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Report of successful modified central vein catheterization: A technical paper

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Abstract

Problem statement: Central vein catheterization (CVC) is a usual and accepted way for monitoring hemodynamic status or prescribing medication in seriously ill patients. internal jugular catheterization, is one of the most acceptable roots for catheterization, because of its accessibility and ability to compress the vein, but in the standard method explained in Robert and Hedges, clinical procedures textbook, there is significant instruction for needle direction and patient position but in some cases, this method is not successful, especially in beginner and trainer students. So new studies have examined new methods in previous approaches (such as the use of ultrasound guides). This paper is about a modified method of catheterization, with a simple modification in needle direction and patient position, based on emergency medicine specialists experience, without any excessive instruments, this method can be used by other physicians as will be explained subsequently.

Objective: This study reports the success rate and complications of a verified method of central vein catheterization (CVC) by emergency medicine specialists.

Methodology: After preparation and cardiac monitoring, the patient is in a neutral position with the head rotate 20-30 degrees to the other side and feet are in line with the body. Then the needle was inserted from the middle of both ends of the sternocleidomastoid muscle, one centimeter above the clavicle bone while the direction of the needle was toward the foot on the same side and along the internal jugular vein, the angle between the skin and needle was 30-40 degrees. While applying negative pressure (suction), after passing the needle through the skin, it was gently inserted into the site up to the 2.5 centimeter distance of the needle tip. In case of unsuccessful venipuncture, the needle was pulled backward gently to the surface of the skin while maintaining suction. In the case of a blood jet inside a vein, the wire was first passed and then a catheter was inserted. After catheterization, chest X-ray was taken from all patients, and complications were checked.

Results: In this trial, all CVC was successful and 9 CVC were with simple complications such as catheter location in the left ventricle (n=3), in the carotid artery (n=1), pneumothorax and hemothorax (n=1).

Conclusion: Since the vein is more available in the innovative modified method than the standard method, it may be preferred to the standard conventional method.

Keywords: Central Venous Catheters, Dialysis, Emergency Medicine

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Introduction

Central vein catheterization (CVC) is an accepted method in a wide range of patients for monitoring hemodynamic status or prescribing medication, chemotherapy, blood and blood products transfusions, venous fluids, hemodialysis, and implantation of a pacemaker(1). Early complications that can occur immediately after central vein catheterization include mechanical complications (arterial puncture and pneumothorax) and complications due to malposition of the catheter(2). In the standard method explained before, in Robert and Hedges, clinical procedures, the needle direction (during internal jugular catheterization, central approach) should be toward the same side nipple, in some cases, this method goes to mechanical complications, especially in beginner and trainer students(3). New studies have examined new methods in previous approaches (such as the use of ultrasound guides(4). In some cases, ultrasound has replaced chest x.ray after catheterization(5).

This paper reports the success rate of the modified method of catheterization, based on emergency medicine specialists' experience with modification in needle direction during catheterization, by determining the success rate and its complications, in patients in whom the standard implantation method has not been successful.

Materials and Method

This paper reports the success rate of the modified method of catheterization performed in Shahid Sadoughi and Shahid Rahnemoon educational hospitals with Ethic Code No. IR.SSU.MEDICINE.REC.1397.165.

All of these patients need to urgent central vein catheter, and the preferred root for all of these patients was the internal jugular, but the standard method of catheterization wasn`t successful. The first CVC was done by surgery resident, or specialist. After preparation and cardiac monitoring, the patientlye in neuterpositionwith head rotate 20-30 degrees to other side and foots are in line with the body.

Then, the needle was inserted from the middle of both ends of the sternocleidomastoid muscle, one centimeter above the clavicle bone while the direction of the needle was toward the foot on the same side and along the internal jugular vein, the angle between the skin and needle was 30-40 degrees.

While applying negative pressure (suction), after passing the needle through the skin, it was gently inserted into the site up to the 2.5centimeter distance of the needle tip.

In case of unsuccessful venipuncture, the needle was pulled backward gently to the surface of the skin while maintaining suction.

In the case of a blood jet inside a vein, the wire was first passed and then a catheter was inserted.

