of an IVCF is the best option for treatment and prophylaxis of future VTE episodes.

Keywords: Deep venous thrombosis, pulmonary embolism, tibia shaft fracture, thrombolytics, anticoagulants, inferior vena cava filter.

Introduction

Major orthopedic procedures place patients at risk for Deep venous thrombosis (DVT) and venous thromboembolism (VTE), including pulmonary embolism (PE). Complications of

DVT include postphlebotic syndrome or death from PE. Therefore, prophylaxis with anticoagulant medications, as well as the adjunctive use of mechanical devices, is essential. Deep venous thrombosis (DVT) involves a disorder of venous return

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Author's Photo Gallery



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Figure 1: Pre-operative X-ray - right midshaft tibia fracture.



Figure 2: Computed tomography pulmonary angiography shows saddle embolus.

caused by abnormal blood clotting in deep veins, often occurring in lower limbs due to limited mobility, prolonged bed rest, and the use of intraoperative tourniquets [1]. Virchow's triad implicates three contributing factors in the formation of thrombosis: Venous stasis, vascular injury, and hypercoagulability with venous stasis being the most consequential. VTE includes DVT and PE [2]. When a thrombus formed of DVT is dislodged in the body, the embolus travels down the inferior vena cava (IVC) to the pulmonary artery through the blood flow, causing a serious complication like PE.

Risk factors to develop VTE events include increased age and

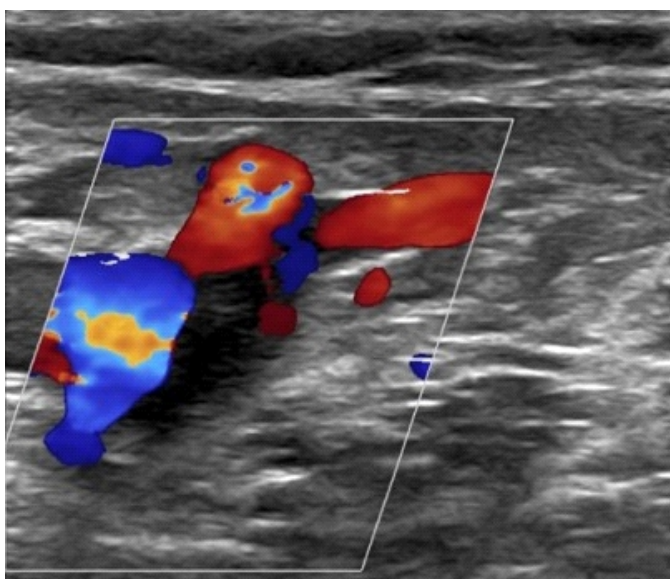


Figure 3: Venous Doppler of right leg shows persistent partial thrombus at the saphenofemoral junction.

body mass index, comorbidity of diabetes mellitus, high American Society of Anesthesiologists score, surgery requiring intubation, immobility, and estrogen. Female sex, smoking, congestive heart failure, and cancer are commonly thought to be secondary risk factors. DVT is recognized sequelae of isolated lower extremity fractures, with a 10–40% incidence after isolated fractures of the tibia and distal bones of the lower extremity [3, 4]. Gao et al. [5] found that (28.65%) cases with tibiofibular fractures developed DVT, including popliteal vein thrombosis, accounting for 13.7% (14/102). Other studies [6] reported that the incidence was lower, about 2.86–11.5%.

The current gold standard invasive diagnostic techniques are venography and pulmonary angiography. The non-invasive diagnostic test for DVT is venous compression ultrasonography with a sensitivity and specificity of 97% and 98%, respectively. Another safe and cost-effective way of evaluation is a D-dimer assay which is a very sensitive laboratory test, and a negative assay is useful in ruling out the presence of DVT and PE.

There are currently two main types of prevention methods for VTE: Mechanical prophylaxis and chemical/pharmacological prophylaxis. Early post-operative ambulation helps in reducing the incidence of post-operative thromboembolism [7]. Mechanical prevention mainly includes compression stockings, external mechanical equipment, etc. which reduce the chance of DVT by reducing stasis in venous blood flow. The main drugs commonly used for pharmacological prophylaxis include heparin, factor Xa inhibitors, Vitamin K antagonists, direct coagulation inhibitors, and antiplatelets.

