Case Report

ARTERIOVENOUS FISTULA OF THE AORTIC ARCH COMPLICATING STAB WOUND OF THE NECK

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Arteriovenous fistulae arising in the superior mediastinum are rare. Proctor[5] reported the first case of repair of an arteriovenous fistula of the aortic arch. Since then a further 4 similar cases treated successfully have been reported in the literature. MacLean *et al.*[2] reported 8 cases of innominate arteriovenous fistulae. At Baragwanath Hospital, where an average of 150 cases of stab wounds of the neck are admitted annually, there is no record of such cases, whereas injuries to the vessels of the carotid sheath or of the subclavian group are relatively common and arteriovenous fistulae in these locations are met with from time to time. The reason for this discrepancy is that injuries of major vessels in the superior mediastinum are rapidly fatal. Rarely, when the patient reaches the hospital speedily, a timely intervention and repair of the injured vessels prove life saving.

Those injuries that progress to the formation of an aneurysm or of an arteriovenous fistula must of necessity be less extensive and are likely to become sealed off. Either a false aneurysm develops, which ruptures eventually into an adjacent vein, which may *pari passu* have been injured, or the weakened scar of a damaged artery is the starting point of the aneurysm. If the artery had become adherent to the scar of a similarly injured vein then the aneurysmal dilatation may, conceivably, on reaching bursting point, rupture into the vein as the *locus minoris resistentiae*. Hence the relatively long interval before these patients come forward for treatment. Of the 4 cases of arteriovenous fistulae described in the literature between the aortic arch and the left innominate vein the shortest history was of 13 months (McCook[3]) and the longest was of 12 years (Conrad *et al.*[1]), the latter presenting with gross cardiac insufficiency, whereas the former had merely some cardiac enlargement.

At exploration of a stab wound of the neck the surgeon may be aware that it has penetrated the superior mediastinum; if however there is no haemorrhage and the field is haemostatic it is a difficult decision to make whether to cease exploration of the wound and await the passage of events, or to embark on a sternum-splitting procedure. The latter seems hardly justifiable if the exploration is negative, although a timely repair of a damaged vessel may not only prove life-saving but also save the patient considerable morbidity later on. Angiographic studies pre-operatively in all cases where the straight film of the chest shows widening of the upper mediastinal shadow should help the establishment of a diagnosis, although false negative results are not uncommon.

CASE REPORT

Symptoms

David M., an African male aged 19, was admitted to Baragwanath Hospital in October 1963. He gave a history of having received a stab wound in the neck some 2 years previously. He had then stayed in hospital for a few days. A local exploration had apparently been done. He was well afterwards for 18 months before he began to experience discomfort in his left upper limb and a heaviness which were aggravated by heavy manual labour particularly. He further noticed enlarged veins in his left axilla and at the root of the neck. There were no other complaints, nor did he suffer from exertional dyspnoea and any symptoms suggesting cardiac insufficiency.

Examination

On examination he was a healthy looking young man. The left upper limb had a larger girth than the right; there were many tortuous and distended veins over the left axilla, the left side of the chest and the root of the neck. A fullness was apparent at the root of the neck on the left side, which exhibited an expansile pulsation, but the veins were not pulsatile. There was a surgical scar 3 in. in length over the anterior border of the lower half of the left sterno-mastoid muscle. On palpation both upper limbs were of equal temperature, although after exertion the left one was slightly warmer to touch. A thrill was felt over the manubrium sterni and over the root of the neck to the left of the midline.

