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Mitral Valve Repair in Pediatric Patients with Dilated Cardiomyopathy and Mitral Insufficiency: Single-Center Experience and Results

Dilate Kardiyomiyopati ve Mitral Yetmezlikli Çocuk Hastalarda Mitral Kapak Onarımı: Tek Merkezli Deneyim ve Sonuçlarımız

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ABSTRACT

Objective: Idiopathic dilated cardiomyopathy (DCM) is a serious disease causing mitral regurgitation and contraction defects of the myocardium. Through mitral valve (MV) repair surgery, the clinical status of patients can be improved.

Methods: Pediatric patients with DCM and mitral insufficiency who underwent mitral repair procedures between 2019 and 2023 were retrospectively investigated. The patients' demographic characteristics, preoperative and postoperative clinical conditions, and echocardiographic findings were compared. The techniques used in patient operations were examined. Similarly, data regarding the postoperative intensive care unit processes and mortality data of the patients were recorded.

Results: Mitral repair was performed in 3 patients during the study period. The mean age of the patients was 4.66 months (±3.05) and body weight was 5.25 kg (±0.25). In the preoperative period, left ventricular ejection fraction decreased slightly in all patients [mean: 43.3% standard deviation (SD): ±2.8]. Although the preoperative and postoperative values of left ventricular end-diastolic diameter (LVEDd) and LVEDd Z-scores were above normal, respectively, they showed a decreasing trend after the operation. Although the mitral annulus diameters decreased slightly after the operation in all three patients, they remained high (mean: 17.6 mm SD: ±1.5). A significant decrease in MV insufficiency was observed in postoperative follow-ups after discharge (1^{st}-2^{nd} degree). Wooler annuloplasty and posterior valve pericardial patch augmentation were applied as the primary approach in all patients. The patients did not develop additional morbidities, and no mortality was observed during hospitalization.

Conclusion: Successful surgical interventions to prevent mitral regurgitation in pediatric patients with DCM and mitral regurgitation, may improve the clinical status of these patients.

Keywords: Cardiomyopathy, dilated, mitral valve, infant, mitral valve annuloplasty, heart failure

ÖZ

Amaç: İdiyopatik dilate kardiyomiyopati (DCM), mitral yetersizliğine ve miyokardın kasılma bozukluğuna neden olan ciddi bir hastalıktır. Mitral kapak (MK) onarımı ameliyatı ile hastaların klinik durumu iyileştirilebilir.

Yöntemler: 2019-2023 yılları arasında mitral onarımı yapılan DCM ve mitral yetmezliği olan pediatrik hastalar retrospektif olarak incelendi. Hastaların demografik özellikleri, ameliyat öncesi ve sonrası klinik durumları ve ekokardiyografik bulguları karşılaştırıldı. Hastaların ameliyatlarında kullanılan teknikler incelendi. Benzer şekilde hastaların postoperatif yoğun bakım süreçleri ve mortalite verileri kaydedildi.

Bulgular: Çalışmanın yapıldığı tarih aralığında 3 hastaya mitral tamir uygulandı. Hastaların ortalama yaşı 4.66 ay (±3,05) ve vücut ağırlığı 5.25 kg (±0,25) idi. Preoperatif dönemde hastaların hepsinde sol ventrikül ejeksiyon fraksiyonu hafif azalmıştı [ort.: %43,3±2,8 standart deviasyon (SD)]. Sol ventrikül diyastol sonu çapı (LVEDd) ve LVEDd Z-skorları sırayla preoperatif ve postoperatif değerleri normalin üzerinde olsa da operasyondan sonra azalma trendi göstermiştir. Her üç hastada da mitral annülüs çapları operasyon sonrasında hafif gerileme gösterse de yine yüksek sebat etmiştir (ort.: 17,6 mm ±1,5 SD). Postoperatif taburculuk sonrası takiplerde mitral kapak yetmezliğinde belirgin azalma görülmüştür (1.-2. derece). Tüm hastalarda primer yaklaşım olarak Wooler annüloplasti ve posterior kapak perikardial yama augmentasyonu uygulandı. Hastaların hastanede yatış süreleri boyunca ek morbiditeleri gelişmedi, mortalite izlenmedi.