Heparin analogs are unfractionated heparin (UFH) and low molecular weight heparin (LMWH). Factor Xa inhibitors

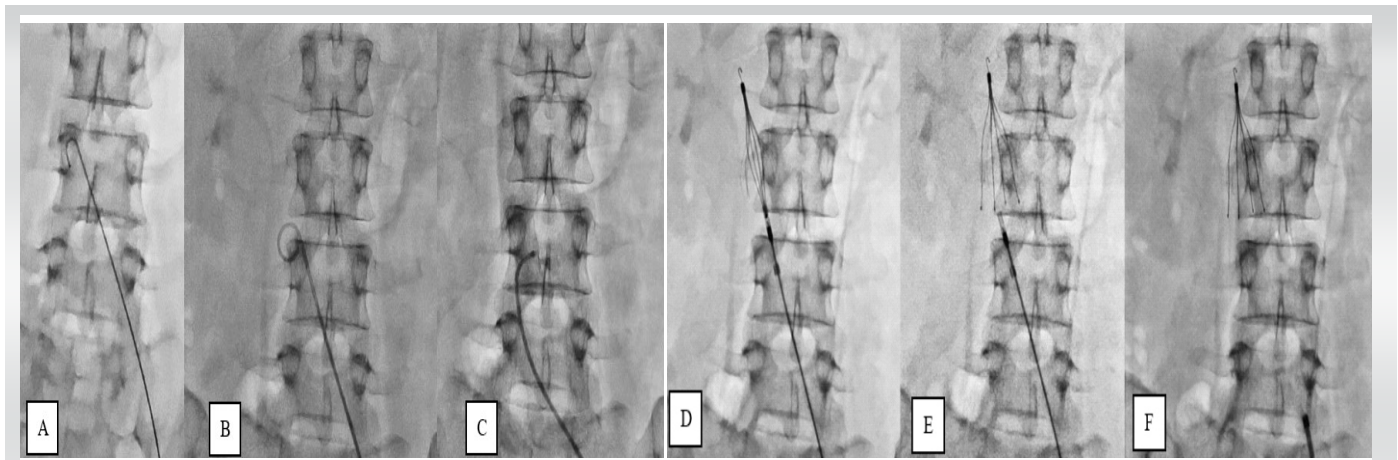


Figure 4: (A-C) shows the insertion of trochar through the femoral vein to reach the inferior vena cava. (D-F) show the procedure of dislodgement of the inferior vena cava filter.

include sodium fondaparinux and rivaroxaban. Vitamin K antagonists like warfarin [8, 9] should be started as soon as possible after the diagnosis of VTE, in combination with UFH, LMWH, or sulforaphane sodium. Direct thrombin inhibitors include dabigatran whereas antiplatelet agents are aspirin and clopidogrel.

Tenecteplase, a fibrinolytic drug, is a recombinant tissue plasminogen activator which has been the drug of choice for intravenous (IV) thrombolysis.

The inferior vena cava filter (IVCF) is an intravascular interceptor device that intercepts foreign bodies flowing through the IVC and prevents them from reaching the

pulmonary artery and causing PE. However, the function of IVCF is to intercept thrombus and not to prevent thrombosis.

Case Report

The case was treated at a corporate hospital, Navi Mumbai, India, in January 2024 and followed up to May 2024, approximately a span of 6 months. This case was of a 39-year-old female having a history of road traffic accidents, brought to ER with a right-sided compound Type 2 mid-shaft tibia fracture on January 25, 2024 (Fig. 1). There was a lacerated wound of 4×2 cm² with graze abrasions over the anterolateral aspect of the right upper leg.

