



## A RETROSPECTIVE ANALYSIS OF THE CLINICAL OUTCOMES FOLLOWING SURGICAL CORRECTION OF RUPTURED SINUS OF VALSALVA ANEURYSMS.

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### KEYWORDS :

#### INTRODUCTION

The essential defect in Sinus of Valsalva aneurysm is understood to consist of a localized rupture or discontinuity in the lamina elastica of the aortic sinus media, which leads to a progressive expansion (in varying degrees) of the aortic wall, usually in a windsock-like protrusion that can invade neighboring structures and perforate into them 1 (as quoted by 14). Rupture into the right ventricle (the most frequent event), the right atrium (the 2<sup>nd</sup>-most frequent event), the pericardium (in the form of a pseudoaneurysm), left ventricular septum, and the left atrium have been described 2.

A Ruptured Sinus of Valsalva aneurysm is a relatively rare condition. Because of recent advances in diagnostic technique, however, the number of patients undergoing surgery have been increasing, including patients without rupture. Various surgical methods have been reported with good results, depending on the size of the aneurysm, the site of occurrence, the site of rupture, and the complicating cardiac disease. Additional bacterial endocarditis, concomitant ventricular septal defect repair, and aortic valve replacement do not independently influence long-term survival.3.

In this study we review and discuss the presentation, clinical features, investigations and factors, which influence the surgical outcome in patients with Ruptured Sinus of Valsalva Aneurysms.

#### AIMS AND OBJECTIVES

To retrospectively evaluate the presentation, clinical features, investigations and factor which influence the surgical outcome in patients with Ruptured Sinus Of Valsalva who underwent surgery at Dept of Cardiothoracic Surgery, Tamilnadu Govt MultiSuper Speciality Hospital, Chennai - between January 2015 and July 2018.

#### METHODS AND MATERIALS

##### PATIENT POPULATION

Between between January 2015 and July 2018, 22 patients who underwent surgery for Ruptured Sinus Of Valsalva Dept of Cardiothoracic Surgery, Tamilnadu Govt MultiSuper Speciality Hospital, Chennai formed the basis of this study. The age ranged from 15 to 42 years. There were 17 males and 5 females. Duration of symptoms ranged from 20 days to 18 years with the average age of 26.8 years.

The clinical diagnosis was made on the basis of history, clinical examination, electrocardiogram, chest skiagram, echocardiogram, cardiac catheterisation and cine angiocardiogram. In all patients detailed history was recorded with special emphasis on duration of symptoms, mode of onset, dyspnea, fatigue, palpitation, chest pain, weight gain, syncope, recurrent respiratory infection, pain in right hypochondrium, effort tolerance, fever. All patients were examined in detail, recording pulse, blood pressure, jugular venous pressure, pedal edema, hepatomegaly, anemia, position and character of cardiac apical impulse and any other palpable pulsations or thrills.

On auscultation, details of first and second heart sounds, murmurs (duration, site of maximum intensity, conduction, radiation, variation with respiration or other manoeuvres) in all areas of the precordium and any other auscultatory event were recorded. Electrocardiogram was analysed for rate, rhythm, electrical axis,

heart blocks, ST and T wave changes, chamber enlargement or any other changes.

Chest skiagram was examined for the evidence of cardiac chamber enlargement, type of cardiac apex, pulmonary artery enlargement, pulmonary plethora, any other abnormality.

Echocardiography was done to study the various chamber dimensions and function, valve function and gradient across them, continuity of aortic root and continuity of the interventricular septum and any other abnormality. Right and left heart cardiac catheterisation was done in cases where an unequivocal diagnosis was not made on the basis of an echocardiogram. Pressures and oxygen saturations in right atrium, right ventricle, pulmonary artery, aorta and left ventricle and any other findings were recorded. QP and QS, pulmonary vascular resistance and oxygen consumption was calculated. Cineangiography was done to demonstrate the sinus involved, chamber of termination, ventricular septal defect, aortic insufficiency and any other abnormality.

A retrospective review of the clinical, surgical, echocardiographic and cardiac catheterization was done. Preoperative diagnoses were established by echocardiography in 22 patients, additionally cardiac catheterization was done in 6 patients.

