COMPARISON OF POSTOPERATIVE OUTCOMES WITH AND WITHOUT TRICUSPID LEAFLET DETACHMENT IN PATIENTS UNDERGOING VENTRICULAR SEPTAL DEFECT REPAIRS

Muhammad Usman Riaz[1], Tariq Waqar[2], Mirza Ahmad Raza Baig[3]

[1-2] Department of Paediatric Cardiac Surgery, Chaudhry Pervaiz Elaihi Institute of Cardiology, Multan - Pakistan.
[3] Clinical Perfusionist, Chaudhry Pervaiz Elaihi Institute of Cardiology, Multan - Pakistan.
Address for Correspondence:
Dr. Muhammad Usman Riaz
Senior Registrar,
Paediatrics Cardiac Surgery,
Chaudhry Pervaiz Elaihi Institute of Cardiology, Multan - Pakistan.
Email: usman1i@yahoo.com
Date Received:
July 26, 2016
Date Revised:
May 24, 2017
Date Accepted:
June 02, 2017

ABSTRACT

Objective: To compare outcomes of peri-membranous ventricular septal defects (VSD) closure with and without tricuspid valve detachment (TVD) in terms of residual VSD's, postoperative heart blocks, tricuspid regurgitation and operative time.

Methodology: This retrospective study was conducted in Department of Pediatric Cardiac Surgery, Chaudhry Pervaiz Elahi Institute of Cardiology, Multan from January 2009 to June 2015. There were 32 patients in tricuspid detachment (TVD) group and 204 in non-TVD group. The study endpoints were any incidence of postoperative residual VSD, heart block or tricuspid regurgitation. Fischer's exact test was used to compare study endpoints.

Results: In TVD group 18 (56.3%) were male and in non-TVD group 141 (68.1%) were male. Mean age in the TVD group was 13.38 ±6.91 years. While in non-TVD group it was 11.34 ±6.06 years. Mean cross clamp time was 67.91 ±27.3 minutes and mean bypass time was 98.13 ±32.5 minutes in TVD group. In non-TVD group mean cross clamp time was 58.63 ±24.46 minutes and bypass time was 93.40 ±30.11 minutes (p values were 0.07 and 0.44 respectively). Only 1 (3.1%) case was noted in TVD group with moderate tricuspid regurgitation and 4 (2.0%) cases were noted in non-TVD group. One (3.1%) case was noted with residual VSD in TVD group while 7 (3.4%) were noted in non-TVD group.

Conclusion: In our study difference in outcomes did not come up to a statically significant difference but it showed low incidence of tricuspid regurgitation and residual VSD in TVD group.

Key Words: Ventricular septal defects, Tricuspid valve detachment, Tricuspid regurgitation

This article may be cited as: **Riaz MU, Waqar T, Baig MAR. Comparison of postoperative outcomes with and without tricuspid leaflet detachment in patients undergoing ventricular septal defect repairs. J Postgrad Med Inst 2017; 31(3): 247-50.**

INTRODUCTION

A ventricular septal deformity (VSD) is characterized as an opening or hole in the interventricular septum. Separated VSD happens in roughly 2 out of each 1000 live births and constitutes more than 20% of all congenital heart sickness. In the light of this fact, separated VSD may be the most common type of inherent cardiac illness[1,2].

The lion's share of ventricular septal deformities (VSD) can be effectively managed utilizing a transatrial approach working over the tricuspid valve[3]. In few patients chordal connections of the tricuspid valve cloud the edges of the deformity. In these patients, situation of sutures might be difficult bringing about contortion of the tricuspid valve resulting in tricuspid regurgitation (TR), remaining VSD and heart block. Separation of the septal leafet of the tricuspid valve from the annulus to enhance perception of VSDs was at first depicted by Hudspeth and partners in 1962[3,4]. There has been worry that unit of the tricuspid valve leaflet may weaken, increased bypass time and the occurrence of postoperative heart block. A few reports, be that as it may, have proposed that tricuspid valve detachment (TVD) is a sheltered method to enhance presentation for conclusion of VSDs[3-5]. Certain configurations of VSD's restrict tranatrial approach because such approach in terms of better exposure at septal perimembranous level; may result in residual defects and valvular damage due to retractors translating into tricuspid regurgitations. Since proposal by Hudspath and colleagues[3], the method of tricuspid valve detachment hadn't get wide spread acceptability. This is further attributed to the fear of dam-

aging the valvular apparatus and the conduction system. Regardless of these reports, TVD has not picked up acknowledgment as a valuable and safe method. In our setup we have recently started peri-membranous ventricular septal defects (VSD) closure with tricuspid valve detachment. The present study was embraced to compare the outcomes of peri-membranous ventricular septal defects (VSD) closure with and without tricuspid valve detachment (TVD) in terms of residual VSD's, postoperative heart blocks, tricuspid regurgitation and operative time.

