**Table S1: Anatomic selection criterions for small pulmonary ventricles and one-and-a-half ventricle repair (Van Arsdell GS et al18,E20,E27)**

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| --- | --- | --- |
| **Tricuspid z values** | **Pulmonary ventricular volume** | **Operation** |
| > -2 | >80% | Biventricular repair |
| < -2 | <80% | One-and-a-half ventricle repair with cavopulmonary anastomosis |
| < -2 | <50% | One-and-a-half ventricle repair, cavopulmonary anastomosis, atrial fenestration, possible delayed fenestration closure |
| < -10 | <30% | Fontan procedure |

**Table S2: Degree of pulmonary ventricle hypoplasia and surgical management of patients undergoing one-and-a-half ventricle repair (Chowdhury UK et al19,20)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S.No.** | **Variables / surgical management** | **RV hypoplasia** | | |
| **Mild** | **Moderate** | **Severe** |
| 1 | Tricuspid Z value | >1.5 | -1.5 to -4.8 | <4.8 |
| 2 | Tricuspid valve diameter (% of normal) | 70.5% | 45%-70.5% | <45% |
| 3 | Tricuspid valve diameter/ mitral valve diameter | 0.80 | 0.54-0.80 | <0.54 |
| 4 | RV diastolic volumes (% of predicted normal) | 75% | 45%-75% | <45% |
| 5 | RV morphology\* | Tripartite | Bipartite | Unipartite |
| 6 | RV cavity and outflow tract | Approximately 2/3 of normal, well-developed RVOT | 1/3 to 2/3 normal, RVOT inadequate | <1/3 of normal size, absent RVOT |
| 7. | Definitive operation | Two-ventricle repair | One-and-a-half ventricular repair | Univentricular repair |

RV= Right ventricular, RVOT= Right ventricular outflow tract

**\***In addition, a combination of parameters namely, tricuspid Z-values, tricuspid / mitral valve diameter, right ventricular morphology, right ventricular diastolic volumes, presence of absence of right ventricular-coronary artery fistulae and the degree of right ventricular endocardial fibroelastosis are taken into consideration for the decision-making of pulsatile superior cavopulmonary connection, biventricular or an univentricular type of repair.

**Table S3: Summary of the published investigations documenting the mid-term and long-term results of the so-called one-and-a-half ventricle repair**

| **S. No.** | **Author** | **Year of publication** | **No. of patients** | **Age**  **Mean±SD (range)** | **Follow-up**  **Mean±SD (range)** | **Early and late mortality** | **Results** | **Recommendations** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1. | Chowdhury UK et al19 | 2001 | 50 | 3.44±6.15 years  (4 months=42 years)  <4 years (n=42) | 98.6±6 months  (8-116 months) | 6 (12%)  2 (4.5%) | At a mean follow-up (30.4 months), O2 saturation 84%-95% (mean 88%) in patients with a functioning fenestration, 3 spontaneous closure fenestration  At 97 months actuarial survival 74%  NYHA class I: 88% | Moderate right heart hypoplasia is a safe anatomic category for one and one half ventricle repair. Patients with any probability of postoperative pulmonary artery hypertension, raised pulmonary vascular resistance, relative contraindication for one and one half ventricle repair |
| 2. | Chowdhury UK et al20 | 2005 | 84  (50 previous series, 34 present series) | 47.9±57.3 months  (4-504 months)  <4 years (n=62) | 87.7±56.6 months  (12-178 months) | Hospital death (10.7%)  Late death (8%) | Peri and postoperative supraventricular arrhythmias 14.3% and 15.9% survivors mean late SVC 14.2±1.52 mmHg, mean RAP 6.6±0.74 mmHg  Actuarial survival 81.9%±0.04%  NYHA I/II: 89.8% (n=62) | Physiologic criterions similar to Fontan candidates. one and one half ventricle repair reverses the Fontan paradox; no consequences of pulsatile Glenn. 45% of survivors demonstrated significant growth in tricuspid valve, right ventricle on MRI. None qualified for biventricular repair. |
