IOSR Journal of Nursing and Health Science (IOSR-JNHS)
e-ISSN: 2320–1959.p- ISSN: 2320–1940 Volume 10, Issue 2 Ser. VII (Mar. – Apr. 2021), PP 23-30
www.iosrjournals.org

Port-a Cath - A friendly partner in the care of child with cancer A Case presentation.

Mrs. Menaka Raghuraman
Associate Professor, Pediatric Nursing, College of Nursing, CMC, Vellore

Abstract
Pediatric cancer management is highly challenging. Children with malignancies require a promising central venous access device (CVAD) for the safe administration of chemotherapeutic agents, supportive care such as blood and blood product transfusions. Port -a -Cath is the highly trusted and practically reliable CVAD used in tertiary care hospitals where cancer care is provided. Since nurses are the front-line care providers they need to be equipped with adequate knowledge and skills for the safe handling and maintenance of the port- a- Cath device to ensure its longevity there by to assure quality of care rendered to children.

Key words: Port- a- Cath, central venous access device, Advantages, Insertion, Huber point needle, port access and de-access, Maintenance, complications, Restoration, Prevention

---

Date of Submission: 14-04-2021 Date of acceptance: 28-04-2021

I. Introduction

Children with cancer require long term intravenous access to ensure safe administration of chemotherapy and supportive care. One of the most widely used therapeutic modalities in Pediatric oncology is chemotherapy. (Gozzo TO-2017). The most troublesome aspect of treatment is the multiple venipunctures made for administration of cytotoxic agents, anti-biotics, blood products, and nutritional supplements.(I A Burney-2001) Long-term venous access is cumbersome in children because of their thin caliber veins, less cooperative nature, and easy compromise of venous integrity. Chemo port is the best option for children who require chronic venous access.(Veerabhadra Radhakrishna,2019). In modern oncology, central venous port systems are increasingly replacing short-term and permanently tunneled central venous catheters.(Ulf K Teichgräber. 2011).

Port-a-Cath

Port-a-Cath is a subcutaneously placed device or totally implanted central venous access device (TICVAD). It is also known as an implanted port, sub cutaneous port, medi-port, infusa port and chemo port. Totally implantable chemo ports are preferred in children with solid and hematological malignancies because of decreased pain, the rate of infection, and ability to maintain patency for the long term.(Rajeev Redkar2019).

Port- a- Cath vs other venous access devices

In terms of the longevity though there are not much of evidence Port-a-Cath can be used for up to 5 years. Peripherally Inserted Central Catheter (PICC) can be used for weeks to few months, Subclavian lines are long line catheters can be used for few weeks to months. Tunneled central venous catheter (Hickman line) may be used for several months to years. (CDC guidelines 2011). The physical and psychological impact of multiple punctures involved in a peripheral line, with the risk of extravasation of toxic chemotherapeutic drugs, makes it the least preferred access in children receiving chemotherapy(Rajeev Redkar2019).Port-a-Cath was proved to be very reliable, without mechanical complications, and was rarely subject to the problems seen with percutaneously placed catheters that are left in place for prolonged infusion.(Yasuhiro Inoue and Masato Kusunoki,2014) Port-a-Cath's were shown to be both safer and cheaper than Hickman lines for patients requiring infusional chemotherapy (F Ng, H Mastoroudes,2007). Compared to other central venous catheters, port- a-cath is expensive and involves surgical procedure under general anesthesia. Despite this initial investment, it turns out more cost effective because of its long life and due to lower risk of sepsis. (S. Aparna,2015).

II. Background

The implantable port device was originally described in 1963 by Ommaya as a cerebrospinal fluid reservoir and manual pump. The device was introduced to facilitate repeated injections of drugs into the cerebrospinal fluid of patients with fungal meningitides. The device subsequently proved to be of considerable mechanical value in the treatment of malignant neoplasms of the nervous system by allowing the perfusion and

instillation of cytotoxic agents. An implantable pump system that allows for continuous infusion of drugs, including heparin, was developed in 1972. The first use of this device to deliver chemotherapeutic agents to hepatic tumors was reported in 1980. (Yasuhiro Inoue and Masato Kusunoki,2014) Niederhuber *et al*. introduced the currently used type of port system into clinical use in 1982 (Niederhuber *et al*.1982).