Sonuç: DCM ve mitral yetmezlikli çocuk hastalarda mitral yetersizliğini önlemeye yönelik başarılı cerrahi girişimler hastaların klinik durumunu iyileştirebilir.

Anahtar Sözcükler: Kardiyomiyopati, dilate, mitral kapak, infant, mitral kapak annüloplasti, kalp yetmezliği

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INTRODUCTION

Idiopathic dilated cardiomyopathy (DCM) is a myocardial disease in which the left or both ventricles are affected simultaneously, leading to contraction disorders, and the underlying cause cannot be revealed. This condition, which can affect both adults and children, is much less common in children (annual average 1:170,000 vs. 1:2500) (1,2). However, the clinical course of DCM in children is unfortunately more severe than in adults. The rate of death or transplantation requirement of patients during 1 and 5-year follow-ups is 31% to 46%, respectively (1,2). Approximately 30% of pediatric patients with DCM, the disease may regress under medical treatment or spontaneously over the years. However, in the majority of patients, the clinical picture progressively worsens, and they begin to require frequent hospitalization and inotropic therapy. Patients with poor left ventricular contraction, a high degree of mitral insufficiency (MI), lower functional capacity, and those who do not respond to medical treatment have a poor prognosis. These patients may require mechanical support and/or heart transplantation. DCM is the most common cause of heart transplantation in pediatric patients (3). However, today, due to the scarcity of donors, several patients cannot be transplanted in a timely manner, and approximately 30% of patients die while waiting for transplantation (4). In addition, chronic rejection may develop in transplanted patients in the subsequent years, and the 25-year survival rate of the patients may decrease to 37%.

The suboptimal long-term outcomes of heart transplantation, considered the definitive treatment for end-stage heart failure, have prompted clinicians to explore alternative medical and surgical approaches. Especially in the last two decades, repair procedures for MI, frequently observed in patients with DCM, have gained popularity in both adult and pediatric patients. Studies have reported that by eliminating or reducing MI through repair or replacement, the clinical status of some patients improved, and the need for transplantation was postponed. The aim of this study is to investigate changes in the clinical status and echocardiographic (ECHO) data of pediatric patients with DCM and severe MI who underwent mitral valve (MV) repair and to compare the results obtained with those reported in the current literature.

MATERIALS AND METHODS

This study is a retrospective observational study, and its cohort consists of pediatric patients (<18 years old) diagnosed with DCM and severe MI who were referred to mitral repair surgery at Ankara Bilkent City Hospital between August 2019 and August 2023. The study protocol was approved by the Ankara Bilkent City Hospital (approval number: E2-23-5860, date: 06.12.2023).

The diagnosis of DCM was based on the presence of the following signs and symptoms: heart failure symptoms, left ventricular end-diastolic diameter (LVEDd) Z-score >2, a thin-walled left ventricle (LV) with a spherical shape, and left ventricular ejection fraction (LVEF) below 50%. The study included patients with idiopathic DCM, while those with myopathies developing secondary to viral or other factors were excluded to ensure homogeneity.

The indications for the operation in patients were determined as signs of congestive heart failure that could not be diminished with maximum medical treatment, such as tachypnea, tachycardia, intense sweating, difficulty in feeding, and failure to gain weigh as well as poor cardiac function and severe MI. The patients' demographic characteristics, preoperative clinical conditions, ECHO findings, operative details, postoperative intensive care data, and post-discharge follow-up data were retrospectively investigated. In the ECHO assessment, both preoperative and postoperative (after discharge) measurements of patients' LVEF, left ventricular fractional shortening (LVFS), LVEDd and Z-scores, MV annulus diameters and Z-score and MI grading were evaluated. EF and LVEDd measurements were obtained using the biplane Simpson method. In the clinical evaluation, the patient's modified Ross classification, daily diuretic use dose, and the child's ability to gain weight were examined both preoperatively and postoperatively. Post-discharge changes in the patients' MI and whether there was a need for an increase in the diuretic dose were assessed.

Statistical Analysis

Categorical measurements were summarized as numbers and percentages, and numerical measurements were summarized as mean and standard deviation (SD). All statistical analyses were performed using IBM SPSS version 25.

