# Clinics in Diagnostic Imaging (44)

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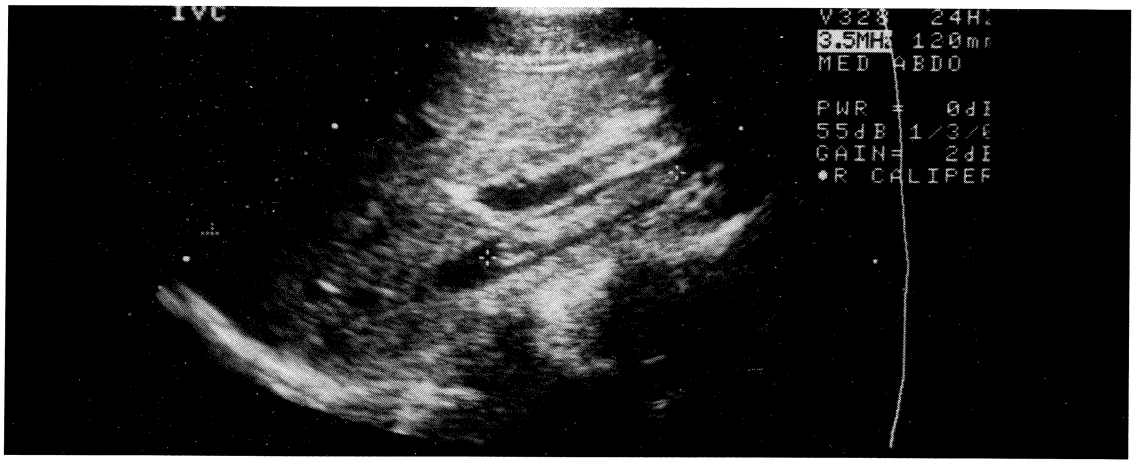


**Fig 1** – Longitudinal US of the liver shows the intra-hepatic portion of the IVC.

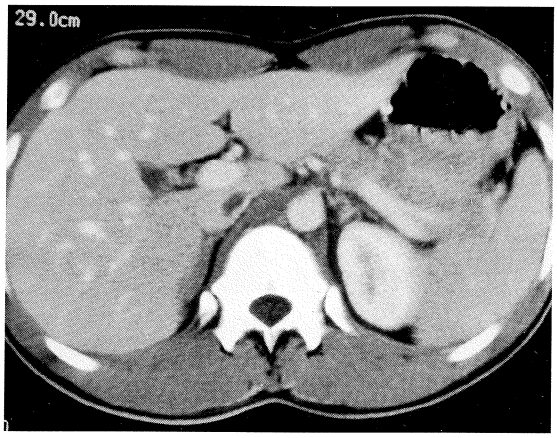


**Fig 2a**

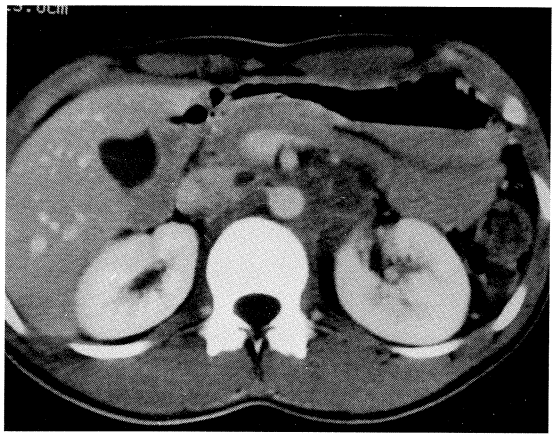

**Fig 2b**

**Fig 2** – Contrast-enhanced CT scans taken at the level of the (a) mid-liver and (b) inferior lobe of liver.

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## CASE PRESENTATION

A 20-year-old Indian man presented with a two-week history of non-specific right hypochondrial pain. He was anicteric and afebrile. Physical examination, including palpation of the genitalia, was unremarkable. The clinical diagnosis initially was that of biliary colic or gastritis. Laboratory investigations including serum transaminases, alkaline phosphate and serum analyses were normal. Oesophago-gastro-duodenoscopy revealed only duodenitis. Ultrasonography (US) of the hepatobiliary system was essentially normal. However, a peculiar finding was noted in the inferior vena cava (IVC) (Fig 1). The US finding prompted request for computed tomography (CT) of the abdomen and thorax (Fig 2a & 2b). What did US and CT scans show? What is the likely diagnosis and what other investigation will be most useful?