His blood pressure was 150/65 mm.Hg in both upper limbs; the radial pulses were of equal volume, and somewhat collapsing in character. On auscultation there was a continuous murmur with a loud systolic ejection component heard maximally over the manubrium sterni and propagated over the precordium and root of the neck. A straight (PA) X-ray film of the chest (Fig. 1) showed enlargement of the superior mediastinum and some cardiomegaly. The electrocardiogram was normal. Arteriography was performed by the Seldinger technique via the femoral artery. It demonstrated an arteriovenous fistula between one of the major arterial vessels in the superior mediastinum and the left innominate vein, which was considerably dilated, with the dilatation extending to the superior vena cava (Fig. 2). By selective angiography it was possible to exclude involvement of the left subclavian artery, although one could not be certain whether the fistula was arising from the arch of the aorta or from the base of the left common carotid. There was a large aneurysm situated just above the arch of the aorta and indenting it. It appeared constricted at the waist. A venogram (Fig. 3) demonstrated the cluster of veins in the left axilla.

Operation

At operation the lesion was exposed via a complete median sternotomy. There was an aneurysm 3 × 2 in. overlying the arch of the aorta and traversed by the left innominate vein, along which a well-marked thrill was palpable. The innominate vein and the left common carotid and subclavian arteries could be dissected free of the aneurysmal mass. After encirclement of the left innominate vein proximal and distal to the aneurysm a clamp was put across the arch isolating the aneurysm but allowing good flow into the major vessels. The aneurysm was then opened (Fig. 4). Communication with the arch of the aorta was by means of a slit ¾-in. long and the openings into the innominate vein were at opposite ends of the aneurysmal sac. The aortic opening was then repaired from within the sac with 5×0 silk and the rest of the sac excised, leaving a gap of about 3 in. between the ends of the innominate vein. A teflon patch was placed across the antero-superior aspect of the arch and sutured into position with the object of reinforcing the repair and the adjacent area. Continuity of the innominate vein was restored by means of a teflon prosthesis. This turned out to be an unsuccessful venture since the veins became prominent again within 2 - 3 weeks and a venogram confirmed the loss of patency of the graft. Postoperatively his blood pressure had remained at 140/75 mm.Hg. There was a pulmonary infection which caused a pyrexia of 99°F. This responded readily to antibiotic therapy and physiotherapy. An interesting feature was a rise

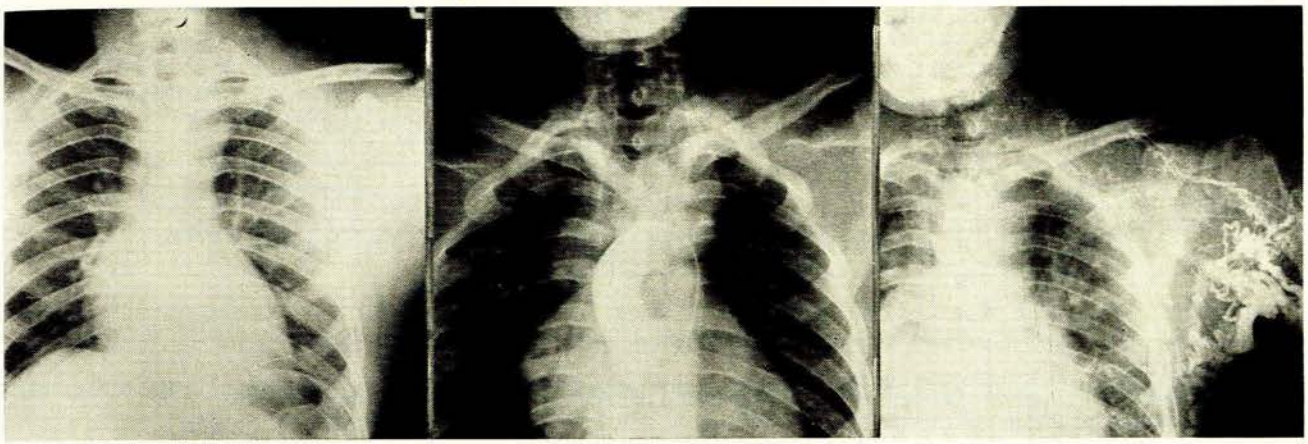

Fig. 1 *Fig. 2* *Fig. 3*

Fig. 1. Widened superior mediastinum and cardiomegaly. *Fig. 2.* Angiogram of the arch of the aorta showing immediate filling of venous tree, distension of left innominate vein and superior vena cava. *Fig. 3.* Venogram obtained by injection of contrast in the left ante-cubital vein showing the varicosities of the axillary veins.

