



THE AGA KHAN UNIVERSITY

eCommons@AKU

Department of Anaesthesia

Medical College, Pakistan

June 2018

# Misplaced central venous catheter in carotid artery during emergency surgery for the total correction of tetralogy of fallot of an adolescent boy

Shabbir Ahmed

*Aga Khan University*, [shabbir.ahmed2@aku.edu](mailto:shabbir.ahmed2@aku.edu)

Faisal Junejo

*Aga Khan University*

fazal Wahab khan

*Aga Khan University*, [fazal.hkhan@aku.edu](mailto:fazal.hkhan@aku.edu)

Follow this and additional works at: [https://ecommons.aku.edu/pakistan\\_fhs\\_mc\\_anaesth](https://ecommons.aku.edu/pakistan_fhs_mc_anaesth)

 Part of the [Anesthesiology Commons](#)

## Recommended Citation

Ahmed, S., Junejo, F., khan, f. W. (2018). Misplaced central venous catheter in carotid artery during emergency surgery for the total correction of tetralogy of fallot of an adolescent boy. *Journal of the College of Physicians and Surgeons*, 28(6), 479-481.

**Available at:** [https://ecommons.aku.edu/pakistan\\_fhs\\_mc\\_anaesth/342](https://ecommons.aku.edu/pakistan_fhs_mc_anaesth/342)

# Misplaced Central Venous Catheter in Carotid Artery during Emergency Surgery for the Total Correction of Tetralogy of Fallot of an Adolescent Boy

Syed Shabbir Ahmed, Faisal Junejo and Fazal Hameed Khan

## ABSTRACT

Ultrasound-guided central venous cannulation is now considered as the standard of care, and this has largely replaced blind central venous cannulation using anatomical landmarks. We are reporting a case of inadvertent placement of central venous catheter in the right common carotid artery with the use of ultrasound guidance during emergency surgery for the total correction of Tetralogy of Fallot (ToF). This patient luckily had a favourable outcome despite this inadvertent catheter placement which was not recognised even after completion of surgery. The patient also received drug infusions of inotropes and vasopressors through this misplaced central line into the aorta. The possible mechanism, consequences, prevention and management of this inadvertent cannulation are discussed in this report.

**Key Words:** Central venous catheter. Congenital heart surgery. Tetralogy of Fallot. Ultrasound.

---

## INTRODUCTION

It is recommended to use ultrasound (US) rather than using the landmark technique alone to pass central venous catheter (CVC).<sup>1</sup> The Agency for Healthcare Research and Quality of the USA and the UK National Institute of Clinical Excellence, both recommended CVC with US guidance as one of the safest practices to augment better patient care.<sup>2</sup> In our institute, we frequently use US for CVC insertion.<sup>3</sup> Tetralogy of Fallot (ToF) is the most common complex cyanotic congenital heart lesion. If the defect is not corrected at a younger age, then some of these patients later present with major aorto-pulmonary collateral arteries (MAPCAs). This is extremely rare; however, in areas where patients have limited access to surgical care, especially in developing countries like Pakistan, patients sometimes present with ToF along with MAPCAs.

## CASE REPORT

A 15-year boy, who was a diagnosed case of ToF weighing approximately 40-45 kg, presented to the emergency department with history of cough, epistaxis, and hemoptysis. He was vitally stable. Hemoglobin was 18.9 g/dL with hematocrit of 58%. Platelet count was 172 x 10<sup>9</sup>/L and oxygen saturation (SpO<sub>2</sub>) was 78% in room air. His transthoracic echocardiography showed ToF

including severe pulmonary valve stenosis, and large conoventricular ventricular septal defect (VSD). Clinically, there was also a suspicion of major aorto-pulmonary collateral arteries (MAPCAs). He had massive hemoptysis resulting in aspiration of blood into the lungs. This resulted in respiratory distress, so he was intubated and mechanically ventilated. Later, he was resuscitated and moved to radiology for angioembolization. His CT showed mesh of collaterals arising from thoracic aorta supplying both lungs and pulmonary arteries. Some of these arteries were embolized. Bleeding settled, but he became severely hypoxic. His partial pressure of oxygen (PO<sub>2</sub>) dropped to 34 mmHg from 70 mmHg on 100% fraction of inspired oxygen (FiO<sub>2</sub>).

