Comparative results of the two methods of port catheter application and evaluation of patient comfort with visual analogue scale

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ABSTRACT

Objectives: **To evaluate the two different methods of port catheterization and evaluation of patient comfort with an objective scale.**

Background: **Port catheters are essential in long term drug administrations such as chemotherapy or intravenous alimentation.**

Methods: **Forty-six patients were port-catheterized between 01.05.2013 - 31.10.2013 in our clinic. Group 1 (n=21) consisted of non-aided catheter procedures and Group 2 (n=25) consisted of ultrasonography aided catheter application procedures. The patients were asked to evaluate the in-procedural pain, the duration of the procedure, their comfort in the procedure and mark it on a visual analogue scale. The scale was a 10 cm length straight line on plain paper numbered 1 at one end and 10 at the other end representing minimum and maximum values.**

Results: **The mean age of the patient population was 53.85 years (ranged between 13 and 80 years) and consisted of 25 (54.3%) males and 21 (45.7%) females. The catheter placement sites are as follows respectively (Group 1/Group 2): right internal jugular vein 20 / 22, left internal jugular vein 0 / 3 and right basilic vein 1 / 0. A statistically significant difference was found in the operation length, puncture count, pain score and comfort score data of the groups. Operation length, puncture count and pain score were lower and comfort score was higher in Group 2 (p values respectively 0,001; 0,003; 0,031; 0,047).**

Conclusion: **Visually aided port catheterization is less risky and more comfortable for both the surgeon and the patient.**

Key words: **Port catheterization, central catheterization, vascular ultrasonography, chemotherapy**

Introduction

Vascular port catheters provide an easy method of vascular access when it is difficult to find a durable venous vascular access in oncology patients who have to get long term chemotherapy . Patient comfort and adherence to medical treatment may increase with a long lasting port catheter. We aimed to compare the results of the two methods of port catheter application and evaluate the affects on patient comfort in this prospective study.

Material and Methods

We have placed vascular port catheters to a total of 46 patients between 01.05.2013 - 31.10.2013 in our clinic. The indications for port catheter application were long term chemotherapy administration, long term anti-biotherapy administration and intravenous alimentation. The patients were evaluated by their general vital conditions, hemorrhagical diathesis, presence of any kind of mass or local infection at the placement site which is internal jugular vein or subclavian vein. Informed consent was taken from all of the patients before the procedures. All catheters were placed by the same surgery team. Prophylactic anti-biotherapy was not routinely administered.

Right internal jugular vein was the first site of choice for the port catheter application. In case of any abnormal state at that location and mastectomy patients, contra-lateral vein was preferred. If ultrasonographic examination was needed, jugular veins were evaluated before the sterilization of the catheter site. The whole process was conducted in the surgery room after proper monitoring was set and under local anesthesia. Single lumen port catheters were used in all of the patients (Vortex VX Port, AngioDynamics Manchester, USA). A subcutaneous port pocket was prepared in the anterior chest wall. After connecting the port body and catheter parts, the flow of the catheter was checked by flushing with normal saline. Then it was filled with heparinized saline solution (2500 units of heparine in 10 cc normal saline). The port body was implanted into the subcutanous pocket. All patients were evaluated for pneumothorax, the orientation, kinking and malpositioning of the catheter with chest radiogram 1 hour after the procedure. The non-complicated patients were discharged 2 hours after the procedure with per oral antibiotic (cefuroxim 500 mg 2x1) and analgesic (paracetamol 500 mg 3x1) drugs prescription. At 1 week follow-up patients were examined for complications such as hematoma, endurance, erythema, oedema and suture dehiscence at the port implantation site.

The patients were asked to evaluate the in-procedural pain, the duration of the procedure and their comfort in the procedure and mark it on a visual analog scale. The scale was a 10 cm long straight line on plain paper numbered as 1 at one end and 10 at the other end representing minimum and maximum values.

Surgical Technique:

The procedure was done in the operation room. After proper cardiac rhythm and arterial blood pressure monitoring and local anesthesic drug administration venous punction was done with the 18 gauge venous needle. After venous puncturation 0.035 inch thick guidewire was inserted into superior vena cava. Then the same side of the pectoral region with the venous punction was locally anesthesized about 2-3 cm caudal to the clavicula to prepare the subcutaneous pocket for the port body. The subcutaneous pocket was prepared by blunt disection of the subcutaneous tissue through a 3 cm long skin incision. Care was taken to prepare the pocket at the proper size for the port reservoir. Then a tunnel was formed between the port pocket and the catheterization site with the help of a trocar and the catheter was placed through this tunnel. A peel-away sheath was placed over the guidewire and then the guidewire was pulled out. The other end of the catheter was inserted through this sheath. Then the sheath was peeled away. The catheter was cut after adjusting the proper length and then connected to the port body itself. The catheter-reservoir connection was checked for any leakage with a Huber needle. The port reservoir was firmly fixed to the chest wall with two silk sutures. The subcutaneous tissue and the skin incisions were sutured properly.