Operative Technique

In all patients, the MV was accessed through median sternotomy. After inducing moderate hypothermia and achieving cardiac arrest, the interatrial groove was dissected, and entry into the left atrium was made through Sondergaard's groove. Improved visualization of the MV was achieved by placing suspension sutures in both trigone and the middle of the posterior annulus. Subsequently, both valves and the subvalvular apparatus were meticulously examined using nerve hooks. The intensity and characteristics of the MI (central or eccentric) were then assessed by applying a saline test. The size of the annulus diameter and anterior mitral leaflet were determined using appropriate scales. Intraoperative examination revealed that the MV and subvalvular apparatus were structurally healthy. No thickening or shrinkage that could be considered pathological was observed. No major finding that could be compatible with rheumatic or infective endocarditis was detected. The scallops on both leaflets of the valve were prominent, and the coaptation surfaces had smooth anatomy. No clefts were observed in the MV leaflets. The primary causes of MI in all patients were annular dilatation and restriction of movement of the posterior leaflet. The anterior MV and its associated subvalvular apparatus move freely. However, it was noted that the configuration of the posteromedial papillary muscle was disturbed by LV dilatation. The LV had thinned free walls, and the chordae of the posteromedial papillary muscle had restricted the movement of the posterior leaflet. In the saline test, it was observed that the posterior leaflet could not completely cover the coaptation surface, leading to functional central insufficiency, especially in the P2-A2 line. Subsequently, Wooler annuloplasty and posterior leaflet augmentation using autologous pericardium were performed in all patients (Figure 1a,b). In patient number 2, upon observing that central MI persisted in the intraoperative saline test, Wooler annuloplasty stitches were removed, and posterior annular shortening plasty reinforced with an autologous pericardial strip was performed on the posterior leaflet. Additionally, in patient number 1, since serious MI was observed on intraoperative transesophageal

echocardiography (TEE), the surgical repair was re-evaluated by applying a cross-clamp for the second time. It was observed that the posterior suture line of the autologous pericardium was detached from the native MV tissue, probably due to weak stitches. The entire anastomosis was re-performed and strengthened. After all these interventions, it was observed that MI decreased to trace or grade 1 in all patients. All patients had moderate tricuspid valve insufficiency. The reason for this was thought to be related to secondary pulmonary hypertension due to severe MI and distortion of the morphology of the right chambers by the enlarged left chambers. Because there were no obvious signs of right heart failure in the patients and it was thought that the existing insufficiency could improve in the long term, no additional intervention was applied to the tricuspid valve.

RESULTS

During the study period, mitral valvuloplasty was performed in three pediatric patients diagnosed with DCM and severe MI. Two of the patients were female, and one was a boy. The mean age of the patients was 4.66 months (±3.05 SD), and their body weight was 5.25 kg (±0.25 SD). In the preoperative period, LVEF slightly decreased in all patients [mean 43.3% (±2.8 SD)]. LVFS was observed at the lower limits of normal in all three patients [mean 24.3% (±2.08 SD)]. Although the preoperative and postoperative values of LVEDd and LVEDd Z-scores were above normal, respectively, they showed a decreasing trend after the operation. In all three patients, MV annuli were observed to be very large in the preoperative period [mean 19.3 mm (±2.08 SD)]. Although these values showed slight regression after the operation, they remained high [mean 17.6 mm (±1.5 SD)]. Similarly, the diameter of the left atrium increased significantly in all patients preoperatively, and some regression was observed after the procedure. Severe (grade 3-4) insufficiency in the MV was observed in all patients before the operation. A significant decrease in MI was observed during postoperative follow-up after discharge. Additionally, the modified Ross score of patients decreased, and the need for diuretic use decreased slightly. The perioperative variables are summarized in Table 1.