## IMAGE INTERPRETATION

An echogenic mass (between crosses) measuring about 1.4 cm in diameter and 5 cm in length was noted within the intra-hepatic portion of the IVC (Fig 1). CT showed a long filling defect in the opacified IVC (Figs 2a & b) as well as extensive para-aortic lymph node disease (Fig 2b). Intrapulmonary metastases were also demonstrated on CT of the thorax (not shown). In a young male patient, US of the scrotum was indicated and this showed a heterogeneous hypoechoic mass within the left testis. It had calcified foci and small cystic areas, diagnostic of testicular tumour (Fig 3).

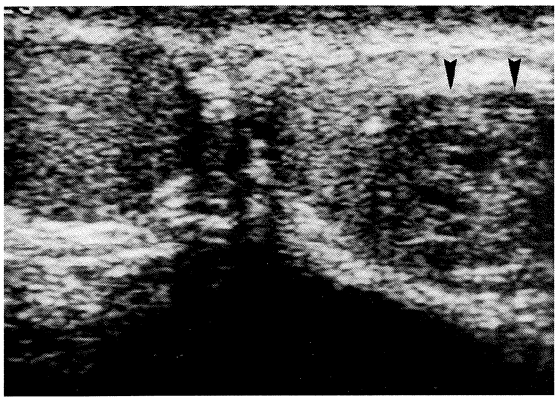

**Fig 3** – Scrotal US shows a heterogeneous lesion within the left testis, consistent with a testicular tumour (arrowheads).

## DIAGNOSIS

Testicular tumour with retroperitoneal lymphadenopathy and inferior vena cava thrombosis

## CLINICAL COURSE

The patient's serum alpha feto-protein and beta human chronic gonadotrophin levels were elevated at 144 $\mu$g/L (normal range 1 – 10) and 113 IU/L (normal range 0 – 7) respectively. The extent of IVC thrombus was further evaluated by magnetic resonance (MR) imaging, which demonstrated extensive para-aortic and retrocaval lymphadenopathy (Figs 4a & b). Tumour thrombus was noted within the left renal vein, which extended into the IVC up to the intrahepatic portion. The patient underwent left inguinal orchidectomy. Histology revealed an intratesticular mixed germ cell tumour, showing predominance of embryonal carcinoma and smaller components of yolk sac tumour and seminoma. Lymphatic embolisation was also present.

The patient was then referred for chemotherapy. He underwent 3 courses of bleomycin, etoposide, and cisplatin (BEP) chemotherapy. Follow-up CT at 2 months post-orchidectomy and chemotherapy showed complete resolution of the vena caval thrombus and para-aortic lymphadenopathy (Fig 5). Patient remained well at 9 months follow-up and is currently asymptomatic.

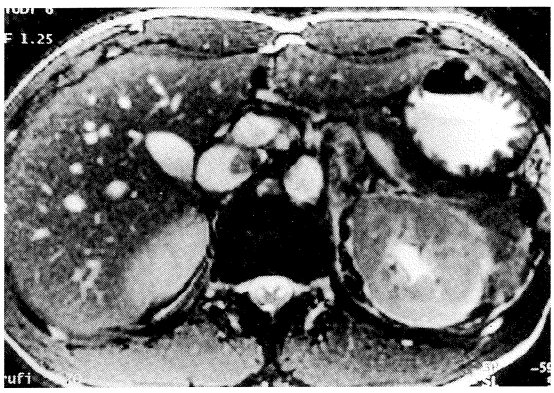

**Fig 4a**

**Fig 4b**

**Fig 4** – (a) Axial and (b) coronal T2-weighted MR images show a linear thrombus within the IVC (arrowheads).

## DISCUSSION

The IVC may be involved in a number of malignant and benign conditions. This includes extension from adult and paediatric renal, adrenal and hepatic tumours, which are not uncommon; as well as rare intrinsic caval disease such as smooth muscle tumours of the IVC[1] (Table I). In particular, renal cell carcinoma (RCC) involves the IVC in 5% to 10% of cases[2]. Recent reports show that for RCC with vena caval involvement, an aggressive surgical approach is warranted in the absence of identifiable metastasis[3].

In recent years, there have been significant advances in imaging of the IVC. Inferior vena cavography, an invasive modality, is now rarely performed. Ultrasonography, including use of colour Doppler, is preferred as it is non-invasive, inexpensive and widely available. The intra-hepatic portion of the IVC can generally be well visualised, but the infra-hepatic portion can be obscured by overlying bowel shadows. Measurement of flow signals by Doppler can enhance the diagnostic accuracy.

