



# The evaluation of implantable venous access ports in patients with cancer

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# **The evaluation of implantable venous access ports in patients with cancer**



Laurea University of Applied Sciences

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- Objective: The evaluation of implantable venous access ports in patients with cancer

- The purpose: To describe evaluation methods for IVAP in patients with cancer and produce new information about the evaluation methods for IVAP in patients with cancer.

- The beneficiaries: Peijas Hospital

- Theoretical framework: Cancer itself is relatively hidden. Most cancers have a long incubation period. Chemotherapy drugs cause great damage to blood vessels. Many tumor patients are also accompanied by diabetes, hypertension, vascular embolism and other diseases. The vascular condition is generally poor, so veins appear during puncture and treatment. The probability of inflammation increases significantly. If the chemotherapeutic drugs extravasate, it will cause local tissue necrosis, reduce the quality of life of patients, and increase the economic burden of patients. Implantable venous port access (IVPA) have the advantages of avoiding repeated puncture, less irritation, safe infusion, and long use time, and are widely used.

- Methods used: Descriptive literature review methods

- Key results: Through these articles, we knew that how to evaluate the IVAP site and how to prevent infections in IVAP site in patients with cancer.

- Analysis of the results: There are 5 points to evaluate the IVAP site. The most important point for preventing infection is strict aseptic care of the puncture site.

-Conclusions and recommendations: Infection remains the most common complication of the venous access system in cancer patients. Changing the access needle and clear dressing every 7 days is a safe, cost-effective, and efficient way to disinfect and keep the exit site clean.

Keywords: Evaluation, Implantable venous access ports, Cancer.

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## 1 Introduction

(Shuzheng Hong,2017.11) has been conclude with the change of people's living environment and lifestyle, the incidence of cancer is increasing year by year. Cancer is generally treated clinically, and surgical surface treatment after postoperative chemotherapy is particularly important, since chemotherapy drugs are highly toxic to a patient's blood vessels. In recent years and clinical experience and fact background,, total implantable venous access port (IVAP) has been increasingly used in chemotherapy for patients in tumour and cancer therapy.

In the background of clinical experience and facts, most patients have different degrees of necrosis of local tissues due to the stimulation of blood vessels by drugs after chemotherapy, which seriously affects the treatment effect of patients and increases the suffering of patients.

Therefore, IVAP, which is low-infection, safe, effective, economical, and practical, gradually becomes the first choice for cancer patients. This thesis will study this emerging technology in depth and refer to the literature for analysis.

The thesis focused on the evaluation of puncture site and puncture technique for implantable venous access ports in patients with cancer and trying to explain how to avoid the patient suffering from long-term complications.

## 2 Theoretical framework

### 2.1 implantable intravenous infusion port

As long as (Sidika Kurul et al. 2002.11) reserch found fully implantable venous access is a valuable tool for long-term intravenous therapy in cancer patients, but both the implantation and use of these devices are associated with complications. IVAP is an important part of the care of patients with chronic conditions. Clinically, (Jan P. Goltz et al. 2011) conclude it provides a reliable method for safe and permanent central venous access, it is an important factor in the treatment of cancer patients and those who requiring long-term antibiotic therapy or artificial nutrition, in addition to the possibility of giving high-dose chemotherapy and artificial nutrition, injection of other drugs or contrast agents or blood sampling and administration while minimizing disruption to the patient's lifestyle. (Sidika Kurul et al. 2002.11) Today's ports are lighter and stronger due to improvements in materials and catheter.

In addition to recent research (Sidika Kurul et al. November 2002, 01) has demonstrated perioperative problems, long-term complications may occur; these can be grouped into five categories—catheter dysfunction, catheter-related venous thrombosis, catheter-related infection, port-related complications, and extravasation injury.

