CASE REPORTS

SAVING SUBCLAVIAN ARTERIES WITH PERCUTANEOUS APPROACH: A SOLUTION FOR CATHETER MISPLACEMENT

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Abstract

Introduction: *Inadvertent placement of a central venous catheter (CVC) into a major artery can lead to potentially devastating complications. In critically ill patients, the use of vascular closure devices is an attractive therapeutic option. We report two cases of catheter misplacement into cervical arteries managed with the Perclose ProStyle® system.*

Methods: *A retrospective analysis was conducted on adult patients admitted to the Intensive Care Unit (ICU) between July and December 2023 who underwent removal of a misplaced catheter using an endovascular approach.*

Results: *Two patients were identified. One catheterization occurred in the operating room prior to ICU admission, and the other in the ICU. Misplacement was detected within six hours via chest radiography, and diagnosis was confirmed by computed tomography angiography (CTA). Catheters were removed using the Perclose ProStyle® device.*

Conclusion: *The ProStyle® system was safe and effective in these patients. These cases highlight the importance of detailed procedural documentation during CVC placement. Additionally, periodic audits could help prevent technical errors and reinforce adherence to best clinical practices.*

Keywords: *central venous catheterization, arterial iatrogenic injuries, vascular closure devices, critical care*

INTRODUCTION

Reports of iatrogenic vascular injury after CVC insertion are increasing, with an incidence of 0.1–2.7%.[1-4] Inadvertent catheter placement into a major artery may result in severe complications, such as pseudoaneurysm, hematoma with potential airway compression, stroke and death.[1]

Treatment options include endovascular and open surgical repair.[4-7] In critically ill patients, endovascular techniques represent an attractive alternative. The Perclose device is a suture-mediated closure system originally designed for femoral vessels, with "off-label" application in other arterial sites.[1, 4, 5, 7]

We present two cases of inadvertent catheterization of cervical arteries successfully managed using the Perclose ProStyle® system, thereby contributing additional evidence to current literature.

METHODS

Study Design

A six-month retrospective study conducted in the ICU of a Portuguese tertiary hospital.

Study Population

Inclusion criteria were: (1) patients admitted to the ICU between July and December 2023; (2) adults aged ≥18

