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Migration of the Tip of a Central Venous Catheter

Presented here is a 47-year-old man for whom right central venous chemoport catheterization was performed without radiological guidance. Within 8 days, the catheter became non-functional and non-contrasted thoracic CT was performed to trace its course. The tip of the catheter appeared to have perforated the opposite wall of the ipsilateral brachiocephalic vein and entered the adjacent brachiocephalic artery. It then maintained its course along the ascending aorta to perforate, once again, the opposite wall of the aorta before finally resting in the aortopulmonary soft tissue. Migration of chemoport is not uncommon, and may present in many ways. However, it is rare for a migration to occur in the way described here and only present with catheter blockage. Radiological guidance of any central vascular catheterization greatly reduces the risk of complications.

Keywords: Migration, Chemoport, Thorax, Computerized Tomography, Catheterization

Introduction

Long-term central venous access devices have been increasingly used in the last few decades for the administration of antibiotics and chemotherapeutic drugs, total parenteral nutrition, providing high-flow access for hemodialysis and plasmapheresis, and obtaining frequent blood samples. There are various complications associated with the use of central venous catheters despite the advances made in the design, material of the catheter and the technique of insertion.[1] Complications may be categorized as early or late.[2-5] Early complications include procedural complications directly related to catheter placement, such as haematoma, arterial puncture or injury, venous rupture, pneumothorax, hydrothorax, haemothorax, chylothorax, hydromediastinum,[6] air embolism, primary malpositioning, and catheter transection that results in its migration. Imaging guidance such as ultrasound or angiofluoroscopy during catheter placement can significantly reduce the rate of most early complications. Late complications include catheter-related infection, catheter occlusions or thrombosis, catheter fracture and migration. Migrations are rarer than primary malpositionings.[1] Both malpositionings and migrations are often detected by a chest radiograph control.[2-5] On a chest x-ray, the tip of the central venous catheter should be located to the right side of the midline, ideally just above the level of the right atrium, overlying the anatomical position of SVC. Radiological examinations play an important role in confirming the correct placement of a central venous catheter, confirming the wrong position of a catheter, the repositioning of a misplaced catheter, and in retrieving a migrated intraluminal catheter.

Case Presentation

A 47-year-old man was admitted to receive de Gramont regimen as second line chemotherapy due to recurrence of adenocarcinoma of the rectum using

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fluorouracil (5FU) and folinic acid. A stormy history of hospitalization ensued. During the first cycle, he developed allergic urticaria and generalized body swelling. With repeated chemotherapy, through a peripheral vein access, thrombophlebitis occurred. A chemoport was then inserted under local anesthesia on June 25, 2007, without radiological guidance. During the procedure, he had an episode of seizure on the table, but the cause could not be identified. An immediate post-chemoport insertion chest radiograph was performed (Fig. 1A) and the catheter tip deemed to be in the correct position by the treating doctors. Chemotherapy agents (5FU and folinic acid) were successfully delivered through the chemoport for one week. On July 3, 2007, blockage of the chemoport catheter occurred. The initial post procedure chest radiograph was reviewed by a radiologist and it was suggested that the catheter tip was located too centrally. A repeat chest radiograph after catheter blockage showed the catheter tip almost at its initial position (Fig. 1B). In an attempt to locate the tip of the catheter, a series of radiological examinations were carried out. The patient underwent a peripheral venogram on July 12, 2007 (Figs. 2A&B). Contrast was injected via a peripheral vein. The examination showed the right subclavian vein, brachiocephalic vein and SVC being opacified. The tip of the chemoport catheter was however not within the SVC. It was too centrally located and its position could not be ascertained.

Subsequently, a non-contrasted thoracic CT was carried out on July 19, 2007 (Figs. 3A-G). The line of the chemoport catheter was seen traveling along the right subclavian vein to the right brachiocephalic vein. It then punctured the wall of the right brachiocephalic vein to enter the brachiocephalic artery and ascending aorta. The catheter maintained its inferomedial course and its tip eventually punctured the opposite wall of the aorta to lie in the soft tissue of the aortopulmonary region. Interestingly there was no hemothorax, pericardial effusion or pseudoaneurysm.