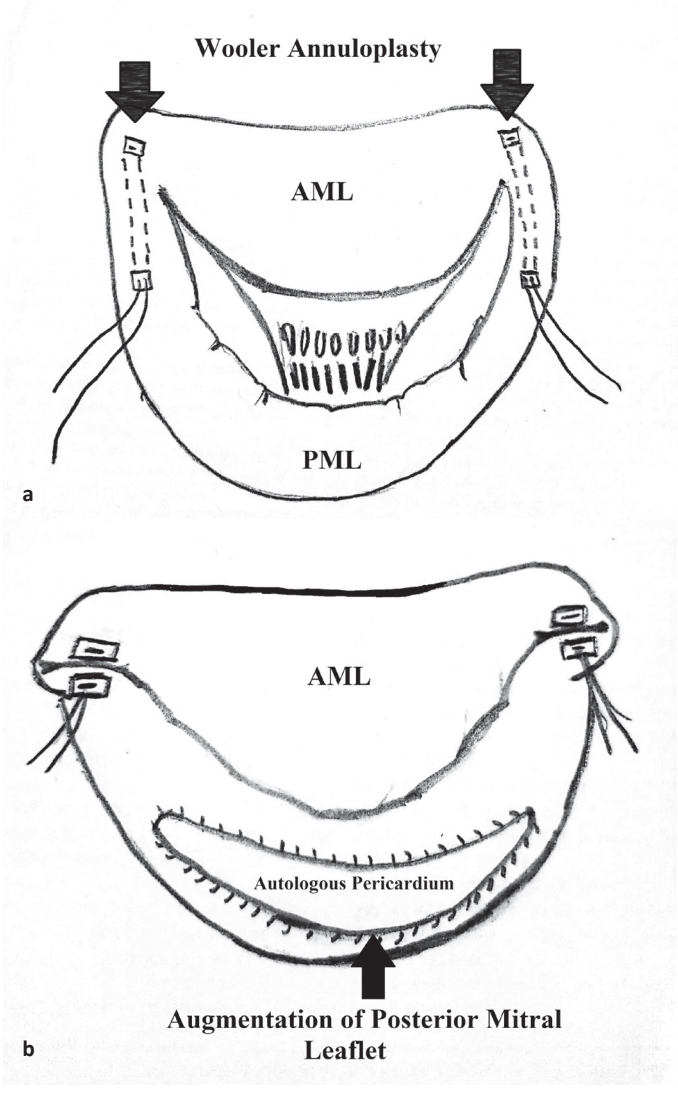

Figure 1. (a, b) Wooler annuloplasty procedure combined with augmentation of posterior mitral leaflet with autologous pericardium.

The operations of the patients were performed in a standard manner, and the cardiopulmonary bypass (CPB) and cross-clamp times of two patients was observed to be under 60 minutes. In one patient, CPB support was needed for the second time after residual severe MI was detected in the control performed with TEE. Wooler annuloplasty and posterior valve augmentation were applied as the primary approach in all patients. In patient number 1, the surgical procedure was revised in the same session, and in patient number 2, the posterior annulus was narrowed little more with modified Paneth annuloplasty reinforced with the untreated autologous pericardial strip technique (5), as the lid coaptation was not to the desired extent after the procedures. Postprocedure intraoperative TEE measurements mostly showed grade 1 MI. In the postoperative period, patient number 1's need for ICU and inotrope due to heart failure lasted significantly longer, and this was not observed in other patients. The patients did not develop additional morbidities, and no mortality was observed during the hospitalization period. Operative and ICU data are summarized in Table 2.

DISCUSSION

Approximately half of the pediatric patients diagnosed with DCM are in the infant age group. When all pediatric cardiomyopathies are evaluated, the rate of patients remaining free from death or heart transplantation over a 5-year period ranges between 46% to 60%. DCM is the most frequently transplanted pathology among all cardiomyopathies in pediatric patients (2).

Pediatric patients diagnosed with DCM may present with different clinical characteristics and ECHO findings. In this disease, myocardial thinning, LV dilatation and functional MI occur mainly secondary to progressive myocardial damage. Functional MI initiates a vicious circle, further increasing LV preload. This leads to LV dilatation, increased LV wall tension, prolongation of the distance between the papillary muscles, and further aggravation of functional MI. Consequently, the increasing MI, stretched, and enlarged left atrium and ventricle, and decreasing LV systolic function contribute to a further increase in MI and a gradual decrease in effective stroke volume. Patients become symptomatic with left heart failure due to this vicious circle. It is stated that the degree of MI at first admission