Parts of the Port-a-Cath

Port- a- Cath is a combination of a port & an intravascular device. The portal is a drum/disk shaped small chamber or reservoir made up of stainless steel, plastic or titanium, sealed with a silicone septum/diaphragm on the top (figure 1). The silicone top is known as the venous access point and it can be used around 2000 times. The intravascular device/catheter is a thin flexible tube that connects to the portal through the connector. Single lumen and double lumen ports (figure 2) are used based on the need of the patient.

Figure 1

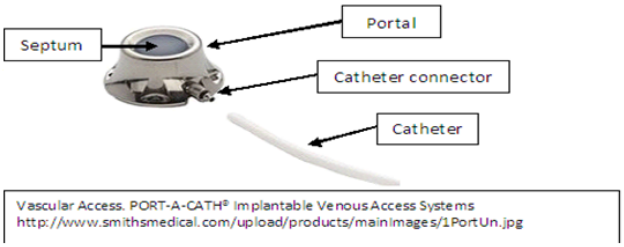
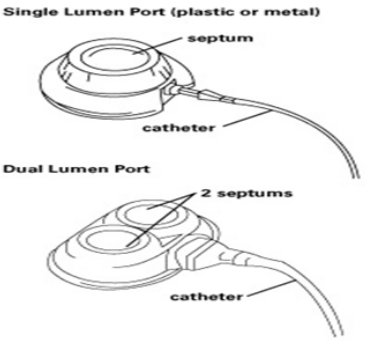


Figure 2



Advantages of Port a Cath

The main aim of implanting Chemo port is to administer systemic chemotherapy drugs, IV fluids, electrolytes, antibiotics, blood and blood products, and parenteral nutrition. Provides easy access for blood sampling. Port systems can markedly alleviate the burden of intravenous therapy and thereby improve these patients' quality of life (Ulf K Teichgräber. 2011). The port access needle can be removed after each infusion and the skin covering the port reservoir serves as a natural protection against infection whereas in open, tunneled central venous catheter systems one end of the catheter remains outside the body increasing the risk of infection. Once accessed the needle can be in situ for use up to 5-7 days.

The device can be used immediately following the implant. Does not require daily care and allows the older child to be active, mobile and enjoy the esthetic appearance of self with the catheter in place when the device is not accessed for use. Port-a-Cath is MRI conditional, which means that they may safely undergo magnetic resonance imaging with magnetic field strength of 3.0 or lower. Owing to the safe, reliable, and low complication rate of chemo ports, more children can be saved from deadly illnesses. The most common indication for chemoport insertion was acute lymphoblastic leukemia (51.5%) (Veerabhadra Radhakrishna,2019).

Port a Cath insertion/ implant or placement

Implanting the port is a minor surgical procedure and takes less than an hour. The procedure is performed by an interventional radiologist or pediatric surgeon under local anesthesia with IV sedation in the outpatient department or under general anesthesia as an inpatient depending on the unit policy.

Pre- operative preparations:

History collections *include* any known allergies to medications**.**

System wise physical examination include monitoring of the baseline vital signs, and anthropometric measurements. **Blood tests** include complete blood cell counts, bleeding time, clotting time, and blood borne virus study. **Starvation:** Child is kept on nil per oral for 4-6 hours prior to the procedure if planned under general anesthesia.

Informed consent is taken by the physician after adequate explanation to parents.

Prophylactic anti biotic is administered around the time of implant as per unit policy.

Appropriate size sterile port- a -Cath set, and appropriate size Huber point needle is to be kept ready.

Port- a- Cath insertion/implant / placement

Two ways of Port placement: (figure 3)

1.Chest-placed system*:* is the most common approach to Port placement. The procedure involves a 3cm skin incision on the chest wall which is 2-3 cm below the clavicle for the port pocket and 5mm incision in lower neck to enter the vein. The port is placed with the catheter completely inside the body. One end of the catheter is tunneled under the skin and inserted into the subclavian or internal jugular vein and the tip of the catheter is located in a Superior Vena Cava(SVC) , while the other end is connected to the portal, under the skin. The procedure is done using ultrasound and fluoroscopy to guide the catheter placement. The placement of the line is checked by accessing the port and aspirating blood as well as with an X ray (figure 4) of the chest. Finally, a dressing is applied over the area. After the placement, the port device looks like a small bump on the skin (figure 5)

2.Arm-placed system*:* The port is placed under the skin and the catheter is inserted into a vein in the upper/lower arm. The tip of the catheter lies in the SVC.

