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Valve Replacement Performed on the Beating Heart with Continuous Retrograde Coronary Sinus Isothermic Blood Perfusion Combined with Coronary Bypass

Çalışan Kalpte Sürekli Retrograd Koroner Sinüs İzotermik Kan Perfüzyonu ile Aort Kapak Replasmanıyla Kombine Koroner Baypas

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ABSTRACT

An operation on the beating heart was planned for a 60-year-old woman who applied to our clinic with aortic stenosis, three vessel coronary artery disease and poor left ventricular function. There are reports about beating heart valve surgery perfomed alone or combined with coronary artery bypass operations using continuous retrograde coronary sinus isothermic blood perfusion in patients with poor ventricle. We performed a coronary revascularization process for three-vessel disease on the pump beating heart and aortic valve replacement under cross-clamp using continuous retrograde coronary sinus isothermic blood perfusion in the same session. She was discharged on the sixth postoperative day after an uneventful recovery. She is well and active 24 months after the operation. Valve replacement using the retrograde coronary sinus isothermic blood perfusion technique due to its protective effect on the already borderline myocardial functions in patients with poor ventricles is a useful and clinically successful method.

Key Words: *Aortic valve; coronary sinus; coronary artery bypass.*

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ÖZET

Altmış yaşında kadın hastaya global hipokinezisi ve aort kapak darlığı nedeniyle çalışan kalpte koroner baypas ve aort kapak replasmanı planlandı. Bir süredir çeşitli yayınlarda koroner baypasla birlikte ya da tek başına aort kapak replasmanın başarılı bir şekilde çalışan kalpte yapıldığına dair makaleler yer almaktaydı. Ciddi kalsifik aort darlığı (kapak alanı 0.7 cm²'nin

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altında), üç damar koroner revaskülarizasyona gereksinimi olan hastaya çalışan kalpte pompa destekli koroner baypas ve aynı seansta kross-klemp altında sürekli retrograd koroner sinüs izotermik kan perfüzyonu ile aort kapak replasmanı gerçekleştirdik. Altmış yaşındaki hastanın hipertansiyonu ve diabetes mellitus komorbiditesi vardı. Geçirdiği miyokart enfarktüsü ejeksiyon fraksiyonunu azaltmıştı. Hasta yapılan üçlü baypas ve hemen sonrasında icra edilen aort kapak replasmanı ile altı gün hastane kalış süresi sonunda kendi işlerini yürütebilecek şekilde taburcu edildi. Hasta postoperatif 24. ayında sağlıklı şekilde izlenmektedir. Son zamanlarda uygulanan, morbidite ve mortaliteyi düşüren, kötü ventriküllü hastalarda akılda tutulması gereken bir tekniği hatırlatması açısından bu olguyu sunmaya değer bulduk.

Anahtar Kelimeler: *Aort kapak; koroner sinüs; koroner arter baypas.*

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INTRODUCTION

There are successful reports about beating heart valve surgery perfomed alone or combined with coronary artery bypass operations using continuous retrograde coronary sinus isothermic blood perfusion (RCSP) in patients with poor ventricle[1,2]. In this report we present a patient with poor ventricle and severe calcific aortic stenosis who needed a coronary revascularization process for three-vessel disease. She underwent surgery on the pump beating heart for coronary revascularization and aortic valve replacement under cross-clamp using continuous retrograde coronary sinus isothermic blood perfusion in the same session. She is well and active 14 months after the operation.

CASE REPORT

A 60-year-old woman applied to our clinic with complaints of dyspnea, orthopnea and angina pectoris. She had diabetes mellitus, hypertension and recent inferior myocardial infarction history. Her EKG showed 1° AV block, Q wave in inferior leads, and loss of R wave progression in anterior leads. Echocardiography revealed an ejection fraction of 32%, severe calcific aortic stenosis with a valve area under 0.7 cm^2, left ventricular hypertrophy and dilatation of left heart chambers. Coronary angiography was performed which demonstrated occlusion in proximal LAD, significant stenoses in the circumflex and right coronary arteries. A combined aortic valve replacement and coronary bypass operation was planned.

