

Aortic valve replacement with unsupported fascia lata¹

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Hearn, K., Somerville, Jane, Sutton, R., Wright, J., and Ross, D. (1973). *Thorax*, 28, 603–607. Aortic valve replacement with unsupported fascia lata. Twenty-five patients in the National Heart Hospital have had aortic valve replacement with unsupported autologous fascia lata and have been followed for two to three and a half years. Three patients died before leaving hospital. Nine of the 22 survivors required re-operation for severe aortic regurgitation and the other 13 developed aortic incompetence. In 11, regurgitation dated from the operation and progressed; and in 11 it appeared later and progressed. In view of the disappointing results which were obvious within six months unsupported autologous fascia lata valves have not been used for aortic valve replacement since December 1970.

During recent years, autologous fascia lata has been used for the replacement of diseased heart valves (Ionescu *et al.*, 1970) and for reconstruction of the right ventricular outflow tract (Lincoln *et al.*, 1971). The results of tricuspid replacement with mounted fascial valves have been bad (Dalichau, Gonzalez-Lavin, and Ross, 1972), and progressive shrinkage of the graft has been shown to occur quickly in the pulmonary position (Ross and Somerville, 1971). Frame-mounted mitral fascial valves have also shown evidence of progressive dysfunction after the first year (McEnany, Ross, and Yates, 1972). However, Senning (1967, 1969) reported encouraging results using unsupported fascia lata valves for aortic valve disease, and at a time when homografts were in short supply, and there was concern about late calcification, Ionescu and Ross (1969) adapted Senning's methods.

This report concerns the experience in the National Heart Hospital with a modification of Senning's technique for lone aortic valve replacement.

PATIENTS

Between February 1969 and December 1970, 25 patients had aortic valve replacement with unsupported autologous fascia lata.

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The patients were aged 24 to 60 years (average age 45.6 years) and five were women. Thirteen had dominant aortic stenosis and 12 had dominant aortic regurgitation with lone severe aortic regurgitation in eight. The aetiology was rheumatic in 17 patients, congenital in seven, and Marfan's syndrome in one. Five had had at least one episode of infective endocarditis and three patients had had previous aortic valve replacement, two with stored aortic homografts and one with a strutted pulmonary autograft. All patients had evidence of severe left ventricular hypertrophy and although none was asymptomatic, 12 had only mild symptoms. No patient had congestive heart failure.

Six patients required additional surgery: three had a mitral valvotomy or repair; one had a wedge resection from the left ventricular outflow tract for secondary subaortic obstruction, one required closure of a small atrial septal defect, and one had an aortocoronary saphenous bypass graft for a blocked left anterior descending artery.

Unsupported autologous fascia lata was used in all adults below the age of 60 years requiring elective lone aortic valve replacement from September to December 1970. Prior to this period, frame-mounted fascia lata was also used but there was concern over outflow gradients when small supporting valve frames were used.

The patients were reviewed following surgery with routine electrocardiograms, chest radiography, and physical examinations at one, three, and six months unless their condition warranted more frequent attendance. Three patients lived at such a distance that we have relied on reports from their local physicians. No patient has been lost to follow-up.

Postoperative cardiac catheterization was carried out in 16 patients to assess the function of the aortic valve. In 11 this was performed as a routine before discharge from hospital, and in five between four and eight months after surgery. One was investigated and re-operated on in the Cleveland Clinic. Five patients refused reinvestigation.

The duration of postoperative follow-up varied from two to three and a half years with a mean period of 2.6 years.

SURGICAL TECHNIQUE

In the first two patients in the series, Senning's technique (1966, 1967) was used but both developed central regurgitation within the first three days. The method adopted for the next 23 patients was based on the work done by Yates (1971), who showed that the normal aortic valve is a horizontal section of a cone, namely, a frustum where the radius at aortic root level bears a constant relationship to the longer radius at the top of the commissures. The radius of the root is easily measured at the time of operation following removal of the diseased valve. Once this measurement is known the frustum, or cone-shaped section, of fascia lata could be fashioned rapidly (Fig. 1a).