Immediate post procedure care for port implantation

Child's vital signs are monitored, adequacy of airway, breathing and circulation is ensured until anesthesia wears off.

Figure 3:

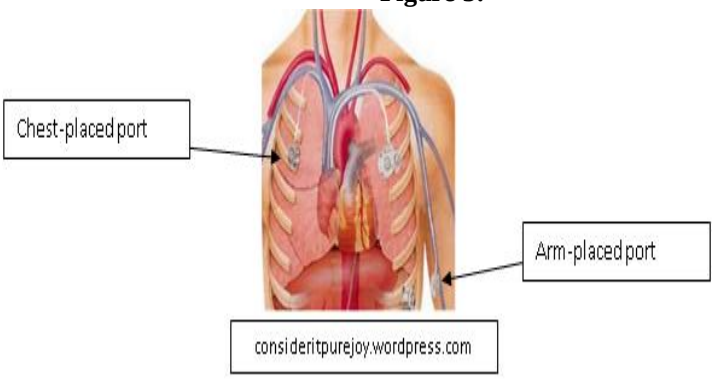


Figure 4:

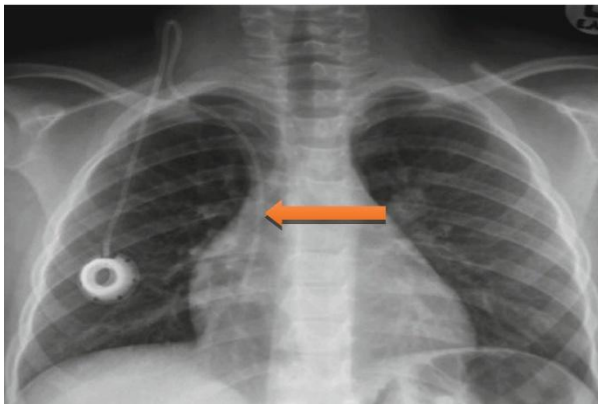
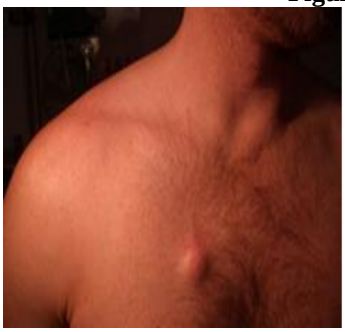


Figure 5:



Huber point /Non coring needle

The subcutaneous device is accessed by puncturing the overlying skin and the underlying silicone septum with a non-coring needle, also known as Huber point needle.

Huber point needle is a long, beveled tip (figure 6) that can go through the skin &the silicone septum of port's reservoir. The beveled tip prevents a chunk of silicone or skin from lodging in the catheter line.

