

Complications of chemotherapy port catheters (CPC) in patients with cancer, A 5-year follow up study

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Abstract:

Totally implanted central venous port systems are widely used for chronically ill patients, who need long-term access to central veins for prolonged therapy. As we do not have enough data about the rate of complications in the Iranian population, we designed this study to investigate our early and late complications related to chemotherapy port catheters (CPC), implanted by vascular surgeons, assessing some risk factors and proposing ways to avoid or reduce them. In this prospective study, 160 patients treated for cancer in Sina and 5th Azar hospitals in the department of chemotherapy from January 2016, were participated. Our inclusion criteria were age >18 years old, port surgery at our institution by vascular surgeons, ability to understand the procedure, and provide consent for the study. Patients with serious physical diseases or mental problems and children were excluded. A total of 160 patients (56 men and 104 women) were included. The mean age (\pm standard deviation) of patients was 53.5 (\pm 16.49) years. Forty-six patients (28.8%) had breast cancer and 72 (45 %) had gastrointestinal cancer. We had 2 missing data in our follow-up, fifty patients (31.2%) still have their catheters, 70 (43.8%) died and 38 (23.8%) catheters were explanted. We didn't have early complications as we did the procedure under ultrasound and fluoroscopy guidance. Our overall rate of complication was 6.8%. In this study, we reported infection as the most frequent late complication related to our 160 chemotherapy ports. Future multi-centered studies with large cohorts are needed to further corroborate our findings.

Keywords: port catheters-complication-cancer

Introduction:

Totally implanted central venous port systems are widely used for chronically ill patients, who need long-term access to central veins for prolonged therapy. [1]The implantable port device was originally described in 1963 by Ommaya[2-3] as a cerebrospinal fluid reservoir and manual pump.[4]There are several important complications associated with central venous ports [5-6]. Port complications can be subdivided into procedural complications, catheter-related complications and vascular complications[4] Short-term complications include accidental arterial puncture, hematoma, air embolism, pneumothorax or vessel perforation [7], but these

complications are rare in modern oncology. Surgical complications arise in <2 % of cases in experienced hands [8]. Clinical oncologists are currently most often concerned with major long-term complications associated with the use of catheters in chemotherapy. The reported incidence of late complications is generally <10%, and most of these are preventable by effective nursing care.[9-10]

Method and material:

In this prospective study, 160 patients treated for cancer in Sina and 5th Azar hospitals in the department of chemotherapy from January 2016, were participated. Our inclusion criteria were age >18 years old, port surgery at our institution by vascular surgeons, ability to understand the procedure, and provide consent for the study. Patients with serious physical diseases or mental problems and children were excluded from this study. After approval from the Ethics Committee of the University Faculty of Medicine, patient-specific data and information were retrieved from the hospital medical records. Written informed consent was obtained from all patients prior to their inclusion.

Early complications were those that appeared peri operatively and were seen in less than 30 days after implantation. They were: Arrhythmia, Hematoma, Pneumothorax, seroma and Hemothorax, thoracic duct injury, arterial malpositioning. Late complications divided into venous Thrombosis, venous stenosis, infection, catheter migration, extravasation, skin necrosis, catheter embolization, air embolism and defined to those that appeared after 30 days.[1-11-12]

All subjects underwent regular preoperative examination, including routine blood examination, coagulation time, and chest fluoroscopy. CPC was implanted by ultrasound guidance and fluoroscopy. They were implanted by catheterizing either a subclavian vein(right or left) or jugular vein(right or left). The position of the catheter was confirmed by chest radiography. All patients were successfully catheterized at the first attempt (by using ultrasound). During the treatment period when the CPC was used, needles were changed every week; when not in use, the CPCs were flushed with diluted heparin solution (100 IU/mL) once a month.

Follow up:

After insertion of the port, the patients were followed up on day-14, and 1, 3, and every 6 months post-insertion for 5 years (up to now). Data pertaining to age, sex, diagnosis, and surgical history (i.e., vein accessed, whether re-insertion and death) were reviewed. Telephonic interviews were conducted to collect information regarding general health, the position of port, complications, and if they have suspicious problems they asked to come for physical examination at Hospital.

Statistical Analysis:

We used SPSS v.18 to analyze our data. Complications were reported in terms of frequency for each type. For quantitative variables (age, duration of port cath placement), mean and standard deviation were calculated. Logistic regression was used to evaluate risk factors of complications (sex, age, cancer type, duration). $P < .05$ was considered statistically significant.

Results:

Demographic and characteristics of patients:

A total of 160 patients (56 men and 104 women) were included. The mean age (\pm standard deviation) of patients was 53.5 (\pm 16.49) years. Forty six patients (28.8%) had breast cancer and 72 (45 %) had gastrointestinal cancer. Demographic characteristics are shown in table 1.

Table 1- Demographic and basic clinical characteristics of patients.