She was taken for debridement of a wound with intramedullary nailing for tibial shaft fracture (closed, Static) immediately on January 26, 2024. A prophylactic dose of injection LMWH 0.4 was given subcutaneously post-operatively after 6 h and once daily later. Triple antimicrobials were given as a prophylaxis for wound infection. She was mobilized non-weight-bearing on the right lower limb for 2 days, but on the 3rd day during physiotherapy and mobilization, she developed shortness of breath. She was evaluated clinically and her arterial blood gas analysis (ABGA) and chest X-ray were apparently normal. Her D-Dimer was found to be elevated >6.5 .

She was evaluated by a cardiologist and pulmonologist and investigations electrocardiogram (ECG), 2D echocardiogram (ECHO) and computed tomography pulmonary angiography (CTPA) were done. ECG was within normal parameters but 2D ECHO showed dilated right atrium (RA), and right ventricular (RV) with normal ejection fraction. CTPA showed saddle embolism at the junction of pulmonary artery division extending into B/L pulmonary arteries and into lobar, segmental arteries (Fig. 2).

She was shifted to the intensive care unit (ICU) for monitoring



Figure 5: 3 months post-operative after tibia interlock nailing show signs of fracture healing for shaft tibia fracture.

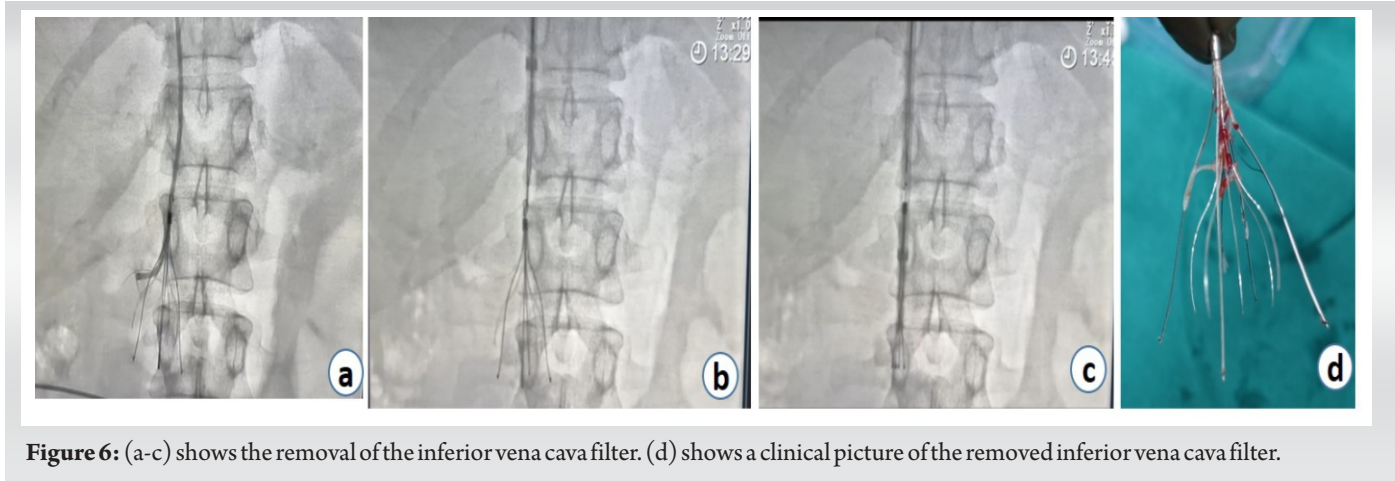


Figure 6: (a-c) shows the removal of the inferior vena cava filter. (d) shows a clinical picture of the removed inferior vena cava filter.

and was decided upon two options for treating PE: First was to aspirate the thrombus with a catheter by doing an angiogram and second was to do IV thrombolysis with drugs. IV thrombolysis with injection tenecteplase 30 mg was given stat. In post-thrombolysis, there was no active bleeding or soakage from an operative wound or sutured lacerated wound. Later, she was started on an injection of LMWH 0.6 twice daily and the prothrombin time-international normalized ratio was monitored. After 2 days, the patient was shifted out from ICU and started on tab rivaroxaban 20 mg once daily.

Follow-up 2D ECHO showed normal RA, and RV with normal ejection fraction. A bilateral venous Doppler was done which showed DVT on the right lower limb (Fig. 3) and sluggish blood flow on the left lower limb. The patient was discharged after 1 week on February 06, 2024 with tab rivaroxaban 15 mg twice daily for 18 days.

