

Experience with Autologous Pericardial Patch Closure of Ventricular Septal Defect

Jabbar Jasim AL-Tae

ABSTRACT:

BACKGROUND:

Conventionally, Ventricular Septal Defects (VSDs) are repaired with synthetic patch-Dacron (polyethylene terephthalate) or Goretex (expanded polytetrafluoroethylene). Recently, we began using glutaraldehyde-treated autologous pericardial patch to repair VSDs. We review our experience.

OBJECTIVE:

In this study, we are evaluating the result of closure of VSD by pericardial patch instead of synthetic patch.

MATERIALS AND METHOD:

Between January 2009 to April 2014, 60 children had their VSDs repaired with glutaraldehyde-treated autologous pericardium. There were 20 males and 40 females, aged between 2 years and 12 years with a median age of 4 years. The diagnosis was isolated VSD in 49 patients, multiple VSD in 3: Tetralogy of Fallot (TOF) in 8 patients. The chest was opened by median sternotomy incision. After establishing cardiopulmonary bypass, a strip of pericardium was harvested from patient and fixed in 0.6% glutaraldehyde for about 25 minutes. It was then washed out with 0.9% saline solution. The defect was repaired with 4/0 suture using a continuous suture technique.

RESULTS:

There was no hospital mortality. Postoperative echocardiogram revealed trivial leaking in 10 patients. Follow up was for 3 to 6 months (mean 2 months). No patient required reoperation for residual VSD.

CONCLUSION:

Glutaraldehyde-treated autologous pericardium is an excellent material for surgical patch closure of VSD. It is easily available and does not require sterilization.

KEY WORDS: VSD, pericardial patch, dacron patch, Goretex patches.

INTRODUCTION:

VSD closure is the commonest congenital procedure. Synthetic materials like Dacron and Goretex patches are used for VSD repair. Autologous pericardium is attractive because it is free, easily available and sterile. Experience with bovine pericardial patch closure of congenital VSD is limited. We report our experience with glutaraldehyde-treated pericardium for VSD closure in our congenital cardiac surgical practice.

AIM OF STUDY:

In this study, we are evaluating the result of closure of VSD by pericardial patch instead of synthetic patch.

Department of Cardiac Surgery, Ibn Al-Nafees Hospital for Cardiothoracic Diseases.

MATERIAL AND METHODS:

Between January 2009 to April 2014 in Ibn-alnafees hospital for cardiovascular diseases, 60 patients had surgical patch closure of VSDs in our unit using glutaraldehyde-treated autologous pericardium. There were 20 males and 40 females aged between 2 years to 12 years, with a median age of 4 years. The weight range was 10 Kg to 20 Kg (mean 13 Kg). The clinical profile is depicted in table 1. The diagnosis was established by two-dimensional (2D) echocardiogram, 5 patients required cardiac catheterization and angiogram to clarify the pulmonary artery anatomy.

After routine median sternotomy, the thymus was carefully dissected from pericardium and partially removed. A free graft of pericardium was harvested, taking care to avoid injury to phrenic nerves. It was stretched out on a stiff, sterile cardboard paper to

PERICARDIAL PATCH CLOSURE

remove wrinkles and fixed with hemoclips. It treated with 0.6%

glutaraldehyde solution for 25 minutes and rinsed 3 times in 0.9% saline solution for 5 minutes.

Table1: Clinical Profile.

Daignose	No.of patients
1.Subaortic VSD	34
2. .Multiple VSD	3
3.VSD,PDA	3
4.VSD,PS	4
5.VSD,ASD	4
6.VSD-AR	3
7.Subpulmonic VSD	1
8.TOF	8

Abbreviations: VSD-ventricularseptal defect: PDA-patent ductusarteriosus:PS-pulmonarystenosis:ASD-arterialseptaldefect:AR-aorticregurgitation:TOF-Tetralogy of Fallot.

Cardiopulmonary bypass was established with aortobicavalcannulation. Under moderate hypothermia and cold blood cardioplegic arrest, the right atrium was opened and the VSD was inspected. Infundibular resection was done in tetralogy patients. The pericardium patch was trimmed to match the size of the VSD. The defect was closed with the pericardial patch using 4/0 polypropylene continuous suture; starting from the inferior margin and proceeding towards the anterosuperior margin and superiorly toward the aortic valve, avoiding injury to the aortic cusps. With second arm of the suture, the posteroinferior margin was closed up to the septal leaflet of the tricuspid valve. The tricuspid margin of the defect was closed with a reinforcing strip of pericardium. Patients with TOF required a slightly larger patch for intraventricular tunnel repair of the defect. Infundibular resection was necessary in the patients with TOF and all of them also required a transannular pericardial patch augmentation of the right ventricular outflow tract (RVOT). 3 patients required additional direct closure of muscular VSDs. Patent ductus arteriosus ligation was done in 3 patients simultaneously.

RESULTS:

The mean cardiopulmonary and aortic crossclamp times were 90 and 20 minutes respectively. The mean Intensive Care Unit (ICU) stay was 2 days; ventilation 24 hrs; and hospital stay 7 days. There was no hospital mortality. 3 patients had nodal rhythms that were managed with temporary pacing and resolved with one week. One patient required permanent pacemaker because of complete heart block. 2 patients with noncompaction ventricle were managed with inotropic support.

All patients had postoperative 2D echocardiogram before discharge. 10 patients had trivial leak across patch. No patient required redo surgery.

Follow-up was for 3 to 6 months. None of them showed patch aneurysm, vegetation, significant residual shunt or calcification.

