Successful Aortic Valve Repair in Pediatric Patients Using the Trussler Technique: A Five-Year Case Series at Soetomo Hospital Surabaya

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ABSTRACT

**Background:** The coexistence of ventricular septal defect (VSD) and aortic regurgitation (AR) presents complex challenges in pediatric cardiac care. Undetected and untreated cases can lead to severe morbidity and mortality, emphasizing the importance of effective surgical intervention. While the Trussler technique has shown promise in addressing aortic valve pathologies, its application in the Indonesian population remains understudied.

**Discussion:** We present a retrospective case series of eight pediatric patients with VSD and AR undergoing aortic valve repair using the Trussler technique at Soetomo General Academic Hospital. Preoperatively, patients exhibited varying degrees of AR severity. Postoperatively, significant improvements were evident, with 87.5% achieving complete closure of VSD without residual flow, and 87.5% demonstrating only Mild AR. These outcomes highlight the efficacy of the Trussler technique in managing complex cardiac anomalies, particularly in cases of VSD, which are associated with higher rates of AR.

**Conclusion:** Our findings support the efficacy of aortic valve repair in pediatric patients with concurrent VSD and AR, emphasizing the importance of tailored surgical approaches. Further research with larger cohorts and longer follow-up periods is needed to validate these outcomes and refine clinical management strategies..

***Keywords:*** *Aortic Regurgitation, Aortic Valve Repair, Surgical, Trussler, Ventricular Septal Defects.*

1. INTRODUCTION

Ventricular septal defect (VSD) constitutes a significant portion of the intricate and challenging landscape of cardiac abnormalities. VSD presents a spontaneous closure rate ranging from 70-85% (1,2). Paradoxically, undetected and untreated cases in children lead to substantial mortality and morbidity. The emergence aortic regurgitation (AR) in undiagnosed VSD cases exacerbates the situation, culminating in left ventricular overload, congestive heart failure.3 Both perimembranous and Subarterial doubly committed (SADC) VSDs are linked with AR, with muscular VSDs showing the least association. Incidence rates as high as 83% for AR associated with SADC VSD. Factors such as deficient leaflet support, malformed commissure suspension, and thinned aortic valve cusps are believed to contribute to the pathogenesis (3,4). Trusler pioneered the paracommissural plication technique to address prolapsing cusps, renowned for its simplicity and widespread adoption. Trusler emphasized the importance of prioritizing aortic repair before VSD closure. Post-release of aortic cross-clamping,

Trusler performed a right ventriculotomy to confirm the effectiveness of aortic repair via the subaortic defect, followed by closure using a Dacron patch (4,5).

In an initial investigation, we explored the promising outcomes of aortic valve repair in VSD cases. However, it is worth noting that in our centre, many VSD cases go undiagnosed until later stages, and associated AR often progresses further than reported in other studies (3,4). Consequently, there is a notable scarcity of published data concerning the extent of aortic valve disease associated with VSD and the post-surgical prognosis in the Indonesian population. This study aims to evaluate the efficacy of aortic valve repair in pediatric patients with concurrent VSD and AR, providing insights into surgical outcomes and the impact of VSD and AR characteristics on postoperative results

1. METHOD

Pediatric patients with both Ventricular Septal Defect (VSD) and Aortic Regurgitation (AR) who underwent aortic valve repair surgery using the Trussler technique at Soetomo General Academic Hospital between 2018 and 2023 were included. Patients were categorized based on VSD type (Perimembranous or Subaortic Doubly Committed) and AR severity (Moderate, Moderate to Severe, or Severe). Surgical details, including the Trussler technique employed, operative approach. Postoperative assessments were conducted to evaluate aortic valve function, VSD resolution, and AR improvement over a five-year period.

This retrospective case series aimed to assess the efficacy of aortic valve repair in pediatric patients with concurrent VSD and AR, providing insights into surgical outcomes and the impact of VSD and AR characteristics on postoperative results.

1. RESULTS

Eight pediatric patients (mean age ± standard deviation: 17.25 ± 11.63 years) underwent aortic valve repair utilizing the Trussler technique at Soetomo General Academic Hospital. The characteristics of the study in this article can be observed in Table 1. The majority were female (75%), and most had Subaortic Doubly Committed VSD (62.5%). Preoperatively, the severity of AR varied, with 50% classified as Moderate to Severe and 37.5% as Severe. Following surgery, VSD closure was achieved in 87.5% of cases without residual flow, while one patient (12.5%) demonstrated minimal residual flow. A significant improvement in AR severity was noted postoperatively, with 87.5% of patients exhibiting only Mild AR and one patient (12.5%) showing Moderate AR.

