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Features of surgical line managements in Baku

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ABSTRACT

Aims: Central venous catheters (CVC) have become an acceptable form of permanent access in patients with limited access options. Proper management of this procedure is crucial for a successful treatment period. Therefore, we aim to demonstrate our insertion steps and discuss our findings with the literature, highlighting the successful outcomes we have achieved.

Methods: After the approval of the hospital directorate, central catheters were inserted into pediatric patients at a Children's Hospital in Baku through a retrospective review of patient notes over the last two years. Experienced or inexperienced staff, operating theatre or ward, emergent or elective insertions, catheter diameters, catheter dimensions, selected models, number of lumens, reason for insertion, insertion method, fixation methods, dressings, and locations of catheter tips are evaluated. Also, companies that produce catheters are mentioned.

Results: Sixty-three CVC insertions were performed via CVC between 2021 and 2023. Forty-one catheters were inserted by senior staff. Sixty-one were inserted in the operating theatre. Fifty-four were emergent applications. Mainly, 6.5 and 7 French lines were used. Three different international companies supplied the catheters. Half of the catheters used were double-lumen. Oncology diseases were the most common reasons for insertions (n=40). Seldinger's method was the main one chosen for insertions (n=59). Prolene sutures are mainly used to fix catheters. After insertions, iodine dressings (tegaderm®) are commonly used (n=48). The right atrium was the principal place for the lumen tip (n=39).

Conclusion: Our procedures for central venous catheterizations are similar to those in the literature. Nevertheless, the catheter might be positioned at the ending area of the superior vena cava. We observed no harm in the patients with the right atrium location. Also, fixation and trademarks might be matters of evaluation about the effectiveness of procedures.

Keywords: Children, central venous catheters, features

INTRODUCTION

Central venous catheters (CVC) are devices that must be used inevitably when medium or long-term vascular access is required.[1-3] Their use has been significantly increased, especially in the last 20 years.[2] The most crucial factor in this situation has been the emergence of the need for reliable vascular access for modern daily health care.[4] Central catheters have become preferred over time for their comfort, convenience, cheapness, and long-term use against the possibility of complications.[5]

Especially in intensive care units, emergency rooms, operating rooms, and wards, situations requiring urgent or planned insertion for reasons such as patient diagnosis and treatment frequently occur.[1,3,6] CVCs are used for various reasons: hemodynamic monitoring, parenteral nutrition, extracorporeal treatments, blood samples, drug and fluid treatments, and supplementation of blood and its products.[6,7] The reasons for using CVC are generally for treating oncological diseases.[8] They also form the permanent access option in a limited subset of dialysis patients. If a CVC is placed in an emergency, removing it after 48 hours is also recommended. The purpose of the use is essential in terms of catheter choice.[4,7] It is necessary to evaluate which catheter will be preferred.[7]

Placement of central catheters is an application that requires technical expertise.[3] Otherwise, it may cause an increase in complications and infections.[3] Practitioners' ability to implement the central venous catheter with evidence-based practical information will ensure effectiveness and sustainability.[9] Although institutional conditions may vary, effective use can be designed by paying attention to basic features.[9]

Differences may occur regarding catheter insertion in emergency or elective situations and the ability to use the catheters. If a central venous catheter is inserted in an emergency, it is also recommended to be removed after 48 hours.[7]

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The diameter of the catheters is related to the catheter and catheter location to be used according to the patient's needs. When choosing a catheter, it must be smaller than the venous diameter, but it is reported that its use will be problematic in case of excessive stenosis.[7] Therefore, catheters of different diameters are available.

While the evaluation of catheter brands in terms of effectiveness and sustainability is not a widely discussed topic, it is an area that warrants attention. These brands offer various types of catheters, and choosing between silicone or polyurethane catheters can also impact effectiveness. Therefore, future research should consider the role of catheter brands in CVC management.

They are generally defined as tunneled central catheters, peripherally located central catheters, and implanted catheters.[9] The catheters are generally tunneled, cuffless, or cuffed catheters.[7] These may also be called subcutaneous ports or Hickman-Broviac.[8] The purpose of CVCs used with cuffs is to prevent infection by causing fibrosis in the cuff area and to fix the catheter.[8] Mainly, dual-lumen catheters are used. Dual-lumen tunneled catheters are the preferred form of access for intermediate use. One of the indications for using CVC is to cover the examination and treatment process in emergencies.[7] Although methods such as a peripheral catheter or intraosseous catheter are at the forefront, placement of CVC is also essential when necessary.[7]

It has been stated that when a central catheter is inserted, fixation without stitches is better and that subcutaneous anchorage, cyanoacrylate adhesive, or a semitransparent dressing can be used.[7]

One of the necessary conditions for central catheters to be used under appropriate conditions is the placement of the catheter with a maximum sterile protection barrier.[10] Catheter dressings can be made with sterile gauze or transparent and semi-permeable materials.[10] In a study conducted in Mexico, it was stated that complications caused by infection will decrease if various parameters are taken into consideration.[5] In addition to appropriate dressing, hand hygiene, skin asepsis, maximum barrier use, timely catheter removal, and maximum infection prevention in pediatric intensive care units have been identified as the most critical factors.[5]

Improper placement of central catheters is a situation that can be considered a complication.[5] Methods that can be used to insert the catheter include blind insertion, venography (an old method), ultrasonography, or fluoroscopy.[7] The tip of the central catheter is expected to be adjacent to the right atrium and superior vena cava.[3] It is essential to determine the catheter location.[11] For this purpose, USG and X-ray evaluation can be used.[11]

We evaluated these features in our patients and tried to understand local behavior compared to the literature.