An emergency total correction was decided. CVC was inserted in internal jugular vein (IJV) under direct US guidance, but there was a clinical suspicion of arterial puncture in spite of the visualisation of needle in the vein, necessitating another attempt to be made with an 18G IV cannula, 7Fr multilumen CVC was inserted into the vein using Seldinger wire technique. Once the catheter was connected to the pressure transducer, arterial waveform tracing was observed with mean pressure between 45 and 53 mmHg. There was a strong suspicion that the central venous cannulation may have gone into the artery, but the fact that vein was punctured under direct US guidance and the assumption that right sided pressures are high due to more overriding of aorta resulted in confusion. There was no back flow of blood from the CVC lumen when a drip was attached to one of the ports. We started infusing fentanyl, atracurium, and tranexamic acid through this line. No abnormal findings were noted by the surgeons around aorta or during cross clamping of aorta. The defect was totally corrected and the patient was successfully weaned off from the

---

*Department of Anaesthesiology, The Aga Khan University Hospital, Karachi.*

*Correspondence: Dr. Syed Shabbir Ahmed, Senior Instructor, Department of Anaesthesiology, The Aga Khan University Hospital, Stadium Road, P.O. Box 3500, Karachi-74800.  
E-mail: shabbir.ahmed2@aku.edu*

*Received: October 06, 2017; Accepted: November 28, 2017.*

cardiopulmonary bypass. After weaning, we started inotropes like epinephrine, milrinone, dopamine, and nitroglycerin as needed; and also gave calcium chloride, potassium chloride, heparin, and protamine through this line. The tracing did not get better even after successful operation, so a suspicion of inadvertent arterial cannulation was made. Blood sample was withdrawn both from the radial artery catheter and the assumed central line. This confirmed that the central line has been misplaced in an artery as the PO<sub>2</sub> of both the samples was 84 mm Hg. Chest X-ray done postoperatively in our cardiac intensive care unit (CICU), which clearly demonstrated that the line had gone inadvertently into the aorta. Another central line was passed through the right femoral vein, shifting all the drug infusions to this new central line.

Next morning patient was fully awake and responded to verbal commands, but unfortunately started to bleed again from the lungs. He was arrested and had a brief cardio-pulmonary resuscitation (CPR) and was revived. The chest tube had fresh blood, so patient was rushed to the operating room again. This time left thoracotomy and left lower lobectomy was done due to AV malformation and persistent bleeding from the left lower lobe. After this surgery, US of the neck was done to see the point of entrance of central catheter into the artery. It was revealed that the CVC pierced the posterior wall of right internal jugular vein and entered the right common carotid artery. As there was space available to compress the artery, so catheter was removed in the theatre and the pressure applied to the site of carotid puncture for 20 minutes. He remained hemodynamically stable after this episode, and was on ventilator for 24 hours; and then finally extubated. Patient was discharged after staying in the hospital for 20 days.

## DISCUSSION

CVC is a routine procedure in cardiac surgery. Numerous complications are associated with CVC placement and selection of vein cannot be guaranteed to avoid complications, but appropriate use of technology with expertise is the key to avoid complications. Overall complication rate of 15% includes pneumothorax, hematoma, arterial puncture, hemothorax, infections, and thrombotic complications.<sup>4</sup> Mauricio and colleagues, showed that vein was located lateral to the artery in 24.3%, anterolateral in 33.8%, and anterior in 41.9%; and relation between IJV and carotid artery can be variable with the angle of rotation of neck. Arterial puncture was observed in 3-15% of central venous access procedures.<sup>5,6</sup> However, additional complications could be devastating, if it goes unrecognised and infusion continues in arterial system,<sup>7</sup> as happened in this case; where, all drugs were infused including blood products into the arterial system. According to our knowledge, it is the first case reported where all drugs were infused

through arterial system during the whole procedure. Although some cases are reported here only for propofol infusion in arterial system in cardiac surgery.<sup>7</sup>