After 1 week of discharge, she complained of high-grade fever with persistent swelling over the right upper leg and was admitted again on February 13, 2024, on evaluation, she had a urinary infection, her urine was culture positive and started with antibiotics. She underwent bilateral lower limb venous Doppler which showed persistent thrombi. Later, she noticed bleeding PV, so the case was discussed with the cardiologist, tab rivaroxaban was stopped, and it was decided to put an IVCF to prevent further embolization. Accordingly, IVCF placement was done by the cardiologist team in CATH-LAB on February 22, 2024 (Fig. 4). In post-procedure, the patient was stable and discharged again without any oral anticoagulants.

After IVCF insertion, she was observed for any bleeding tendency (menstrual cycle) for 1 month. Tab rivaroxaban was started on March 26, 2024, and continued up to 16 May (3-month post-IVCF insertion). At 3-months postoperatively (April 2024), the fracture tibia was assessed radiologically and she started walking full weight bearing right lower limb without pain.

This patient was treated by pharmacological agents, such as IV thrombolytic, IV anticoagulant, and oral anticoagulant. Finally, the mechanical agent- IVCF was used for persistent thrombi. The patient was followed up in orthopedics in April 2024, after 3 months of surgery (interlock nailing) which showed signs on fracture healing for shaft tibia fracture (Fig. 5). Patient was followed up in cardiology in May 2024, after 3 months of IVCF placement, for bilateral lower limb venous Doppler which showed no persistent thrombi.

Hence, the decision of IVCF removal was made at 3 months (Fig. 6). After assessing her bleeding in her menstrual cycle at the time of IVCF removal, we decided to continue tab rivaroxaban for further 3 months.

Discussion

Lapidus et al. [10] reported that VTE events occurred in 2.2% of patients with internal fixation for tibial shaft fracture, and PE occurred in 0.6% resulted in fatal in all cases.

In 2012, American college of chest physicians evidenced based clinical practice guidelines suggested no prophylaxis rather than pharmacologic thromboprophylaxis in patients with isolated lower-leg injuries without history of VTE [4].

External mechanical devices should not be used in patients with lower limb trauma and compression stockings are contraindicated in patients with peripheral arterial disease and atherosclerosis. These methods do not increase the risk of bleeding compared to pharmacological prophylaxis [4]. Evidence suggests that these device use has been limited in the inpatient setting because of concerns with comfort and compliance [9].

LMWH decreases the risk of DVT by 50–60% and the risk of PE by approximately two-thirds [4]. The use of the anticoagulants can be accompanied by some negative effects. For example, heparin-induced thrombocytopenia may occur with the use of

heparin [11], use of aspirin increases the risk of gastrointestinal bleeding [12] and gastric ulcers, and the use of various anticoagulants increases the risk of bleeding.

One of the challenges in using pharmacologic agents is balancing benefits of anticoagulation and the risk of bleeding complications [13]. The impact of anticoagulation therapy on wound healing also makes orthopedic surgeons cautious about the use of anticoagulants post-operatively. Some surgeons therefore opt for prophylactic implantation of an IVCF to prevent PE and to avoid the risks associated with anticoagulation [14].

Considering aspiration of thrombus with a catheter, that is, catheter-directed thrombectomy (CDT), this procedure is performed emergently in phlegmasia cerulea dolens, where severe edema from venous obstruction threatens limb viability [15]. Urgent CDT is also indicated for IVC thrombosis, especially when patients are at risk of renal or hepatic vein involvement. Patients at high risk for bleeding may be more appropriately managed with aspiration thrombectomy techniques without the use of thrombolytic agents.

Absolute contraindications to catheter-directed pharmacologic thrombolysis include cerebral infarction, neurological and eye procedures or head trauma within 3 months, and known intracranial lesion. Relative contraindications include major trauma, surgery, or obstetrical delivery within 10 days, uncontrolled hypertension, gastrointestinal bleeding within 3 months, pregnancy, infected venous thrombus, and bleeding diathesis or known severe allergy to anticoagulant, or thrombolytic agent. Since the patient had contraindication (major limb trauma), it was decided to consider IV thrombolysis over aspiration with CDT.