METHODS

The study was carried out with the permission of Ethical Committe Ege Hospital (Date: 17.09.2024, Decision No: 392). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

After the hospital directorate approved the study, data from 63 patients hospitalized in the Clinical Medical Center were evaluated. The study evaluated the staff that inserted CVC, the place insertion performed, emergency or elective insertions, line sizes, catheter trademarks, catheter types, reason for insertions, insertion method, surgical sutures used for insertions, dressing types, and catheter tip. Features of the central venous catheter insertions were documented to define our cumulative management strategies retrospectively-all parameters, where available, were discussed with literature.

RESULTS

CVC insertions were performed in 63 patients. All data are defined in the **Table 1** and **Table 2**. Emergent procedure is performed in fifty-four patients, and elective procedure is performed in 11. Senior surgeons performed forty-one insertions, and 22 insertions were performed by residents. Sixty-one were performed in the operating theatre. Fifty-four insertions were performed in emergent conditions. Different catheter sizes were used between 3F and 12F. The most used catheter was 6.6F, and 27 catheter insertions were performed with this size. Seven-French size catheter was the second most used one. Products from three companies were used. Double-lumen catheters were the most needed type, and 29 catheters were in this group. Forty oncology patients received the insertions. Parenteral nutrition, hematology diseases, and antibiotics-related treatment patients followed this group.

Table 1. Features of CVC insertions and number of interventions

Line inserted by	Senior: 61		
	Junior: 2		
	Total: 63		
Line insertions	Operating theatre: 61		
	Ward: 2		
Planning	Emergent: 54		
	Elective: 9		
Line size	6.6Fr: 27	7Fr: 23	4.2Fr: 4
	5Fr: 4	3Fr: 2	6Fr: 1
	10Fr: 1	12Fr: 1	
Type of catheters	Double lumen: 29		
	Single lumen: 8		
	Hemodialysis: 3		
	NA: 21		

NA:Not available, CVC: Central venous catheters

Table 2. Features of CVC insertions and number of interventions

Patient diagnosis	Oncology: 40
	Parenteral nutrition: 12
	Hematologic: 5
	Antibiotics: 3
	NA: 3
	Total: 63
Insertion technique	Percutaneous: 59
	Surgery: 4
Fixation	Prolene: 15
	Polydioxanone: 2
	Silk: 1
	NA: 45
Dressing	Tegaderm: 43
	Gel contents:10
	Biopatch: 3
	Steril sponges: 3
	NA: 4
Tip locations	Right atrium junciton: 39
	Upper right atrium: 16
	Superior vena cava: 6
	Middle atrium: 1
	NA:1

NA:Not available, CVC: Central venous catheters

Almost all of them were inserted using Seldinger's method. Fifteen catheters were fixed with prolene sutures; two were with polydioxanone, and one was with silk sutures. Unfortunately, information for surgical sutures for other patients was not found. Forty-three patients were treated with tegaderm; other dressings were biopatch, jelly, and povidon-iode. Thirty-nine catheter tips were located at the right atrium junction. Sixteen were in the upper atrium. One was in the middle atrium. Six were in superior vena cava.

DISCUSSION

While the problems caused by catheters can be disturbing even in adults, it can be expected that children's compliance with a central venous catheter and the problems may be more psychologically complex.[8] For this reason, much work is being done worldwide on the placement and maintenance of CVC.[9] Naturally, in case of systematic central catheter use errors, a review will be mandatory individually or in the healthcare system.[9] For this reason, the most crucial point for CVC is to observe the effectiveness of catheter placement before treatment.[9] Studies have stated that the most crucial point for these practices to be effective and sustainable is to be trained in using central catheters and, therefore, to allow people to perform these practices.[1,9] It is stated that to prevent complications, experienced physicians should perform central catheter placement, or an experienced physician should be present next to the inexperienced physician.[6] The American Board of Internal Medicine reports that approximately 10-290 catheter insertion procedures must have been performed to gain experience.[6] In our clinic, 61 of the 63 catheters were made by an experienced surgeon. It has been observed that this approach is compatible with general acceptance. It is essential for physicians working as assistants to be involved in and observe these procedures.[8] These observations will ensure they understand the device and are familiar with all the procedure features.[8] For now, two catheter placements have been performed with junior staff.

