CASE REPORT

Hypoplasia of the inferior vena cava in a young man presenting with extensive deep venous thrombosis

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SUMMARY

We present a case of a 34-year-old man with extensive deep venous thrombosis (DVT) who was found to have multiple abnormalities of venous anatomy, notably hypoplasia of the inferior vena cava with azygous continuation. DVT has an annual incidence of around 1 in 1000 people in the UK. Many cases will have readily identifiable risk factors, such as underlying malignancy, immobility or thrombophilia, but at times, these might not be so straightforward and unexpected contributing factors may be found. Although relatively uncommon in the general population, congenital venous abnormalities have been found at higher incidence in young adults presenting with spontaneous DVT and should therefore remain a consideration when classical risk factors are absent.

BACKGROUND

The annual incidence of deep venous thrombosis (DVT) is around 1 in 1000 people in the UK.¹ Many cases will have readily identifiable risk factors, such as underlying malignancy, immobility or thrombophilia. At times, these features might not be so straightforward and unexpected contributing factors may be found. We describe the case of a young man diagnosed with an extensive DVT of the lower limb and on further imaging noted to have a hypoplastic inferior vena cava (IVC) with azygous continuation and considerable superficial venous abnormalities. These had not been identified previously despite a similar presentation with DVT in the right leg 14 years prior.

Congenital absence of the IVC is recognised as a risk factor for the development of DVT, but is described infrequently in the literature and is relatively uncommon in the general population. This case highlights the importance of considering more unusual causes in patients, particularly younger individuals who present with extensive DVT but in whom classical risk factors are absent.

CASE PRESENTATION

A 34-year-old Caucasian man presented to the emergency department, with a 2-day history of worsening painful swelling in his left leg. This had severely limited his mobility. He did not report any shortness of breath, cough or chest pain, he was afebrile, and his observations were stable. Examinations of the cardiovascular and respiratory systems did not reveal any abnormalities.

The left lower limb was found to be erythematous and diffusely swollen. The peripheries were cool but dorsalis pedis and posterior tibial pulses

were palpable. There was venous distension in the right inguinal region, extending to the lumbar and flank areas, but examination of the right lower limb was normal.

The patient was usually fit and well. His medical history was remarkable for right lower limb DVT 14 years previously. No cause had been identified for this episode following thrombophilia screen. The patient recalled that lifelong warfarin therapy had been recommended at that time, but he had ceased treatment of his own accord after 3 years.

There was no family history of note, particularly of venous thromboembolism (VTE) or thrombophilia. He reported only occasionally drinking alcohol, he was a non-smoker and worked in the financial industry.

Ultrasound in the emergency department confirmed extensive clot, with complete occlusion of the external iliac vein, and common, deep and superficial femoral veins. The popliteal vein, posterior tibial veins, peroneal veins and anterior tibial veins were all partially occluded.

The patient was discharged initially with low-molecular-weight heparin and follow-up planned for the next day, but later re-attended with worsening pain. Pulmonary embolus was excluded on CT pulmonary angiography and a CT venogram of the lower limbs was requested for further assessment.

INVESTIGATIONS

Table 1 indicates blood results at admission.

CT venogram of the abdomen and pelvis confirmed the presence of a left-sided DVT, extending up into the common iliac vein and towards the vertebral venous plexus. In addition, there were multiple abnormalities of venous anatomy, predominantly of the superficial veins on the right, and of the deep abdominal and pelvic veins on the left. The patient's IVC was noted to be hypoplastic, with enlargement of the vertebral venous plexus and azygous continuation of the IVC. On the right, there were extensive venous abnormalities arising from the superficial veins, extending through the subcutaneous tissues of the anterior abdomen and right flank.

The left adrenal was shrunken and calcified, possibly as a result of previous ischaemia, but appearances of the remaining intra-abdominal organs were within normal limits.

Only on questioning after his diagnosis did the patient recall intermittent swelling of both his legs as a child, but nothing more. It transpired that he had also undergone appendicectomy around the

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Table 1 Blood results at admission

Haemoglobin (g/L)	135
White cell count ($\times 10^9/L$)	7
Platelets ($\times 10^9/L$)	292
d-Dimer ($\mu g/L$)	3580 (normal range 0–550)
U&Es	All in normal range
LFTs	All in normal range

LFT, liver function tests; U&Es, urea and electrolytes.

time of his first DVT. Abnormal pelvic vasculature had been noted at that time, although no further investigations had been offered.

Echocardiogram demonstrated normal situs and structure with good systolic function.

The patient had undergone a thrombophilia screen after his first DVT, and reported that this had been negative. A repeat screen was requested including factor V Leiden mutation, protein C and S activity, protein G20210A mutation and antithrombin activity, and these were normal. Lupus anticoagulant was positive at the time, and, following haematology review, it was recommended that this blood test be repeated in a few months' time.

TREATMENT

The patient was started on treatment dose low-molecular-weight heparin before converting to warfarin therapy as an outpatient. He was keen to be considered for conversion to a novel oral anti-coagulant secondary to his previous experience of warfarin therapy and monitoring after his first DVT.

OUTCOME AND FOLLOW-UP

The patient remains on therapeutic anticoagulation, at present with warfarin, with a target international normalised ratio (INR) of 2–3. He has continued to experience ongoing swelling in the left leg although his symptoms of pain were beginning to improve. Lower limb duplex examination showed evidence of recanalisation of the left-sided clot.