| 3. | Kreutzer C et alE7 | 1999 | 30 | 6.7±8.5 years  (4 months-40 years) | 1-10 years | Hospital death 2 (6.6%)  Late death 1 (3.3%) | Actuarial survival at 5 years (90%)  NYHA I: 77% (n=21)  Mean early postoperative SVC pressure 14.12±3.5 mmHg, mean RAP 10.3±5.16 mmHg, Oxygen saturation root air at 1 year 93.6%±3.6% | Early and intermediate term follow-up results compare favourably with those of the Fontan procedure.  Long-term follow-up is needed |
| 4. | Kim S et alE18 | 2009 | 114 | 3 months-59 years | 1 month-38 years | Hospital death (6.1%)  Late death (20.2%) | SaO2 increased from 83.5% to 94.5% following repair (p<0.001). Freedom from new atrial arrhythmias was 92.2% at 20 years. Actuarial survival at 5, 10 and 20 years (83.4%, 80.1% and 69.3%)  NYHA I/II: 98.8%. No patient had PLE or PAVM, NYHA I (86%), NYHA II (13%) | One-and-a-half ventricle repair demonstrate on-going late patient attrition that is cardiac related. Atrial and ventricular arrhythmias occur, no PLE, the complication risk related to pulsatile SVC-PA connection- 7%, anastomotic takedown-2.6% |
| 5. | Lee Yo et al10 | 2011 | 29 | Median 26 months  (6 months-26 years) | 85.6±44.6  (3 months-190 months)  Median: 24 months | Hospital death 4 (13.8%)  Late death - nil | Freedom from late reoperation were 80.0±12.6% in group A and 51.4±20.4% in group B  NYHA class I (n=21)  No recurrent cyanosis, pulmonary arteriovenous malformations, chronic arrhythmias, SVC syndrome | Good NYHA without late complications of Fontan pathway, one and one half ventricle repair is a valid alternative to Fontan and biventricular repairs |
| 6. | Numata S et alE50 | 2003 | 13 | 4±3 years  (10 months-9 years) | 10±4 years  (3-15 years) | Hospital death - nil  Late death 1 (7.7%) | 1.5 VR- PA/IVS (7), PS, hypoplastic RV (6).  One patient died of arrhythmia, 2 patients- conversion TCPC  Actuarial survival at 10 years (88.9%).  Freedom from arrhythmia was 80% and 20% at 10 and 12 years respectively. Exercise testing showed anaerobic threshold values equivalent to those of Fontan and inferior to those who could have undergone biventricular repair. Consecutive cath- no changes in % RVEDV, % TVD at 1, 5, 10 years. Exercise testing- anaerobic threshold 16.6±3.4 ml/kg/min and 13.1±2.7 ml/kg/min at 5 and 10 years. | Functional results not hopeful in long-term. Conversion to total cavopulmonary connection may be needed in some patients. |
| 7. | Stellin G et al11 | 2002 | 8 | 9.1 years  (7 months-35 years) | 29.8 months  (8 months-7.3 years) | Hospital death - nil  Late death - nil | NYHA I (n=8) | 1.5 VR reduces the surgical risk of biventricular repair compared to Fontan circulation, reverses the Fontan paradox and improves the systemic arterial oxygen saturation  A longer follow-up is needed |
| 8. | Van Arsdell GS et al18,E20 | 1996 | 38 | Median 3.5 years  (5 months-51 years) | 46.3±36.9 months  (1-174 months) | Hospital death - nil  Late death - nil | Salvage 1.5 VR (4)🡪 3 died (95%)  No protein losing enteropathy  NYHA I (n=22), II (n=8) | Acceptable intermediate term outcomes. Results as a salvage operation unsatisfactory. |
