

## Original Article



# Port Implantation and Its Side Effects in Cancer Patients: An Oncology Center Experience

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## ABSTRACT

**Objectives:** Port placement is a helpful tool in cancer patients requiring long-term intravenous therapy. However, the tool is used in a small number of patients in Iran due to various reasons, such as no facilities and time, limited access, and poor patient cooperation. This study aims to examine the frequency of port placement and its complications in cancer patients.

**Methods:** In this prospective study, the data of cancer patients who underwent port placement and received chemotherapy were collected from October 2019 to September 2020. Then, we reviewed and analyzed their demographic characteristics, method and frequency of port placement, and the associated complications.

**Results:** Of 2634 patients who received chemotherapy, 50 underwent port placement (1.9%). Of whom, 15 were excluded due to missing data or no access to the patients or their files. In the remaining 35 patients, the most common method of port placement was surgical (91%), and the most common methods of flushing and locking were using distilled water (88%) and heparin (100%), respectively. The frequency of main complications was 20% which included infection (11.4%) and mechanical catheter dysfunction (8.5%). Six patients (17.1%) underwent catheter removal.

**Discussion:** The number of patients who underwent port placement was very low, possibly due to the above reasons. The frequency of complications was low, but it can be further reduced by using better materials and techniques and following port maintenance instructions.

**Keywords:** Port catheter, Cancer, Chemotherapy, Catheter, Heparin

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## 1. Background

**E**ffective and reliable intravenous access is one of the essential elements of modern cancer treatments. Cancer patient management requires sustained intravenous access, used for a wide range of procedures such as chemotherapy, blood transfusions, antibiotic therapy, and fluid replacement [1]. Central venous access devices are among the most frequently used methods for sustained intravenous access [2]. These devices include Central Venous Catheters (CVCs) and implantable vascular access devices or “ports” [3]. The port is a reservoir that is surgically placed under the skin of the chest, and its removal after the end of systemic treatment is more complicated than CVC [4]. One of the advantages of the port over a CVC is that the former does not entail daily dressing changes and frequent flushing. In addition, the port is more aesthetically pleasing for patients due to the lack of an external part, and patients feel more comfortable and satisfied with the port [5].

Early complications of port placement occur 4 weeks before catheter implantation and include pneumothorax, hemothorax, arrhythmia, air embolism, catheter malposition, etc. Late complications occur 4 weeks after catheter implantation and include catheter fracture, dislocation, extravasation, infection, and occlusion by thrombosis and or embolism [1]. Several studies have addressed the potential risk factors for port-related complications in cancer patients. These risk factors include previous venous catheterization, patient age, sex, and body mass index, with somewhat inconsistent results [4]. Some have also reported that the time interval between port placement and its first use affects the rate of complications [6], while others have not observed such a correlation [7].

Port placement is performed by different operators, including surgeons, interventional radiologists, and skilled nurses. It is used on a small number of patients in Iran for various reasons, such as no facilities and time, limited access, and lack of patient cooperation. Therefore, we conducted this study to investigate the frequency of port implantation methods and their complications. The study results can be used to inform patients and therapists about the important role of port implantation.

## 2. Materials and Methods

This prospective study involved all patients who underwent chemotherapy in the Department of Clinical Oncology at Ahvaz Golestan Hospital from October 2019 to

September 2020. We determined the frequency of patients who underwent port implantation by referring to the Chemotherapy Registry and the archive office of the department. Then the demographic characteristics of the patients who underwent port implantation, including age, sex, and type of cancer, were recorded. The methods and intervals of insertion, flushing, and locking of the port, as well as the type and frequency of complications, were recorded in the questionnaire by referring to the patient file and asking nurses and patients. The collected data were analyzed by descriptive (mean, standard deviation, and frequency) and analytical statistics (the Chi-square test and independent samples t-test) using SPSS statistical software version 22. The significance level was set at 0.05.

## 3. Results

Of 2634 patients who received 17010 chemotherapy injections, 50 underwent port placement (1.9%). Of whom, 15 were excluded due to lack of access to the file, missing data in the file, or lack of access to the patient. Regarding the 35 patients studied, their mean age was  $51.25 \pm 9.89$  years (age range 30-74 years), and 34 (97.1%) were female. The most common cancer type was breast cancer, observed in 29 patients (82.9%) (Table 1).

The method of port placement was surgical in 32 patients (91.4%) and radiological in 3 patients (8.6%). The most common methods of flushing and locking were using distilled water (88.6%) and heparin (100%), respectively. The most common interval between flushing and locking was 1 month (60%) (Table 1).