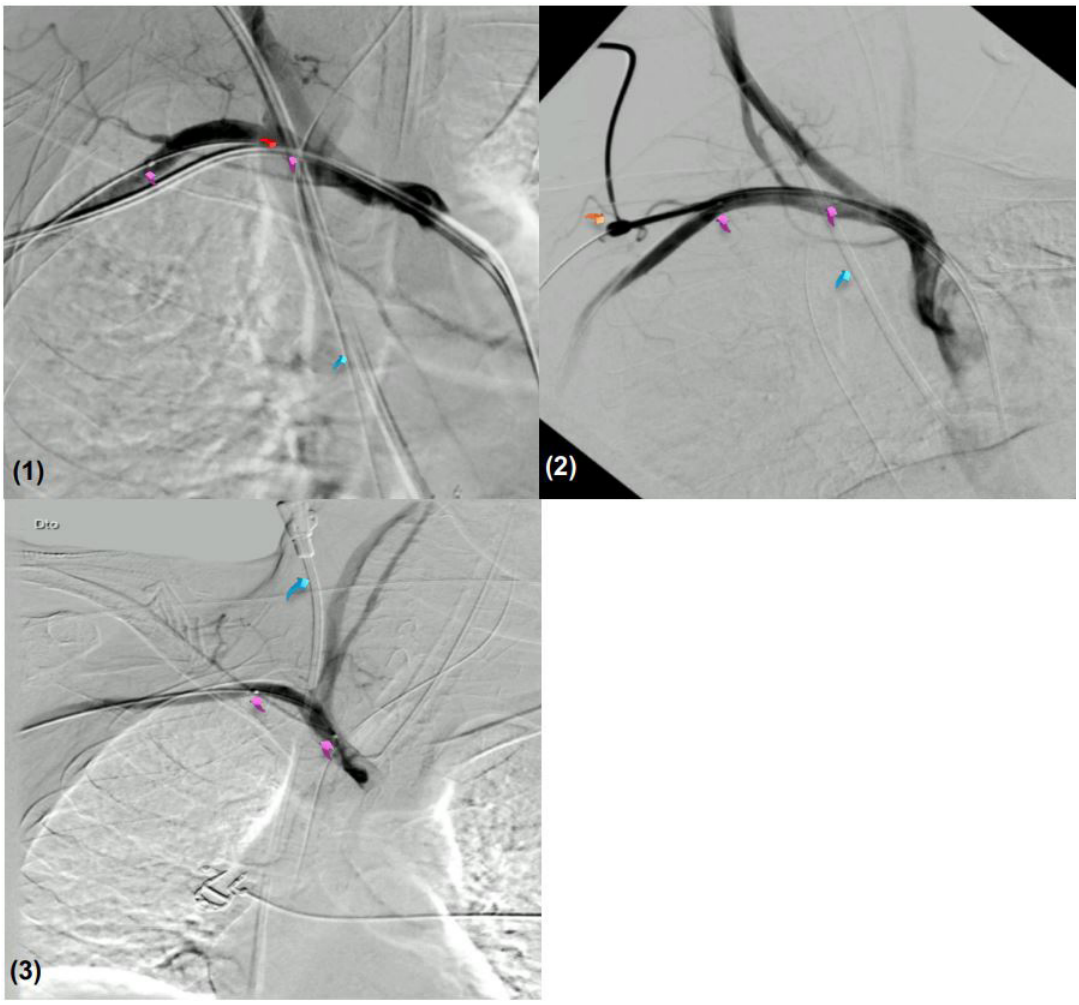

Figure 1

Case 1. Anterior-posterior angiogram of the chest showing the braquicephaclic trunk, right common carotid artery, right subclavian artery and righ vertebral artery.
Legend: (1) Red arrow: entry site of misplaced catheter. Purple arrows: PTA balloon is placed via radial artery (2) Stiff wire inserted through the misplaced catheter to guide 9-french sheath (Orange arrow) and Prostyle device for haemostasis (3) Final angiogram; blue arrow: correctly positioned jugular central venous catheter.

years; and (3) CVC misplacement in a cervical artery treated with the ProStyle® system.

Data Collection

Data were retrieved from electronic medical records, including demographics, relevant medical history, diagnostic method of arterial catheter misplacement, and early clinical outcomes.

Ethical Considerations

Informed consent was obtained for publication, including approval for the use of associated images.

RESULTS

Case 1

A 70-year-old patient was admitted to the ICU following a suicide attempt. A 9.5 Fr catheter was placed with a single ultrasound (US)-guided puncture. Central venous blood gas analysis and chest X-ray raised suspicion of arterial placement. CTA confirmed catheterization of the right subclavian artery. Following multidisciplinary discussion involving vascular and cardiothoracic teams, the catheter was removed using the ProStyle® system. No vascular or neurological complications occurred. The patient recovered and was discharged four days later.

Case 2

A 60-year-old patient was admitted to the ICU with secondary peritonitis and septic shock. During exploratory laparotomy, a 9.5 Fr CVC was inserted; however, procedural details were unavailable. Five hours later, routine venous blood gas analysis suggested malposition. CTA confirmed inadvertent arterial catheterization. After immediate evaluation by vascular surgery, the catheter was removed and arterial closure was achieved using the Perclose