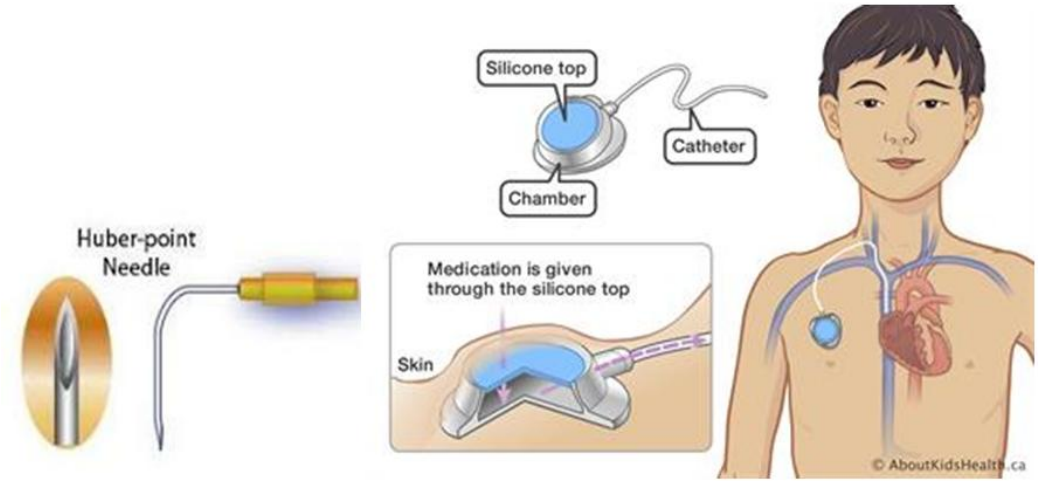


Figure 6:

Central Venous Catheter (CVC) Clinical Care Management Bundle (Charles A. *Schiffer, et al, 2013)*

Component	Criteria
Hand hygiene	Every person entering the room during the insertion procedure should perform hand hygiene
Maximal barrier precautions upon insertion	Sterile drape extends from head to toe; all health care providers participating in the procedure employ mask, cap, sterile gown, and sterile gloves
Chlorhexidine skin antisepsis	Skin at the insertion site should be scrubbed with 2% chlorhexidine for 30 seconds and allowed to dry for at least 30 seconds
Assessment of CVC necessity	Prompt removal of CVC line after completion of therapy unless clinical circumstances suggest that further infusional therapy is likely to be necessary in the future

Points of emphasis for the best maintenance of the Port-a-Cath

Aseptic non touch technique: Use of standardized technique to prevent contamination of sterile key parts and aseptic key sites by ensuring that they are not touched either directly or indirectly. (Lisa A. Gorski-2021)

For example, while administering IV injection or collecting blood sample the sterile syringe tip (key part) must only contact with the luer-lok or connector (aseptic key site) of the Huber needle.

Dressing: Securing the device and maintaining the dressing dry and intact decrease catheter migration, dislodgment, catheter damage, phlebitis, thrombosis, and catheter related blood stream infection (CRBSI). Transparent dressing to be changed weekly and gauze dressing to be changed every 2days.Change dressing as required if blood under dressing is moist, edge(s) of dressing lifting (CDC guidelines 2011). Frequent visual inspections are needed to check for swelling, redness, or collections. Daily assessment and documentation of dressing integrity is mandatory.

Maintain patency: Recommendations vary regarding the frequency of the solution used to flush and lock the port that is not accessed for current use. At least 10 mL of 0.9% sodium chloride (i.e., normal saline) should be used for flushing before and after each infusion. Some studies suggest saline alone may be as effective as heparin. If heparin is used, 5 mL (10 units or 100 units/mL) is recommended every 4–12 weeks. (Lisa A. Gorski-2021)

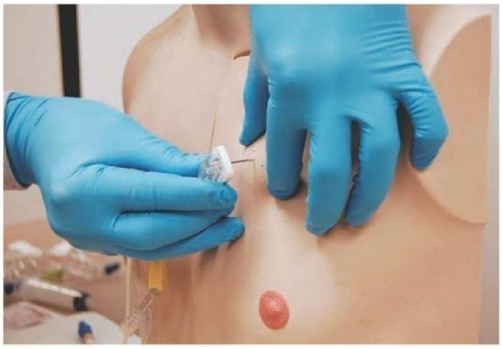
Training The port access, dressing and every handling is done by a doctor or a nurse after adequate training and periodic competency check using the procedure checklist available in the unit.

Port access, drug/fluid administration, dressing, flushing, locking-Procedure

- Explain to the older child or parent, Ensure privacy
- Wash hands and collect equipment on a clean work surface or trolley.