#### SURGICAL TECHNIQUE

Median sternotomy was used in all patients. All patients underwent intracardiac repair on cardiopulmonary bypass. Bicaval cannulation was used. Either Cold blood or crystalloid cardioplegia was administered antegrade through the root. Aortotomy was done in all cases to assess aortic valve and sinus involved and chamber of termination was opened for repair of the fistula. If ventricular septal defect was present with rupture in right ventricle then dumb bell dacron patch closure was done. Aortic valve was replaced if it had fenestration's, deformed, thickened and fibrous cusps or was calcified. Depending upon size of aortic root left Ventricular cavity, aortic valve was replaced by low profile disc or a ball and cage prosthetic valve. The mean bypass time was 129 min, mean duration of circulatory arrest was 93 min. All patients were cooled to 32 C. All patients were weaned of cardiopulmonary bypass with inotropic support.

#### POST OPERATIVE MANAGEMENT

In postoperative period patients were ventilated and hemodynamic stability was maintained. If indicated inotropic, preload and afterload reducing agents were used.

#### WEANING PROTOCOL

All patients were electively ventilated. If patients were haemodynamically stable weaning was started. Fruesemide was given approximately 3 hours before extubation. They also received one dose of steroids prior to extubation. Mean ICU stay was 3.45 days. Patients were discharged from the hospital after a mean interval of 14.2 days (range, 6 to 31 days).

#### ECHOCARDIOGRAPHIC AND CARDIAC CATHETERISATION STUDIES

Echocardiography was done for 21 patients while additional cardiac catheterization was done for 5 patients. Most of our diagnosis was

based on echocardiography.

**Follow-up**

Any death within 30 days postoperative period was recorded as early death and after that as late death. In the followup patients were assessed clinically, by chest X-rays, electrocardiogram, echocardiogram and. Patients were asked to report for first followup after 6 months and then annually. If they developed any problem they were asked to report immediately in between.

**DATA ANALYSIS**

The SPSS version 11 statistical program was used to analyze results. Chi square test was used for discrete variables.

**OBSERVATION**

**Table.1. Incidence of ruptured sinus of Valsalva.**

Total no. of open heart, surgeries done during the period	985
No. of ruptured sinus Valsalva aneurysms	21

**Table II. Sex and age distribution.**

Age(in years)	Male	Female	Total no.(%)
10-19	03	00	03(19)
20-29	09	03	12(57)
30-39	04	00	04(19)
40 and above	01	01	02(10)
Total(%)	17(80)	04(19)	21(100)

49Youngest patient was 15 years and oldest patient was 42 years.

**Table III. Duration of Symptoms**

Duration of symptoms	No. of Patients	%
Asymptomatic	2	9
<1 month	4	19
1-3 months	7	33
3-12 months	5	24
>12 months	3	14

**Table IV. Mode of onset of symptoms.**

Mode of onset	No. of cases	(%)
Acute / sudden	11	52
Gradual	09	38
Asymptomatic	02	10

**Table V. Symptomatology.**

Symptoms	No.of cases	(%)
Dyspnea	17	80
Precordial pain	13	61
Palpitation	15	66
Orthopnea	07	33
Fatigue	17	80
Paroxysmal nocturnal dyspnea	02	10
Fever	05	24

**Table VI : Clinical findings.**

Physical signs.	No. of cases	(%)
1. Collapsing pulse	15	71
2. Raised jugular venous pressure	10	45
3. Hepatomegaly	09	40
4. Basal crepts	07	31
5. Pedal edema	05	22
6. Increased precordial activity	15	71
7. Cardiomegaly	16	77
8. Thrill	08	36
9. Murmur (left sternal border)		
a. Continuous	18	80
b. Systolic and diastolic	02	10
c. Systolic only	01	05

**Table VII: E1 electrocardiographic findings.**

Findings	No. Of Cases	(%)
1- Axis		
Normal axis	15	71
Right axis deviation	04	18
Left axis deviation	02	09
2. Ventricular hypertrophy		
Right	02	09
Left	12	54
Biventricular	03	13

**Table VIII: Skiagram chest findings**

Finding	No.of cases	(%)
1. Cardiomegaly	17	81
2. Pulmonary plethora	15	71

**Table IX: Cardiac Catheterisation studies**

	No. of Cases	%
1. Sinus of origin	4	80
• RCS	1	20
• NCS		
2. Level of oxygen step-up	1	20
• RA	4	80
• RV		
3. Pulmonary artery pressure	3	60
• Normal	2	40
• Elevated		

Was done in five cases.

