

An Evaluation of Complications in Ultrasound-Guided Central Venous Catheter Insertion in the Emergency Department

Acil Serviste Ultrasonografi Eşliğinde Takılan Santral Venöz Kataterlerin Komplikasyon Açısından Değerlendirilmesi

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SUMMARY

Objectives

In emergency departments, emergency physicians frequently have to perform central venous access. In cases where peripheral venous access is not possible, central venous access is required for dialysis, fulfillment of urgent fluid need, or central venous pressure measurement. This study was carried out to evaluate the emergence of complications in the process of and in the 15 days following the insertion of central venous catheter under ultrasound guidance in the emergency department.

Methods

For this study, patients who presented to the emergency department over a period of eight months with an urgent need for central catheter were examined prospectively. Age, gender, and accompanying diseases of patients as well as the type, time, duration, and indication of the venous access were recorded. Furthermore, the amount of experience of the physician was taken into consideration.

Results

In the emergency department, physicians performed ultrasound-guided central venous catheter insertion for 74 patients (40 men and 34 women). For access, internal jugular vein was used in 65 (87.8%) patients, and femoral vein was used in 9 (12.2%) patients. The reason for access was urgent dialysis need in 55 (74.3%), CVP measurement in 3 (4.1%), fluid support due to severe hypovolemia in 6 (8.1%), and difficulty of peripheral venous access in 10 (13.5%) patients. None of the patients developed complications in the process of or after the insertion. Patients did not have infections related to the catheter in 15 days following the insertion.

Conclusions

Central venous access is frequently required in emergency departments. The risk of complication is little if any in ultrasonography-guided access carried out under appropriate conditions.

Key words: Central venous catheter; emergency department; ultrasound-guided.

ÖZET

Amaç

Acil servislerde acil tıp hekimlerince santral damar yolu işlemi sık uygulanır. Periferik damar yolu açılmadığı hallerde, diyaliz, acil sıvı ihtiyacı veya santral venöz basınç ölçümü gereken durumlarda hastalar için santral damar yolu gerekmektedir. Acil serviste, ultrasonografi (USG) kılavuzluğunda uygulanan acil santral venöz katater girişimi sürecinde ve uygulamayı takip eden 15 gün içerisinde komplikasyon varlığını değerlendirmek amacı ile bu çalışma yapıldı.

Gereç ve Yöntem

Sekiz aylık sürede acil servise başvuran ve acil santral katater gereksinimi olan hastalar ileriye dönük olarak incelendi. Hastaların yaşı, cinsiyeti, eşlik eden hastalıkları ile tercih edilen girişimin yolu, saati, süresi ve endikasyonu kaydedildi. Ayrıca girişimi yapan hekimin çalışma yılı da değerlendirmeye dahil edildi.

Bulgular

Ultrasonografi eşliğinde santral venöz katater takılan 74 (40 erkek, 34 kadın) hastanın 65'inde (%87.8) internal juguler ven, dokuzunda (%12.2) femoral ven girişim için kullanıldı. Uygulama olguların 55'inde (%74.3) acil diyaliz ihtiyacı, üçünde (%4.1) CVP ölçümü, altısında (%8.1) ciddi hipovolemi için sıvı desteği, 10'unda (%13.5) periferik damar yolu güçlüğü nedeniyle yapıldı. Hastaların hiçbirinde işlem esnasında ve sonrasında komplikasyon izlenmedi. Yatırıldıkları bölümde takiplerinde 15 günlük süre içerisinde katater ile ilişkili enfeksiyon da saptanmadı.

Sonuç

Acil servislerde santral damar yolu gereksinimi siktir. Kılavuzların önerisi doğrultusunda USG eşliğinde uygun şartlar altında yapılan girişimlerde komplikasyon riski yok denecek kadar azdır.

Anahtar sözcükler: Santral venöz katater; acil servis; ultrason kılavuzluğu.