Characteristics	N(%)
Gender	56(35%)
Male(%)	
Female(%)	104(65%)
Mean age \pm SD(y)	53.5 \pm 16.49
Diagnosis	
Gastrointestinal	72(45%)
Breast	46 (28.8%)
Lymphoma	8(5%)
Ovary	5(3.1%)
Brain	4(2.5%)
Hepato-Biliary-Pancreas	4(2.5%)
mean port cath survival \pm SD(months)	23.22 \pm 13.9

We had 2 missing data in our follow-up, fifty patients(31.2%) still have their catheters,70(43.8%) died and 38(23.8%) catheters were explanted. We didn't have early complications as we did the procedure under ultrasound and fluoroscopy guidance.

Table2- Determination of late complications associated with port catheters:

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characteristics	(n/160)%	
infection	6	3.8
migration	2	1.2
thrombosis	2	1.2
Skin Erosion	1	0.6
total	11	6.8

In Logistic regression, neither age nor sex was not statistically Risk factor for the incidence of late complications. (P value>0.05)

In one case after 14 months, we had skin erosion. (figure 1)



Figure 1- Skin necrosis and port expose in a patient after 14 months.

Discussion:

The use of port catheters is a standard practice in patients on long-term chemotherapy, blood transfusion, and parenteral nutrition across the world. As we mentioned above there are early and late complications may occur in patients with port catheters and their rates would rise especially in cancerous patients who have these central vein accesses for the long term. We followed 160 patients with different cancers who underwent port catheter implantation in our Hospital from 2016 up to now to discover their early and late complications. We had no early complications as we used sonography and fluoroscopy during the procedure and most of the early complications like pneumothorax, arterial puncture, hematoma, malpositioning would not appear. Only placement into the right internal mammary vein can be difficult to detect on single-plane chest radiographs.[1] that we can detect with fluoroscopy. Cardiac malpositioning is easily recognized in an AP or PA chest radiograph.

In this study, the rate of late complication was 6.8%, The overall complication rate has been reported to be 7.2–12.5%, with port system infection being most common[11-13] as we recorded in our patients' population. This lower rate of complication may be attributable to our preoperative and intraoperative processing. Although during follow-up periods because of the telephonic interview some minor complications may not be declared by patients.

The major long-term problems of catheter use in patients with cancer are catheter-related infection and thromboembolic complications. Both complications may lead to significant morbidity and impairment of the patient's quality of life.

Infection:

Infectious complications included both systemic and local infections. Local infection refers to skin/soft-tissue infection at the site of venous access and tunnel infection. Systemic catheter infection refers to catheter-related bloodstream infection (CR-BSIs) and was defined as the presence of general systemic symptoms and the absence of any other obvious source of infection.[14] In a study Yu, Xin-Yan BD et al. done in 2018 they evaluated late complication of 500 port catheters in cancerous patients and recorded a 0.6% infection rate. We had a 3.8% rate of infection 1.2% of thrombosis, 1.2% of migration, and one (0.6%) with skin necrosis. This difference emphasizes the importance of nursing care in these patients as they have immune insufficiency because of their underlying cancer. The incidence of port-associated infection ranges from 0.6 to 27%[15]. In the study of Shim et al.[16], 45 out of 1747 (2.5%) implanted port systems were explanted due to infection.

A retrospective study by Yildizeli et al. [15] showed that among 225 implantable port systems, the long-term complications included infection (2.2%), thrombosis (1.3%), extravasation (1.3%), and catheter fracture (2.2%).

Skincare of patients with a port catheter is one of the important aspects of care. Repeated punctures and the side effects of the chemotherapy drugs also lead to impaired immunity. Nurses should educate and instruct the patients to take care of the skin around the infusion ports. Wound management and general anti-infection treatment are required for any infection. The infusion ports should not be used prior to complete control of the infection. Aseptic principles during implantation of the catheter or insertion of the non-damage indwelling needle, or during the change of dressing is essential. If the patients need a long-term transfusion, one suit of non-damage needles could be used for 7 days in a row. [14]

Venous thrombosis:

In a large series[17] on 51,049 patients, 1.81% of patients developed an upper extremity thrombosis. Risk Factors included age < 65, presence of more comorbidities, history of any deep venous thrombosis, non-white race, and presence of certain malignancies (such as lung cancer and gastrointestinal cancer). Thrombotic complications of port systems occur in two forms: stenosis or occlusion of the host vein due to trauma to the venous wall or thrombus formation around the catheter tip[1].

In our study, nonfunctional ports were referred to us by Chemotherapy nurses and we did an ultrasound to detect the presence of catheter obstruction. In order to prevent blood clots and catheter obstruction, good nursing is necessary to save ports and increase their survival. Nurses should check the line before infusion of chemotherapy agents with Normal saline (NS) to seal the tube by positive pressure. In the event of an incomplete obstruction, nurses should draw the fluid as soon as possible and gently inject 1 mL urokinase.

The dressing should be of permeable materials and it should be changed as soon as possible once the dressing falls off. Professional non-damage needles should be used according to the venous access port.

Sibylle machat wrote a review article on complications of central venous ports in 2019, With an incidence of 5–18%, catheter-related thrombosis[1] but we have 1.2% thrombosis that may be because of our professional center of chemotherapy and correct usage of CPCs by nurses.

