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Fluoroscopic Guidance For Optimizing The PICC Line Tip Position

Periferden Takılan Santral Venöz Kateter Ucunun Yerleşiminin Doğrulanması İçin Floroskopi Kullanımı

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ABSTRACT

This study was designed to substantiate the feasibility and the advantage of the use of floroscopic guidance for evaluating the misplacement of the peripherally inserted central catheter line and optimizing the correct tip positioning in the operating theatre.

Material and Method: Ninety patients aged 18-75 years, requiring central vein access were enrolled into this study. Chest fluoroscopy was performed to assess the position of the catheter tip after the insertion of the catheter. Feasibility of the fluoroscopic examination, the time required to verify the catheter tip location, identifying the position of the central catheter line tip (misplacement/correct placement), the entire time required to perform correct catheter tip placement with the aid of floroscopic screening were all recorded in each patient.

Results: Total of 92 concecutive central venous catheters were inserted. The average time required to verify the PICC line tip location with fluoroscopy was 4.2 ± 2.4 min. 16 misplaced PICC line tip were determined. The average time required to perform correct PICC line tip placement with the aid of floroscopic screening was 6.5 ± 5.5 min.

Conclusion: It is concluded that fluoroscopic examination following central venous line insertion helps to determine the catheter misplacement, and provide correct positioning of the misplaced catheter line tip without causing too much time delay.

Keywords: *Central venous catheter, fluoroscopy*

ÖZET

Bu çalışmanın amacı, yanlış yerleşmiş santral kateter ucunun belirlenmesi için floroskopi kullanılmasının uygunluğunu ve avantajlarını araştırmak ve operasyon odasında, floroskopi eşliğinde doğru kateter ucu yerleşimini optimize etmektir.

Materyal ve Metod: 18-75 yaş arası santral ven kateterizasyonu ihtiyacı olan 90 hasta bu çalışmaya dahil edildi. Her hastada, floroskopinin uygulanılabilirliği, kateter ucunun floroskopi ile değerlendirilmesi için gerekli olan süre, santral kateterin ucunun pozisyonunu (yanlış yerleşim/doğru yerleşim) ve floroskopi eşliğinde, doğru kateter ucu yerleşimini sağlamak için geçen süre kaydedilmiştir.

Bulgular: Total olarak 92 santral venöz kateter takıldı. Santral kateter ucunun yerinin floroskopi eşliğinde değerlendirilmesi için geçen süre ortalama 4.2 ± 2.4 dakikaydı. Floroskopik görüntüleme eşliğinde doğru santral kateter ucunun doğru yerleşiminin sağlanması için geçen süre 6.5 ± 5.5 dakikaydı.

Sonuç: Santral venöz kateter takılmasını takiben floroskopik değerlendirme yapılmasının çok fazla zaman kaybına yol açmadan, yanlış kateter yerleşiminin tespit edilmesinde ve kateter ucunun yerinin doğru pozisyona getirilmesinde faydalı olduğuna inanıyoruz.

Anahtar Kelimeler: *Santral venöz kateter, floroskopi.*

INTRODUCTION

Peripherally inserted central catheters (PICC) tips are terminated in the distal innominate or 3 to 5 cm proximal to the caval-atrial junction regardless of the insertion site (1) Proper catheter tip location is a very important but often ignored consideration in PICC (1). Positioning of the catheter tip within the right atrium or right ventricle must be avoided. Cardiac tamponade secondary to cardiac wall perforation due to the catheter tip is not rare (1). The reason of the perforation by catheter tip migration is due to the motion of the beating heart or arm and neck movements (1). Because these procedures are initially performed without imaging guidance, post procedure chest radiographs are routinely obtained to evaluate the PICC malposition (2-4). Neverheless, despite its simplicity, chest radiography may be time-consuming and time required to complete the entire procedure (from the phone call to the radiology department to receiving chest radiography results) may take more than 30 min (5). Ultrasound examination is also mentioned as an alternative to chest radiography after PICC insertion. But this method needs a radiologist or at least a medical staff who is specifically trained on ultrasonographic practice and postprocedural ultrasonic examination (5). This investigation aimed to assess the the efficacy of post procedure flouroscopy for evaluating the misplacement of the peripherally inserted central catheter line and optimizing the correct tip placement in operating theatre.

MATERIALS AND METHODS

The study was conducted throughout a 18 month period (between november 2006-june 2008) at a university hospital. The study was carried out according to the local ethics committee guidelines for human research. Informed consent was obtained from each patient. Ninety patients aged 18-75 years, undergoing urologic surgery and requiring central vein access were enrolled in this study. The exclusion criteria were obesity (BMI greater than 35 kgm-2). The patient was monitored electrocardiographically. For peripherally inserted central catheters, either the basilic or cephalic veins above the antecubital fossa were used and 16-gauge (Cavafix® Certo® Braun Melsungen, AG, Germany) single lumen catheters were chosen. During procedures catheter through the needle technique

