Hydrothorax due to extravasation of intravenous contrast after power injection through right subclavian catheter

經右鎖骨下靜脈導管加壓注射造影劑外滲導致胸腔積水

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We report a case of hydrothorax after receiving intravenous (IV) contrast material by power injector through right subclavian central venous catheter (CVC) line. A 38-year-old woman presented to the local emergency department with hypotension after a pedestrian accident. After resuscitation, CVC was inserted into her right subclavian vein and fluid was administered well before computed tomography (CT) enhancement. Contrast-enhanced CT scan showed a large amount of extravasation of contrast material and fluid collection in the thoracic and pericardial cavities which was not shown in non-enhanced CT scan. During operation, vascular perforation was found in right subclavian vein. This case highlights that emergency physicians must keep in mind the possibility of vessel injury after CVC insertion and contrast material is preferably injected via peripheral IV access. (Hong Kong j.emerg.med. 2011;18:50-53)

我們報告一個經右鎖骨下靜脈導管加壓注射造影劑外滲導致胸腔積水的案例。一名38歲女子因為行人事故被送到急診室，當時有低血壓。搶救後，經右鎖骨下靜脈插入中心靜脈導管，在電腦斷層掃描（CT）前進行輸液。加強顯影之電腦斷層掃描發現，胸腔和心包腔有大量造影劑外滲和積水，這在之前未加強顯影之電腦斷層掃描未有發現。在手術過程中，發現在右鎖骨下靜脈有血管穿孔。這個案例提醒我們，插入中心靜脈導管後要注意血管穿孔的可能性，並應使用外周靜脈注射造影劑。

**Keywords:** Central venous catheterisation, complication, indwelling catheter, rupture

**關鍵詞：**中心靜脈導管，併發症，留置導管，破裂

**Introduction**

Central venous catheter (CVC) insertion is one of the most important procedures in emergency department. The placement of CVC is for administration of various therapies, including chemotherapy, blood product transfusion, intravenous (IV) fluid replacement, total parenteral nutrition, or IV contrast.

But CVC is associated with numerous complications. They may be acute or delayed, often serious and sometimes fatal. Complications include pneumothorax, haemothorax, infection, plebothrombosis, arrhythmia, cardiac tamponade, perforation of great vessel, etc. There are many case reports describing extravasation of CVC fluid. We present a case of extravasation after IV contrast injection by mechanical pump through a CVC.

**Case report**

A 38-year-old woman presented to the local emergency
department with hypotension after a pedestrian accident. At presentation to the trauma centre, she was alert (Glasgow comascore 15), with a blood pressure of 80/50 mmHg, pulse rate of 100 beats/min, respiration rate of 18 breaths/min and body temperature of 36.5°C. Her medical history was not significant. On physical examination, she had no tenderness in the abdominal area, but a 2-cm long superficial skin laceration in the upper area of the pubic bone was found. She had tenderness in the left (Lt) iliac area. An examination of the extremities revealed tenderness in the Lt scapular area and Lt lower leg.

No visible fluid collection was found on performance of focused abdominal sonography for trauma (FAST). Subsequently, a large bore IV line was placed for the administration of crystalloid fluid. A CVC (9 Fr, 2 lumen, 10 cm, MAC™ two-lumen central venous access set with integral haemostasis valve, Arrow® International, Reading, PA, USA) was also inserted into the right (Rt) subclavian vein. Post-procedural chest radiography showed that the CVC tip was appropriately placed (Figure 1).

On radiologic evaluation, the patient was diagnosed with the following: cervical sprain, Lt pelvic ramus fracture, Lt scapular fracture, supraspinatus and infraspinatus fossa fracture, and Lt tibia fracture.

Subsequently after 6 hours of hospitalisation, contrast-enhanced computed tomography (CT) was performed to exclude retroperitoneal haemorrhage due to pelvic bone fracture and liver injury due to elevated liver enzyme levels. Contrast material was injected through the CVC inserted into her Rt subclavian vein. The patient received 150 ml of Utravist®300 (nonionic IV contrast media with low osmotic pressure, Schering AG, Germany) via a mechanical pump (Stellant®, Medrad™, Warrendale, PA, USA) at a rate of 2 ml/s under a pressure limit of 325 psi (Figure 2). Non-enhanced CT scan yielded no specific findings, but contrast-enhanced CT scan showed a large amount of extravasation of contrast material and fluid collection in the thoracic and pericardial cavities (Figure 3).

