



MULTIMEDIA MANUAL OF

CARDIO-THORACIC SURGERY

[Home](#)

[Core Skills](#) (Cardiac - Cardiopulmonary Bypass)

[Cardiac](#) (Training & Simulation)

TUTORIAL

How to perform a direct axillary artery cannulation

07:37

Published: October 14, 2022

DOI: 10.1510/mmcts.2022.075

Fundamental

Surgical Videos



Abstract

Hide -

The choice of the arterial cannulation site has been a matter of debate over the years. The femoral artery has been used for a long time due to its ease of isolation and the possibility of percutaneous cannulation. However, it is associated with the risk of embolization because of the retrograde flow, and it is more dangerous in the case of aortic dissection because perfusion is unpredictable and retrograde flow exposes the patient to the risk of malperfusion. Cannulation of the axillary artery has recently gained popularity because of its advantages, in particular for antegrade aortic perfusion during cardiopulmonary bypass and for its ability to facilitate cerebral perfusion during hypothermic circulatory arrest. We show tips and tricks to facilitate the isolation and direct cannulation of the axillary artery because we think that this procedure should be practiced by all cardiac surgeons, even those who are just beginning their practices.

Introduction

Hide -

A variety of cannulation strategies have been used for cardiac surgery interventions throughout the years. In the last 2 decades, a number of studies reported the excellent outcomes of the use of the axillary artery compared to other arteries. Thanks to antegrade flow, the risk of embolization is reduced. Moreover, it facilitates cerebral perfusion during circulatory arrest, and it is rarely involved in the dissection process.

The axillary artery can also be used effectively for venoarterial extracorporeal membrane oxygenation (ECMO), as an approach for a transcatheter aortic valve implant (TAVI) and, in redo patients, for initiation of cardiopulmonary bypass via peripheral cannulation before a re sternotomy. If the surgeons are routinely prepared for this procedure, it can be performed rapidly to expose the femoral artery.

For these reasons, we present our method for performing a safe and easy direct cannulation of the axillary artery.

Surgical Technique & Videos

Hide -



1 - Introduction (0:12)

The cannulation of the axillary artery has recently gained popularity because of its advantages. It is useful for antegrade aortic perfusion and cerebral perfusion during interventions on the aortic arch, as access for TAVI, for venoarterial ECMO, or for initiation of cardiopulmonary bypass via peripheral cannulation before resternotomy.

Before starting the procedure, it is important to check the relevant anatomic landmarks: the jugulum, the clavicle, and the humerus. By making a triangle with the clavicle and the humerus, we can easily find the deltopectoral groove, where we perform the incision.

After positioning the sterile drapes, we connect the Y tube to the arterial line in order to have another branch available to cannulate the femoral artery or a lateral branch in case of arch replacement. We fill the 2 lines, paying attention to the de-airing. For a complete de-airing, we normally connect the arterial line again with the venous line before using it.



2 - Incision and dissection (1:54)

A 5- to 7-cm skin incision is made at the level of the right deltopectoral groove. After the subcutaneous plane, dissection is carried out sequentially in the anatomic planes between the deltoid and the pectoralis major muscles. At this level, specific care should be taken not to injure the cephalic vein where it penetrates the fascia to join the axillary vein. It could be divided only if necessary. An autostatic retractor is placed to improve surgical exposure.

After the incision of the clavipectoral fascia, the pectoralis minor is retracted laterally or sectioned according to the patient's anatomy. We usually section the muscle by surrounding it and lifting it up using a cystic forceps in order to avoid damaging the underlying structures.



3 - Axillary artery is exposed (3:15)

Usually at this stage we can find the arterial branches of the thoracoacromial trunk and, if necessary, we divide them to gain full access through the fatty tissue that is located above the axillary vessels.

During the careful dissection, the axillary vein is usually encountered first. The axillary artery lies cranially and deeper than the vein and is readily palpated.

After the dissection, a shoestring tie is passed around the artery to improve the exposure. Pulling it gently it allows us to separate the axillary artery from the cords of

the brachial plexus. If necessary, the collaterals of the axillary artery can be temporarily preserved with a vessel loop.



4 - Direct cannulation (4:13)

Once proximal and distal control of the artery is achieved, the shoestring tie is passed through a tourniquet. At this point, heparin is administered to the patient. Two straight vascular clamps are placed proximally and distally to the cannulation site. We always use a direct cannulation rather than the Seldinger technique. Moreover, we prefer a longitudinal incision in order to facilitate the next closure of the artery and to reduce the risk of dissection.