With the presence of VTE events, IVCFs could be an indication for patients who have a high risk of bleeding under anticoagulation (as in our case), anticoagulant contraindication, recurrent PE despite anticoagulant treatment (failed treatment) [16] or patients with high-risk factors for acute VTE who are planned for pelvic or lower extremity surgery [17]. The placement of an IVCF could be indicated in the post-operative treatment of the fracture, because of residual DVT (floating thrombus) following the anticoagulation therapy (as in our case).

Some other indications of IVCFs include use in high-risk burn or trauma patients, or in patients undergoing ilio-caval thrombolysis or pulmonary thrombectomy. When used in combination with anticoagulants or mechanical compression therapy in high-risk orthopedic patients, IVCFs are found to effectively prevent PE [18].

IVCF complications in descending order were filter migration/displacement, recurrent embolization, filter tilt, IVC perforation, and filter fracture [19]. Filter tilt is when the angle between the central axis of the filter and the longitudinal axis of the IVC exceeds 15°, slanted filters have a lower filtration capacity for smaller thrombi. Filter displacement is described as the filter being more than 10 mm away from the intended point, so the risk of renal vein embolism or renal failure increases. Filter migration to the heart and lungs, can lead to serious consequences. Vena cava perforation into structures surrounding the IVC wall, such as the aorta, psoas major, duodenum, and kidney. Filter fracture, according to Li et al., is caused by the IVC's rhythmic expansion and contraction during the cardiac cycle.

Recurrent thromboembolism is due to the adverse hemodynamic effects of the filter on the body after the interception of the thrombus by the IVCF, which slows the blood flow.

Prolonged placement of IVCF affects the hemodynamics within the IVC and can lead to a higher incidence of DVT in patients with filters than in those without filters [20].

Most of the current literature and guidelines suggest that primary prophylaxis with an IVCF is not recommended for major surgery in patients without known VTE [4, 21]. These complications of IVCF make the risks of filter placement for the average patient undergoing orthopedic surgery higher relative to the benefits.

In summary, it is recommended that IVCFs be withdrawn as soon as indications disappeared (between 29 and 54 days after placement) to avoid complications and obtain the maximum clinical benefit.

Conclusion

Clinical evaluation of patients is of utmost importance for detection of DVT-PE. Our patient only had a complaint of breathlessness on exertion and we immediately investigated the patient in a sequence of investigations- ECG, Chest X-ray, ABGA (baseline investigations) followed by D-Dimer.

She was diagnosed with PE and confirmed by 2D ECHO and CTPA, and immediately treated by the cardiac team with thrombolytics and anticoagulants.

In such conditions where a patient is on anticoagulants and develops bleeding tendencies (like bleeding PV in our case), insertion of IVCF is the best option for treatment and prophylaxis of a future VTE episode.

Ideally, removal of the IVCF is done at 3 months when purpose is solved.

Clinical Message

Clinical evaluation of our patient's complaint of breathlessness on exertion was important for early diagnosis of DVT-PE and was followed by immediate treatment with thrombolytics and anticoagulants. When our patient on anticoagulant therapy, developed a bleeding tendency, it was advisable to stop this therapy and plan for insertion of IVCF for prophylaxis of VTE.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