About 80% of the patients had no main complications. However, 3 patients (8.5%) had mechanical catheter dysfunction, and 4 (11.4%) developed an infection. Pneumothorax, hemothorax, hematoma, cardiac arrhythmia, embolism, and catheter malposition were not observed in any patient. Miscellaneous complications were seen in 11.4% of patients, with 2 patients (5.7%) having fever and myalgia after each flushing and 2 patients (5.7%) having slight swelling. Two of the 3 patients who underwent port placement by radiological method had main complications. One had mechanical catheter dysfunction, and the other had an infection. Mechanical catheter dysfunction and infection were seen in 2 and 3 cases out of 32 patients who had undergone surgical implantation, respectively. Catheter removal was performed on 6 patients (17.1%) (Table 2).

**Table 1.** Patients characteristics and study variables

Characteristic		No. (%)
Sex	Male	1(2.9)
	Female	34(97.1)
Cancer	Breast	29(82.9)
	Brain	1(2.9)
	Bladder	1(2.9)
	Nasopharynx	1(2.9)
	Rectum	3(8.6)
Port implantation method	Surgical	32(91.4)
	Radiological	3(8.6)
Flushing method	Distilled water	31(88.6)
	Normal saline	4(11.4)
Locking method	Heparin	35(100)
	Normal saline	0(0)
Flushing/locking interval	≤3 weeks	9(25.7)
	3 to 4 weeks	21(60)
	1 to 3 months	0(0)
	3 to 5 months	2(5.7)
	No flushing/locking	3(8.6)

**Table 2.** Frequency of port implantation complications and catheter removal

Variables		No. (%)
Main complications	Infection	4(11.4)
	Mechanical catheter dysfunction	3(8.5)
	No main complication	28(80)
Miscellaneous complications	Fever and myalgia after flushing	2(5.7)
	Slight swelling	2(5.7)
	Mild itching	1(2.9)
Catheter removal	Yes	6(17.1)
	No	29(82.9)

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#### 4. Discussion

In the present study, the mean age of the participants was 51.25 years, and almost all patients (97.1%) were female. The most common cancer type was breast cancer (82.9%), followed by colorectal cancer (8.6%). In Kakkos et al. study in France, the mean age of the patients with port catheter implantation was 54 years [4]. In Ignatov et al. study, the mean age of patients was 55 years, and 63% had breast cancer [8]. Ji et al. reported that the mean age of cancer patients with port catheter implantation in their study was 54 years and that 73.4% were male, with the majority of patients having lung cancer [9]. According to Seok et al., the mean age of cancer patients with port catheter implantation was 55 years, and 60% were women, with the most common cancers being colorectal, breast, and lung cancer [10].

Because breast, lung, and colorectal cancers were the most common cancers reported worldwide in 2020 [11], it is expected that in most studies, most cancer patients for whom a port catheter is implanted suffer from these three types of cancer. Owing to the mentioned reasons, port implantation is used in a small number of cancer patients in Iran, and it is usually limited to patients with breast cancer. Another reason is the limited access to superficial veins in the affected upper limb and the increased risk of lymphedema in the affected upper limb following any trauma. This finding justifies the high ratio of breast cancer compared to other cancers and women to men in the present study.

In our study, the most common method of port placement was surgical. The port catheter placement by the

interventional radiologist is an outpatient procedure, a significant advantage that cancel the need for an operating room schedule. Vardy et al. reported that using this method in cancer patients is successful and safe, and the rates of complications and port catheter removal by radiologic methods are low [12]. Damascelli et al. reported that the frequency of complications such as infection, thrombosis, and port removal is lower in the radiological method than in the surgical method [13]. In the present study, the port catheter was surgically implanted in most patients, but it is recommended that the radiological method be used more often because of its advantages over the surgical method. However, 2 out of 3 patients in our study who had undergone implantation by the radiological method developed serious complications. Also, 5 out of 32 surgically implanted patients developed main complications. This difference is probably due to the patient's conditions or less experience with the radiological method. Because of the limited number of patients who were implanted by the radiological method, it was not possible to determine the statistical difference between the two methods in terms of complications.

In the present study, the most common methods of flushing and locking were using distilled water and heparin, respectively. The intervals between flushing and locking were 1 month in 60% of the patients, 21 days in 25.7%, and 3-5 months in 5.7% of the patients. According to the manufacturer's instructions, it is recommended to flush the port catheter with normal saline or distilled water followed by heparin locking every 4 to 6 weeks. However, to avoid late complications, the latest guidelines recommend flushing/locking methods every four weeks [14].

