his vision began to improve. (He was not receiving hypotensive therapy.) After 14 short haemodialyses over a period of three weeks he was started on a twice-weekly 14-16-hour overnight dialysis programme. He left hospital with his eyesight fully restored five weeks after starting the programme.

He is now completely asymptomatic, with a blood-pressure of 130/70, and ready to start work again. His blood urea rises to 100 mg./100 ml. pre-dialysis and falls to 25-30 mg./100 ml. post-dialysis. He is able to set up his own dialysis circuit, connect himself to the artificial kidney, and disconnect himself, and requires only a trained nurse to monitor the dialysis during his sleeping period. He enters the hospital at 4.30 p.m. on Mondays and Fridays and leaves at 9 a.m. on Tuesdays and Saturdays. He eats and drinks what he likes during dialysis, but any gain in weight is controlled by ultrafiltration. Between dialysis he remains on a diet with 10 mEq of sodium and 30 g. of protein, and 25 g. of "resonium" daily to control hyperkalaemia.

COMMENT

The ability to control uraemia and hypertension by a haemodialysis system which the patient is able to run himself has not previously been reported. The relatively low cost of this system—as the coil can be reused on as many as 8 to 10 occasions—and the low blood requirement make it an economic proposition for the treatment of uraemia and hypertension in carefully selected individuals.

The advantages of the femoral venous-venous prosthesis are the ease of insertion of the catheters without loss of the vessel and the accessibility of the catheters to the patient's hand (an essential prerequisite to self-dialysis). The absence of arterial catheterization renders the system safer if a catheter should fall out, as the patient has been instructed in the control of venous haemorrhage. The dangers of sepsis have not materialized because of very careful prophylaxis. The skin of the thigh has been cleaned daily with chlorhexidine and the puncture sites are sprayed with neomycin and bacitracin powder, resulting in clean

granulations without induration around the punctures. The danger of thrombosis to the vessels exists, but as there is a rapid flow of blood in the femoral vein and inferior vena cava and a state of regional heparinization is achieved (without significant prolongation of whole-blood clotting-times) this possibility is regarded as unlikely. However, the patient has been instructed to report immediately should swelling of the ankle of the catheterized limb occur.

The possibility of electronic monitoring replacing nursing monitoring must be considered. If this could be achieved the ultimate aim of home dialysis could result in the treatment of larger numbers of patients at present dying with terminal renal failure.

We would like to thank Dr. K. Ball for referring the patient; Nurses J. Barnett, P. Fowler, F. Giles, M. Higgins, B. Quennell, and S. V. Tooze for invaluable and skilled assistance; and Misses K. O'Connor, J. Ryder, and J. Hird for biochemical assistance. The teflon catheters and heparin perfusers will shortly be available from the Watson-Marlow Air Pump Co., Marlow, Bucks.

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Medical Memoranda

Spontaneous Rupture of Aortic Aneurysm into Inferior Vena Cava

Aneurysms of the abdominal aorta rarely rupture into the inferior vena cava. We have found no report of this occurrence in the British literature of the last 40 years, though 13 have appeared in other countries (Lehman, 1938; Dussaillant *et al.*, 1949; Viar and Lombardo, 1952; Cooley, 1955; Eiseman and Hughes, 1956; Shumacker and Jontz, 1956; Buzzi *et al.*, 1957; Zampi, 1957; Bulgrin and Jacobson, 1958; Greenstone *et al.*, 1959; Williams and Webb, 1959; Thistlethwaite *et al.*, 1960; Gerstle de Pasquet *et al.*, 1961). The increase in reports during recent years may reflect the greater possibility of successful treatment rather than a rising incidence. The true incidence is probably higher than is suggested by the number of reports, since the condition can be rapidly fatal and so escape diagnosis. Though our patient was too ill to withstand an operation, we are reporting his case to draw attention to a condition in which surgery, though hazardous, can now be life-saving.

CASE REPORT

A labourer aged 59 was admitted to Ashford Hospital complaining of severe and increasing pain in the lumbosacral region for a week. In the previous two days the pain had spread to the abdomen and genitals. He described it as a continuous, drawing pain. For six days he had eaten little and had no bowel motion. He thought there had been a swelling in his right groin for about 35 years. In 1946 he had noticed right-sided varicose veins, and these were tied in 1951. In 1953 he had had five days off work on account of low back pain.

He was a thin, elderly-looking man who was ill, restless, short of breath, and in great pain. His head and trunk moved perceptibly with each heart-beat. The pulse was regular at 130 a minute and collapsing in type. The systolic blood-pressure was 115 mm. Hg in both arms; the sounds faded gradually when the pressure in the cuff fell below 50 mm. but remained clearly audible at zero. There was a large mass in the abdomen at the level of the umbilicus, extending from the midline towards the right flank. Expansile pulsation was felt in it, and a continuous thrill spread out radially from it. A "machinery" murmur was audible over the whole abdomen, but was loudest over the mass. Large pulsating swellings were seen on both femoral arteries in the groins. There were many tortuous distended veins in both legs and thighs; the blood flow in them was upward and the pressure 12 cm. of saline above the sternal angle. The jugular venous pressure was estimated to be 5 cm. above the sternal angle. The cardiac impulse was

thrusting in type and felt most easily in the fifth left interspace, 12 cm. from the midline. The heart sounds were normal, and no other abnormality was found. Considerable cardiac enlargement with a normal aortic shadow was seen on a "portable" chest x-ray film. An electrocardiogram showed sinus tachycardia and right bundle-branch block. The blood Wassermann and Kahn reactions were negative.