A vascular surgical opinion was sought, with the recommendation of compression hosiery. No invasive interventions have as yet been advised with regard to symptom control or future prevention.

DISCUSSION

Congenital venous abnormalities are estimated to affect around 1% of the population, with an anomaly specifically of the IVC in approximately half of these.² Agenesis or hypoplasia of the IVC has been previously described, usually after patients have presented with acute DVT.³ It is likely that the structural anomaly contributes to venous stasis and hence clot formation.

A review from 2010 identified 62 cases of IVC agenesis published in the English literature. All of these were diagnosed after sonographically confirmed DVT, abdominal or pelvic CT or MRI. The review found that the patients were predominantly male and that the presentation of DVT usually followed intense exercise. Several cases had concurrent abnormalities of blood clotting.⁴

On assessment of a reference population of 550 000 over 3 years, one haematology department in Aberdeen identified IVC anomalies in 6.7% of young adults presenting with spontaneous DVT, markedly above the expected background rate of 0.5%.² The authors also noted that an excess of bilateral thrombosis was observed in patients with structural anomalies. Since

overt or occult malignancy would represent another differential for bilateral clots, it is prudent to be aware that anatomic abnormalities may also be contributory.

Obernosterer *et al*⁵ reviewed 97 patients with DVT finding five of these (just over 5%) to have an anomaly of the IVC. Of note, those patients with DVT in the presence of an IVC anomaly were significantly younger than those with normal IVC anatomy, the average age of those with anomalies being 25 years ($\pm$ SD 6 years) compared to an average of 53 ± 19 years among those without.

Andres *et al*⁶ presented a similar case to that outlined above, of a 30-year-old man without classical risk factors for DVT who was found to have agenesis of the infrarenal IVC. The authors also quote an additional Spanish language publication that highlights agenesis of the IVC as an important factor to consider in young people who develop DVT, and states that the prevalence may be as high as 5% in this group.⁷ García-Fuster *et al*⁸ quoted figures as high as 16.2% for the incidence of IVC anomalies in patients under 50 years of age with iliac thrombosis.

The literature suggests that IVC abnormalities are a relatively rare yet important cause of DVT in young adults. VTE is typically considered a disease of older individuals, with incidence reported to rise rapidly after 45 years of age; from an estimated 1 in 10 000 annually before the fourth decade of life to 5–6/1000 each year in those over 80 years of age.⁹ Given the varying figures presenting in the literature, the true percentage of young people with acute DVT who have IVC anomalies is not clear. With this uncertainty in mind, it is difficult to either recommend or dissuade from cross-sectional imaging to hunt for potential IVC anomalies in such patients. Further research would be required to establish the cost-benefit of screening, particularly if identifying the anomaly eventually has little bearing on the way the patient is managed clinically.

In the absence of the necessary data, it remains that the diagnosis of anatomical anomaly should be considered in those who lack the usual risk factors for VTE. Furthermore, in those patients with clotting abnormalities, cross-sectional imaging should still be considered as part of the work up, as it has been shown that several different aetiologies can be present.

The treatment approach in patients with DVT is also an area warranting further discussion. Current guidelines from the National Institute for Health and Care Excellence (NICE) recommend low-molecular-weight heparin or fondaparinux as the mainstay of treatment in confirmed proximal DVT, or pulmonary embolism, with unfractionated heparin and thrombolysis to be considered in the context of pulmonary embolism with haemodynamic instability.¹⁰

The decision to thrombolyse in patients with DVT is rather less clear cut, with catheter-directed thrombolysis being listed as a consideration (rather than a recommendation) in patients who fulfil all of the following criteria:

- ▶ Symptomatic iliofemoral DVT;
- ▶ Symptoms of less than 14 days' duration;
- ▶ Good functional status;
- ▶ Life expectancy of 1 year or more;
- ▶ Low risk of bleeding.

Gogalniceanu *et al*¹¹ reviewed the literature pertaining to thrombolysis in DVT. Where loss of limb or even life, is a possibility in massive DVT with phlegmasia cerulea dolens, the use of thrombolysis for rapid clot dissolution is widely acknowledged.

The authors conclude that catheter-directed thrombolysis may improve short-term and mid-term outcomes for patient with proximal DVT, but recommend further randomised controlled trials. Despite data suggesting the superiority of directed

thrombolysis in achieving clot lysis, higher long-term patency rates and protection against the development of post-thrombotic syndrome (such as chronic pain, oedema and ulceration), invasiveness, cost and longer hospital stays could influence its use.

In the patient whose case we have presented, thrombolysis was considered, albeit briefly, once he came under the care of the medical team. There had been marked improvement in symptoms in comparison to those at presentation, with reduction in pain, swelling and erythema, and no evidence of vascular compromise to the lower limb.

Learning points

- ▶ Inferior vena cava (IVC) anomalies are a rare cause of deep venous thrombosis (DVT) that may be missed if cross-sectional imaging is not requested during investigation of the patient.
- ▶ The rate of IVC anomalies has been found to be higher in patients with acute DVT than the background rate in the general population.
- ▶ In younger patients for whom no classical risk factors are found, anatomic abnormalities should be considered as a possible predisposing factor, although further research is needed to clarify the prevalence of these anomalies in the population.

Contributors BEPA and TB were part of the medical team managing the patient's care during hospital admission. JdB was an elective medical student on placement

with the primary medical team and wrote the Case presentation and Investigations sections. BEPA and TB contributed to the Background, Discussion and Learning points sections.

Competing interests None declared.

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