A 10-mm incision is made using a #11 surgical blade, and a 20 Fr or 22 Fr OptiSite arterial cannula (Edwards Lifesciences, Irvine, CA, USA) is used, depending on the body mass index of the patient.

It is really important to insert the cannula without applying pressure on the clamp that the assistant is gradually opening.



5 - Arterial connection (4:55)

After the insertion, the tourniquet is tightened to the artery to hold the cannula. By evaluating the backflow of the blood, we can further determine the correct position.

We usually connect the selective cerebral perfusion cannula for the left carotid directly to the arterial cannula in order to perform bilateral cerebral perfusion.

To further improve the neurological outcomes, bilateral brain perfusion is mandatory during the period of circulatory arrest. In our opinion, the best strategy is to establish cardiopulmonary bypass and selective cerebral perfusion using the same arterial cannula rather than through a separate circuit. At this point the cannula is connected to the arterial line and secured to the skin.

The distal clamp is left in place until the end of cardiopulmonary bypass after protamine is given.



6 - Decannulation (6:12)

At the termination of the cardiopulmonary bypass, we proceed with the decannulation.

We cut the 2 stitches. The surgeon gently removes the cannula while the assistant gradually closes the artery with a vascular clamp. At this point, the artery is easily reconstructed with a 6-0 polypropylene running suture.

The distal clamp is removed for de-airing the artery. Then the proximal clamp is removed as well, and the surgeon can tighten the stitch.

After hemostasis, the different planes are closed in the classical fashion without drainage.

The echocardiographic color Doppler check that we carried out in the intensive care unit shows an excellent result without appreciable acceleration of the flow.

Outcome & Discussion

Hide -

We have been practicing axillary cannulation since the end of the 1990s [1] in all dissections and operations involving the ascending aorta in order to perform an antegrade flow, to be able to clamp as distally as possible, and to resect a greater portion of the diseased aorta.

Before starting the procedure, it is of paramount importance to check the jugulum, the clavicle, and the humerus. They are the most important anatomic landmarks. By making a triangle with the clavicle and the humerus, the deltopectoral groove is easy to find. The incision has to be performed in this location. At the level of the deltopectoral groove, the artery is more superficial; dissection is easy and reproducible, even in severely obese patients.

A more proximal incision is feasible; however, the access is more difficult because the artery lies more deeply. Distally, the artery is smaller in caliber and surrounded by the brachial plexus, so it is of paramount importance to pay particular attention not to injure it during the dissection.

In our opinion, direct cannulation is of outmost importance, in particular during interventions for dissection, in order to view the intima and insert the cannula correctly, reducing the risk of an intimal lesion. We experienced 2 episodes of dissection of the axillary artery during cannulation in about 800 patients treated with this procedure. The color Doppler echocardiographic follow-up examinations that we carried out on the brachial artery after the procedure always showed excellent results without appreciable acceleration of the flow.

Given the need of rapid cannulation in case of dissection and to avoid bleeding after the administration of heparin, we prefer not to use a Dacron tube. However, it is a well-defined technique, accepted in other institutions [2].

Before the operation, it is really important to verify the humeral pulse. It allows for the detection of proximal involvement of the subclavian artery. A reduced pulse is likely due either to direct subclavian or to innominate artery dissection. In such cases the use of the axillary artery is discouraged. However, involvement of an axillary artery by the dissection process is rare [3]. In our group of patients, we did not find any vessel with intimal flap formation.

Moreover, axillary artery cannulation reduces the occurrence of an early embolic stroke and early death after open arch repair with circulatory arrest [4].

For these reasons and because of the possibility of an antegrade flow, it can also be used effectively for venoarterial ECMO [5].

Another indication for the use of the transaxillary approach is the TAVI. The advantages compared to transfemoral and transcarotid transcatheter aortic valve replacement are the ability to safeguard the cerebral vessels, more direct access to the aortic valve [6] compared with femoral access, and for Al-Balah et al., significantly fewer major vascular complications [7].

Another important use is in patients having redo procedures for initiation of cardiopulmonary bypass via peripheral cannulation before resternotomy by adding a percutaneous femoral vein cannulation.

Surgical exposure to the axillary artery is easy to carry out. If the operative field and the patient are routinely prepared for this procedure, it is performed as rapidly as femoral exposure.

Unlike for the femoral vessels, the risk of arm ischemia is low during the occlusion for cardiopulmonary bypass because the axillary artery benefits from the rich collateral flow from the thyrocervical trunk to the suprascapular and transverse cervical arteries.

In conclusion, axillary artery cannulation represents an easy, safe, and effective procedure that should be in the armamentarium of all cardiac surgeons.