Removal of the chemoport under fluoroscopy guidance was planned. However, due to the many uncertainties and as there was reconstitution of flow through the catheter, a catheterogram was performed on August 15, 2007. This time, the tip of the catheter was found to be in the ascending aorta. Contrast was injected through the chemoport catheter. Instead of opacifying the SVC, contrast flowed into the ascending aorta, opacifying the arch of aorta and its branches. No extravasation of contrast was noted. The chemoport was finally removed in the operating room under general anesthesia with the cardiothoracic team on stand by. Remarkably, there was no complication. Reinsertion of the chemoport was achieved under angiofluoroscopic guidance in the radiology department on August 23, 2007 (Fig. 4).

Discussion

Migration of the tip of an intact central venous catheter is not uncommon. Reported sites of migration include the opposite brachiocephalic vein, the jugular vein and the azygous veins. A rarer site of migration is the aorta, in which case vascular perforation has to occur. One case of migration to the popliteal artery has been reported in a patient with a cavopulmonary shunt.[7] In the case presented here, the catheter has migrated from the venous system into the ascending aorta, indicating that a vascular perforation has taken place. Vascular erosion is postulated as the cause of perforation.[8,9] Vascular erosion is a rare complication. It is usually identified late due to pre-existing, underlying pleural effusion or lack of awareness of this complication. A combination of factors for wall erosion has been postulated.[10] The fixation of the catheter to the skin combined with head, neck and central line motions results in the back and forth movement of the tip against the venous wall. A stiff catheter in the left internal jugular vein has to take a curved course to the SVC bringing the catheter tip into close proximity of the wall of SVC. The content of the infusion also contributes to the likelihood of erosion. Infusions of high acidity or alkalinity solutions, such as total parenteral nutrition, antibiotic infusions, and sodium bicarbonate increase the chances. The poor nutritional state in patients needing central venous catheters results in poor tissue condition, which accelerates vascular mural erosion. It is also found that the higher incidence in female patients may be related to a smaller vein size. From 1990 to 1991, Bach reviewed over 1,500 patients with central venous catheters in the critical care ward.[1,11] In his study, all

catheters were made of polyurethane. Only 8 patients (an incidence of 0.5%) had vascular erosions. Most patients presented with breathlessness or chest discomfort 2.9 ± 0.8 days (1 to 7 days) after catheter insertion. The patient in this case report had no symptoms pertaining to vascular erosion, which occurred 8 days after insertion. In Bach's study, the diagnosis was delayed for 3.0 ± 1.5 days (0 to 11 days) after vascular erosion. Seven patients had the catheter passing through the left brachiocephalic vein, 6 abutted against the lateral wall of the superior vena cava and the catheter was bent. The left internal jugular vein (IJV) approach was most commonly quoted as a high risk factor for vascular erosion. This report is of a case