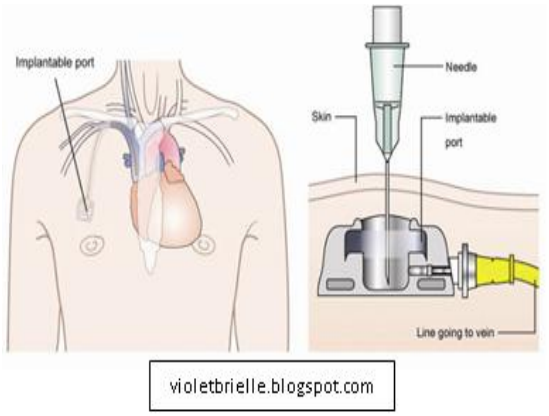
- Remove child's top clothing and old dressing
- Locate by palpation the implanted venous access port and the silicon septum under the skin.
- Repeat hand washing
- Open dressing pack & drop other sterile supplies onto opened dressing pack using Aseptic Non-Touch Technique(ANTT)
- Don sterile gloves. Draw up 10--20 ml of sterile normal saline and attach to Luer -lok cap that has been screwed on to Huber point needle
- Flush through the Huber point needle with 1 ml of sterile normal saline, leaving the saline filled syringe attached, and return the Huber needle to the sterile field. (Vicky.R.Bowden,2003)
- Using forceps to hold sterile gauze soaked with 0.9% Sodium Chlorides clean old blood and any exudates & dispose of this swab.
- Prepare the skin over the port of the indwelling catheter with betadine or 2% chlorhexidine swab. Start at the septum of the port and work outward in a circular pattern for several inches. Repeat 2 more times with new swab each time. Use friction to enhance the anti fungal and antibacterial effects of the cleansing swab.
- Allow site to air dry. Do not fan or blow.
- Using an alcohol swab remove the betadine solution (if used) from the skin. Repeat 2 more times with new swab each time.
- With the non dominant hand stabilize the port of the indwelling catheter between the thumb and the forefinger on the overlying skin, grasp the Huber point needle with the dominant hand using the forefinger to support the needle to keep it from bending. Insert the needle directly perpendicular (90' angle) to the port of the septum (figure 7). continuously apply steady pressure until you feel the resistance/ needle touch the base of the port reservoir (figure 8).
- Pull back on plunger of syringe until blood is aspirated freely.
- Slowly and steadily inject the remainder of the normal saline into the port and clamp when completed.
- Remove the syringe and apply the prescribed fluid by attaching the administration set directly to the luer -lok cap of the Huber point needle and begin IV fluids or place catheter to heparin lock for intermittent infusions.
- Stabilize the placement of the Huber needle with a folded 2x2 sterile guaze pad if there is a ½ -inch or greater gap between the skin and the Huber needle
- Place sterile gauze and dressing pad over the port needle ensuring there is maximum coverage in all directions from the port needle& secure with adhesive or apply transparent dressing
- Replace articles. Dispose waste appropriately. Wash hands, Document in the patient's chart.

Figure 7:



De -access/Removal of port needle: Wash hands. Draw up 20 ml of sterile saline in a syringe and 5ml od heparinized saline in another syringe and keep it on a sterile area. Don the gloves and cleanse the hub of the port needle and infuse the saline solution first then the heparinized saline using pulsatile technique and apply the clamp. Remove the old dressing gently. Visually inspect the needle exit site and the surrounding skin to identify signs of infection. With the non-dominant hand stabilize the port of the indwelling catheter between the thumb and the forefinger on the overlying skin. Grasp the Huber point needle with the dominant hand between the thumb and the forefinger. Withdraw the needle at a perpendicular angle to the skin. (Vicky. Bowden,2003).

Figure: 8



Patient and family education:

- During the post insertion period monitor the incision site for signs of infection (redness, swelling, drainage, tenderness, pain,) bleeding and report to physician.
  Avoid rigorous activities that include arms or chest for minimum 10 days at-least. Reduce activities that include excessive movement of upper arms or chest, respectively, example, swimming, lifting heavy weights, playing cricket, exercising etc. performing such activities could possibly damage or break the catheter placed inside the body. Avoid sleeping on the chest. This can loosen up stitches and can cause pressure on the incision and may lead to bleeding. Skin excoriation to be avoided.
- When the port is accessed, it needs dressing. Always keep the dressing area clean & dry. Avoid touching the catheter tube hanging outside the body to avoid the risk of infections.
  Anchoring the catheter to the body well to prevents the needle & tube from being pulled out accidentally. Report fever, pain or any significant discomfort experienced while the port is used not used for therapy (Cure search for children's cancer,2011).
- When the port is not used the skin over the port can be washed just like the rest of the body. The device needs flushing with normal saline and locking with heparin saline once in 4 weeks or as per the physician's recommendation.

