

Morbidity of implantable ports placement in oncologic patients

¹Bogdan Micu, ^{1,2}Carmen Micu, ¹Tudor R. Pop, ¹Nicolae Constantea

¹ Vth Department of Surgery, "Iuliu Hatieganu" University of Medicine and Pharmacy, Municipal Clinical Hospital, Cluj-Napoca, Romania; ² Department of Anatomy and Embryology, "Iuliu Hatieganu" University of Medicine and Pharmacy, Cluj-Napoca, Romania.

Abstract. Aim: To evaluate intra and postoperative complications of the method used by us in insertion of implantable ports in oncologic patients. Material and Methods: We conducted a prospective study in which we analyzed 320 procedures performed between 2012-2016 at the Fifth Surgical Clinic of the Municipal Hospital Cluj-Napoca. Implantable ports were installed in all cases, by echo-guided puncturing the internal jugular vein. Results: Patients were aged between 18 and 76 years, with a median of 60 (50;68), 198 were women and 122 were men. Two hundred and eighteen of patients were stage IV of disease. Postoperative complications were externalization of the port in 8 cases (2.5%), abscesses at the site of implantation in 7 cases (2.19%), or internal jugular vein thrombosis in 5 cases (1.6%). Conclusions: The method used by us has very good results regarding postoperative morbidity in oncologic patients.

Key Words: implantable ports, surgery, postoperative morbidity.

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Corresponding Author: C. Micu, email:carmenmicu@yahoo.com

Introduction

Implantable ports are medical devices consisting of a reservoir compartment (port) and a catheter. The port is mounted subcutaneously and the catheter connects the port to a central vein. These devices are used to deliver chemotherapy to cancer patients. The main advantages of implantable ports are the preservation of venous capital, the easier venous access, lower risk of extravasation of chemotherapeutic agents and the ability to inject irritants agents that can cause, in other conditions, skin necrosis (Ku et al 2009).

The catheter can be inserted into a central vein (subclavian vein, external jugular vein, internal jugular vein, cephalic vein, basilica vein) by either open access or puncture: using the classic Seldinger technique or an ultrasound-guided method (Biffi et al 1998).

The main intraoperative complications may include: incorrect placement of the catheter, bleeding, cardiac rhythm disturbances, puncture of the carotid artery, pneumothorax, hemothorax, or even death. Among postoperative complications, the following can occur: infections of the skin and subcutaneous tissue, subcutaneous abscess, venous thrombosis, sepsis, pneumothorax, hemothorax, migration of the port, externalization of the port, rotation of the port, occlusion or migration of the catheter, catheter fracture, catheter disconnection, difficult removal of the catheter. Complications vary in type and frequency depending on the method used in mounting the port and the catheter. However, morbidity ranges from 8.6 to 31% with a mortality of up to 1.4% (Marcy et al 2010).

The method used by us involves the insertion of the catheter into the internal jugular vein via ultrasound-guided puncture, and the placement of the port in the subcutaneous tissue in the anterior chest. The aim of our study was to analyze the morbidity of this method, used in our clinic, by evaluate intraoperative and postoperative complications.

Material and methods

We conducted a prospective study which included cancer patients who underwent surgery at the Fifth Surgical Clinic of the Municipal Hospital in Cluj-Napoca between 2012 and 2016. Surgeries were performed by the same surgical team.

Intervention description: Following local anesthesia, a lateral-cervical incision was performed and under ultrasound guidance will allow the puncture and cannulation of the internal jugular vein. After the longitudinal incision in the anterior pectoral region, the port is inserted into the subcutaneous tissue. A subcutaneous path will allow the connection between the catheter and to the port. After coupling, the position of the catheter and port-catheter permeability is checked by puncturing the port with a Huber point needle and flushing the port with a saline solution. The catheter is secured with absorbable sutures. Skin suture and postoperative wound dressing end the surgical procedure. In all cases, the implantable port was inserted using the ultrasound-guided puncture of the internal jugular vein.

The interventions lasted between 20 and 60 minutes. To check catheter placement, chest x-ray was performed in all patients 30 minutes after the surgical procedure. The correct positioning

of the catheter was assessed in accordance with the criteria described by Petersen et al (1999).

The follow-up of patients was performed for 6 months and consisted in a general clinical examination performed once every 30 days. Cervical ultrasound and chest X-ray were performed if there was a clinical suspicion of venous thrombosis or if patients experienced local pain, swelling, local edema or possible occlusion of the catheter or port.

Postoperative complications are divided into: intraoperative complications (failure, incorrect puncturing, puncturing of the carotid artery, arrhythmias, hemorrhage, pneumothorax or hemothorax) and postoperative complications (thrombosis of the internal jugular vein, superior vena cava syndrome, abscesses at the implantation site, externalization, pneumothorax, local hematoma, hemothorax, extravasation or catheter rupture) (Walser et al 2012).