Immediately, the fluid infusion through CVC was stopped, and tube thoracostomy was performed. Seven
A hundred ml of bloody fluid was drained via chest tube. The patient was closely monitored for symptoms of anaphylaxis, cardiac tamponade, and cardiopulmonary function. She exhibited stable vital signs and did not complain of pain, dyspnoea, or other symptoms.

An emergency operation was performed. During the operation, a 0.5-cm long vascular perforation was found at the site of the CVC tip, which was inside the vascular lumen, just below the junction of the Rt internal jugular vein and Rt subclavian vein. The emergency operation was performed successfully, and then, the patient was admitted to thoracic surgery department. Later, multiple fracture sites were treated with open reduction and internal fixation. She was discharged approximately 2 months later without complications.

**Discussion**

Since the introduction of CVC in clinical medicine, CVC insertion is commonly used in the emergency department. Numerous complications of CVC insertion have been described in the literature. Among them, perforation of the great vessels has been reported infrequently, but is often fatal when not recognised early.

Perforation occurs within a few hours to days after catheter insertion; about 90% occur within the first 6-24 hours. Proposed mechanisms for these complications when they manifest during or immediately after catheter placement include trauma from dilator, guide-wire, or the catheter itself.

Numerous factors influence the risk of perforation. Stiffer catheters and those with excessively mobile tips are reported to be associated with an increased risk of vessel perforation. The angle formed between the catheter tip and the wall of the vein is of significance; the more perpendicular the angle, the greater the risk of perforation.

Lt sided catheters themselves pose a particular problem as the Lt brachiocephalic vein forms a near right angle with the superior vena cava, increasing the risk of impingement. High-pressure fluid infusion is another risk factor. It is likely that some perforations are secondary to guide-wire or dilator trauma, particularly when complications occur soon after insertion. Moreover, if the catheter tip is in close proximity to the wall of the vessel, the hyperosmolar solution may damage the intima. If the catheter tip abuts the wall of the vessel, mechanical and chemical irritation may act synergistically to ultimately erode the vessel.

![CT scan showing a normal chest in non-enhancement (left) and hydrothorax with enhancement (right).](image-url)
Because many patients requiring CVC have poor peripheral IV access, it is necessary to administer IV contrast material through the CVC; this is also more convenient for the patient. Moreover, power injection of contrast material has become a routine step in many CT protocols involving the brain, chest, abdomen, and pelvis. The power injection ensures uniformity and predictability of contrast injections. The current models of power injectors allow a pressure limit to be predetermined so that the injection rate is automatically reduced or the injection is terminated when a particular pressure is attained. This pressure limit act as an additional safety measure when using the power injector with a CVC and helps prevent catheter or vessel injury. However, currently, there are no set recommendations for using these 2 devices together.

In our case, there was no evidence of tip malposition on radiologic study after CVC insertion and no complaint of symptoms suggesting perforation. Moreover, fluid was administered well before CT enhancement was performed using a power injector. Therefore, we believed that CVC insertion was not entirely responsible for simple vascular erosion. We postulated that the vascular wall might be initially damaged by CVC insertion, and then finally, the damaged site of the vascular wall was perforated by the power injection.

Schieman et al reported that after contrast-enhanced chest CT examination through a catheter inserted into the Lt subclavian vein, a patient had a contrast leakextravasation resulting in hydromediastinum. Choi et al also reported a case of hydrothorax after contrast material injection through the CVC inserted into the Lt subclavian vein. However, these cases did not show a definite finding of hydrothorax on CT; they were confirmed later by chest radiography, and the patients were treated only with conservative therapy. We used a stiffer CVC (9 Fr, 10 cm, polyurethan) than those used by others; furthermore, we used the Rt subclavian instead of the Lt subclavian vein.

In summary, this case shows that IV injection of contrast material by a power injector through a CVC can rupture the great vessels. After CVC insertion, especially when using a stiffer CVC, the emergency physician must keep in mind the possibility of vessel injury, and, to avoid mechanical complications, contrast material is preferably injected via peripheral IV access. Particular attention should be paid to the injection of contrast material through a CVC line.

References