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ORIGINAL ARTICLE

Antegrade Versus Continuous Retrograde del Nido Cardioplegia in the David I Operation

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Background The efficacy of continuous retrograde del Nido cardioplegia for myocardial protection is still controversial. We hypothesised that antegrade and retrograde cardioplegia offer equivalent safety for myocardial protection in the David I procedure.

Methods We retrospectively reviewed 33 patients undergoing the David I operation with antegrade or retrograde del Nido solution from June 2014 to January 2016. The outcomes were compared. The follow-up was 1 month to 15 months.

Results There was no hospital mortality or reoperation in both groups. Cardiopulmonary bypass, and aortic clamp times were similar. Troponin I level (TnI), creatine kinase level (CKMB), left ventricular ejection fraction (LVEF), ventilation times, intensive care unit (ICULOS) and hospital stay times (THLOS) were similar between the two groups. The lactate level was slightly higher (9.26 ± 2.56 vs 7.17 ± 1.58, $p = 0.01$) in the antegrade group compared with the retrograde group. The incidence of heart block was higher (four patients) in the retrograde group (26.7% vs 0%, $p = 0.019$). Only one patient (6.7%) required implantation of a permanent cardiac pacemaker.

Conclusion Antegrade and continuous retrograde del Nido cardioplegia can be used safely and effectively in the David I operation. The continuous retrograde del Nido cardioplegia is associated with a higher rate of temporary AV block which does not require permanent pacing, and a lower lactate level.

Keywords Retrograde cardioplegia • del Nido cardioplegia • David procedure • Myocardial protection

Introduction

Satisfactory myocardial protection is critical to successful clinical results during cardiac surgery [1]. Improvements in myocardial protection have greatly reduced the morbidity and mortality of cardiac surgery. The hyperkalaemic cardioplegic solutions have become the gold standard of myocardial protection since being introduced in the 1970s [2]. The depolarisation of the extracellular membrane potential can be achieved via the delivery of the cardioplegic solution through aortic antegrade perfusion. The use of intermittent doses every 20 to 30 minutes is required to preserve myocardial arrest and achieve washout of metabolic products and inhibitors after the initial dose. It is critical to avoid myocardial dysfunction.

Abbreviations: TEE, transoesophageal echocardiography; IABP, intra-aortic balloon pump; ECMO, extracorporeal membrane oxygenator; EF, ejection fraction; AV block, atrio-ventricular block; CS, coronary sinus; CPB, cardiopulmonary bypass

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In patients who are diagnosed with aortic valve regurgitation or the aorta aneurysm or dissection, antegrade cardioplegic perfusion via the coronary ostia is the alternative method for myocardial protection, but sometimes it is hard to accomplish when the orifices of coronary artery are involved by dissection and the manoeuver is dangerous to the right coronary ostium. We have performed the David I procedure to treat the majority of these patients from June 2014. To avoid damage to the coronary ostia and interruption of the operation, some surgeons use the retrograde cardioplegic protection for long aortic cross clamping.

In this study, we have retrospectively reviewed our experience with two myocardial protection strategies for David I procedure requiring nearly two hours or more of aortic cross-clamping time. The purpose of this study is to analyse the clinical outcome of using antegrade and retrograde strategies.

Patients and Methods

Patients

Between June 2014 and January 2016, we performed 33 David 1 procedures in our department. Patients older than 50 years received coronary angiography to evaluate the coronary arteries. All patients required cardiac arrest, and antegrade delivery of cardioplegic solutions alone was used in 18 cases. The retrograde strategy was used in 15 cases, with the cardioplegia administered directly into the coronary sinus, and a purse-string suture around the orifice was used to fix the position of the coronary sinus cannula. The patients were allocated into two groups depending on the preference and experience of the surgeons. Patients requiring deep hypothermia and arch replacement were excluded. Table 1 presents the main clinical characteristics of both groups.

Procedure

Transoesophageal echocardiography (TEE) was used to evaluate the aortic valve preoperatively and the possibility of reconstruction. Median sternotomy was performed in all patients. Cardiopulmonary bypass (CPB) was established with right axillary artery and femoral artery cannulation, and two individually cannulated venae cavae. We have used the aortic cannulation rarely because replacement of the ascending aorta and hemi-arch is very common in the patients with aortic disease in our department. We performed moderate haemodilution (Hct = 25%) on bypass with mild hypothermia (30–32 °C). The saphenous vein was used for revascularisation to be careful.

After aortic cross-clamping, cardiac arrest was accomplished with antegrade infusion of cold (4 °C) blood cardioplegic solution at a 1:4 blood: hyperkalaemic solution ratio for 1000 ml. Cardiac arrest was maintained in the antegrade group by intermittent antegrade infusion of 500 ml of half strength cardioplegic solution every 30–60 minutes. In the retrograde group, a short (3 cm) atriotomy was made on the anterior free wall of the right atrium and a commercially available 13F retrograde coronary sinus perfusion catheter

Table 1 Baseline characteristics of patients receiving either antegrade or retrograde cardioplegia.

	Antegrade (n = 18) No. (%) or Mean ± SD	Retrograde (n = 15) No. (%) or Mean ± SD	*p* Value
Age, years	56.38 ± 12.37 (29–78)	54.8 ± 13.74 (28–77)	0.729
Female	14 (77.8%)	8 (53.3%)	0.138
Coronary artery disease	13 (72.2%)	8 (53.3%)	0.261
Pulmonary disease	2 (11.1%)	2 (13.3%)	0.871
Hypertension	11 (61.1%)	9 (60%)	0.948
Smoking	10 (55.6%)	9 (60%)	0.797
Left ventricle EF	47.3 ± 6.5	47.2 ± 3.1	0.651
NYHA class			
I	3 (16.7%)	2 (13.3%)	0.857
II	5 (27.8%)	6 (40%)	0.632
III	7 (38.9%)	5 (33.3%)	0.823
IV	3 (16.7%)	2 (13.3%)	0.857
Aortic disease			
Aortic aneurysm	8 (44.4%)	7 (46.7%)	0.912
Aortic dissection	5 (27.8%)	4 (26.7%)	0.932
Aortic root aneurysm	5 (27.8%)	3 (20%)	0.856
Tricuspid aortic valve	15 (83.3%)	12 (80%)	0.914
Bicuspid aortic valve	3 (16.7%)	3 (20%)	0.854
Marfan syndrome	6 (33.3%)	4 (26.7%)	0.621

Abbreviations: SD, Standard deviation; EF, ejection fraction.

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