

Case report: central venous catheterization via internal jugular vein with associated formation of perioperative venous thrombosis during surgery in the prone position

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Abstract An unusual case of central venous catheter (CVC)-related thrombosis during supine surgery in the prone position is presented. A 76-year-old woman was scheduled for elective surgery to repair a broken lumbar instrument. A single-lumen CVC was inserted via the right internal jugular vein. Surgery was performed in the prone position, with the patient's face directed downward in the standard median position (i.e., no rotation), but with slight forward flexion at the neck. After the surgery, the external jugular vein was dilated, and a postoperative X-ray revealed an infiltrative shadow in the right thoracic cavity. Because cervical echography showed dilated cervical veins with a “moyamoya-type” echo, possibly indicating a thrombus, contrast-enhanced computed tomography was performed, revealing a venous thrombus in the right internal jugular vein. An internal jugular venous-velocity measurement suggested that her slightly flexed neck position and her prone position during surgery may have kinked the internal jugular vein, causing engorgement with venous blood. The presence of the internal jugular venous catheter may have created thrombogenic conditions. A patient's position during surgery can reduce deep venous-flow velocity, and venous blood may stagnate, contributing greatly to thrombogenicity. We should consider a patient's position during surgery as a risk factor for thrombus formation, and a careful preoperative evaluation should be made as to which route should be chosen for CVC.

Keywords Central venous catheter · Venous thrombosis · Prone position

Introduction

Central venous catheters (CVCs) are commonly used under general anesthesia, and CVC-related complications are of great interest to anesthesiologists. CVC-related thrombosis, one of these complications, is important because it may result in infection or pulmonary embolism or both, potentially life-threatening conditions. Various risk factors are known for CVC-related thrombosis, and there is reason to believe that the position of the patient during surgery could be an important factor. We report a case in which perioperative venous thrombosis was associated with prone-position surgery.

Case description

A 76-year-old woman (height 149 cm, weight 46 kg; ASA physical status 2, with a medical history of hypertension, pulmonary tuberculosis, and surgery to create a posterior lumbar spinal fusion for spondylosis deformans) was scheduled for elective two-stage surgery to repair a broken lumbar instrument. General anesthesia was induced with thiopental, remifentanyl, and rocuronium, and then maintained with sevoflurane during both surgeries. Her peripheral veins were so thin and weak that central venous catheterization was planned in anticipation of heavy blood loss. At the time of the first surgery, a single-lumen CVC (CV catheter Seldinger kits, 16 G, 30 cm; Covidien Japan) was inserted via the right internal jugular vein with full barrier precautions, without complications. The landmark

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method was chosen for the puncture, and the CVC was stitched onto the skin at 14 cm in depth. Surgery was performed in the prone position, with the patient's face directed downward in the standard median position (i.e., no rotation), but with slight forward flexion at the neck. Operative duration was 216 min. Surgical blood loss was 350 ml; transfusion was not performed. After the surgery, the external jugular vein was dilated, and a postoperative X-ray revealed an infiltrative shadow in the right thoracic cavity. Because cervical echography showed dilated cervical veins with a “moyamoya-type” echo, possibly indicating a thrombus, contrast-enhanced computed tomography (CT) was performed. CT revealed pleural thickening, probably caused by pulmonary tuberculosis, and a venous thrombus in the right internal jugular vein (Fig. 1). After discussion with cardiologists and orthopedists, CVC removal was planned, and anticoagulation therapy was intended to be started after confirming hemostasis. The CVC was immediately removed, but no thrombi were attached. Elastic stockings and a device for intermittent pneumatic compression of the lower extremities were used to prevent further deep venous thrombosis. Postoperative measurements of PT-INR, FDP, D-dimer, and ATIII were 0.93, 6.6 $\mu\text{g/ml}$, 3.8 $\mu\text{g/ml}$, and 65%, respectively. Three days after the surgery, a follow-up contrast CT scan revealed that the venous thrombus had disappeared without leaving any signs of its presence. Subsequently, ambulation was allowed, and the prophylactic devices intended to prevent deep venous thrombosis were removed. After re-discussion with cardiologists and

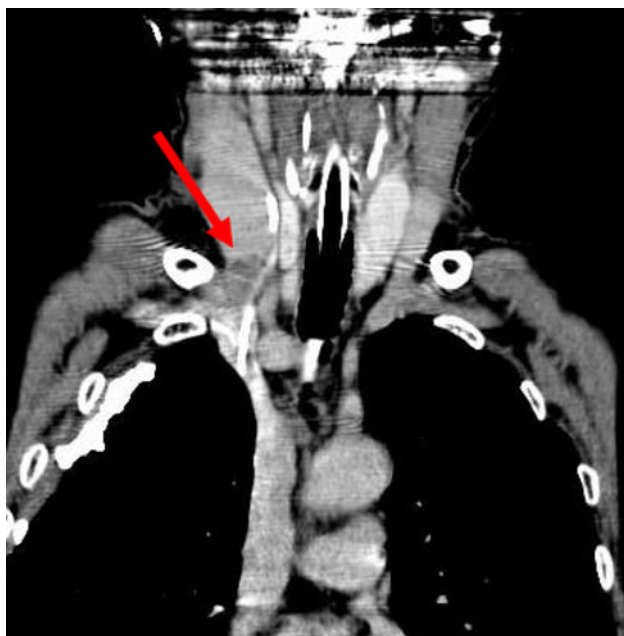


Fig. 1 Chest computed tomography (CT) showed that the internal jugular vein was kinked at the inlet portion of the thorax. Arrow indicates venous thrombus in internal jugular vein

orthopedists, prophylactic anticoagulation therapy was not begun because the thrombi had completely disappeared.

