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CLINICAL INFORMATION

When one port does not return blood: two case reports of rare causes for misplaced central venous catheters

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Abstract We present two cases of misplaced central venous catheters having in common the absence of free blood return from one lumen immediately after placement. The former is a case of right hydrothorax associated with central venous catheterization with the catheter tip in intra-pleural location. In this case the distal port was never patent. In the latter case there was an increased aspiration pressure through the middle port due to a catheter looping.

The absence of free flow on aspiration from one lumen of a central catheter should not be undervalued. In these circumstances the catheter should not be used and needs to be removed. © 2014 Sociedade Brasileira de Anestesiologia. Published by Elsevier Editora Ltda. All rights reserved.

Quando uma porta não apresenta retorno sanguíneo: relato de dois casos de causas raras de mau posicionamento de cateter venoso central

Resumo Apresentamos dois casos de mau posicionamento de cateter venoso central. Têm em comum a ausência do retorno sanguíneo livre em um dos lúmens imediatamente após a colocação. O primeiro é um caso de hidrotórax direito associado ao cateterismo venoso central, com a ponta do cateter em localização intrapleural. Nesse caso, a porta distal nunca esteve patente. No segundo caso houve um aumento da pressão de aspiração através da porta medial por causa da formação de alça no cateter.

A ausência de fluxo livre na aspiração de um lúmen do cateter central não deve ser subestimada. Nessas circunstâncias, o cateter não deve ser usado e deve ser removido.

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Introduction

Central venous catheterization is a common procedure in anesthesia practice, used for therapeutic and diagnostic purposes, such as monitoring of central venous pressure, and perioperative fluid and drug administration.

Overall this technique has a complication rate of about 15%,¹ including thrombosis, infection, obstruction, and mechanical complications that commonly occur during insertion and which depend on the anatomical relations of the central veins.

We present two cases of rare complications associated with catheterization of the right internal jugular vein, intending to emphasize the importance of ascertaining the patency of each port before proceeding with its use, even when there were no difficulties in the technique.

Case report 1

A 33-year-old woman, ASA (*American Society of Anesthesiologists* physical status classification) I, weight 54 kg, height 155 cm, with hepatic adenoma presented for elective left hepatectomy.

After induction of anesthesia, a 7.0-French triple lumen central venous catheter was inserted in the right internal jugular vein (Certofix® Trio – B. Braun), using anatomical landmarks and Seldinger technique. The insertion was achieved in one attempt by an experienced anesthesiologist and according to the hospital protocol. At this point free blood return was observed from proximal and middle catheter ports, but not from the distal one. All ports were easily flushed. The catheter was fixed at 12 cm length. Central venous pressure monitoring was attached to the distal port.

The surgery progressed uneventfully. The central venous pressure was kept below 5 mmHg, without the need for vasodilators.

At the end of the procedure the patient was awake with no signs of respiratory distress. Later in the post-anesthetic care unit, 6 h after surgery, the patient complained of right chest pain and dyspnea. At auscultation there were no breath sounds in the right hemithorax with dullness at percussion. Central venous catheter was not permeable and no blood return was achieved.

The chest radiograph showed opacity on the right hemithorax and the catheter tip was noted to be in the opposite direction of the cardiac silhouette (*Fig. 1*).

A chest tube was inserted with immediate drainage of 2500 mL of serous fluid accompanied by symptomatic relieve. The patient was transferred to the ward. The chest tube was removed after 5 days and she was discharged, fully recovered.

Case report 2

A 67-year-old woman, ASA III, presented to the emergency department because of a 2-week history of abdominal pain and diarrhea. A foreign body (chicken bone) was found jammed at the sigmoid. After unsuccessful attempt to remove it by colonoscopy, she was proposed for exploratory laparotomy. Her past medical history included morbid obesity (weight 110 kg, height 150 cm), ischemic heart disease



Figure 1 Portable chest X-ray showing right hydrothorax 9 h after insertion of the central venous catheter.

with angina on moderate exertion, diabetes mellitus, chronic obstructive pulmonary disease and hypothyroidism.