| 9. | Zhang S et alE17 | 2017 | 31 | Median 5.4 years  (0.75-12 years) | 3.3±2.1 years | Hospital death - nil  Late death - 1 (3.2%) | NYHA I 83.3% (n=25)  NYHA III/IV, n=6 (19.3%)  No conduit change | 1.5 VR technically feasible in CCTGA, LVOTO, Cardiac malposition |
| 10. | Malhotra SP et alE2 | 2011 | 48 | 3 years  (3.9 months-24 years) | 59.2 months  (1 month-15 years) | Hospital death - 1 (2%)  Late death - Nil | Freedom from reintervention, 1, 5, 10 years (91.5%, 76.8%, 71.8% respectively)  11 (23%) patients required 10 reoperations, 3 interventions | Right ventricle-pulmonary artery conduit longevity improved  Prolonged conduit life, reduced baffle / sinus node related complications |
| 11. | Malhotra A et al13 | 2020 | 69 | Median 17 years (1-68 years) | Mean 3.2±1.2 years (range-----) | Hospital death - 2 (2.9%)  Late death - Nil  1 delayed repair failure | Mean indexed TAPSE 15.0±6.7 vs 16.6±5.6 mm/m2, p=0.21 | 1.5 VR provides a functionally competent, non-stenotic, durable tricuspid valve as compared to two ventricular repair. 1.5 VR does not result in facial swelling or pulmonary arteriovenous malformations |
| 12. | Corno AF et alE24 | 2002 | 3 | 8, 16, 35 years | Mean 33 months | Hospital death - Nil  Late death - Nil | Ebstein’s anomaly severe TR, bidirectional shunt through ASD, LVEF 58%, mean shortening fraction 25%  NYHA I/II (3), LVEF 77%, mean shortening fraction 40% | Good functional results.  Late presenters of Ebstein’s anomaly with reduced biventricular function- one-and-a-half ventricle repair is feasible |
| 13. | Sasikumar N et alE136 | 2012 | 1 | 20 years male | 6 months | Survived | Ebstein’s anomaly with severe RV dysfunction. Operation - 1.5 VR🡪 failure to wean from CPB, atrial septectomy ineffective, TEE- progressive RV dilation compressing the LV🡪 22mm PTGE from IVC to RPA- extracardiac conduit | RV exclusion with univentricular palliation- Effective bail out strategy in difficult surgical scenarios in Ebstein’s anomaly |
| 14. | Sharma V et alE48 | 2012 | 10 | Median 24 years (range 14-41 years) | Median 8 years (2-20 years) | Hospital death - Nil  Late death - Nil | NYHA I (9), awaiting cardiac transplant (1)  Postoperative median SVC pressure 14 mmHg (10-18 mmHg), median RAP 10 mmHg (8-14 mmHg), oxygen saturation 92%-98% (median 95%) | The backward regurgitation of Bjork-Fontan circuit may facilitate RV enlargement. Fontan conversion to one-and-a-half ventricle repair is feasible in selected patients. Arrhythmia surgery should be routine. |
| 15. | Liu J et alE41 | 2011 | 30 | Median 60 months (2-192 months) | Median 22.5 months (4-61 months) | Hospital death - 1 (3.3%) | TR preoperative moderate (8), severe (22); postoperative mild (26), moderate (3), severe (1); cone reconstruction with 1.5 VR (20) | Bidirectional Glenn in severe Ebstein’s undergoing cone reconstruction- effective treatment strategy |
| 16. | Quinonez LG et alE66 | 2007 | 14 (169 Ebstein’s anomaly) | Median 6 years (17 months-57.8 years) | Median 18 months (3 months-6.5 years) | Hospital death - 1  Late death - Nil | Severe Ebstein’s anomaly, dilated right-sided chambers, and/or right ventricular dysfunction, NYHA I (9), Echo (4) at mean 11 months (6-15 months), LV and RV functions remained same, 1 patient- LVEF 40% -60%, ECMO (2), IABP (2) | 1.5 VR may be planned in anticipation of RVF, it may be used as a salvage procedure for established RVF, it may help to improve depressed LV function, may be an alternative for patients considered for cardiac transplantation |