Statistical Analysis:

The statistical analysis of the data was done with SPSS 13 (Statistical Package for the Social Sciences) for Windows program. The normality of the data was tested with Shapiro-Wilk test. The normally distributed data were evaluated with t-test and non-normally distributed data were evaluated with chi-square test and Mann- Whitney U test. P values lower than 0.05 were accepted as statistically significant.

Results

A total of 46 patients between 01.05.2013 - 31.10.2013 were port catheterized in our clinic. The mean age of the patient population was 53.85 years (ranged between 13 and 80 years) and it consisted of 25 (54.3%) males and 21 (45.7%) females. The patients were divided into two groups. In Group 1 (n = 21), venous punction was done manually and in Group 2 (n = 25) it was done with the aid of ultrasonography (Esaote Europe BV 8100; The Netherlands) using a sterile covered 13 MHz linear probe. The demographical data of the groups are listed in Table 1.

The main indication for port catheterization was intravenous drug administration except in 1 patient. That patient needed a port catheter for intravenous (IV) alimentation. The diagnosis and catheter indications of the groups are listed in Table 2.

The catheter placement sites are as follows respectively (Group 1/Group 2): right internal jugular vein 20 / 22, left internal jugular vein 0 / 3 and right basilic vein 1 / 0 (Table 3). A statistically significant difference was found in the operation length, puncture count, pain score and comfort score data of the groups. Operation length, puncture count and pain score were lower and comfort score was higher in Group 2 (p values respectively 0,001; 0,003; 0,031; 0,047) (Table 4).

Malpositioning of the catheter occured in 1 patient in Group 1. The catheter went through the right subclavian vein. Then it was retracted partially and re-inserted into the superior vena cava with the help of the guidewire. Hematoma occurred in 2 patients in Group 1 at the venous puncture site. Port infection occurred in 2 patients in Group 2 and ports were removed. Skin erosion occurred in 1 patient in Group 1 after 3 months of the procedure and the port body re-placed somewhere else. There were no hemothorax, pneumothorax, vein thrombosis or kinking (Table 3).

Table 1: Demographic data of the group

	Group 1 (n=21)	Group 2 (n=25)	p value
Age Median (min-max)	57 (13 - 78)	56 (19 - 80)	n.s.
Gender			
- Male	11	14	n.s
- Female	10	11	n.s
DM	1	2	n.s.
HT	4	2	n.s.
COPD	1	3	n.s.
Smoking	6	8	n.s.
Obesity	2	4	n.s.

BMI: Body mass index; DM: Diabetes mellitus; HT: Hypertension; COPD: Chronic obstructive pulmonary disease.

Table 2: Indications for port catheterization

Indication	Group 1 (n=21)	Group 2 (n=25)	p value
Breast ca	1	3	n.s.
Colon ca	10	7	n.s.
Stomach ca	0	3	n.s.
Rectum ca	2	2	n.s.
Nasopharynx ca	1	2	n.s.
Other	7	8	n.s.

Other: Parotid ca, Acute lymphocytic leukemia, Hypopahrynx ca, Oesaphagus ca, Omentum tumor, Small Intestine ca, Cerebral Palsy, Uterus ca, Mesothelioma, Bone tm

Table 3: Port catheterization sites

	Group 1 (n=21)	Group 2 (n=25)	p value
Right internal jugular vein	20	22	n.s.
Left internal jugular vein	0	3	n.s.
Right basilic vein	1	0	n.s.

Table 4: Operational data and visual analogue scale (VAS) scores

	Group 1 (n=21) Mean (min - max)	Group 2 (n=25) Mean (min - max)	p value
Venous puncture count	3.57 (1 - 8)	1.56 (1 - 4)	0.003
Operation time (mins)	31.29 (15 - 66)	20.0 (13 - 31)	0.001
VAS scores:			
Pain score	4.67 (1 - 10)	3.12 (1 - 6)	0.031
Operation length score	4.71 (1 - 8)	3.88 (1 - 8)	n.s.
Comfortability score	8.24 (7 - 10)	8.72 (8 - 10)	n.s.

Discussion

We found that operation length, puncture count and pain scores were lower and comfort score was higher in Group 2 (p values respectively 0,001; 0,003; 0,031; 0,047). The port catheter itself can provide a safe and long lasting vascular access in chronic chemotherapeutic drug recipients and for IV alimentation purposes. We think that ultrasonography support in the procedure may shorten the operation time, reduce the complication rates and increase patient comfort.

The main indication for port catheterization we see nowadays is to provide a safe vascular access in malignancy patients. Also it is not very rare to see port catheters in patients who need long time hospital care such as chronic gastrointestinal system illness or neurological disease and usually peripheral venous access of these patients are dried out. The port catheters seem to be advantageous according to other tunneled catheters with lower infection rates, longer durability and non-restriction on the patients' daily life activities (1,2). Hajek et al (3) reported that in malignancy patients with longer than 6 month life expectancy, vascular port cathterization is better than other percutaneous interventions.

