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Subaortic Membrane Resection with Septal Myectomy or Septal Myotomy -A Surgical Dilemma

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ABSTRACT

Subaortic membrane (SAM) is a fixed subaortic obstruction in which a fibrous membrane is located below the aortic valve. It ranges from discrete subaortic stenosis to a severe form of Shone complex. Affected patients face an increased risk of bacterial endocarditis and of Aortic Insufficiency (AI) when fibrous strands extend into the base of aortic leaflets. The development of left ventricular hypertrophy (LVH) or aortic insufficiency (AI) is a clear indication for operation. The timing of intervention in the asymptomatic patient is controversial. Surgical treatment involves the resection of the fibromuscular subaortic membrane with or without septal myotomy or myectomy. Despite excellent early results, the recurrence rates for subaortic stenosis have been disappointing.

Hence a retrospective study was conducted for the superiority of the subaortic membrane resection with septal myectomy and myotomy. But, similar results are seen with both the methods with no complications and low recurrence rate.

KEYWORDS subaortic membrane, septal myectomy, septal myotomy

Introduction:

Discrete subaortic stenosis was first reported by Chevers [1] in 1842 and 2 distinct anatomic types, membranous and fibromuscular, have since been identified.[2] Subaortic stenosis is generally considered a progressive lesion and the rate of progression is variable. Affected patients face an increased risk of bacterial endocarditis and of Aortic Insufficiency (AI) when fibrous strands extend into the base of aortic leaflets.[3] Myocardial hypertrophy as a result of the hemodynamic stress may be more or less important and is generally more pronounced at the septal insertion of the membrane.

The development of left ventricular hypertrophy (LVH) or aortic insufficiency (AI) is a clear indication for operation. The timing of intervention in the asymptomatic patient is a controversy. Some have suggested the presence of a membrane as an indication for operation.[4] Where as others wait until the gradient reaches a peak of 25–30 mmHg, or AI or LVH develops.[5, 6] Surgical treatment involves the resection of the fibromuscular subaortic membrane with or without septal myotomy or myectomy.[4,5,7] Despite excellent early results, the recurrence rates for subaortic stenosis have been disappointing. Ranging almost from 11.7–35%.[4, 8, 9]

A retrospective study was thus conducted to find the superiority of the subaortic membrane resection with septal myectomy and myotomy.

Aims and objectives:

The results of the septal myectomy and septal myotomy by assessing the post op gradients across the left ventricular outflow.

The recurrence after both the procedures.

Complications mainly the conduction abnormalities after both procedures.

Associated anomalies and the procedures done for them.

Outcome of the patients.

Inclusion criteria:

All the patients with Sub aortic membrane with LVOT gradient >30mm Hg.

Patients having anomalies other than aortic valve hypoplasia and ascending aorta hypoplasia.

Exclusion criteria:

Patients with aortic valve hypoplasia.
Patients with ascending aorta hypoplasia.
Shone complex.

Material and methods:

A retrospective study of the cases that were operated for sub aortic membrane and discrete subaortic stenosis was done from 2007 to 2016. The entire patient's preoperative and post operative 2D-Echo findings were recorded. The diagnosis was noted down with the associated anomaly. The pre-operative and post operative left ventricular outflow gradiants were recorded including the left ventricular ejection fraction. Base line ECG was noted down.

The procedure done was noted down regarding the septal myectomy and myotomy. Also the associated procedure done was recorded.

Patients were grouped into two groups:
Group 1- Membrane resection with septal myomectomy. (20 cases)

Group 2- Membrane resection with septal myotomy. (40 cases)

Operative steps:
In all the patients, Myocardial protection was ensured by cold blood cardioplegic administration antegradely. The mean cardiopulmonary bypass time was 90+/-40 minutes and the mean cross-clamp time was 35 ± 20 minutes. The obstructive lesion was approached through an oblique aortotomy in all cases. Earlier the subaortic membranes were removed with sharp dissection with myectomy. Later cases instead of myectomy we converted to septal myotomy due to the concept of conservative approached. Attention was always taken to avoid injury to both the conduction tissue and the mitral valve.

Septal myectomy was performed with a deep incision made at the nadir of the right coronary aortic cusp into the septal muscle that protruded into the LVOT and a second incision was made caudal to the commissure between right and left coronary aortic cusps and both incisions were joined at their upper and lower edges. A deep wedge septal resection was then performed.

The myotomy consisted of a deep incision made at the nadir of the right coronary aortic cusp into the septal muscle that protruded into the LVOT.

When either myotomy or myectomy was performed the goal was to obtain a free patent subaortic area that would admit a Hegar dilator matched with body surface area.

All the patients who had VSD, Dacron patch closure was done through the RA approach using interrupted, pledgeted, prolene mattress sutures.

Aortic valve replacement was done in cases with severe AR and those with severe Aortic Stenosis. Patients with moderate AR underwent repair with commissuroplasty. PDA ligation was done simultaneously but coarctation repair was done later.