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Introduction

The insertion of central venous catheters (CVC) has increased in emergency departments particularly with the spread in usage of ultrasonography (US). While internal jugular vein is commonly preferred for placement under ultrasound guidance, subclavian and femoral vein access has decreased due to higher complication risks. Emergency physicians apply CVC primarily in cases of hemodialysis, difficulty of peripheral venous access, measurement of central venous pressure (CVP), and need for rapid fluid resuscitation.^[1]

Following the insertion of CVC in the emergency department, complications such as infection, pneumothorax, hemothorax, subcutaneous hemorrhage, or puncture of vertebral and cervical arteries, catheter breakage, catheter malposition, thrombus formation, and infection may emerge.^[1-3]

In order to reduce CVC complications, the healthcare personnel placing the CVC is required to work under sterile conditions, be experienced, and use the appropriate technique for each unique patient. The quality of material used is also important.^[4] This study focuses on the complications that may develop in the process of and in the 15 days following the insertion of CVC under ultrasound guidance in our clinic.

Materials and Methods

This study was carried out prospectively in the emergency department of a university between January 2011 and August 2011 after the approval of the local board of ethics was obtained. The study involved patients aged over 18 in urgent need of CVC, who agreed to take part in the study or whose relatives gave consent. Patients with trauma, who were pregnant at the time of admittance, and patients who has two or more septic inflammatory response syndrome criteria^[5] (fever of more than 38°C (100.4°F) or less than 36°C (96.8°F), heart rate of more than 90 beats per minute, respiratory rate of more than 20 breaths per minute or arterial carbon dioxide tension (PaCO₂) of less than 32 mmHg, white blood cell count >12,000/μL or <4,000/μL or >10% immature forms) were excluded. All interventions were performed by emergency physicians under US guidance, who previously received training on US. For the purpose of the study, age, gender, and accompanying diseases of patients as well as the type, time, duration, and indication of the venous access were recorded. Furthermore, the physician's level of experience was taken into consideration. All patients were taken to a unit where vital and cardiac findings were monitored. The patients or their relatives were informed and their consent was received. In supine position, the patients were evaluated for an appropriate vein for US-guided intervention. For this purpose, the anatomic characteristics of the patients as

well as the proximity of vein to the skin, lumen diameters, and the proximity of vein to vital organs were checked. After the location of access was determined, local skin cleaning was performed with 10% povidone-iodine. The probe was covered with sterile glove (Figure 1) and area of access was covered with sterile drape. Once sterility was assured, sedoanalgesia and/or local anesthesia were administered with the agents appropriate for the clinical situation of each patient. 7.5 MHz linear probe, used in US scan (Sonosite, Titan) was covered appropriately. The vascular structures in the relevant area were displayed on the transverse axis (Figure 2). The intervention was performed on the location where the vein is most proximate to the skin, the lumen is largest, and the adjacent artery is most protected. During the intervention, the needle movements were followed on the US screen dynamically. When the blood flow into the injector in the vein became clear, the catheter (double lumen hemodialysis catheter, 12F, 15 cm, Sentia) was placed using the Seldinger method. Blood and fluid flow were checked using heparin-containing fluid (50 U/ml), administered through the catheter. Following the intervention, all patients were checked for subcutaneous emphysema, local hematoma, and bleeding by physical examination, for pneumothorax and hemothorax by US, and for the position of catheters and again pneumothorax and hemothorax by chest radiography. Then, in the intensive care unit or other departments where patients were transferred, they were observed for 15 days to detect any CVC-induced infections or other complications due to catheter placement by emergency physicians. Rash, temper-

Table 1. Patient characteristics

| Properties | n | % |
|------------------------------------|----|------|
| Sex | | |
| Male | 40 | 54.1 |
| Female | 34 | 45.9 |
| Past medical history | | |
| Diabetes mellitus | 15 | 20.3 |
| Renal insufficiency | 15 | 20.3 |
| Hypertension | 13 | 17.6 |
| Malignancy | 6 | 8.1 |
| None | 23 | 31.1 |
| Catheter location | | |
| Internal jugular vein | 65 | 87.8 |
| Femoral vein | 9 | 12.2 |
| Indications | | |
| Dialysis | 55 | 74.4 |
| CVP | 3 | 4.1 |
| Hypovolemia | 6 | 8.1 |
| Difficult peripheral venous access | 10 | 13.5 |

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