

Mortality of Children with Mechanical Valve Prostheses at the CUOMO Cardio-Pediatric Center of University National Hospital of Fann (Dakar)

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Abstract

Introduction: Mechanical valve replacement in pediatric age is a dreaded but sometimes inevitable surgery. The purpose of this study was to determine the mortality of children with mechanical valve prostheses in the short, medium and long term. **Patients and Methods:** This was a retrospective and descriptive study conducted at the CUOMO cardio-pediatric center at Teaching National Hospital of Fann between January 1st, 2017 and December 31st, 2021. We included, children whose age is less than or equal to 16 years of age and who have benefited from a mechanical valve replacement and with a follow-up period of more than 6 months post-operative in the CUOMO cardio-pediatric center. Patients whose age at the time of surgery was over 16 years were excluded; patients who have benefited from bioprosthesis or valvular plastic surgery alone; as well as patients for whom a follow-up of more than 6 months was not found. Statistical analyses were carried out using the SPSS (Statistical Package for Social Science) software version 18 to calculate averages and percentages. **Results:** We included 85 patients. The average age was 12.84 ± 2.52 years. The male gender predominated with a sex ratio of 1.65. Dyspnea was found in 96.47% of children. Pure mitral regurgitation was the most common valve disease found in 67.06%. Rheumatic etiology was noted in 87.06% of cases. Mono valve replacement was performed in 84.71% of patients and double valve replacement in 15.3% of cases. Major mechanical complications were reported in 8 patients including 5 severe aortic mismatch cases. Hemorrhagic complications were observed in 4 patients requiring surgery. Hemodynamic complications were dominated by right ventricle dys-

function in 14 patients. Supraventricular rhythm disorders were present in 11 patients and one case of ventricular tachycardia. We found six cases of infectious endocarditis. Eight deaths were recorded with a mortality rate of 5.88%. Significant predictors of mortality were stage IV dyspnea of NYHA and preoperative overall heart failure. **Conclusion:** Our study showed good results in terms of short-, medium- and long-term mortality. Complications related to mechanical valve prostheses are not negligible, hence a rigorous life-time monitoring after surgery.

Keywords

Morbidity, Mortality, Mechanical Valve, Children, Dakar

1. Introduction

Rheumatic valvulopathies, sequelae of acute articular rheumatism, represent one of the main cardiovascular diseases of the child. They are a real public health problem, especially in developing countries [1] [2] [3]. Acquired or congenital valvular pathologies represent a real surgical challenge in the pediatric age. If conservative repair (plastia) remains the most physiological therapeutic solution, it is unfortunately no longer possible in a number of patients. For these patients, only replacement of the valve with a prosthesis is possible [4] [5]. Mechanical valve replacement in pediatric age is a dreaded but sometimes inevitable surgery. However, it exposes to significant morbidity and mortality. There is an immediate life-threatening risk due to the usually advanced character of heart disease, the degree of deterioration in left ventricular function and long-term aortic mismatch [6]. Monitoring of anticoagulant treatment is restrictive in children and balance is often difficult to obtain. Mechanical prosthesis is also a significant risk factor for infectious endocarditis and therefore requires rigorous dental hygiene in particular. For all these reasons, mechanical valve replacement in children is a long-delayed surgery [4] [5]. The lack of local data on the mortality of these children has prompted us to carry out this work. The main objective of this work is to determine the mortality of children with mechanical valve prostheses in the short, medium and long term.

2. Patients and Methods

We conducted a retrospective, descriptive and analytical study from January 1st 2017, to December 31st, 2021.

Were included, children whose age is less than or equal to 16 years of age and who have benefited from a mechanical valve replacement and with a follow-up period of more than 6 months post-operative in the CUOMO cardio-pediatric center. The cardiovascular pediatric surgery center (CUOMO) at Fann Hospital is the only cardiac surgery reference centre in the country. The children were operated on by the local team or by humanitarian missions.

The funding was through “themselves” or social assistance.

