


Address for Correspondence/Yazışma Adresi: Dr. Volkan Tuzcu
Özel Medipol Mega Hastaneler Kompleksi, Çocuk Kardiyolojisi Bölümü, Bağcılar, İstanbul-Türkiye
Phone: +90 212 460 77 77
E-mail: vtuzcu@gmail.com
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Percutaneous right internal jugular venous cannulation in minimally invasive cardiac surgery

Minimal invaziv kalp cerrahisinde perkütan sağ internal juguler venöz kanülasyon

Introduction

The applications of cardiac surgery (CS) have progressed most notably with the development of minimally invasive techniques. The usage of smaller diameter venous cannulas and vacuum-assisted venous return (VAVR), greatly provided the opportunity to perform minimally invasive procedures (MIPs). This has increasingly led surgeons perform cardiac procedures through smaller than traditional incisions which was suggested by Doty et al. in 1998 (2, 3). Nonetheless, the reduced incision size has been matched by a corresponding increase in technical difficulty and operative time due to the limited cardiac exposure (2). With this regard, taking as much the cannulas off the operation field was a concern in order to ease the manipulation and exposure (4). Moreover, the success and relative ease of peripheral cannulation along with the use of VAVR has permitted the application of cardiopulmonary bypass (CPB) feasible for MIPs (1, 5-7).

The aim of this article is to inform in regard to the advantages and the ease of the application of percutaneous right internal jugular venous cannulation (PRIJVC) in MIPs.

Case Report

In 2011, we performed two minimally invasive secundum atrial septal defect (ASD) closure with PRIJVC. The ASDs were inappropriate for percutaneous device closure due to inadequate antero-superior septal rim. The demographic and operative characteristics of the cases’ are summarized in Table 1.

The jugular cannulation in both cases was performed as the first step before sternotomy percutaneously under 1 mg/kg intravenous heparinization with a 20 Fr femoral artery cannula (Edwards Lifesciences, FemFlex II, Irvine, CA, USA). The cannulation was performed with Seldinger technique through anterior approach in Trendelenburg’s position (Fig. 1). The cannula was secured on the understanding that the final positioning of the tip of the cannula will be adjusted just before the superior caval tourniquet with inspection and palpation during cardiac exposure. The remaining 2 mg/kg intravenous heparin was administered after sternotomy in case 1 and before the femoral arterial cannulation in case 2.

Both operations were performed through 6 cm skin incision with distal partial ‘T’ sternotomy (Fig. 2) along with the application of -20 to -40 mmHg VAVR (Baxter, Las Vegas, Nevada, USA). In both cases, the ASDs were closed with ePTFE patch and the termination of CPB was

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Case 1</th>
<th>Case 2</th>
</tr>
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<tbody>
<tr>
<td>Age, years / Gender</td>
<td>17/Female</td>
<td>35/Male</td>
</tr>
<tr>
<td>Body surface area, m²</td>
<td>1.6</td>
<td>2.1</td>
</tr>
<tr>
<td>Venous cannulation sites</td>
<td>IVC and RIJV</td>
<td>RFV and RIJV</td>
</tr>
<tr>
<td>Arterial cannulation site</td>
<td>Ascending aorta</td>
<td>Right CFA</td>
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<tr>
<td>Volume of prime solution, cc</td>
<td>1200</td>
<td>1450</td>
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<tr>
<td>Flow rate, L/min</td>
<td>3.75</td>
<td>5.16</td>
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<tr>
<td>Duration of CPB</td>
<td>40</td>
<td>45</td>
</tr>
<tr>
<td>Duration of ACC, min</td>
<td>14</td>
<td>12</td>
</tr>
<tr>
<td>Duration of operation, min</td>
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<td>Duration of ICU stay, hours</td>
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<td>18</td>
</tr>
<tr>
<td>Duration of hospitalization, days</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

ACC - aortic cross clamp, CFA - common femoral artery, CPB - cardiopulmonary bypass, ICU - intensive care unit, IVC - inferior vena cava, RFV - right femoral vein, RIJV - right internal jugular vein

Figure 1. Percutaneous right internal jugular venous cannulation 1 (a-c) and 2 (d-f)
performed in standard fashion. None of the cases experienced neurologic or access site related complications.

In Fig. 3, the setting of CPB along with the inferior vena cava cannula initiated through the skin incision of the pericardial drain is presented. The ASD can easily be explored in Fig. 4. The setting of CPB together with femoral vein cannulation in case 2 is demonstrated in Fig. 5.

