

# Three Indications for Bovine Jugular Vein Grafts in a Single Tertiary Centre in Jeddah: A Retrospective Study

Sameh Ibrahim Sersar<sup>1,\*</sup>, Ayman A. Sallam<sup>2</sup>, Mohammed M. Hassan<sup>3</sup> and Mohamed Abdelzaher<sup>4</sup>

<sup>1</sup>King Abdullah Medical City (KAMC), Makkah; KSA and Mansoura University Hospitals, Mansoura, Egypt, <sup>2</sup>Tanta University, Egypt; <sup>3</sup>KAMC Cardiac Surgery Department and <sup>4</sup>Critical Care Medicine Department, Cairo University Hospitals and KAMC, Makkah, KSA

**Abstract:** *Introduction and Aim of the Work:* Bovine jugular vein grafts (Contegra) can be used not only in the reconstruction of an abnormal right ventricular outflow tract (RVOT) but also for VSD repairs and as an extra-cardiac conduit for the Fontan circulation. (1-2-3-4-5). We aimed to present and review the preliminary results of contegra in the 3 different indications.

*Patients and Methods:* We reviewed the available charts of 22 patients who needed contegra as an RVOT reconstructive graft, 23 cases for Fontan extracardiac conduits and 8 cases of VSD in a single tertiary centre in Jeddah in more than 8 years between 2002 and 2011. The available demographic data, operative, ECHO findings, results, complications and the follow up data are presented and analysed.

*Results:* Fifty three cases were included in this retrospective study from June 2002 to January 2011. The Median age at the time of operation was 3.5 years (range 1-26 years). The thirty days mortality was 7.5 % (four patients); one Fontan patient died because of arrhythmia & sepsis, the other Fontan one due to lately detected thrombosed Fontan connection. The 3<sup>rd</sup> patient was a case of Fallot tetralogy who died because of ventricular dysfunction and the 4<sup>th</sup> one was a repaired VSD died because of sepsis and DIC. Follow-up was available for 40 (75.4%) patients at a mean of 19.8 months (range 8-78 months) postoperatively.

*Conclusion:* The Contegra xenograft is a good conduit for RVOT reconstruction, a potential acceptable alternative conduit for the extracardiac Fontan connections and can be used to close the VSD if it is associated with one of the previous 2 indications

**Keywords:** Bovine jugular vein grafts, Contegra.

## INTRODUCTION AND AIM OF THE WORK

**Contegra** has been clinically used as a reconstructive graft for the RVOT for more than 20 years with good results. It serves as a biologic valve that achieve a competent pulmonary valve. Due to the increasing number of grown up children who have congenital heart there is an increase in the dysfunction of the PV and the RVOT. If a competent valve is inserted early in the pulmonary position, it may protect the RV from irreversible pathological damage. Pulmonary homografts have functioned well and continued to be the gold standard [1-6]. The indications of contegra were extended to include VSD repairs and as an extra-cardiac conduit for the fontan circulation [4, 5]. Before the end of the 2<sup>nd</sup> millenium, the **Contegra** bovine jugular valved conduit (Medtronic, Inc., Minneapolis, MN, USA) was proposed, suggested and successfully used in the reconstruction of the RVOT [1-9].

The clinical trials for its use as a possible alternative to the homograft pushed it to gain a growing popularity

as an RVOT reconstructive conduit The early and midterm results of the **Contegra** conduit in the RVOT reconstruction is still controversial with some pros and cons. The **Contegra** conduit is a heterologous bovine jugular vein graft with a trileaflet venous valve and natural sinus slightly larger in diameter than its lumen. A large number of congenital heart diseases patients need valved conduits to establish an anatomical continuity between the right ventricle outflow tract (RVOT) and the pulmonary artery [6-13].

We aimed to review an 8 years experience in the use of Contegra for 3 indications in a single tertiary centre in Jeddah.