Trouble shooting and management

Besides the unique advantages of port -a -Cath there are also chances for number of complications.
The associated complications can be minimized with proper insertion techniques and strict protocols for handling ports, periodic training of concerned nursing staff and doctors. (Rajeev Redkar2019).

INTERVENTIONS FOR COMPLICATIONS OF ACCESS DEVICES (Joanne K Itano,2016)

Complication	Prevention	Restoration
Loss of blood return	Maintain flushing routine, flush with push-stop method to cause swirling action in device	Change patient position, roll on to right or left side, sit up, lie flat. Change intrathoracic pressures: have patient inhale fully and hold breath or exhale fully and hold breath. Attempt push-pull method using normal saline-filled syringe (avoid using high force or high pressure) or a thrombolytic agent.
Occlusion	Maintain flushing routines, flush with push-stop method to cause swirling, prevent clotting. Always flush with normal saline before and after drug administration, blood withdrawal, and administration of blood products. Avoid incompatible drugs.	If occlusion the result of clotted blood, tissue plasminogen activator may be instilled with a physician order. If drug precipitate, determine type of drug, check with pharmacist for drug to dissolve precipitate such as the following: Lipids dissolve with ethyl alcohol 70% via 22-mcg filter. Drugs dissolve with sodium bicarbonate (1 mEq/mL) or hydrochloric acid (0.1 N).
Pinch-off syndrome	Proper placement by surgeon	Surgical removal is performed, as indicated, to avoid catheter fracture.
Infection	Wash hands thoroughly. Follow strict aseptic techniques when using device.	Culture blood, body fluids, and exit site. Administer antibiotic, as ordered, by the physician. Remove device, as indicated.
Dislodgement	Avoid pulling on the catheter. Tape device securely. Teach patient to avoid manipulation of catheter or port and prevent trauma to catheter.	Refer to physician for re suturing if tip of the catheter remains in the vessel. Remove device, as indicated
Catheter	Protect device from trauma.	Refer to physician for repositioning catheter using fluoroscopy.

migration	Anchor device appropriately with sutures.	Remove device, as indicated.
Erosion of port through subcutaneous tissue	Avoid placing port at sites of actual or potential tissue damage (in radiation field). Avoid trauma or pressure over port.	Refer to physician for removal of device
Port-catheter separation	Avoid trauma and high-pressure infusions, or flushing with 1-ml or 3-mL syringes when clogged.	Refer to physician for removal of device
Dislodgement of port access needle	Tape needle securely in place. Avoid tension on the needle or tubing	Remove needle and re-access port using a sterile non-coring needle

The rate of implantation-associated complications is less than 2% in experienced hands (Ulf K Teichgräber2011)

Another possible complication is extravasation. Rates of occurrence range from 0.5–6% (Deborah Tomlinson-2010). Extravasation means infiltration or leakage of an intravenous chemotherapeutic agent into the surrounding tissue which results in local damage. (Kassner, 2000). While injecting saline observe for signs of extravasation such as swelling in the port pocket, which indicates incorrect Huber needle placement. If unable to verify needle placement, remove existing needle and re access with new needle according to procedure.

If swelling exist over port, do not attempt re access until swelling is resolved. If unable to re access port reservoir, damage may have occurred to device, which can be confirmed by radiographic dye study through the device (Vicky R. Bowden,2003)

An observational study conducted by Aparna et al (2015) showed that a total of 209 ports were implanted in 200 patients and 24 ports were removed due to port-related complications. There were 122 boys and 78 girls whose ages ranged from 4 months to 13 years (median age 2.5 years). About72% of patients were <2 years old. The cumulative duration of catheterization was 54,100 days. Of 209 ports, there were 36 complications that led to the removal of 21 ports. Port-related infection was the most common infection observed in their study (0.66/1000 catheter days and 11.9%). Mechanical complications were seen in 9 patients. Venous thrombosis and skin necrosis occurred in one patient each.

