Technology Update

IMPLANTABLE PORTS IN PEDIATRIC ONCOLOGY PATIENTS

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Between January 2003 till September 2004, twenty-five venous access devices have been implanted in 25 children with various types of cancer. Healthport MiniMAX (Baxter) was inserted in 19 patients and Vortex 7.2 F (HMP) in 6 patients. The catheter was inserted percutaneously in the right internal jugular vein or the right subclavin vein. Cumulative total venous access was 7321 patient-days; mean 293 days per patient, range 8-638 days. Infection and occlusion were the only complications encountered in 4 patients. With proper placement technique and adequate nursing care they represent a definite improvement in pediatric cancer therapy.

Key words: Implantable Ports, Pediatric Oncology, Totally Implantable Central Venous Access Device.

DUE to new aggressive treatment protocols, survival from cancer in children has increased considerably during the last two decades. However, such intensive chemotherapy regimes require safe and prolonged access to the venous system [1]. Peripheral veins may be inadequate from the beginning or may gradually be occluded during the course of treatment. The risk of necrosis of skin due to extravasation of antineoplastic drugs is always there and may be disastrous. Some patients may require repeated blood sampling or transfusion, hyperhydration and parenteral nutrition. Repeated venipuncture causes increasing physical and psychological trauma especially in children.

The externalized subcutaneously tunnelled catheter developed in 1973 is a good option for a safe and prolonged access to the venous system, but the high risk of catheter sepsis and interference in the day to day life like clothing, bathing, playing and swimming make them far from ideal for outpatient care [2].

In 1984, the first totally implantable central venous access system (Port-a Cath, Pharmacia) became commercially available and since then a wide variety of similar system have developed. The advantages of these devices as compared to the externalized tunnel catheters are (*i*) minimal risk of infection (*ii*) minimal maintenance and (*iii*) excellent patient comfort. This has resulted in a high level of patient acceptability and makes them the best type of device for outpatient oncology treatment [3].

MATERIAL AND METHODS

Between Jan 2003 till September 2004 twenty-five ports (*Fig.*1) have been implanted in 25 patients requiring prolonged chemotherapy. There were 10 girls and 15 boys. The age ranged from 9 months to 18 years. (Median - 5 yrs) (*Table* 1)

The conditions requiring placements of ports were Wilm's Tumor, Neuroblastoma, Lymphoma, Leukemia, Rhabdomyosarcoma, CNS Germinoma and Germ Cell Tumor (*Table* 2). Two different types of port were placed during the study depending upon the age of the patient (*Table* 3). All the ports were placed before the commencement of treatment or when the conditions were optimal (normal or near normal neutrophils and platelets) so as to minimize complications, as it is an elective procedure. All patients received a broad-spectrum antibiotic prophylactically. All the ports were put by a single surgeon who had previously placed more than 250 adult ports. The procedure was done under general anesthesia and under strict aseptic condition in the operation theater. The catheter was introduced percutaneously by Seldinger technique into the right internal jugular vein in 6 patients or in the right subclavian vein in 19 patients. The tip of the catheter was placed at the terminal part of the superior vena cava, which was measured from the point of entry of catheter in the skin to the sternal angle. This was checked later by a Chest X-ray (*Fig.* 2). We did not use a fluroscopy during the procedure but did use a cardiac monitor. The reservoir was placed subcutaneously in the infraclavicular space. The catheter was then subcutaneously tunnelled and attached to the port. The port was fixed to the chest wall by 3-0 Vicryl and the wound subcutaneously closed with 4-0 Monocryl. The system was flushed with Inj. Heplock 10 cc. The port was allowed to be used from the first day of implantation (*Fig.*3). Before and after usage of the device and after

Table 1. ***Patient Characteristics.***

Characteristics	Number of patients
Age (Years)	
Range	9 months - 18 yrs
Median	5 yrs
Distribution:	
0 – 3	4
3+ – 5	8
5+ – 10	9
10+ – 20	4
Sex	
Male	10
Female	15

Table 2. ***Conditions requiring placement of port***

Diagnosis	Number of patients
Wilm's Tumor	2
Neuroblastoma	2
Lymphoma	3
Leukemia	13
Rhabdomyosarcoma	3
CNS Germinoma	1
Germ Cell Tumor	1

