Case Report
JCAM

Inadvertent Arterial Puncture During Central Venous Catheter Insertion

Santral Ven Kateterizasyonunda Kasıtsız Arter Delinmesi

Arterial Puncture During Central Venous Catheter Insertion

Hassan Soleimanpour[1], Samad EJ Golzari[2,3], Farzad Rahmani[4], Mohammad Mokhtarpour[5]
[1]Cardiovascular Research Center, Tabriz University of Medical Sciences, Tabriz,
[2]Physical Medicine and Rehabilitation Research Center, Tabriz University of Medical Sciences, Tabriz,
[3]Students' Research Committee, Tabriz University of Medical Sciences, Tabriz,
[4]Emergency Medicine Department, Tabriz University of Medical Sciences, Tabriz, [5]Army Hospital Khanevedeh, Tehran, Iran

Özet

Santral ven kateterizasyonun en korkutucu ve tehlikeli komplikasyonlarıdan biri kasıtsız arter delinmesidir. Mevcut çalışmada, bir kasıtsız karotis arter delinme vakiasi santral ven kateterizasyonda bildirilir. Hastamizda hipotansif ve ciddi hipoksemik olmak nedeniyle ve önceki santral ven kateterizasyonunn hasarlı olmak nedeniyle, yeni santral ven kateterizasyonu gerekli oldu. Benzerli durumlarda, santral ven kateterizasyonun doğruluğunu kanatlamk için eşzamanlı oksijen içerik farkını kanüle olan dammar ve arter kinyla ölçmek önerilmektedir.

Anahtar Kelimeler

Santral Ven Kateterizasyon; Hipoksemi; Kasıtsız Arter Delinmesi

Abstract

One of the most important and dangerous complications of central venous catheterization is unintentional arterial puncture. In the current study, were report a case of unintentional arterial catheterization into the carotid artery in a hypotensive patient with severe hypoxemia in which central venous catheterization was required due to loss of intravenous line. In similar situations, it is suggested to measure the difference between O2 content of the cannulated vessel and arterial blood simultaneously for further confirmation of the central venous catheterization.

Keywords

Central Venous Catheter; Hypoxemia; Unintentional Arterial Puncture

DOI: 10.4328/JCAM.1699 Received: 27.02.2013 Accepted: 22.03.2013 Printed: 01.04.2016 J Clin Anal Med 2016;7(suppl 2): 93-5
Corresponding Author: Hassan Soleimanpour, Fellowship in Trauma Critical Care and CPR, MD. Cardiovascular Research Center, Tabriz University of Medical Sciences, Daneshgah Street, Tabriz -51664, I.R Iran. T.: +989141164134 F.: +984113352078 E-Mail: soleimanpourh@tbzmed.ac.ir

Introduction

Patient safety and acquiring skilled practice has always been of great importance for the physician of all eras [1;2]. Central venous catheters (CVCs) provide us with the evaluations of the hemodynamic parameters which could not be assessed via non-invasive methods. Furthermore, medication administration and nutritional supports which could not be delivered through peripheral lines can be easily given to patients using CVCs [3;4]. Nevertheless, administration of CVCs has been reported to be associated with undesirable complications imposing extra costs to both patients and health systems. More than 15% of the patients with CVCs have suffered numerous complications including mechanical (5-19%), infectious (5-26%) and thrombotic (2-26%) complications [3].

Case Report

Our patient was a 78 year old male who had undergone mechanical ventilation due to acute respiratory distress syndrome (ARDS) and refractory septic shock. His hemodynamic status was monitored continuously through the existing arterial line and hit vital signs were as follows: SBP=55mmhg, DBP=24mmhg, Pao2=45mmhg, PH=6.98, Lactate›15mg/dL, Paco2=12mmhg, HCO3=4meq/lit

Due to loss of the existing right Internal jugular CVC and the prompt need for establishing an appropriate intravenous line, it was decided to establish a CVC through left internal jugular vein. To confirm the correct placement of the catheter, it was attached to a pressure transducer which did not show any pulsatile or forward-coming blood stream or any high pressure flow of blood into the line. Furthermore, taken samples from the CVC were dark similar to venous blood. Considering the critical status of the patient and the existing evidence, to increase the blood pressure of the patient noradrenaline infusion was initiated from the established CVC. After a few minutes, commencement of a pulsatile and forward-coming blood stream with high pressure flow of blood into the line assured us from the incorrect placement of the CVC in the artery.

Discussion

CVCs have been reported to be associated with numerous complications including catheter-related infections, thrombosis, pneumothorax, arterial puncture, incorrect placement, chylothorax, hydrothorax, right atrium puncture and airway compression due to hematoma [3].

Pneumothorax, arterial puncture and hematoma are of the most common mechanical complications of CVCs [3;5]. Pneumothorax and hemothorax are more common in subclavian compared to internal jugular approach whereas arterial puncture is more common in internal jugular approach. Arterial puncture and hematoma are also common in femoral approach; however, subclavian and jugular approaches are mostly preferred to femoral approach due to its more frequent association with mechanical complications [3;4]. Arterial puncture has been reported to occur in 6.3-9.4% of the jugular approach, 3.1-4.9% of the subclavian approach and 9-15% of the femoral approach [3]. Factors contributing to increased complication rates in the patients include inexperienced intervener, increased number of attempts for catheterization, 20>BMI>30, short neck, low blood pressure, coagulopathy, large size catheter (e.g. dialysis catheter), history of radiotherapy on the site, previous catheterization and catheterization in the emergency situations [4;5].

