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RESEARCH ARTICLE

USE OF PORT-A-CATH IN CANCER PATIENTS: A SINGLE SURGEON EXPERIENCE

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ABSTRACT

Objectives: To indicatea single surgeon's experience in using of port-a-cath in patients who have cancer and discover the most frequent complications encountered with such procedure during a particular period in a single institution. **Methods:** A subcutaneous port catheter was received in a potential study between 2015 and 2018 by 130 patients; Data on implantation complications and complications during usage of the catheter have been collected. **Results:** The procedure was performed with an average of 44 minutes in most of the patients under local anesthesia. Many patients had their catheters inserted with almost no intraoperative complications through the right internal jugular vein. Postoperative complications arisen in 17 patients (13.1%).In 5 patients, complications occurred in the form of port site infection (3.8%), 3 patients blocked catheter (2.3%), venous thrombosis in 3 patients (2.3%), In 3 patients, persistent fever with a positive blood culture (2.3%), puncture site hematoma in 1 patient (0.8%), skin necrosis in 1 patient (0.8%) and upside down tilt of the hub in 1 patient (0.8%). **Conclusion:** In modern oncology, Port-a-cath is a reliable and effective venous access but associated with a certain risk of complications. Medical staff should give care for both the patient and catheter to reduce the risk of complications.

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INTRODUCTION

Chemotherapeutic control in modern oncology relies on regular and safe access to the venous system for medication and fluid delivery and cyclical monitoring of the effects of treatment (Reed, 1993). Completely implantable vein access devices offer safe access and long-term use delivering chemotherapy in cancer patients (Bow, 1999). A commonly used form of venous access system is the port-a-cath device. Port-a-Cath is a completely implantable venous access device consisting of a storage hub/tank placed in a surgical pocket on the chest wall or on the upper arm and connected to a catheter that inserted into a central vein. The port septum provides access to the reservoir with a non-coring needle (Ahn, 2012). Since first introduction of subcutaneous implantable port-a-cath by Niederhuber in 1982, this procedure gained widespread in treatment of cancer patient (Neiderhuber *et al*., 1982). Subcutaneous port-a-cath is favored to peripheral catheter because it is more comfortable to the patient and reduces the rates of wound infection (Krupski, 1995). It also reveals the benefit of ease of fixation using local anesthesia, minimal patient pain, low complication rates and the ability to continue treatment at home after patient discharge with less disturbance of daily activity (Biffi, 1997). The learning curve for the procedure is short and its insertion implemented by radiologists, surgeons and oncologists. It is recommended that ultrasound guidance and fluoroscopy be used to reduce the complication rate during the procedure (Surov, 2008; Lorch, 2001). The use of the ports for a variety of indications has also led to a wide range of well-known recorded complications in the literature (Çil, 2006; Denny, 2003; Dysarz, 1998; Malm, 2005). This study was conducted to assess a single surgeon's experience of using port-a-cath during a specified period starting from learning to perfection and to show the immediate and long-term complications of port-a-cath insertion and to determine if the complication rate was consonant to that stated in the literature.

PATIENTS AND METHODS

Through the period extending from June 2015 till August 2018, 165 patient required central venous access during their treatment plan in Kuwait Cancer Control Center to receive chemotherapy either as neoadjuvant, adjuvant, or palliative treatment. Some needed this access for chemotherapy and bone marrow transplant. These venous accesses were Port-A-Cath, Hickman's Line, or Permacath.

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All these patients had their central venous access fixed by the same surgeon. The first 20 cases were excluded from the study as we consider them needed to attain good learning curve and were done with assistance or under observation from senior trained staff. From the rest; 130 patients with solid organ tumors had a Port-A-Cath inserted along the period. Written informed consent was taken from each patient explaining the procedure and its benefits and possible complication, with agreement on using the data regarding the procedure or imaging for research devotions. Pre-operative check of patient common condition and investigations included CBC and coagulation profile done for all patient and platelet count of at least 50000 /ml^3 was needed and INR of not more than 1.5.Prophylactic preoperative antibiotic was used as a single dose 3rd generation cephalosporin given preoperatively.