Sixteen days after the first-time repair surgery, second-time repair surgery was performed without complications. At that time, internal jugular venous-flow velocity was measured in both the supine position and the prone position. Venous velocity was found to be decreased by half in the prone position (Fig. 2).

Discussion

CVC-related thrombosis is a common complication, with reported incidence from 1.9% to 33% [1–4]. Because such a thrombosis may result in infection or pulmonary embolism, both potentially life-threatening conditions, knowing the risk factors is clinically important. To judge from the literature, the major risk factors for CVC-related thrombosis are age, obesity, current malignancy, and recent major surgery. Joffe et al. [5] reported that for deep venous thrombosis of the upper extremity (UEDVT), the most powerful independent predictor was the presence of an indwelling CVC (adjusted odds ratio, 9.7; 95% confidence interval, 7.8–12.2). In addition, the position of the patient during surgery may be an important factor in the formation of a thrombosis. Venous velocity can be altered by the position of the patient, and decreased deep vein blood velocity is a key factor in the formation of a deep vein thrombosis [6]. An additional problem may be that because the internal jugular vein is tethered to surrounding tissues, certain neck positions can cause venous kinking, with consequent venous stasis [7]. In these conditions, the presence of a foreign material, such as a CVC, may activate the clotting cascade, so that thrombi form more easily. In the present case, the patient's slightly flexed neck position and prone position during surgery may have kinked the internal jugular vein, causing engorgement with venous blood, and the presence of the internal jugular venous catheter may have created thrombogenic conditions. Her postoperative normal PT-INR, increased FDP and D-dimer, and decreased ATIII also indicated that thrombi could be easily formed. In such conditions, we might be better advised to choose subclavian venous catheterization, a less thrombogenic route for a central venous line. Moreover, with hindsight, we could have made an appropriate adjustment to her neck position to prevent internal jugular vein kinking.

Because of the paucity of randomized controlled trials of treatment for CVC-related UEDVT, optimal management continues to be controversial [8, 9]. Anticoagulation is the most common treatment, consisting of low molecular weight heparin and a vitamin K antagonist. Although anticoagulation is the standard treatment, its initiation

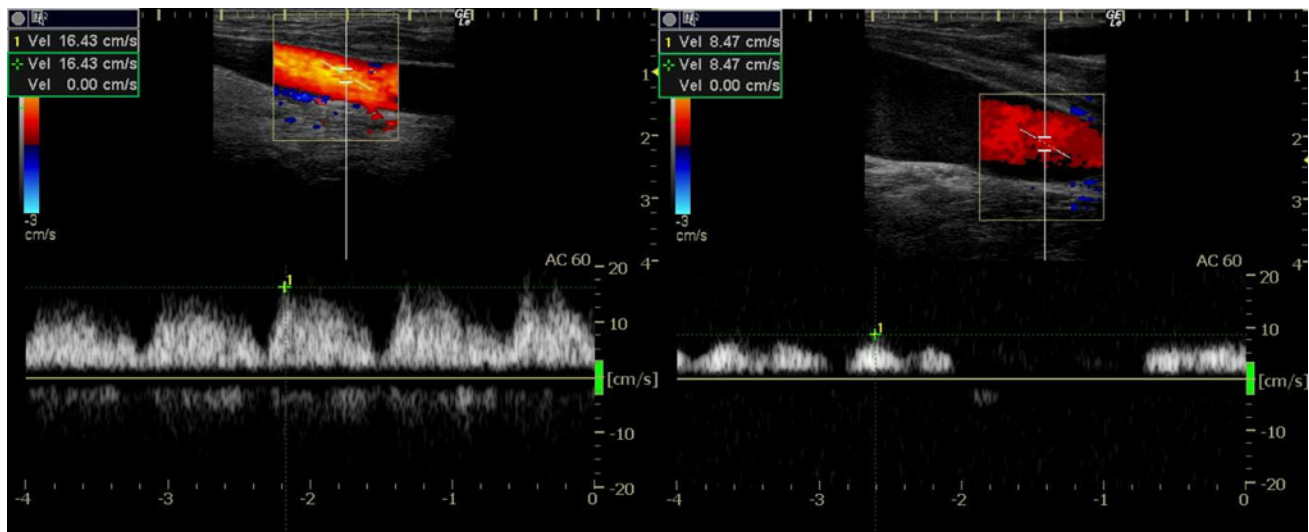


Fig. 2 *Left* internal jugular venous-flow velocity of this patient in the supine position. *Right* venous flow velocity in the prone position. Ultrasound examination was performed during the second repair surgery. Velocity is decreased by half in the prone position

immediately after surgery is not recommended for fear of postoperative bleeding. Thrombolysis, surgery, thrombectomy, and balloon dilatation with/without stent placing are used far less often because these aggressive forms of treatment may have serious complications. In patients with UEDVT, the decision when to remove the CVC is clinically important. For patients with CVC-related thrombosis, but who no longer need a CVC, guidelines from the American College of Chest Physicians (ACCP) recommend removal of the catheter after 3–5 days of anticoagulation treatment [10]. However, some clinicians think that prompt removal of the main risk factor, the CVC, could be beneficial [11]. Although in this patient the CVC was, fortunately, removed uneventfully soon after the surgery, later removal of a CVC (after confirmation of hemostasis and completion of 3–5 days of anticoagulation treatment) may be much safer.

In conclusion, we experienced a case of perioperative CVC-related venous thrombosis in a patient who was in the prone position during surgery. A patient's position during surgery can reduce deep venous-flow velocity, and stagnant venous blood contributes greatly to thrombogenicity. We should consider a patient's position during surgery as a risk factor for thrombus formation, and a careful preoperative evaluation should be made as to which route should be chosen for CVC.

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