METHODOLOGY

This retrospective study was conducted in Department of Pediatric Cardiac Surgery, Chaudhry Pervaiz Elaihi Institute of Cardiology. After approval of study from local ethics committee, data base of cardiac surgery department was searched for closure of perimembranous VSD between January 2008–June 2015. All cases who underwent closure of peri-membranous ventricular septal defect (VSD) with and without tricuspid valve detachment of any age group and gender were included in this study. Patients with peri-membranous VSD associated with other cardiac anomalies like tetralogy of fallot, atrial septal defects and transposition of great vessels were excluded. Patients were divided in 2 groups; Group 1 in whom tricuspid valve was detached along with VSD closure and group 2 in whom tricuspid valve was not detached and only VSD closure was done. There were 32 patients in tricuspid detachment (TVD) group and 204 in non-TVD group.

All procedures were performed by 2 cardiac surgeons (one was of associate professor rank while other was of assistant professor rank). Peri-membranous VSDs were subjected to closure through opening in right atrium. Dacron patch was used to close VSD after retracting by retractors or detaching septal leaflet of tricuspid valve. Tricuspid valve detachment (TVD) by separating the septal leaflet and sometimes anterior leaflet of tricuspid valve from the annulus by giving an incision just at their confluence to have better view of VSD. Detached leaflet was resutured by using interrupted prolene 6/0 (ethicon) stitches.

The study endpoints were any incidence of postoperative residual VSD, heart block or tricuspid regurgitation. Residual VSD was confirmed by flow across applied Dacron patch on applying color Doppler modality on echocardiography. Complete Heart block either temporary or permanent was diagnosed by random P waves and QRS complexes on electrocardiography. Tricuspid regurgitation was labeled if there was reflux of blood from right ventricle to right atrium using color Doppler on echocardiography. It was graded as; no, trivial, mild, moderate and severe depending upon the severity of regurgitation.

The collected information was entered and analyzed through SPSS version 23. Descriptive statistics were used to analyze the data. The quantitative variables like age, cross clamp time, bypass time were expressed by taking mean±standard deviation and compared by using independent sample t-test. Gender and study endpoints e.g. residual VSD, heart blocks and tricuspid regurgitation in both groups were compared by chi-square test or Fisher's exact test. P value equal or less than 0.05 ($P \leq 0.05$) was taken to be significant.

RESULTS

Analysis of our record generated 236 cases which were operated for VSD during the period included in study. 32 patients were operated with tricuspid valve detachment, while 204 were operated without tricuspid valve detachment. In TVD group 18 were male (56.3%) and in non-TVD group 142 (70.0%) were male. There was no significant difference in mean cross clamp time and bypass time between the groups (table 1). There was no case of severe tricuspid regurgitation in either group. Only 1(3.1%) case was noted in TVD group with moderate tricuspid regurgitation and 4 (2.0%) cases were noted in non-TVD group. No incidence of permanent or temporary heart block was observed in either group. Only 1 (3.1%) case of residual VSD was noted in TVD group while 7 cases (3.4%) in non-TVD, (p value 1.0) [Table 2].

Table 1: Comparison of baseline and operative characteristics between the groups

Variable	TVD Group 1	Non-TVD Group 2	P-value
Age (Y)	13.38±6.9	11.34±6.06	0.12
Male Gender	18 (56.3%)	142 (70.0%)	0.28
Cross-clamp time (min.)	67.91±27.3	58.63±24.46	0.07
Bypass time (min.)	98.13±32.59	93.40±30.11	0.44

Table 2: Comparison of study endpoints

Variable	TVD Group 1	Non-TVD Group 2	P-value
Residual VSD	1 (3.1%)	7 (3.4%)	1.0
Tricuspid Regurgitation			
Trivial TR	3 (9.4%)	22 (10.8%)	0.86
Mild TR	2 (6.3%)	19 (9.3%)	
Moderate TR	1 (3.1%)	4 (2.0%)	
No TR	26 (81.3%)	159 (77.9%)	

DISCUSSION

In this study we reported the outcomes of peri-membranous ventricular septal defects (VSD) closure with and without tricuspid valve detachment. We found that there was no significant difference regarding outcomes of the surgery in patients in whom tricuspid valve detachment was done as compared to the patients without tri-cuspid valve detachment. Freckner et al[4] applied this method in 27 patients. They did not reported any complication in these patients. By 1990's this method started to gain acceptance as more and more researchers showed its efficacy in managing difficult VSD's. Maile et al[5] used this technique in 67% of cased and reported no significant postoperative problems. In our study we used it in 13.55 % of cases.