Patient medical data was analyzed regarding the location of the primary tumor, disease stage, body mass index, oncologic history (preoperative chemotherapy, cervical-thoracic radiotherapy), duration of surgery, intra and postoperative complications that occurred, time until first use and the reasons and the incidence of premature removal (port removal program before the end of chemotherapy infusion).

All patients included in the study signed the informed consent form and the study was approved by the Ethics Committee of the Municipal Clinical Hospital, Cluj-Napoca.

Results

Between 2012 and 2016, ports were implanted in 320 oncologic patients aged between 18 to 76 years (median age 60) at the Fifth Surgical Clinic of Cluj-Napoca Municipal Hospital. Of these patients, 198 (61.9%) were women and 122 (38.1%) were men. Tumor location is presented in Table 1.

Table I. Location of primary tumor

Location of tumor	Number of patients	Percentage (%)
Brest	122	38.1
Pulmonary	36	11.2
Colorectal	35	10.9
ENT	30	9.3
Ovary	26	8.1
Stomach	20	6.25
Esophagus	10	3.1
Sarcomas	10	3.1
Urogenital	9	2.8
Pancreas	6	1.8
Melanoma	4	1.2
Cervix	4	1.2
Leukemia	3	0.9
Peritoneum	2	0.6
Gallbladder	1	0.3
Limfoma	1	0.3
Eyes	1	0.3

The catheter was inserted in the right internal jugular vein in 306 (95.6%) cases and in the left internal jugular vein in 14 (4.4%) cases. Placement of the catheter in the left we made in cases where we felt that a right approach would be difficult or impossible (right surgery, radiotherapy).

Of the 320 cancer patients, during implantation, 218 (68,1%) were in stage IV and 31,9% were in stages I-III.

The main intraoperative complications that occurred in our study group were represented by: port implantation failure (4 cases/1.25%), incorrect placement and migration in the subclavian vein (2 cases/0.6%), puncture of the common carotid artery (4 cases/1,25%), occurrence of paroxysmal tachycardia during catheterization (1 case/0.3%). The presence of hemothorax or pneumothorax was not detected in any of the cases.

In case of incorrect catheter placement, the catheter was repositioned immediately. In case of accidental carotid artery puncture (the problem was identified intraoperatively by the presence of red arterial blood with high pressure at the injection site) the needle was quickly removed and mechanical compression was applied for about 5 minutes; after the bleeding has stopped and the presence and size of the hematoma was identified (ultrasound), jugular vein puncture and correct placement of the catheter were resumed, ensuring 100% success rate. These situations appeared when the normal anatomy of the region was affected by surgery or radiotherapy in the latero-cervical region. Paroxysmal tachycardia during surgery was identified in one case and the catheter was quickly removed and it was safely reinserted after the resumption of normal heart rhythm.

Postoperative complications that occurred during the 6-month follow-up were the following: internal jugular vein thrombosis (5 cases/1,6%), infection (8 cases/2,5%), abscess at the implant site (7 cases/2,19%), externalized port (8 cases/2,5%), local hematoma (3 cases/ 0.9%), non-functional implants (6 cases/1.9%) with 4 cases of reimplantation, extravasation (2 cases/0.6%) and one case of twisting port in subcutaneous tissue.

Abscesses at the implant site developed either by using the port in less than 7 days after the surgery or due to the immunosuppressive effects of preoperative chemotherapy or to locoregional radiotherapy performed preoperatively, tissues in these areas being extremely fragile.

In case of internal jugular vein thrombosis, patients accused localized pain in the right cervical region, and swelling of the region, three, respectively four months after surgery. The suspicion of thrombosis was confirmed by ultrasound. A CT angiography was also performed to exclude the presence of superior vena cava syndrome. Anticoagulants were administered in all cases, with a favorable evolution. In three cases, the port was removed prematurely at the patient's request.

Externalization of the port occurred in 8 cases (five cases of pancreatic cancer, one case of stage IV colon cancer, one case of stage IV melanoma), 6 months postoperatively, probably because all these patients underwent home-based chemotherapy using elastomeric pumps, which add extra traction to the port and tissues, exerted continuously over 24 or 48 hours. In these cases, the port could not be preserved using surgical repositioning methods and had to be removed prematurely.

When problems in terms of functionality occurred while using the port, we tried to solve them using conservative methods. In six cases, we failed and we had to remove the port prematurely.

In two cases we managed to reinsert the port using the same approach path, while in the other four cases, patients refused reimplantation.

Extravasation was detected in two case (stage IV gastric cancer), when chemotherapy was injected in the subcutaneous tissue around the port and due to its highly irritating effect, it caused necrosis of the tissue. Thus, we had to remove the port. The twisting port in subcutaneous tissue, appeared at an obese patient with sarcoma who also underwent home-based chemotherapy using elastomeric pumps continuously over 48 hours; and because of her illness and pain she had a vicious body position that probably brought the twisting of the port.

The main causes for the premature removal of the port (before the end of chemotherapy) in our study group were represented by: externalization (8 cases), infection and abscesses (15 cases), mechanical problems (6 cases), pain at the implantation site (4 cases), thrombosis (3 case), extravasation (2 case) and twisting (1 case).

