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Post-operative outcome of partial atrioventricular canal repair- in a pediatric cardiac center in Bangladesh

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Abstract
Background: We assessed the post-operative result of patients who went through surgical repair of partial atrioventricular canal defect and quantify the short-term outcome.
Objective: To find out the Post-operative outcome of Partial Atrioventricular Canal Repair.
Materials and Methods: This is a perspective study, in our center, where we included children undergoing surgical repair of Partial AV canal defect from 2012 to 2019. Total 70 patients were enrolled in this study. We performed the intracardiac repair and monitor these patient whether they have developed mitral valve regurgitation, any residual defect and immediate post-operative complications and reappearance of symptoms.
Results: During the study period 70 patients were selected and performed intracardiac repair of partial av canal defect and along with mitral valve cleft repair. The group for this analysis included 70 patients (43 partial; 27 transitional). Male 40 (57.1%) and female were 30 (42.9%) (Figure 1). Weight z-scores at surgery ranged from −4.8 to 4.2 (median −0.66). Patients with partial AVSD underwent repair significantly later than patients with transitional defects, but their weight z-scores were similar. The median age of repair was 2.8 years.There were no operative death only 1 death after 1 month post operatively due to infective endocarditis, and 2 post-operative wound infection. During our one year follow-up, no reoperation was done. However, 10 patients were detected mild to moderate left ventricular outflow tract obstruction, with minimal symptoms, may require reoperation in future. No patient had post-operative pacemaker implantation. 4 patients were detected mild to moderate mitral valve regurgitation, may need surgery in future. Mean hospital stay was 9 ±2 days. Our average follow-up periods were 12 months.
Conclusion: Intracardiac repair of partial atrioventricular canal defect is quite good at the median age of 2.8 years with no increased in mortality, re-operation and other complications which were reveal with one year follow-up. Patients will be needed to monitor more to order to quantify in the long-term outcome.

Keywords: atrial septal defect (ASD), coronary sinus (CS), surgical repair.

1. Introduction
The first triple-crown surgical repair of an entire chamber congenital heart defect (CAVSD) was performed by C. Walton Lillehei in 1955 [1]. Since that point, advances in surgical and medical management have resulted in shriveled perioperative mortality and improved early survival [2, 4]. Previous studies5,6 have incontestable a 15-year survival of 86% to 89%.However, despite improved survival, single-center study report that up to 10% of patients, when initial CAVSD repair, could need reoperation among ten to fifteen years, to handle leftatrioventricular (AV) valve regurgitation and left Ventricular outflow tract obstruction [3, 5, 7]. Providing survivors of CAVSD repair area unit currently presenting to the Adult innate heart condition Program in their third and fourth decades of life, we tend to sought-after to see the long-run survival and want for reoperation in patients when partial repair, at our establishment. Children with partial and shift atrioventricular congenital heart defect (AVSD) area unit for the most part well thus referral for surgical repair is often delayed to educational institution or older ages [8, 9]. Recently, single centers have rumored smart ends up in younger children [10]. Though there is also theoretical benefits to earlier repair, like minimizing the child's exposure to pulmonic overcirculation and right heart volume overload, these factors should be weighed against the potential for unfavorable outcomes within the younger child. The aim of this study was to explain up to date outcomes when repair of partial or shift AVSD in an exceedingly multicenter cohort.

2. Objective
- To find out the Post-operative outcome of Partial Atrioventricular Canal Repair.

3. Methods and Materials
A total of 70 patients who had undergone complete surgical repair for partial between the years 2012 and 2019 were identified from the Dhaka Shishu (Children) hospital, Dhaka, Bangladesh surgical database. Patients with an associated diagnosing of outlined as subvalvular and controller stricture that needed intervention at the time of CAVSD repair, were excluded from this total. Patients with partial Jewish calendar month congenital heart defect (ostium primum chamber septate defectintermediate-type

AV septal defect (a common AV valve or 2 separate AV valve orifices, but restrictive or absent ventricular septal defect), or unbalanced forms of AV septal defect who underwent single-ventricle palliation were excluded. In child with left cardiac valve regurgitation (LAVVR) once AVSD repair, consecutive kids with parent/guardian consent were listed into AN observation-only section for twelve months postoperatively to permit the guts to adapt to surgical intervention. Throughout this twelve months amount, prospective clinical and echocardiographic knowledge were collected for one hundred of the seventy patients during this analysis. To report outcomes representative of the whole sickness spectrum, we tend to supplemental all screened patients in our information from a similar fundamental measure clinical exclusion criteria for the trial (e.g., planned reoperation, left cardiac valve [LAVV] stenosis) to the analysis cohort. These patients had demographic characteristics like people who had been listed within the observation section of the study.

