TECHNIQUE AND VALUE OF AORTOGRAPHY

REPORT OF A CASE OF EXTERNAL ILIAC ARTERIAL GRAFT

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Although aortography was introduced by Dos Santos *et al.* in 1929, it has never been a popular form of investigation in this country, and it is still considered by many to be a difficult and hazardous procedure of no clinical value. Recent developments in vascular surgery, however, have made aortography an absolutely essential investigation in certain cases. It is, in fact, neither difficult nor hazardous, and can be performed under sedation alone. The use of general or high spinal anaesthesia is unnecessary.

Technique

The patient is brought to the x-ray room having had, one hour before, "omnupon," $\frac{1}{2}$ gr. (22 mg.), and scopolamine, 1/150 gr. (0.43 mg.). In the x-ray room he is given a test dose of 1 ml. of 70% diodone. This is an important precaution, as, although toxic manifestations are rare, an occasional severe reaction will be encountered. The patient is placed on the x-ray table in the prone position and a marker is fixed opposite the spinous process which is judged to be correct. If aortography is being performed to show the iliac vessels the injection is made opposite the third lumbar vertebra. If it is desired to display the renal vessels the injection must be made opposite the first lumbar vertebra or opposite the twelfth dorsal vertebra, to show the coeliac axis and its branches.

A preliminary film is taken. This is viewed and the position of the marker checked before the injection is given. Before proceeding with the injection a dose of intravenous pethidine is administered. This is a most important part in the technique, as it obviates the use of spinal or general anaesthesia. In an average case 100 mg. gives good sedation, but sometimes less is sufficient. A small intradermal weal is raised with 2% lignocaine hydrochloride opposite

the selected vertebral spine and 4 to 4½ in. (10 to 11.4 cm.) from the midline. The needle is of s.w.g. 16 and 7 in. (18 cm.) in length. It is inserted through the weal and directed towards the vertebral body. If the latter is struck the needle is redirected to pass in front of it. The aorta is easily punctured and at once a strong pulsating flow of blood comes from the needle. It is important to advance the needle a few more millimetres before giving the injection. The needle is connected to the syringe filled with 30 ml. of 70% diodone by an intervening length of about 12 in. (30 cm.) of pressure tubing. In this way the surgeon making the injection stands well clear of the beam of x rays. The needle itself is firmly held in 5 in. (12.5 cm.) of soft tissue, and it is unnecessary for the surgeon to steady it with a hand, thereby exposing himself to x rays. The injection is given as rapidly as possible and the film exposed as the last few millilitres are going in. If the injection is to be

FIG. 2.—Case 3. Extensive atheroma and thrombosis.

made at the level of D 12 or L 1 it is necessary to direct the needle obliquely upwards, as the twelfth rib prevents its insertion opposite the first lumbar vertebra.

We have not encountered any serious ill effect using this technique. On two occasions the needle has been satisfactorily placed at the beginning of the injection but has come out before the injection was completed and a periaortic deposit of dye has been made. This occasions some pain in the back, which passes off readily as the dye is absorbed. Two patients with acute embolic occlusion of the aorta have died within 48 hours of aortography. In each case the site of the needle puncture was difficult to find at necropsy, and no extravasation of blood was seen.

Indications and Results

There are many occasions in which aortography may give extra help in the elucidation of a pathological process, and because it is simple to perform we have used it on a variety of clinical problems. Its greatest value is that it can be used to define exactly the site and extent of a block in the aorta or iliac arteries, the result of embolus or thrombosis.

We have not had a patient with aortic embolus admitted early enough to get a recovery, but the following two examples will illustrate the value of aortography in these cases.

Case 1.—A man aged 56 had complained of anginal pain for five years, but there was no clear history of a recent coronary occlusion. Four weeks before admission he had a sudden loss of power in both legs which lasted only 10 minutes. Two weeks later he went to bed after a sudden attack

FIG. 1.—Case 2. Aortic embolus.

