SURGICAL REPAIR OF RUPTURED SINUS OF VALSALVA ANEURYSM: EXPERIENCE AT CARDIOVASCULAR DEPARTMENT, LADY READING HOSPITAL, PESHAWAR

Abdul Malik[1]✉, Tariq Sohail Babar[2], Imran Khan Khalil[3], Murad Ali Shah[4], Nasreen Laiq[5]

[1]✉ Associate Professor, Cardiovascular Surgery Department, Lady Reading Hospital , Peshawar, Pakistan
Email: malik119pk@yahoo.com
Cell: 0300-5927014

[2-4] Cardiovascular Surgery Department, Lady Reading Hospital, Peshawar, Pakistan

[5] Department of Anaesthesia, Lady Reading Hospital, Peshawar, Pakistan

Date Submitted: April 14, 2014
Date Revised: July 16, 2014
Date Accepted: July 20, 2014

ABSTRACT

OBJECTIVES: To determine the frequency of ruptured sinus of Valsalva aneurysm (SVA) and to study its surgical outcome in terms of morbidity and mortality in our set up.

METHODOLOGY: This case series study was conducted on 23 patients of ruptured SVA's, operated at cardiovascular department, Lady Reading Hospital, Peshawar, from January 2003 to December 2011 and followed up till December 2013. Informed consent was taken from all patients. Surgical repair was performed using cardiopulmonary bypass (CPB) via a median sternotomy. Age, sex, presentation, site and outcome of surgical repair were analyzed.

RESULTS: Ruptured SVA's was more common in males (73.91%). Right coronary cusp was involved in 86.95% patients of the ruptured SVA's cases. Most common ruptured site was right ventricle (91.30%). Aortic regurgitation was observed in 21.73% and ventricular septal defects in 13.04% cases. Primary closure of the defect with pladgeted stiches done in 86.95% cases while patch closure was done in 13.05% cases. Preoperatively, 34.78% & 52.17% patients were having NYHA functional status III & IV respectively, while postoperatively 45.45% & 36.36% patients were having NYHA functional status I & II respectively. Mortality was 4.35% (n=1/23) and one (4.35%) patient had residual leak and managed conservatively. Two years follow up showed no complication regarding ruptured SVA.

CONCLUSIONS: SVA are very uncommon anomalies in our setup, commonly involve right coronary cusp and rupturing mostly into right side of heart. Surgical repair of VSA is a safe procedure having good outcome in terms of morbidity and mortality.

KEY WORDS: ruptured sinus of valsalva, congenital aortic lesion, congenital cardiac lesions.

THIS ARTICLE MAY BE CITED AS: Malik A, Babar TS, Khalil IK, Shah MA, Laiq N. Surgical repair of ruptured sinus of valsalva aneurysm: Experience at cardiovascular department, Lady Reading hospital, Peshawar. Khyber Med Univ J 2014;6(3): 116-120.

INTRODUCTION

Sinus of Vasalva Aneurysms (SVAs) are rare aortic lesions.[1] It is very much common among Asians (about 1.2% to 4.94%) compared to Western populations (about 0.5% to 1.5%) and it is more common in adolescence.[2] It constitutes about 0.1 to 3.5% of all congenital heart defects and 0.14 to 1.5% of all open cardiac surgeries.[3,4]

SVA's lesions may be acquired or congenital. The congenital type is much common and occurs as a weakness at the junction of the aortic media. Annulus fibrosus is the most common cause of it. Acquired lesions occur secondary to syphilis and infective endocarditis.[1,5]

SVA's are commonly associated with other congenital cardiac defects like ventricular septal defects (VSD), atrial septal defects (ASD) and aortic regurgitation (AR).[6,7] These commonly rupture into right ventricle and right atrium but rarely into left heart chamber because of left ventricle have thick wall.[6-8]

Once an aneurysm ruptures, the median survival is reduced to one to two years (if left untreated) and patients usually end up in congestive cardiac failure or infective endocarditis.[3,9] For ruptured SVA prompt surgical repair is the optimal therapy and mainstay of treatment. Surgical repair has a very low perioperative risk and satisfactory long-term outcomes. Surgical repair of associated VSD, ASD and AR is required when involved.[1,6]

In the light of above mentioned facts about SVA and that no such study has ever been conducted in our country we planned this study which will help to share our experience regarding management of SVAs. This study was conducted to determine the frequency of ruptured SVA and to study its surgical outcome in terms of morbidity and mortality in our set up.