Definition

Published definitions of AVSD subtypes vary. For this study, partial AVSD was characterized by associate ostium primum chamber inborn heart defect (ASD) with intact structure septum; a transmutation AVSD was characterized by associate ostium primum ASD, two-orifice heart valve, and restrictive water structure inborn heart defect (VSD) [11, 12]. Since every partial and transmutation AVSD finish in right heart volume overload with little or no structure level shunt, data from youngsters with either defect were combined for this analysis.

Clinical and Surgical Data Collection

Data were collected at surgery, at intervals one month of surgery, and at twelve months when surgery. Operative reports from all patients were severally reviewed for uniformity in defect classification and details of repair by 3 investigators unsighted to outcomes. Annuloplasty enclosed any extra left heart valve surgery on the far side cleft closure that concerned reduction within the annulus size. Sex, presence of Down syndrome, associated defects, age and weight at surgery, complications requiring a modification in medical aid, and length of mechanical ventilation, medical aid, and total hospitalization were obtained from medical records. Weight-for-age z-scores were calculated victimisation sex-specific reference values for Down syndrome and traditional youngsters [13, 14, 15] as applicable. For traditional youngsters, weight-for-age z-scores were calculated victimisation each World Health Organization fourteen and Centers for malady management fifteen information. As a result of results were similar and every one inferences a similar, solely Centers for malady management information square measure reportable. Patients with weight z-score of −2 or less were thought to own growth failure. Hearth failure scores were obtained twelve months when surgery victimisation the Ross failure classification sixteen or big apple Heart Association (NYHA) [17] classification, as age applicable. Cardiac medications were recorded at the time of the echocardiograms.

Statistical Analysis

Patient characteristics by type of defect were compared using Fisher's exact test for categorical variables, the Wilcoxon rank sum test for positively skewed variables, and a t test for all other continuous variables. Descriptive statistics are reported as mean ± SD unless otherwise noted.Six-month amendment in continuous outcomes was analyzed employing a paired T test. Rectilinear regression was utilized to spot freelance predictors of 6-month amendment in weight-for-age z-score. Statistic generalized additive modeling was accustomed determine nonlinear associations between covariates and outcomes. Logistical regression was accustomed determine surgical correlates of operative LAVVR grade and predictors of the presence of moderate or bigger LAVVR at twelve months once surgery. All variables vital at the 0.20 level in univariate analysis were evaluated for inclusion in variable models for amendment in weight z-score and for the presence of moderate or bigger LAVVR 12 months once surgery.

4. Results

The group for this analysis (Table 1) included 70 patients (43 partial; 27 transitional). Male 40 (57.1%) and female were 30 (42.9%) (Figure 1). Weight z-scores at surgery ranged from −4.8 to 4.2 (median −0.66). Patients with partial AVSD underwent repair significantly later than patients with transitional defects, but their weight z-scores were similar. Weight z-score of −2 or less (growth failure) was present in 17 of 70 (24.2%). At least moderate LAVVR was present on the preoperative echocardiogram in 27 of 87 (38.5%). The most common associated defect noted at surgery (Table 2) was an additional atrial level shunt (48 of 70 patients, 68.5%). The median age at repair was 2.8 years, with 17 of 70 (24.2%) repaired at less than 1 year, and 3 at less than 3 months.

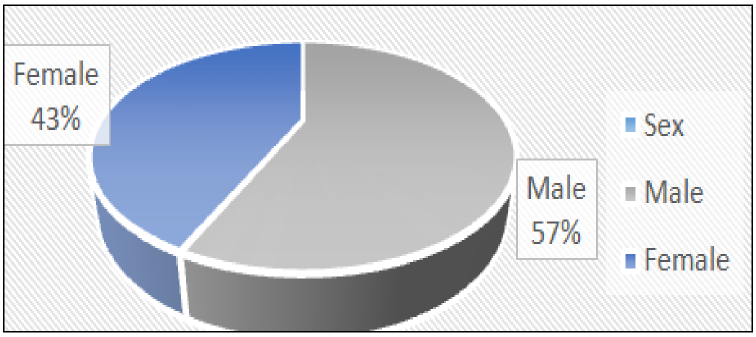

Fig 1: Sex distribution of the Atrioventricular Septal Defect patients.