Patients whose age at the time of surgery was over 16 years were excluded; patients who have benefited from bioprosthesis or valvular plastic surgery alone; as well as patients for whom a follow-up of more than 6 months was not found.

The various parameters studied were marital status (age and sex ratios), background and socio-economic status. Clinical and paraclinical pre-operative signs have been identified. The trans-thoracic echocardiography had made it possible to specify the parameters for each valvular lesion and also to determine the etiologies of valvulopathies. We also studied the surgical and resuscitation data. Morbidity and mortality in the short, medium and long term was assessed.

Statistical analyses were carried out using the SPSS (Statistical Package for Social Science) software version 18 to calculate averages and percentages.

3. Results

We included 85 patients. The average age was 12.84 ± 2.52 years with extremes of 7 and 16 years. Males predominated with a sex ratio of 1.65. Twenty-one patients had dropped out of school because of their illness. Forty-nine patients were rural, 58% and 36 patients were urban, 42%. Recurrent angina was found in 67.1% of patients. The socio-economic level was low in 69 patients, 81.18% and average in 16 patients, 18.82%.

Dyspnoea was found in 96.47% of the population. Pure mitral regurgitation was the most common valve disease found in 67.06%. Rheumatic etiology was noted in 87.06% of cases. All patients were operated on with extra-corporeal circulation (ECC) after median sternotomy. 68.24% of cases had mitral valve replacement, 16.47% had aortic valve replacement and 15.3% had double valve replacement. Standard Carbomedics and Medtronic prostheses were most used in the mitral position in 33 and 18 patients, respectively, and in the aortic position, Saint Jude Medical prostheses in 10 patients. The average ECC time was 125.88 ± 42.04 min with extremes of 55 and 310 min. The mean aortic clamping time was 96 ± 36.64 min with 37 and 269 min extremes. Del Nido cardioplegia was most used in 64 operations, or 75.29%. Sixty per cent of the patients had needed to be medicated. The average length of stay in resuscitation was 3.8 ± 2 days with extremes of 1 and 15 days.

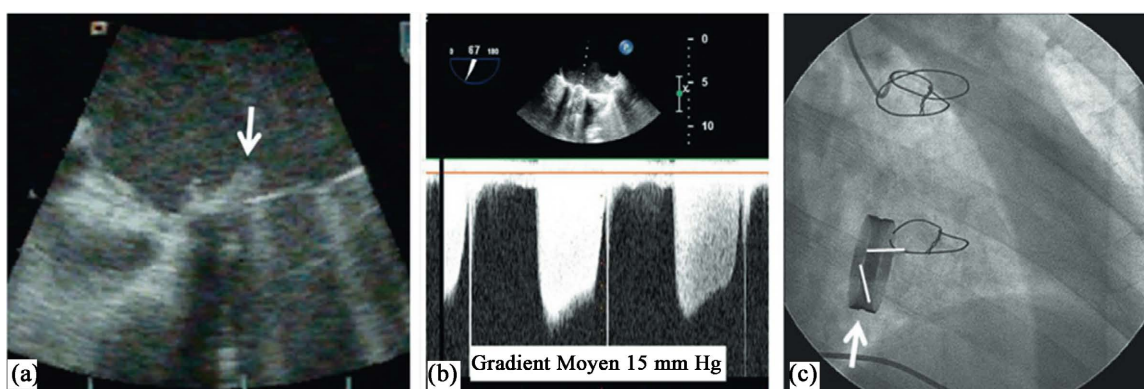
Major mechanical complications were identified in the medium term: prosthetic thrombosis in 2 patients (**Figure 1**), severe aortic mismatch and denture removal in 2 patients and 1 patient respectively. In the long term, we found three aortic mismatches. Hemorrhagic complications were observed in 4 patients requiring surgical recovery (two major bleeding of the drain, a compressive hematoma of the right ventricle and an abundant circumferential haemopericard). Other hemorrhagic complications were mostly anemia from blood spoliation in 18 patients, or 51.43% in the short term. In the medium and long term, we have identified one hemoarthrosis and 5 cases of epistaxis. In our series, 58.8% ($n = 50$) of patients had hemodynamic complications during follow-up, most of

which were right ventricle dysfunction in 36.84% (n = 14). In the short term, supraventricular rhythm disorders were present in 11 patients and one case of ventricular tachycardia. No cases of major conductive disorder were noted. We found 6 cases of infectious endocarditis throughout the follow-up.