It has been determined that the area of placement is as essential as catheter placement. Studies have stated that hospitals try to prevent central catheter use outside intensive care units.[1] It has been stated that they aim to prevent possible complications by ensuring that it is used by specific procedures.[1] It was stated that 33 pediatric hospitals work at specific standards to ensure catheter placement with appropriate procedures. All these hospitals are members of an organization called "Children's Hospital Solutions for Patient Safety" and collaborate.[1] In a study conducted in Italy, any central, peripheral, or intraosseous catheter that can be placed in patients' emergencies is expressed as necessary.[7] Central catheters with or without tunnels are also included. However, if a CVC is inserted in an emergency, it is also recommended to remove it after 48 hours.[7] It has been determined that central catheters inserted in operating rooms will likely cause bloodstream infections.[2] In our study, it is seen that most of the catheters are incompatible with the literature because they are inserted in the operating room. Another study determined that the PICU was where the procedure was performed the least.[9] The reason for the few insertions in the PICU was that the unit was less preferred due to its complexity.[9]

There are different types of CVCs. These are subcutaneous ports, Hickman-Broviac, and non-tunnelled catheters that can be placed peripherally.[8] The purpose of CVCs used with cuffs is to prevent infection by causing fibrosis in the cuff area and to fix the catheter.[8] CVCs are placed for various reasons, such as hemodynamic monitoring, parenteral nutrition, extracorporeal treatments, blood sample collection, drug and fluid treatments, and supplementation of blood and its products.[6] A study found a lack of peripheral vascular access in 47% and the need for hemodynamic monitoring in 22%.[6] In the same study, the authors found their reasons to be 28% fluid and drug therapy, 25% extracorporeal therapy, and 25% lack of peripheral vascular access.[6] The catheters used in our hospital were mainly used for oncological reasons and international use. After this reason, according to the frequency of use, patients used for parenteral nutrition, hematological reasons, and antibiotics come next. What the diseases are is excluded from the purpose of our study. In addition, the majority of catheters used were double-lumen catheters. Single-lumen and hemodialysis catheters follow this type of catheter. It is understood that this choice is compatible with international practice.

Evaluation according to the diameter of catheters is very rare in the literature. One study reported that catheters should be smaller than the venous diameter, but if necessary, they will have problems in case of excessive stenosis.[7] We used catheter diameters as data in our study, but no study or evaluation criteria evaluate diameters according to cases. However, planning which catheter is most appropriate has been examined.[1] For this purpose, it has been stated that central venous catheter sets are established, and the catheter properties are determined according to the patient's condition.[1] It has been stated that catheter-related complications can be reduced this way, but there is little literature on this type of information for children.[1] For this reason, detailed analysis was not used in our study. The use of 6.6 and 7F catheters as a preference can be expressed as a clinical feature.

There is no comparison and effectiveness analysis of catheter brands. This is understandable. In our study, the brands were taken into account, but instead of expressing them as names, it was deemed appropriate to identify the three most used brands worldwide. We believe that the necessity of performing effectiveness analyses of these brands should be considered a principle in future studies.

In our study, almost all catheter placements were performed using the percutaneous (Seldinger's) method using ultrasonography. No difference was found in complications of central venous catheter complications, especially infection and thrombosis, between using and not using ultrasonography.[6]

It has been stated that when a central catheter is inserted, fixation without stitches is better, and subcutaneous anchorage, cyanoacrylate adhesive, or semitransparent dressing can be used for this.[7] Our study found that sutures were placed in nearly half of our patients. We have recorded the sutures, but a detailed study needs to be done. We tried to find records of the subjects in our archives for many of our patients. It was decided to follow the issue in our subsequent clinical follow-ups.

A study showed that catheter-related infections were significantly reduced if catheter care was performed with povidone-iodine.[2] Although there are drawbacks to the

use of chlorhexidine because it causes skin problems, especially in premature babies, it continues to be preferred worldwide.[2] In our patients, a semitransparent iodine-impregnated drape was used, and other methods were used. This situation was thought to be compatible with the literature.

A study stated that the tips of the catheters could be visualized at a rate of 95% using USG.[11] In the same study, care was taken to ensure the catheter tip was placed adjacent to the tracheal bifurcation.[11] If the catheter is placed in the cranial direction, problems such as central venous pressure measurement error or spontaneous catheter removal may occur. If it is sent too much toward the heart, problems such as arrhythmias, tears in the atrial or ventricular walls, and hemopericardium may occur. It is known that the optimal placement area is the lower 1/3 of the superior vena cava until its junction with the right atrium.[11] The tracheal carina is the best landmark. However, in some studies, it can be expressed as slightly below the carina.[11] It was determined that the catheter was located close to the cranial position in one of our patients and that the others were located typically.

CONCLUSION

Our catheter applications in operating room conditions differ from the literature, and when compared, it is understood that we do not have a definitive, standard application. However, paying attention to the practitioner's characteristics, being sensitive about the location of the catheter, and the care shown for the care processes are at world standards. We cannot say whether CVC placement is similar across our country, but the information of our clinic is important as a start.

ETHICAL DECLARATIONS

Ethics Committee Approval

The study was carried out with the permission of Ethical Committe Ege Hospital (Date: 17.09.2024, Decision No: 392).

Informed Consent

Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

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Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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