

CASE REPORT

Seizures and hemiparesis after subclavian vascular access

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Abstract

We present a patient with seizures and hemiparesis with long-lasting sequelae following injection of medication and total parenteral nutrition through a centrally placed catheter. The central catheter was inadvertently placed arterially even though no suspicion for incorrect placement had been raised on control chest X-ray. When there is difficult central venous access or doubt about the correct positioning of a catheter, position should be confirmed with chest X-ray in combination with pressure measurement and/or blood gas analysis. At present there is no evidence for specific treatment of neurological symptoms after arterially administered total parenteral nutrition.

Introduction

Complications associated with the placement of a central venous catheter such as pneumothorax, infection at puncture site or line sepsis, brachial plexus injury, haematoma, arterial puncture are well known.¹⁻³

Inadvertent arterial placement of a subclavian central venous catheter (CVC) however, is a rare but potentially life-threatening complication of central venous catheterization if it is not recognized straight away.

We describe a case in which a central venous catheter was inserted into a patient's subclavian artery with serious neurological consequences due to intra-arterial administration of medication and total parenteral nutrition.

Case description

The anaesthetist was asked to place a CVC for total parenteral nutrition (TPN) and long-term antimicrobial treatment in a

60-year old male patient with graft-versus-host disease after stem cell transplantation for multiple myeloma. The patient received dalteparin in a therapeutic dose (12500 IE s.c. once daily) because of deep venous thrombosis and pulmonary embolism during a previous admission.

In total three attempts were made to place a triple lumen CVC in the left subclavian vein in Trendelenburg position using the Seldinger technique. Correct placement of the CVC was confirmed by both the anaesthetist and the radiologist through a chest X-ray, without signs of complications such as a pneumothorax (see *figure 1*). The anaesthetist did not suspect arterial placement of the CVC so that no pressure measurements were taken after catheter placement. An infusion of normal saline with a volumetric pump was started on one of the lumens while the other lumens were locked after being flushed with saline. TPN was started afterwards on the ward.

The next day the anaesthetic registrar on call was consulted because the patient had complained about left-sided facial numbness and tingling after bolus injections of metoclopramide through the CVC. Moreover, 23 hours after placement he had developed partial and secondary generalized tonic-clonic seizures. A transient right-sided hemiparesis was noted. The symptoms of central nervous dysfunction were initially not related to the possibility of arterial placement of the CVC. However, when arterial placement was presumed and confirmed with blood gas analysis, showing an oxygen saturation of 97%, TPN infusion and medication through the CVC were stopped immediately.

Seizures were symptomatically treated with clonazepam, phenytoin and levetiracetam. Cranial CT scanning performed

24 hours after CVC placement was normal, but a repeated cranial CT scanning two days later revealed a small hypodense left parieto-occipital lesion suggestive of cerebral infarction (see figure 2).

Because of the patient's prior thrombo-embolic events, anticoagulation was continued and the arterially placed CVC was removed by the radiologist using fluoroscopy with placement of vascular closure device (AngioSeal) without complications.^{3,4} Unfortunately, the patient died two weeks later due to refractory intestinal graft-versus-host disease with large intestinal fluid loss and both renal and respiratory failure.

Discussion

Accidental puncture of an artery during central venous catheterization is a fairly common complication with a reported frequency ranging from 1-2% in subclavian to 9 %

Figure 1. Chest X-ray after placement of the CVC with the catheter projecting above the left clavicle and the tip on the lateral border of the sternum (arrow).