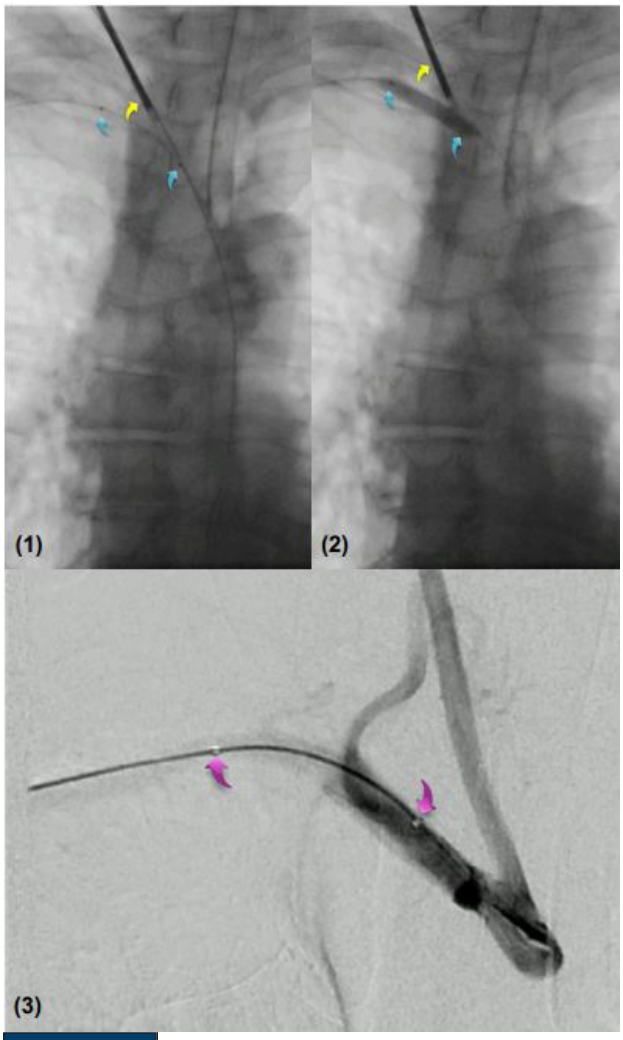

Figure 2

Case 2. Anterior-posterior chest radiography showing the placement of a prostyle device after removal of misplaced central venous catheter.
Legend: (1) Yellow arrow: Prostyle device; blue arrows: PTA balloon placed via radial artery
(2) PTA balloon inflated to achieve haemostasis following Prostyle deployment and withdrawn (final step before final angiogram, not shown in Case 1).
(3) Final angiogram; purple arrows: previously placed PTA balloon.

system. The patient subsequently died from unrelated complications.

Technical Details: In both cases, arterial closure was performed under fluoroscopic guidance with balloon assistance via the right brachial or radial artery using a 5 Fr introducer. A stiff guidewire was advanced into the distal end of the misplaced catheter prior to removal. The arteriotomy was sequentially downsized using 8 Fr to 7 Fr introducers over the guidewire. The ProStyle device was then advanced to the arterial defect and deployed according to manufacturer instructions.

DISCUSSION

CVCs are widely used for multiple clinical purposes; however, complications may still occur, leading to increased morbidity and hospital costs.[1, 2, 5]

Early detection of arterial puncture can be achieved through blood gas analysis and chest radiography.[8] The American Society of Anesthesiologists Task Force on CVC recommends that in the event of inadvertent arterial cannulation with a dilator or large-bore catheter, it should be left in situ, and immediate consultation with a vascular or general surgeon or interventional radiologist should follow. CTA is often performed to determine catheter location, guide therapeutic planning, and exclude complications.[1, 2]

Surgical repair remains the standard of care, though it carries higher risk. Endovascular management has emerged as a valuable option, although standardized recommendations are lacking. Several authors have described "off-label" use of the Perclose device—originally intended for femoral access—for arteries such as the subclavian, carotid, axillary, and vertebral, with low complication rates.[4, 9]

In our series, guidewire maintenance during downsizing and closure allowed safe re-attempts in case of suture failure, a technique previously described.[4, 9] Balloon occlusion catheters were also used for contrast evaluation of hemostasis and as backup in case of suture failure, consistent with existing reports.[1,5]

Ultrasound guidance during CVC placement reduces complication rates compared with landmark-based techniques.[1,3-5] Despite being operator-dependent, inadvertent arterial puncture still occurs, but is reported in less than 1% of cases. Preventive strategies include the use of short-axis view to avoid posterior wall perforation and long-axis view to confirm guidewire position before dilation and catheter insertion.[10] The long-axis view is especially valuable during subclavian access, as it allows continuous visualization of needle trajectory (in-plane technique).[8,10] In our cases, hemodynamic instability may have contributed to unrecognized arterial puncture.

CONCLUSION

In our center, despite its "off-label" use, the PerStyle® device proved to be a safe and effective option for management of inadvertent arterial catheterization. Regular audits and accurate procedural documentation may help reduce technical errors and improve adherence to best practice standards.

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