Table 1. Perioperative variables

	Patient number					
Perioperative variables	**1**		**2**		**3**	
	Preop	**Postop**	**Preop**	**Postop**	**Preop**	**Postop**
Age (month)	8	10	4	10	2	4
Weight (kg)	5.3	5.8	5.5	6.2	5	5.3
LVEF, (%)	45	58	40	57	45	60
LVFS, (%)	25	28	22	28	26	31
LVEDd (mm)	46	35	36	31	28	28
LVEDd Z-score	10.3	6.18	6.34	3.83	3.56	2.33
LVPWt (mm)	6	7	6	9	5	6
Mitral annulus (mm)	21	19	17	16	20	18
Mitral annulus Z-score	15.5	14.8	14.3	13.7	15.3	14.7
Mitral valve Insufficiency	3-4	1	4	1	3-4	1-2
Valve with restricted mobility	PML	-	PML	-	PML	-
Left atrium (mm)	41x35	30x36	35x35	30x30	40x35	35x35
RVSP (mmHg)	45-50	40-45	70-75	30-35	55-60	40-45
Tricuspid insufficiency	2	1-2	1-2	1	2	1
Additional cardiac anomaly	-	-	-	-	Large PDA	
Medication (mg/kg/d)						
- Spirinolacton	2.2	1.1	0.65	-	1	-
- Furosemid	2	1,8	0.72	1.12	2	2
- Captopril	2.2	1.5	0.62	0.5	0.8	0.8
Modified ross classification	3	2	3	1	3	1

LVEF: Left ventricular ejection fraction, LVFS: Left ventricular fractional shortening LVEDd: Left ventricular end diastolic diameter, LVPWt: Left ventricular posterior wall thickness, PDA: Patent ductus arteriosus, PML: Posterior mitral leaflet, RVSP: Right ventricular systolic pressure.

is a very important prognostic factor in the prognosis of patients with DCM, and functional MI is observed in 60-87% of all DCM patients at first admission or during follow-up (6,7).

In their study of 42 patients with DCM, Fernandes et al. (8) found that MI may increase even if EF remains stable in long-term follow-ups. Moreover, they observed that each degree of increase in MI doubled the risk of transplantation and death. Additionally, there is a correlation between a higher degree of MI and the worsening of patients' functional clinical status. However, an inverse relationship was observed between the patient's high degree of MI at the time of the initial diagnosis and exclusion from death or transplantation (8).

While MI develops in some patients with DCM but is not observed in others. The underlying reason for this remains unclear. However, based on these assumptions, it is thought that the disease progresses more severely in the myocardium of patients who develop MI, and dysfunction in the MV rapidly develops as a secondary effect of papillary muscle involvement. Additionally, it is believed that some as-yet-unidentified genetic factors may also influence the MV in certain patients, potentially paving the way for the development of insufficiency (6). The initial step in treating idiopathic DCM and MI involves alleviating congestive heart failure symptoms through medical interventions. Patients who respond successfully to medical treatment undergo close outpatient cardiological examinations for follow-up. Those whose symptoms cannot be adequately controlled through medication are hospitalized, and inotropic treatment is initiated. Individuals whose general condition does not improve despite these interventions, and who suffer from functionally severe heart failure were, are placed on the heart transplant list. If necessary, mechanical support devices can be implemented as a bridge to transplantation. Presently, due to a shortage of donors, patients on the transplant list face prolonged waiting times, leading to a distressing reality in which approximately 30% of these patients succumb to their condition before transplantation. Moreover, transplanted patients inevitably confront chronic rejection over the long term, with less than half of them reaching adulthood (4). The suboptimal results of transplantation treatment in pediatric patients have prompted clinicians to explore alternative surgical procedures that aim to alleviate patients' symptoms, delay the need for transplantation, and potentially eliminate this requirement altogether.

Endovascular or surgical repair techniques for MI are now commonly employed in adult patients with DCM. The perioperative mortality rate for adults with DCM who undergo MV surgery ranges between 2% and 11% (9). Given that this rate is comparable to the 1-year survival of transplanted patients, there is a growing trend in the frequency of interventions for MI in this patient group today. However, experience regarding the applicability and outcomes of these treatment methods in pediatric patients is limited. Few case

Table 2. Operative and ın-hospital follow-up data

	Patient number		
	1	**2**	**3**
CPB duration	108*	61	50
Cross clamp duration	49*	46	43
Mitral valve repair	Wooler annuloplasty, posterior leaflet augmentation	Posterior leaflet augmentation modified paneth annuloplasty†	Wooler annuloplasty, posterior leaflet augmentation
Mitral regurgitation after intraoperative repair (TEE)	1-2	Trivial-1	Trivial-1
Morbidity in the ICU	-	-	-
Duration of mechanical ventilation (h)	34	8	13
Duration of inotropic treatment	266	16	32
ICU stay (d)	12	2	4
Total hospital stay (d)	28	7	8
Mortality	-	-	-