The base of the frustum was then sutured horizontally into the aortic root using a continuous stitch and incorporating a thin 3 mm strip of Dacron cloth to ensure a buttressed suture line. The wide end of the fascial valve was then pulled up into the aorta and the top edge was fixed to the aortic wall using mattress stitches which passed through the aortic wall and were tied over Teflon pledgets at points corresponding to the three commissures (Fig. 1b). The redundant fascia at the upper end then fell naturally into position to form three cusps.

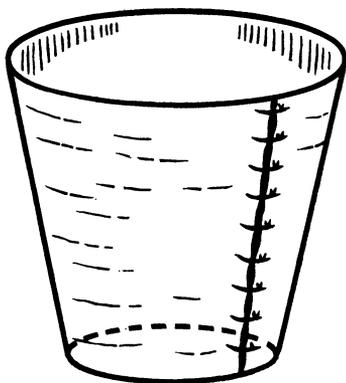


FIG. 1. (a)

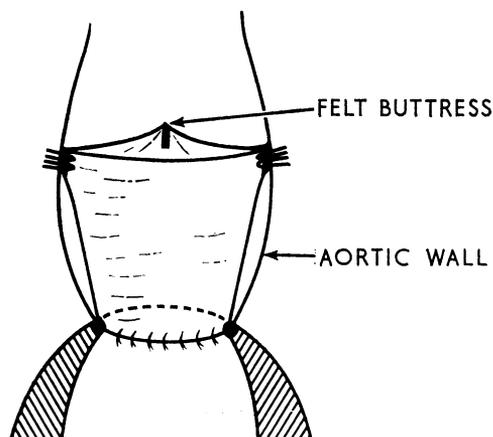


FIG. 1. (b)

FIG. 1. (a) A strip of fascia lata sutured to form a frustum prior to insertion into the aortic root. (b) Sagittal section of aortic root to show frustum sewn to the aortic wall at its narrower end and stitched to the aortic wall at the three commissural points.

RESULTS

MORTALITY Three patients died within 30 days of operation. Two of these had failed homografts and their deaths were due to a low cardiac output syndrome following long bypass times. The other hospital death occurred two weeks after surgery and was due to septicaemia from wound sepsis and rewiring of the sternum. Prior to death the fascial valve was competent.

Two of the 22 survivors died later. Both had required re-operation for progressive aortic regurgitation 7 and 10 months after the first operation; signs of aortic regurgitation had been present when they left hospital after one month.

POSTOPERATIVE COMPLICATIONS The complications in the early postoperative period were the same as after other forms of valve replacement. In addition, four patients had large haematomas in the leg and a number of patients were more conscious of the leg wound than of the medial sternotomy for several months after surgery. No clinical evidence of thrombophlebitis was seen although one had a small pulmonary embolus three days after surgery presumably arising from the legs.

GENERAL FOLLOW-UP The auscultatory findings in these patients are all similar (Fig. 2). The ejection systolic murmur is preceded by an ejection click and the aortic component of the second sound is usually easily heard at first. The early diastolic murmur is also characteristic.

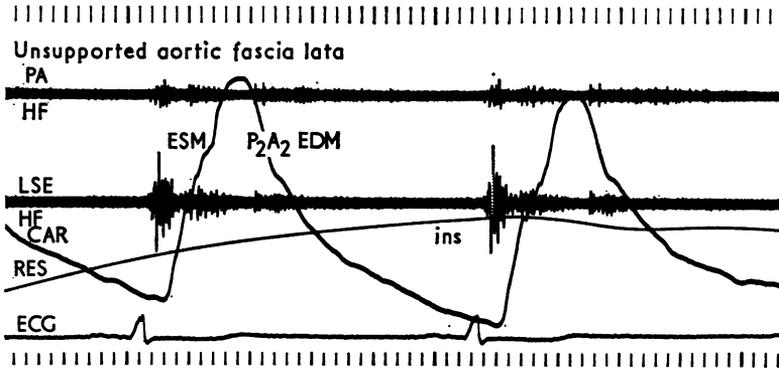


FIG. 2. Phonocardiogram from a patient 18 months after insertion of unsupported aortic fascia lata valve. ECG=electrocardiogram; RES=respiratory trace; ins=inspiration; CAR=carotid pulse; HF=high frequency phonocardiogram; PA=pulmonary area; LSE=left sternal edge; ESM=ejection systolic murmur; EDM=early diastolic murmur.