Another observational study conducted by Veerabhadra Radhakrishna (2019)revealed that a total of 169 chemoports were implanted in 159 children. The mean chemo port days were 832±666 days. Among the 169 chemoports, 55.0% were removed after treatment completion. Sixteen patients (0.1 per 1,000 chemo port days) had a premature chemo port removal. The indications were port-related bloodstream infection (12 patients), port pocket infection (1 patient), exposed chemoport (1 patient), and blocked chemoport catheter (2 patients). Twenty-two patients (0.15 per 1,000 chemoport days) had complications of port-related bloodstream infection (0.09 per 1,000 chemoport days), making it the most common. Other complications include block, fracture, arrhythmias, avulsion, bleeding, decubitus-over-port, and port pocket infection.)

Removal of Por-a-Cath:

Indication: Port a- Cath is most often removed when the planned therapies are completed, and the treating team decides that it is no longer needed. Daily audits to be performed to decide whether central line is needed and prompt removal of any intravascular catheters that is no longer essential (CDC guidelines 2011).

Procedure: The removal of chemo port is much easier and less painful compared to its placement process.

Port a-Cath removal is performed under general anesthesia, or sedation, or local anesthesia depending on patient health factors and preference. The child is kept nil per oral for 4-6 hours if the removal is planned under anesthesia. A small incision is made over the port site and port is freed from any tissue by cutting the sutures to remove the fittings. After successful removal of the entire device, surgeon sutures the inner and outer incisions by absorbable stitches. The skin is covered with a firm gauze dressing. The entire chemo port removal procedure requires nearly about 30 minutes.

Case presentation

Master X was 4years old child when he was diagnosed to have B cell Acute Lymphoblastic Leukemia with intermediate risk in a tertiary care center in Tamilnadu. Parents were counseled about the advantage of having a Port- a- Cath at the time of starting the chemotherapy, but due to the financial concern's parents were not willing for the port insertion. Around 5 weeks later the port was implanted for the child.

When the child completed the induction phase and was due for the consolidation phase of chemotherapy it was unfortunate that he suffered right renal abscess and fungal (mucomycosis) pyelonephritis and suspected to have fungal pneumonia. The blood specimen collected for culture from the Port- a- Cath device was found to be negative.

He underwent right sided nephrectomy and was treated with Inj. Amphotericin for a period of 3 months. To complete the long term anti-fungal treatment, the remaining phases of chemotherapy and other

necessary supportive care. Port -a- Cath was found to be therapy friendly as well as comfortable and convenient for the child, nurses, and the family members. The catheter was flushed with normal saline and locked with heparin saline once in every 4 weeks when not used. Following the completion of planned treatment and since the investigations revealed that the child is clinically free from the disease he was admitted for port removal procedure under general anesthesia and successfully the device was removed. The catheter days for master X was around 1000 and the days were found to be free from any of the possible complications related to Port-a-Cath.

III. Conclusion

Port-a-Cath is safe and reliable CVAD in children requiring long-term chemotherapy. Studies, and experiences show that the use of the Port-A-Cath in treatment & management of cancer patients, results in shorter hospital stay, less nursing time spent trying to access veins, preservation of the small veins, fewer emergency visits, decreased cost of therapy and overall greater patient satisfaction. The health care team members especially the doctors and nurses need to be knowledgeable and skillful in the effective maintenance of the device to ensure its durability for the optimum care of child on cancer treatment.

References

[1]. Aparna, S. Ramesh, L. Appaji, Kavitha Srivatsa, Gowri Shankar, Vinay Jadhav, and Narendra Babu, "Complications of chemoport in children with cancer", Experience of 54,100 catheter days from a tertiary cancer center of Southern India,South Asian J Cancer,2015,Jul-Sep,V 4(3) page 143-145. Retrieved from : https://europepmc.org/article/PMC/4756491

[2]. Burney I A Khurshaidi N, M T Akbar, F N Bhatti, T Siddiqui, Z Sophie, "Complications of in-dwelling venous access devices: a single institution experience",J Pak Med Assoc. 2001 Dec;51(12):434-7. Retrieved from : https://pubmed.ncbi.nlm.nih.gov/11850980/

[3]. Centers for Disease Control and prevention, Guidelines for the Prevention of Intravascular Catheter-Related Infections (2011).