Postoperatively the 2D-Echo findings regarding the LVOT gradient, presence of any remnant of the membrane and the left ventricular ejection fraction were studied.

The patients were followed up for regularly with 2D-Echo and ECG.

Results:
From the period of 2007 to 2016, 60 patients were operated for subaortic stenosis. In 20 (33.34%) patients membrane resection with septal myectomy was done till 2011 but later due to conservative approach instead of myectomy the patients were subjected to septal myotomy. Male preponderance was seen with 45 (75%) cases and females being 15 (25%) cases. The mean age was 19.7 years with 44 (73.34%) patients in NYHA class I and 12 (20%) patients with NYHA Class II and 4 (6.67%) patients in NYHA class III.

The mean pre-operative Left Ventricular Outflow gradient (LVOT) was 82.38 mm of Hg. (Graph 1) The mean LVEF was 35 – 65%. And all the patients had left ventricular hypertrophy.

Type of the sub-aortic lesion:
Isolated discrete fibrous membrane – 38 (63.34%) cases.

Localized muscular hypertrophy – 10 (16.67%) cases.

Long segment diffuse membrane forming tunnel – 12 (20%) cases.

Associated lesions:
Aortic regurgitation – 15 (25%) cases.

Mild AR – 8 (13.34%) cases

Moderate AR – 3 (5%) cases, underwent valve repair.

Severe AR – 3 (5%) cases, underwent valve replacement.

Aortic stenosis with regurgitation – 4 (6.67%) cases, underwent valve replacement.

Ventricular septal defect – 13 (21.67%) cases, underwent Dacron patch closure.

PDA – 1 (1.67%) case, simultaneous ligation.

Coarctation was seen in – 6 (10%) cases, 3 of which underwent surgical repair, 2 balloon dilatation and one had low gradiant with multiple follow up.

AP window – 1 (1.67%) case, underwent simultaneous patch repair.

Mitral regurgitation – 1 (1.67%) case, also had severe AR and underwent Double valve replacement.

Post operative follow-up:
There were no immediate post operative deaths in both the groups. Post operatively all the patients were subjected to 2D-Echo and ECG.

All the patients had mean LVOT gradient's of 17.75 mm of Hg. LVEF was improved in all the patients with the mean of 55 $\pm$ 10%. The gradients in the group 1 were far less than the group 2, with mean of 15.06 mm of Hg and that of the group 2 was 19.5 mm of Hg. (Graph 2 and graph 3, graph 4)

2 (10%) patients from group 1 had conduction abnormalities of which one had nodal rhythm and regained the normal sinus rhythm. One (5%) patient developed AV Block later was paced.

1 (2.5%) patient from group 2 had AV Block and was paced. But 2 (5%) patients had LVOT gradient of 30 $\pm$ 5 mm of Hg and were followed up but finally lost to follow. Thus, the recurrence was only 5% of the cases with group 2 i.e group with septal myotomy.

Discussion:
Subaortic stenosis occurs in about 8% to 20% of all forms of left ventricular outflow tract obstruction [10, 16]. There is considerable uncertainty about the rapidity of progression and the timing of surgical repair[11, 12,13]. DSS does not occur in neonates, which suggests it is an acquired lesion. Reports of a familial incidence, as well as a predisposition in Newfoundland dogs, suggest a genetic predisposition.

Several authors have suggested that subtle alterations in the left ventricular outflow tract result in turbulent flow, which then cause an injury to the endothelium and the development of the membrane.[14, 15]

Irrespective of the gross appearance, the stenosing lesions exhibited five tissue layers, beginning from the luminal aspect, endothelium, acid mucopolysaccharide-rich subendothelial layer, collagen-rich fibrous layer, fibroelastotic layer, and a smooth muscle layer[17].