Standard median sternotomy and two-stage single atrial cannulation were performed. LIMA-LAD, saphenous vein-OM1 and saphenous vein-OM2 bypasses were initially done on the beating heart. Thereafter the aorta was cross-clamped and the aortic valve was explored using continuous RCSP. A Medtronic DLP 94915 (Grand Rapids, MI, USA) cannula was used for RCSP. RSCP pressure was kept around 40 mmHg and was not allowed to exceed 60 mmHg in order to prevent a possible rupture. The coronary sinus perfusion pressure was retained around 300 mL/minute. As RSCP was being performed the backflow from the right coronary sinus was observed and the position of the retrograde perfusion cannula was adjusted accordingly. The LIMA was not clamped with a bulldog clamp after the LIMA-LAD anastomosis to allow both anterograde and retrograde perfusion of the coronary arteries. The aortic valve which was block-calcified was excised and all three annuli were decalcified. The aortic valve was replaced using a 21 mm St. Jude Masters HP Series (Hemodynamic Plus, effective diameter equal to 23 mm) (St. Jude Medical® St. Paul, Minnesota, USA) with teflon buttressed 2-0 Ti-cron® (Davis-Geck, Wayne, NJ, USA) braided sutures. Cross-clamp and cardiopulmonary bypass times were 36 and118 minutes respectively.

She was discharged on the postoperative sixth day after an uneventful recovery. The patient is being followed in her postoperative 24th month with an improved EF of 35% and a decresed basal septal thickness of 1.1 cm.

DISCUSSION

Minimally invasive approaches in cardiac surgery, especially the beating heart technique, are gaining popularity as they are reported to decrease postoperative morbidity including reperfusion injury[3]. Satisfactory results have been shown in cardiac surgery with the use of beating heart surgery. Even coronary endarterectomies are being done satisfactorily using beating heart techniques[4]. Reperfusion injury is a well-known phenomenon which has been shown to be a result of injuries inflicted on the

myocardium by cardioplegia used during cardiopulmonary bypass (CPB)[5]. RCSP method is an effective technique to perform operations with as little ischemic insult as possible in patients with ischemic hearts with hypertrophic left ventricles[6]. Use of cardioplegic arrest increases operative risk in patients with low EF by causing reperfusion injury[2,7]. Short periods of intermittent reperfusion was shown to cause apoptotic and nonapoptotic cell death by stimulting several intracellular cascades in cardiomyocytes[8]. This in turn results in loss of myocardial function increasing surgical risk. Because of this it has become the main aim to minimalize possible myocardial injury by using alternative methods to cardioplegic arrest in patients with poor ventricle[9].

The ischemic component decreases to minimal when the heart is operated beating without using the cross-clamp[2]. Normothermic blood cardioplegia may also cause postoperative myocardial stunning because of the unaerobic environment it creates[7]. Mortality and morbidity increases in patients with poor ventricle if reperfusion injury due to myocardial edema caused by cardioplegic arrest in diastoli is added[2,10]. Beating heart surgery prevents postopeartive edema and with the addition of RCSP to these conditions optimum myocardial circumstances are provided[11]. This method also permits the surgeon operating using beating heart to test additional valve repair procedures under physiological conditions because the heart is beating within physiological limits and normal tonus[11]. Additionally use of this technique has been reported to decrease postoperative complications by reducing postoperative blood loss, need of transfusion and time under mechanical ventilation[12].

The first surgeons to use retrograde coronary sinus perfusion in aortic valve replacement was Lillehei et al. in 1956[13]. This method was revitalized using blood by Solorzano in 1978 and begun to be used routinely by Menasché in 1982[14,15]. Thus the door was opened for performing valve operations without reperfusion injury by keeping the heart working within physiological limits using retrograde oxygenated coronary sinus blood perfusion.

Continuous oxygenated blood is administered to the coronary sinus ostium, like in administration of retrograde cardioplegia, as the valve replacement proceeds on the beating heart. Matsumoto et al. compared PaO_2 levels between the retrograde perfusion blood and the coronary sinus backflow in their report about patients who were delivered RCSP[2]. The results showed that RCSP provided aerobic myocardial environment.

It was shown that administration of RCSP on the beating heart decreases levels of postoperative CK-MB, troponin T and requirement of inotropoic support and mechanical ventilation[1]. Beating heart valve surgery also does not differ in terms of postoperative neurocognitive functional status in comparison to the postoperative functional status in patients undergoing replacement with the cardioplegic arrest method[11]. Successful results with the RCSP method also have been reported in reoperative valve replacement[16]. Our successful result in combined valve replacement on the beating heart with coronary bypass under cross-clamp shows the usefulness of this method.

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