

Cannulation of jugular vein and carotid artery for extracorporeal circulation during a minimally invasive surgery through minithoracotomy in a multimorbid patient with no standard vascular access

Kaniulacja żyły i tętnicy szyjnej do krążenia pozaustrojowego podczas operacji z minitorakotomii u pacjenta obciążonego bez możliwości klasycznego dostępu

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STRESZCZENIE

Do leczenia małoinwazyjnego kwalifikowani są kolejni pacjenci z wadą zastawki mitralnej, trójdzielnej oraz pacjenci z guzami serca. Ograniczone do minimum nacięcie niezbędne do wykonania zabiegu zmniejsza krwawienie, ból pooperacyjny oraz powikłania krążeniowo-oddechowe. Techniki małoinwazyjne prężnie rozwijają się na całym świecie, nie są wciąż dostępne we wszystkich ośrodkach. W niniejszej pracy przedstawiono przypadek skrajnie obciążonej chorej z rozpoznaniem śluzakiem lewego przedsionka poddanej zabiegowi małoinwazyjnemu z zastosowaniem alternatywnego dostępu naczyniowego do krążenia pozaustrojowego.

Słowa kluczowe: kaniulacja szyjna, wideoskopia, chirurgia torakoskopowa, zastawka mitralna, śluzak

Kardiol. Inwazyjna 2018, 13 (6), 34–37

ABSTRACT

Minimally-invasive surgery is more and more often considered to be an advisable treatment in case of patients with mitral or tricuspid valve dysfunctions, as well as those with heart tumor. The incision is reduced to minimum. As a result, the blood loss, postoperative pain and cardiorespiratory complications are also reduced. Minimally-invasive techniques are being developed dynamically all over the world, although they are not available yet in many medical centres. In this article, a case of a female patient in extremely severe condition is described. The woman had been diagnosed with left atrial myxoma and underwent a minimally-invasive surgery with alternative access used for the purpose of extracorporeal circulation.

Key words: jugular cannulation, carotid cannulation, minimally invasive thoracoscopic surgery, mitral valve, myxoma

Kardiol. Inwazyjna 2018, 13 (6), 34–37

INTRODUCTION

Contemporary cardiac surgery searches for more advanced methods and tools that would reduce the invasiveness to minimum. Minimally invasive access provides a number of benefits, the most significant including: less postoperative bleeding, pain reduction, mitigation of cardiorespiratory complications and considerable cosmetic effect [1]. Initially, minimally-invasive cardiac surgery through minithoracotomy has been limited to the selected group of patients. Recently however, it has been reaching for higher risk consecutive patients in experienced centers [2]. One of the problems that a surgeon can face is a vascular access for cannulation.

We describe a case of an unusual cannulation of both carotid artery and jugular vein for extracorporeal circulation in an extremely complex with no standard vascular access referred for urgent myxoma removal performed in a minimally invasive technique.

CASE REPORT

An 84-year female patient was admitted to our department with an acute non-specific resting dyspnea without angina pectoris. In the medical history, it was found out that the woman was an in-patient in September 2014 with a treatment of and right brachial artery. Six months before the woman was underwent the bilateral femoral and right brachial artery embolectomy for an acute ischemia of the extremities. On admission she suffered from bilaterally impaired healing and lymphorrhoea. The left subclavian artery was used repeatedly for central lines. Other conditions found in the medical interview included among others, persistent atrial fibrillation, myocardial infarct in the past, arterial hypertension, insulin-dependent type 2 diabetes, chronic obstructive pulmonary disease, hypothyroidism with hormone replacement therapy, right lung tumor (neo-type unconfirmed diagnosis), severe degenerative changes of the vertebra. The patient has undergone a surgery due to the cataract of both eyes. EuroScore II 8.18, logEuroScore-45% reduced mobility on a daily basis. 6/7 according to Canadian Study of Health and Aging Clinical Frailty Scale.

At the moment of being admitted to the Clinical Department of Cardiac Surgery, the patient was in a severe general condition with a suspicion of myxoma/blood clot in the left atrium.

TTE results indicate the enlargement of both atria (RA 22 cm², LA 33 cm³), moderate mitral regurgitation (CV 4.6 mm), moderate tricuspid regurgitation, increased pressure in right ventricle — sPAP 77 mm Hg, mPAP 40 mm Hg and enlargement of the pulmonary trunk up to 31 mm. The results of the test revealed the existence of a mobile structure in the left atrium, probably pedunculated, moving to the left ventricle, size 20 × 20 mm. Moreover, hypokinesis of the inferior wall has been found, with -50% ejection fraction and depressed left ventricular systolic function (12 mm TAPSE) (Figs 1, 2).

The patient is prepared for a surgery of a life-saving, emergency type. Due to a severe condition and the lack of a possibility to perform an extracorporeal circulation with an femoral access or access through subclavian vessels, a decision was made to choose a minimally-invasive technique with the exposure of the right carotid artery and jugular vein. A 4 cm incision was made in a typical manner, along the sternocleidomastoid muscle with the head rotated about 30 degrees left and both carotid artery and jugular internal vein were exposed (Figs 3, 4). With a full dose of heparin, the arterial line was connected using Fem-Flex 18F (Edwards, Irvine, CA, USA) arterial cannula via a vascular prosthesis sewn into the external carotid artery (6 mm valve for injections were used, as well as 6-0 monofilament suture). The internal jugular vein was cannulated with the



Figure 1. Left atrial tumor in transthoracic echocardiography



Figure 2. The surface area of the left atrial tumor in transthoracic echocardiography



Figure 3. Videoscopic intraoperative left atrial tumor view



Figure 4. Cannulation of right jugular vein and carotid artery for extracorporeal circulation

femoral venous cannula Fem-Flex II 20F, Edwards, Irvine CA, USA) using Seldinger method, secured with a monofilament suture 5-0 purse string.

