How we do it: effective stabilization of the apical delivery sheath during transapical aortic valve implantation

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Abstract

A technique is described by which an effective stabilisation of the apical introducer sheath is achieved by a pneumatic holding arm, during transapical aortic valve implantation procedure.

Keywords: Aortic valve • Minimally invasive surgery • Transapical

INTRODUCTION

Transapical aortic valve implantation (TA-AVI) is a minimally invasive, off-pump technique to treat aortic stenosis in high-risk patients. The procedure consists of a left anterolateral mini-thoracotomy for direct antegrade surgical access through the apex of the left ventricle, apex puncture, insertion of a guide wire across the stenotic aortic valve, followed by a 26-French introducer sheath, balloon valvuloplasty and valve deployment. During the whole procedure, the 26-French sheath must be kept stable by the assistant’s or surgeon’s hand. This static holding work against a beating heart can create considerable problems that may hinder the smooth progress of surgery.

To minimize strain for the entire operating team, and to increase the range of activities that can be performed by the assistant or the surgeon, a pneumatic surgical camera-holding system was used to stabilize the 26-French delivery sheath.

TECHNIQUE

The device is a Unitrac® pneumatic holding arm (Aesculap AG, Tuttlingen, Germany) which we routinely use for our minimally invasive mitral valve reconstructions for holding 5 mm or 10 mm endoscopes. The pneumatic holding system is modelled after the human arm, with a series of three lockable joints (Fig. 1A). It is held by a clamp attached to the side rail of the operating table (Fig. 1B). The holding arm is operated by a button on the handle. At the distal end of the arm is a handle to which an endoscope interface can be attached by a quick-fitting adapter (Fig. 1C).

Implantations were performed in our hybrid operating room. The principal surgical technique has been described in detail by Walther and colleagues [1]. After sterile covering of the patient, the support was passed through the covers and fixed to the left-hand side of the head end of the operating table.

Following puncture of the apex, the guide wire is passed through the endoscope interface and inserted antegrade across the stenotic valve (Fig. 1D). The 26-French transapical delivery sheath is also passed through the endoscope interface before being inserted into the heart. Further adjustment can be performed once the handle button is pressed, so that proper sheath positioning and angulations are achieved (Fig. 1E). Once in the correct position, the screw at the endoscope interface is tightened and the delivery sheath is locked against unintended axial movement. Both balloon valvuloplasty and valve deployment are performed through the same 26-French sheath without changing from the 14-French to the 26-French sheath (Fig. 1F). After valve implantation, the apical delivery sheath and guide wire are simultaneously retrieved through the apex and the endoscope interface. The apex is closed in the routine manner, using previously placed purse string sutures.

Eighteen TA-AVI patients have been operated using the pneumatic scope-holding system. Acute procedural success was observed in 100%. The device was successfully placed in the desired position in all cases, with no fixation-related complications. No access-related complications (e.g. apical rupture, apical bleeding or left ventricular tear) were observed. There were no limitations concerning fluoroscopy. None of the patients experienced early postoperative bleeding requiring reoperation. Malposition of the valve—that is, deployed slightly too high or too low, causing either severe aortic regurgitation (AR) or coronary obstruction—was not observed in any of the cases. There was no intraoperative mortality. There was one case of postoperative death on the second day, related to myocardial infarction.

COMMENT

Static holding work against a beating heart can create considerable problems that may hinder the smooth progress of surgery.
Fatigue of the assistant holding the sheath may cause physiological tremor, resulting in movement of the sheath. The sheath can be pulled out of the ventricle at an inopportune moment, leading to blood loss and/or haemodynamic deterioration. Furthermore, the constant pressure at the tip of the heart can cause cardiac impairments, leading to haemodynamic instability during the procedure. Besides these problems, the hand that is holding the sheath is always exposed to unwanted X-ray radiation and its presence may inhibit clear imaging.

The pneumatic scope-holding system was easy to operate and allowed the surgeon to position the arm with one hand using the button on the handle. The delivery sheath could be kept stably in position, minimizing strain for the entire operating team and increasing the range of activities that could be performed by the assistant. This met with much approval. The speed of locking and unlocking was fast enough to enable operative procedures to be carried out smoothly and without delay. All sheath positions necessary for the interventions could be achieved. The surgeon's and assistant's working space and field of vision were not impaired by its presence.

Our data suggest that the technique presented herein is safe and feasible and may minimize the risk of bleeding, haemodynamic deterioration or apex-related complications during TA-AVI. The holding system enables the surgical team to work more comfortably.

Conflict of interest: none declared.

REFERENCE