## PATIENTS AND METHODS

We retrospectively reviewed the charts of 22 patients who received contegra as an RVOT reconstruction, 23 cases for Fontan extra-cardiac conduits and 8 cases of VSD in a single tertiary centre in Jeddah in more than 8 years between 2002 and 2011. The demographic data, available ECHO, operative findings and follow up data are presented. The data were presented in means and medians P value was significant if <0.05 The Student t-test, chi-

\*Address correspondence to this author at the King Abdullah Medical City (KAMC), Makkah, KSA and Mansoura University Hospitals, Mansoura, Egypt; E-mail: Sameh001@yahoo.com

square test and Fisher's exact test were used for statistical analysis, with the level of significance set at 95%. The ideal sized conegra was chosen and prepared, rinsed 2-3 times for about 5 min in normal saline solution before use. Cardiopulmonary bypass and moderate hypothermia or normo-thermia was used in most of the cases. The distal anastomosis was performed using 4/0 or 5/0 continuous Prolene sutures. Care was taken to prevent the purse-string effect. If needed, the incision to the left or right pulmonary artery was extended to allow proper fitting of the interposed graft. It was done 1st in cases of RVOT reconstruction and 2nd in Fontan. Only a small remaining piece was used to close the VSD. Trans-esophageal echocardiography was performed routinely in the operating room. Postoperatively, only the Fontan cases were given anti-platelets for life and anti-coagulation for 1-2 years. The patients were followed up by surgeons in 2 weeks and then after by their referring pediatric cardiologists. In case of any abnormal unexpected findings, the patients were asked to return earlier. Peak gradient  $\geq 50$  mmHg across the RVOT was considered as a severe stenosis. Peak gradient  $\geq 10$  mmHg across the Fontan circuit was considered as a severe Fontan circuit stenosis. A pulmonary valve regurgitation grade 3 (on a scale of 4) or more was considered severe. The follow-up mean time was 19.8 months (range 8-78 months) and it was 75.4% complete.

## RESULTS

This is a retrospective study that contains a cohort of different congenital cardiac pathologies. Fifty three cases were included in this retrospective study from June 2002 to January 2011. The inclusion criterion was implantation of conegra graft in our patients. The Median age at the time of operation was 3.5 year (range 1-26 years). It was 26 months in RVOT reconstruction, 72 months in Fontan and 11 months in VSD group. Females were more than males (28 vs 25) (Table 1). Fontan was indicated for; 12 cases of Tricuspid atresia, 4 CAVSD, 3 Mitral atresia, 1 Criss-cross, 1 RORV, 1 DILV, 1 HLHS with single ventricle physiology. RVOT reconstruction was indicated for TOF/DORV/VSD + pulm atresia in 17, Pulm atresia + IVS in 3 and truncus arteriosus in 2 cases. The 30 days mortality was 7.5 % (four patients); one Fontan patient died because of arrhythmia & sepsis, the second Fontan one due to thrombosed Fontan connection which was detected late. The 3<sup>rd</sup> patient was Fallot case who died because of ventricular dysfunction and the 4<sup>th</sup> one was a VSD patient that died because of DIC (Table 2). The ranges of intensive care unit stay, chest tube duration, and hospital stay were 1-21 days (median, 3 days), 3-38 days (median, 7 days), and 5-47 days (median, 11.5 days), respectively. Eleven cases developed chylothorax; seven of them were post Fontan and 4 post RVOT reconstruction. Two cases

**Table 1: Demographics and some Operative Data**

	RVOT reconstruction (22)	Fontan (23)	VSD (8)
Age in months (Median)	26	72	11
Sex M/F	12/10	9/14	4/4
CPB (Min.)	89	80	46
Graft Size (MM)	20	18	-

**Table 2: 4 Analysis of the Deaths Data**

Death	RVOT reconstruction (1/22)	Fontan (2/23)	VSD (1/8)
No.	1	2	1
Cause	Ventricular dysfunction	Arrhythmia, Thrombosis	DIC
Age in Months	78	24 and 186	17
sex	M	M 1 F 1	M P.0.003
CBP time in Minutes	110	98	45 P0.007
Graft Size	20	18	=

needed urgent exploration for bleeding. Follow-up was possible for only 40 (75.4%) patients at a mean interval of 19.8 months (range 8-78 months). Their room air oxygen saturation during follow up ranged between 76% and 100% (mean, 92.1%). There have been 3 thrombo-embolic episodes; all post Fontan and 1 early post VSD repair dehiscence during the hospital stay.