Table 3. ***Types of port.***

	Vortex Port (HMP)	Healthport MiniMAX (Baxter)
Weigh	8 gm	5 gm
Height	11	0.5mm
Internal volume	0.6 ml	0.20 ml
Catheter size	7.2 F	5.0 f
Catheter material	Silicon	Polyurethane
Total inserted	6	19

every 3 weeks when the device was not used was flushed with Inj. Heplock. Apart from chemotherapy the port was used for blood sampling, blood transfusion, IV fluid administration and parenteral nutrition. The port was accessed by 22 gauge non-coring Huber needle.

RESULTS

The total cumulative venous access in this study was 7321 patient days. The mean access time per patient was 293 days ranging from 8 - 638 days.

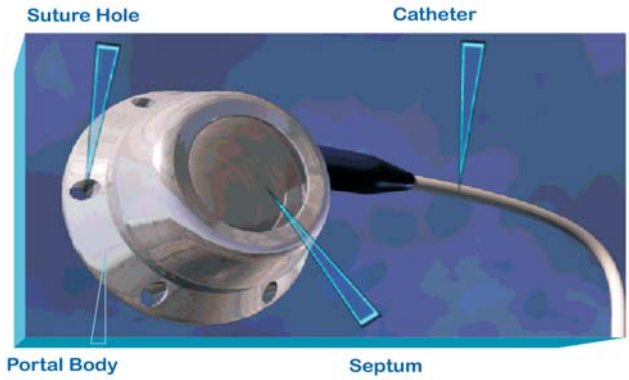

Fig. 1. Central venous port with the catheter.

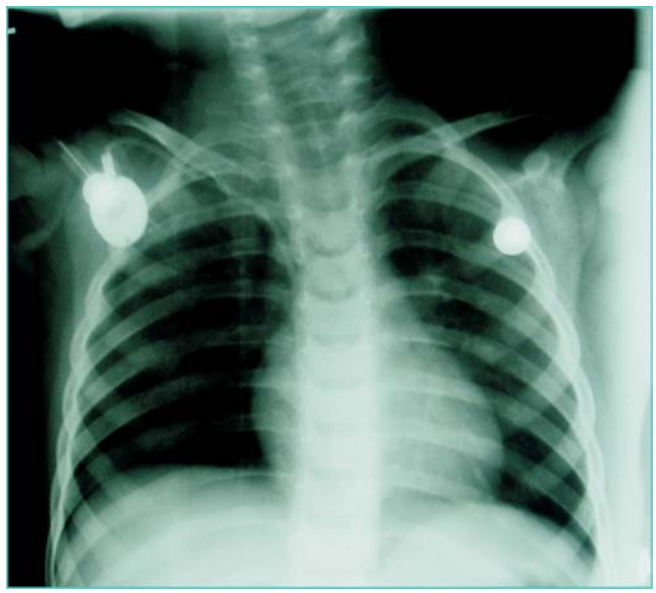

Fig. 2. Check chest X-ray to confirm the tip of the catheter.

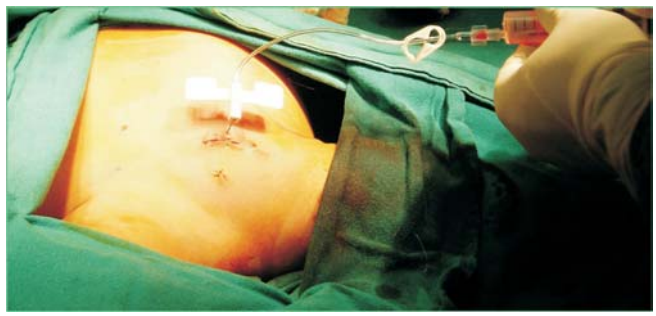

Fig. 3. Port is being checked soon after the placement.

There were no per operative complications. In 22 patients there were no complications. One patient had withdrawal occlusion after 3 weeks of insertion of port. Attempt to rapidly infuse fluid had not resolved the withdrawal block. However, patient completed chemotherapy through the same port.

Key Message

- For delivering chemotherapy agents in pediatric patients central venous ports are the best type of device available for outpatient oncology treatment.