DISCUSSION:

Generally VSDs are repaired with synthetic material: either Dacron (polyethylene terephthalate) or Goretex (expanded polytetrafluoroethylene) depending on surgeon's preference. Dacron elicits a fibrous reaction that is probably helpful in sealing off tiny residual VSDs that are often seen by echocardiogram in the early postoperative period⁽¹¹⁾. Autologous and xenograft (bovine, equine) pericardium also be used for VSD closure. Fresh, untreated pericardium is difficult to handle and with time can both shrink as well as stretch. Schoof et al reported that aneurysm formation can occur due to not only the use of fresh autologous pericardial patches but also intra-operative patch oversizing⁽³⁾. There is evidence from its use to construct conduits that there can be an impressive degree of enlargement^(4,5).

Glutaraldehyde was introduced into cardiac surgery by Alain Carpentier. Treatment of pericardium with 0.6% glutaraldehyde results in cross-linking of collagen molecules and strengthens the pericardium as well as fixing its shape and reducing its elasticity⁽⁸⁾. There are several benefits derived from fixing pericardium. The patch can be cut and shaped with expectation that when it is exposed to pressure it will retain approximately the same shape and size⁽¹²⁾. The risk of aneurysmal dilation is reduced by fixation.⁽⁶⁾

Bovine pericardium may evoke an immune response and is expensive. Synthetic patches carry a small but definite risk of endocarditis⁽⁷⁾.

We prefer to use a continuous suture technique for VSD closure. Occasionally, the defect may be obscured by chordal tissue⁽⁹⁾. Continuous sutures allow weaving in and out between these chordal tissues. Detachment of the base of the tricuspid septal leaflet has been advocated by some to improve exposure of a difficult VSD⁽⁸⁾, but we have never had to use this technique so far⁽¹⁰⁾. Patch sizing is important to reduce the risk of aneurysmal dilation and to prevent right/left ventricular outflow tract obstruction (RVOTO/LVOTO);⁽¹³⁾ we have not encountered any of these complications. In our experience, none of the patients had significant residual VSDs. 10 patients had trivial residual shunts without any haemodynamic significance.

CONCLUSION:

Autologous pericardium is easily available, sterile and nonimmunoreactive. Fixation in 0.6% glutaraldehyde improves its handling qualities and reduces the risk of aneurysmal dilation. VSD can be closed effectively without significant residual shunt. Unlike the synthetic patches (Dacron, Goretex) and bovine pericardium, it is inexpensive. We conclude that glutaraldehyde-treated autologous pericardial patch is an excellent material for VSD closure. However, follow-up is required to assess its long term efficacy.

REFERENCES:

1. Fyler DC. Trends. In Fyler DC (ed). Nadas' pediatric cardiology. Philadelphia: Hanley Et Belfus, 1992: 273-80.
2. Us MH, Sungun M, Sanioglu S, Pocan S, Cebeci BS, Ogus T, et al. A retrospective comparison of bovine pericardium and polytetrafluoroethylene patch for closure of ventricular septal defects. J Int Med Res. 2004;32:218-21.
3. Schoof PH, Hazekamp MG, van Ulzen K, Bartelings MM, Bruyn JA, Helbing W, et al. Autologous pericardium for ventricular septal defect closure. J Heart Valve Dis 1998;7:407-9.
4. Kreutzer C, Kreutzer GO, DeC Mayorquim R, Roman MI, Vaguez H, Simon JL, et al. Early and late results of autologous fresh pericardial valved conduits. Semin Thorac Cardiovasc Surg Pediatr Card Surg Annu 1999;2:65-76.
5. Kawashima Y, Nakano S, Kato M, Danno M, Sato K: Fate of pericardium utilized for the closure of ventricular septal defect. Postoperative ventricular septal aneurysm. J Thorac Cardiovasc Surg 1974;68: 209-18.
6. Bennink GB, Hitchcock FJ, Molenschot M, Hutter P, Sreeram N. Aneurysmal pericardial patch producing right ventricular inflow obstruction. Ann Thorac Surg 2001;71:1346-47.
7. Amato JJ, Douglas WI, AbouEid GJ, Lukash F. Removal of an infected ventricular septal defect patch after tetralogy repair. Ann Thorac Surg 2000;70:2140-42.
8. Castaneda AR, Jonas RA, Mayer JE, Hanley F: Ventricular septal defect. In cardiac surgery of the neonate and infant. Philadelphia: Saunders, 1994; Chap 11:187-20.
9. Bacha EA, Cao QL, Starr JP, et al. Pericardial device closure of muscular ventricular septal defect. J Thorac Cardiovasc Surg 2003;126:17-18.
10. Joanna Chikwe, David Tom Cooke, Aaron Weiss. Cardiothoracic Surgery. 2nd Ed. United Kingdom: OXFORD university press, 2013: 566-67.
11. Holzer R, de Giovanni I, Walsh KP, Tometzki A, Goh T, Hakim F, Zabal C, de Lezo JS, Cao QL, Hijazi ZM. Transcatheter closure of perimembranous ventricular septal defects using the Amplatzer membranous VSD occluder: Immediate and midterm results of an international registry. Catheter Cardiovasc Interv 2006;68:620-28.
12. Xunmin C, Shisen J, Jianbin G, Haidong W, Lijun W. Comparison of results and complications of surgical and Amplatzer device closure of perimembranous ventricular septal defects. Int J Cardiol 2007;120:28-31.
13. David D. Yuh, Luca A. Vricella, Stephen C. Yang, John R. Doty, Johns Hopkins Textbook of Cardiothoracic Surgery. 2nd edition. US: Medical, 2014:1037-38.

