spite of the fact that they lead a comparatively much more sheltered and indoor type of life, that they are mostly vegetarian, and that addiction to tobacco or alcohol is practically unknown among them.

The role of the fat content of diet in the aetiology of coronary disease is a controversial point. It may be of some significance to mention that the fat content of diet taken by the vast majority of our cases is poor as compared with European standards. Consequently we find it difficult to believe that dietary fat can play any significant part in the causation of coronary disease. Our observations show that vegetarians are no less prone to develop coronary disease, and the same is true of non-smokers. No less than one-half of our cases belonged to the Sikh community, whose religion forbids smoking.

Obesity has long been recognized as an important predisposing factor. We find it much more true in the case of females.

After a long search in the necropsy room and biochemical laboratories we are now advised that the answer to the cause of coronary disease may come from an epidemiological survey. It will not be out of place to quote the *Lancet* (1955): "In the golden period of discovery, the causes of the great fevers were elucidated largely by epidemiological methods. To-day we have come to recognize that these methods are equally applicable to non-infectious disorders, and we are hoping that they will reveal the origins of some of the other major sources of morbidity and mortality. More and more attention is being paid, for example, to the epidemiology of coronary artery disease."

Coronary disease is a major cause of mortality in countries that are materially more advanced. We in India at present have to continue to think in terms of more important problems, such as those in infant mortality, infectious diseases, nutritional disorders, overpopulation, and a host of other public health problems. All the same, when we glance through the medical literature we come across views of writers abroad, every now and then, that coronary disease is uncommon amongst Asiatics. With the present standard of our vital statistics it is difficult to give the true incidence of coronary disease in this part of the world. But with coronary disease accounting for 28.4% of our 3,054 cardiac cases we obviously find it difficult to share the view held by some Western writers about coronary disease being uncommon in materially less favoured countries. With this background, some of our observations on local factors may provide material for further investigation into the aetiology of coronary disease.

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EXCISION OF ATRIAL MYXOMA

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The commonest benign tumour inside the heart is the so-called myxoma: it is usually found in the left auricle, suspended from an area on the interauricular septum about the site of the foramen ovale. It has been found during operations for mitral stenosis, as an unexpected cause of mitral obstruction, hanging through the mitral orifice into the left ventricle. If it is detached by the exploring finger from its root on the septum, it floats off into the blood stream and becomes impacted in the aorta, usually at the bifurcation.

This account describes a method of safely removing such a myxoma.

Case Report

A married woman aged 43 was seen in October, 1955, complaining of increasing tiredness since 1953, when she gave up playing tennis. Epigastric discomfort occurred when she was tired. Tiredness had reached the stage that she could not walk up a slight incline or up five steps. There was no nocturnal dyspnoea.

Her general condition was good: no raised jugular venous pressure; pulse small volume, regular; B.P. 100/80. Apex: long rumbling mid-diastolic murmur; fairly loud first sound; soft systolic murmur heard occasionally; widely split second sound at apex, indistinguishable from an opening snap. Base: P2+, no early diastolic murmur. The epigastrium was tender, but the liver was not enlarged. There was no other sign of congestive failure. No postural change was noticed.

Radiological studies: right ventricle enlarged; left atrium moderately enlarged with no calcification of the valve; left ventricle normal; heart generally not enlarged; lungs hazy throughout, with large pulmonary artery at both hila.

The E.C.G. showed notched P waves and moderate right ventricular hypertrophy.

She was thought to have a fairly tight mitral stenosis, with probably a minor degree of incompetence.

Operation

On November 7 a left antero-lateral thoracotomy and left auricular cardiectomy was performed, the surgeon standing in front of the patient; the auricle was found to be moderately enlarged. In introducing the finger, a large obstructing tumour was at once felt, shaped like a hen's egg, entering the mitral valve from above. The tumour fitted into the mitral ring fairly accurately, allowing no entry into the ventricle. The growth was felt to be attached to the medial or interatrial wall above the anterior cusp by a broad pedicle 2 cm. in diameter; there was very little room in the atrium, and a complete examination could not be made for fear of detaching the tumour into the circulation. To avoid this disaster it was decided that the first thing to do was to push the mass up from below. The finger was therefore withdrawn and the auricle clamped.