Mean age in our study was 13.38 ±6.9 years for the TVD group and 11.34 ±6.06 years for the non TVD group. These figures are different from other studies where majority of operations are performed on children younger than 1 year of age. More and more applicability of the technique is being explored and Bang et al[6] even used in patients younger than 3 months of age. Zhao et al[7] in there study showed mean age to be 4.7 years. Mean cross clamp time and by-pass time was slightly longer in TVD group than non TVD group. But it was not statistically significant as shown by p value. This finding was also noted by Zhao et al[7]. It was contrary to believe that tricuspid valve detachment leads to a significant prolongation of operative time as shown by Bang et al[6] in their study. They showed a significant prolongation of operative time in infants less than 3 months of age.

After tricuspid valve detachment main concern is tricuspid regurgitation afterwards in the long run. Gaynor and colleagues[8] reported no patient more than mild tricuspid regurgitation in TVD group while 6 (4.4%) patients in there non-TVD group has more than mild regurgitation. In our study, 1 patient has moderate TR in TVD group and 4 patients had moderate TR in non TVD group. This finding was statistically insignificant. Sasson et al[9] defined the criteria which can be used in deciding whether to go for TVD or not. They included cases in which VSD margins were obscured by tricuspid leaflet, studded with chordal straddling or forming an aneurysmal tissue. Such abnormalities on TVD and repairing afterwards tend to correct itself. This might explain low incidence of TR as shown by them in their study.

Second concern after TVD is occurrence of post-operative complete heart block. Reason for it is as conduction bundle is lying in vicinity of tricuspid valve and there are chances of entrapping it during repair of tricuspid leaflet. None of the patients in our study developed complete or temporary heart block. Anderson and colleagues[10] studied 2,079 patients who underwent VSD closure either alone or in association with other heart abnormalities. Of them 996 were operated only for VSD's with 7(0.7%) patients developed complete heart block (CHB). Tucker et al[11] reported incidence of 1.1% and concluded Down's syndrome to be one of the most common association with CHB.

We have used interrupted sutures to attach detached tricuspid leaflet to the annulus when patient is still under cardiac arrest. Accurate placement being desired probably resulted in prolonger cross clamp and bypass time. Some surgeons use running sutures to attach leaflet to annulus. Our concern was that employing this technique may result in purse string effect resulting in distorted tricuspid valve. This finding was advocated by Tatebe and colleagues[12] in small children and infants with Down's syndrome.

We have used circumferential incisions to detach tricuspid valve from annulus. Russel et al[13] employed a different method in 236 patients by employing a radial incision in dividing tricuspid leaflet. They used an incision on the septal leaflet near anteroseptal commissure dividing tricuspid leaflet between attachments of chordae. Study was conducted over a period of 15 years. They also reported it to be a reliable and safe technique that allows complete closure of VSD without any significant increase in any of the complication described above. They have recommended circumferential technique in cases where there is excessive tricuspid valvular attachments with the crest of VSD because anatomy here renders radial technique bit unsafe. Kapoor et

al[14] described a technique in which the chordae arising from the annulus of VSD were detached. VSD is repaired and chordae were attached with a pledget to their native place. Our consciousness alarm us of immediate development of tricuspid insufficiency in cases of avulsion of that pledgeted stitch. So we don't recommend such technique. Bol-Raap and colleagues[15] from Netherlands also employed the technique in 39 out of total 149 patients and they found that there is no incidence of tricuspid regurgitation after detachment. However, they found a relatively higher incidence of trivial residual VSD in patients where detachment of leaflet was not employed. They also noted a higher cross clamp time in tricuspid detachment group.

LIMITATIONS

Main limitation of our study was that it was done on older children as compared to most of the centers where surgery is being done at a comparatively younger age group. Secondly decision to divide leaflet was wholly on surgeon discretion rather than certain set measureable criteria. Thirdly, it was a retrospective study and proper randomization protocols and assessment could not be employed. Fourthly, follow-up echocardiography was not performed by a single cardiologist. So element of operator to operator variability could not be ruled out.