## DISCUSSION

The indications for the use of Contegra were; RVOT reconstruction in Fallot Tetralogy, extra-cardiac Fontan conduit and VSD closure. Contegra conduit is an acceptable alternative to homografts for right ventricular outflow tract reconstruction [14].

A published study from many centres in Europe found the performance of the that the performance of the Contegra conduit to be comparable to that of the homografts when used to reconstruct the right ventricular outflow tracts [15].

Different patch materials have been utilized in repairing ventricular septal defect (VSD) with great success. Dr Baslaim G 2008 reported the successful repair of VSD by fashioning and tailoring a patch from a segment of the Contegra xenograft conduit. Being free of infection, thrombo-embolism, and re-intervention during follow-up, in addition to the advantage of shelf ready availability and cost-effectiveness offered by using the same bovine material, imply that Contegra xenograft is a promising alternative patch material for VSD [4].

Baslaim G 2008 reported that the Contegra xenograft is a good conduit for the RVOT reconstruction and a potential alternative conduit for the extracardiac Fontan connections. One year later, Schoof P and Waterbolk T. 2009 report about their very bad experience in using the contegra as an extra-cardiac Fontan conduit [5].

This was the stimulus to review our preliminary experience. The 30 days hospital mortality was 7.5 % (four patients); one Fontan patient died because of arrhythmia & sepsis, He was 2 years male S/P Glenn 1 year ago. He received an 18mm contegra. The second Fontan one due to thrombosed Fontan connection which was detected late. She was a 15 years old female and received an 18mm Contegra. The 3<sup>rd</sup> patient was a 6 years old male Fallot case who received a 20 mm Contegra and died because of ventricular dysfunction and the 4<sup>th</sup> one was a VSD male

1.5 years old male patient that died because of sepsis and DIC on the 11<sup>th</sup> day (Table 2).

Eleven cases developed chylothorax. Seven of them were post Fontan and 4 were post RVOT reconstruction. The ranges of intensive care unit stay, chest tube duration, and hospital stay were 1-21 days (median, 3 days), 3-38 days (median, 7 days), and 5-47 days (median, 11.5 days), respectively. They were longer in the Fontan Group due to the higher incidence of chylothorax because of the high venous pressure. It was managed conservatively by keeping the patient NPO, chest tube drainage, monogen branched chain fatty acid milk and Total parenteral nutrition. Two post Fontan cases needed an urgent exploration for bleeding. One of them was generalised surface ooze and the other one was an ooze from the IVC side of anastomosis. Follow-up was possible for only 40 (75.4%) patients at a mean interval of 19.8 months (range 8-78 months). The room air oxygen saturation during follow up ranged between 76% and 100% (mean, 92.1%). There have been 3 thrombo-embolic episodes after Fontan; one of them died, one needed urgent conduit replacement and the 3<sup>rd</sup> one received successful systemic lytic therapy and 1 VSD dehiscence during the hospital stay which was successfully re-repaired by dacron patch. During Follow up, a 5 years old female post Fontan patient developed pulmonary venous obstruction managed successfully by putting a stent 3 years postoperatively. We noticed that the 30 days mortality was higher in the fontan group (although statistically non significant), the early postoperative course is significantly more difficult in the same group and the short and midterm complications were more in the extra-cardiac Fontan position. However, compared to the use of other conduit for Fontan procedure, the results are comparable and acceptable [14, 15].

With other types of Fontan conduits, Kim SJ, *et al.*, 2008 reported hospital mortality of 3.0% and late mortality of 3.6% with a mean follow-up of 52.4 ± 32.2 months (range 18 days to 120 months). Their hospital mortality rate was 4.7% in patients with fenestration and 1.7% in those without fenestration. They used an expanded poly tetra fluoro ethylene tube conduit (Gore-Tex vascular graft; W. L. Gore & Associates, Inc, Flagstaff, Ariz) was used throughout except for 20 patients In those twenty, Hemashield graft (Boston Scientific, Natick, Mass) was used in 18 patients, and a homograft in 2 [16].