References

1. El-Daly I, Reidy J, Culpan P, Bates P. Thromboprophylaxis in patients with pelvic and acetabular fractures: A short review and recommendations. *Injury* 2013;44:1710-20.
2. Konstantinides SV, Torbicki A, Agnelli G, Danchin N, Fitzmaurice D, Galie N, et al. 2014 ESC Guidelines on the diagnosis and management of acute pulmonary embolism. *Eur Heart J* 2014;35:3033-80.
3. Selby R, Geerts WH, Crowther MA, Kreder HJ, Bent M, Schemitsch E, et al. A prospective cohort study of the epidemiology of symptomatic venous thromboembolism (VTE) after isolated leg fractures distal to the knee without thromboprophylaxis. *Blood* 2004;104:492.
4. Falck-Ytter Y, Francis CW, Johanson NA, Curley C, Dahl OE, Schulman S, et al. Prevention of VTE in orthopedic surgery patients: Antithrombotic therapy and prevention of thrombosis, 9th ed: American College of Chest Physicians evidence-based clinical practice guidelines. *Chest* 2012;141:e278S-325.
5. Gao F, Wang G, Wang D, et al. Characteristics and risk factors of deep vein thrombosis in tibiofibular fractures. *Orthop J Chin* 2020;28:1085-8.
6. Li S, Zhang K, Heng L, Feng D, Cai X, Tian D. Incidence and risk factors of deep venous thrombosis of lower extremities within 24 hours after closed fractures of lower extremities. *Int J Orthop* 2019;40:306-10.
7. Talec P, Gaujoux S, Samama CM. Early ambulation and prevention of post-operative thrombo-embolic risk. *J Visc Surg* 2016;153:S11-14.
8. Witt DM, Clark NP, Kaatz S, Schnurr T, Ansell JE. Guidance for the practical management of warfarin therapy in the treatment of venous thromboembolism. *J Thromb Thrombolysis* 2016;41:187-205.
9. Samoukovic G, Malas T, deVarennes B. The role of pulmonary embolectomy in the treatment of acute pulmonary embolism: A literature review from 1968 to 2008. *Interact Cardiovasc Thorac Surg* 2010;11:265-70.
10. Lapidus LJ, Ponzer S, Pettersson H, de Bri E. Symptomatic venous thromboembolism and mortality in orthopaedic surgery-an observational study of 45 968 consecutive procedures. *BMC Musculoskelet Disord* 2013;14:177
11. Franchini M. Heparin-induced thrombocytopenia: An update. *Thromb J* 2005;3:14.
12. Sostres C, Lanas A. Gastrointestinal effects of aspirin. *Nat Rev Gastroenterol Hepatol* 2011;8:385-94.
13. Granziera S, Cohen AT. VTE primary prevention, including hospitalised medical and orthopaedic surgical patients. *Thromb Haemost* 2015;113:1216-23.
14. Rosner MK, Kuklo TR, Tawk R, Moquin R, Ondra SL. Prophylactic placement of an inferior vena cava filter in high-risk patients undergoing spinal reconstruction. *Neurosurg Focus* 2004;17:E6.
15. Vedantham S, Thorpe PE, Cardella JF, Grassi CJ, Patel NH, Ferral H, et al. Quality improvement guidelines for the treatment of lower extremity deep vein thrombosis with use of endovascular thrombus removal. *J Vasc Interv Radiol* 2006;17:435-47; quiz 448.
16. Tornetta P, Bogdan Y. Pulmonary embolism in orthopaedic patients: Diagnosis and management. *J Am Acad Orthop Surg* 2012;20:586-95.
17. Vascular Surgery Group of Surgical Society of Chinese Medical Association. Guidelines for the diagnosis and treatment of deep venous thrombosis (3rd edition). *Chin J Vasc Surg* 2017;2:201-8.



18. Strauss EJ, Egol KA, Alaia M, Hansen D, Bashar M, Steiger D. The use of retrievable inferior vena cava filters in orthopaedic patients. *J Bone Joint Surg Br* 2008;90:662-7.

19. Ayad MT, Gillespie DL. Long-term complications of inferior vena cava filters. *J Vasc Surg Venous Lymphat Disord* 2019;7:139-44.

20. Cloney MB, Driscoll CB, Yamaguchi JT, Hopkins B, Dahdaleh NS. Comparison of inpatient versus post-discharge

venous thromboembolic events after spinal surgery: A single institution series of 6869 consecutive patients. *Clin Neurol Neurosurg* 2020;196:105982.

21. Mismetti P, Laporte S, Pellerin O, Ennezat PV, Couturaud F, Elias A, et al. Effect of a retrievable inferior vena cava filter plus anticoagulation vs anticoagulation alone on risk of recurrent pulmonary embolism: A randomized clinical trial. *JAMA* 2015;313:1627-35.

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