Table 1: Patient Characteristics by Atrioventricular Septal Defect Subtype (n=70)

Variable	n	All	n	Partial	n	Transitional
Number	70	70	43	27	27	
Male	40	57.1%	23	57.5%	17	42.5%
Female	30	42.9%	17	56.6%	11	43.4%
Median age in years at repair (range)[a]	70	1.6 (0.01 to 12.7)	43	2.8. (0.01 to 14.7)	27	0.6 (0.3 to 3.8)
Median weight-for-age z-score at surgery (range)		−0.66 (−4.8 to 4.2)		−0.55 (−4.8 to 2.0)		−0.66 (−5.5 to 4.2)
Race	70		43	61.4%	27	38.6%
Trisomy 21	70	100%	43	61.4%	27	38.6%
Moderate or greater preoperative LAVVR	70	100%	43	61.4%	27	38.6%

Partial versus transitional p< 0.001 for age at repair; no other comparisons significant at the 0.05 level. [b] Hispanic ethnicity unknown for 1 subject. LAVVR = left atrioventricular valve regurgitation.

Table 2: Associated Defects[a] Noted at Surgery (n=70)

Associated Defect	N	% (n = 70)
Additional atrial shunt	48	46
Patent ductus arteriosus	10	12
Persistent left superior vena cava	3	3
Subaortic stenosis	2	2
Double orifice mitral valve	2	2
Parachute mitral valve	2	2
Coarctation of the aorta	1	1
Additional ventricular septal defect	1	1
Congenital complete heart block	1	1

Defects are not mutually exclusive.

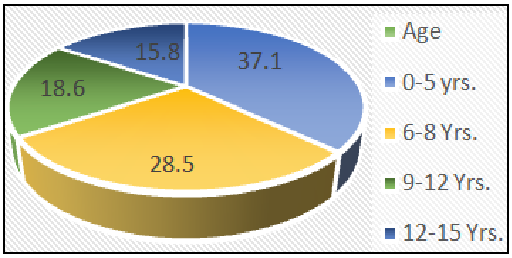

Fig 2: Distribution of age (years) percentage at repair of partial/transitional atrioventricular septal defect.

Figure 2 shows: 0-5 yrs. 37.1%, 6-8 Yrs. 28.5%, 9-12 Yrs. 18.6% and 12-15 years 15.8%. Distribution of age (years) percentage at repair of partial/transitional atrioventricular septal defect of high risk 0-5 yrs. and this year's contribute the observation of follow-up.

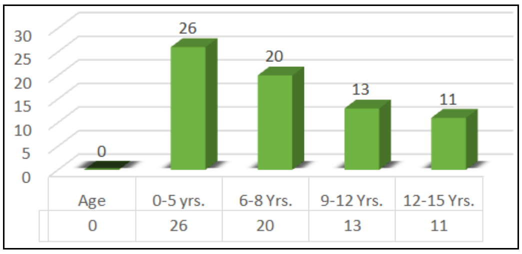

Fig 3: Distribution of age (years) at repair of partial/transitional atrioventricular septal defect.

Figure3 shows: Median age at repair is 2.8 years.Out of the 27 patients with transitional AVSD, 26 underwent VSD closure. Cleft closure was performed in 66 of 70 patients (94.2%) and annuloplasty in 22 of 70 (31.4%, including 16 partial and 6 transitional AVSD). Annuloplasty was associated with the presence of significant LAVVR on the preoperative echocardiogram: 42% of patients with moderate or greater LAVVR on the preoperative echocardiogram underwent annuloplasty, compared with 16% who had none/trace or mild preoperative LAVVR (odds ratio [OR] 3.77, 95% confidence interval [CI]: 1.38 to 10.34, p = 0.01). There was no significant variation in annuloplasty use among centers (p = 0.30).There was 1 in-hospital death (1%), of a 4-day-old infant who underwent arch reconstruction in addition to partial AVSD repair. This infant also had repeat valvuloplasty for low cardiac output and progressive LAVVR and subsequently died of multiorgan failure.Median days for mechanical ventilation were 1 (range, 0 to 53), intensive care stay 2 (range, 1 to 63), and hospitalization 5 (range, 3 to 70); and all were independent of age at surgery (*p*=not significant). We identified 20 complications that required change in therapy (Table 3). Within 1 month (6.9 ± 6.7 days) after surgery, 20 of 70 (28.7%) had LV dysfunction and 17 of 70 (24.2%) had moderate or greater LAVVR. Patients advised to perform and within to preform medications noted at the first postoperative echocardiogram included diuretics in 84%, ACE inhibitor in 8% (5 patients with moderate or greater LAVVR, 2 with LV dysfunction), and digoxin and beta-blocker in 1 child with LV dysfunction (LVEF 47%).