If unsuccessful, patients underwent catheterization by other veins, such as subclavian or femoral catheterization.

After catheterization, chest X-ray was taken from all patients and the presence or absence of pneumothorax and the correct location of the catheter were checked. Information on all of the above was collected and reviewed.

Moreover, the patient's blood pressure, pulse rate, any respiratory symptoms (such as shortness of breath, distress, increased respiration rate), and swelling or hematoma at the catheter site were checked every 1 hour after catheterization 6 times.

Results

27 patients 13 patients (48.1%) were male and 14 patients (51.9%) were female.

The mean age of patients was 48.4±18.04 years. There were not any failures in catheter placement. 18 (66.7%)of CVC location in control CXR was correct, and 9 (33.3%) location was in the wrong place.

According to Table 1, One patient (3.7%) suffered from pneumothorax (Ptx), whose, the chest tube was inserted immediately.

Short-term complications are complications that occurred just at the moment of the procedure or some minutes after that, in Table 2 these complications are listed, and theirs treatment.

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Table1. Reasons for catheter placement in the wrong place after chest control radiography

Problem observed	Tip of the catheter is located in the left ventricle	The catheter is present in the carotid artery	The catheter is not close enough to the right place
N (%)	3 (11.1)	1 (3.7)	4 (14.8)
Corrective action taken	The catheter was pulled back and placed in place	The catheter was removed and re-inserted	Due to the fact that the catheter did not malfunction, no change was made in the catheter location

Table 2. Short-term complications after catheterization

Bleeding from the catheter site	Incidence of respiratory distress	Hematoma at the site
2 (7.4%)	1 (3.7%)	6 (22.2%)
One patient was controlled with a compression bandage after 6 minutes of bleeding	A case of pneumothorax occurred. The patient already had brief pleural effusion for which a chest tube was inserted	3 cases of hematoma with a size of less than 2 * 2 cm
One person was controlled by tying another suture next to the bleeding catheter		3 cases of hematoma with a size between 2-4 cm
Both had a small hematoma next to the catheter after 6 hours		

Discussion

The use of jugular internal vein has been more popular for CVC due to its ability to compress (in cases of arterial puncture and hematoma), a clear landmark, and less infection rate.

The rate of pneumothorax in the case of the standard method and the intensive care unit is (1.7%-2.5%) and in this method was 3.7%, this result is comparable(6).

Mal positioning of the catheter is an acceptable problem during this type of surgery and its occurrence rate in our modified method (27%), is comparable with standard methods. Other complications such as bleeding and hematoma or pulmonary injury, were 7.4, 22.2, and 3.7% respectively. In the innovative method, the foot of the same side is pointed regardless of the artery. This method probably reduces the errors related to normal vascular anatomical variations. In the innovative method, we try once toward the foot, and if we do not succeed, we try only once toward the breast on the same side. As a result, over-manipulation of the site and the related complications are diminished.

The failure rate in the standard method is 5-10% for skilled clinicians and 4.19% for less skilled ones. Considering that the approach to the central venous catheter has not been reviewed and studied for the last 19 years, and due to the convenience of the approach to the vein in the innovative method, also given that it is not much different from the standard method, it can be concluded that the innovative method may become one of the standard modalities in the future. Since the vein is more available in the innovative method than the standard method, it may be preferred to the standard central route method.

In the modified method, the patient is supine and given a Trendelenburg or neuter position, the head is placed in the neuter position, or slightly away from the approach, and don`t need for Valsalva maneuver, and the inertance site of the needle is one centimeter above the clavicle, we enter between the sternocleidomastoid muscle.

But in the standard method, there are some differences, such as; a towel with a roll is placed under the scapula, to improve the position. The head

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is positioned 5 to 10 degrees to the opposite side. Valsalva maneuver is needed, we enter near the top of the triangle between sternocleidomastoid muscle and clavicle.

Conclusion

Since the vein is more available in the innovative modified method than the standard method, it may be preferred to the standard conventional method. It is suggested that other physicians also use this method and report its success rate.

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Conflict of interest

The authors declare no Conflict of interest.

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