CT has become a key investigation both for diagnosis as well as staging of various malignancies, including renal and testicular tumours (Fig 6). However, as with venography, there may be occasional difficulties in interpretation due to flow artefacts from mixing of opacified and non-opacified blood within the IVC to give a false impression of thrombus. The timing of the injection of the contrast material is therefore critical, particularly with rapid sequence spiral CT scanners.

In the assessment of extent of inferior vena cava involvement, MR imaging has proved to be superior.

**Table I – Causes of inferior vena cava obstruction**

| Mechanism and pathology | Remarks |
|---|---|
| *A. Intrinsic obstruction* | |
| Neoplastic* | Most frequent cause |
| Renal cell carcinoma | Occurs in 5% – 10% of cases |
| Adrenal carcinoma, phaeochromocytoma | |
| Hepatic tumour, pancreatic tumour | |
| Metastasis to retroperitoneal lymph nodes | |
| Non-neoplastic | |
| Budd-Chiari syndrome | |
| *B. Intrinsic caval disease* | |
| Neoplastic | Rare |
| Leiomyoma, leiomyosarcoma, endothelioma | |
| Non-neoplastic | |
| Congenital web, thrombus extension | |
| *C. Extrinsic compression* | |
| Neoplastic | Similar pathology to causes of intrinsic obstruction |
| Non-neoplastic | |
| Hepatomegaly | |
| Tortuous aorta and abdominal aneurysm | |
| Gravid uterus | Functional obstruction |

Goldfarb et al[4] conducted a comparative study between MR imaging and venacavography as well as CT in the assessment of vena caval tumour thrombi. The majority of patients had renal cell carcinoma. Venacavography was accurate in 94% of patients but in 50%, a retrograde and antegrade study was required. CT demonstrated the presence of a tumour thrombus in all patients but could accurately assess the cephalic extent of the thrombus in only 33%. On the other hand, MR imaging accurately delineated the presence and extent of the thrombus in all the patients. The imaging findings were all confirmed during operation.

The role of MR imaging in the evaluation of the IVC in patients with non-seminomatous germ cell tumours (NSGCT) had only been reported recently by Ng et al in 1997[5]. In their series of 5 patients, the MR imaging findings were compared with those of CT. They noted that in all patients, the MR imaging studies provided better information than CT regarding the detection of partial and total occlusion of the IVC by both intraluminal thrombus and extrinsic compression.

The possible mechanism for involvement of the IVC in patients with testicular cancer can either be from lymphatic or vascular spread (Fig 7). The propensity of early lymphatic spread prior to extensive local disease is a notable feature of testicular tumour. The para-aortic lymph nodes are the pre-dominant site of nodal spread in NSGCT of the testis. In patients with large volume retroperitoneal disease, the IVC may be partially or completely occluded by extrinsic tumour compression. Simple clot thrombus may develop because of the diminished flow. With long-standing obstruction, organisation of thrombus and fibrosis may lead to obliteration of the vena cava. Alternatively, tumour extension from massive lymph node disease may also directly invade the wall of the IVC to produce an intra-luminal tumour thrombus. Similarly, other neoplastic conditions may cause IVC obstruction by causing either extrinsic compression

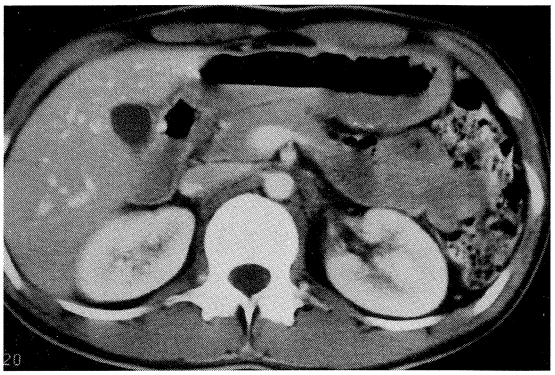

**Fig 5** – Contrast-enhanced CT scan (2 months post-orchidectomy and chemotherapy) shows complete resolution of the thrombus in the inferior vena cava and of the lymph node disease.

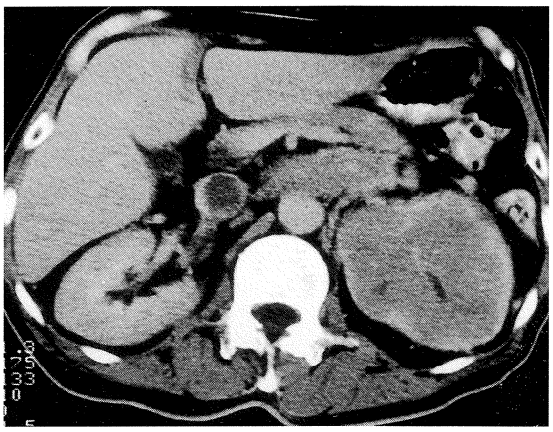

**Fig 6** – Contrast-enhanced CT scan of another patient shows a left renal tumour, distended left renal vein and tumour-thrombi within the IVC. Radial nephrectomy and en-bloc vena cava/ thrombectomy were subsequently performed.