| 17. | Hoashi T et alE44 | 2011 | 9 | - | Median 27 months (3.3-99.8 months) | Hospital death - 2  Late death - 1 | Previous Fontan (3), bidirectional Glenn (6)- on Fontan track, 1.5 VR conversion- protein-losing enteropathy (2), pulmonary arteriovenous malformations (1), preference for biventricular anatomy (6), All NYHA I | Selected patients initially treated with single ventricle palliation can be converted to 1.5VR and two ventricle physiology with acceptable outcomes |
| 18. | Miyaji K et alE107 | 1995 | 3 | - | Upto 10 years | Nil | Pulmonary atresia, intact ventricular septum. Preoperative Z scores tricuspid valve -5.2 to -6.5, cath at 10 years, TVD in 2 patients increased 52.5% 🡪 74.8% of normal; 56.0% 🡪 71.9% of normal, SaO2 94.3%-96.3% in 2 patients. Patient 3🡪 95.4% to 89.2%- developed pulmonary arteriovenous malformations | Despite performing one-and-a-half ventricle repair with tricuspid valve Z-score <-5.0, 10 year results remain acceptable |
| 19. | Cabrelle G et al5 | 2020 | 29 | Median 3.5 years (IQR 0.8-7.8 years) | Median 13.2 years (IQR 3.2-25.6 years | Hospital death - Nil  Late death - 3 (2 non cardiac following stroke) | Simple anatomy- Ebsteins, PA, IVS (15), complex anatomy- DORV, TGA, AVSD (14).  Postoperative MRI (10) at median 10.5 years- RVEDV median 63.5 ml/m2 (IQR 45-82), interventional procedure (6), median 2.8 years (IQR 1-4.9 years), PA angioplasty (4), percutaneous closure hemiazygos vein (1), ASD closure (1), Fontan conversion to 1.5 VR (1)- successful cardiac transplantation. Overall survival at 25 years - 89.3%, median SaO2 (98%), freedom from adverse events, reoperation, and interventional procedures- 57.1%, 82.1%, and 78.6% respectively. Cardiac stress test (12)- VO2 max/kg/min higher than Fontan opulation | RV pulsatile function in 1.5VR has a positive effect on the liver and was not associated with worse early or late adverse long-term outcomes |
| 20. | Padalino MA et alE81 | 2014 | 1 | 29 years male | 30 months | Survived | Hypoplastic RV, pulmonary valve stenosis, Bjork- Fontan at 3 years age, recurrent atrial fibrillation, atrial flutter, cath- massively enlarged RA, mean RAP 13 mmHg, PAP 12 mmHg, SaO2 74%. 2D Echo- hypoplastic RV, hypoplastic TV, RVSF 34%, 3D echo- RVEDV 32 ml-17ml/m2, RVESV 25 ml, 3ml/m2, RVEF 22%. RA reductive plasty, RF ablation - atrial pathways, resection RV muscle bands, RVOT, TV papillary splitting, RV-PA conduit- Contegra Medtronic Inc. 6 months later- progressive RVF, massive GI bleed, multiple bleeding varices - endoscopy. 26 months later- 2 mm Melody valve in RV-PA conduit, 9 mm ASF. Symptomatic improvement- antifailure medications. 30 months later cardiac transplant | In the setting of one-and-a-half ventricle repair, the right ventricle needs to be of sufficient size and function and without any right ventricular outflow tract for operative success |
| 21. | Huang SC et alE72 | 2006 | 4 | - | Late follow-up not mentioned | Survived | Tricuspid valve endocarditis, tricuspid valvulectomy and 1.5 VR | One-and-a-half ventricle repair concept can be safely applied following total tricuspid valvulectomy for intractable tricuspid valve endocarditis. Acceptable hemodynamics. |
