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Research Paper

Examining the Frequency of Port Catheter Complications and the Duration of Its Performance Associated With the Length of the Catheter in Patients With Port Placement

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ABSTRACT

Background and Aim: Considering that the use of port catheters in long-term treatments and the quality of life (QoL) of patients with special conditions, including children, is particularly important, we decided to investigate the effect of the length of the port catheter on the duration of its performance in children.

Materials and Methods: All the files of patients referred to the Surgery Department of Hazrat Masoumeh (PBUH) hospital, who underwent catheterization, were examined by observing the inclusion and exclusion criteria. The inclusion criteria included patients aged 14 years or younger with proven acute leukemia and the need for long-term intravenous access, survival of more than one week at the time of the patient's entry into the study, and undergoing aggressive chemotherapy. The exclusion criteria included any contraindication to surgery or local anesthesia, sensitivity to lidocaine or anesthetics, evidence of any contraindication to using a subcutaneous catheter, clinical superior vena cava syndrome, and any mass or anatomical anomaly. A pediatric surgeon performed all ports. In the last stage, all the information related to the research was extracted from the existing files of these patients and analyzed with SPSS software, version 22.

Results: In this study, the infection rate was 4(3.3%), bacteremia rate 5(4.2%), and thrombosis 13(10.8%). No statistically significant relationship was observed between the frequency of catheter port complications (infection, bacteremia, and thrombosis) with the gender of the patients or the catheter length. Furthermore, it was found that with the increase in the length of the catheter port, the time of complications also increased, and this increase was statistically significant.

Conclusion: Considering the complications of catheter port, the correct way to use and how to take care of the catheter during the treatment of patients should be optimally done.

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Journal of Vessels and Circulation
Qom University of Medical Sciences

1. Introduction

Injection treatment using the venous port system is one of the secondary ways of treatment [1]. The use of ventricular assist devices (VAD) is vital in the treatment and health status of children and infants, and they are used in acute and chronic conditions of patients or long-term treatments [2, 3]. According to the recommendations of the European Association, solutions with a low osmolality of less than 850 mosm/L via peripheral vein catheters can be used. Dodrick introduced central venous catheters in 1968, and were first used in 1973. In 1980, the subcutaneous system of port catheters was used for the first time [4]. A catheter port is usually used in cases of long-term treatment, such as intravenous injection of blood products. As a result, the catheter port system limits the need to use peripheral veins and improves patients' quality of life [5]. Port catheters have three parts: a portal containing a septum in the upper part, a narrow flexible catheter, and a catheter interface connecting the catheter with the portal [6, 7].

Applying port catheters is usually done with two methods in the chest and arm. The place of the catheter is better to be in the chest because, in this case, it will be easier to access the jugular and subclavian veins. The tip of the catheter is usually placed at the entrance of the superior vena cavae to the heart [8]. Port catheters are usually used in chemotherapy, intravenous feeding, taking a blood sample, injecting blood products, antibiotic therapy, injecting coagulation factors, and injecting radiological contrasts for imaging. Some conditions are considered cases of definitive use of port catheters, including all patients with malignancy despite the condition of the diseased vessels and hemophilia patients who receive coagulation factors for long-term prophylaxis or are treated with factor inhibitors. The possibility of allergic reactions, local or systemic signs of infection, or signs of disseminated intravascular coagulation (DIC) or disseminated vascular coagulation during catheter operation are absolute contraindications to the use of port catheters [9, 10]. The most common complication of port catheters is pneumothorax. To reduce this complication, internal jugular veins can be used in subcutaneous surgeries (based on vascular anatomy) instead of subclavian veins, which may not be available based on vascular structure. As a result, it is better to use the catheter under imaging guides (plain doppler, echo-color doppler, and digital venography) [11]. Many factors affect the duration of catheter port operation. In the studies conducted in this field, factors such as the origin of malignancy [12, 13], infection [14], improper placement of the catheter [15], bleeding [16], skin necrosis caused by infection [17], and port reservoir filling [18] were effective and studied factors in this field. Until now, enough studies have not been conducted on the effect of catheter port characteristics, including its length, in the world and especially in Iran. Considering that the use of port catheters in long-term treatments and the quality of life of patients with special conditions, including children, is particularly important, we decided to investigate the effect of the port catheter length on the duration of its performance in children.