Routine use of anticoagulants was restricted to the first three weeks after surgery. However, two patients have since suffered transient disturbances of vision associated with small white patches in their retinæ which were thought to represent retinal emboli. Infective endocarditis was not seen in this series in spite of the absence of specific precautionary measures such as those used by Senning (1967).

AORTIC REGURGITATION The most serious complications with the use of unsupported fascia lata for aortic valve replacement has been the high incidence of important aortic regurgitation. This occurred in 11 of the 22 survivors by the time they left hospital. It is noteworthy that 10 of these patients were in the first half of the series. The regurgitation in this group has become increasingly severe and for this reason eight of them have now had their fascia lata valves replaced.

Among the 11 whose valves were competent at the time of discharge from hospital, eight had developed aortic regurgitation by three months and in the remaining three patients an early diastolic murmur was first heard at 10, 14, and 16 months respectively. Only one of this group has required a further valve replacement, and in this instance the regurgitant murmur was first heard six weeks after surgery.

The two valves which were inserted by Senning's technique were removed at three days and four months respectively. In both, considerable prolapse of one cusp was demonstrated although the fascia lata appeared healthy and

pliable. Another valve removed at 10 months also had pliable cusps but regurgitation had occurred through a large stitch hole at the base of one cusp. The cause of the regurgitation in these cases thus appeared to be technical.

The remaining six valves presented a uniform appearance. The fascia lata cusps were sym-

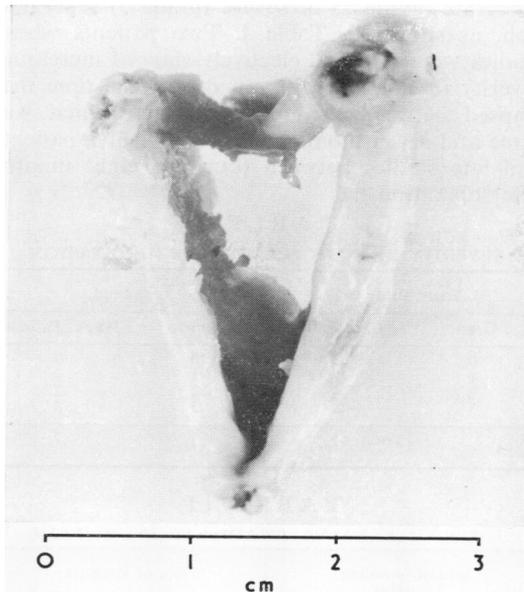


FIG. 3. Unsupported aortic fascia lata valve, seen from above, removed after seven months. Thickening and contraction of the cusps has resulted in a wide central regurgitant orifice. This valve was competent when the patient left hospital.

metrically thickened and retracted, leaving a wide central orifice which was clearly responsible for the regurgitation. The valve removed from the patient who developed regurgitation six weeks after surgery is shown in Figure 3.

No calcification was evident macroscopically in any of the nine valves. The duration of survival of these valves varied from three days to 20 months (mean 10 months).

Thirteen patients with aortic regurgitation have not required re-operation. In five patients the regurgitation is mild with a normal diastolic blood pressure and evidence of regression of the left ventricular hypertrophy on the electrocardiogram or a decrease in heart size on the chest radiograph since surgery. The other eight have moderate regurgitation with no improvement in any of these indices, and there is evidence from the serial measurement of blood pressure that the regurgitation is increasing in all of them.