METHODOLOGY

It is a case series study conducted from January 2003 to December 2011 and then follow completed till December 2013. Twenty-three patients of ruptured SVA's were operated in cardiovascular department, Lady Reading Hospital, Peshawar. Ethical committee approval was taken. An informed consent was taken from all patients. All diagnosed cases of ruptured sinus of valsalva aneurysms (RSVA) were selected. Patients with any suspicion or evidence of infective endocarditis, non-ruptured SVA's were excluded.

Surgery was performed in a short time once RSVA was diagnosed. Surgical repair was performed using cardio-pulmonary bypass (CPB) non-beating heart technique via a median sternotomy. CPB was instituted via standard double aortic-bicaval cannulation and moderate hypothermia 32 to 28°C. Myocardial protection was achieved by antegrade heart perfusion. Age, sex, presentation, site and outcome of surgical repair were analyzed. The patients were followed up to 2 years at our outpatient department.

Data analyzed by using Statistical Package for Social Sciences (SPSS) version 17.0.

RESULTS

The frequency of RSVA's was more in male (n=17; 73.91%) compared to females (n=6; 26.08%). Patients were ranging in age from 17 to 49 years with median age of 27 years. All patients were Khyber Pakhtunkhwa province of Pakistanis. The base line characteristics including presentation, cusp involvement, site of rupture, associated anomalies and techniques' used for repair are given in Table 1. Most of the patients presented with palpitation (78.26%) and shortness of breath (56.52%). Asymptomatic murmur was present in 2 patients (8.69%).

Transesophageal echo was done in all patients to investigate and diagnose SVA's cases. CT angiography was done in 34.78% of the patients and angiography was done in only those patients aged above 40 years.

Few cases were also associated with other cardiac anomalies. In 2 cases (8.69%), with severe aortic regurgitation, aortic valve was also replaced with mechanical prosthetic valve by prolene 6/0 along with repair of ruptured SVA's.

Preoperatively, 34.78% & 52.17% patients were having NYHA functional status III & IV respectively, while

TABLE 1: TABLE 1: BASIC CHARACTERISTICS OF PATIENTS

Characteristics		Frequency (n=23)	%age	Characteristics		Frequency (n=23)	%age
Presentation	Palpitation	18	78.26	Rupture site	Right Ventricle	21	91.30 %
	Shortness of breath	13	56.52		Right Atrium	2	8.69
	Acute chest pain	2	8.69	Associated Anomalies	Aortic Regurgitation	05	21.73
	Asymptomatic murmur	2	8.69		Ventricular Septal Defects	03	13.04
Cusp involvement	Right coronary cusp	20	86.95	Techniques for Repair	Direct Pladgeted Closure	20	86.95%
	Non coronary cusp	3	13.04		Patch Closure	03	13.04%

TABLE II: PRE & POST-OPERATIVE FUNCTIONAL STATUS OF PATIENTS AS PER NEW YORK HEART ASSOCIATION (NYHA) FUNCTIONAL CLASSIFICATION

NYHA# Status	Pre-operatively		Post-operatively	
	Frequency n=23	Percentage	Frequency n=22	Percentage
I	0	0 %	10	45.45%
II	3	13.04%	8	36.36%
III	8	34.78%	4	18.18%
IV	12	52.17%	0	0%

#New York Heart Association

postoperatively 45.45% & 36.36% patients were having NYHA functional status I & II respectively (Table II). Mortality was 4.35% (n=1/23) and one (4.35%) patient had residual leak and managed conservatively. Two years follow up showed no complication regarding ruptured SVA.

DISCUSSION

Aneurysm of the sinus of Valsalva is a relatively rare cardiac abnormality with congenital basis in most of the cases. Detailed illustrations of the sinuses of Valsalva were first published in 1740, in Antonio Maria Valsalva's Opera.[10] Congenital aneurysms are caused by weakness at the junction of the aortic media and the annulus fibrosus.[1,5,11] Acquired lesions occur secondary to disease processes that involve the aortic root like syphilis and infective endocarditis.[12]

In our study the frequency of RSVA's was more in male compared to female (73.91% v 26.08%). Patient's age was between 17 to 49 years with median age of 27 years. This supports other national and international studies reporting higher frequency of RSVA's in young males.[1,6,13-14] As this study had been conducted in Pakistan so all patients belonged to Asian race.

