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## Case Report

## Unexpected complication of arteriovenous fistula of the left common carotid to internal jugular vein following central venous catheterization

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## ABSTRACT

Incidence of inadvertent arterial puncture secondary to central venous catheter insertion is not common with an arterial puncture rate of <1%. This is due to the advancements and wide availability of ultrasound to guide its insertion. Formation of arteriovenous fistula after arterial puncture is an unexpected complication. Till date, only five cases (including this case) of acquired arteriovenous fistula formation has been described due to inadvertent common carotid puncture. The present case is a 26-year-old man sustained traumatic brain injuries, chest injuries and multiple bony fractures. During resuscitative phase, attempts at left central venous catheter via left internal jugular vein under ultrasound guidance resulted in inadvertent puncture into the left common carotid artery. Surgical neck exploration revealed that the catheter had punctured through the left internal jugular vein into the common carotid artery with formation of arteriovenous fistula. The catheter was removed successfully and common carotid artery was repaired. Postoperatively, the patient recovered and clinic visits revealed no neurological deficits. From our literature review, the safest method for removal is via endovascular and open surgical removal. The pull/push technique (direct removal with compression) is not recommended due to the high risk for stroke, bleeding and hematoma formation.

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## Introduction

Central venous catheter (CVC) is an important tool which has been used for more than 70 years. It was used initially for the treatment of soldiers who sustained wounds from the battlefield.<sup>1</sup> Since then, over 7 million catheters are inserted yearly mainly for intra- and postoperative monitoring, intravenous drug and parenteral nutrition administration.<sup>2</sup> With the advances of ultrasound devices and its wide availability, the complications that accompany this procedure have been significantly reduced.<sup>3</sup>

In this case report, we report a young male who sustained head injuries with multiple facial and long bone fractures after traumatic motor vehicle accident. Through the process of emergency treatment, inadvertent puncture of common carotid artery occurred.

This led to the formation of common carotid to internal jugular arteriovenous fistula.

## Case report

A 26-year-old male was brought to the hospital emergency department after a motor vehicle accident. Primary survey and subsequent investigations identified an acute traumatic right basal ganglia haemorrhage, facial fractures, left rib fractures with pneumothorax, and fractures of the upper and lower limbs.

A left chest drain was inserted. Prompt operation with a burr hole and insertion of intracranial catheter for intracranial pressure monitoring was conducted by the neurosurgery team. Intraoperatively, a triple Lumen 7fr CVC was inserted to infuse inotropic support through the procedure. The insertion was via Seldinger technique under direct ultrasound guidance via the left internal jugular vein. The catheter was inserted on a second attempt by senior medical personnel. Due to overt suspicion of catheter misplacement, a second triple Lumen CVC was inserted into the right femoral vein under ultrasound guidance. The

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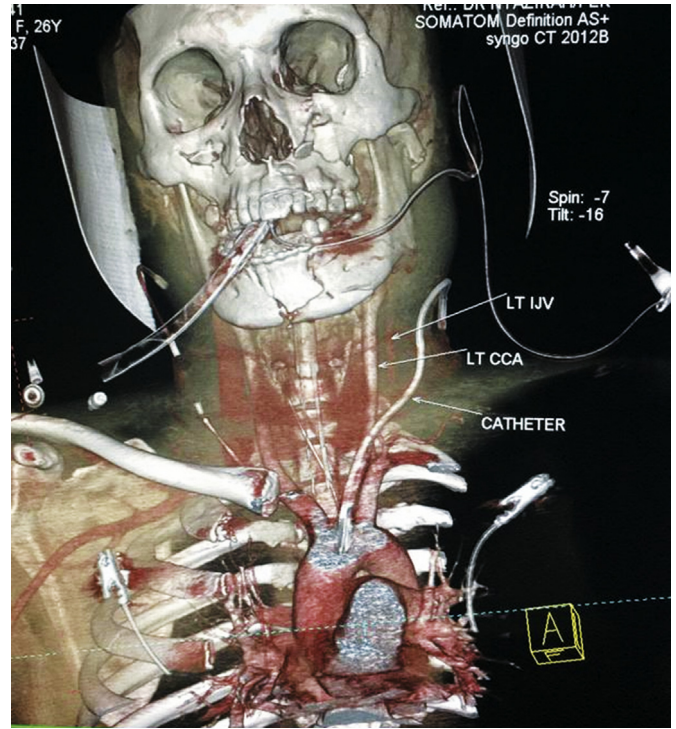
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catheter which was placed at the left internal jugular vein was not removed immediately due to the risk of hematoma formation.