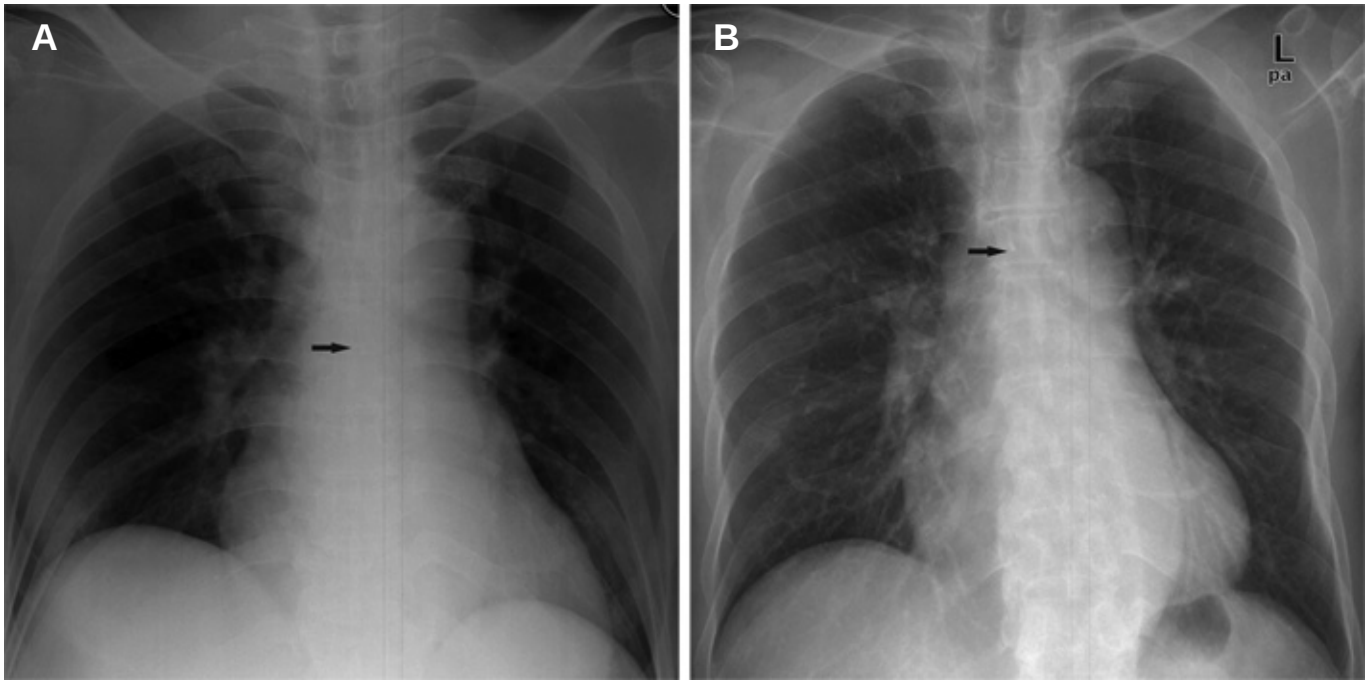

Fig. 1. 47-year-old man with colorectal carcinoma.

A. Chest radiograph immediately taken after the insertion of chemoport. Tip of the catheter appears to be too centrally located.

B. Chest radiograph taken one day after the catheter was blocked. Tip of the catheter appears to be almost at the same position of the post insertion radiograph.

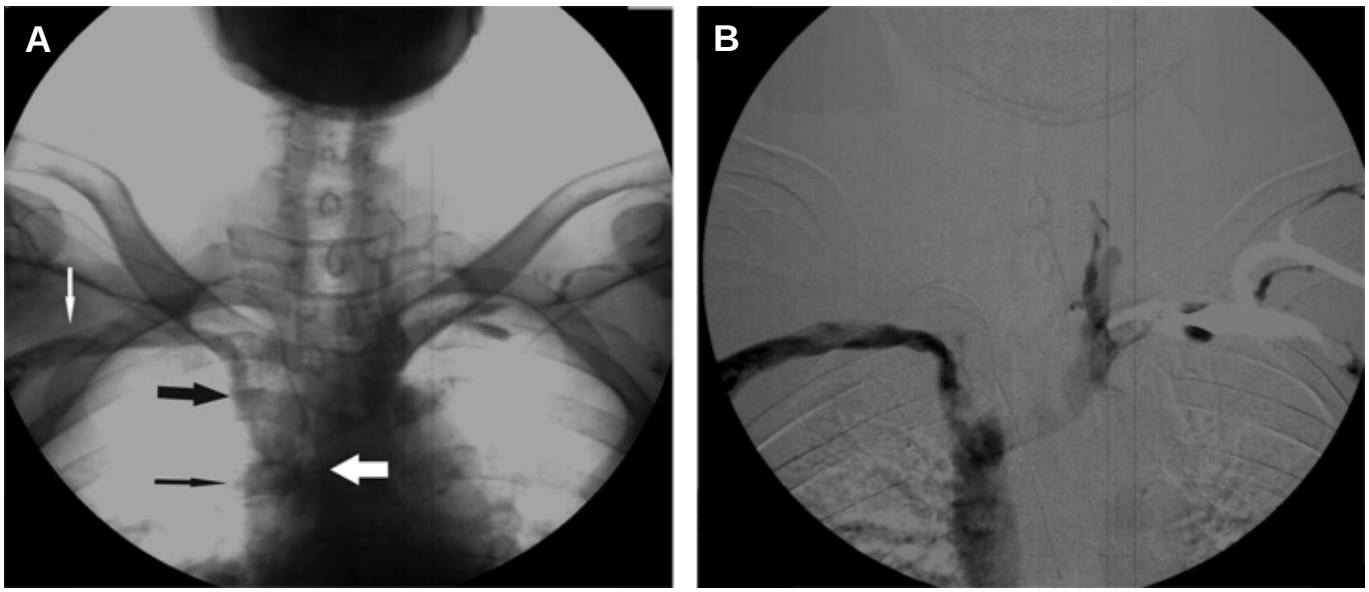

Fig. 2. 47-year-old man with colorectal carcinoma.