Technique of insertion: A polyurethane Port-A-Cath kit POLYSITE® provided by PEROUSE MEDICAL, France, used in all patients with size ranging between 8-10 F.Fig. 1. Selection of the route of venous access left for surgeon preference putting in mind the easiness of puncture and the presumed least possible complications stated in literature. So right internal jugular vein came in first place followed by left internal jugular vein, right subclavian and finally left subclavian. One special situation in females with right breast cancer the selection was preferentially for left internal jugular or left subclavian vein in order to easily place the subcutaneous port away from side of surgery and possible radiotherapy field. In theater the heart rate, blood pressure and oxygen saturation of the patient was monitored throughout the procedure. Under complete aseptic technique, while the patient in 15-20 degree Telendenburg position, Seldinger's technique was used to get venous puncture under US guidance (LOGIC 5, GE Health Care Medical Systems, USA) then a guide wire introduced and its position in the right side of the heart checked using intraoperative fluoroscopy by C-arm machine (GE OEC 9900 Elite) Fig 2. The port site was anaesthetized by xylocaine then 2-3 cm skin incision done and a subcutaneous pocket created to accommodate the drum then the catheter was tunneled from this pocket to come out at the puncture site where the guide-wire still in place. A peel-away sheath with a dilator was introduced over the guide wire then the dilator removed and the catheter was inserted via the sheath. Position of the catheter tip was adjusted to be at the atrio-caval junction and checked by C-arm machine. Once in place the catheter was cut to the appropriate length and connected to the drum with a plastic lock then the drum was sutured by 3 point fixation to the under lying fascia. The drum and catheter was tested for backflow and in flow using non-coring Huber needle then it was locked by heparinized saline and the skin closed over it. Fig 3. Data was documented regarding age, sex, type of cancer, route of venous access, usage of US, time taken for insertion and immediate intraoperative complications if any.

Post-operative care: All patients were discharged within 6 hours post operatively with post-operative chest x-ray done for all patients had a subclavian access or who complained of any chest tightness or dyspnea during the procedure. Patients allowed using the catheter for their chemotherapy starting from the day 1 post-operative and the actual start was documented on first follow up visit. Post-operative care and maintenance carried out by dedicated trained nurse at chemotherapy room. Patients were followed up on day 7 and 30 post operatively, also on emergency basis at any time if indicated or suggested by medical doctor or chemotherapy nurse.

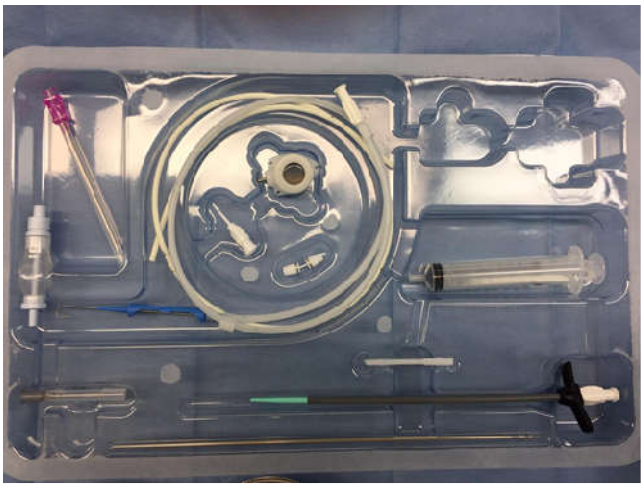

Figure 1. Polysite® Port-A-Cath Kit, opened before insertion and showing contents: guide-wire, catheter and drum, peel away sheaths with its dilator, metal tunneler, 10 ml standard syringe and needle

