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CHEMO PORTS IN PEDIATRIC: THE VERACIOUS BOOSTER IN PEDIATRIC ONCOLOGY PATIENTS ON THEIR EN ROUTE TO WIN AGAINST CANCER

Oncology

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ABSTRACT

Background: Vascular access in pediatric oncology patients presents unique challenges due to smaller vessel calibers, repeated chemotherapy sessions, and the need for long-term reliable access. Despite their widespread use, chemoport insertion in children poses unique challenges related to anatomy, physiology and long term device maintenance. **Objective:** To share clinical experience, technical nuances, and perioperative considerations in securing chemoports for pediatric oncology patients. To evaluate indications, techniques, success rate, complications and outcomes of pediatric chemoport insertions. **Methods:** A retrospective observational study of pediatric patients (age 2-14 years) undergoing chemoport insertion under general anesthesia at a tertiary care centre over a 2 year period. Key parameters analyzed included demography, indications, site of insertion, technique used, complications, and port longevity were analyzed. **Results:** Out of 25 patients the internal jugular vein was the preferred site (90%) under ultrasound guidance. The success rate on the first attempt was 96%. No major vascular injury or anesthetic related complication was reported. No procedure related to mortality. Port provided long term venous access with good patient and caregiver satisfaction. **Conclusion:** Pediatric chemoport insertion is a safe and effective method for long term venous access when performed using standardized techniques and strict aseptic precautions. Multidisciplinary coordination and meticulous followup are crucial to minimize complications.

KEYWORDS

Chemoport, complications, venous access, morbidity,pediatric

INTRODUCTION:

The advent of long term venous access devices has revolutionized the management of pediatric oncology patients. Chemo Ports are the Totally Implantable Venous Access Devices (TIVAD), which provide secure and reliable venous access in administration of chemotherapy, total parenteral nutrition (TPN), blood products and other supportive therapies.

Peripheral venous cannulation is often distressing, technically challenging, and insufficient for the administration of vesicant chemotherapy. Hence, central venous access devices, particularly chemoports, have become indispensable in pediatric oncology. The incidence of catheter related bloodstream infections, thrombosis, extravasation of chemotherapeutic drug, occlusion are very less in chemo ports compared to any other venous access devices.[1]

While extensively used in adults, pediatric patients pose unique considerations due to differences in anatomy, physiology, and the psychosocial impact of long-term devices. In this article, we describe our institutional experience with pediatric chemo ports regarding the indications, insertion techniques,handling protocol, complications and their management.

MATERIALS AND METHODS:

25 pediatric oncology patients who underwent chemoport insertion from August 2023 till December 2024 were respectively analysed and included in the study. Data was collected from hospital records and patient related records. Demographic data, type of malignancy, type of insertion, perioperative complications, type of anesthesia, date and time of insertion, post insertion complications and removal date were noted.

MRI™Implantable port @BardPort ™ Hickman Radiopaque silicone single lumen catheter was implanted. Depending on age and vascular status of patient size of lumen varying from 5 - 8 Fr (french Gauge catheter) were used.

1) Preprocedural Investigations And Preparation:

Informed and written consent were obtained from the parents or caregivers. Preanesthetic evaluation was done to all pediatric patients prior to surgery. Children with anemia and thrombocytopenia were transfused with packed red blood cells(PRBC) and platelets respectively. In addition if required during intraoperatively, adequate amounts of blood products were kept reserved prior to surgery. Complete blood count and coagulation profile blood analysis were obtained night before surgery. Platelet count <60,000; absolute neutrophil count <500/mm^3; INR above 1.5 [2]

Of the 25 children, 15 children had hematologic malignancy, 10 children had solid malignancy. Since most of the children had previous central line insertion, doppler ultrasonography was performed to confirm the patency of internal jugular vein (IJV) and subclavian vein on either side. Right IJV is the most preferred site but if there is anatomical or patency abnormality then the decision of insertion is made accordingly.