We had no drug extravasation in our study but in drug extravasation, nurses should terminate transfusion as soon as possible and draw the liquid residue with an empty syringe.

We didn't find any statistical correlation between age, sex, duration of functional CPC,type of cancer but in Yu, Xin-Yan et al. article in China, Patients with breast cancer, lung cancer, and gastric cancer had a higher rate of complication.[14] This was likely attributable to the higher rate of indwelling CPCs in patients with these cancer types as compared with that in patients with other cancers in their hospital. They had 500 CPCs, so we need to increase our sample size to evaluate these factors again.

Conclusion:

In this study, we reported infection as the most frequent late complication related to our 160 chemotherapy ports. Future multi-centered studies with large cohorts are needed to further corroborate our findings.

Authors had no conflict of interest.

References:

1- Sibylle Machat , Edith Eisenhuber , Georg Pfarl , Josef Stübler , Claus Koelblinger , Johannes Zacherl and Wolfgang Schima. Complications of central venous port systems: a pictorial review. *InsightsintoImaging* (2019) 10:86

2- Ommaya AK. Subcutaneous reservoir and pump for sterile access to ventricular cerebrospinal fluid. *Lancet*. 1963;2:983–984. doi: 10.1016/S0140-6736(63)90681-0. [[PubMed](#)] [[CrossRef](#)] [[Google Scholar](#)]

3- Ratcheson RA, Ommaya AK. Experience with the subcutaneous cerebrospinal-fluid reservoir. Preliminary report of 60 cases. *N Engl J Med*. 1968;279:1025–1031. doi: 10.1056/NEJM196811072791904. [[PubMed](#)] [[CrossRef](#)] [[Google Scholar](#)]

4-Yasuhiro Inoue and Masato Kusunoki, Advances and directions in chemotherapy using implantable port systems for colorectal cancer: a historical review. *Surg Today*. 2014; 44(8): 1406–1414.

- 5- Vescia S, Baumgärtner AK, Jacobs VR, Kiechle-Bahat M, Rody A, Loibl S, et al. Management of venous port systems in oncology: a review of current evidence. *Ann Oncol.* 2008;19:9–15. doi: 10.1093/annonc/mdm272. [[PubMed](#)] [[CrossRef](#)] [[Google Scholar](#)]
- 6- Mansfield PF, Hohn DC, Fornage BD, Gregurich MA, Ota DM. Complications and failures of subclavian-vein catheterization. *N Engl J Med.* 1994;331:1735–1738. doi: 10.1056/NEJM199412293312602. [[PubMed](#)] [[CrossRef](#)] [[Google Scholar](#)]
- 7- Teichgräber UK, Gebauer B, Benter T, Wagner J. Long-term central venous lines and their complications. *Rofo.* 2004;176:944–952. doi: 10.1055/s-2004-813258. [[PubMed](#)] [[CrossRef](#)] [[Google Scholar](#)]
- 8- Teichgräber UK, Pfitzmann R, Hofmann HA. Central venous port systems as an integral part of chemotherapy. *Dtsch Arztebl Int.* 2011;108:147–153. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]
- 9- Yildizeli B, Lacin T, Batirel HF, et al. Complications and management of long-term central venous access catheters and ports. *J Vas Access* 2004;5:174–8.
- 10- Dougherty L. Maintaining vascular access devices : the nurse's role. *SupportCareCancer* 1998; 6:23–30.
- 11- Nakamura T, Sasaki J, Asari Y, Sato T, Torii S, Watanabe M (2017) Complications after implantation of subcutaneous central venous ports (PowerPort). *Ann Med Surg (Lond)* 17:1–6
- 12- Kakkos A, Bresson L, Hudry D et al (2017) Complication-related removal of Totally implantable venous access port systems: does the interval between placement and first use and the neutropenia inducing potential of chemotherapy regimens influence their incidence? A four-year prospective study of 4045 patients. *Eur J Surg Oncol* 43:689–695
- 13- Kakkos A, Bresson L, Hudry D et al (2017) Complication-related removal of totally implantable venous access port systems: does the interval between placement and first use and the neutropenia-inducing potential of chemotherapy regimens influence their incidence? A four-year prospective study of 4045 patients. *Eur J Surg Oncol* 43:689–695
- 14- Yu, Xin-Yan BD; Xu, Jia-Lan BD; Li, Dan BD; Jiang, Zi-Fang MS*. Late complications of totally implantable venous access ports in patients with cancer Risk factors and related nursing strategies *Medicine* (2018)97:38
- 15- Yildizeli B, Laçın T, Batirel HF, Yüksel M. Complications and management of long-term central venous access catheters and ports. *J Vasc Access.* 2004; 5:174–178. [[PubMed](#)] [[Google Scholar](#)]
- 16- Shim J, Seo T, Song M et al (2014) Incidence and risk factors of infectious complications related to implantable venous-access ports. *Korean J Radiol* 15:494–500
- 17- Tabatabaie O, Kasumova GG, Kent T et al (2017) Upper extremity deep venous thrombosis after port insertion : what are the risk factors? *Surgery* 162:437–444