were used. In order to prevent malposition of the catheter tip, the length of insertion was estimated by measuring the distance from the venipuncture site to the manubriosternal junction for the antecubital approach. For all other lines the right internal jugular was the vein of choice and double lumen 7F catheter was inserted by Seldinger technique. If the right internal jugular vein was unacceptable, the left internal jugular vein was chosen. All of the central venous access procedures were performed by minumum 3 years experienced anesthesia residents. Prior to obtaining chest fluoroscopy catheters were secured at 15 cm and 17 cm mark for the right-sided and left-sided IJV respectively. Post-line insertion chest fluoroskcopy was performed to assess the position of the catheter tip. Fluoroscopy procedures, were performed with the flexible surgical C-Arm (Ge Flexi-view 8800 GE healtcare, Salt Lake City, Utah). with a range of 55-85 kVp and mean of 0.8 mA. One fluoroscopy technician, one consultant anesthetist (S.K) stayed in the operating theatre during fluoroscopy in each case. In order to limit radiation exposure they used lead shielding every time. The patients genital area were also protected with lead shielding. Fluoroscopic examination was assessed as feasible when the PICC line tip is distinguished with the fluoroscopic image. The time required to verify the catheter tip location with fluoroscopy (from fixing up the flouroscopy unit until verifying the catheter tip location), the assesment of the position of the PICC line tip (misplacement/correct placement), the entire time required to perform correct PICC line tip placement with the aid of floroscopic screening were all recorded in each patient. Malposition was defined as a Statistical analysis SPSS software (SPSS, Chicago, Illinois, USA) was used for data analysis. Categorical variables were described as frequencies (%). Continuous variables were described as means ± SD.

RESULTS

During the study period; the total of 92 concecutive PICC were inserted into 90 patients; of which 83 were single lumen catheters inserted from antecubital region, and 9 were double lumen catheters inserted from right internal jugular vein. All the catheter tips were visible with fluoroscopic examination. The avarage time required to verify the PICC tip location with fluoroscopy, and the number of misplaced PICC line tip were shown in table 1. The avarage time required to perform the correct PICC line tip placement with the aid of floroscopic screening was also shown in table 1.

DISCUSSION

PICC line is often required for diagnostic or therapeutic procedures, long-term total parenteral nutrition, the infusion of irritant medications or vasoactive agents and patients whose peripheral access is not possible. Confirmation of central venous line placement is very important but often ignored (1). The ideal location for the central venous catheter tip is the distal innominate or 3 to 5 cm proximal to the caval-atrial junction (1). As the cardiac tamponade secondary to catheter tip perforation of the cardiac wall is not rare (1), and two-thirds of patients suffering from this complication die (6-8), positioning of the catheter with in the right ventricle or right atrium must be avoided. There are different techniques for correct placement of the catheter tip. Intravascular electrocardiography is an easier and more accurate way to ensure proper catheter tip location compared to other techniques such as chest radiography or ultrasonic examination (9).

Table 1. The total number of catheterization, the total number of misplaced central line tip, the length of time required to verify and correction of the catheter tip location.

Central venous catheterization characteristic	
The total number of central venous catheterization	92
The number of misplaced central venous catheter line tip	16 (17.3)
The avarage time required to verify the central venous catheter tip location with fluoroscopy	4.2 ± 2.4 min.
The avarage time required to perform correct catheter tip placement with the aid of floroscopic screening	6.5±5.5 min.

Data are presented as n (%) or mean ± SD.

During the intravascular electrocardiography technique an adapter is used, and the central venous catheter is inserted while monitoring lead II on a standard EKG. During the advancement of the central venous catheter tip into the right atrium a large P wave on the lead II tracing is observed. Once the p waves are observed, 3 to 5 cm withdrawal of the catheter tip usually ensures correct positioning (9). This technique needs a special catheter. False negative or false positive results in patient having cardiac arrhythmia is another disadvantage of the technique (10). Ultrasonic examination for the PICC line tip confirmation has also some disadvantages such as requiring a radiologist or at least a medical staff who is specifically trained on ultrasonographic practice.(5) Because the fluoroscopic images were the same with X-ray images, during fluoroscopic imaging the clinician who are trained for the X-ray evaluation do not required any specific training. In our study the investigator (SK) evaluated all the fluoroscopic imaging while a technician who had already trained for the fluoroscopic guidance asssisting her. Chest radiography for confirmation of the correct central catheter line tip position also have some disadvantages. Beside of the clasical knowledge in the literature such as chest radiography must be taken every after central venous catheter insertion (1-4), with the advancement of imaging guidance, it became clear that the techniques used for other procedures could also be applied to central venous catheter insertion (11). Although the tradition of obtaining a postprocedure chest radiography persists in many institutions, there are some articles reporting that the chest radiography causes time and money lost, and misallocates the use of nursing and technical staff (11,12). The number of misplaced central venous catheter line tip was 16. All of these misplaced catheters were repositioned directy under fluoroscopic guidance, and the avarage time for these corrections was only 6.5±5.5 min. However, we might not have been aware of the additional time lost for the chest radiography to be obtained per patient. In the study of Maury et al (5) the mean time of the catheter tip examination with chest radiography was reported as 80.3± 66.7 min. In another study by Cullinane et al (12) the authors reported that the avarage time from completion of the central line insertion until the radiographic confirmation was 60.2 min. Our study suggests that the fluoroscopic examination is faster than the aforementioned methods. Keckler et al (13) reported that postoperative chest x-ray in asymptomatic patients added unnecessary cost when compared to catheters placed under fluoroscopic guidance. Harako et al (14) also pointed out that the tip of the catheter was not always reliably identified on the initial portable chest X-ray, and the medical charges increased by $272 for the second

radiography. A second fluoroscopic imaging does not bring any extra cost. We believe that the fluoroscopic examination may also be beneficial for reducing medical charges. We did not compare the medical cost of the fluoroscopic confirmation with other methods. We think that further studies researching this topic may be helpfull.

In conclusion, this study suggests that fluoroscopic examination following PICC line insertion helps to determine the catheter misplacement, and provide correct positioning of the misplaced catheter line tip without causing too much time delay.

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