A diagnosis of rupture of an aortic aneurysm into the inferior vena cava was made, but the patient was clearly too ill for any effective intervention, and his condition rapidly worsened. He developed increasing pulmonary oedema and jugular congestion and became anuric. He died in coma 48 hours after his admission and nine days after the onset of his backache.

At necropsy (Dr. A. Siedlecka) a saccular aneurysm the size of a small coconut was found arising from the abdominal aorta 2 cm. below the orifice of the renal arteries. It was lined with thrombus 2 cm. thick and its wall was thin and partly calcified. A ragged opening 1.3 by 0.8 cm. led into the inferior vena cava. The aorta and the common iliac arteries showed gross atherosclerosis and there were fusiform aneurysms on both the femoral arteries. The heart, and especially the right ventricle, was grossly dilated. The coronary arteries were neither narrowed nor occluded, but they were slightly atheromatous. The valves were not diseased. There were some subepicardial haemorrhages. The lungs, liver, spleen, and kidneys were congested.

DISCUSSION

Only 11 of the 13 case reports referred to contain enough clinical detail to make an adequate comparison with our case possible. We have therefore added data from five cases of abdominal aorto-caval fistula due to gunshot wounds reported during the same 40-year period (Bigger, 1940; Pemberton *et al.*, 1946; Freeman and Storck, 1947; Decker, 1950; Grant *et al.*, 1958).

These 17 cases present a remarkably similar clinical picture. All were in men. A loud murmur was present in each of them, and was described as continuous in 13. In 14 an abdominal mass was felt, and in these the murmur was also abdominal; in one of the three patients without a palpable mass the aneurysm was above the renal arteries and the murmur was dorso-lumbar. An abdominal thrill was noted in 10 cases. Fourteen were stated to have cardiac enlargement, and in 10 this was considerable. The pulse pressure was over 80 mm. Hg in 10 cases. Dependent oedema was also mentioned in 10 reports, and prominent superficial veins in the abdominal wall or the legs in six. Ten patients had abdominal pain and eight had alimentary disturbances, two of them developing paralytic ileus. Six patients beside our own had backache. It is clear that the clinical picture is so characteristic that the main obstacle to a correct diagnosis is the incredulity of the observer.

Our patient's fistula was about 1 sq. cm. in size, and most of the others which have been reported were as large or larger. An orifice of this size must divert a considerable proportion of the aortic blood flow, even though the systemic arterial resistance is greatly lowered. The resulting increase in the load on the heart is likely to prove an intolerable one, as is borne out by the fact that all but two of the reported cases developed progressive cardiac failure; in one case compression of the inferior vena cava by a large aneurysmal sac was thought to have minimized the shunt and so protected the heart. This form of cardiac failure, in common with those occurring in other "high output" states—for example, anaemia, thyrotoxicosis—responds poorly to any form of treatment other than the correction of the abnormality which necessitates the high output. It

follows that an abdominal aorto-caval fistula will almost certainly be fatal if it is not closed.

We have found 12 reports of the successful closure of these lesions. Six (Bigger, 1940; Pemberton *et al.*, 1946; Freeman and Storck, 1947; Decker, 1950; Grant *et al.*, 1958; Williams and Robinson, 1961) were in young men whose cardiovascular system was otherwise healthy, the fistulae being due to bullet wounds. Lehman (1938) had previously closed a fistula resulting from the rupture of a syphilitic aortic aneurysm, but the patient died 15 hours after the operation. More recently, six reports of the successful closure of spontaneous fistulae have appeared (Cooley, 1955; Eiseman and Hughes, 1956; Shumacker and Jontz, 1956; Williams and Webb, 1959; Thistlethwaite *et al.*, 1960; Gerstle de Pasquet *et al.*, 1961).

Since heart failure resulting from an aorto-caval fistula is likely to be progressive and intractable, surgery should probably not be long delayed when this complication is present. A postponement designed to improve the patient's condition may actually worsen it. The underlying cardiovascular state will, however, influence both the speed with which failure develops and the chance of diminishing it by pre-operative medical treatment. A patient in whom an atherosclerotic aneurysm ruptures spontaneously into the vena cava is unlikely to have a healthy heart, and will therefore require an early operation. On the other hand, a young man with a traumatic aneurysm may benefit from delay if this can be used to improve or maintain his general condition: Decker (1950) points out that the subsidence of the acute inflammatory reaction around the traumatic lesion, and its replacement by fibrous tissue, may make the operation less hazardous.

We wish to thank Dr. K. D. Keele for permission to publish this case report, and for his helpful advice.

ADDENDUM.—Since this medical memorandum was accepted for publication a similar case has been treated at St. Bartholomew's Hospital, London, and successfully operated upon (Ross, 1963).

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