A. Unsubtracted image of peripheral venogram performed after the catheter was blocked shows the right subclavian vein (white arrow), brachiocephalic vein (bold black arrow) and SVC (black arrow) being opacified. The tip of the chemoport catheter (bold white arrow) was however not within the SVC and its position could not be ascertained.

B. Subtracted image of venogram.

of central venous catheter tip migration, which was only revealed after its failure to deliver the desired chemotherapeutic agents due to blockage. This was confirmed during the peripheral venogram (Figs. 2A&B). It was fortunate that the patient had not developed severe or fatal complications. Images of the thoracic CT (Fig. 3) revealed the catheter tip within the aortopulmonary soft tissue, while a catheterogram at a later date demonstrated the tip dwelling within the ascending aorta. The catheter position in the immediate post-insertion chest radiograph (Fig. 1A) was deemed correct. As we compared that to the post-blockage chest radiograph (Fig. 1B), we realized that the catheter tip position in both radiographs

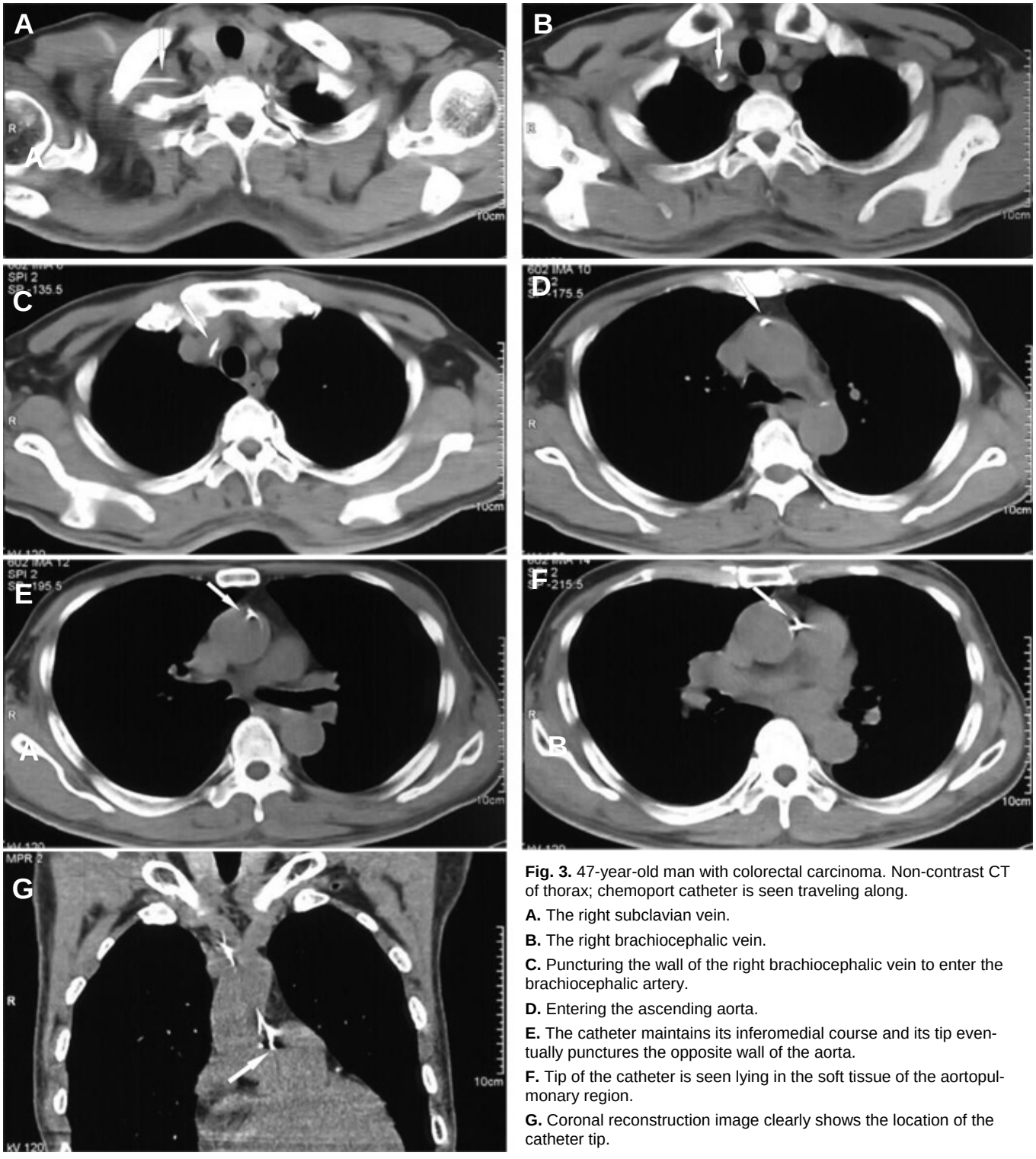

Fig. 3. 47-year-old man with colorectal carcinoma. Non-contrast CT of thorax; chemoport catheter is seen traveling along.

A. The right subclavian vein.

B. The right brachiocephalic vein.

C. Puncturing the wall of the right brachiocephalic vein to enter the brachiocephalic artery.

D. Entering the ascending aorta.

E. The catheter maintains its inferomedial course and its tip eventually punctures the opposite wall of the aorta.