[4]. Charles A. Schiffer, Pamela B. Mangu, James C. Wade, Dawn Camp-Sorrell, Diane G. Cope, Bassel F. El-Rayes, Mark Gorman, Jennifer Ligibel, Paul Mansfield, and Mark Levine, "Central Venous Catheter Care for the Patient With Cancer", American Society of Clinical Oncology Clinical Practice Guidelines, Journal of clinical oncology,Vol. 31, No. 10, April 1, 2013,retrieved from https://ascopubs.org/toc/jco/31/10

[5]. Cure search for children's cancer, Children's Oncology Group, family handbook 2nd edition (2011).

[6]. Deborah Tomlinson,Nancy E.Kline,(2010)Pediatric Oncology Nursing,Advanced Clinical Handbook,Springer Publications.

[7]. F Ng, H Mastoroudes, E Paul, N Davies, J Tibballs, D Hochhauser, A Mayer, R Begent, T Meyer, "A comparison of Hickman line- and Port-a-Cath-associated complications in patients with solid tumours undergoing chemotherapy",Clin Oncol (R Coll Radiol).2007 Sep;19(7)551-6.

[8]. Gozzo TO, Santos LAC, Cruz LAP da et al,(2017), "Knowledge of the nursing team on the prevention and management of extravasation of chemotherapy drugs",J Nurs UFPE on line., Recife, 11(12), Dec:4789-97

[9]. Lisa A. Gorski, "A Look at 2021 Infusion Therapy Standards of Practice ", Volume 39, (2)page 68,wolters Kluwer health.

[10]. Joanne K Itano, Jeannine M Brant, Franciso A, Conde Marlon G, Saria, "Core curriculum for Oncology Nursing",5th edition (2016), Elsevier publication, page no.277-278

[11]. Kassner.E(2000). ", Evaluation And Treatment Of Chemotherapy Extravasation Injuries",,Journal of Pediatric Oncology Nursing,17(3),135-148.

[12]. Niederhuber JE, Ensminger W, Gyves JW, Liepman M, Doan K, Cozzi E. "Totally implanted venous and arterial access system to replace external catheters in cancer treatment", Surgery. 1982; 92:706–12. [PubMed] [Google Scholar]

[13]. Rajeev Redkar, Anant Bangar, Janani Krishnan, Vinod Raj, C. Swathi, and Shirin Joshi,"Role of Chemoports in Children with Hematological/Solid Tumor Malignancies - Technical Implications and Complications: An Institutional Experience", J Indian Assoc Pediatr Surg,2019,Jan-Mar,24(1),27-30 Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6322184/#

[14]. Ulf K Teichgräber, PD Dr. med.,Robert Pfitzmann, PD Dr. med.,and Herbert A.F Hofmann, Dr. med

[15]. Central Venous Port Systems as an Integral Part of Chemotherapy, Dtsch Arztebl Int. 2011 Mar; 108(9): 147–154.

[16]. Veerabhadra Radhakrishna, Chittur Narendra Radhakrishnan, Ravikiran Cheelenahalli Srinivasa Rao, and Gollamandala Kireeti, "Chemoport-A Savior in Children Who Require Chronic Venous Access: An Observational Study",Vasc Specialist Int. 2019 Sep; 35(3): 145–151.Retrived from : https://pubmed.ncbi.nlm.nih.gov/31620400/

[17]. Vicky R.Bowden, "Pediatric Nursing Procedures", 1st edition(2003),Lippincott Williams &Wilkins,A Wolters Kluwer company, page no 325-337.

[18]. Yasuhiro Inoue and Masato Kusunoki, "Advances and directions in chemotherapy using implantable port systems for colorectal cancer: a historical review", Surgery today, 2014; 44(8): 1406–1414. Retrieved from : https://pubmed.ncbi.nlm.nih.gov/23893159/

Mrs. Menaka Raghuraman. "Port-a- Cath - A friendly partner in the care of child with cancer, A Case presentation." *IOSR Journal of Nursing and Health Science (IOSR-JNHS)*, 10(2), 2021, pp. 23-30.