The vast majority of these complications can be attributed to unprofessional handling of the port and should therefore be avoided. To get the most benefit from IVAP, all health care providers must be familiar with equipment use and routine maintenance procedures and treatment options for catheter-related complications. (Sidika Kurul et al. 2002.11)

Recent research (Guanhua Li et al. 2019) has demonstrated the most important feature of catheterization is strict adherence to aseptic technique. It is mainly composed of puncture port and venous catheter system, which can be used for infusion of various chemotherapy drugs, supplementary fluid, nutritional support treatment and blood transfusion. The catheter tip at the junction of the superior vena cava and right atrium is the correct location for insertion, and if the tip is in the subclavian vein rather than the right atrium, thrombotic complications can lead to high failure rates. According to (Sidika Kurul, Pinar Saip, and Tulay Aydin (2002,11) conclude that 2 main methods are usually used: chest port or arm port.

Insertion techniques The Seldinger technique has life-threatening risks such as subclavian hemorrhage, pneumothorax, hemothorax, or perforation of the vein wall. Whereas implants (Braun Melsungen AG, Germany) were less invasive by the percutaneous approach of the Braunule technique, after the surgery, the patient should undergo a chest X-ray to confirm catheter placement and rule out pneumothorax

## 2.2 Cancer

Zhao Chengyuan, (2017) has been approved cancer itself is more hidden. Most cancers have a long incubation period, either from a mutation in an oncogene or from persistent infection with a cancer-causing virus, to eventual cancer formation. During this process, there may be no obvious clinical symptoms, and the patient is not easily aware of it. Once perceptible clinical symptoms appear, metastasis often occurs and the cancer is at an advanced stage.

Recent research (Zhang Xiaoling et al. 2015) has demonstrated in recent years, the incidence of malignant tumors has continued to increase, and chemotherapy still plays an important role in the treatment of malignant tumors. Tumor patients need long-term intravenous chemotherapy drugs or intravenous nutritional support. Chemotherapy drugs cause great damage to blood vessels, and many tumor patients are also accompanied by diabetes, hypertension, vascular embolism and other diseases, so the vascular conditions are generally poor, so puncture and the probability of phlebitis in the course of treatment was significantly

increased. If the chemotherapeutic drugs extravasate, it will cause local tissue necrosis, reduce the patient's quality of life, and increase the patient's economic burden.

As (Zhang Xiaoling et al. 2015) said Implantable Venous Port Access (IVPA) and Peripheral Inserted Central Catheter (PICC) are widely used due to their advantages of avoiding repeated puncture, less irritation, safe infusion, and long use time. used in cancer patients. IVPA, also known as implantable central venous port access system (CVPAS), is a closed venous infusion device that is completely implanted under the skin and left in the body for a long time. It is used for the use of various high-concentration drugs, reducing the pain of repeated venipuncture in patients and the difficulty of nursing upper venous treatment, preventing and treating the damage of irritating drugs to peripheral superficial veins, and making the daily life of patients unrestricted, improving patients with frequent infusions quality of life. IVPA was first reported in 1982, and it has been used clinically since then. It is considered to be a permanent channel for infusion chemotherapy for cancer patients, and it can also be used for blood sample collection in addition to infusion. PICC is a central venous catheter that is punctured by a peripheral vein. The service life is about 1 year, and it cannot be used for blood sample collection. The ends of the two infusion devices are terminated in the superior vena cava. Rapid blood dilution and dissemination of chemotherapeutic drugs can prevent the damage of chemotherapeutic drugs to the vascular intima, and can meet the needs of tumor patients for long-term repeated chemotherapy, nutrition and other intravenous infusion, and provide a long-term painless infusion for tumor and cancer treatment of patients aisle. So for the infusion of cancer patients, we take IVAP.

