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Olgu Sunumu

Complication of Right Subclavian Vein Catheterization: Superior Vena Cava Perforation

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SUMMARY

Central venous catheterization is an invasive approach which is routinely used in thoracic surgery operations. Pneumothorax and hemothorax are among the most frequent complications. Vena cava superior (VCS) perforation (0.5 %) is very rarely observed.

A 65-year-old male patient was admitted to the hospital with the complaint of cough. With the examinations performed, he was diagnosed with epidermoid lung cancer located in the right lower lobe of the lung (Stage IB, T2N0M0). To prepare the patient for the operation, endotracheal intubation and right subclavian vein catheterization were performed by the anesthesia team. During exploration, it was found that the central catheter placed into the right subclavian vein perforated the vein, and after proceeding a little in the intrathoracic space, entered the vena cava superior in front of the phrenic nerve. The catheter was withdrawn and vena cava superior was repaired with 5/0 prolene sutures. The patient didn't develop any post operative problems, thus he was discharged with full recovery following right lower bilobectomy.

Key words: *subclavian vein catheterization, complication, superior vena cava perforation, central venous catheterization*

ÖZET

Sağ Subklaviyan Venöz Kateterizasyonun Nadir Bir Komplikasyonu: Superior Vena Kava Perforasyonu

Santral venöz kateterizasyon toraks operasyonlarında rutin kullanılan invaziv bir girişimdir. En sık komplikasyonlar pnömotoraks ve hemotorakstır. Komplikasyon olarak vena kava superior (VKS) perforasyonuna (% 0,5) oldukça ender rastlanmaktadır.

Altmış beş yaşında erkek hasta öksürük şikayeti ile hastanemize başvurdu. Hastada sağ akciğer alt lobda lokalize akciğer epidermoid kanser tespit edildi (Evre IB, T2N0M0). Ameliyat öncesi hazırlık olarak anestezi ekibi tarafından hastaya endotrakeal entübasyon ve sağ subklaviyan ven kateterizasyonu uygulandı. Eksplorasyonda, yerleştirilen santral kateterin sağ subklaviyan veni perfore ettiği ve kısa bir mesafe intratorasik boşlukta seyrettikten sonra frenik sinirin önünden vena kava superiora girdiği izlendi. Kateter geri çekilerek vena kava superior 5/0 prolen ile onarıldı. Hastada postoperaitf dönemde herhangi bir problem gelişmedi ve sağ alt bilobektomi sonrası sorunsuz olarak taburcu edildi.

Anahtar kelimeler: *subklaviyan ven kateterizasyonu, komplikasyon, superior vena kava perforasyonu, santral venöz kateterizasyon*

INTRODUCTION

Central venous catheterization is a routine invasive procedure among thoracic operations and usually subclavian vein or internal jugular vein is preferred. Subclavian vein catheterization is a procedure usually performed successfully and without any complications [1-4]. Reported complication rate for the central venous catheterization is 0.3-12 %, and the most common complications are pneumothorax and hemothorax [2]. The serious and fatal complications are cardiac tamponade, aortic puncture, arteriovenous fistula and perforation of superior vena cava (SVC). Vascular perforation rate reported in the literature is less than 1 % [2-5].

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We would like to present a case of punctiform perforation of superior vena cava occurring due to right subclavian vein catheterization in a patient who would undergo thoracotomy for lung cancer.

CASE REPORT

A 65-year-old male patient had undergone total gastrectomy + gastrojejunostomy for stomach adenocarcinoma in 2008. Thorax CT taken in June 2011 revealed a 41x34 mm mass lesion in the lower lobe of the right lung. Flexible bronchoscopy revealed endobronchial lesion in the superior segment of the right lower lobe, and the biopsy result was reported as epidermoid cancer. No distant metastasis was detected during screening tests. The patient was evaluated as Stage IB (T2N0M0) NSCLC and surgical treatment was planned. The patient was 168 cm high and 61 kg weight. His body mass index (BMI) was 21.61 kg/m^2. He was considered as an ASA II patient having no preoperative problem.

The patient, who would have right lower lobectomy, underwent indirect arterial blood pressure, ECG and peripheral pulse-oximetry monitoring in the operation room before the operation. In the first measurements, arterial blood pressure was 120/70 mmHg, pulse rate was 72/min, and SpO_2 was 99 percent. The patient was intubated with a left endobronchial tube for one-lung ventilation. Under sterile conditions, subclavian venous catheterization was successfully achieved with the Seldinger technique (7F/20 cm, 3 lumen, Certofix, Braun, Melungen AG, Germany) at the 3rd attempt by a third-year resident under the supervision of a senior assistant professor of anesthesia. To prevent pleural puncture during central catheterization, left one-lung ventilation was achieved by collapsing the right lung. After the procedure, no problem was observed. Then the patient was positioned on the left side and right posterolateral thoracotomy was performed.

Pleural adhesions, specifically in the apical region, were detected during the exploration. One-lung ventilation was performed and the pleural adhesions were freed. It was detected that the central catheter inserted into the right subclavian vein perforated the vein, travelled some distance through the intrathoracic space and entered the superior vena cava just in front of the phrenic nerve. There was neither hemothorax nor mediastinal hematoma in the right hemithorax (Figure 1). The catheter was withdrawn, and superior vena cava was primarily closed with 5/0 prolene sutures (Figure 2). The patient, who had developed no peroperative problem, underwent right lower lobectomy. The patient, whose postoperative follow-up were normal was discharged with full recovery on postoperative 9th day.

