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CONCLUSION

Retrograde continuous coronary sinus infusion of oxygenated warm blood potassium is an easy-doing, simple and effective procedure of myocardial preservation. It is hopeful to be an evolving application to preserve the donor heart during the anastomotic stage of heart transplantation.

REFERENCE

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逆行灌注温血钾保护心肌在心脏移植中的应用

摘要 于1992及1994年中, 为两例原发性心肌病施行原位心脏移植时, 在移植吻合时期创用经冠状静脉窦逆行连续灌注温血钾保护供心, 术后经过顺利, 均获得长期存活。认为本方法可以使供心的冷缺血时间明显缩短, 从而缺血性再灌注损伤可以减轻, 心肌保护的效果改善。本文结合病例对方法学和应用效果作了介绍。

关键词 温血; 心肌保护; 逆行灌注; 心脏移植

Evolving Application of Continuous Retrograde Warm Blood Cardioplegia in Heart Transplantation

Xia Qiuming 夏求明, *Chen Zidao* 陈子道, *Chen Houkun* 陈厚坤, *Tian Weichen*
田伟忱, *Xiang Guiyu* 向桂玉, *Tang Yurong* 唐玉荣, *Ning Xiaohua* 宁晓华
Li Jingfang 黎京芳

(Thoraco-Cardiovascular Surgery, The Second Affiliated Hospital)

Abstract In 1992 and 1994, continuous retrograde infusion of warm blood potassium was applied in two cases of heart transplantation during the anastomotic procedure. End-stage of primary cardiomyopathy was diagnosed preoperatively. The postoperative course was smooth and uneventful, high quality of living and long-term survival were obtained. The hypothermic ischemic period of the donor heart is much shortened, and accordingly the ischemic re-perfusion injury would be lessened. Methodology and clinical material were reported.

Key Words Warm blood cardioplegia; Retrograde infusion; Myocardial protection; Heart transplantation

Hypothermic myocardial preservation has long been the standard for most cardiac surgery, including the heart transplantation (HT). The safety of hypothermic preservation was time-limited and its effectiveness of protection from ischemic injury decreases along with prolongation of ischemic period and accumulation of anerobic substances. Recently, warm blood cardioplegia has been modified and re-introduced with much increasing frequency of clinical application in cardiac procedures and favorable results were reported^[1-3]. Basing on our clinical experience of using this method in various heart surgery, evolving application of retrograde infusion of warm blood cardioplegia was employed in 2 cases of orthotopic HT of end-stage of primary cardiomyopathy, in 1992 and 1994 respectively. The cold ischemic period of the donor heart was much shortened. Smooth postoperative course, good quality of living, and long-term surviving were obtained.

Patients Two cases of primary cardiomyopathy suffered from chronic congestive heart failure and malignant cardiac arrhythmia resisted to intensive medical treatment for 2-4 years, were treated with orthotopic heart transplantation. The second case was resuscitated twice from attacks of ventricular fibrillation and the emergent HT was performed under persistent intensive medical control.

Tab. 1

Case report

Case no.	Date of Operation	Sex	Age	Diagnosis	Heart failure (Class)	Cardiac function (Class)
1	Apr. 26, 1992	M	36	Dilated cardio-myopathy	II	IV
2	Feb. 8, 1994	M	32	Primary cardio-myopathy	II	IV

Postoperative event Sinus rhythm presented immediately upon resuscitation of the donor heart. Extracorporeal circulation was weaned off easily on due time. The respiratory and circulatory system were kept in good functional state, giving an uneventful postoperative course. Triple therapy of immuno-suppressive agents were given with freeing of any complications.

Both cases survived up-to-now with good condition. The first case has re-occupied 6 months after surgery, the second case has been keeping on active living.