HAEMODYNAMIC INVESTIGATION Sixteen patients were studied following surgery with a right and left heart catheter and an ascending aortogram. In 11 patients the study was performed early and electively within four weeks of operation, and at this stage the valve was competent in only three. The remaining patients had mild (grade 1), moderate (grade 2) or severe (grade 3) regurgitation, as shown in Table I. Two patients whose studies were repeated electively showed increasing severity of the regurgitation during the time that elapsed between their investigations which was three and seven months respectively. Five patients had late studies between four and eight months after operation.

TABLE I
SEVERITY OF POSTOPERATIVE REGURGITATION

Early Study		Late Study	
Grade	No. of Patients	Grade	No. of Patients
0	3	0	0
1	2	1	0
2	4	2	2
3	2	3	5
Total 11		7	

TABLE II
POSTOPERATIVE VALVE GRADIENTS IN 10 PATIENTS

Size of Gradient (mmHg)	No. of Patients
< 10	5
10-19	2
20-29	1
30-39	2
Total	10

An aortogram was performed in all patients who were catheterized, and in each case the demonstrated a central regurgitant jet. Frequently the fascial cusps were seen to be thickened and their movement restricted.

The peak systolic gradient across the fascia lata valve was measured in only 10 patients and is shown in Table II. None of the other patients in the series has developed significant stenosis as judged by the contour of the carotid pulse.

DISCUSSION

Although the insertion of fascia lata valves is technically more difficult and takes longer than prostheses, the hospital deaths in this series cannot be attributed directly to the use of fascia lata. Two of the early deaths and one late death followed a second cardiac operation and the higher mortality for re-operation is expected (Wisheart, Ross, and Ross, 1972).

One of the problems with any method of valve replacement is durability of the valve *in vivo*. The present series of patients have been followed for periods of between two and three-and-a-half years, which is a short period in a lifetime, but it has become clear that progressive aortic regurgitation is a serious problem.

Senning's (1967) observation of patients with unsupported fascia lata covered four years, and although many of his series had early trivial regurgitation, this did not appear to be progressive unless infection was present.

The progress of patients following surgery in the present series depended partly on whether or not the valve was competent at the time of discharge from hospital. Patients with incompetent valves were mainly in the first half of the series and all but one have required re-operation. It seems very likely, therefore, that technical factors were mainly responsible. However, in the patient who had serial catheterizations progressive regurgitation was clearly demonstrated and the valves removed at surgery were consistently contracted and very thickened. This suggests that a progressive pathological change had occurred in these valves which is likely to have been encouraged and accelerated by the aortic reflux.

It would be unreasonable, however, to place the entire blame for the unsatisfactory results on the surgical technique. Those patients who left hospital with a competent valve also show evidence of a progressive change but its course appears to be rather slower. In two patients whose valves had been shown to be competent

in the first three months, aortic regurgitation developed at 10 and 16 months and progressed. These valves when removed were contracted and thickened. We assume that pathology is the same in those who have developed late regurgitation but have not yet required re-operation. It appears to be a slowly progressive lesion but it is not necessarily serious at the three-year point of follow-up. Naturally we are concerned about the future even in those who would be classified as good or excellent results.

The behaviour of transplanted autologous fascia lata in the aortic position in this series appears different from that reported by Senning (1967) and it may be that differences in design and manufacture of the valve are responsible. The use of frame-mounted fascia lata in place of the aortic valve has certainly been much more satisfactory either alone (Dalichau *et al.*, 1972) or in combination with mitral valve replacement (Gonzalez-Lavin and Ross, 1971). However, it is not entirely clear why the supported and unsupported valves should behave so differently and the technical problems must be partly responsible.

It was expected that the use of fascia lata would provide a durable living structure which was free from the long-term complications of prosthetic valves. Even though haemolysis and infection have not caused trouble in this small series, minor thromboembolism, possibly due to platelet emboli, has occurred and the durability of the valve over a two-year period has been poor. For these reasons the use of unsupported fascia lata for aortic valve replacement has now been abandoned at this hospital.

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