CPB: Cardiopulmonary bypass, TEE: transesophageal echocardiography, ICU: Intensive care unit, *Patient number 1 was cross-clamped for the second time after severe residual central mitral insufficiency was observed in intraoperative TEE, †In patient number 2, modified Paneth annuloplasty was performed after Wooler annuloplasty failed.

series have been described to date, and the long-term results of MV repair surgery in pediatric patients with DCM are still under investigation. Nevertheless, many studies optimistically report that following MV repair, patients experience fewer symptoms, a reduced need for inotrope, and decreased hospitalization requirements. Additionally, it is suggested that this approach is effective in postponing the need for transplantation in such patients.

The primary surgical choice for pediatric patients with DCM and severe MI is MV repair. Studies conducted on adult patients with DCM indicate high mortality rates when direct mitral valve replacement (MVR) is applied in these cases. This finding is attributed to disruption of the subvalvar apparatus and loss of LV function associated with MVR. Preserving annulus and papillary muscle continuity has been demonstrated to play critical roles in maintaining LV geometry and reducing LV wall stress. Consequently, valve repair is preferred over replacement in MI cases in patients with impaired contractile function. Long-term results in both pediatric and adult patients undergoing MV repair show promise in terms of favorable outcomes related to mortality and morbidity (5,7). However, if the desired result cannot be achieved after mitral repair or signs of insufficiency recur in the long term, MVR is recommended as a last resort. The potential risks and disadvantages of MVR in children have been recognized for many years. These include the absence of prostheses designed for patients with a narrow annulus (<15 mm) and the necessity to employ annulus expansion techniques in these patients. Other concerns involve the potential development of patient-prosthesis mismatch due to the patient's growth in the post-implantation period and the likelihood of re-replacement. These challenges encompass the need for replacement, difficulties in applying anticoagulation in pediatric patients, the risk of permanent heart block, and the threat of thromboembolism. Despite these considerations, mechanical valves are still widely used globally in pediatric patients who are not suitable for repair. In a study involving 17 pediatric patients with a mean age and body weight of 3.2 months and 5.2 kg, respectively, MVs that were deemed unsuitable for repair were replaced with a 15 mm STJ mechanical valve. Subsequently, 11 patients required a new valve replacement due to patient-prosthesis incompatibility after an average of 2.9 years. During an average follow-up of 9.6 years, mortality occurred in 2 patients, 1 early and 1 late (12%). Throughout the follow-up period, thromboembolic events developed in 4 patients, and permanent neurological damage occurred in only 1. When no other option was available, the authors concluded that MVR with a 15 mm mechanical valve can be performed safely (10). Unfortunately, to date, there are no prospective controlled studies examining the long-term outcomes of MVR in pediatric patients with DCM.

On the other hand, there are few cases series in the literature about patients with DCM who underwent mitral repair. In a study involving 7 pediatric patients with an average age of 5.5±4.2 years who underwent mitral repair and replacement due to severe MI, it was found that their fractional shortening stabilized, although not significantly improved. Additionally, their LV end-diastolic and end-systolic Z-score significantly decreased in the positive direction. Furthermore, a significant reduction was observed in the need for hospital admission to the heart failure clinic within 1 year in these patients, with no early postoperative mortality reported. Moreover, in 2 patients who underwent transplantation during follow-up after mitral repair, the need for transplantation increased over 2 years. The authors concluded that surgical interventions using MV in patients with DCM and MI are reliable and can be performed to postpone transplantation (9). Sugiyama et al. (11) conducted non-transplant surgical interventions in 6 out of 11 pediatric patients with DCM. Among these, partial left ventriculotomy and Alfieri mitral repair were performed in 5 patients. In 2 of those who underwent repair, severe MI developed during follow-up, leading to MVR. After more than 5 years of clinical follow-up, 3 of these patients (50%) were able to continue education and were followed up without complaint. The authors suggest that partial left ventriculotomy and MVR may play an important role in palliative treatment as a bridge to transplantation. They even propose that in patients in end-stage heart failure clinics

not suitable for transplantation, these interventions could be considered permanent treatment when combined with aggressive medical management (11). Hsu et al. (12) conducted 6 operations on 5 pediatric patients with DCM. Two of these patients underwent elective partial left ventriculotomy and MV repair, respectively, and both successfully underwent orthotopic heart transplantation 7 and 5 months after the operation, respectively. The other three patients underwent surgery under emergency conditions, and all of them died either immediately after the operation or due to heart failure that developed during early follow-up. The authors suggest that non-transplantation cardiac surgery may provide palliation as a biological bridge to heart transplantation in pediatric patients and may serve as an alternative to mechanical support treatments (12).