| 22. | Toh N et al17 | 2020 | 58 | 32 patients aged >16 years | Median 7.7 years (IQR 4.1-11 years) | Nil | BVR (24), 1.5 VR (3), UVR (5). Follow-up: BVR (1) died, heart failure (7), arrhythmias (5), reoperation (10)- conversion to 1.5 VR (5), conversion to Fontan (3). Survival at 5 years, 10 years 96.2%, 75.9 respectively. | Adults- good long-term survival while at risk for heart failure, arrhythmia, and reoperations |
| 23. | Malhotra SP et alE10 | 2009 | 57 (1.5 VR =31) | Median 8.1 years (7 months-40.4 years) | 3 months-6 years | Nil | Reoperation for severe TR (4), Follow-up: all patients- acyanotic, NYHA I, TR mild (49), moderate (6), selective BDG- resting cyanosis, post bypass RAP/LAP- 1.5: 1, size of the functional tricuspid annulus <2.5 cm in a 70 kg patient | Excellent mid-term outcomes can be obtained with a selective one-and-a-half ventricle repair approach |
| 24. | Akaishi J et alE134 | 2003 | 1 | 11 years | 2 years | Nil | Ebstein’s anomaly with hypoplastic RV; Carpentier’s repair with annuloplasty.  On table- RAP 11mmHg, TEE- decreased biventricular function, dilated RV. Asymptomatic at follow-up, tricuspid annulous decreased to 28 mm, mild TR | Salvage 1.5 VR on operation table - effective procedure |
| 25. | Wright LK et al14 | 2018 | 616 | <7 days (512)  7 days-1 month (104) | Median 16.7 years (IQR 12.6-22.7) | 20 year survival (overall 66%), single ventricle (97.6%), 1.5 VR (90.9%), 2 ventricle (98%), p=-0.05 | Weight <2.5 kg = 117  >2.5 kg = 494  Males (344)  RV- coronary fistulas=164  Atresia >1 ostium= 17  No abnormalities= 342  Initial intervention: shunt only (247), shunt + RV decompression (273), RV decompression (96), aortopulmonary shunt (247), 61 in-hospital death, 1 transplant, 75% transplant free survival; AP shunt + RV decompression (273)- 41 in-hospital death, 85% transplant free survival; RV decompression (96), 23 in-hospital deaths, 76% transplant free survival; Survivors (491): Fontan (96), HD (5), 1.5 VR (39), HD (4), 2 ventricular (201, HD 1 | Significant neonatal mortality irrespective of the type of intervention. Excellent survival tend towards 1.5 VR |

1.5 VR: One-and-a-half ventricle repair; AP shunt: Aortopulmonary shunt; ASD: Atrial septal defect; AVSD: Atrioventricular septal defect; BDG: Bidirectional Glenn; BVR: Biventricular repair; CCTGA: Corrected transposition of the great arteries; DORV: Double outlet right ventricle; ECMO: Extracorporeal membrane oxygenation; GI: Gastrointestinal; HD: Hospital death; IABP: Intraaortic balloon pump; IQR: Interquartile range; IVC: Inferior vena cava; IVS: Interventricular septum; LAP: Left atrial pressure; LV: Left ventricle; LVF: Left ventricular failure; LVOTO: Left ventricular outflow tract obstruction; MRI: Magnetic resonance imaging; NYHA: New York Heart Association; PA: Pulmonary artery; PAP: Pulmonary artery pressure; PLE: Protein-losing enteropathy; RAP: Right atrial pressure; RF: Radiofrequency; RPA: Right pulmonary artery; RV: Right ventricle; RVEDP: Right ventricular end-diastolic pressure; RVEDV: Right ventricular end-diastolic volume; RVEF: Right ventricular ejection fraction; RVESV: Right ventricular end-diastolic volume; RVF: Right ventricular failure; RVOT: Right ventricular outflow tract; RVSF: Right ventricular systolic function; SaO2: Systemic arterial oxygen saturation; SVC: Superior vena cava; TAPSE: Tricuspid annular plane systolic motion; TEE: Transesophageal echocardiography; TGA: Transposition of the great arteries; TR: Tricuspid regurgitation; TV: Tricuspid valve; TVD: Tricuspid valve diameter; UVR: Univentricular repair