2. Materials and Methods

This study was cross-sectional analytical. The target population of this study was all patients with port placement under 14 years of age with acute leukemia in Hazrat Masoumeh Hospital in Qom City, Iran. The required sample size was estimated at 118 people according to the following formula and considering the frequency of catheter complications equal to 53.7% based on similar studies [19], considering the confidence level of 95% and the accuracy of 0.09. The sampling method in this study was convenience sampling and target-based sampling. After approving the design and obtaining the ethical code from the Research Committee of Qom University of Medical Sciences and coordination with the hospital and the agreement of the treatment staff, all the files of the patients were referred to the Surgery Department of Hazrat Masoumeh Hospital, who underwent catheterization, were reviewed by observing the inclusion an exclusion criteria. The inclusion criteria included patients under the age of 14 years with proven acute leukemia and the need for long-term intravenous access, survival of more than one week at the time of the patient's entry into the study, and undergoing aggressive chemotherapy. The exclusion criteria included any contraindication to surgery or local anesthesia, sensitivity to lidocaine or anesthetics, evidence of any contraindication to subcutaneous catheter use, clinical superior vena cava (SVC) syndrome, and any mass or anatomical anomaly were excluded from the study. All ports were performed by a pediatric surgeon. In the last step, all the information related to the research was extracted from the existing files of these patients. Study descriptive statistics, including Mean±SD, percentage, and frequency of the study objectives, were analyzed in SPSS software version 22. An independent t-test was used to analyze quantitative data. The Chi-square test was used to analyze qualitative data. In this study, a significance level of≤0.05 was considered.

3. Results

In this study, 71 boys (59.2%) and 49 girls (40.8%) were examined. The Mean±SD age of the studied patients was 38.3±39.3 months.

In 73 patients (60.8%), the catheter length was less than 12 cm, and in 47 patients (39.2%), it was more than 12 cm. The duration of complications of the catheter used in patients was less than 3 months in 14 cases (11.7%), between 3 and 12 months in 7 cases (5.8%), more than 12 months in 1 case, and no complications in 98 cases (81.7%). Catheter infection occurred in only 4 cases (3.3%), and no infection occurred in 116 cases (96.7%). Bacteremia occurred in 5 cases (4.2%) and thrombosis in 13 cases (10.8%).

Two men (50%) had an infection, 3 men (60%) had bacteremia, and 10 men (76.9%) had thrombosis. Also, 2 women had an infection (50%), 2 women (40%) had bacteremia, and 3 women (23.1%) had thrombosis. Fewer complications were observed in women, but infection (χ^2=0.14, P=0.90), bacteremia (χ^2=0.001, P=0.97), and thrombosis (χ^2=1.90, P=0.17) had no statistically significant relationship with the gender of patients (Table 1).

Among people with a catheter length less than 12 cm, 9 people (69.2%) had thrombosis, 1 person (25%) had an infection, and 3 people (60%) had bacteremia. Also, with a catheter length of more than 12 cm, 4 people (308%) had thrombosis, 3 people (75%) had an infection, and 2 people (40%) had bacteremia. The Chi-square test showed that the frequency of catheter port complications (thrombosis) (χ^2=0.43, P=0.50), infection (χ^2=2.23, P=0.30), bacteremia (χ^2=0.002, P=0.99) has no statistically significant relationship with catheter length (Table 2).

Table 1. Determining the frequency of catheter port complications in terms of patient's gender

Complications		No. (%)			P
		Gender		Total	
		Boy	Girl		
Infection	Positive	2(50)	2(50)	4(3.3)	χ^2=0.14 P=0.90
	Negative	69(59.5)	47(4.5)	116(96.7)	
Bacteremia	Positive	3(6)	2(40)	5(4.2)	χ^2=0.001 P=0.97
	Negative	67(59.1)	47(40.9)	115(95.8)	
Thrombosis	Positive	10(76.9)	3(23.1)	13(10.8)	χ^2=1.90 P=0.17
	Negative	61(57)	46(43)	107(9.2)	

Table 2. The relationship between catheter length and complications in patients with port placement

Complications		No. (%)		P
		Catheter Length		
		≤12 cm	≥12 cm	
Thrombosis	Yes	9(69.2)	4(30.8)	0.5
	No	64(59.8)	43(40.2)	
Infection	Yes	1(25)	3(75)	0.3
	No	72(62.1)	44(37.9)	
Bacteremia	Yes	3(60)	2(40)	0.99
	No	70(60.9)	45(39.1)	

Journal of Vessels and Circulation
Qom University of Medical Sciences

Table 3. Determining the relationship between the length of the catheter port and the duration of its performance in patients