Figure 1. Central catheter placed into the right subclavian vein and after proceeding in the right hemithorax entered the vena cava superior (SV: Subclavian vein, VCS: Vena cava superior, PhN: Phrenic nerve).

DISCUSSION

Central venous catheters are used in various areas for diagnostic and therapeutic purposes. Although the central venous catheter-related complication rate is as high as 10 %, the rate of serious or fatal complications is quite low [1-5]. Potential complications include failure to enter into the vein for cannulation, subclavian arterial puncture, misplacement of the catheter, pneumothorax, hemothorax, damage to neighboring nerves and mediastinal hematoma [4,5]. The most common complication is pneumothorax with a rate of 2-3 %, and about one-quarter of these complications are observed in unsuccessful catheter attempts [3]. On the other side, the most common vascular complication is the subclavian vein injury. Superior vena cava perforation due to central venous catheterization is a rare event (0.5 %). This complication leads to hemothorax, pneumothorax, hydromediastinum or pneumomediastinum [3-6].

Some of the complications or failures can be predicted before placing the central venous catheter. Predictors of failed attempts include BMI of the patient ($\geq$ 30 kg/m^2 or $\leq$ 20 kg/m^2), previous operation or radiotherapy at the catheter insertion site [2,3]. It is recommended that central venous catheter placement in these patients should be performed by a more experienced personnel or it should be applied with the guidance of ultrasound [3].

The experience of the person who performs the procedure and more than one procedural attempts have been mentioned as significant risk factors. The rate of complication has been reported to be 4.3 % for 1 attempt, 10.9 % for 2 attempts and 24 % for 3 or more attempts, respectively [2]. Additionally, large-bore

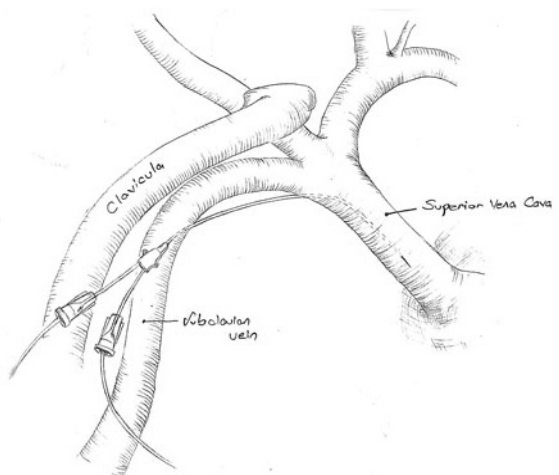

Figure 2. Illustration of superior vena cava puncture due to central venous catheterization.

catheter, catheter texture of poor quality, rigidity of the catheter and a catheter with a mobile tip are other risk factors for the venous perforation [4,5].

Left subclavian and internal jugular vein catheterizations are the procedures with higher venous perforation rates because innominate vein makes a right angle with superior vena cava and the catheter may cause damage on the lateral wall of superior vena cava [4,5]. It has also been reported that as well as mechanical trauma, vein perforation can occur due to the chemical damage caused by the infusion solution. Perforation may occur within 0-60 days following the catheter placement, and about 50 % them seem to occur within the first two days. The most important symptoms and clinical findings are shortness of breath, chest pain, cough, hypotension, a new and suddenly developed pleural effusion and mediastinal widening [5,7].

In the literature, there have been case reports on the perforation of the intrapericardial ascending aorta after right subclavian vein catheterization. In all of these reported cases, right subclavian vein catheterization has been performed via infraclavicular approach, and the patients have developed cardiac tamponade and cardiac arrest [8,9]. Robinson et al reported in their article that 6 out of 10 patients in whom vein perforation was detected had undergone right subclavian vein catheterization, and the most important finding was the enlarged mediastinum detected on the postoperative chest X-ray. Only four of the patients could be diagnosed in the operation room [8].

In our case, SVC perforation occurred due to a preoperatively placed right subclavian venous catheter. The BMI of the patient was 21.61 kg/m^2, and he had neither undergone an operation nor received radiotherapy directed at the site of central venous intervention. The patient was under general anesthesia and one-lung ventilation, and there were adhesions in the apical region of the pleura, so no symptoms or signs of pneumothorax and/or hemothorax were observed. In our case, three attempts to succeed in catheterization seems to be a significant risk factor in the development of complication. There were no abnormal findings in O_2 saturation and breath sounds of the patient. Therefore we didn't perform chest X-ray. Posterolateral thoracotomy revealed that the catheter had perforated the subclavian vein, traveled some distance through the thorax, and entered superior vena cava in front of the phrenic nerve. An the exploration, no hemothorax was observed. This might be due to the pleural adhesions caused by the pleural problems the patient had experienced before. We believe that aspiration of blood while the catheter was entering and leaving the subclavian vein and advancement of the needle too far had not played a role in the development of the perforation.

In conclusion, if thoracotomy had not been performed, such a complication might have been missed, and spontaneous migration or the withdrawal of the catheter could have caused hemorrhage and consequently led to serious problems. Therefore, when the central venous catheter is placed after several attempts, the position of the catheter should be controlled with the imaging methods.

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DECLARATION OF CONFLICTING INTERESTS

The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

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