F. Tip of the catheter is seen lying in the soft tissue of the aortopulmonary region.

G. Coronal reconstruction image clearly shows the location of the catheter tip.

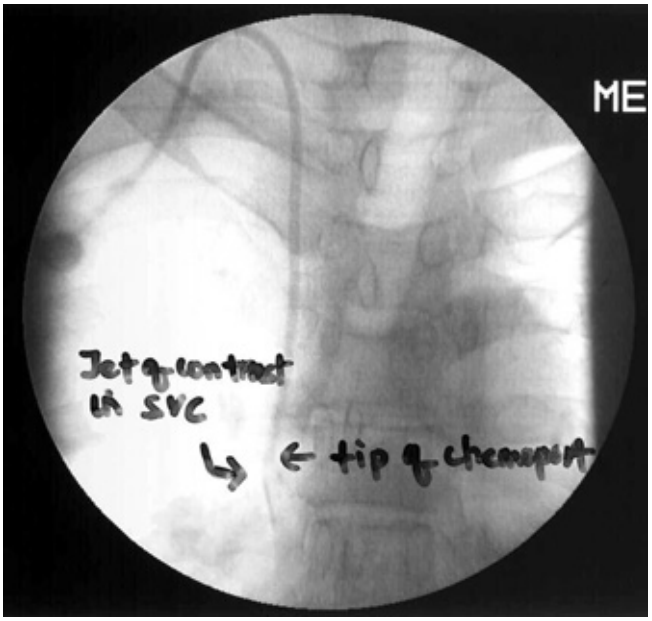

Fig. 4. 47-year-old man with colorectal carcinoma. Reinsertion of the chemoport was done with radiological guidance. The image shows the tip of the chemoport (arrow) and jet of contrast in SVC (curved arrow).

were similar. The tip was too medially located, indicating that it may not have been within the SVC right from the beginning and most likely located within the ascending aorta. This means that the infusion of drugs prior to the blockage could have been intra-aortic. Migration of the catheter tip to the aortopulmonary soft tissue only occurred eight days after the catheter was positioned and was only detected due to blockage of the catheter.

In these days when central venous access is increasingly advocated, correct positioning is easily taken for granted, especially due to time constraint. When a radiologist reports an immediate post-chemoport-insertion chest radiograph, the location of the tip must be viewed with caution. A malpositioned tip is easily mistaken as correctly placed, sometimes resulting in detrimental consequences. Radiological guidance and intervention is of utmost importance and is mandatory in confirming the placement of central venous catheters, and in the correction of migrated or malpositioned catheter tips.

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