Most of the patient (78.76%) having RSVA presented to our unit with symptoms of exertional dyspnea, palpitations, and chest pain. Twenty per cent of the cases presented with acute symptoms to their setup.[5,6]

Preoperatively, 52.17% & 34.78% of patients were having NYHA functional status IV & III respectively, while postoperatively 45.45% patients were having NYHA functional status I. These results are comparable to those cited in literature.[6,13-15] The frequency of New York Heart Association class showed that more patients belonged to higher classes in our study population and similar findings were observed in other studies.[6,13-15]

In our study, right coronary cusp (86.95%) was involved in most of the patients of the ruptured SVA's cases followed by non-coronary cusp (13.04%). These figures correlate well with the prevailing literature.[2,6,7,11,14-20] SVAs arising from the left coronary sinus can rupture into the left ventricle or atrium.[22,23]

The literature reveals that the most common site of ruptured sinus of valsalva is right ventricle (50-73%).[2,6,7,11,14-20] Our study also supports this fact as 91.30% and 8.69% of our cases had ruptured their right ventricle and right atrium respectively. We did not observe any case of ruptured SVA opening into left chambers.

SVAs are commonly associated with other cardiac and aortic conditions like VSD, AR, coarctation of aorta and tricuspid insufficiency. VSD frequently occurs in these patients and is considered as a common predisposing factor for aortic valve insufficiency.[2,6,7] In our study among the cases, AR was present in 21.73% and VSD in 13.04%. But in literature the association of VSD is very much high 27-73% compared to aortic valve insufficiency 5-35%.[2,6,7,11,14-20] Asian patients have a higher incidence of VSD compared to patients from western countries. In a study from China and Japan conducted on 654 patients revealed that VSD occurred in 343 patients (52.4%), whereas only 37.5% of Western patients had associated VSD.[2] It was also depicted that in case of AR, if aortic valve was repaired, the operative results and postoperative long-term survival rates were both excellent.[2,14] Successful aortic valve–sparing operations, such as remodeling or reimplantation procedures for sinus of Valsalva aneurysms, have recently been reported. But they are suitable for mild to moderate aortic insufficiency.[24, 25]

The surgical approach for closure of a ruptured aneurysm is based on its position and associated lesions.[26] Currently Three approaches are practised to repair ruptured aneurysms, one is through the terminal chamber, another via the aortic root, and third one is combined one. Trans-aortic repair may cause postoperative aortic regurgitation because of the geometric distortion of the aortic sinus.[14,16] Morrow AG, et al[27] and Bigelow WG, et al[28] described the first surgical repair of SVA in the mid-1950s using hypothermia and inflow occlusion techniques.

All patients presented to our unit with ruptured SVA's underwent surgical repair of ruptured sinus along with removal of the aneurysmal sac. There are various factors which will define the surgical approach like whether the aneurysm is ruptured or not, the aortic valve replacement requirement, and the presence or absence of an aneurysmal orifice. The procedure of choice in most of the cases (21-95%) is patch closure of the orifice of the aneurysm.[2,6,7,11,14-20]

In our study, the primary defect was closed with pladgeted stiches in 86.95%, while the patch closure was done in 13.04% of cases. Patch closure technique was employed in cases, which were associated with ventricular septal defects. In contrast to our experience, Liu et al[6] stressed on patch closure for prevention of post-operative AR. He observed that direct suture closure of

RSVA may be associated with a higher risk of early worsening of postoperative AR. Ring et al[3]favor closing the SVA with a patch when the diameter of the defect exceeds 0.8 cm; while smaller defects can be closed with pledged interrupted sutures. In SVA patients, there is a potential risk of rupture, endocarditis, stroke and sudden death. So these all risks justify surgical repair of SVA even in asymptomatic cases, considering even better results from uncomplicated SVA.[26]

Once rupture has occurred, the mean survival period for untreated patients is 1–2 years.[3] In our study, one patient died within 24 hours after surgery because of low cardiac output and multi organ failure. One patient had residual leak. In literature, perioperative mortality for VSA is very low from 0 to 5% and long term survival after repair has found to be 59-100% in 10 years.[2,7,15-17] Two years follow up showed no complication regarding ruptured sinus of Valsalva in our study.