A purse-string was sutured into the anterior wall of the left ventricle to the left of the anterior descending coronary vessel: a small incision was made into the muscle and dilated with Hegar dilators to size 13, about $\frac{7}{8}$ in. (2.2 cm.) in diameter. The right index finger, which is of the same size, was then put through this hole, coming into immediate

contact with the tumour projecting between two papillary muscles. On trial, it was quite easy to push the tumour upwards a short distance. The index finger of the other (left) hand was then put into the atrium by releasing the clamp in the usual way, and the finger-nail was pushed into the tumour pedicle. This separated fairly easily and smoothly from the interatrial wall, while the ventricular or right finger pushed the tumour upwards. Withdrawal of the left index enabled the right finger to push the tumour upwards and into the hole in the left auricle, acting as a cork from inside. The auricular hole had to be enlarged by about 2 cm. with the nail of the left index finger. The tumour popped out of the hole like a cork, followed by a small gush of blood. The assistant, standing ready with the auricular clamp, grasped the auricle at the first attempt, and little blood was lost. A more dignified exit could easily have been made if the tumour had been pushed less forcefully. The auricle was then closed with a continuous suture by the assistant. The right index was removed from the ventricle while the purse-string was tightened: there was no blood loss from this. During the separation of the mass the carotids were compressed in the neck by the anaesthetist.

While the auricle was being closed the opportunity was taken to feel the mitral valve cusps from below, and no nodules or other abnormalities were found. The heart beat continued regular throughout, and only a slight weakening occurred after the sudden blood loss. The wall of the ventricle was normally thick, and showed no sign of hypertrophy or dilatation.

Post-operative recovery was peaceful for the first 10 days: the patient got up on the third day and was discharged on the ninth day. Two days later, however, she had a right pulmonary embolus associated with pain in the left calf and was readmitted to hospital. After 13 days of anticoagulant treatment she was discharged and no complication has since occurred. In December the heart sounds were normal and have not changed since then. When seen 18 months later she was completely well, and had regained her exercise tolerance and lost all other symptoms. The heart sounds were normal, the heart looked normal on radiology, and the left atrium had shrunk to a normal size. The E.C.G. showed a Q wave in lead I and an inverted T wave in leads V5 and V6.

The specimen was an egg-shaped mass measuring 6 by 5 by 4 cm. It was shiny and smooth, with a rough area at its upper end, 2 cm. in diameter, where it had been detached. On section it was grey and semi-translucent, with darker areas of old haemorrhage.

Histology showed an amorphous mucoid matrix with a few stellate cells with spindle-like processes. There were a few elastic and muscle fibres in the mass, and a few developing capillaries. The surface was endothelial, covering a fibrous layer continuous over the whole tumour. There were some areas of old haemorrhage.

Comment

In reviewing the operation, certain points arise. The direction of approach—from the front of the patient (who was lying on her right side)—happens to be L.F.'s usual stance, and was the easier in this case: the right index finger in the left ventricle and the left finger in the auricle allowed a clear view for the assistant, standing behind the patient, to place the auricular clamp with his left hand from behind forwards, towards the pulmonary artery. If the surgeon were to stand behind the patient, and had to put his left index in the ventricle and his right in the auricle, the assistant would be hampered in putting on the clamp. During such an operation the surgeon should, if necessary, change position and place himself in front of the patient.

The myxoma is always larger than the index finger, since it is large enough to obstruct the mitral valve and produce symptoms; the auricular hole will therefore always be closed when the tumour has been jammed into it, and when the

left index is removed no bleeding will occur. The hole will need enlarging to allow removal of the mass. The enlargement should be done in the direction in which it is easier to apply the clamp, and this is probably backwards, above and parallel to the AV groove, and about $\frac{1}{2}$ in. (1.3 cm.) away from it. The hole should be enlarged gradually, until it is seen to be just big enough to let the tumour squeeze through: the purse-string should be opened as required to allow space for the incision, or, if no purse-string is used, the edges can be caught with forceps. The tumour is pushed out either by the internal finger or by squeezing it out gently with the clamp, or both. The inside finger should not be removed until there is no further danger of the tumour slipping back or of breaking.

Extraction is done slowly, and the intraventricular finger can judge when the incision is large enough by exerting gentle pressure *a tergo*: it can be kept between the mitral cusps as long as is necessary, since it will always be smaller than the valve orifice, which usually takes two fingers and has, in any case, been occupied by the tumour. The outside hand can prevent a too sudden explosive ejection of the tumour and may itself grip the edges of the auricular hole and partly or entirely close it. If the procedure is done slowly and gently, fragments will not be torn off and the carotids need not be compressed for a longer time than is needed to detach the tumour from the inter-auricular septum.

