angiography showed a hypoplastic right ventricle with a thick tricuspid valve.

Catheter results are shown in Table 1. These findings indicated that she was unsuitable for a Fontan procedure and unlikely to tolerate the attempt to close the Waterston shunt and leave her right ventricle to perfuse her pulmonary circulation. She was therefore considered for heart-lung transplantation.

The donor was a 3½-year-old victim of a road accident. The standard body measurements are shown in Table 2. Her postoperative course was uneventful and on discharge her immunosuppressive therapy was Imuran 10 mg and cyclosporine 15 mg per kg per day.

Table 2. Standard body measurements

	Donor (mm)	*Recipient (mm)*
Suprasternal notch to tip of acromion	90	110
Tip of acromion to subcostal margin on lateral aspect of chest	200	210
Suprasternal notch to xiphoid process	110	130
Circumference of chest at level of nipples	540	520
Maximum chest circumference usually near subcostal margin	510	510

Discussion

The first serious experimental work in combined heart and lung transplantation was performed by the Russian surgeon Demikhov[1] who operated on dogs. After the advent of cyclosporine, Reitz and associates[2] performed the first primary allotransplant operations with long term survival. Since then a clinical programme on heart-lung transplantation commenced. The patients had end stage lung disease and did not respond to medical therapy[3].

Although transplantation in children has legal and logistic problems[4], this case demonstrates that children stand to benefit from heart-lung transplantation. With continuing developments in the fields of immunosuppression and donor heart-lung storage, it would appear that the results of transplantation can only improve and the procedure steadily become available to an increasing number of patients[5].

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Inferior vena cava thrombosis following a cycle ride

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Keywords: thrombosis; inferior vena cava; renal artery

Inferior vena cava (IVC) thrombosis due to non-malignant causes is rare; however, when it does occur it is often in young, otherwise healthy, individuals. We report a patient who was initially thought to have a lymphoma until at laparotomy he was found to have IVC thrombosis secondary to an aberrant renal artery. We have not found this previously reported.

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Case report

A normally very fit 22-year-old roof tiler suddenly felt unwell and 'dizzy' during a 3 h cycle ride. These symptoms persisted for 30 min after stopping and he then gradually developed back pain radiating into both groins. His general practitioner considered a disc lesion, and so advised bed rest. Eight days later he was no better and therefore was referred to hospital. On admission, the only abnormal signs were dilatation of the superficial veins over both groins together with oedema of both legs.

Routine haematological and biochemical investigations were unremarkable. Liver function tests, immunoglobulins and autoantibodies were normal. A clotting screen and fibrinogen level (performed a year postoperatively) were normal. Blood and urine cultures were negative. Ham's test, lupus anticoagulant and an homocystinuria screen were all negative. However, bilateral venograms showed extensive thrombosis of veins of both sides of the pelvis. An ultrasound scan suggested a lobulated mass surrounding the inferior vena cava. Chest X-ray and lung isotope scan were normal.

A thorough laparotomy was performed; this showed that the IVC was completely occluded due to thrombus up to the point where an aberrant renal artery crossed from the aorta to the lower pole of the right kidney, grooving the IVC (Figures 1 and 2). The laparotomy was otherwise normal; in particular no