### 2.3 Puncture site evaluation

In a recent survey (Sidika Kurul et al. 2002.11), it was found that patients receiving TIVAP indwelling venous catheters are cancer patients undergoing intensive therapy, such as breast cancer, autologous bone marrow transplantation or long-term intermittent or continuous combination chemotherapy, or concomitant chemoradiotherapy. The most important issues in inserting and maintaining the IVAP, in addition to the type of drug to be infused and the planned duration of use, are the history of previous indwelling catheters, central venous patency, the patient's ability to maintain the catheter, the patient's age, and body size, amount of blood, samples to be drawn, patient's medical history and his or her performance status. Insertion technique typically, devices for central venous access are inserted percutaneously via the Seldinger technique to access the right or left internal jugular or subclavian vein. According to Jan P. Goltz, Ralph Kickuth and Anne Scholl (2011) these are to be assessed and considered, therefore, when we evaluate the puncture site, we need to fully understand and interfere with the various factors.

According to ( Eric Voog et al. 2017,07), the IVAP infection remains the most common clinical complication and infection can be local or systemic (catheter bloodstream infection). Local infections can be divided into two categories; exit site and port pocket infections. Infections are confined to skin wounds or over the port Needle access site with localized tenderness, pain, erythema, induration and edema. Most exit site infections are caused by *Staphylococcus epidermidis* and require only basic antimicrobial therapy and do not require catheter removal. However, if there is evidence that CRBI is associated with outlet site infection and may require removal of the catheter if the isolated pathogen is *Staphylococcus aureus*. The main cause of port pocket infection is the observation of induration, erythema, and tenderness around the port. Many of these infections are associated with varying degrees of peripheral cellulitis related.

### 3 Purpose and aim

The purpose of the study was to describe evaluation methods for IVAP in patients with cancer. The aim of the study was to produce new information about the evaluation methods for IVAP in patients with cancer.

The research questions are:

“How to evaluate the IVAP site in patients with cancer?”

“How to prevent infections in IVAP site?”

### 4 Methodology

The question about the evaluation of puncture site and puncture technique for implantable venous access ports in patients with cancer is answered with a descriptive literature review. The thesis applies a literature review to analyse and interpret the data. To analyze large volumes of textual or visual data collected from surveys, literature reviews, or other sources. (Shoma Mc Combes 2019). The inclusion and exclusion criteria was used when we searched these literatures. For example, searched for keywords: Evaluation, Implantable venous access ports. (Shoma Mc Combes 2019)

There are four key steps that we searched from relevant literature: Before you begin searching for literature, we made a clearly defined topic. The evaluation of puncture site and puncture technique for implantable venous access ports in patients with cancer. We were searched for literature related to our research problem and questions. And then we made a list of keywords. Start by creating a list of keywords related to our research question. Include

each of the key concepts or variables we were interested in, and list any synonyms and related terms

#### 4.1 Descriptive literature review

A literature review is a survey of scholarly sources on a specific topic. It provides an overview of current knowledge, allowing you to identify relevant theories, methods, and gaps in the existing research. Writing a literature review involves finding relevant publications (such as books and journal articles), critically analyze them, and explaining what our found. (Shona Mc Combes. 2019) This study focused on Utility and nursing experience of implantable venous access ports in patients with cancer and the evaluation of puncture site and puncture technique for IVAP in patients with cancer and trying to explain how to avoid the patient suffering from long-term complications, include five categories-catheter failure, catheter-related venous thrombosis, catheter-related infection, port-related complications, and extravasation injury.

#### 4.2 Literature search

The thesis provides based on a series of inclusion and exclusion criteria. Inclusion criteria were the following: (1) In the study were patients with cancer. (2) Implantable venous access ports. (3) Languages: English. (4) Full text, no full text available/only abstract available.(5) Publication date: between 2011-2021. (6) Academic articles and research. The exclusion criteria were as follows:(1) No cancer patient. (2) peripherally inserted central catheter,PICC. (3) Languages:other langufages.(4) The other criteria would be peer reviewed article/no peer reviewed article. (5) Publication date:before 2011. (6) Non-academic articles.