Pneumo/hemothorax, malpositioning, malfunctioning, arrhythmia, cardiac perforation, hematoma in port pocket or in vascular puncture site, venous thromboembolism, arteriovenous fistula, left thoracic duct rupture, phrenic nerve or brachial plexus injury are common complications in the early period after port cathterization procedures. Later complications can be skin necrosis, breaking in the catheter, embolisation of the catheter, infection, disconnection, difficulty in blood aspiration through the catheter and fluid extravasation (4-7). Visual aid in the catheterization procedure may mostly prevent the complications such as pneumothorax, hemathorax, arterial injury and catheter malpositioning (8).

Preparing the port pocket too close to the skin and large port selection in thin patients may cause skin erosion in the pocket site. Skin erosions are reported to be in about 1% of the patients (9). Placing the port too close to the skin may be related to the experience of the surgeon but to avoid skin erosion in thin patients the port may be placed under the pectoral fascia or pectoral muscle. We have seen skin erosion in 1 patient in Group 1 after 3 months of the operation. In that case the port body was removed and placed 2 cm lateral to the original site under local anesthesia. We have also seen two cases of port access difficulties. Those patients were port catheterized in some other hospitals and attended our clinic with the complaint of port access difficulty. We have seen that those ports were placed under the pectoral muscle. The port bodies were replaced closer to the skin surface and thus the difficulty in accessing the ports was corrected.

We preferred right internal jugular vein in the first place for the venous access site. Right internal jugular vein and superior vena cava forms a straight line so that the catheter contacts less to the vascular wall and the risk of venous thrombosis diminishes (10). We have preferred left internal jugular vein in patients with right internal jugular vein occlusion or mastectomy.

Different rates of port infection are reported in the literature ranging between 2.6% and 9% (9,11,12). We did not see any infection in the early period (in 1 week). In the later period we saw 2 (8%) port related infections in Group 1 and these ports were removed. In one of these patients port pocket infection was found and Pseudomonas was determined in wound site specimen culture. The other patient had repeating fever episodes weekly after 1 month of the procedure but no other source of infection was spotted in that patient.

One of the important complications of the central venous catheters is the catheter related thromboembolism. Ignatov et al (13) reported the incidence of thrombosis to be about 7.5%. Bern et al (14) reported that administration of 1 mg oral warfarin daily reduces the risk of thromboembolism about 20%. We did not administer any anti-coagulant or anti-aggregant agent in our study. But the port-catheter system maintenance was done by flushing the system with normal saline and then re-filling it with diluted heparine-saline solution. We did not see any thrombosis in the early period in our study patients. We have seen a catheter thrombosis after 4 months of the procedure but this patient was catheterized in some other clinic and we removed the thrombosed catheter.

We have accepted it as failure of catheter application when ultrasonography aid was needed in the procedure in Group 1 patients and these patients were included into Group 2. We had 4 (16%) procedures in which the catheters were intended to be manually inserted but after some trials ultrasonography aid was needed. In a study conducted with over 400 patients it is reported that the rate of success in port catheterization with the conventional surgical technique is about 80% (15). Our success rate is 84% and is similar to the literature. Most of our study patients were accepted for catheterization in the early postoperative period of oncological surgery and most of the patients were dehydrated. We think that these factors may reduce the success rates in the non-ultrasonography aided group.

Arterial, nerve or pleural injury may be reduced when the ultrasonography aid is used in the procedure (16). Randolph et al (17) reported that the risk of vascular or nerve injury is reduced about 80% when ultrasonography is used. Gebauer et al (18) used fluoroscopy and ultrasonography in the procedure and reported that they had no complications such as nerve injury, hematoma or pneumothorax. The venous puncture count before catheter insertion was significantly lower in the ultrasonography aided group (Group 2) in our study (p=0,003). We had 2 local hematomas at the venous puncture site in Group 1 but the hematomas resolved in time.

The Visual Analogue Scale (VAS) was used in this study. It is commonly used in many clinical and behavioural studies to standardize and measure the non-objective data such as pain and comfort (19 - 21). VAS is consisted of a 10 cm long line on a plain paper. One end of the line represents the worst condition or lowest degree and the other end represents best condition or highest degree and patients are asked to mark their degree of what is being measured on the scale (22). The VAS scores of pain are significantly lower in Group 2. That means patients had felt less pain when the procedure was done with ultrasonography aid. The comfortability scores were nearly

equal with each other. That means patient comfort during the procedure was nearly equal.

Conclusion

Most of the hospitalized patients suffering from chronic illnesses also suffer from central or peripheral vascular catheters. These catheters may be occluded, infected or inflammated and then need to be revised or changed. Every attempt of re-catheterization means pain and risk of infection for the patient. Also no clinician would like to lose a patient because of septicemia caused by a small venous catheter. We think that the port catheters come in aid here. They can be inserted with low complication rates and if ultrasonography aided these rates are even lower. Also they increase patient comfort and daily life quality.

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