Catheter Length	No. (%)				P
	Time				
	No Complications	≤3 Months	3-12 Months	≥12 Months	
≤12 cm	60(82.2)	12(16.4)	1(1.4)	0(0)	χ^2=11.60 P=0.009
≥12 cm	38(80.9)	2(4.3)	6(12.8)	1(2.1)	
Total	98(81.7)	14(11.7)	7(5.8)	1(0.8)	12(100)

Journal of Vessels and Circulation
Qom University of Medical Sciences

Among people with a catheter length of less than 12 cm, the longest complication time was less than 3 months (16.4%). In people with a catheter length of more than 12 cm, the longest complication time was in the time interval between 3 and 12 months, and the Chi-square test showed that with the increase in the length of the catheter port, the complication time also increases, and this increase is statistically significant (χ^2=11.60, P=0.009), (Table 3).

4. Discussion

This study was conducted to examine the prevalence of port catheter complications and factors related to the duration of its performance in patients with port placement in Hazrat Masoumeh Hospital, Qom City. In this study, 71 boys and 49 girls who had port catheters were examined. Based on the results obtained from this study, the rate of infection was 4(3.3%), bacteremia 5(4.2%), and thrombosis 13(10.8%). Also, no significant relationship was observed between the frequency of catheter port complications (infection, bacteremia, and thrombosis) with the patient's gender. Studies conducted regarding the prevalence of catheter infection in different centers have reported up to 15% [20-23]. For example, Begi et al. aimed to investigate the prevalence of catheter port complications in acute leukemia patients. They reported thrombosis in 11.9%, cellulitis in 4.8%, and bacteremia 14.3% [24]. Di Carlo et al. reported the complications as 1 case of movement, 2 cases of infection, 1 case of thrombosis, and 3 cases of obstruction [25]. The results of our study also showed the complications of the catheter in the same range, while the complications of port placement can be related to factors such as the surgeon's experience, nurses' care, proper placement of the port, and hygiene.

Regarding thrombosis two types of thrombosis are caused by catheters, small thrombosis that is limited to the tip of the catheter and large thrombosis of catheterized veins. In our study, the overall prevalence of thrombosis was investigated, which occurred in 4 patients (3.3%); in Di Carlo's study, only one catheter tip blockage was observed [25]. In the study by Kock et al., thrombus was reported at 2.5% [26]. Also, no statistically significant relationship was observed between the frequency of port catheter complications (infection, bacteremia, and thrombosis) with catheter length. Furthermore, among the people who had a catheter length of less than 12 cm, the time of occurrence of complications was observed in more than 3 months in about 1.4% of cases, while in people who had a catheter length of more than 12 cm, the time of occurrence of complications was observed more than 3 months in about 15% of the cases. In this context, the Chi-square test showed that with the increase in the length of the catheter port, the complication time also increased, which was statistically significant.

Young Hun Choi et al. also conducted a study in 2015 to determine the appropriate length for placing central venous catheters through the right and left internal jugular veins. The findings of this study showed that age, height, and weight significantly correlate with the optimal length of the right and left jugular veins. Also, the length of the optimal data suggested by the information of this study was 0.034×height (cm)+3.173 for the right internal jugular vein and 0.072×height (cm)+2.113 for the left internal jugular vein [27]. In our study, unfortunately, due to the type of study that was retrospective, it was impossible to access this data to accurately estimate the proper length of the catheter about age, height, and weight, and the only finding of our study in this field showed that with increasing the length of the port catheter, the time of complication also increases. Alexey Surov et al. conducted a study aimed at the rate of port catheter embolization, its mechanism, clinical features, and its management. In this study, catheter malfunction occurred in 39%. Furthermore, in 53.7% of cases, catheter embolization was randomly found. The average length of these pieces was 11.6 cm. Catheter emboli may be undiagnosed for a long time and be found randomly. In these patients, the symptoms are mainly local; however, severe systemic clinical

symptoms may develop. Furthermore, the risk of serious complications in asymptomatic catheter embolization is unknown, and catheter parts should be removed to prevent further complications [28].

5. Conclusion:

This study showed no significant relationship between the frequency of port catheter complications (infection, bacteremia, and thrombosis) with the length of the catheter. However, with the increase in the length of the catheter port, the time of complications also increased, which was statistically significant.

Ethical Considerations

Compliance with ethical guidelines

This study has been approved by the Ethics Committee of Qom University of Medical Sciences (IR.MUQ.REC.1397.157).

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Authors' contributions

All authors equally contributed to preparing this article.

Conflict of interest

The authors declared no conflict of interest.

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