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Case Series

Combined operation for coronary artery bypass grafting and mitral valve replacement; risk and outcome

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ABSTRACT

Introduction: The combination of mitral valve replacement (MVR) with coronary artery bypass grafting (CABG) is generally thought to have a greater early and late mortality than either procedure alone. The aim of this study is to review single center experience for the concomitant MVR and CABG.

Patients and methods: This is a single center, retrospective, single cohort study, composes of consecutive cases. It included all the cases of combined operation of MVR and CABG. The patients were followed up for a median duration of two years (six months to four years). The data were collected from hospital records and registers of hospital statistics. The followings were obtained; socio-demographic data, information regarding clinical courses, intraoperative findings, and post-operative follow up data.

Result: The study included 72 cases, the mean age was 56 years, 38 of them (53%) were males and 34 (47%) were female. The most common comorbidity was hypertension which was found in 24 patients (33%). The mean preoperative ejection fraction was 59%. Twenty-two patients (30.6%) had single graft, 21 patients (29.2%) underwent 3-vessel grafting, 16 patients (22.2%) had 2-vessel grafting, and 13 cases (18.1%) underwent 4-vessel grafting. The CPB duration ranged from 108 to 280 min with a mean of 182 min and cross-clamp time ranged from 80 to 186 min with a mean of 122 min. The most common complication was plural effusion which occurred in 8 cases (11.1%) and managed by aspiration. Overall mortality was 8.3% (4 patients).

Conclusion: CABG and chordal-sparing and posterior leaflet replacement has favorable outcome, as well as minimizes the need of redo surgery as in repair.one of the best options for CAD and sever MR.

1. Introduction

Mitral valve disorder is one of the most common valvular heart diseases in the developed countries reaching about 2% of general population [1,2]. Patients who have both mitral valve dysfunction and atherosclerotic coronary artery disease (CAD) form a heterogeneous group in terms of origin of the valvular disease, extent of coronary atherosclerosis, left ventricular dysfunction, and hemodynamic status at operation [3]. Chronic ischemic mitral regurgitation (IMR) is a frequent and important complication after myocardial infarction. Its pathophysiologic mechanisms account for remodeling of segmental/global left ventricle (LV) inducing papillary muscle displacement and leaflet tethering [4].

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Approximately 15%–20% of patients undergoing mitral valve replacement for non-ischemic mitral valve disease need coronary artery bypass grafting (CABG) [5,6]. The combination of mitral valve replacement (MVR) with CABG is generally thought to have a greater early and late mortality than either procedure alone. Although CAD is often associated with mitral valve disease, but it may not be the cause of the valve dysfunction [7]. Current guidelines recommend mitral valve surgery for severe IMR, but do not demonstrate a specific type of procedure like combination operation [8,9]. The aim of this study is to review single center experience for the concomitant MVR and CABG. The study has been written in line with process guidelines [10].

2. Patients and methods

2.1. Design and setting

This is a single center, retrospective, single cohort study, composes of consecutive cases during four year period (2016–2020). It included all the cases of combined operation of MVR and CABG. Those patients with double valvular intervention were excluded from the study. Follow-up of patients was performed through clinical visits and telephone interviews with patients and/or their family. The patients were followed up for a median duration of two years (six months to four years).

2.2. Registration

The research was registered in Chinese Clinical Trial Registry. The registration number was ChiCTR2000033249. The link is 中国临床试验注册中心 - 世界卫生组织国际临床试验注册平台一级注册机构 (chictr.org.cn).

2.3. Preoperative intervention

All patients underwent transthoracic echocardiography (TTE) and preoperative coronary angiography. Carotid Doppler study was requested for those patients with previous stroke and/or peripheral vascular disease (PVD).

2.4. Operative intervention

Standard cardiac surgery monitoring was used. The operation was performed through a complete median sternotomy. Before the institution of cardiopulmonary bypass (CPB) the grafts were harvested. The left internal mammary artery (LIMA) was harvested in the pedicle fashion. The saphenous vein was harvested in the standard fashion. After heparin administration CPB was instituted, aortic cross clamping, Normohermia used for patients with borderline renal function, and mild hypothermia for the rest. Delnido, blood cardioplegia was used in all cases, induction was commenced by antegade root, and maintenance by retrograde one. Venting the left ventricle was established through superior pulmonary vein. Distal anastomoses were done first, followedy left atriotomy. The anterior leaflets were removed wile posterior one preserved. All of the patients underwent prosthetic mitral valve replacement. No repair was attempted because all of the cases were young, there was a limited experience in repair and no consensus guidelines preferring repair over replacement. Separated suture technique was performed to implant the mitral prosthesis. The heart was de-aired and the aortic clamp was removed. The proximal anastomoses were done lastly. Mediastinal and pleural drains were placed before chest closure. Post operatively, all patients were kept on oral anticoagulant and antiplatelet.

2.5. Data collection

The data were collected from hospital records and registers of hospital statistics. The followings were obtained; socio-demographic data, information regarding clinical courses, intra-operative findings, and post-operative follow up data.

2.6. Data analysis

The information was collected and registered into an excel file, after coding of the data, a Statistical Package for Social Sciences (SPSS) software was used to analyze the data. Frequency, percentage, mean and range (descriptive statistics) were calculated to present the data.

3. Result

The study included 72 cases, the mean age was 56 years (ranging from 42 years to 78 years), 38 of them (53%) were males and 34 (47%) were female. The most common comorbidity was hypertension which was found in 24 patients (33%) (Table 1). The mean preoperative ejection fraction was 59% (ranging from 40% to 62%). Twenty-two patients (30.6%) had single graft, 21 patients (29.2%) underwent 3-vessel grafting, 16 patients (22.2%) had 2-vessel grafting, and 13 cases (18.1%) underwent 4-vessel grafting. The CPB duration ranged from 108 to 280 min with a mean of 182 min and cross-clamp time ranged from 80 to 186 min with a mean of 122 min. The average duration of admission to the intensive care unit was 51 h ranging from 48 h to 72 h. The patients stayed at hospital a mean of 7 days (ranging from 5 to 10 days). The most common complication was plural effusion which occurred in 8 cases (11.1%) and managed by aspiration (Table 2).