1. Neri E, Massetti M, Capannini G, Carone E, Tucci E, Diciolla F, et al. Axillary artery cannulation in type A Aortic dissection operation. JTCVS 1999;118(2):324–329.
[PubMed Abstract](#) | [Publisher Full Text](#)
2. Calvario D, Voisine P, Mohammadi S, Dumont E, Dagenais F. Axillary artery cannulation. Multimedia Man Cardiothorac Surg. 2012 Jan 1;2012:mms004.
[PubMed Abstract](#) | [Publisher Full Text](#)
3. El-Hamamsy I, Ouzounian M, Demers P, McClure S, Hassan A, Dagenais F, et al. State-of-the-art surgical management of acute type A Aortic dissection. Canadian Journal of Cardiology 2016;32:100–109.
[PubMed Abstract](#) | [Publisher Full Text](#)
4. Kim JH, Lee SH, Lee S, Youn YN, Yoo KJ, Joo HC. Comparison of outcomes following transfemoral versus trans-subclavian approach for transcatheter aortic valve Implantation: A meta-analysis. JTCVS. 2020;159(3):772–778.
5. Pisani A, Braham W, Brega C, Lajmi M, Provenchere S, Danial P, et al. Right axillary artery cannulation for venoarterial extracorporeal membrane oxygenation: a retrospective single centre observational study. Eur J Cardiothorac Surg. 2021 Apr 13;59(3):601–609.
[PubMed Abstract](#) | [EJCTS Full Text](#)
6. Anselmi A, Tomasi J, Giardinelli F, Bedossa M, Rosier S, Verhoye JP. Safety and effectiveness of the transsubclavian approach for transcatheter aortic valve implantation with the 14-F CoreValve Evolut R device. J Cardiovasc Med. 2018;19(11):664–668.
[PubMed Abstract](#) | [Publisher Full Text](#)
7. Al-Balah A, Naqvi D, Houbby N, Chien L, Sen S, Athanasiou T, Salmasi MY. Comparison of outcomes following transfemoral versus trans-subclavian approach for transcatheter aortic valve Implantation: A meta-analysis. Int J Cardiol Heart Vasc. 2020;31:100668.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)

Author & Tutorial Information

Hide -

Authors

Veronica Lorenz, Luigi Muzzi & Eugenio Neri

Author Affiliations

Division of Cardio-Thoracic Surgery, Department of Medical Biotechnologies, Azienda Ospedaliera Universitaria Senese, Siena, Italy.

Corresponding Author

Veronica Lorenz

Division of Cardio-Thoracic Surgery,

Department of Medical Biotechnologies,

Azienda Ospedaliera Universitaria Senese,

Siena,

Italy.

Email: veronica.lorenz@yahoo.it

Keywords

Arterial cannulation Axillary artery Cardiac surgery Cardiopulmonary bypass Cannulation
Cannulation techniques

© The Author 2022. Published by *MMCTS* on behalf of the European Association for Cardio-Thoracic Surgery. All rights reserved.

You may also like

TUTORIAL



Axillary artery cannulation

Axillary cannulation provides an antegrade systemic flow, allows easy initiation of antegrade cerebral perfusion during circulatory arrest, and reduces the rate of retrograde cerebral embolization compared with a femoral cannulation.

TUTORIAL



Double-arterial cannulation during aortic arch reconstruction in pediatric patients

A simple and safe technique of double arterial cannulation for perfusion of the brain and lower body during pediatric aortic arch reconstruction.

TUTORIAL



Author Profiles

Veronica Lorenz

Show +

Luigi Muzzi

Show +

Eugenio Neri

Show +

Share

MORE FROM EACTS

INTERDISCIPLINARY
CARDIOVASCULAR
AND **THORACIC**
SURGERY

Interdisciplinary CardioVascular and Thoracic Surgery

EUROPEAN JOURNAL OF CARDIO-THORACIC SURGERY

European Journal of Cardio-Thoracic Surgery



MMCTS Residents' Tutorial Competition



36th EACTS Annual Meeting

MMCTS

[About](#)

[Aims & Scope](#)

[Editorial Board](#)

[Author Guidelines](#)

[MMCTS Submission Form](#)

[Author Directory](#)

[Privacy Policy](#)

[Contact](#)

[Resident's Tutorial Competition](#)

[Connect with us](#)

[Indexed by PubMed](#)

[Multimedia Manual of Cardio-Thoracic Surgery](#)

[Online ISSN: 1813-9175](#)

Copyright © 2023 EACTS

All rights reserved.