Among the recent advances in cases of SVA, compared to direct closure, cases with trans-catheter closure of ruptured SVA have also been done.[13,29,30] Large number of cases also repaired on On-pump beating heart surgery.[14] On-pump beating-heart surgery is characterized by avoidance of ischemia-reperfusion injury and cardioplegia.

Limitations of the study: Limited number of cases and a relatively short follow-up period are the main limitations of our study.

CONCLUSION

Our study revealed that SVA are very uncommon anomalies in our setup which commonly involve right coronary cusp in majority of the cases rupturing mostly into right side of heart.Surgical repair of VSA is a safe procedure having good outcome in terms of morbidity and mortality.

REFERENCES

1. Sarikaya S, Adademir T, Elibol A, Büyükbayrak F, Onk A, Kirali K. Surgery for ruptured sinus of Valsalva aneurysm: 25-year experience with 55 patients. Eur J Cardiothorac Surg 2013; 43(3): 591-6.
2. Wang Z, Zou C, Li D, Li H, Wang A, Yuan G, et al. Surgical Repair of Sinus of Valsalva Aneurysm in Asian Patients. Ann Thorac Surg 2007; 84(1): 156-60.
3. Ring WS. Congenital Heart Surgery Nomenclature and Database Project: aortic aneurysm, sinus of Valsalva aneurysm, and aortic dissection. Ann Thorac Surg 2000; 69: S147-63.
4. Lisowski P, Hirnie T, Adamczuk A, Lisowska A, Sobkowicz B, Nadlewski S, et al. Rupture of the sinus of Valsalva aneurysm complicated by infective endocarditis–diagnosis difficulties. Kardiol Pol 2006; 64: 77-79.
5. Feldman DN, Gade CL, Roman MJ. Ruptured Aneurysm of the Right Sinus of Valsalva Associated with a Ventricular Septal Defect and an Anomalous Coronary Artery. Tex Heart Inst J 2005; 32(4): 555-9.
6. Liu YL, Liu AJ, Ling F, Wang D, Zhu YB, Wang Q, et al. Risk factors for preoperative and postoperative progression of aortic regurgitation in congenital ruptured sinus of Valsalva aneurysm. Ann Thorac Surg 2011; 91: 542-8.
7. Moustafa S, Mookadam F, Cooper L, Adam G, Zehr K, Stulak J, et al. Sinus of Valsalva aneurysms – 47 years of a single center experience and systematic overview of published reports. Am J Cardiol 2007; 99: 1159-64.
8. Saito T, Asano M, Ishida M, Sasaki S, Nomura N, Ukai T et al. Ruptured left coronary sinus of valsalva aneurysm into the left ventricle. Ann Thorac Surg 2004; 78: 2187.
9. Maruo A, Higami T, Obo H, Shida T. Ruptured sinus of Valsalva aneurysm associated with aortic regurgitation caused by hemodynamic effect solely. Eur J Cardiothorac Surg 2003; 24: 318-9.
10. Valsalva AM: Viri celeberrimi Antonii MariaeValsalvae. Opera 1740.
11. Ott DA. Aneurysm of the sinus of Valsalva. SeminThorac Cardiovasc Surg Pediatr Card Surg Ann 2006; 9: 165-76.
12. Generali T, Garatti A, Biondi A, Varrica A, Menicanti L. Aorta to right atrial shunt due to the rupture of a degenerative aneurysm of the noncoronary sinus of Valsalva. J Cardiovasc Med (Hagerstown). 2013; 14(1): 71-3.
13. Kerkar PG, Lanjewar CP, Mishra N, Nyayadhish P, Mammen I. Transcatheter closure of ruptured sinus of Valsalva aneurysm using the Amplatzer duct occluder: immediate results and mid-term follow-up. Eur Heart J 2010; 31: 2881-7.
14. Mo A, Lin H, Surgical correction of ruptured aneurysms of the sinus of Valsalva using on-pump beating-heart technique. J Cardiothorac Surg 2010; 5: 37.
15. Yan F, Huo Q, Qiao J, Murat V, Ma SF. Surgery for sinus of Valsalva aneurysm: 27-year experience with 100 patients. Asian CardiovascThorac. Ann 2008; 16: 361-5.
16. Zhao G, Seng J, Yan B, Wei H, Qiao C, Zhao S et al. Diagnosis and surgical treatment of ruptured aneurysm in sinus of Valsalva. Chin Med J (Engl) 2003; 116: 1047-50.
17. Lin CY, Hong GJ, Lee KC, Tsai YT, Tsai CS. Ruptured congenital sinus of valsalva aneurysms. J Card Surg 2004; 19: 99-102.
18. Harkness JR, Fitton TP, Barreiro CJ, Alejo D, Gott VL, Baumgartner WA et al. A 32-year experience with surgical repair of valsalva aneurysms. J Card Surg 2005; 20: 198-204.
19. Jung SH, Yun TJ, Im YM, Park JJ, Song H, Lee JW et al. Ruptured sinus of Valsalva aneurysm: transaortic repair may cause sinus of Valsalva distortion and aortic regurgitation. J Thorac Cardiovasc Surg 2008; 135: 1153-8.
20. Guo HW, Sun XG, Xu JP, Xiong H, Wang XQ, Su WJ et al. A new and simple classification for the non-coronary sinus of Valsalva aneurysm. Eur J Cardiothorac Surg 2011; 40: 1047-51.
21. Ouali S, Kortas C, Brockmeier K, Boughzela E. Adult aortic coarctation discovered incidentally after the rupture of sinus of Valsalva aneurysm: combined surgical and interventional approach. Interact CardiovascThorac Surg 2011; 13(6): 688-90.
22. Tan H, Chen FR. Clinical analysis of 133 patients with ruptured sinus of Valsalva aneurysm. South China J Cardiovasc Dis 2003; 9: 268-70.
23. Desai A, Mehta N, Mandurke V, Vichare S, Sonawane A. Left coronary sinus of Valsalva aneurysm ruptured into the left ventricle – Case report. J Indian Coll Cardiol 2013; 3(1): 32-6.
24. Akashi H, Tayama E, Tayama K, Kosuga T, Takagi K, Aoyagi S. Remodeling operation for unruptured aneurysms of three sinuses