Inclusion	Exclusion
In the study were patients with cancer	No cancer patient
Implantable venous access ports	peripherally inserted central catheter,PICC.
Full text,no full text available/only abstract available.	The other criteria would be peer reviewed article/no peer reviewed article.
Publication between 2011-2021	Publication before 2011
Language: English	Other languages
Academic articles and research	Non-academic articles

Table 1: Inclusion and Exclusion criteria Abstract

## 4.3 Data collection

The thesis uses qualitative research method for data collection. We collected data from internet. The materials selected from CLNAHL with EBSCO, Laurea Finna, Joanna Briggs Institute EBD Data base (Ovid), E-book Central, ProQuest Central.

key words : Evaluation, Implantable venous access ports, Cancer.

As the data collection of literature review, we used the data table to construct a clear descriptive summary of the included studies. We made the following comparisons in the Table 2. It included headline, author(s), purpose of the study, data collection method, analysing method, main results.

Headline	Author s	purpose of the study	data collection method	analysing method	main results
Evaluation of infectious complications of the implantable venous access system in a general oncologic population	Lilu Chang, Jir-Shiong Tsai, Shin-Ju Huang et al	This study was conducted to evaluate the infectious morbidity associated with 2 common types of implantable port systems used in a cancer center in Taiwan.	Semiquantitative methods, Observation, Patient records	Time series analysis, Cohort analysis	Infection is the most common complication of venous port system use among cancer patients. It is safe and cost-effective to change exit-site needles and transparent dressings every 7 days.
Totally implantable venous access ports: a prospective long-term study of	Eric,Loïc Campion, Pauline Rusquec et al.	Totally implantable venous access ports (TIVAP) have been widely used for many years in the management	Observation, Patient records, Survey	Descriptive analysis Time analysis, Cohort analysis	This study demonstrates excellent tolerability, with only occasional complications. Most of these occurred during the year following implantation. ATIVAP may also be left in

early and late complications in adult patients with cancer		of patients suffering from cancer.			place for an extremely long time.
Retrospective evaluation of totally implantable venous access port devices: early and late complications.	Gurkan S, Tekirdağ, Seber S et al.	The role TIVAD have an important role in providing care to cancer patients who require continuous or frequent venous access route either for their primary or supportive care treatments.	Observation, Patient records, Survey	Descriptive analysis, Cohort analysis	Most of the complications of TIVAD were early without requiring removal. Port catheters for chemotherapy are safe and well tolerated with acceptable complication rates.
Totally implantable venous-access ports: local problems and extravasation injury	Sidika Kurul, Pinar Saip, Tulay Aydin	TIVAP placement procedures and TIVAP complications are discussed in this review, with special emphasis on local problems and extravasation	Patient records, Reporting, Register-based data	Descriptive analysis inferential analysis	Most TIVAP complications are attributable to inexpert handling of ports and, therefore, should be avoidable with team training and education of patients. In many cases, with the help of a specific diagnostic investigation, the fault can be identified and

		injuries. all health-care personnel must be familiar with the use and routine maintenance procedures of the devices and treatment option			corrected so that the system installed continues to function.
Arm port vs chest port: a systematic review and meta-analysis	Guanhua Li Yu Zhang Hongmin Ma	Two prevailing, totally implantable venous access ports are routinely utilized in oncology: chest port or arm port. This systematic review with meta-analysis was conducted to compare safety and efficiency of the two techniques	Patient records, Reporting, Register-based data	Descriptive analysis inferential analysis	safety and efficiency of the two techniques are similar, but age may be a risk factor for intra-operative events.
Explanation of totally implantable	Jan P. Goltz, Ralph Kickuth	To evaluate indications for, and complications	Patient records	Descriptive analysis inferential analysis	Removal of TIVAPs of the forearm shows a high technical success rate and a low

e venous access ports of the forearm: reasons for removal and observed complications	, Anne Scholl et al.	during, explantation of interventionally placed totally implantable venous access ports (TIVAPs) of the forearm			complication rate. There is a low risk of interventional removal failure with a resulting need for open surgery to remove the device.
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Table 2, data collection of literature review

#### 4.4 Data analysis

We use descriptive analysis methods for data analysis.