CONCLUSION

In our study difference in outcomes did not come up to a statically significant difference but it showed low incidence of tricuspid regurgitation and residual VSD in TVD group. In our opinion tricuspid valve detachment in difficult cases of limited exposure to VSD is an effective technique. It not only eases exposure to the operating surgeon which interim results in better postoperative outcome. Increased cross clamp time can be weighed against better post-operative results.

REFERENCES

1. Mavroudis C, Backer CL, Idriss FS. Ventricular septal defect. In: Mavroudis C, Backer CL, eds. Pediatric cardiac surgery, 2nd ed. St. Louis: Mosby, 1994:201–24.
2. Mitchell SC, Korones SB, Berendes HW. Congenital heart disease in 56,109 births: incidence and natural history. Circulation 1971;43:323.
3. Hudspeth AS, Cordell AR, Meredith JH, Johnston FR. An improved transatrial approach to the closure of ventricular septal defects. J Thorac Cardiovasc Surg 1962;43:157-65.
4. Frenckner BP, Olin CL, Bomfim V, Bjarke B, Wallgren CG, Björk VO. Detachment of the septal tricuspid leaflet during transatrial closure of isolated ventricular septal defect. J Thorac Cardiovasc Surg. 1981 Nov;82(5):773-8.
5. Maile S, Kadner A, Turina MI, Pretre R. Detachment of the anterior leaflet of the tricuspid valve to expose perimembranous ventricular septal defects. Ann Thorac Surg 2003;75(3):944-6.
6. Bang JH, Park CS, Park JJ, Yun TJ, Baek JS, Yu JJ, et al. Detachment of the tricuspid valve for ventricular septal defect closure in infants younger than 3 months. J Thorac Cardiovasc Surg. 2016 Apr 12. pii: S0022-5223(16)30074-5. doi: 10.1016/j.jtcvs.2016.03.067. [Epub ahead of print]
7. Zhao J, Li J, Wei X, Zhao B, Sun W. Tricuspid valve detachment in closure of congenital ventricular septal defect. Tex Heart Inst J. 2003;30(1):38-41.
8. Gaynor JW, O'Brien J, Rychik J, Sanchez G, DeCampli W, Spray T. Outcome following tricuspid valve detachment for ventricular septal defects closure. Eur J Cardiothorac Surg 2001;19:279–82.
9. Sasson L, Katz MG, Ezri T, Tamir A, Herman A, Bove EL, et al. Indications for tricuspid valve detachment in closure of ventricular septal defect in children. Ann Thorac Surg 2006;82(3):958-63.
10. Andersen HØ, de Leval MR, Tsang VT, Elliott MJ, Anderson RH, Cook AC. Is complete heart block after surgical closure of ventricular septum defects still an issue? Ann Thorac Surg. 2006 Sep;82(3):948-56.
11. Tucker EM, Pyles LA, Bass JL, Moller JH. Permanent pacemaker for atrioventricular conduction block after operative repair of perimembranous ventricular septal defect. J Am Coll Cardiol. 2007 Sep 18;50(12):1196-200. Epub 2007 Sep 4.
12. Tatebe S, Miyamura H, Watanabe H, Sugawara M, Eguchi S. Closure of isolated ventricular septal defect with detachment of the tricuspid valve. J Card Surg 1995;10(5):564-8.
13. Russell HM, Forsberg K, Backer CL, Wurlitzer KC, Kaushal S, Mavroudis C. Outcomes of radial incision of the tricuspid valve for ventricular septal defect closure. Ann Thorac Surg. 2011 Aug;92(2):685-90; discussion 690. doi: 10.1016/j.athoracsur.2011.03.023.
14. Kapoor L, Gan MD, Bandyhopadhyay A, Das MB, Chatterjee S. Improved exposure of isolated perimembranous ventricular septal defects. Ann Thorac Surg 2000;69:291–2.
15. Bol-Raap G, Bogers AJJC, Boersma H, De Jong PL, Hess J, Bos E. Temporary tricuspid valve detachment in closure of congenital ventricular septal defect. Eur J Cardiothorac Surg 1994;8:145– 8.

CONTRIBUTORS

MUR conceived the idea, planned the study, and drafted the manuscript. TW and MARB helped acquisition of data, did statistical analysis and critically revised the manuscript. All authors contributed significantly to the submitted manuscript.