of Valsalva. J Thorac Cardiovasc Surg 2005; 129: 951-2.

25. Hughes GC, Swaminathan M, Wolfe WG. Reimplantation technique (David operation) for multiple sinus of Valsalva aneurysms. Ann Thorac Surg 2006; 82: 14-6.
26. Galicia-Tornell MM, Marín-Solís B, Mercado-Astorga O, Espinoza-Anguiano S, Martínez-Martínez M, Villalpando-Mendoza E. Sinus of Valsalva aneurysm with rupture. Case report and literature review. Cir Cir 2009; 77: 441-5.
27. Morrow AG, Baker RR, Hanson HE, Mattingly TW: Successful surgical repair of a ruptured aneurysm of the sinus of Valsalva. Circulation 1957; 16: 533-8.
28. Bigelow WG, Barnes WT: Ruptured aneurysm of aortic sinus. Ann Surg 1959; 150: 117-21.
29. Srivastava A, Radha AS. Case report; transcatheter closure of ruptured sinus of valsalva aneurysm into the left ventricle: a retrograde approach. Pediatr Cardiol 2012; 33(2): 347-50.
30. Szkutnik M, Kusa J, Glowacki J, Fiszer R, Bialkowski J. Transcatheter closure of ruptured sinus of valsalva aneurysms with an Amplatzer occluder. Rev Esp Cardiol 2009; 62: 1317-21.

AUTHOR'S CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under:

AM: Study design, acquisition of data, drafting the manuscript, final approval of the version to be published

TSB, IKK, MAS: acquisition and analysis of data, drafting the manuscript, final approval of the version to be published

NL: drafting the manuscript, critical revision, final approval of the version to be published

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

CONFLICT OF INTEREST

Authors declare no conflict of interest

GRANT SUPPORT AND FINANCIAL DISCLOSURE

NIL

KMUJ web address: www.kmuj.kmu.edu.pk

Email address: kmuj@kmu.edu.pk