Postoperatively, the patient was nursed in the intensive care unit. Clinical assessment revealed no surrounding hematoma, carotid bruit or any carotid murmur. A chest roentgenogram showed that the catheter tip was at the fourth intercostal space (Fig. 1). As the patient was initially hemodynamically unstable, an urgent computerized tomography (CT) angiography of the neck and thorax was performed only on postoperative day 2 after patient was fit for transfer to CT room. The reconstructed CT images revealed that the catheter was inserted into the left internal jugular vein which pierced into the left common carotid artery without any clot formation (Fig. 2).

Decision was made for open left neck exploration and removal of the CVC in view of unavailability of endovascular services locally. No duplex ultrasound was performed as the aim of neck exploration was to remove the catheter for damage control. Intraoperative findings revealed that the catheter had punctured through the internal jugular vein into the common carotid artery (Fig. 3). There was hematoma and inflammatory tissue surrounding the catheter which leads to an early formation of arterio-venous fistula via the common carotid artery and internal jugular vein. The common carotid artery was isolated with proximal and distal control using vessel loops. Subsequently the catheter was removed together with the fistula tract communicating into the common carotid. During the process, the internal jugular vein was ligated. The common carotid artery was repaired with Prolene 6/0 sutures.

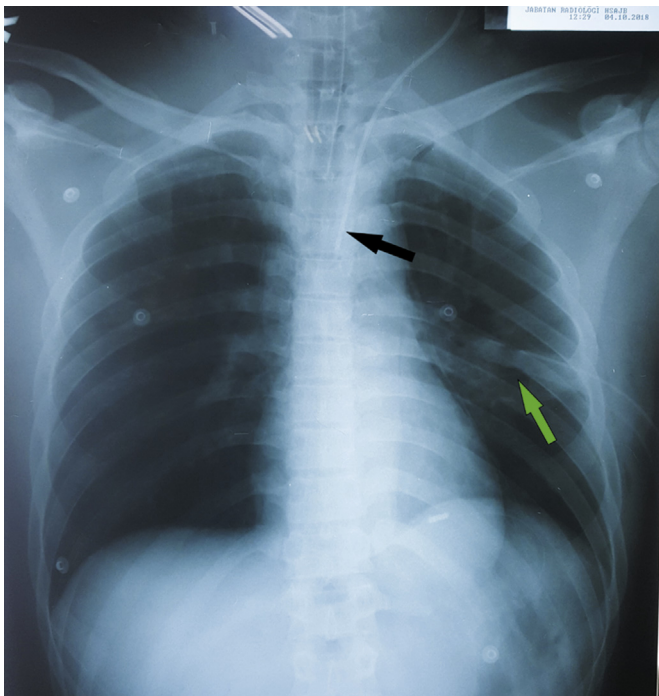
Postoperative recovery was uneventful. The patient made a full recovery after two months of hospital stay. Assessment in the surgery clinic at three months after discharge revealed no power loss over the upper and lower limbs (Medical Research Council grade, 5/5) and sensation was intact. There were no signs to indicate any incident of postoperative ischemic stroke.