As per Yuan SM. 2012, Contegra is a biomaterial suitable for the right ventricular outflow tract reconstruction and for patch repair for ventricular septal defect, but not apt for Fontan procedure [17].

Iyer KS 2012 noticed that the Contegra conduit has acceptable function and longevity in the larger sized conduits much better in the smaller sizes. He believes that there is no other commercially available tissue valved conduit to compete with. Till the time a better conduit presents itself the Contegra will continue to be a part of the pediatric cardiac surgeon's armamentarium [18].

Maclver RH, Permut LC and McMullan DM. 2013 described the use of a downsized Contegra conduit to replace an infected PTFE right ventricle-to-pulmonary artery graft in a neonate with life-threatening purulent mediastinitis [19].

Eleferiades JA, *et al.*, 2012 described a modification of the carbol shunt in cases of refractory bleeding after ascending aortic replacement using a valved Contegra graft, which obligates unidirectional flow and eliminates venous back-bleeding. This renders the Cabrol fistula an even more useful technique [20].

## LIMITATIONS

This study is a retrospective one including a heterogeneous cohort of patients. It has the inherent defects of retrospective studies. The fontan group was a cohort of different pathologies with both right and left ventricular dominances. The Follow up was relatively short and complete in only 75%.

## CONCLUSIONS

The Contegra xenograft is a good acceptable conduit for the RVOT reconstruction, a potential alternative conduit for the extra-cardiac Fontan connections and the remaining piece can be used to close the VSD if it is used for the other previous indications. These encouraging preliminary results may support to use it more in these 3 indications. Further and bigger volume studies with more sophisticated investigations for a longer period of time are needed to prove this.