We collected articles with high relevance. One article summarized that how to comprehensively evaluation the IVAP puncture site problems in cancer patients. Four articles mentioned of the complications study for long-term treatment with IVAP in cancer patients. One article on reasons for removal IVPA in cancer patients.

During repeated reading of these articles, texts in line with the review objectives were identified. We summarized the most relevant things to the review and write them in the results.

#### 4.5 Results

Through these articles, we knew that how to evaluate the IVAP site and how to prevent infections in IVAP site in patients with cancer.

Recent research (Sidika Kurul et al. 2002.11) has demonstrated, the complications can be classified in five categories-catheter malfunction, catheter-related venous thrombosis, catheter-related infection, port-related complications, and extravasation injury. Therefore, we can evaluate through these five aspects.

The patency of the catheter needs to be assessed. After each use of IVAP, needs to be assessed with does the catheter flushed.

Prevention of IVAP-associated infections require periodic evaluated the puncture site. In the recent survey (Sidika Kurul et al. 2002.11), it was found that if the exit-site infections are localised at the skin wound or in the needle-access site over the port and manifested by local tenderness, pain, erythema, induration, and oedema. The nurse should record the situation in detail and report it to the doctor. And according to doctor's advice to give symptomatic care.

Prevention of Port-related complications, requires frequent assess the skin around the port site. According to Sidika Kurul, Pinar Saip, and Tulay Aydin (2002,11), Most IVAP complications are attributable to inexpert handling of ports and, therefore, should be avoidable with team training and education of patients

The most important point for preventing infection is strict aseptic care of the puncture site. According to Liu Chang (2019), It is safe and cost-effective to change exit-site needles and transparent dressings every 7 days.

Observed the extravasation condition also very important, the nurse must carefully observe that does the patient has slightly swollen during the initial instillation. It is better that asking the patient if he or she has any discomfort or feels burning around the area. Recent research (Sidika Kurul et al. 2002.11) has demonstrated if extravasation is suspected, the infusion should be stop soon and make the patient taken radiograph.

## 5 Ethical considerations

The ethical committee of Laurea's research and ethical board provided an ethical review for the planned study (Appendix 4) as required by Finnish National Board on Research Integrity(TENK 2019).Researchers in all disciplines are guided by the following general ethical principles: a) The researcher respects the dignity and autonomy of human research participants.b) The researcher respects material and immaterial cultural heritage and biodiversity.c) The researcher conducts their research so that the research does not cause significant risks, damage or harm to research participants, communities or other subjects of research.(TENK 2019)

From these thesis we know that how to prevent complication and harm, repair harm. When weighing potential harms, pain and benefits in implantable venous access ports and early detection, considering setbacks to privacy or other interests, as well as physical and psychological outcomes, often is appropriate.

## 6 Reliability and relevance

We have done a valid and reliable literature based on our research questions. All the collected data is based on our keywords related to our study. It also ensures the relevance of our research to the greatest extent possible. We have chosen more authoritative data. The sample of participants were meet the research topic target group which provide us well organized and constructive categories with ideal quality data. All the research articles that we analyzed were from trusted data sources. All studies we reviewed were used accurate tools and measurements in their study methods to ensuring the validity of the results. There reviewers did data collection, extraction and analysis to ensure the valuable data will not left out. Sources referenced correctly in the end of this review and can be easily followed.

## 7 Conclusion

However, infection remains the most common complication of venous access systems in cancer patients. Therefore, infection rates can be significantly reduced when appropriate preventive strategies and diligent sterile care by trained nursing staff can greatly reduce catheter-related infections. Changing visiting needles and clear dressings every 7 days is safe, cost-effective and efficient to disinfect and keep the exit site clean.

