Catheterization-induced Injury of the Superior Vena Cava during Concurrent Chemoradiotherapy

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Injury of the superior vena cava after central venous catheterization is an uncommon but potentially lethal complication. When chemotherapy and radiotherapy are being performed simultaneously, complication risk will be increased. Here, we present a case of 56-year-old man with locally advanced esophageal carcinoma who was complicated by catheterization-induced injury of the superior vena cava during concurrent chemoradiotherapy. As far as we know, this is the first report of catheterization-induced injury of the superior vena cava that concurrent chemoradiotherapy was substantially associated with. Due to the vulnerability of vascular wall, caution should be paid when central venous catheterization during concurrent chemoradiotherapy.

Key words: angiography, catheterization, complications, drug therapy, radiation

Introduction

Central venous catheterization has considerably improved the management of cancer patients because they facilitate chemotherapy, transfusions, parenteral nutrition, and blood sampling. However, use of large-caliber catheter is associated with thromboembolic occlusion and injury of the superior vena cava (SVC)1). Chemotherapy and radiotherapy are other precipitating factors because both treatments damage vascular endothelial cells2). Recommendations for central venous catheter placement include placing the catheter tip in the SVC, above the right atrium, and parallel to the vessel wall3, 4). But there has been no report on the feasibility and the safety of catheter placement within the radiation field. Here we report a case of post-catheterization injury of the SVC in a patient with advanced esophageal carcinoma who had been undergoing concurrent chemoradiotherapy. In this case report, all the procedures were in accordance with the Helsinki Declaration of 1975, as revised in 1983.

Case report

A 56-year-old man with locally advanced esophageal carcinoma of the midthorax was referred to our department due to the minimal backflow of blood from the central venous catheter. Pretreatment computed tomography (CT) scan showed no stenosis of the SVC (Fig. 1). The patient had undergone placement of a 7 French double-lumen central venous catheter (Blue Flex Tip, Arrow International, Inc. Reading, PA, USA) through the right jugular vein during the course of concurrent chemoradiotherapy. The catheter tip was placed in the SVC, approximately 1 cm above the right atrium. The concurrent chemoradiotherapy consisted of cisplatin (40 mg per square meter of body-surface area on days 1 and 8), 5-fluorouracil (400 mg per square meter of body-surface area given as a 120-minute infusion on days 1 and 8), and thoracic irradiation (Fig. 2). The patient was treated with 6 MV x-ray using an anterior-posterior parallel opposed field with a daily fraction of 2 Gy to a total dose of 28 Gy.

Cannulation of the right jugular vein was performed by a blind technique and a spontaneous backflow of blood was initially confirmed from the endhole and the sidehole of the catheter. However, due to the decreased backflow from the sidehole (5 cm from the catheter tip), venography was performed 2.5 hours after catheter placement. Using a manual injection techn-
nique, venography through the sidehole demonstrated diffuse stenosis and irregular shaped filling defect, suggesting injury of the vein and thrombosis (small arrow). The prominent collateral venous return to the superior vena cava was seen (large arrow). The endhole (arrowhead) of the catheter is located within the radiation field.

Fig. 3  Venography through the sidehole of the indwelling catheter in the superior vena cava demonstrated diffuse stenosis and irregular shaped filling defect, suggesting injury of the vein and thrombosis (small arrow). The prominent collateral venous return to the superior vena cava was seen (large arrow). The endhole (arrowhead) of the catheter is located within the radiation field.

Fig. 2  Simulation image illustrating boundaries of anterior and posterior portals used to irradiate the squamous cell carcinoma of the esophagus. The superior vena cava above the right atrium is included in the radiation field.

The vascular injury, the catheter was removed and the chemoradiotherapy was ceased. The patient remained hemodynamically stable with no further vascular injury during the 4 weeks following catheterization, but died of metastatic disease 3 months after the start of chemoradiotherapy.

Discussion

This case demonstrated a potential risk of SVC injury associated with catheterization during concurrent chemoradiotherapy. Since both chemotherapy and radiotherapy damage vascular endothelial cells, thrombus formation is promoted within the radiation field. When a large-caliber catheter is advanced through the thrombosed narrow lumen, the thrombus formation is further promoted. In this case, we consider that the injury of SVC was partially due to the catheter manipulation, yet the endothelial damage induced by chemoradiotherapy was also an important precipitating factor.

Since many catheter-related complications are asymptomatic, diagnostic imaging studies are important. In this case, venography and CT clearly depicted these asymptomatic complications. Failure to obtain such studies could delay necessary catheter manipulation or allow inappropriate infusion therapy. Although catheter repositioning or reinsertion into other central vein is efficacious in some cases, we did not attempt further catheterization because of the discontinuation of chemoradiotherapy. To avoid catheter-related complications (e.g., mispuncture, vascular injury, outflow failure), image-guided puncture using ultrasound or fluoroscopy might be useful.

References