Table 3: Complications Requiring Change in Therapy (n=70)

Complication [a]	N%	(n = 70)
Infection	6	7
Bacterial positive sepsis (3)	-	-
Viral positive (2)	-	-
Pleural effusions	4	5
Nonchylous (3)	-	-
Chylous (1)	-	-
Transient arrhythmias	4	5
Ventricular tachycardia (2)	-	-
Junctional tachycardia (1)	-	-
Complete heart block (1)	-	-
Pericardial effusion	2	2
Intubated >2 weeks postoperatively	2	2
Pneumothorax	1	1
Bloody stool (transfused)	1	1

[a] Complications are not mutually exclusive

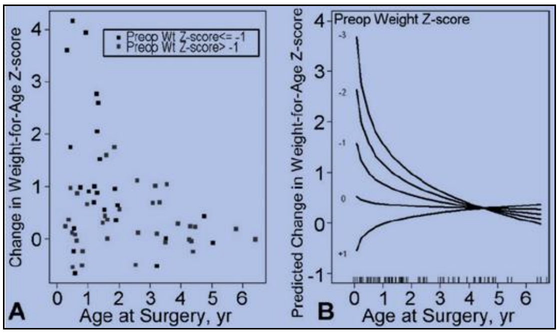

Fig 4: A Scatterplot of 6-month modification in weight z-score by age at surgery and surgical weight z-scores.

Pearson correlations versus log (age) = zero (n = 36) and −0.44 (n = 24) for subjects with surgical weight z-scores −1.0 or less (black) and larger than 1.0 (blue), severally. Regression was supported all subjects with paired information, however is truncated at age half-dozen.4 years (oldest subject once exclusion of 16-year-old outlier). (B) foretold modification (12 months minus preoperation) in weight-for-age z-score at surgery and surgical weight z-score. Log (age) by surgical weight-for-age z-score interaction p = 0.002; R2 = 0.40. The association with log (age) is important only if weight z-score is −1 or less. The hatch lines at all-time low of the plot represent the determined ages within the dataset. Modeling was supported all subjects with 6-month information, however the plot is truncated at age 6.4 years, (oldest subject once exclusion of 16-year-old outlier).

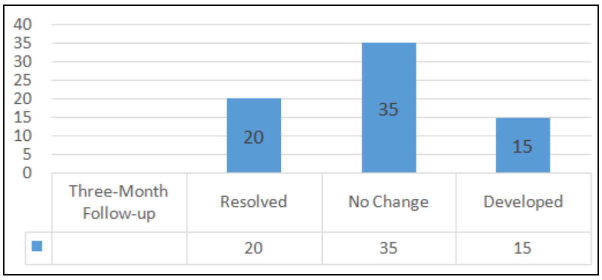

Fig 5: Change in mild to moderate or greater left atrioventricular valve regurgitation (LAVVR) from preoperation and less than 3 month follow-up.

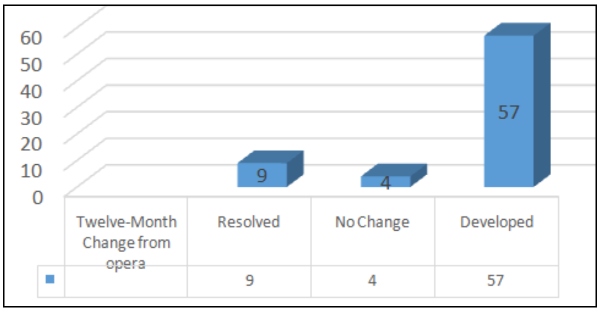

Fig 6: Change in mild to moderate or greater left atrioventricular valve regurgitation (LAVVR) from preoperation less than 1 month after operation and 12 months after operation process.