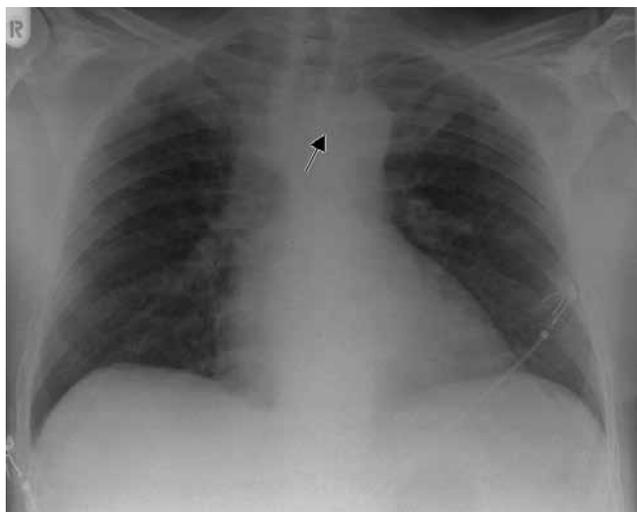


Figure 2. CT-cerebrum with intraparenchymatous hypodensity parieto-occipital left (arrow).



in a combined group with subclavian, jugular and femoral catheterization. The incidence of arterial cannulation is less common and ranges from 0.09% to 0.77%.^{5,6} The use of ultrasound has reduced the number of complications and increased success rate in central venous catheterization.^{7,8} At the time of the complication in our patient, ultrasound was not readily available.

Symptoms such as stroke and seizures after arterially administered medication and TPN have been described previously. Nevertheless, in the present case, it was not until 24 hours later that central nervous system disorders were related to arterial misplacement of and infusion through the CVC. Treatment with hyperbaric oxygen has been described in one patient with similar symptoms after intra-arterial infusion with TPN who made a good recovery.⁹ However, no clear evidence for this therapy was found in acute ischemic stroke, let alone in a rare complication such as this.¹⁰

Sherman et al. and Shah et al. described one and three cases respectively of arterial administration of medication with or without TPN. These patients developed neurological symptoms and no specific treatment was given. Only one patient made a good recovery, this patient did not receive TPN.^{11,12} Wang et al. described a case of a young female with transient ischemic attacks after intra-arterially administered TPN who made a full recovery after removal of the catheter. However, MRI showed cerebral and cerebellar infarction.¹³ In a case reported by Lynch and Shehaby, a patient suffered a similar complication and received corticosteroids without improvement of symptoms.¹⁴ The neurological symptoms after arterial injection of medication or TPN are postulated to be secondary to cerebral vasospasm and micro-emboli. The high osmolar content of TPN may cause microthrombosis in the cerebral microcirculation.¹⁴ Reports have been published with spinal cord ischemia and infarction after accidental arterial injection of gluteal intramuscular penicillin. The pathophysiological mechanism is presumed to be micro-embolism of antibiotic salts. A similar mechanism could be responsible for cerebral symptoms after arterial injection of medication.¹⁵ Our patient received antibiotic treatment and TPN which could both have led to his symptoms.

In most reports there had been suspicion of malpositioning of the catheter on chest film, either after or even before the start of therapy. Yet chest X-ray is not routinely required after an uncomplicated insertion of a CVC.¹⁶ On a plain chest X-ray, the tip of a correctly placed CVC in the jugular or subclavian vein, should project in the superior vena cava or right atrium on a chest X-ray. A position of the tip on the left side of the sternum after a left-sided puncture, or crossing the midline of the sternum after a right-sided puncture, indicates the possibility of arterial placement, since the descending aorta lies on the left side and a catheter entering the aorta will divert in the direction of the flow.¹⁷ Obviously, a simple cause for a

left-sided catheter should be ruled out (catheter too short or not inserted completely). The subclavian artery is anatomically located dorsocranial to the subclavian vein, sometimes even above the clavicle. On a true anterior-posterior projection of a chest X-ray, a position of the CVC cranial to the clavicle might indicate arterial placement. On the chest X-ray in the present case, the catheter projected above the clavicle and on the left side of the sternum, suggesting arterial placement. This was unfortunately not recognized on the chest X-ray taken directly after insertion.

In conclusion, symptoms of central nervous system dysfunction after the placement of a CVC should raise suspicion of arterial placement even without signs of complications during or after insertion of the catheter. Correct intravenous position of a CVC should be confirmed with blood gas analysis and/or pressure measurement after a difficult insertion of the CVC or when there is any doubt about its position. Neurological symptoms after intra-arterial administration of TPN are associated with poor outcome and should be treated symptomatically.

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