In our case the mass was easily cut off the inter-auricular septum by the gloved finger-nail; if the pedicle had been too tough for this, Brock's valvotomy knife would have served the purpose. The septum was left smooth and normally elastic, and gave no impression of there being a tumour growing from the septum.

Two views of myxoma removed at operation, split and folded open. The site of attachment is clearly seen.

Discussion

The gross physical characters of the myxoma are fairly constant in essentials, the appearance, size, and shape being due to moulding and compression of the tumour by the heart muscle, and by the mitral valve, which it accurately fits. In fact, in all the cases described, the tumour is large enough and of such shape as to obstruct the blood flow and almost to fill the left atrium, whatever its size. This is beautifully shown in the angiocardigrams of Goldberg *et al.* (1952) and Goldberg and Steinberg (1955), in which two hearts are shown, containing myxomata, one of them twice the size of the other.

The tumour is smooth, shiny, roughly egg-shaped, lobulated at its lower end, and in reported cases measures from 10 by 6 by 4.5 cm. (Mahaim, 1945a) to 4 by 4 by 2 cm.: a

number of small non-occlusive ones have been found by chance. Its upper end is attached to the atrial septum above the postero-medial end of the anterior mitral cusp, about the site of the foramen ovale. It hangs through the mitral orifice into the left ventricle, impinging on the musculi papillares and the ventricular wall; its lobulations correspond to the irregularities of this contact. It occurs much less commonly on the right side of the heart, attached at the same place, on the fossa ovalis; it has never been described as occurring in both auricles at once, nor has a projection been seen through the atrial septum; and perforation of the septum by tumour is unknown.

Opinions differ whether the mass is a myxoma or an organized clot, but we are not discussing the controversial problem of its origin. It is covered with endothelium and a subendothelial fibrous layer, both continuous with the surface layers of the atrial wall. Van Buchem and Eerland (1957), in a case diagnosed and treated by them, say that the "pedicle was easily detached from the septum," and that at necropsy "the site of the myxoma was only indicated"; both facts suggest that we are not dealing with a true growth of the septum. A number of surgeons have cause to regret the ease with which the tumour can be detached. No other simple tumour has such a frail pedicle. In the present case however, the pedicle was firm.

When the tumour has grown to over 3 cm. in diameter pieces may break off and form emboli in the brain (Mills and Philpott, 1951), aorta (Likoff *et al.*, 1954), spleen, etc. The histological appearance of the embolus is characteristic enough to be identified with certainty. Even to the naked eye the grey semi-translucent jelly with a smooth surface is so different from the rough brown surface of the ordinary blood clot that the origin of the embolus can be immediately recognized. Embolism is relatively common, and may be large, blocking the aortic bifurcation: in true mitral stenosis an embolus that can get through the narrow orifice is very unlikely to block the aorta. Sudden enlargement of the tumour by bleeding into its substance may precipitate obstruction and pulmonary oedema or a severe "peripheral arterial syndrome" with gangrene of the toes, fingers, nose, etc. (Mahaim, 1945a).

The consistency of the myxoma is usually described as "rubbery" and fairly soft; in the present case the finger could be pushed into it if moderate force was used, but it was elastic enough not to break up or to form fragments.

Signs and Symptoms

Myxomata have been found in patients of all ages between 3½ and 68 years, and of both sexes. In some cases the history has been a relatively short one, and this may be a useful though not decisive point in the distinction from mitral stenosis. In one of Goldberg and Steinberg's (1955) cases there was a history of 23 years.

Other symptoms are those of mitral stenosis—namely, dyspnoea on effort, tiredness, nocturnal dyspnoea, haemoptysis, syncopal attacks, peripheral arterial syndrome (Desbaillets *et al.*, 1953).

The signs are those of mitral stenosis: much has been made of the fact that they are variable, sometimes being those of mitral incompetence and at other times of mitral stenosis. This variability has been particularly associated with posture, but this association has not been clearly defined in most of the reported cases: it would be expected that on lying on the back signs of mitral incompetence would be produced, and on leaning forward those of mitral stenosis. In hardly any of the reported cases has this been emphasized; but Mahaim (1945b) mentions two patients in whom a systolic murmur appeared, one in decubitus and the other on sitting up. In the first patient a pre-systolic murmur appeared on sitting up. Further, it must be remembered that in true mitral stenosis the signs are sometimes variable at different times and in different positions, and especially variable is the systolic murmur. This systolic murmur is sometimes attributable to tricuspid incompetence.