In their case report, Kobayashi et al. (13) performed MV annuloplasty at the age of 18 months and size 21 MVR at the age of 3 in pediatric patients who developed DCM and severe MI secondary to enteroviral myocarditis in the neonatal period. The patient, on whom they performed debridement due to pannus formation in the mechanical valve in the 4th year after replacement was followed up with an LVEF of 47% and a mean transmitral gradient of 5 mmHg at the age of 7. The authors state that appropriate and timely mitral intervention can delay the need for transplantation (13). Walsh et al. (2) employed different MV repair techniques in 5 pediatric patients with DCM and MI who were aged between 3 months and 4 years and weighed 4.3 to 12.0 kg. Following the repairs, it was observed that the MI in 4 of the patients significantly regressed, their symptoms significantly decreased, and their functional capacity increased. Although no significant increase in LVEF was noted in these patients, the left atrial diameters and LVEDd were significantly decreased. The authors suggest that symptomatic improvement can be achieved in patients who undergo MV repair. However, a clear comment cannot be made regarding whether transplantation will be required in the future after this repair (2).

In this case series, Wooler annuloplasty and posterior leaflet augmentation were used in combination for three patients with DCM and MI. Through these techniques, we achieved symmetrical annular narrowing and expanded the posterior leaflet surface area was expanded, facilitating the coaptation of both leaflets close to normal. In one patient, we incorporated posterior annular shortening plasty reinforced with an autologous pericardial strip because the MI persisted above grade 2 during intraoperative TEE evaluation. As a result, we observed improvements in the clinical conditions of patients during the early postoperative and early postdischarge periods. Additionally, ECHO analysis revealed a regression in LVEDd, left atrial diameter, and MI levels. Diuretic and cardioprotective agents were continually administered to all patients. During follow-up, the patients gained weight, and their Ross scores decreased. Despite the positive findings observed in our patients after mitral repair, the long-term outcomes remained uncertain. Experience from other series indicates that diverse clinical courses may be encountered in these patient groups. While some children may experience a rapid regression of heart failure symptoms and an increase in daily activities, others may continue to require inotrope even if MI is successfully eliminated. MI may reoccur during follow-up in some patients, leading to the necessity of MVR, and eventually, these patients may become candidates for transplantation (9).

Because there are no large case series and controlled studies on this subject, we consider the potential for the recurrence of MI based on previous case series. However, we also believe that patients have the potential to recover at the myocardial level. Some studies have suggested that in certain patients with DCM and MI, reverse remodeling may occur in the LV, and ventricular function may improve after mitral repair. On the other hand, it has been indicated that this reverse remodeling does not occur, and ventricular dilatation progresses in patients in whom MI surgery is unsuccessful. Based on these data, we believe that mitral repair is a method that can be considered for bridging or as treatment before transplantation in patients with DCM and MI.

CONCLUSION

The presence of MI is a poor prognostic finding in pediatric patients with DCM. Successful surgical interventions for MI in this patient group may improve clinical status, reduce the frequency of hospitalization, and postpone the need for transplantation.

Ethics

Ethics Committee Approval: The study protocol was approved by the Ankara Bilkent City Hospital (approval number: E2-23-5860, date: 06.12.2023).

Informed Consent: Retrospective study.

Authorship Contributions

Concept: M.Y., A.A., Design: M.Y., Supervision: İ.E., H.A.G., Resources: M.Y., B.S.T., Material: B.S.T., Data Collection or Processing: İ.E., H.A.G., Analysis or Interpretation: M.Y., A.A., Literature Search: B.S.T., A.N.E., Writing: M.Y., A.A., Critical Review: A.N.E., A.A.

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