During decannulation, after neutralization with protamine, the jugular venous cannula was pulled away and hemostasis was achieved by manual compression for 10-15 minutes (Fig. 6a). After surgical hemostasis was achieved, the chest was closed in standard fashion (Fig. 6b, c).

**Discussion**

The advancements have been explosive sweeping aside the old standards in CS. The RIJV represents one of the most commonly used central venous access site for CS patients (8-10). Minimally invasive cardiac surgery (MICS) patients are increasingly becoming the greater part of the CS population. MICS is an important frontier facing the profession with a huge oasis of opportunity for both the cardiac surgeons and the patients. From another point of view, while this approach provides adequate exposure, only one operator could see well thus, it makes difficulties for assistants to help and moreover, it is hard to train residents how to perform these procedures via this incision (2). In our opinion, taking off the most cannulas out of operation field helps trainees to rule over the operation more efficiently. Use of a head video camera is thought to be an attractive way to take attention of the residents for the procedure.

It is apparent that the method of PRIJVC provides a less cluttered operative field, particularly when the arterial cannulation is made other than the site of ascending aorta.

**Conclusion**

PRIJVC in MIPs can readily be accomplished in most cases with relative ease and safety in experienced hands. As cardiovascular surgeons in this era of minimally invasiveness, we are responsible to embrace the future of the profession and the management of these patients that we will be expected to be facile with the commencement of CPB through RIJV.

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EmrahŞişli, Ali Aycan Kavala1, Gökçen Özserim2, Öztekin Oto2
Clinic of Cardiovascular Surgery, Antakya State Hospital, Hatay-Turkey
Clinic of Cardiovascular Surgery, Bakırköy Sadi Konuk Education and Research Hospital, İstanbul-Turkey
Department of Cardiovascular Surgery, Faculty of Medicine, Dokuz Eylül University, İzmir-Turkey

**References**

An 80-year-old male patient was referred to our Institution for fever of unknown origin, disorientation, and recent onset of dyspnea (Euro- score: 10). Four months previously he had undergone a transfemoral TAVI with a CoreValve® prosthesis (Medtronic Inc., Minneapolis, Minnesota, USA). After the procedure he was discharged on oral double anti-platelet therapy (aspirin and clopidogrel) as prevention for valve thrombosis. He was then submitted 2 months later, in another hospital, to a trans-urethral prostatectomy and cystostomy for a benign prostate hypertrophy. In order to perform the procedure, the anti-aggregation was interrupted, no prophylactic heparin was given, and single anti- aggregation (aspirin) was restarted few days later. Infective endocarditis prophylaxis was administered before the procedure.

At admission the patient presented in good hemodynamic compensation. Standard blood and urine analysis documented elevated phlogos- is indexes (C-reactive protein 13.0 mg/dL) and leucocyturia (WBC 500/ µl). Blood cultures resulted positive for Enterococcus faecalis and a targeted antibiotic therapy with vancomycin was started. In spite of maximal medical treatment, the patient remained febrile. At this stage, a transesophageal echocardiography (TEE) was performed documenting a mobile 18x7mm mass on the CoreValve® prosthesis (Fig. 1. Video 1. See corresponding video/movie images at www.anakarder.com). Heart and prosthesis function were within normal limits. After collegial discussion with the cardiac surgeons, and in consideration of the high surgical risk profile of the patient (Euro-SCORE: 45%), it was decided to manage the condition medically. To exclude the possibility of a prosthe- sis thrombosis, a therapeutic regimen of sub-cutaneous low molecular weight heparin was coupled with the oral aspirin. The patient improved slowly and a control TEE performed 10 days after initiation of the target- ed antibiotic therapy showed complete resolution of the mass and confirmed normal function of the prosthesis (Fig. 2. Video 2. See cor- responding video/movie images at www.anakarder.com). After 6 weeks of antibiotic therapy, a second TEE documented a normally functioning prosthetic valve without any vegetation and without signs of structural degeneration or lesion. The patient was eventually discharged home in good hemodynamic and general condition.

Discussion

Endocarditis after TAVI has been previously reported and success- fully treated with conventional surgery (1). It should be emphasized that in high-risk patients previously rejected to surgery, emergent interven- tion for eradication of prosthetic endocarditis carries a heavy morbidity and mortality burden. For this reason, certainty of the diagnosis and adequate medical treatment should be advocated before referring the patient for a more invasive intervention. Furthermore, the endocarditis prophylaxis should be administered before surgery and emergent inter- vention in patient after TAVI.

Moreover, the adequate anti-aggregation regimen for patients after TAVI remains controversial. Discontinuation of anti-aggregation and