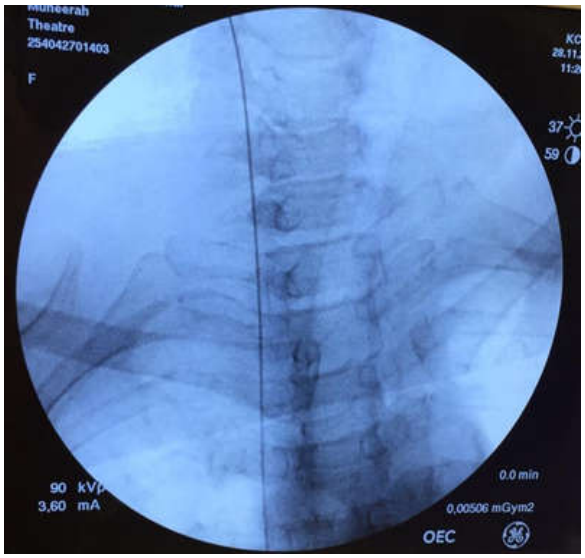

Figure 2. Fluoroscopic view showing a guide-wire in the RT side of the heart

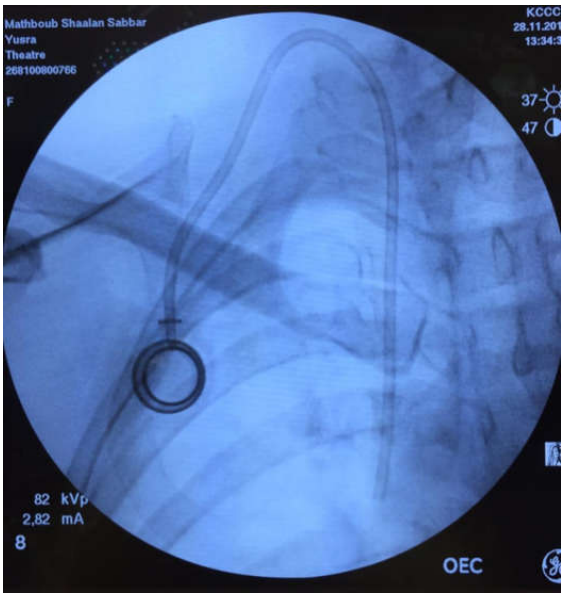

Figure 3. Fluoroscopic view showing the portacath in place after insertion

The catheter needed to be removed when any complication necessitated that (wound infection, skin necrosis over the port, fever with bacteremia with no other obvious cause, thrombo-embolic event, non- functioning catheter) or on completing the course of treatment and advised to be removed by medical doctor.

RESULTS

Of the 130 implantations, 70 were males (53.8%) and 60 were females (46.2%). Mean age was 41 years (range 24-80). All patients had confirmed malignant conditions. Gastrointestinal tract malignancies were the most common diagnoses (43.8%), followed by breast cancer (24.6%) Table 1 In our series port-a-cath insertion was done using local anesthesia or local anesthesia with sedation. Only two patients had there catheter inserted while under general anaesthesia one was very anxious and afraid to undergo the procedure under local and the other had her catheter inserted while her surgery for breast cancer. The port-a- cath was inserted through the right internal jugular vein in 86.9 % of the patients and via the right subclavian vein in 5.4%, left subclavian vein in 3.8% and left internal jugular vein in 3.8%. The details are shown in Table 2.

The estimated time of the procedure, measured from starting giving local anaesthesia and vein puncture till wound closure, ranged between 30-80 minutes with average of 44 min. (Table 3). Post-operative complications occurred in 17 patients (13.1%) where port site infection came first and occurred in 5 patients (3.8%), followed by catheter related bacteremia, catheter blockage and venous thrombosis (2.3% each). (Table 4)

Table 1. Underlying malignancies of the patients with Port A Cath

Breast	32
Colon	31
Ovary	14
Rectum	13
Pancreas	10
Stomach	8
Lymphoma	8
Esophagus	4
Cholangiocarcinoma	3
Lung	2
Gall bladder cancer	1
Nasopharyngeal cancer	1
Pseudomyxomapretonii	1
Sarcoma	1
Appendicular cancer	1

Table 2. Route of catheter insertion

Route	Number of patients
Right internal jugular vein	113
Right subclavian vein	7
Left internal jugular vein	5
Left subclavian vein	5
Total	130

Table 3. Time of insertion of the Port A Cath

30 minutes	16 patients (12.3%)
35 minutes	16 patients (12.3%)
40 minutes	44 patients (33.8%)
45 minutes	15 patients (11.5%)
50 minutes	20 patients (15.4%)
60 minutes	14 patients (10.8%)
65 minutes	1 patient (0.8%)
70 minutes	3 patients (2.3%)
80 minutes	1 patient (0.8%)

Table 4. Complicationsconnectedto Port-A-Cath implantation

Wound infection	3.8% (n=5)
Blocked catheter	2.3% (n=3)
Venous thrombosis	2.3% (n=3)
Unexplained fever with positive blood CS	2.3% (n=3)
Puncture site hematoma	0.8% (n=1)
Skin necrosis	0.8% (n=1)
Upside down drum	0.8% (n=1)