One patient had port pocket infection characterized by fever, tenderness and redness over the port, 5 days after insertion of port. The port was retrieved by treating with intravenous broad-spectrum antibiotics.

Two patients had line sepsis, in which cases Candida had grown during the course of treatment. The ports were removed in both the cases.

DISCUSSION

The study confirms the benefit of totally implantable central venous access device popularly known as ports for the treatment of children with cancer.

With the aggressive chemotherapy regime, it is now possible to treat children of any age with cancer because of the sure, safe and prolonged availability of the venous system by the usage of ports. Compared to the externalized tunnelled catheters it has a decreased risk of infection, minimal maintenance requirement and absence of interference with clothing, bathing, playing and swimming. This results in a high level of patient acceptability and makes the best type of device for outpatient oncology treatment [3]. The only disadvantage is the pain experienced by the child when the needle is introduced into the port septum, which can be partially relieved by the application of local anesthetic cream (EMLA 5%). Exerting pressure against the rib cage, while piercing the skin may also be painful and this should be discussed with the patient before placement. As in the literature, there are some 80% of patients who have an uneventful course after insertion of port [3]. In this study 87% patient had no complications. There are however some patients who will develop one or another complication related to the presence of the device.

Although we did not have any per operative complication like pneumothorax, hemothorax, air embolism or vascular perforation, we do recommend placement of port in children by a surgeon who has a reasonable experience of placing ports in adults.

Ports are placed under general anesthesia in children compared to local anesthesia in adults. However, a subgroup of older children who are at high risk for general anesthesia maybe a candidate for placement of port under local anesthesia.

Since its introduction in 1984 several design of ports are now available. The choice of port will essentially be a choice between 'pediatric' or 'adult' port and between plastic and metal one. The pediatric port though attractive may get occluded more often than the adult type due to smaller outlet and smaller diameter catheter. Plastic ports are lighter and unlike the metallic ports do not cause distortion of MRI images and also does not create dose non-uniformity in underlying tissues [4]. In our study we used titanium ports in all cases, since they are easier to handle, taking care that they do not come under the radiation field.

The choice of catheter will largely depend on the surgeon's experience with percutaneous puncture. Both catheter material, silicon and polyurethane, have proved their reliability [3]. In our study all patients had percutaneous insertion of catheter and we prefer the polyurethane catheter because it is thin walled and extremely suitable for percutaneous insertion with little need for hazardous vessel dilatation. But they kink very easily and are poorly suited for jugular or cephalic vein.

Though the catheter may be placed surgically (open method) into the central vein, percutaneous method (Seldinger technique) remain the preferred choice of catheter placement even in younger children. All our patients in this study had an uneventful placement of catheter by the percutaneous technique. The choice of vein depends again on the surgeon’s preference. Our preferences have been subclavian vein though literature has suggested various complications. In case we have thrice failed in our attempt to puncture the subclavin vein or the subclavin artery has been punctured, we then choose the internal jugular vein. However, we also recommend that in very small children internal jugular vein is a safer option for the placement of catheter. We have noticed that the catheter in the internal jugular vein has been of discomfort to the patient and the parents because of its prominence in the neck.

Selection of patients is an important criterion for placing a port. Malnourished patients are best avoided since the body tissue will not hold the port and the skin over the port may get necrosed. Patients who have an infection or suspected to have infection should be appropriately treated with antibiotics before placing the port. Ideally the blood picture should be near normal at the time of placement of port. For this reason we recommend that the port should be inserted at the onset of chemotherapy treatment rather than after a first period of treatment by peripheral vein punctures. This allows insertion under the best circumstances, with

maximum benefit of the port, preservation of the peripheral venous arsenal, and better wound healing.

Lastly, the ports should be maintained by nursing staff and doctors who have been adequately trained to do so, so that there is less complication [5, 6].

CONCLUSION

The use of chronic indwelling venous access implantable port has proved a dimension of independent living for many patients while they receive life saving therapy as outpatient.

For the physician, these devices have proved an opportunity to develop a new level of sophistication in planning effective therapy for a variety of neoplastic conditions.

Although significant problems can occur, careful patient monitoring, education and prompt intervention by health care personnel can frequently resolve these complication and ensure the continuous use of the device.

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