In a meta-analysis, Fornaro et al. reported no difference in the frequency of obstruction, infection, and mechanical dysfunction between patients whose flushing was between 1 and 2 months apart. Therefore, flushing and locking every 8 weeks is both practical and safe. This delayed program may improve patients' quality of life and reduce the workload of nurses and the costs of the national health system [15]. Wu et al. reported that increasing the flushing interval to more than 4 weeks is safe and feasible. Also, increasing the flushing interval to 8 weeks may not increase the overall complications and blockage of the catheter. However, there is no report on whether the flushing interval can be extended to 3 months or more [16].

In our study, 80% of the patients had no main complications, showing the safety and efficiency of port implantation in these patients. The most common main complications were infection and mechanical catheter dysfunction in 11.4% and 8.5%, respectively. In the Ignatov et al. study, the frequency of port complications in cancer patients was 19%. Early complications included catheter malposition (0.5%), pneumothorax (0.3%), tachycardia (0.3%) and dyspnea (0.1%), and late complications were infection (7.6%), thrombosis (2.5%), catheter displacement (2.5%), and extrusion (1.8%) [8]. In the Kakkos et al. study in France, the frequency rates of infection, mechanical dysfunction, and extrusion were 2.3%, 0.4%, and 0.4%, respectively [4]. Ji et al. observed infection in 9.59% of the patients [9]. In the Biffi et al. study, the early complications were pneumothorax (3.4%) and port dysfunction (4.4%), while late complications included catheter leakage and embolism (1.5%), venous thrombosis (1.5%), pocket infection (0.3%), and bacteremia (2.4%) [14]. Seok et al. reported that port catheter complications were observed in 21% of cancer patients [10].

In a prospective study by Narducci et al., the overall complication rate was 16.1%, and the main complication was infection [17]. Lorch et al. found that 11.2% of cancer patients experienced early complications associated with port catheters. The frequency of long-term complications was also reported to be 7.2% [18]. In our study, the frequency of main complications was 20%, which is consistent with the above-mentioned studies. Hematoma, embolism, and catheter dislocation were not observed in any patient, but the frequency of infection and mechanical dysfunction was slightly higher than in other studies.

In the present study, catheter removal was reported in 6 patients (17.1%). Kakkos et al. found that the frequency

of port catheter removal was 17.1%, of which 7.2% was due to side effects [4]. In the Ignatov et al. study, the frequency of catheter removal was 15%, of which 8% was due to side effects [8]. The frequency of port catheter removal due to complications was 15.25% in Ji et al. [9], 17% in Seok et al. [10], 13.2% in Biacchi et al. [19], 1.8% in Biffi et al. [14], and 11.9% in Kock et al. [20]. The findings of these studies are similar to our study.

As can be seen, the frequency of port complications and catheter removal vary to some extent in different studies. This difference could be due to various methods of port catheter placement, port implantation operator, port usage time, locking and flushing intervals, patient-related factors, etc. Compared to external venous access, ports have many advantages for patients who need constant intravenous access. These advantages include cost-effectiveness and a lower risk of infection and thrombosis. In addition, the port is more aesthetically pleasing for patients due to the lack of an external part, and patients feel more comfortable and satisfied with the port [5]. However, port implantation may be associated with various complications, the most important of which is an infection, although many can be effectively prevented [17]. Complications can be prevented and minimized with the joint efforts of oncologists, surgeons, and nursing staff by using better materials and techniques and following port maintenance instructions [18].

## 5. Conclusion

The number of patients who underwent port placement was very low in our study, possibly due to lack of facilities and time, limited access, and lack of patient cooperation. Patients and therapists should be more aware of the importance of port placement and become more familiar with its methods and techniques. The frequency of complications was low in our study, and they could be prevented and minimized with the joint efforts of oncologists, surgeons, and nursing staff by using better materials and techniques and following port maintenance instructions.

## Ethical Considerations

### Compliance with ethical guidelines

All ethical principles are considered in this article. The participants were informed of the purpose of the research and its implementation stages. They were also assured about the confidentiality of their information and were free to leave the study whenever they wished, and if desired, the research results would be available to them.

A written consent has been obtained from the subjects. principles of the Helsinki Convention was also observed. In addition, this article has received permission to carry out research activities from the ethics-research committee of Ahvaz Jundishapur University of Medical Sciences. (Code: IR.AJUMS.HGOLESTAN.REC.1398.001).

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### Authors' contributions

All authors equally contributed to this project and article.

### Conflict of interest

The authors declare no conflict of interest.

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