



Clinical experience with coronary sinus catheterization in minimally invasive aortic valve surgery under transesophageal echocardiography guidance

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Abstract

We aimed to show conventional coronary sinus (CS) catheter could be used with transesophageal echocardiography (TEE) guidance through the limited surgical field in aortic valve surgery with 'J' sternotomy. This method was performed in 14 patients and completed successfully in 12. We believe that in minimally invasive aortic valve surgery, the insertion of the conventional retrograde cardioplegia catheter to the CS with routine way may not be possible but application of TEE guidance is cost-effective and easily applicable method without significant complications.

Introduction

Cardioplegia delivery via coronary sinus (CS) with retrograde cannulation or combined with antegrade is a preferable method in open heart surgery [1, 2]. Although delivery of cardioplegic solution through direct cannulation of both coronary ostia is possible but may cause intimal injury of the ostia, therefore retrograde cardioplegia has an important role in aortic valve surgery [2]. During minimally invasive aortic valve surgery, insertion of the conventional retrograde cardioplegia catheter to the CS is possible but may not be easy due to limited surgical field [3]. We have been inserting the retrograde cardioplegia catheter with transesophageal echocardiography (TEE) guidance in minimally invasive aortic valve surgery for 9 months. Catheterization of CS becomes easy with the control of tip of the catheter position in two-dimensional TEE.

In this study, we aimed to share our experiences of CS catheterization with TEE guidance in 14 patients in minimally invasive aortic valve surgery with 'J' sternotomy.

Methods

Retrograde CS cannulation with TEE guidance in 14 patients in minimally invasive aortic valve surgery between October 2000 and June 2001 studied retrospectively.

After anesthetic induction and central venous catheterization 5.0 MHz multiplane TEE probe was placed. Following the routine echocardiographic examination of the heart, the probe (GE Vingmed Ultrasound Horten, Norway) was advanced in the transverse plan (0°) four chamber view until the CS was seen (Figure 1A).

Adequate surgical exposure was obtained to replace the aortic valve with 6–8 cm 'J' sternotomy described by Gundry et al. [4]. Routine CS catheter (15 Fr., Medtronic DLP, Grand Rapids, MI, USA) was inserted into the right atrium through a small purse string. The tip of the catheter was guided with TEE to the CS ostium so that when the catheter turned towards the right ventricle or inferior vena cava, drawn back slightly and directed to the CS again. After the catheter entered to the

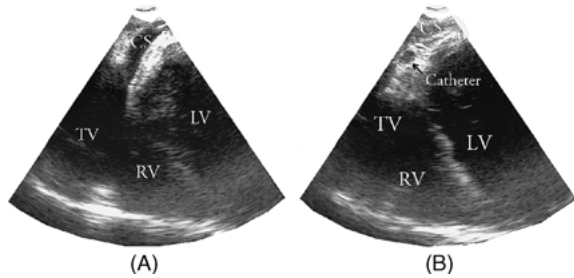


Figure 1. (A) TEE 0° image showing CS. (B) TEE 0° image showing the CS catheter with in the lumen of the CS. CS – coronary sinus; TV – tricuspid valve; LV – left ventricle; RV – right ventricle.

ostium, advanced 3–4 cm into the CS, subsequently its position was confirmed by typical CS waveform after the balloon inflation (Figure 1B).

Results

In 12 of 14 patients who underwent minimally invasive aortic valve surgery with ‘J’ sternotomy, insertion of the retrograde cardioplegia catheter into the CS was completed successfully. Initially, we had longer cannulation time but got better. We were not able to cannulate in two patients despite many attempts and cardioplegic solution was given through the coronary ostia directly.

In one patient, we diagnosed catheter displacement during surgery with TEE and direct coronary ostial cannulation was used.

One patient produced atrial fibrillation during the insertion but since the catheter was in right position, cardioplegic solution delivered and maintained good arrest. Mean insertion time was 3.41 min (min–max: 0.45–11.30 min).

Discussion

Minimally invasive approaches for aortic valve replacement have been preferred because of reduced postoperative pain and length of stay in hospital, and also cosmetic reasons [5–7]. But with this approach, surgeon may not feel safe if possibility of retrograde cardioplegic delivery is not possible due to difficult manipulations. Recently,

TEE monitoring is an available and important part of all cardiac surgical procedures as well as minimally invasive approaches and gives us very important informations about catheter positions, valve functions, wall motions and other pathologies of the heart all way through the surgery [8].

‘J’ sternotomy approaches can provide enough surgical exposure to establish cardio pulmonary bypass and perform the aortic valve replacement in a safe way [4, 9]. With this technique ascending aorta approached easily but manipulation of the heart and insertion of conventional retrograde cardioplegia catheter to the CS might be extremely difficult and sometimes impossible. On the other hand repeated blind attempts would increase the possibility of complications and false cannulations. After aortotomy, direct delivery of cardioplegic solution through both coronary ostia is possible but may cause intimal injury which cause acute dissection or late ostial stenosis [2]. Using the percutaneous CS catheter insertion via internal jugular vein is possible but expensive, and also needs TEE guidance and experienced hands.

Plotkin et al. [3] reported their experiences about percutaneous CS cannulation via internal jugular vein guided by TEE. In this study they found that the mean CS cannulation time was 10.5 min after placement of the introducer (min–max: 1.5–42 min). This period is longer than our mean cannulation time since the length of the catheter is shorter and needs less manipulation in our method. This is a improved technique which does not need a lot of experience and cheaper than percutaneous technique.

Since the insertion of the conventional retrograde cardioplegia catheter to the CS with TEE guidance is cost-effective and easily applicable in short period of time and does not cause any morbidity. This method is expected to be popular in minimal invasive aortic valve surgery and with the advent of intracardiac echocardiography, it will be able to be applied much more easier.

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