Overall mortality was 8.3% (4 patients), the causes were as the followings; failure of weaning from bypass in one case (1.4%), CVA in one case (1.4%), multi-organ failure in one case (1.4%) and cardiac tamponade in one case (1.4%) who was presented two weeks after operation.

4. Discussion

Despite the prevalence of IMR in patients referred for surgical revascularization and its association with poorer clinical outcomes, the optimal management of moderate to-severe IMR remains unclear [11].

Acker et al. Found that chordal-sparing mitral valve replacement has no significant difference with mitral valve repair in patients with severe ischemic mitral disease. This conclusion was based on the absence of a significant difference in left ventricular reverse remodeling and in the rate of major adverse cardiac or cerebrovascular events at 12 months. Mitral valve replacement provides a considerably more durable correction of mitral regurgitation, which may have an important effect on long-term outcomes [12]. A case-matched study found that replacement was associated with

Table 1
Comorbidities of the participants.

Comorbidities	Number (%)
Hypertension	24 (33)
Diabetes mellitus	20 (27)
Dyslipidemia	16 (25.8)
Atrial fibrillation	8 (11)
Chronic obstructive airway disease	4 (5.5)
Stroke	2 (2.7)
Percutaneous coronary intervention	2 (2.7)

Table 2
Postoperative complications.

Complications	Number (%)
Pleural effusion	8 (11.1)
Arrhythmia	8 (11.1)
Heart block	4 (5.5)
Renal impairment	4 (5.5)
Respiratory complication	3 (4.2)
Pericardial effusion	2 (2.7)
Deep sternal wound infection	2 (2.7)
Re exploration	2 (2.7)
Stroke	2 (2.7)
Gastrointestinal bleeding	2 (2.7)

lower incidence of valve-related complications than was repair and both mitral valve procedures showed no significant difference in left ventricular function at follow-up [13]. However, replacement had greater thromboembolic and ischemic stroke rates than repair despite anticoagulant therapy [14].

In a meta-analysis by Wang et al. which covered 11 studies, including those patients undergoing repair or replacement electively with CABG surgery, no differences were found regarding peri-operative mortality and long-term survival. However mitral valve replacement was associated with lower incidence of mitral regurgitation in patients with IMR during CABG [15].

In this study all of the cases underwent MVR.

CPB and aortic cross-clamp duration was found to be significantly higher in patients undergoing CABG and MV surgery. This is an intuitive finding given the increased complexity of a combined procedure. Longer CPB and aortic cross-clamp duration has been linked with a number of complications, including micro emboli, increased transfusion requirements, coagulation defects, and immunosuppression [14]. The combined operation mandate a prolonged operation in term of both cross clamp time and CPB duration. Mantovani and associates reported an average of 173 min of CPB duration and 131 min of cross clamp time while Ljubacev and colleagues reported 152 min of CPB and 99 min of cross clamp time [16]. In the current study, the CPB was 182 min and cross clamp time was 122 min.

Valve replacement in patients who require CABG for associated coronary artery disease presents a unique problem in achieving and maintaining adequate myocardial protection. Earlier studies of simultaneous valve replacement and CABG showed a higher risk for the combined procedure [17]. The impact of etiology of associated mitral disease and a valve procedure on operative and long term outcomes after coronary bypass grafting surgery is yet to be clearly defined. Several studies have shown that severe CAD, acute myocardial infarction, low ejection fraction, ischemic mitral regurgitation, advanced heart failure symptoms, failure to use internal mammary artery, valve replacement surgery and emergency operations are important predictors of operative mortality. Other investigators showed that among the preoperative criteria, only congestive heart failure (CHF) was a risk factor for in-hospital mortality after concurrent CABG with MVR operation, whereas age, history of other major predisposing factors for CAD, and NYHA score did not influence on in-hospital mortality [18]. The Society of Thoracic Surgeons declared that mitral valve repair + CABG group had approximately 5% (4.8% in-hospital mortality and 5.3% operative mortality) nationwide mortality rates in contrast with 8% (7.8% in-hospital mortality and 8.5% operative mortality) for MVR + CABG group [19]. In this study, the mortality rate was 8.3%.

There are important limitations for this study that cannot be neglected; small sample size, study design (no comparison group), single center, and lack of experience in valve repair.

5. Conclusion

CABG and chordal-sparing and posterior leaflet replacement has favorable outcome, as well as minimizes the need of redo surgery as in repair.one of the best options for CAD and sever MR.

Conflict of interest statement

None to be declared.

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Ethical approval

Kscien's ethical approval was taken.

Consent

Consent was taken from the patients and the family of the patients.

Authors contribution

Okba F. Ahmed: Substantial contribution to the concept and design, data collection, literature review and writing of the manuscript.

Saoud Y Al-Neaimy: data collection, literature review and writing of the manuscript.

Fahmi H. Kakamad, Rawezh Q.S, Shvan H.M: substantial contribution to the concept and design, drafting the manuscript. Final approval of the manuscript.

Abdulwahid M. Salih: substantial contribution to the concept and design and Final approval of the manuscript.

Registration of research studies

The research was registered in Chinese Clinical Trial Registry. The registration number was ChiCTR2000033249. 中国临床试验注册中心 - 世界卫生组织国际临床试验注册平台一级注册机构 (chictr.org.cn)

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