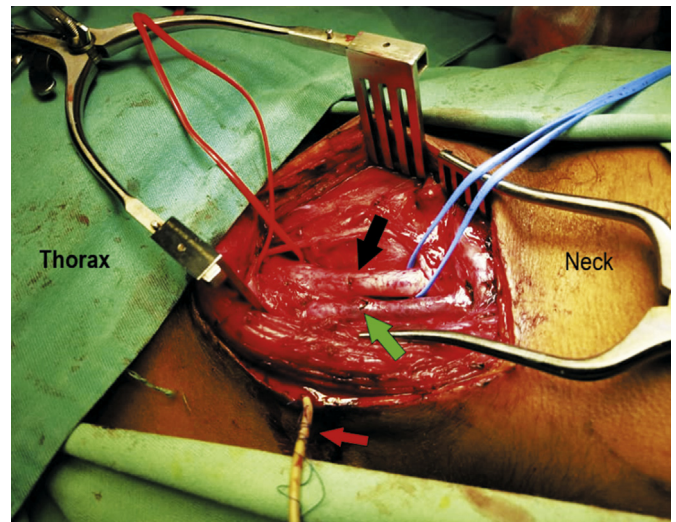
**Fig. 2.** Computerized tomography angiography reconstructed image showing insertion of central venous catheter (white arrow) into the left internal jugular vein (white arrow: LT IJV) which pierces into the left common carotid artery (white arrow: LT CCA).

## Discussion

Historically, CVC was first described by Aubaniac<sup>1</sup> in 1952 in battlefield-injured patients. Almost 70 years later, the use of CVCs has increased exponentially and is almost needed in the majority of acute care management.<sup>2</sup> Current practice with evidence from multiple randomized control trials makes ultrasound-guided CVC insertion a relatively safe procedure with a success puncture rate of



**Fig. 1.** Chest roentgenogram following left central venous insertion (black arrow: tip of left central venous catheter; green arrow: left chest tube).



**Fig. 3.** Intraoperative picture showing the dislodged central venous catheter (red arrow); visible puncture marks showing abnormal communication between the common carotid (black arrow) and internal jugular vein (green arrow).

>94%.<sup>3</sup> Common complications which may occur include injury to the surrounding anatomical structures such as the nerves, oesophagus, pleura or arteries.<sup>4</sup> The incidence of inadvertent puncturing into the surrounding arteries has been reported to be around 0.1%–0.8%.<sup>5</sup> The sequelae from this complication is hematoma that may cause airway obstruction, pseudoaneurysm, arteriovenous fistula and stroke secondary to thromboembolism.<sup>6</sup>

Ortiz et al.<sup>7</sup> was the first one who described the formation of arteriovenous fistula following inadvertent inferior thyroid artery puncture via CVC insertion. Their patient was treated surgically with neck exploration and ligation of the inferior thyroid artery, internal jugular vein and excision of fistula tract.<sup>7</sup> To our knowledge there are only four cases of inadvertent arteriovenous formation of carotid to internal jugular vein due to iatrogenic CVC insertion till date.<sup>8</sup> The rare sequelae of inadvertent carotid puncture is probably due to the advancements in ultrasound devices and its availability.<sup>3</sup>

The symptoms of arteriovenous fistula arising from common carotid artery to internal jugular vein is usually a loud roaring bruit at the neck, fainting episodes and ischemic attacks involving the cerebral hemispheres.<sup>8</sup> Taking into consideration of patient's young age and to reduce the risk of further insults to the brain and formation of pseudoaneurysm, the options available for CVC removal include: (1) pull/pressure technique (direct removal and compression), (2) endovascular<sup>9</sup> (which was not available in our local centre) and (3) surgical exploration and fistula tract excision. Guilbert et al.<sup>2</sup> concluded that the pull/pressure technique is associated with a significant risk of hematoma, airway obstruction and pseudoaneurysm. The possible safest method was via endovascular or surgical exploration. But due to unavailability of these services and unfit for transfer, an open approach was taken for our patient.

This case report highlights the rare occurrence of arterial venous fistula formation due to inadvertent puncture from CVC insertion. In the event of high suspicion, the catheter should be left in place first to seal off any possible bleeding which may leads to a hematoma and diagnosed with CT angiography. It serves as a reminder to always include it during informed consent as it may be a devastating morbidity from this relatively common procedure. The

authors also advocate proper risk counselling with family member prior proceeding with any treatment as this may lead to permanent ischemic stroke due to thrombus and permanent neurologic disabilities in this young man.

### Funding

Nil.

### Ethical Statement

Informed consent has been obtained from the patient.

### Declaration of Competing Interest

The authors declare that they have no conflicts of interest.

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