Therapeutic embolization of an internal mammary artery damaged by placement of a central venous catheter

G. Abbott* and P. Evans

Department of Radiology, Countess of Chester Hospital, Liverpool Road, Chester CH2 1UL, UK
*Corresponding author

We describe the embolization of a left internal mammary artery damaged by left internal jugular venous catheterization. Because potentially serious complications can occur with a blind approach for central venous catheterization, portable ultrasound machines should be used more often to ensure correct placement of the catheter.

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Central venous catheters are used commonly in hospital practice for the administration of fluid, drugs and parenteral nutrition as well as for the measurement of central venous pressure to guide fluid balance. They can cause rare but potentially serious complications.1-7 We describe a case in which inadvertent arterial puncture occurred during attempted left internal jugular catheter insertion via a skin puncture at the root of the neck. This damaged the internal mammary artery. Bleeding after removal of the catheter was treated successfully by microcatheter embolization.

A 22-yr-old primigravida was admitted to hospital at 41 weeks gestation with pre-eclampsia. Labour was induced by artificial rupture of the membranes and an epidural catheter was inserted. Labour failed to progress satisfactorily, and when meconium staining of the liquor was noted plans were made for emergency Caesarean section. A central venous catheter was inserted to monitor central venous pressure according to the local protocol for the management of pre-eclampsia.

A left jugular approach with a puncture at the root of the neck was used. A single-lumen 19 G catheter was inserted using the Seldinger technique and the procedure was described as straightforward. Blood was freely aspirated, and this was taken as evidence that the tip of the catheter was within the lumen of the vein. A water manometer was used to measure the central venous pressure, which was recorded as 0 mm of water.

The Caesarean section was completed uneventfully and a healthy child was delivered. After the operation the patient became tachycardic and oliguric. The chest X-ray (Fig. 1) taken 6 h later shows shadowing in the left lower and mid zones and an unusual course of the central cannula, but the importance of this was not appreciated at the time. The haemoglobin concentration was 73 g litre⁻¹ and three units of blood were transfused.

The patient subsequently improved but the left basal shadowing persisted despite starting antibiotics. An ultrasound scan showed fluid rather than consolidation at the left base, and 1 litre of bloodstained fluid was aspirated from the left pleural cavity 3 days after delivery. The following day the left internal jugular catheter was removed. The patient immediately became hypotensive (systolic blood pressure 40 mm Hg) and collapsed. She was given i.v. fluids and a chest X-ray showed a large left-sided effusion with mediastinal shift to the right side. An intercostal chest drain was inserted and heavily bloodstained fluid was aspirated. A leaking vessel in the left side of the chest was suspected and the patient immediately underwent angiography to identify the source of bleeding. Selective left subclavian artery angiography using a 5F vertebral catheter from the groin demonstrated extravasation of contrast from the left internal mammary artery (Fig. 2). The left internal mammary artery (IMA) had been inadvertently punctured during the insertion of the central line and the line had been introduced alongside this vessel, which led to bleeding. Some leakage of arterial blood around the catheter had occurred whilst it was in place, but when the catheter was removed a potentially catastrophic bleed occurred.

A tracker 18 coaxial catheter (Target Fremont, California, USA) was used to catheterize the left IMA selectively. A 4 mm pretzel coil was placed in the IMA just distal to the laceration in order to 'close the back door'. This was followed by two further 4 mm coils, one at the site of laceration and one proximal to it, just beyond the origin of the IMA. As a supplementary measure, a small volume of 300–500 μm Ivalon particles was carefully injected in order
to promote rapid thrombosis within the coils. Check angiography after this procedure confirmed complete cessation of the leak (Fig. 3). The patient’s pleural effusion persisted, with partial collapse of the left lung. The effusion was very loculated and resistant to aspiration, and eventually pleural decortication was done to allow re-expansion of the lung. The patient had no further bleeding and eventually made a full recovery.

Discussion

Complications of central venous catheterization are well described. These include inadvertent arterial puncture, haematoma, thrombophlebitis, brachial plexus damage, thoracic duct puncture, mediastinal fluid infusion and pneumothorax.

Central venous catheters can be inserted via the internal jugular and subclavian veins. Complications are less frequent and severe after cannulation of the internal jugular vein compared with the subclavian vein. Internal jugular vein cannulation can be classified as high or low, which refers to the needle’s insertion in relation to the apex of the lung. A high approach is defined as a puncture at or above the apex of the triangle formed by the two heads of the sternocleidomastoid. As many as eleven different approaches to the internal jugular vein have been described. The incidence of pneumothorax and arterial injury is generally greater with the low approach.

Ultrasound guidance when siting venous catheters reduces the incidence of complications, as does direct visualization of the puncture of the vein wall, as well as identifying diminutive or thrombosed vessels. Some recommend that ultrasound guidance should be used for all central venous catheterization.

In this case, misplacement of the jugular venous catheter could have been diagnosed on the initial chest x-ray after the procedure (Fig. 1). This shows that the central catheter does not conform to the path of the left jugular and brachiocephalic veins but pursues a more vertical course. Because blood was freely aspirated, the catheter was believed to be in the internal jugular vein. In fact, this blood was from the...
Therapeutic embolization of internal mammary artery

bleeding from the damaged IMA. The internal jugular catheter was passed intrapleurally and by chance reduced bleeding from the IMA. When the catheter was removed and a haemothorax developed, arterial damage was recognized.

The source of bleeding was well shown by selective angiography, and embolization was performed with a satisfactory result. The microcatheter system allowed selective catheterization and embolization of the IMA. The technique described illustrates the principle of 'closing the back door' before occluding the bleeding vessel to prevent back-bleeding from the distal vessel. The purpose of the Ivalon particles was to promote rapid thrombosis within the coils because of the brisk haemorrhage from the tear.

This is the first case we can identify in the literature in which damage to the IMA caused by low puncture of the neck during internal jugular venous catheterization has been treated successfully by microcatheter embolization.

In conclusion, venous or arterial haemorrhage should be considered in a shocked patient after central catheter removal. Small portable ultrasound machines are now available which allow guided access for all central venous catheterizations. Their use might reduce the incidence of complications and reduce the time taken for catheterization. Should a complication occur, angiography should be considered in order to locate the bleeding, and occasionally embolization may obviate the need for major surgery.

References

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