DISCUSSION

Owing to the advancement of long-term cancer treatments, regular need to access venous system, and the delivery of a plenty of fluids and chemotherapeutics, the use venous catheters has become common in recent years. The greatest advantages of implantable port catheters compared to other types of central catheters are low infection rates, long life span and reduced restrictions on daily activities of patients, increased comfort, long-term usability and reliability without special care (Krupski, 1995; Biffi, 1997; Carlo, 2004). Furthermore, the port insertion into the body which considered as a foreign object is followed by technical difficulties and the risk of complications arising (Eroğlu, 2008). Although the value of the implantable port is greater than that of the inconvenience (Hartkamp, 2000), complications linked to the implantable port may be serious. In this analysis the overall incidence of complications connected with Port-A-Cath was 13.1%. During port insertion, the techniques used by interventional radiologists and surgeons are comparable. During operations, radiologists often use fluoroscopy and ultrasonography. Port insertion under surveillance minimizes procedural complications like pneumothorax, hemothorax, arterial damage and malposition of the tip of the catheter (Biffi *et al*., 1997; Mansfield, 1994). In our study the RT IJV route was the most frequent (86.9%) as it is preferred by the surgeon providing the easiest way by its direct continuation with the SVC and RT side of the heart in comparison to the LT IJV and a less documented rate of pneumothorax in comparison to subclavian vein. The time taken to perform the procedure ranges between 30-80 minute with average of 43.6 and this time include the whole procedure including the use of US-guidance and also the use of fluoroscopy which deployed in all cases. The use of fluoroscopy was of great help avoiding problems that happen sometimes during insertion regarding the position of catheter tip and misdirected guide-wire and catheter especially seen when subclavian or LT IJV used where they may cross to the contralateral side or up into RT IJV. Our port-a-cath related complications were wound infection, blocked catheter, venous thrombosis, persistent fever with positive blood culture, puncture site hematoma, skin necrosis and upside down drum. Puncture site hematoma developed in one patient of our series, in this patient there was in advertent arterial puncture that revealed immediately by high pressure backflow via puncture needle revealed bright red blood coming in jets, so the needle removed and pressure applied for some times then the procedure carried out using another route for venous access. In Krupski case series port-related infections were reported as between 0.5 and 9% (Krupski *et al*., 1995). Typically, infection followed by fever of unknown origin. In these cases, it is advised to remove the catheter as catheter or port pocket-related infections can develop (Krupski, 1995; Lorch *et al*., 2001). Kurul *et al*. (2002). Reported port pocket infection associated with long-term use as 0.3 to 4.4 percent.

For port infection cases, the port responsible for the infection should be removed. In current study, Port Pocket Infection developed in 5 patients, or 3.8%, who had the catheters removed and started antibiotic therapy and operating site treatment following the discovery of infection. Three of patients (2.3%) showed persistent unexplained fever with positive blood culture taken through the catheter with no improvement despite use of antibiotics and this necessitated catheter removal as it was attributed as the only source of infection despite no local manifestation at pocket site. So in our study, port-a-cath related infection including pocket infection and catheter colonization were seen in about 6.1% of all our patients and this goes in correspondence with other series documented catheter-related infection as the cause of precocious removal in 7.1–13.4% of cases (Ray, 1996; Schwartz, 1997; Schuman, 1995). In 1% of their patients, Cil *et al*. (2006) reported skin erosion and related skin necrosis. Lack of technical experience could cause the contiguity of the port pocket to the skin. Appropriate skin thickness should therefore be maintained over the port particularly in thin cachectic patients and suturing the reservoir to pectoral fascia with a non-absorbable suture could also prevent skin erosion over the port (Ahn, 2012; Çil, 2006; Vardy, 2004; Plumhans, 2011). These technical tricks along with proper pocket size also could prevent reservoir malposition, twist or upside down tilt which happened in one patient of our series in whom absorbable suture was used with possibly large pocket relative to reservoir size. In three patients (2.8%), presented with either neck or limb pain and swelling diagnosed as having venous thrombosis so their catheters were removed.

Dysfunction of the port-a-cath indicated by a difficulty in catheter blood aspiration and fluid injection capability and is typically experienced with long-term use. For catheters that are mounted without fluoroscopy or that are not monitored, catheter instability occurs due to catheter kink as in the case of a narrow loop when using internal jugular vein, fibrin accumulation, precipitation of hyperosmolar liquids and medications, inclination of the catheter tip against the wall of the vessel or disconnection of the catheter from the port. (6). Catheter failure or blockage was seen in 3 of our patient representing 2.3% and this goes with reported rate in other series ranging between 2.9-3.4% (Schwartz, 1997; Schuman, 1995; Vardy, 2004). Dislodged catheter fracture occurs in about 0.2–1% of port-a-cath implantation (Kock, 1998; Koller, 1998). The dislocated parts of the catheter normally appear in the central veins (Surov, 2008). However there may be serious complications such as pulmonary embolism, arrhythmia, heart arrest and perforation (Ballarini, 1995; Monreal, 2001; Gowda *et al*., 2004). Luckily, none of our patients demonstrated this important complication. In summary, the insertion and use of port-a-cath in our research is a safe and useful tool for long-term intravenous access with a short learning curve. Through the published data, our complication rate of 13.1% was comparable to most of other series. Nevertheless, the complications related to port-a-cath use can be reduced by using aid of fluoroscopy and US-guidance. Also port-a-cath care and maintenance is critical to maintain low rates of late complications. For early identification of complications, sufficient information ought to be given to the patient before insertion and adequate follow-up after insertion.

Conflict of interest: The surgeon does not have any conflict of interest.

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