However, we did not find guidance in these articles that how do cancer patients observe and evaluate IVAP catheters by themselves, which may be a limitation of our study.

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## 9 Tables

Table 1: Inclusion and Exclusion criteria Abstract..... 19

Table 2: data collection of literature review ..... 19

Inclusion	Exclusion
In the study were patients with cancer	No cancer patient
Implantable venous access ports	peripherally inserted central catheter, PICC.
Full text, no full text available/only abstract available.	The other criteria would be peer reviewed article/no peer reviewed article.
Publication between 2011-2021	Publication before 2011
Language: English	Other languages
Academic articles and research	Non-academic articles

Headline	Author s	purpose of the study	data collection method	analysing method	main results
Evaluation of infectious complications of the implantable venous access system in a general	Lilu Chang, Jir-Shiong Tsai, Shin-Ju Huang et al	This study was conducted to evaluate the infectious morbidity associated with 2 common types of implantable	Semiquantitative methods, Observation, Patient records	Time series analysis, Cohort analysis	Infection is the most common complication of venous port system use among cancer patients. It is safe and cost-effective to change exit-site needles and transparent

oncologic population		port systems used in a cancer center in Taiwan.			dressings every 7 days.
Totally implantable venous access ports: a prospective long-term study of early and late complications in adult patients with cancer	Eric, Loïc Campion, Pauline du Rusquec et al.	Totally implantable venous access ports (TIVAP) have been widely used for many years in the management of patients suffering from cancer.	Observation, Patient records, Survey	Descriptive analysis Time analysis, Cohort analysis	This study demonstrates excellent tolerability, with only occasional complications. Most of these occurred during the year following implantation. ATIVAP may also be left in place for an extremely long time.
Retrospective evaluation of totally implantable venous access port devices: early and late	Gurkan S, Tekirdağ, Seber S et al.	The role of TIVADs has an important role in providing care to cancer patients who require continuous or frequent venous access	Observation, Patient records, Survey	Descriptive analysis, Cohort analysis	Most of the complications of TIVAD were early without requiring removal. Port catheters for chemotherapy are safe and well tolerated with acceptable complication rates.

complications.		route either for their primary or supportive care treatments.			
Totally implantable venous-access ports: local problems and extravasation injury	Sidika Kurul, Pinar Saip, Tulay Aydin	TIVAP placement procedures and TIVAP complications are discussed in this review, with special emphasis on local problems and extravasation injuries. all health-care personnel must be familiar with the use and routine maintenance procedures of the devices and treatment option	Patient records, Reporting, Register-based data	Descriptive analysis inferential analysis	Most TIVAP complications are attributable to inexperienced handling of ports and, therefore, should be avoidable with team training and education of patients. In many cases, with the help of a specific diagnostic investigation, the fault can be identified and corrected so that the system installed continues to function.
Arm port vs chest port: a systematic review and	Guanhua Li Yu Zhang Hongmin Ma	Two prevailing, totally implantable venous access ports are routinely	Patient records, Reporting, Register-based data	Descriptive analysis inferential analysis	safety and efficiency of the two techniques are similar, but age may be a risk factor for intra-operative events.

meta-analysis		utilized in oncology: chest port or arm port. This systematic review with meta-analysis was conducted to compare safety and efficiency of the two techniques			
Explanation of totally implantable venous access ports of the forearm: reasons for removal and observed complications	Jan P. Goltz, Ralph Kickuth, Anne Scholl et al.	To evaluate indications for, and complications during, explantation of interventional placed totally implantable venous access ports (TIVAPs) of the forearm	Patient records	Descriptive analysis inferential analysis	Removal of TIVAPs of the forearm shows a high technical success rate and a low complication rate. There is a low risk of interventional removal failure with a resulting need for open surgery to remove the device.