Figure 6 shows: "Resolved," "no change," and "developed" refer to the presence of mild & moderate LAVVR.The 66 prospective patients included were no operative death only 1 death after 1 month post operatively due to infective endocarditis, and 2 post-operative wound infection and 4 who failed to return for follow-up. In addition, 1 early postoperative echocardiogram was uninterpretable by the core laboratory, preventing paired analysis. Thus, echocardiographic and clinical data pairs were available for 39 and 53 of 70 patients, respectively, with mean follow-up at 4.4 ± 0.2 months. In the interim, there were no deaths or reinterventions, and no additional patients had subaortic or LAVV stenosis. A residual ASD (4 mm) was present in 1 patient, and the 1 residual VSD had spontaneously closed. Six months after surgery, 3 of 39 patients had mild LV dysfunction (LVEF ≥ 55.7% for all 3). The prevalence of diuretic use decreased to 10% (p< 0.001), ACE inhibitor use (7%) was similar to use less than 1 month after repair, and no patient was using digoxin or beta-blocker. Using Ross (n = 55) or NYHA (n = 5) heart failure scores, 58 patients were functional class I, and 2 were class III—both had transitional AVSD and severe LAVVR.Children who underwent surgery before age 18 months had the largest gains. We aimed to identify all independent predictors of weight gain and found an interaction between continuous log (age) and preoperative weight z-score (p = 0.002). Change in weight z-score was unrelated to the presence of trisomy 21 and defect type. At 12 months after surgery, there was also a decrease in the prevalence of growth failure to 8% (5 of 60). Of these 5 children with weight z-scores of −2 or less, 4 had significant LAVVR.The prevalence of moderate or greater postoperativeLAVVR did not change significantly over time (Fig 3): 30.7% (12 of 39) at less than 1 month and 46.1% at 12 months after surgery (18 of 39, p = 0.13) with a higher rate for older children (Fig 4). This finding persisted even after adjustment for 1-month postoperative LAVVR status. Significant LAVVR at 12 months was associated with moderate or greater LAVVR within 1 month of surgery (OR 4.59, 95% CI: 1.21 to 17.24, p = 0.03) but had no independent association with weight, defect type, double orifice or parachute LAVV, annuloplasty, cleft closure, or trisomy 21. Even after adjustment for significantLAVVR within 1 month of surgery, the presence of moderate to severe LAVVR at 12 months was marginally associated with preoperative moderate to severe LAVVR (adjusted OR 3.18, 95% CI: 0.94 to 10.70, p = 0.06). Of patients with none/trace or delicate LAVVR twelve months when surgery, twenty ninth had moderate or bigger LAVVR on the preoperative study. In distinction, of patients with moderate or severe LAVVR twelve months postoperatively, fifty six had moderate or bigger LAVVR preoperatively. Of the eight kids aged four to seven years with moderate to severe LAVVR at 6-month follow-up, five had a minimum of moderate LAVVR on the preoperative echocardiogram. Throughout our one year follow-up, no reoperation was done. However, ten patients were detected delicate to moderate left bodily cavity outflow tract obstruction, with negligible symptoms, could need reoperation in future. No patient had post-operative pacemaker implantation. Four patients were detected delicate to moderate bicuspid valve regurgitation, may have surgery in future. Mean hospital keep was 9 ±2 days. Our average follow-up periods were 12 months.