**Table:X**

Operative Findings	No of Cases	(%)
1. Sinus involved		
Right coronary sinus	18	85
Non coronary sinus	03	14
2. Chamber of termination	16	76
Right, ventricle		
Right atrium	05	24
3. Ventricular septal defect	16	76
4. Aortic cusp abnormalities	08	38

**Table XI: Operative procedures**

Operative procedure	No.of Cases	(%)
1. Direct Closure	01	05
2. Single patch closure	04	19
3. Dumb bell patch closure	16	76
4. Aortic valve replacement	08	36

**Table XII : Post operative complications**

Complication	No.of cases	(%)
1. Re-exploration for bleeding	02	09
3. Paravalular leak	01	04
8. Infective Endocarditis	01	04
9. Heamolysis	01	04

**Table XIII : Long term results (in 18 patients)**

Criteria	No.of cases	(%)
Lost to follow-up	03	14
Early deaths	Nil	Nil
Late deaths	02	11
Asymptomatic	17	81
Period of follow up		
Upto one year	17	81
one year to 3 years	08	38
More than 3 years	03	14

**Table XIV: T-TEST**

**Paired sample statistics**

		MEAN	N	STD.DEVIATION	STD. ERROR MEAN
Pair 1	NYHA (PRE-OP)	2.17	18	0.857	0.202
	NYHA (POST-OP)	1.44	18	0.784	0.185
Pair 2	LVIDd (PRE-OP)	56.17	18	8.535	2.012
	LVIDd (POST-OP)	48.33	18	7.569	1.784
Pair 3	LVIDs (PRE-OP)	36.39	18	7.586	1.788
	LVIDs (POST-OP)	30.28	18	6.257	1.475
Pair 4	LVEF (PRE-OP)	57.89	18	6.115	1.441
	LVEF (POST-OP)	61.11	18	6.398	1.508

**Paired Samples Correlations**

	N	Correlations	Significance
Pair 1 NYHA (pre&post)	18	-0.29	0.909
Pair 2 LVIDd (pre&post)	18	0.619	0.006
Pair 3 LVIDs (pre&post)	18	0.746	0.000
Pair 4 LVEF (pre&post)	18	0.145	0.567

**DISCUSSION**

The incidence of ruptured sinus of Valsalva is 0.25% of all the open heart surgeries carried out in the present series is same as Meyer et al,1975,28 who reported in 0.22% cases. The incidence is much lower than Taguchi et al,1969,21 who reported in 3.5% cases.

Majority of patients were male i.e. 80% of patients as also reported by Meyer et al, 1975.28. The maximum incidence of 57% was in the range of 20 years to 29 years and 18% in the age group of 10 years to 19 years which is similar to Chu et al.15. This differs from Magidson et al,1963,29 as they have reported no sex predominance.

Majority of patients were in NYHA functional class III (46%) and class IV (26%) which is similar to Abe et al ,1988,30 who reported 81% cases in NYHA functional class III and IV and Burakovsky et al ,1988,31 reported 74% cases in NYHA functional class III and IV.

Gradual onset in 52% cases and acute or sudden in 38% was reported in his series is similar to Kirklın et al, 1986,14 who reported gradual onset in 45% and sudden in 35% cases. Mode of onset was defined to be acute when the patient developed severe symptoms within a month, gradual in onset when the patient became symptomatic over a period of six months.

Commonest symptoms recorded were dyspnea (80%),palpitation (66%), precordial pain (61%), and fatigue (80%) which is similar to Burakovsky et al,1980,31 who reported dyspnea in 88.8% cases, chest pain in 67% cases ,intermittent palpitation in 70.8% cases and fatigue in 88.8% cases.

Collapsing pulse (71%), continuous murmur (80%), cardiomegaly (77%) and increased precordial activity (71%) being the commonest clinical findings which is similar to Magidson et al ,1963,29 who reported continuous murmur in 84% cases, cardiomegaly in 58% cases.The electrocardiogram shows left ventricular hypertrophy in 54% cases and biventricular hypertrophy in 13% cases which is similar to Magidson et al ,1963,29 who reported left ventricular hypertrophy in 56% cases and biventricular hypertrophy in 16% cases while Kieffer et al,1960,32 reported left ventricular hypertrophy in 30% cases and right ventricular strain in 10% cases.The skiagram chest shows cardiomegaly and pulmonary plethora in 81% and 71% cases respectively which is similar to Kieffer et al,32 who reported cardiomegaly and pulmonary plethora in 90% cases while Magidson et al,1963,29 reported cardiomegaly in 60% cases and pulmonary plethora in 45% cases. Chu et al,1990,15 reported cardiomegaly and pulmonary plethora in majority of cases.