Different methods have been introduced to increase the success rate of establishing CVCs as following:

1. Experienced intervener: similar to most medical procedures, the rate of the complications decreases according to the expertise of interveners[3].
2. Ultrasonography has gained its way through all fields of the medicine [6]. The use of ultrasonography guide throughout the catheterization: this would decrease complication rates. Using ultrasonography guide throughout the internal jugular catheterization leads to decreased in mechanical complications. However, administration of ultrasonography guide throughout the subclavian vein catheterization has been associated with controversial results due to its anatomical difference. The needle of the catheter is echogenic in ultrasonography while vascular structures can be seen as echoless (black) areas. Key characteristics in ultrasonography assist us in differentiating vein from artery as veins could be easily compressed and they have thin walls without arterial pulsation. In the hospital and medical centers equipped with ultrasonography facilities, physicians should gain the required expertise and utilization of ultrasonography should be borne in mind especially in internal jugular vein catheterization [3-7].
3. Anatomical landmarks: using the landmarks in normal anatomical conditions without normal variations could decrease complication rates [4;7].

Approaches used for confirming that correct placement of the catheter include:

1. CXR: Performing CXR following catheterization is essential to rule out probable pneumothorax and haemothorax and to confirm the position of the catheter tip. CXR should be taken in standing or semi-sitting positions for a better evaluation of air or liquid existence. In ill patients, patient rotation or oblique ray emission could mislead the physician regarding the position of the catheter tip [7].
2. ABG and Po2 content of the catheter sample: following catheter establishment, instantly a blood sample should be sent for ABG and Po2 analysis. This would help us in differentiating arterial from venous blood [4].
3. Attachment of the catheter end to the pressure transducer and evaluation of the pressure curves: this method helps to find the correct place of the catheter. Arterial blood pressure and central venous pressure (CVP) waveforms cannot differentiate arterial and venous placement of the catheter whenever the blood pressure or effective circulatory volume is low [6-8].
4. Evaluation of the blood stream regarding its being pulsatile or not and its colour: in patients with normal blood pressure and arterial oxygen pressure, it would be easy to distinguish arterial puncture due to the fact that following arterial puncture, a pulsatile light red stream of blood could be observed. However, in patients with very low blood pressure, low levels of haemoglobin or low arterial oxygen saturation these findings may not be present. In case of any doubt regarding the introducer needle being either inside an artery or a vein, a single-lumen catheter 18 F should be placed inside the vessel through the wire. This catheter could be attached to a pressure transducer to confirm

the vein wave curves [4;6].

In our patient, considering his being ill and conditions such as low blood pressure and hypoxemia due to underlying ARDS, he could not be sure of the correct catheter placement using CXR due to rotation; or ultrasonography due to lack of arterial pulse; or CVP curves due to low blood pressure; or the color or the pulse of the bloodstream due to our patient's being hypoxemic and hypotensive. In similar conditions, considering the fact that our patient already had an arterial line, we could confirm the correct placement of the catheter comparing Po2 levels of the samples taken from the catheter and the arterial line. However, in patients without arterial line, being hypoxemic and or hypotensive would also limit us regarding the samples taken from peripheral vessels. This leads to the question that how the correct catheter placement could be confirmed in cases without arterial line.

Competing interests

The authors declare that they have no competing interests.

References

1. Soleimanpour H, Gholipouri C, Panahi JR, Afhami MR, Ghafouri RR, Golzari S, Soleimanpour M, Esfanjani RM. Role of anesthesiology curriculum in improving bag-mask ventilation and intubation success rate of emergency medicine residents: a prospective descriptive study. BMC Emerg Med 2011; 11:8.
2. Golzari SE, Khan ZH, Ghabili K, Hosseinzadeh H, Soleimanpour H, Azarfarin R, Mahmoodpoor A, Aslanabadi S, Ansarin K. Contributions of medieval Islamic physicians to the history of tracheostomy. Anesth Analg 2013 [In press].
3. McGee DC, Gould MK. Preventing complications of central venous catheterization. N Engl J Med 2003; 348(12):1123-33.
4. Kusminsky RE. Complications of central venous catheterization. J Am Coll Surg 2007; 204(4):681-96.
5. Pikwer A, Acosta S, Kölbel T, Malina M, Sonesson B, Akeson J. Management of inadvertent arterial catheterisation associated with central venous access procedures. Eur J Vasc Endovasc Surg 2009; 38(6):707-14.
6. Golzari SE, Sokouti M, Ghaffari A, Bazzazi AM, Ghabili K. Ultrasonography in diagnosis of pulmonary hydatid cysts. Lancet Infect Dis. 2013;13(4):294.
7. Izakovic M. Central venous pressure--evaluation, interpretation, monitoring, clinical implications. Bratisl Lek Listy 2008; 109(4):185-7.
8. Pittman JA, Ping JS, Mark JB. Arterial and central venous pressure monitoring. Int Anesthesiol Clin 2004; 42(1):13-30.

How to cite this article:
Soleimanpour H, Golzari SE, Rahmani F, Mokhtarpour M. Inadvertent Arterial Puncture During Central Venous Catheter Insertion. J Clin Anal Med 2016;7(suppl 2): 93-5.