A point to remember is that the axis of the mitral valve, and the direction of the blood flow from the left auricle to the left ventricle, are forward and only slightly downwards, and certainly not in line with the axis of the trunk. With the patient lying on his back the blood stream and the tumour are pointing very nearly straight upwards. A blood flow even as low as 2 litres a minute would make it very unlikely that the tumour could slip back against it, even when aided by gravity.

It is possible, however, that each ventricular systole might push the mass backwards into the atrium, and the tumour may even allow a certain amount of regurgitation of blood by preventing the cusps from closing properly (Zinsser and Johnson, 1953). This may account for the appearance of strong systolic pulsation seen against the oesophagus by van Buchem and Eerland, and considered by them to be strongly suggestive of the diagnosis. Paradoxical pulsation has otherwise been discredited both as a positive sign of mitral regurgitation and as a negative one against mitral stenosis.

Seven pre-operative diagnoses have been made (Goldberg *et al.*, 1952; Zinsser and Johnson, 1953; Goldberg and Steinberg, 1955; Soboff and Zatuchni, 1956) by means of angiocardiology, and no doubt this method will discover many more. But it has not usually been clear on what grounds angiocardiology has been recommended. We have tried to point out the fallacies in all the diagnostic points, and suggest that many cases will occur in which angiocardiology has not been done and the surgeon will be surprised. Goldberg and Steinberg (1955) give four indications for angiocardiology: (1) signs of mitral stenosis not dating from birth in young children; (2) absence of cardiac difficulties until the onset of intractable heart failure; (3) inconstancy of mitral murmurs; and (4) episodes of syncope or cyanosis on change of position. These four points are of value, but certainly the third and fourth are misleading. However, as angiocardiology becomes easier and more reliable (Soboff and Zatuchni, 1956), myxomata will no doubt be discovered more often, and differentiated from mural and ball thrombi.

In 1952 Goldberg *et al.* described the case of a child aged 3½ in whom the tumour was diagnosed by angiocardiology; at operation the heart stopped before the pericardium was opened. The auricle was incised and the tumour removed by spoon and pituitary rongeur. The heart action was started again, but lasted only a few hours.

Crafoord operated successfully on a patient by means of the extracorporeal pump and oxygenator, as reported by van Buchem and Eerland (1957). The tumour was the size of a "small orange."

Brock (1956) has proposed and practised the approach to the myxoma through the right auricle, excising a circle of interatrial wall with the tumour pedicle, pulling out the tumour and stitching up the hole, with an arrested circulation under hypothermia. Eerland, also using hypothermia, removed a myxoma by making an incision in the left atrium as well as in the left auricle, and pushing the tumour in the atrial hole. After dividing the pedicle "the tumour was kept floating and pressed against the site where the left atrium was to be incised. The latter procedure was performed with the left hand. . . ." In both Brock's and Eerland's cases the patients succumbed to the complications of hypothermia. Chin and Ross (1957) succeeded in one case by carrying out Brock's suggestion, again under hypothermia. A few other cases of unsuccessful operative removal of myxoma of the left atrium have been reported (Goldberg *et al.*, 1952; Clowes *et al.*, 1954; Brock, 1956).

Ventricular cardiomyotomy produces ventricular fibrillation more easily than does the auricular approach; but it must be added that this danger is related to ventricular hypertrophy, fibrosis, and ischaemia, and a normal or thin ventricular wall carries little risk. The approach to the mitral valve through the ventricle is used by Logan (personal communication) in cases of difficulty in performing mitral

valvotomy, and he finds it satisfactory. In the present case, as in all cases of mitral obstruction, the muscle was normal and produced only an occasional extrasystole when cut and stretched.

When the tumour is discovered during a mitral valvotomy, one alternative treatment is to stop the operation and repeat it later with the help of hypothermia or cardiac bypass. In one such case the patient died two days after the first operation (Jones and Julian, 1955). Another alternative is to start immediately with hypothermia, but this involves considerable reorganization, whichever method of cooling is to be used. The third alternative is proposed in this paper.