Table 1. Characteristics of the Study

|  |  |
| --- | --- |
| **Variable** | **Value** |
| Age, year, mean ± St. Deviation | 17.25 ±11.63 |
| Sex, n (%) |  |
| Male | 2 (25) |
| Female | 6 (75) |
| **Diagnosis (Preoperative)** |  |
| VSD Type, n (%) |  |
| VSD PM | 3 (37.5) |
| VSD SADC | 5 (62.5) |
| Grade Aortic Regurgitation, n (%) |  |
| Moderate AR | 1 (12.5) |
| Moderate to Severe AR | 4 (50.0) |
| Severe AR | 3 (37.5) |
| **Procedure** |  |
| Aortic Valve Repair (Trussler Technique), n (%) | 8 (100) |
| **Diagnosis (Postoperative)** |  |
| VSD Closure, n (%) |  |
| No Residual Flow | 7 (87.5) |
| Minimal Flow | 1 (12.5) |
| Grade Aortic Regurgitation, n (%) |  |
| Mild AR | 7 (87.5) |
| Moderate AR | 1 (12.5) |

1. DISCUSSION

The results of this case series demonstrate the effectiveness of the Trussler technique in pediatric patients with concurrent VSD and AR. The favorable outcomes observed in terms of VSD closure and AR improvement underscore the potential of this surgical approach in addressing complex aortic valve pathologies in this population.

Ventricular septal defect (VSD) remains the predominant congenital cardiac anomaly, with perimembranous VSD being the most prevalent subtype (2,6,7). However, in this study, patients undergoing aortic valve repair were predominantly characterized by SADC VSD in about 5 patients (62.5%).

The surgical methodology utilized in our study for aortic valve repair was based on the Trusler technique, pioneered by Trusler and colleagues. Trusler's repair technique has demonstrated long-term efficacy, with previous studies showing positive outcomes even after 10 years, and favorable results at 15 years (4,5). Trusler introduced paracommissural plication to address prolapsing cusps, a technique renowned for its simplicity and ease of measurement. Trusler's methodology was initially described in a study involving 16 children with ventricular septal defect. Notably, Trusler emphasized the importance of prioritizing aortic repair before closing the ventricular septal defect, particularly in the absence of echocardiographic guidance. Following the release of aortic cross-clamping, Trusler conducted a right ventriculotomy to verify the success of aortic repair through the subaortic defect, subsequently closing it with a Dacron patch (8).

Several studies were done following patients with VSD and AR which identified several significant risk factors for the progression of AR following repair. These factors include the degree of aortic insufficiency immediately after repair, direct closure of the VSD, size of VSD, operation timing, and the use of multiple plication sutures (7,9–11).

The mean age of our study cohort stood at 17.25 ± 11.63 years, largely attributable to delayed diagnosis and ineffective referral systems. Neither age nor gender emerged as significant risk factors for inadequate repair of AR or subsequent disease progression. Although, previous studies showed varying result regarding this aspect. A study showed that preoperative factors, including gender and age, did not correlate with the long-term postoperative outcome (9). However, Salih et al. identified female gender as a risk factor for the later progression of the disease (7).

Compared to other studies' findings, Kumari et al. demonstrated an 84% regression of aortic valve disease post-surgical repair, with residual VSD decreasing to 27% after one year of follow-up (3). Additionally, they highlighted a favorable prognosis for aortic valve repair, particularly at an earlier age. Waqar et al, observed 94% showing improvement. Residual VSD was evident in only two patients (2.8%) (4). In our study, we observed a higher rate of regression in aortic valve disease, with 100% showing improvement. Only one patient is showing minimal residual flow post closure VSD (12.5%).

Further studies with larger sample sizes and longer follow-up periods are warranted to validate these findings and elucidate the long-term durability and clinical implications of aortic valve repair using the Trussler technique in pediatric patients.

1. CONCLUSION

Aortic valve repair utilizing the Trussler technique is a viable treatment option for pediatric patients with VSD and AR, offering favorable surgical outcomes and significant improvements in valve function. This case series contributes valuable insights into the management of complex aortic valve pathologies in this population, highlighting the importance of tailored surgical approaches to optimize patient outcomes and quality of life

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