In our study, there was no case of death related to surgery, the mortality was 0%.

By analyzing the profile of patients with premature removal of the port, we noticed the presence of several predictive factors. Thus, the longer the duration of surgery, the higher the risk of obstruction. Body mass index (BMI) also plays an important role in the occurrence of skin changes and mechanical problems. Regarding patient history - ENT surgery and cervical-thoracic radiation therapy - have determined the most frequently intraoperative complications.

Discussions

In our study, intraoperative complications were represented by the incorrect insertion of the catheter into the subclavian vein in 0.6% of cases and the accidental puncture of the common carotid artery in 1,25% of cases, while data in the literature indicate higher percentages for these complications, 7.6% and 4.3% (Rykov et al 2016). Another type of intraoperative complication reported in the literature is the placement of the catheter in the right ventricle (Wyles et al 2007), in our study we have not encountered such a case, but we met a case of paroxysmal tachycardia during surgery.

In our study, the use of implantation ports to deliver chemotherapy by means of the ultrasound-guided catheterization of the internal jugular vein did not result in the occurrence of intraoperative or postoperative complication such as pneumothorax or hemothorax. In the literature, there is a 2-4% frequency of pneumothorax, which is also influenced by the implantation method, directly associated with body mass index (LaBella et al 2005). The most common postoperative complications reported in the literature, occurring after port placement for chemotherapy are infections (0.7-7%) and venous thrombosis (1.5-13%) (Aparna et al 2015; Binnebösel et al 2009). In our study, infections (4.7%) were associated with immunosuppression following chemotherapy performed preoperatively and short-timed, less than 7 days between surgery and the first use of the port. In these cases, the quick removal of the port is mandatory. Therefore, we recommend that the port is only implanted at least 14 days after the last chemotherapy session and WBC count should be greater than 3000 / mm³ during surgery. We also suggest that the port should only be used 7 days after surgery.

Internal jugular vein thrombosis occurred in five cases (1,6%) without subsequent superior vena cava syndrome. Patients responded well to anticoagulation therapy, without any requirements for the premature port removal, which only happened when it was removed at the patient's request. We believe that internal jugular vein thrombosis does not require port removal if the patient does not develop superior vena cava syndrome and he/she responds well to anticoagulation therapy.

In our study, the incidence of externalization of the port was 2,5% – reached the upper limit of records from the literature (Aparna et al 2015; Gonda et al 2011), but it complied with the threshold recommended for this procedure by the Society of Interventional Radiology (Gonda et al 2011). It occurred at patients with home-based chemotherapy used elastomeric pumps continuously for 1-2 days. We recommend that the port should be implanted deeper and with additional and stronger fixation in these patients.

Mechanical problems and twisting port arising during the use of the implanted port were solved using conservative methods. In seven cases, the port had to be removed prematurely (2,19%), but it was later repositioned using the same approach and the same vein, which is impossible when inserting the port into the cephalic vein (Vandoni et al 2009).

There was no evidence of catheter breakage or bending in our study. Another important complication, the “pinch-off” syndrome (the catheter is compressed between the clavicle and the first rib), with 1.1-5% incidence in the literature (Ko et al 2016), did not occur as a complication in any of the cases in our study. Extravasation followed by necrosis occurred in two one cases (0.6%). This type of complication has also been reported by other authors and it required premature port removal because of highly irritating effect of the chemotherapeutic agent which caused necrosis of the tissue (Gonda et al 2011).

Conclusions

The method, used by us, in placing the ports for chemotherapy in oncological patient by echo-guided puncture of internal jugular vein have very good results with morbidity lower than in the literature data. This thanks to the technique used but also because of patient selection involving avoidance of preoperative chemotherapy and preoperative cervical-thoracic radiotherapy, shorter duration of surgery and the first use of the port seven days after surgery.

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Authors

- Bogdan Micu, Vth Surgical Department, “Iuliu Hatieganu” University of Medicine and Pharmacy, Municipal Clinical Hospital, 11 Tabacarilor Street, 400139, Cluj-Napoca, Cluj, Romania, EU, email: micubogdan@yahoo.com
- Carmen Micu, Vth Surgical Department, “Iuliu Hatieganu” University of Medicine and Pharmacy, Municipal Clinical Hospital, 11 Tabacarilor Street, 400139, Cluj-Napoca, Cluj, Romania, EU, email: carmenmmicu@yahoo.com
- Tudor R. Pop, Vth Surgical Department, “Iuliu Hatieganu” University of Medicine and Pharmacy, Municipal Clinical Hospital, 11 Tabacarilor Street, 400139, Cluj-Napoca, Cluj, Romania, EU, email: poptudor_2003@yahoo.com
- Nicolae Constantea, Vth Surgical Department, “Iuliu Hatieganu” University of Medicine and Pharmacy, Municipal Clinical Hospital, 11 Tabacarilor Street, 400139, Cluj-Napoca, Cluj, Romania, EU, email: nicuconstantea@yahoo.com

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