In present study right ventricle in 76% cases and right coronary sinus in 86% cases was involved - Nowicki et al, 1977,24 reported right coronary sinus in 67% cases and right ventricle in 56% cases. Chu et al,15 1990 reported right coronary sinus in 76.8% cases and

right ventricle in 71-5% cases. These findings are almost similar to the present study. In 4% of cases a VSD with aortic regurgitation was found to be present, there was no ruptured sinus of valsalva aneurysm.Cardiac catheterisation study was done in five cases. The pulmonary artery pressures were found to be elevated in three of these cases.The ventricular septal defect was present in 76% cases which is more than the series of Kirklın et al ,1986,14 who has reported in 60% cases. Dumb bell closure of ruptured sinus into right ventricle with associated ventricular septal defect was done in 76% cases, and single patch closure in 19% cases and direct closure was done in 4% of cases. Various surgeons have used various techniques for the same type of lesions so no such study could be reported during the review of literature. We have used aortocameral approach in all cases. Other procedures done were similar to Chu et al,1990.15. Aortic valve replacement was done in 36% cases for the patients who needed them for aortic regurgitation while Burakovsky et al,1988,31 did repair in 50% cases and replaced aortic valve in 50% cases. There is no Operative mortality in our present study. Burakovsky et al, 1988,31 have reported 8% operative mortality 4% due to septicemia and 4% due to acute cardiac failure. Higher operative mortality have been reported by Magidson et al,29.The present study shows that 81% of survivors were asymptomatic at a period of six months to 24 years of follow up as also reported by Abe et al, 1988,30. Late death is 11% which is very low as compared to 22% in Meyer et al,28. The residual shunt was seen in four percent cases which is similar to Chu et al ,1990,15. There was one late postoperative death due to infective endocarditis, and another during reoperation for a paravalvular leak. These cases were lost to follow-up.Preoperative and postoperative variables were correlated using the T-test using paired samples correlations. There was a mean downgrading of NYHA class from 2.17 to 1.44. There was also a decrease in LVIDd and LVIDs from 56.17 to 48.33 and 36.39 to 30.29, respectively. The LVEF also increased from 57.89% to 61.11%.

**SUMMARY**

The present study shows that ruptured sinus of Valsalva affects young male, is of gradual onset, presents commonly with dyspnea, palpitations and chest pain. The commonest physical finding are collapsing pulse, raised jugular venous pressure, hepatomegaly and basal crepts. There is cardiomegaly and increased precordial activity and thrill in majority of patients. The commonest murmur is the continuous one on left sternal border.The electrocardiogram in majority of cases shows normal rhythm and axis and left ventricular and enlargement. The chest skiagram shows cardiomegaly and pulmonary plethora in majority of cases.The cineangiography demonstrated the sinus involved , chamber of termination, aortic regurgitation and ventricular septal defect.During operation, it was found that the right sinus was commonly involved and ruptured in the right ventricle. In majority (76%) of cases dumb bell patch was used to repair the fistula and associated ventricular septal defect with ruptures into the right ventricle .Aortic valve was replaced in 08 cases.The early operative mortality was nil and late mortality was 9%. Few patients had postoperative complications common to any other open heart surgery.

The decrease of the NYHA class and the decrease in the left ventricular systolic and diastolic dimensions with an associated increase in left ventricular ejection fraction signify the excellent postoperative results as evidenced with an improved quality of life.The long term post operative results are excellent in majority of cases, patients become asymptomatic.

**CONCLUSION**

Ruptured sinus of Valsalva is an uncommon but not rare cardiac condition. It affects young males.Majority of patients present with typical clinical features. Electrocardiogram and X-ray chest do not provide specific diagnosis. Cardiac echocardiography is an excellent diagnostic aid to detect sinus and chamber involved, presence of aortic regurgitation and ventricular septal defect.

Operation is safe and easy so even in asymptomatic patients early

operation is recommended. The postoperative complications are common to as in any other open heart surgery. The postoperative long term results are excellent.

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