In the short and medium term, 3 deaths were recorded with a mortality rate of 3.53% for each period respectively. In the long term, there were 2 deaths or 2.35%. Significant predictors of mortality are stage IV dyspnea of NYHA (p = 0.0048) and preoperative global heart failure (p = 0.0075). The main results are summarized in **Table 1**.

4. Discussion

The average age in our series was 12.84 ± 2.52 years. This mean age is relatively



TEE: Transesophageal echocardiography.

Figure 1. Obstructive thrombosis of mechanical prosthesis in mitral position. (a) Thrombus on the atrial side of the TEE prosthesis (arrow); (b) Transmitral mean gradient elevation at 15 mmHg (normally < 6 mmHg); (c) Locking of a fin (highlighted in white) in radio-cinema (arrow).

Table 1. Summary of the main results.

Data	Headcount
Total number	85
Average age (years)	12.84 ± 2.52
Sex-ratio M/F	1.65
SVR	72
DRV	13
Mechanical complications	8
Bleeding complications	4
Hemodynamic complications	14
Infectious endocarditis	6
Rhythm and conduction disorders	12
Mortality	8

SRV: Single Valve Replacement; DRV: Double Valve Replacement.

close to that of Edwin, *et al.* in Ghana [7] and in metalysis of Etnel, *et al.* [8] but remains considerably higher than the series of Ibezim, *et al.* [9], which was 4.3 years in the United States and Beierlein, *et al.* [10], which was 3 years in the United Kingdom. This can be explained by the age of early detection of valvular diseases and early surgery in these countries. We found a male predominance with a sex ratio of 1.65. The sex ratio varies according to the series [7] [11] [12].

Prosthetic thrombosis is the major complication of mechanical prostheses. The lack of anticoagulant treatment is frequently involved despite the efforts of patients to educate. Obstructive thrombosis is a vital medical-surgical emergency with no delays in diagnosis and management. Their frequency ranges from 0.3 to 1.3 per 100 patient-year [13]. In our series, prosthetic thrombosis occurred in 2 patients. In the foreign studies [7] [11] [12] [14], the number of cases was generally less than 5. Five patients had mismatched during follow-up, including four patients in the aortic position. This is usually due to a mismatch between prosthesis size and growth [15]. There are two types of bleeding complications, those requiring surgical recovery and those not requiring recovery. Hemorrhagic complications can affect up to 6% of cardiac surgeries performed under CEC, the recovery rate for hemostasis varies between 3% and 10% [16]. The recovery rate for bleeding was 4.7% in our study. The causes of post-operative bleeding can be multifactorial [17]. Any intervention in ECC temporarily impairs systolic and diastolic myocardial function; this dysfunction will be all the more severe as preoperative function is lowered and the operation performed is at risk [18]. In our series, hemodynamic complications were dominated by right ventricle dysfunction in 36.84% (n = 14) patients. Infectious endocarditis is the most severe complication of valve replacement. Infection of implanted equipment affects 3% - 6% of patients with a prosthetic valve [7] [14] [19]. This rate is comparable with our patient results (7.06%) on all follow-ups.

Short-term mortality was 3.53% in our study, which was relatively close to the Edwin *et al.* and Akhtar, *et al.* series [7] [12]. However, Alsoufi, *et al.* [20] reported higher mortality of 18%; and Van Doorn, *et al.* [19] noted a rate of 20.3% in the short term. These differences could be explained by the patient profile, comorbidities and surgical experience [21].

5. Conclusion

Our study showed good results in terms of short-, medium- and long-term mortality. Complications related to mechanical valve prostheses are not negligible, hence a rigorous lifetime monitoring after surgery. State authorities must increase human and material resources and subsidise cardiac surgery.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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