Summary

A case of successful excision of an atrial myxoma is described.

It is shown that the symptoms and signs are almost indistinguishable from those of mitral stenosis, and that most cases will be discovered unexpectedly during the course of mitral valvotomy.

A simple method of dealing with the situation is described: this avoids having to abandon the operation with the intention of performing open cardiomy later, under hypothermia or with the cardiopulmonary bypass. Abandoning the operation is in itself a danger; and open cardiomy is less safe than the operation described.

The method consists of pushing up the myxoma with a finger through a small hole near the tip of the left ventricle; at the same time the index finger of the other hand, through a hole in the atrium, divides its pedicle, and guides it towards the auricular hole. While it is pushed through the hole it acts as a cork, and the auricle is clamped behind it as it falls out.

It is pointed out that the left ventricle in all cases of mitral obstruction is not hypertrophied or ischaemic, and an incision into it carries little risk.

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Following the reorganization in 1955 of the Bexleyheath club for mentally handicapped children into an independent club for children with any type of mental or physical handicap, a committee for youth clubs for the handicapped was set up in 1956 to promote other similar clubs. By January this year a chain of clubs was formed in north Kent, and 17 new clubs had opened in London and the south-eastern counties. The campaign has now spread to four other counties, nine new clubs have opened, and 17 districts are organizing facilities. These clubs aim to socialize and educate handicapped children and give parents an opportunity of regular contact, and to dispel misconceptions and old wives' tales by acting as a focal point of local interest in mental handicap. The Bexleyheath club has 23 members, the age range being 10–33 years, with mental ages of 3–9.

CHRONIC MIDGUT ISCHAEMIA

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Arterial thrombosis secondary to atherosclerosis is initially of limited extent. The surgical exploitation of this pathological finding is now accepted as justifiable, and direct surgical treatment by thrombo-endarterectomy or by the insertion of a graft, either as a replacement or as a shunt, gives better results than any other form of palliative therapy (Martin and Gaylis, 1957; Mavor, 1957). In most cases the atherosclerotic occlusions so treated have been in the aorta, its terminal branches, and the lower-limb arteries (Rob, Eastcott, and Owen, 1956; Martin and Gaylis, 1957). More recently it has been shown that atheromatous narrowing of the internal carotid artery can be successfully dealt with by direct surgery, and the ischaemic cerebral symptoms relieved (Rob and Wheeler, 1957).

Similar opportunities for surgery may exist in relation to the superior mesenteric artery, where for a time severe narrowing or local thrombosis may precede more extensive occlusion and infarction of the bowel. Although the symptoms resulting from such chronic midgut ischaemia have been described previously (Klein, 1921), their treatment by direct surgery on the superior mesenteric artery is now more apparently feasible. Accordingly it appears justifiable to recall the clinical picture and describe two recent cases.

Case 1

A man aged 49 was first seen because of lower abdominal pain. Four months previously he had a sudden onset of severe lower abdominal pain. This was associated with vomiting, and the next day he passed three or four dark fluid stools. The severity of the pain subsided after several days, but some pain remained present daily. This pain, situated in the lower abdomen, was continuous in nature and aggravated by a heavy meal, particularly of meats or fats. He had no abdominal colic, no night pain, and no back pain. Occasionally after a large meal he vomited. During this period he tended to be constipated, but since the original episode had had two episodes of diarrhoea, each lasting a few days. His appetite was poor and he lost 21 lb. (9.5 kg.) in weight in four months.

On examination he was a thin man of good colour. There were no findings of significance in the abdomen. Rectal examination was negative. Stool benzidine examination was positive. Haemoglobin was 92%, and a barium-meal and follow-through examination showed no abnormality.

He was seen twice during the next three months. Diarrhoea had become more persistent and he passed two or three stools daily. These were watery but well coloured. The abdominal pain persisted, being present every day. There was no further vomiting. Weight loss continued, the total loss over seven months being 35 lb. (15.9 kg.). On one occasion rectal examination revealed soft yellowish faeces which suggested fat malabsorption. Fatty acids were present on examination. Stool benzidine examination continued to be positive, and a further haemoglobin estimation was 90%. Barium enema showed no abnormality.

Seven months after the onset of symptoms and while awaiting admission to hospital for investigation, he entered as an emergency case, complaining of severe abdominal