in pulse rate to 120 - 140/minute, which was not in keeping with the rise in temperature and made one wonder if it was not perhaps due to interference with the sub-aortic cardiac plexus of nerves which might have been unwittingly traumatized during the operation; however, this was unlikely. This tachycardia subsided within 2 - 3 days and the patient's progress was from then on uninterrupted. He was discharged from the hospital 3 weeks later and was followed up in the outpatient department. He was last seen 7 months later; his only complaint was an occasional ache in the substernal region but he was otherwise well and had resumed his occupation.

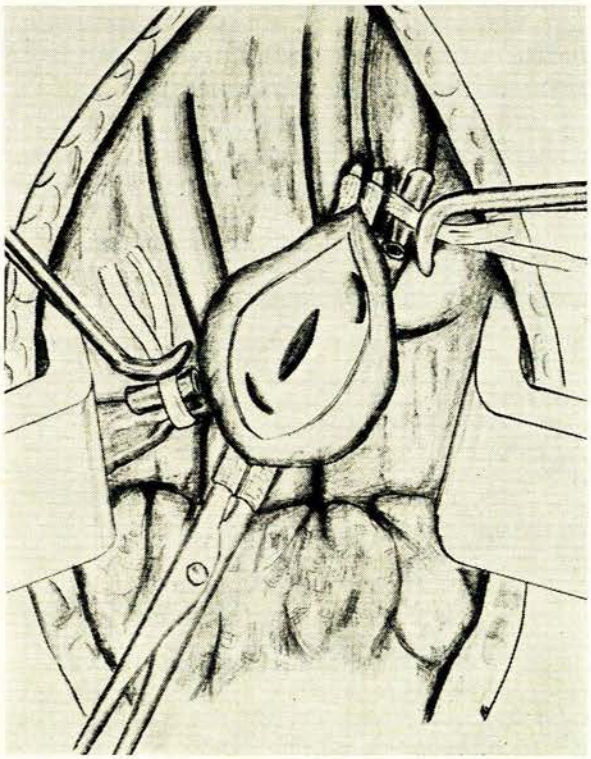

Fig. 4. Appearances at operation. After encirclement of the left innominate vein on either side of the aneurysm and clamping of the arch of the aorta and opening of the aneurysm; the communications with the aorta and innominate vein are demonstrated.

DISCUSSION

The diagnosis of arteriovenous fistula in the superior mediastinum presents no particular problem. Angiography confirms the clinical diagnosis and helps to locate the fistula. It is an added advantage to evaluate the haemodynamic data obtained by cardiac catheterization since not only the size of the shunt may be estimated but its actual location may be determined with more accuracy. It is of special value in those cases where cardiac failure has supervened.

Conrad *et al.*[1] in their paper mention the possibility of left ventricular strain developing at occlusion of the fistula, owing to the sudden rise in peripheral resistance. They also point out the functional similarity with intracardiac shunt, since only the pulmonary circuit is traversed by the excess flow. There was no evidence of left ventricular strain in this case and at no time during the operation did his cardiovascular system give cause for concern. However, one would expect a patient with a failing myocardium as a result of trying to cope with a high output over a relatively long period to show untoward effects from an abrupt change in haemodynamics.

At operation different methods of approach have been used. McCook[3] resected the medial half of the left clavicle and split the sternum to the third interspace. Sealy and Fawcett,[6] and Meredith and Bradshaw[4] have used a bilateral thoracotomy with transsection of the sternum at the third interspace. Similarly to Conrad *et al.*[1] I have found a median sternotomy an excellent incision, providing ample exposure and easy access to the lesion.

SUMMARY

A case is presented of an arteriovenous fistula between the arch of the aorta and the left innominate vein, following on a stab wound in the neck received 2 years previously. There was some cardiac enlargement but no insufficiency. A successful repair was achieved.

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