FIG. 3.—Case 4. Arrows indicate extent of block in external iliac artery.

of pain in the left calf and a cold foot. He was treated with tolazoline hydrochloride and improved somewhat. Thirty-six hours before admission he developed severe pain in both legs and within six to eight hours sensation was gone. A clinical diagnosis of embolus at the aortic bifurcation was made, but operation was considered inadvisable as the condition had been present for so long. Aortography confirmed the diagnosis and indicated the exact sites of obstruction. These were at the origin of the left common iliac and in the right external iliac. Necropsy confirmed the clinical diagnosis.

Case 2.—A woman aged 42 was known to have had auricular fibrillation and mitral stenosis for some years. She was admitted with a 30-hours history of loss of power and sensation in both legs. The lower limbs were mottled and cold and pulsations were absent. A clinical diagnosis of aortic embolus was made and an aortogram taken (Fig. 1). It was evident that the aorta was blocked at the level of the second lumbar vertebra. In view of the lateness of the condition no treatment was attempted and she died 24 hours later. Necropsy confirmed the site of the block.

It is in the locating of arterial thrombosis above the femoral artery that we have found aortography of greatest practical value. Such an obstruction may give rise to gangrene of the toes or to claudication in the calf, thigh, or buttock. The possibility that these symptoms may be relieved by endarterectomy or by arterial graft makes accurate visualization of the great vessels imperative. In many cases the disease will be shown to be diffuse and probably unsuitable for surgery, as in Case 3.

Case 3.—A man aged 59 was admitted with incipient gangrene of the toes of the right foot. The left leg had been amputated in 1948 for gangrene. Aortography (Fig. 2) showed that the left common iliac artery was obstructed at its origin, and that there was considerable narrowing of the proximal half of the right external iliac artery. The femoral artery is also obstructed just below the profunda femoris branch. The circulation to the legs is largely being maintained by anastomotic branches from the inferior mesenteric.

In Case 4, however, it was possible to excise and graft a thrombosed external iliac artery.

Case 4.—A man aged 64 had severe calf and thigh claudication of one year's duration. He had pain as soon as he took a first step and had to stop after 50 yards. There were no pulses in the left leg. Aortography (Fig. 3) showed this to be due to an obstruction of the whole of the external iliac

FIG. 4.—Case 4. Aortogram taken three months after graft to external iliac artery.

artery. The artery was exposed extraperitoneally on August 19, 1952, by one of us (R. E. H.). The great vessels were very atheromatous and the external iliac had no pulsation. The affected artery was dissected free, and after application of clamps to the common and internal iliac arteries trial section of the external iliac was begun. It was found to be blocked at its origin and had to be cut from the common iliac, leaving a window in the latter. In sectioning the lower end of the block a small arterial flow was found in the recanalized mural thrombus, but a clear artery was not found until about 1 cm. above the profunda branch of the femoral. A graft consisting of the aorta of a 4-year-old child was inserted by a continuous everting suture. The posterior tibial pulse did not become palpable until some six hours later, when it soon became strong. The patient was seen on November 1, nearly three months after the operation, and had no claudication, and said he could walk anywhere. The pulses are all present in the leg and are of

FIG. 5.—Enlarged spleen demonstrated by aortography. Arrow indicates artery to lower pole of spleen.

good volume. The post-operative aortogram (Fig. 4) shows the graft in position and of normal calibre. There was an excellent flow of blood in the femoral arteries. In October, 1953, 14 months after his operation, he was still getting an excellent functional result and all the peripheral pulses were present.

In addition to its outstanding value in the two types of case which have been described, aortography has occasional value in other circumstances.

In one patient a lump in the left hypochondrium was particularly difficult to feel because of the build of the patient. Serious doubt existed whether the lump was an enlarged kidney or spleen. Aortography clearly demonstrated that it was an enlarged spleen (Fig. 5), for the renal outline was clearly seen and the splenic arteries spread far beyond the confines of a normal spleen. Thus, in general terms, aortography may be of value in diagnosing a doubtful abdominal tumour. It may be of value in locating the site of a suprarenal tumour in a case of Cushing's disease, but we have not yet had the opportunity of testing this. Goodwin *et al.* (1950) record its use in such a case.

Aortography has been added to the more orthodox methods of pyelography in the investigation of kidney disease, as has been fully described by Griffiths (1950). It is claimed that the pooling of dye which occurs in a hypernephroma will distinguish it from a solitary cyst, but we feel that in the absence of such an appearance it would be dangerous to make a definite diagnosis of renal cyst and not submit the patient to an exploratory operation.