A central venous catheter was indicated because of difficulty in obtaining a peripheral access and the possible need for vasopressor therapy. After induction of anesthesia, a 7.0-French triple lumen central venous catheter was inserted in the right internal jugular vein (Certofix® Trio – B. Braun), using anatomical landmarks and Seldinger technique. The insertion was achieved in one attempt by an experienced anesthesiologist and according to the hospital protocol. The procedure was uneventful except for a slight initial resistance to retrieve the guidewire. The middle port catheter did not present passive blood return and it could only be achieved with aspiration at moderate negative pressure. A mild increased resistance during injection was also observed in this port. The remaining ports were permeable and were easily returning blood. The catheter was fixed at 11 cm length. An infusion with crystalloid was started.

The surgery proceeded and the patient underwent an open sigmoidectomy.

She was transferred to the intensive care unit in the immediate postoperative period to continue mechanical ventilatory support. Vasopressor therapy was not needed.

In this unit a chest X-ray was performed and a loop formation of the central venous catheter was noted (*Fig. 2*).

This catheter was removed without resistance. A new central venous catheter was placed on the right subclavian vein, using anatomical landmarks and Seldinger technique, uneventfully. After 36 h this catheter was removed and the patient was transferred to the ward. Three days later she needed a new central line because of difficult peripheral access. The right internal jugular vein was used, once again using anatomical landmarks and Seldinger technique, without complications. After 10 days she was discharged, fully recovered.

Discussion

Hydrothorax is a rare complication described in about 0.5% of cases in adults with central catheterization.² It is



Figure 2 Portable X-ray showing looping of the central venous catheter.

explained by the close proximity of the superior vena cava to the right pleura.³ This complication is usually described in cases of progressive vascular erosion of an initial intravascular catheter,^{4–6} and may be associated with the poor positioning of the tip or an unsafe catheter fixation with back-and-forth movement.⁷ In our case the absence of blood return on aspiration of the distal port suggests, however, not erosion but a vascular lesion at insertion, representing, as far as we know, the only case of a complication of this kind.

Vascular erosion with consequent hydrothorax after catheterization of the right internal jugular vein is extremely rare, and has been described in 5% of all cases of catheter-associated hydrothorax.² This may be related to the fact that the right internal jugular vein has a straight course to the superior vena cava.⁸ After reviewing the literature we noted that the left-sided subclavian central venous placement is a risk factor for such complication. Dutley et al. described the route of catheterization causing hydrothorax: left subclavian in 46%, right subclavian in 18%, left internal jugular in 20%, right internal jugular in 5%, external jugular in 6% and brachial in 5%.²

Clinical manifestations of chest discomfort are similar to those described in the literature in cases of hydrothorax. A tension hydrothorax may also develop.⁷

In our case the restriction in fluid therapy intended at keeping a low central venous pressure during a partial hepatectomy probably contributed to the delay in diagnosis.

The formation of a loop in central venous catheter is a rare complication, described in 2.9% of catheterizations.⁹ Looping and knotting has been described, mostly during pulmonary artery catheterization or right-sided subclavian vein catheterization.^{10–12}

Looping may occur due to the locking of the catheter tip in the ostium of a tributary vein, allowing consequent progression of the catheter to form a loop.⁹ In our case the looping may have resulted from jamming the tip of the catheter at the ostium of the right subclavian vein or the left brachiocephalic vein. The difficulty in retrieving the guidewire and the difficulty in aspirating blood from the

middle port suggest that the catheter was partly bent but keeping its patency.

Several studies have demonstrated that ultrasound guidance during central venous cannulation can increase success rates and decrease complications.^{13–15} The key benefits from the use of ultrasound include increased overall success rate and reduction in needle puncture time, reduction in carotid puncture and in carotid hematoma, reduction in hemothorax and pneumothorax.¹³

Hydrothorax has been described after ultrasound guided internal jugular cannulation⁷ and we found no cases of catheter or guide-wire looping diagnosed by ultrasound. Ultrasound guided central cannulation seems unable to prevent these rare complications.

Conclusions

Mechanical complications associated with central venous catheterization may occur at the time of insertion or may develop later. Early radiological investigation, primarily with a chest X-ray, can aid to identify the problem and plan the extraction of the catheter. In specific situations other examinations might be useful, such as angiography or computed tomography.¹²

In both clinical cases that we described the only feature was the difficulty in blood return at aspiration in one of the ports, suggesting that this should not be undervalued. Even if the procedure went uneventfully in the event of absence of free flow on aspiration from all lumens, the catheter should not be used and needs to be removed.

Conflicts of interest

The authors declare no conflicts of interest.

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