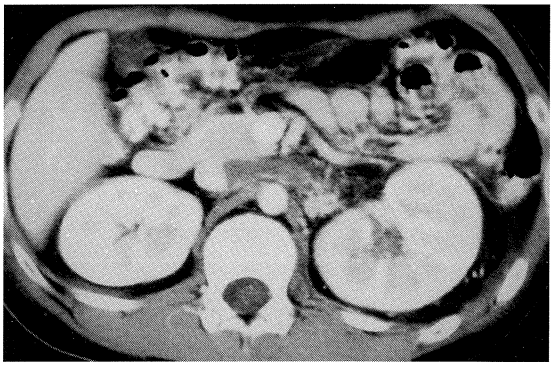

**Fig 7a**

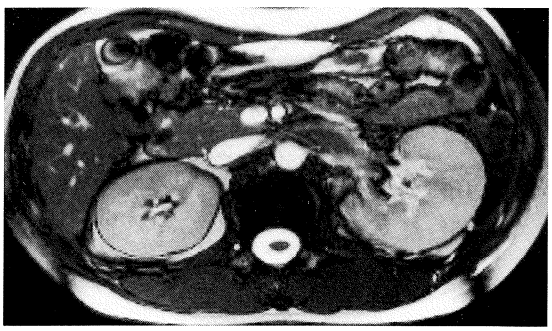

**Fig 7b**

**Fig 7** – Different patient suffering from the nephrotic syndrome, which was complicated by left renal vein thrombosis. (a) Contrast-enhanced CT and (b) T2-weighted MR scans show a thrombus within the distended left renal vein. The left kidney is also swollen.

or intrinsic obstruction (Table I). On the other hand, the insertion of the right gonadal vein into the IVC provides a direct route for vascular spread, which may account for the predominance of right-sided testicular tumours associated with IVC tumour thrombus.

The true incidence of inferior vena cava involvement by germ cell tumours is difficult to determine. This has been examined in 2 autopsy studies and a review of CT scans. Johnson et al[6] found the incidence to be 3% in a postmortem study. In another autopsy series, Bredael et al[7] found 16 of 144 patients (11%) with bulky germ cell tumours to have IVC involvement. Husband and Bellamy[8] reviewed the CT scans of 650 patients with testicular cancer and found 4 cases of involvement of the IVC among 397 patients (1%) with retroperitoneal disease.

In any event, chemotherapy is recognised as the standard primary modality after orchidectomy for patients with stage IIC disease (> 5cm retroperitoneal lymph node)[9,10]. Subsequent retroperitoneal lymph node dissection is indicated for patients with residual disease[11,12]. Occasionally, extensive bulky disease with IVC involvement despite chemotherapy requires surgical intervention[13-15].

While sudden deaths related to pulmonary emboli from vena cava thrombus[16] and intracardiac extension of thrombus requiring emergency operation[17] has been reported, these are rare events. In our patient, the exact nature of the thrombus, whether it is a blood clot, tumour or a combination of both, remains unknown. However, the use of IVC umbrella or filter has not been reported for tumour thrombus related to metastatic NSGCT. It was not deployed in our patient in view of a likely favourable response to chemotherapy. Combination chemotherapy led to complete resolution of nodal disease, rapid disappearance of thrombus and clinical remission of disease.

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## ABSTRACT


**A 20-year-old Indian man presented with a two week history of non-specific abdominal pain. Abdominal ultrasonography incidentally detected a thrombus in the inferior vena cava (IVC). Computed tomography revealed the presence of extensive para-aortic lymph node disease as well as a filling defect in the IVC. Scrotal ultrasonography located a heterogeneous intra-testicular tumour in an otherwise palpably-normal testis. The extent of the IVC thrombus was evaluated by the use of magnetic resonance imaging. Inguinal orchidectomy was performed and histology revealed a non-seminomatous germ cell tumour. Combination chemotherapy led to complete resolution of lymph node disease and IVC thrombus. The patient remained well 9 months after diagnosis. The causes of IVC obstruction, role of imaging in investigating IVC obstruction and the management of tumour involvement of the IVC are discussed.**



**Keywords: germ call tumour, inferior vena cava (IVC), scrotum, testis, ultrasonography, computed tomography**