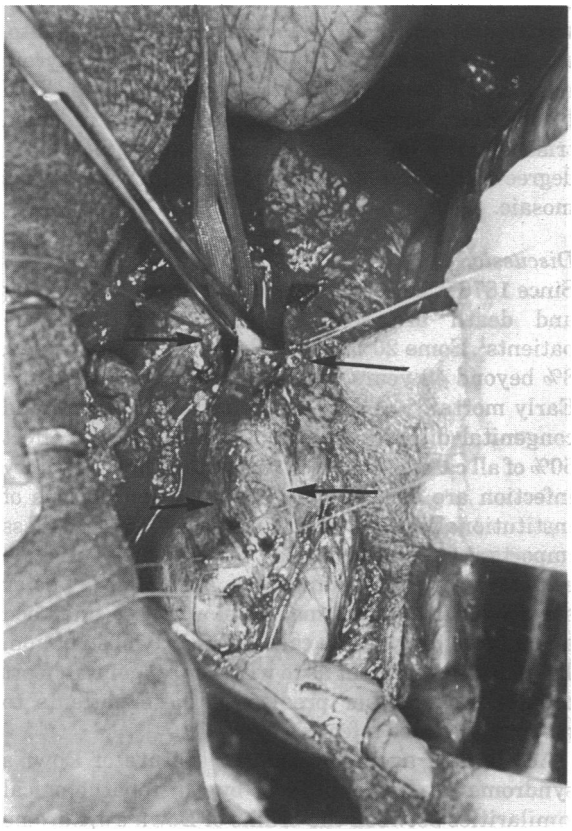

Figure 1. Peroperative photograph. The upper arrows show the cut ends of the aberrant renal artery still attached to ligatures. The lower arrows show the inferior vena cava distended with thrombus

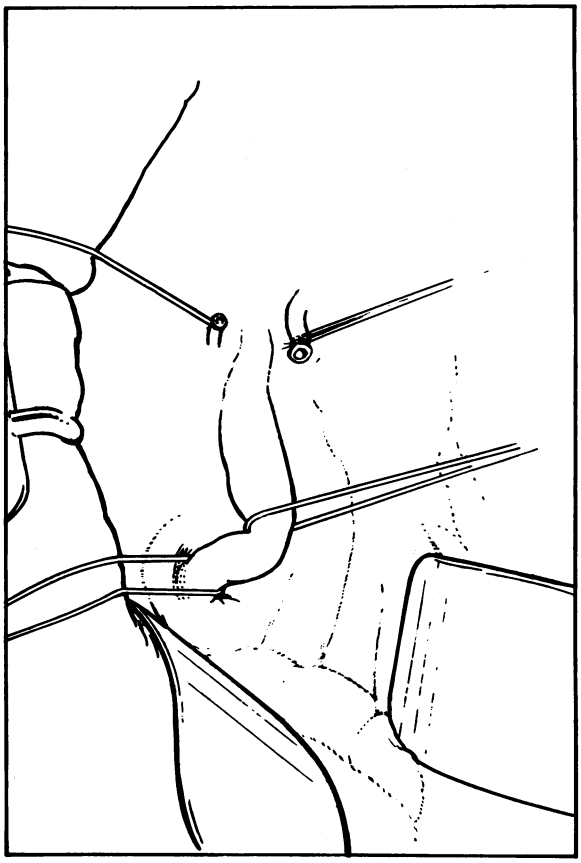

Figure 2. Line drawing of the main features of the peroperative photograph. The cut ends of the aberrant renal artery are shown

neoplasms were found. The obstruction of the IVC was below the junction with the renal veins, and was at the level of the aberrant artery. Therefore the IVC was cleared of thrombus and the aberrant lower pole artery was divided (which caused a small localized papillary necrosis).

The patient was anticoagulated with warfarin after the laparotomy but after several months he discontinued the warfarin himself. Two years later the patient remains well and is back at work. He has no ankle or leg swelling but there are still a few veins on his anterior abdominal wall with cephalad flow.

Discussion

Extrinsic pressure on the vena cava has been invoked as a trigger for IVC thrombosis[1]; it has been suggested that pressure from the diaphragm whilst it moves produces intimal damage predisposing to thrombosis[2]. That the extrinsic pressure may be due to an artery is shown by the left iliac vein compression syndrome[3], in which the left iliac vein is thrombosed up to the point where the right common iliac artery crosses over it. At this point there is an indentation and narrowing of the vein. In people who have a high division of the aorta, the right common iliac artery grooves the IVC. In these patients IVC thrombosis has been reported[4]. Aortic aneurysms are another example of arterial structures triggering IVC thrombosis; these have been reported to cause IVC thrombosis via retroperitoneal fibrosis[5] and chronic retroperitoneal haematoma[6] as well as by direct pressure from the aneurysm sac[7].

In the present case we postulate that IVC obstruction was initiated by intimal damage caused by external trauma from the aberrant right renal artery during prolonged exercise.

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