Tab. 2

Aortic clamping time and state of recovery

Variable	Case 1	Case 2
Aortic clamping (min)	130	110
Cold ischemic (min)	60	43
Retrograde infusion (min)	70	67
Cardiac resuscitation	Spontaneous recovery	Electrical shock (once)
Heart rhythm	Sinus	Sinus
Mechanical ventilation (h)	24	47
Dopamine infusion (d)	1	0
Isoprenaline infusion (d)	4	5
Postoperative course	Smooth	Smooth
Complications	(—)	(—)
Cardiac output	4.24L/min	4.95L/min
Cardiac function class	I	I

METHODOLOGY

The donor heart was harvested, stored, and then transported in hypodermic condition as usual having the aortic cold infusion cannula attached, for latter air evacuation of the left heart during cardiac resuscitation. On arrival in the operation theater, the heart was further dissected, a retrograde infusion cannula was inserted through the sinus orifice and well fixed in position. The heart was delivered to the operation table and the cannula was connected with the warm blood infusion line. Warm blood potassium infusion started when the heart was transferred into the pericardial sac, and carried on until cardiac anastomosis finished. The infusion cannula was taken out through the gap of final stitches of the at-

rial wall anastomotic line, and then these stitches ligated. Aortic clamp released and cardiac resuscitation followed.

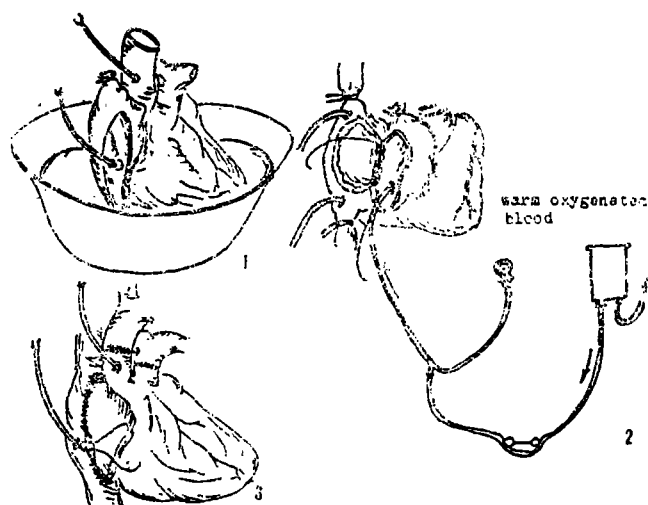


Fig. 1 Aortic hypothermic infusion cannula retained, retrograde infusion cannula inserted during heart dissection

Fig. 2 Warm blood infusion set with retrograde infusion during cardiac anastomosis

Fig. 3 The retrograde infusion cannula withdrawn, the final stitches of the atrial wall suture line then ligated

Composition of warm blood cardioplegia:

The oxygenated blood was delivered from the arterial end of the pump, addition of St. Thomas Solution in a ratio of 3 : 1. Addition of K:25 mmol/L for the first dose and deducted to 0 for the final.

Infusion pressure, less than 5.33kPa.

COMMENT

Hypothermic preservation includes ischemic arrest, its effectiveness decreases along with the prolongation of ischemic period, so it is time-limited, most cardiac operations are only carried out well within the bounds of safe limits. At present, the donor hearts are mostly harvested from distant, and transplanted after transportation, so its total ischemic time is much longer than that of ordinary cardiac surgery. Moreover, the donor heart subjected to more ischemia on account of not only the coronary blood flow but also the noncoronary branches are cut off during harvesting. The myocardium will change into aerobic state instead of anaerobic arrest when warm blood cardioplegia is adopted during the anastomotic stage of heart transplantation, the ischemic period will greatly be shortened as much as one hour, the time that the anastomotic procedure needed.

Takahashi's experimental study^[4] revealed that warm cardioplegic infusion would bring down the coronary vascular resistance caused by hypothermic coronary spasm, and thus favored greater post-ischemic cardiac function. Recent report^[5] of clinical application of intermittent antegrade infusion of blood cardioplegia (8-10°C) and warm blood reperfusion (34°C) before cardiac resuscitation resulted significantly better cardiac recovery when compared with standard crystalloid

myocardial protection. We suppose, continuous infusion of oxygenated blood is much reasonable than intermittent, for its favorable action of continuous supply of the oxygen need and timely washing out of the metabolic substances.

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