5. Discussion

This study indicate that repair of partial or transitional AVSD before educational institution ages is also advantageous for rising weight gain and for LAVV performance. This perspective study is exclusive in exploring the advance in growth once repair of a partial or transitional AVSD. Though poor weight gain could also be a typical indication for surgery in patients with a full AVSD, it is not the everyday reason for repairing the partial or shift subtypes. Amazingly, however, 2 hundredth of this study population met the definition of growth failure at the time of surgery, and conjointly the prevalence born to eight twelve months once repair. to boot, primarily among patients however eighteen months previous with surgical weight z-scores of −1.0 or less, there was a significant increase in weight z-score at twelve months once surgery that was freelance of the presence of anomalousness and defect type. Outcomes throughout this contemporary cohort of children World Health Organization were repaired at a median of 2.8 years senior were sometimes smart. Throughout the study amount seventy patients were elite and performed intracardiac repair of partial Jewish calendar month canal defect and alongside bicuspid valve cleft repair.The median age of repair was 2.8 years. There were no operative death only 1 death after 1 month post operatively due to infective endocarditis, and 2 post-operative wound infection. During our one year follow-up, no reoperation was done. However, 10 patients were detected mild to moderate left ventricular outflow tract obstruction, with minimal symptoms, may require reoperation in future. In-hospital mortality was low (1%) and comparable to recent single-center reports of approximately 2% [21, 22, 23]. Ventilator, intensive care, and hospital days were short and independent of age at repair. Symptomatic infants with partial AVSD who require repair within the first few months of life are known to be higher risk [16], but with only 3 infants younger than 3 months of age, this study was not powered to evaluate the lower bound for repair.Residual shunts were rare (1% or less) in this cohort, comparing favorably with single-center reports. Residual ASDs have been reported in 0% to 4%, rarely needing reoperation [24, 25] and tend to result from sutures near the atrioventricular conduction system being placed excessively shallow to avoid damaging it. The VSDs may remain after repair of a transitional AVSD when shunts through dense chordal attachments are not addressed in an attempt to avoid distorting valve motion. When surgical closure is attempted and a small ventricular shunt remains, it is likely to close spontaneously [26], as shown here.One patient had subaortic stenosis during early follow-up. Other investigators report a prevalence of subaortic stenosis of 5% after AVSD repair, with the majority (approximately 60%) of cases occurring in the partial or transitional forms where attachment of the LAVV leaflet to the ventricular crest further encroaches on an already narrowed LV outflow tract[28]Because subaortic stenosis may develop over time, the 6-month follow-up for this cohort may not be long enough to allow an accurate estimation of the prevalence of this lesion. Left ventricle dysfunction typically improves after AVSD repair [28], consistent with our finding that only 3 patients had mild LV dysfunction at 6-month follow-up. Despite the improvement in mortality and other morbidities, there has been little impact on the prevalence of significant postoperative LAVVR in the recent surgical era. The 20% to 31% prevalence of moderate to severe LAVVR after repair of partial/transitional AVSD in our group appears similar to that in other reports where ranges are given from 15% to 50% at a median age of repair ranging from 3.6 to 5.3 years [29, 30]. Some reports do not consistently discriminate between partial/transitional and complete AVSD, however, prohibiting direct comparisonswith our data. Murashita and colleagues [31] reported 30% of patients with partial/transitional AVSD (median repair age 5.3 years) had at least grade II (scale range, I to IV) LAVVR at hospital discharge that increased to 43% at mean follow-up of almost 9 years. Although the data conflict, potential risk factors reported for significant LAVVR after AVSD repair include partial AVSD, absence of trisomy 21, significant preoperative LAVVR, younger age at repair, incomplete or no cleft closure, technique of repair, and double orifice or parachute LAVV [33, 34, 35, 36].We examined each of these factors and found none predicted significant postoperative LAVVR in this cohort. Although the presence of moderate or greater preoperative LAVVR rendered a threefold risk of significant postoperative LAVVR, the wide confidence interval reflected the clinical variation. We found that moderate or greater LAVVR within 1 month after surgery predicted moderate to severe LAVVR at 6-month follow-up, indicating that early postoperative regurgitation was unlikely to resolve. The prevalence of moderate or greater LAVVR at 6-month follow-up was significantly higher among patients having repair between 4 and 7 years of age. Although annuloplasty has been reported to improve LAVV function [37], it was not associated with a decrease in the prevalence of significant LAVVR in this cohort.It is not clear why LAVVR remains the most common residual lesion after AVSD repair. Some investigators postulate that despite individualizing every case, alterations in pure mathematics and rotation of the axis of closure combined with deficient and abnormalcy subvalvar parts could leave a number of these valves incompetent, despite the advances in valvuloplasty that are achieved within the recent era, [38, 39, 40] As a result of valve regurgitation is progressive, the consequences of comparatively long important LAVVR is also another causative issue. Important LAVVR ends up in fifty-five volume overload, doughnut-shaped dilation, and transforming of the fifty-five from a prolate conic to a lot of spherical and automatically underprivileged form. A regeneration loop exists between fifty-five dilation and LAVVR severity, resulting in parallel augmentation of each forty one. In these circumstances, earlier repair could stop the geometric alterations of the valve and fifty-five and improve surgical results. It’s potential that many factors could play a task in persistent LAVVR when AVSD repair, however this study wasn't designed or steam-powered to check these hypotheses.

6. Conclusion

Intracardiac repair of partial atrioventricular canal defect is quite good at the median age of 2.8 years with no increased in mortality, re-operation and other complications which were reveal with one year follow-up. Patients will be needed to monitor more to order to quantify the outcome. The most common indication for reoperation after initial repair of partial AVSD is LAVV pathology, followed by recurrent left ventricular outflow tract obstruction. The need for further reoperation and late survival is similar between patients undergoing valve repair or replacement. When reoperation is required overall late survival is significantly reduced.

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