## REFERENCES

- [1] Dave H, Mueggler O, Comber M, *et al.* Risk factor analysis of 170 single-institutional contegra implantations in pulmonary position. *Ann Thorac Surg* 2011; 91: 195-302. <http://dx.doi.org/10.1016/j.athoracsur.2010.07.058>
- [2] Dave HH, Buechel ER, Dodge-Khatami A, *et al.* Early insertion of a pulmonary valve for chronic regurgitation helps restoration of ventricular dimensions. *Ann Thorac Surg* 2005; 80: 1615-21. <http://dx.doi.org/10.1016/j.athoracsur.2005.04.058>
- [3] Buechel ER, Dave HH, Kellenberger CJ, *et al.* Remodelling of the right ventricle after early pulmonary valve replacement in children with repaired tetralogy of Fallot: assessment by cardiovascular magnetic resonance. *Eur Heart J* 2005; 26: 2721-7. <http://dx.doi.org/10.1093/eurheartj/ehi581>
- [4] Baslaim G. Expanding the utilization of Contegra for ventricular septal defect repair. *J Card Surg* 2008; 23: 528-9. <http://dx.doi.org/10.1111/j.1540-8191.2007.00559.x>
- [5] Baslaim G. Bovine valved xenograft (Contegra) conduit in the extracardiac Fontan procedure: the preliminary experience. *J Card Surg* 2008; 23: 146-9. <http://dx.doi.org/10.1111/j.1540-8191.2007.00524.x>
- [6] Urso S, Rega F, Meuris B, *et al.* The Contegra conduit in the right ventricular outflow tract is an independent risk factor for graft replacement. *Eur J Cardiothorac Surg* 2011; 40: 603-9.
- [7] Ross DN, Somerville J. Correction of pulmonary atresia with a homograft aortic valve. *Lancet* 1966; 2: 1446-7. [http://dx.doi.org/10.1016/S0140-6736\(66\)90600-3](http://dx.doi.org/10.1016/S0140-6736(66)90600-3)
- [8] Meyns B, Jashari R, Gewillig M, Mertens L, Koma'rek A, Lesaffre E, Budts W, Daenen W. Factors influencing the survival of cryopreserved homografts. The second homograft performs as well as the first. *Eur J Cardiothorac Surg* 2005; 28: 211-6. <http://dx.doi.org/10.1016/j.ejcts.2005.03.041>
- [9] Como AF, Hurni M, Griffin H, *et al.* Bovine jugular vein as right ventricle-to-pulmonary artery valve conduit. *J Heart Valve Dis* 2002; 11: 242-7.
- [10] Breyman T, Thies WR, Boethig D, Goerg R, Blanz U, Koerfer R. Bovine valved venous xenografts for RVOT reconstruction: results after 71 implantations. *Eur J Cardiothorac Surg* 2002; 21: 703-10. [http://dx.doi.org/10.1016/S1010-7940\(02\)00049-0](http://dx.doi.org/10.1016/S1010-7940(02)00049-0)
- [11] Boudjemline Y, Bonnet D, Agnoletti G, Vouhe' P. Aneurysm of the right ventricular outflow following bovine valved venous conduit insertion. *Eur J Cardiothorac Surg* 2003; 23: 122-4. [http://dx.doi.org/10.1016/S1010-7940\(02\)00660-7](http://dx.doi.org/10.1016/S1010-7940(02)00660-7)
- [12] Meyns B, Van Garsse L, Boshoff D, *et al.* The Contegra conduit in the right ventricular outflow tract induces supra-avalvular stenosis. *J Thorac Cardiovasc Surg* 2004; 128: 834-40.
- [13] Breyman T, Boethig D, Goerg R, Thies WR. The Contegra bovine valved jugular vein conduit for pediatric RVOT reconstruction: 4 years experience with 108 patients. *J Card Surg* 2004; 19: 426-31. <http://dx.doi.org/10.1111/j.0886-0440.2004.04083.x>
- [14] Tiete AR, Sachweh JS, Roemer U, Kozlik-Feldmann R, Reichart B, Daebritz SH. Right ventricular outflow tract reconstruction with the Contegra bovine jugular vein conduit: a word of caution. *Ann Thorac Surg* 2004; 77: 2151-6. <http://dx.doi.org/10.1016/j.athoracsur.2003.12.068>
- [15] Breyman T, Blanz U, Wojtalik MA, *et al.* European Contegra multicentre study: 7-year results after 165 valved bovine jugular vein graft implantations. *Thorac Cardiovasc Surg* 2009; 57: 257-69. <http://dx.doi.org/10.1055/s-0029-1185513>
- [16] Kim SJ, Kim WH, Lim HG, Lee JY. Outcome of 200 patients after an extracardiac Fontan procedure. *J Thorac Cardiovasc Surg* 2008; 136: 108-16. <http://dx.doi.org/10.1016/j.jtcvs.2007.12.032>
- [17] Yuan SM. The Contegra valved bovine conduit: a biomaterial for the surgical treatment of congenital heart defects. *Arq Bras Cardiol* 2012; 99: 1159-66. <http://dx.doi.org/10.1590/S0066-782X2012005000105>

- [18] Iyer KS. The Contegra bovine jugular valved conduit: living up to expectations? *Ann Pediatr Cardiol* 2012; 5: 34-5.
- [19] MacIver RH, Permut LC, McMullan DM. Downsized contegra graft as a right ventricle-to-pulmonary artery conduit in the setting of mediastinitis. *Ann Thorac Surg* 2013; 96: 1077-8.  
<http://dx.doi.org/10.1016/j.athoracsur.2013.01.039>
- [20] Elefteriades JA, Youssef S, Rousou L, Nazer R. Novel valved graft modification of Cabrol fistula for bleeding after aortic root surgery. *Ann Thorac Surg* 2012; 94: 1741-3.  
<http://dx.doi.org/10.1016/j.athoracsur.2012.05.114>

---

Received on 29-07-2013

Accepted on 10-10-2013

Published on 21-03-2014

DOI: <http://dx.doi.org/10.12970/2311-052X.2014.02.01.6>

© 2014 Sersar *et al.*; Licensee Synergy Publishers.

This is an open access article licensed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/3.0/>) which permits unrestricted, non-commercial use, distribution and reproduction in any medium, provided the work is properly cited.