It is not known in this case how CVC went into carotid artery. It might have got punctured while threading CVC or while dilating with tissue dilator. An intraluminal position of the needle can be confirmed by observing the needle entering the vein with US guided access coupled with a steady flow of dark blood into the syringe. Bright red and high-pressure pulsatile bleeding is important, but imperfect clue to arterial puncture.<sup>8</sup> Dark, non-pulsatile backflow of blood may be seen with arterial puncture in the face of oxygen desaturation, hypotension, or needle malposition. If there is any doubt, the needle's location can be confirmed by pressure transduction. As an alternative, a blood gas sample can be drawn from the accessed venous site and compared with an arterial sample.<sup>5,7</sup> In our patient, arterial color of blood was already black because of ToF. Therefore, it was not reliable. On the other hand, the blood was slightly pulsatile when IJV was cannulated but not found after placing CVC. It may be happened due to high hematocrit, we did not get much pulsatile blood. We did not transduce at any time before insertion of CVC, which should be considered. Blood or fluid flowing back into the CVC is another sign that may indicate an incorrect arterial CVC placement. Although this was not observed in our case because back flow was unlikely against infusion pump. So, whenever back flow is suspected, it should be checked without any external pressure by simply attaching it with un-pressurised fluid bag to flow freely. So, it is necessary to transduce or use manometer for waveform and pressure monitoring. We strongly agree with Weinberg and colleagues, in employing at least two safety methods to ensure the correct venous CVC placement, especially before starting an infusion. These include blood colour or backflow pulsatility, transduction of central pressure waveform, arterial blood gas analysis confirmation, and US confirmation of both the absence of the catheter in the artery and the presence of the catheter in the vein.<sup>5</sup> Transesophageal echocardiography (TEE) is used for many congenital heart operations. Catheter tips and guidewires are easily imaged with TEE, and one study demonstrated a 100% success rate for TEE-guided CVC placement in the superior vena cava (SVC) when TEE was used, versus 86% when surface anatomical landmarks were used in infants and children undergoing congenital heart surgery.<sup>9</sup> In our case, TEE was placed but not interpreted by a trained person. It was an emergency case, so things were not lined up. In our routine practice, only trained cardiologist or trained anesthetist in TEE are allowed to interpret. Therefore, knowledge of equipment like US and TEE is very important for interpretation.

Gentle traction followed by 20 minutes of local compression was applied to achieve haemostasis. This pull and pressure approach to manage a large bore carotid injury was retrospectively associated with higher complication rate and an immediate stroke risk of about 5.6%. In our case, pull and pressure approach was practised because of higher puncture site in the neck, which was easily accessible. It is worthwhile to go more caudally but should apply non-occlusive pressure which is not easy to monitor. Other available options are open repair or percutaneous device closure.<sup>10</sup>

In conclusion, inadvertent carotid artery CVC placement is a rare and potentially devastating complication, but it can be easily avoided by using multi-confirmatory approach during placement of CVC.

### REFERENCES

1. Shime N, Hosokawa K, MacLaren G. Ultrasound imaging reduces failure rates of percutaneous central venous catheterization in children. *Pediatr Crit Care Med* 2015; **16**: 718-25.
2. Wigmore T, Smythe J, Hacking M. Effect of the implementation of NICE guidelines for ultrasound guidance on the complication rates associated with central venous catheter placement in patients presenting for routine surgery in a tertiary referral centre. *Br J Anaesth* 2007; **99**:662-5.
3. Akhtar MI, Hamid M. Ultrasound guided central venous access; a review of literature. *Anaesth Pain Intensive Care* 2015; **19**:317-22.
4. Hodzic S, Golic D, Smajic J. Complications related to insertion and use of central venous catheters (CVC). *Med Arch* 2014; **68**:300.
5. Powers CJ, Zomorodi AR, Britz GW. Endovascular management of inadvertent brachiocephalic arterial catheterization: clinical article. *J Neurosurg* 2011; **114**:146-52.
6. Ho L, Spanger M, Hayward P. Missed carotid artery cannulation: a line crossed and lessons learnt. *Anaesth Intensive Care* 2014; **42**:793.
7. Chirinos JC, Neyra JA, Patel J. Hemodialysis catheter insertion: is increased PO2 a sign of arterial cannulation? A case report. *BMC Nephrol* 2014; **15**:127.
8. Kornbau C, Lee KC, Hughes GD, Firstenberg MS. Central line complications. *Int J Crit Illn Inj Sci* 2015; **5**:170.
9. Jeon Y, Ryu HG, Yoon SZ. Transesophageal echocardiographic evaluation of ECG-guided central venous catheter placement. *Can J Anaesth* 2006; **53**:978-83.
10. Bechara CF, Barshes NR, Pisimisis G. Management of inadvertent carotid artery sheath insertion during central venous catheter placement. *JAMA Surg* 2013; **148**:1063-6.