The cannulae were positioned under the control provided with transesophageal echocardiography. The result was a good venous drainage, without a need to use a negative pressure in the line, and with efficient hemodynamic supervision of the patient during the surgery. Measured bilateral brain saturation remained within the normal range during the surgery. ECC was started in 32 degree Celsius hypothermia. Right lateral mini thoracotomy was performed in the 4th intercostal space (Fig. 5). A video-camera was inserted through the thoracoscopic ports into the 2nd intercostal space. During the surgery, only silicone retractors were used, which resulted in the retraction of the wall and reduced the postoperative pain. CO₂ insufflation was performed through a trocar (Fig. 5).

The ascending artery was clamped with a Chitwood clamp. Cold blood cardioplegia was provided for the aortic bulb. Left atrium was exposed and opened at the Waterson groove. A well organized, 3–3.5 cm thrombus was removed (Fig. 3). Left atrial appendage was tightly sewn with a continuous double suture. Due to the heart rhythm abnormalities accompanying the condition, atrial fibrillation RF ablation was performed. The left atrium was sewn with a continuous double suture. The aortic clamp was removed. Extracorporeal circulation was concluded with small doses of catecholamines.

The total time of extracorporeal circulation was 99 min with 50 min of aortic clamp.

Jugular vessels were decannulated. The chest was closed layer by layer with a drain left in the right pleural cavity.

The patient was extubated by the midnight following the end of the operation (4 hours after the end, to be specific). During the treatment at the Intensive Care Unit of the Clinical Department of Cardiac Surgery, heart rhythm abnormalities occurred, including atrial fibrillation with a rapid beating. Slowing down and regulating the heart rhythm came as a result of sotalol usage. Moreover, the patient's circulation had to be stabilised with an infusion of catecholamines in small doses provided until the 3rd day after the end of the operation. Total postoperative drainage equalled — 100 ml. The condition of the patient did not require that blood derivatives or substitutes be transfused. In the early postoperative period, steroids were used, both systematically and as an inhalant, due to the accompanying condition of acute COPD. This therapy was maintained for the next 5 days, with a good clinical response. Echocardiography test was performed to check the results. No blood clots have been found in the chambers of heart,

hemodynamic insignificance of both mitral and tricuspid valve was confirmed. No significant pain was noticed. In the first evening after the operation, proper physical therapy was introduced, with a full range of motion.

On the 8th day after the surgery, the patient was transferred to the Early Cardiac Rehabilitation Department of the Central Clinical Hospital of the Ministry of Interior in Warsaw.

DISCUSSION

The cannulation of the jugular blood vessels is a relatively simple and fast method [3]. Surgical access to those vessels is not a problem for a cardiac surgeon, and this technique is more and more often performed in case of carotid artery (e.g. in the surgery of thoracic aorta aneurysm) [4, 5]. Although using the jugular vein to perform the cannulation is a very rare solution, it can have some advantages, especially after the access to the carotid artery is made, and it is a vessel located in the direct neighbourhood, with no need of gaining any additional surgical access. This stretch of the jugular vein is usually quite large and, from the technical point of view, catheterizing it is not a problem. Moreover, the short distance between the place of cannulation and the right anterior is an additional advantage of this method, facilitating the precise localization of the catheter in the right anterior. Similarly as in case of catheterizing performed with the femoral vein, we recommend the application of transesophageal echocardiography in order to locate the introducer in such a manner so that it is inserted in the inferior vena cava, and then to place the cannula in the right anterior [6–8].

A similar technique of creating an extracorporeal circulation had been presented by Professor Paul Urbański, who used this type of access successfully in subsequent surgeries within the ascending aorta, aortic arch and thoracic aorta [3, 4]. Professor Urbański showed the technique of carotid artery cannulating during the International Workshops of



Figure 5. Right mini thoracotomy with use of silicone retractor

surgical treatment of thoracic aorta, organised by Śląskie Centrum Chorób Serca, Zabrze in 2014. It is a fast, safe and effective method of gaining an arterial access, especially in case of the obese patients [2, 3].

We used a cannula which is of common use in our centre to cannulise through a femoral vein during minimally-invasive surgeries. It seems to be endowed with the most important features of a cannula, which can be used for the Seldinger method, as well as the proper length.

We can imagine the usage of this type of access also in a chosen group of patients, when a minimally-invasive surgery is planned, in the form of lateral mini thoracotomy, e.g. in the case of obese patients or the patients with complicated femoral vessels anatomy or local infections.

Another field of use is the case of high risk patients. Recently, the increasing experience in the use of minimally-invasive techniques in cardiac surgery, makes it possible to introduce it also in the group of higher risk patients [9, 10]. Currently, due to the significant advantages of this method especially for the high risk patients, we believe this can be our method of choice.

In our opinion, in the case of the female patient described in this article, small amount of total post-operative drainage, lack of transfusions of blood derivatives, stability of the chest, the reduction of trauma and making the patient able to move in a short time, have had the positive effect on patient's health.

To sum up, cannulation of the jugular vessels is a method that can be used in a safe manner. The usage of minimally-invasive techniques can be useful for high risk patients.

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