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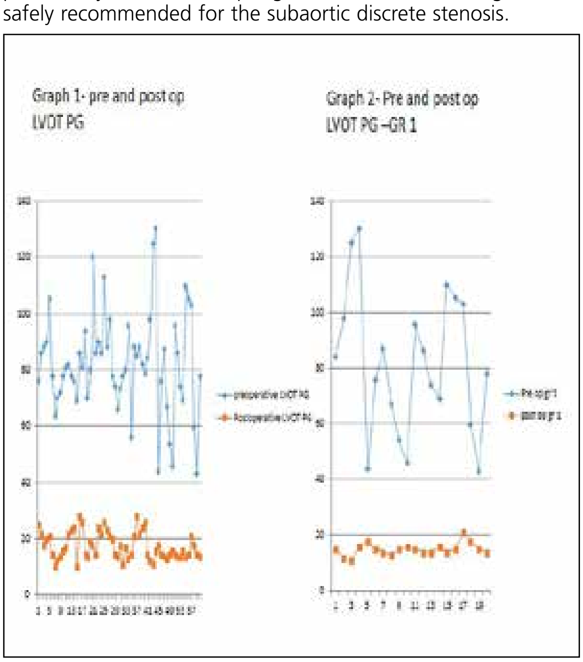
Although significant left ventricular hypertrophy and aortic insufficiency are clear indications for surgery Cape and coworkers[18] proposed a 4-stage etiology for the development and progression of discrete subaortic stenosis. Subtle morphologic abnormalities in the LVOT, such as a steeper aortoseptal angle, result in an altered septal shear stress, which triggers a genetic predisposition leading to cell proliferation and structures in the LVOT. Therefore any surgical treatment should, in addition to relieving the subaortic stenosis, attempt to treat the anatomic abnormality causing increased septal shear stress. Thus the recurrence after resection of subaortic membrane only is common in most published series.[19] In this series the recurrence rate was 27.1% and the reoperation rate was 12.1%[19]. In addition, patients with residual left ventricle–aorta gradient higher than 30 mm Hg at the end of bypass should undergo reoperation with a more aggressive subaortic resection during the same operating session. Myectomy has been favored by several authors [4,7] who demonstrated better initial and long-term results. Moreover, it has been suggested that postoperative residual gradients are related to postoperative sympathetic tone.[20,4]

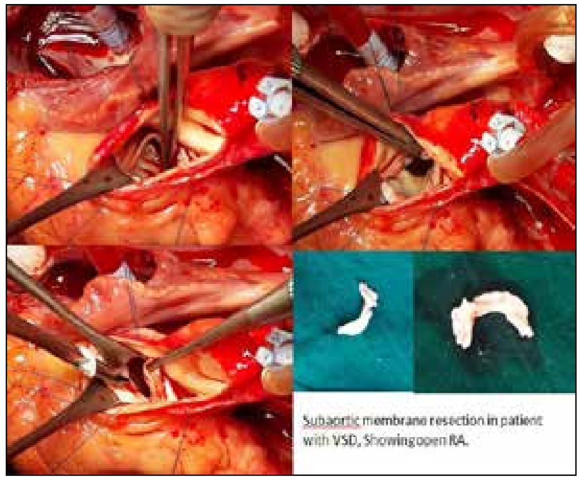
Brauner and colleagues[4] have suggested surgery at the time of diagnosis regardless of gradient to prevent the development of AI. the higher the early postoperative gradients, the higher the rate of recurrence, suggesting the role of sympathetic tone in subaortic stenosis [4]. Brauner and colleagues [4]; also suggested that, the age at initial operation has no impact on the future evolution of an aortic insufficiency and that insufficiency is generally improved by resection of the membrane regardless of the age at operation. over 50% of patients with DSS ultimately develop AI.[4] Once AI has developed, membrane resection does not improve the AI, and may not prevent its progression.[4,5,6.] In addition, Brauner found a decreased incidence of recurrence when the patients underwent surgery at a gradient less than 40 mmHg.

Coleman and colleagues had recommended intervention at a peak Doppler echocardiographic gradient of 25–30 mmHg[5,6].

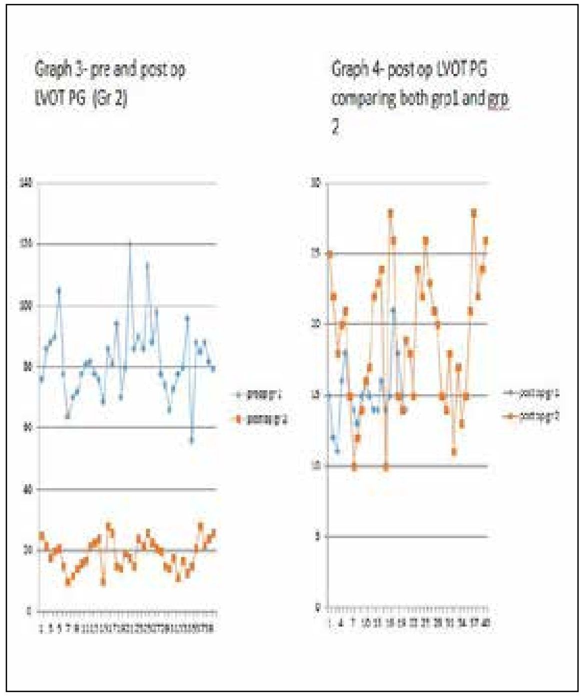
Conclusion:

Septal myectomy may have several positive effects. It is very effective in minimizing any residual outflow gradient and may change the geometry of the outflow tract sufficiently to alter the milieu that led to the development of the DSS. The myectomy may serve to disrupt this circumferential ring of genetically predisposed cells. But, as similar results are seen with both the methods, myotomy may even serve the same purpose as myectomies disrupting the circumferential ring, can be safely recommended for the subaortic discrete stenosis.





Subaortic membrane resection in patient with VSD, Showing open RA.



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