Summary

The technique of aortography under sedation without anaesthesia is described and its value is illustrated.

A case in which an external iliac arterial obstruction was accurately located by aortography is reported. The artery was excised and replaced by an arterial graft, with a satisfactory result three months after the operation.

REFERENCES

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It is estimated that at the present time out of every 100 average men and women in Great Britain only 2 have naturally perfect teeth; 16 need teeth extracted, 42 require other dental attention, and 40 have complete or partial dentures. These statistics appear in an article contributed to *Progress* by Sir William Kelsey Fry. "Dental disease is one of the consequences of civilization," he says. From examining large numbers of skulls, research workers now know that in the Middle Ages quite half the population had no carious teeth. But by fifty years ago it was unusual to see a patient with a healthy mouth, and during the 1914-18 war large numbers of men were rejected as unfit for active service on account of the state of their teeth. During the last war it was estimated that at 18 years of age 98% of the men and 90% of the women were in need of dental treatment. However, Britain has by no means the worst teeth in the world: some parts of the United States and Norway, Australia, and New Zealand have a much higher caries rate. The incidence of caries in Europe declined in both world wars, and the conclusion is drawn that this was closely linked with the reduction in sugar consumption and changes in bread texture. Nowadays dentists find themselves unable to keep pace with the alarming increase in dental disease. In England and Wales there are 10,000 practising dentists, the majority of whom are over 50 years of age. That means that one dentist is expected to keep between 3,000 and 4,000 people dentally fit.

VALUE OF SINGLE-SAMPLE TEST IN DIFFERENTIAL DIAGNOSIS OF JAUNDICE

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In the differential diagnosis of jaundice, although biochemical tests cannot take precedence over clinical findings, cases occur in which the clinical features are puzzling. For example, chronic hepatitis may in some cases present as painless jaundice simulating obstruction arising from a carcinoma of the head of the pancreas; while in other cases the main complaint may be of pain similar to that of biliary colic. In cases where the clinical picture is problematical, biochemical tests, by suggesting an earlier solution, can be of value, the importance of an early diagnosis being the necessity to decide whether surgical intervention is indicated. On the one hand, the dangers of an unnecessary exploratory operation in a case of hepatogenous jaundice must be avoided, and, on the other, the patient must be guarded from the harmful effects of prolonged extrahepatic obstruction.

The "single-sample tests" have the advantages of simplicity in obtaining the specimen with minimal discomfort to the patient, along with economy in time to the patient and the physician. Coleman (1950) has shown that such tests are reliable, irrespective of the stage of the illness. However, many such single-sample tests recommended (for example, by Schwimmer *et al.*, 1945; Shay and Siple, 1948; Mawson, 1948; Popper and Steigmann, 1948; and Hoffbauer *et al.*, 1949) involve an imposing number of biochemical determinations, employing a wide range of tests. Bearing in mind that this is a clinical problem as distinct from interesting research, the simpler tests, which can be carried out in any hospital laboratory, must be given prior consideration.

The object of the present investigation was to find out the minimal number of determinations that should be included in a single-sample test to make this of value in differentiating obstructive from hepatogenous jaundice. It is generally agreed that none of the tests employed will estimate the degree of liver damage, and this aspect of the problem is therefore not touched upon. Likewise, no attempt has been made to assess the prognostic significance, if any, of these tests.

Material and Methods

Material.—The present series consisted of 104 patients who showed signs of jaundice and whose records contained sufficient data to establish an undoubted diagnosis. This series was composed of the following:

Obstructive jaundice (67 cases)

1. Carcinoma obstructing extrahepatic bile ducts ..	27
2. Calculus in the common bile duct	17
3. Chronic pancreatitis	4
4. Stricture of common bile duct	2
5. Carcinomatosis involving liver	17

Hepatogenous jaundice (37 cases)

6. Cirrhosis of liver	20
7. Acute hepatitis	11
8. Miscellaneous cases of hepatogenous jaundice ..	6

Those grouped in "carcinomatosis involving liver" were patients in whom neoplastic metastases invading the liver