PROCEDURE:

Prophylactic antibiotic was administered just before induction of anesthesia. General anesthesia was given to all 25 children. All children were placed in supine position with neck extension. IJV/ subclavian veins were cannulated using modified seldinger technique by percutaneous method. Under aseptic techniques a port fixation site is created subcutaneously at infraclavicular area and the port is fixed using 4-0 polypropylene sutures. The catheter is tunneled subcutaneously to the neck and the catheter is inserted into IJV/subclavian vein using the help of vein dilator. Intraoperatively,with the help of a fluoroscope we confirm two things. Firstly, the position of the tip of the catheter (at junction of right atrium and superior vena cava) and we look for any kinking of catheter at neck area to avoid future complications like difficulty in blood sampling and infusions. After confirmation, the skin and neck side nick is closed using ETHILON 3 -0 or MONOCRYL 3-0 suture. Port is activated with 22 g/ 21g Hubner needle and flushed with heparin saline (10U/ml).

3) Post Procedure Usage And Maintenance:

a) During insertion of Huber needle: All aseptic precautions were followed during insertion of Huber needle.The port area is made sterile by using skin antiseptic solution (containing 2% chlorhexidine and 70% isopropyl alcohol) in circular fashion from centre to periphery covering up to a width of 4cm. This step is

repeated three times and dried for a minute prior to insertion of the Huber needle.
b) For infusions : 10 ml of normal saline is flushed following the catheter is primed with the infusion to be connected. Then fixed using waterproof tape.
c) For Blood sampling: After flushing with 10 ml normal saline, 10 ml of Heparin flush is given following which desired amount of blood is withdrawn. Following which 10 ml of heparin flush is given.
d) Removing of Huber Needle: Under aseptic precautions, following 10 ml of normal saline flush and 1 ml of heparin flush, needle is withdrawn and pressure is applied over the area.

Training programmes are regularly conducted at our institute about all the sterile techniques and above steps to be followed by all the staff handling pediatric chemo ports.

COMPLICATIONS:
Complications are classified as early (< 30days) and late (> 30 days). The complications assessed were occlusion, thrombosis, infections, dislodgement and leakage.

Definition according to infectious disease society of India [3,4], Bacteremia and fungemia absent in peripheral blood stream infection and isolated only in catheter with at least ≥1 positive culture and positive clinical manifestations (fever, chills and/ or hypotension) is termed as catheter related bloodstream infection. If there is failure of targeted antibiotic therapy then chemo port is removed. Blockage could be partial or complete blockage of lumen of port. If the tip of port is not in central venous access then it is termed as dislodgement of port. Port pocket infection is defined as erythema, pus discharge, local tenderness or edema. Chemoport days were calculated from the date of insertion till the endpoint or uptill last day of study.

STATISTICS:
Descriptive statistics are presented as mean, median or frequency with appropriate range. Cox regression analysis was used to find out the individual contribution. The complications were expressed as number, percentage or 100 chemoport days. P value < 0.05 is considered as significant.

RESULTS:
All 25 children had hematologic malignancy of which, acute lymphoblastic leukemia (ALL) being the most common indication (96%) and hematologic malignancies (60%) and solid malignancies (40%) shown in demographic chart Table 1. Amongst 25 pediatric patients 14 (56) were boys and 11(44) were girls.

The mean duration of catheterization per patient was 250 days ranging from 30 days to 567 days. The cumulative venous access was 786 days. Mean access time per patient was 64.3 days, ranging from 0 to 230 days. No death occurred related to port inserted complications.

Table 1: Demographic And Clinical Profile Of Patients (n = 25)

Parameter	Number (n)	Percentage (%)
Total Patients	25	100
Male	14	56
Female	11	44
Age < 5 years	6	24
Age 5-10 years	9	36
Age > 10 years	10	40
Hematologic Malignacies	15	60
Solid tumors	10	40

Port catheters were mostly inserted into the internal jugular vein and only 1 case was inserted into the subclavian vein shown in Table 2. There were nil intraoperative and immediate postoperative infections. The total infection rate was seen in the same month, accounting for 4.5% as shown in Table 3. So, the nursing staff involved in chemo port handling were adequately trained and aseptic technique handling was briefed during the session. Among the three infections, two were staphylococcus epidermidis and other organisms isolated were Burkohlderia cepacia. For isolated gram positive organisms antibiotic lock up therapy was given with vancomycin for 12 hours for a period of 3 days. Additional to this lockup therapy all 3 patients were given intravenous antibiotics and all the three ports were salvaged.

Table 2: Procedural Characteristics:

Variable	Number (n)	Percentage (%)
Right Internal Jugular Vein	21	84
Left Internal Jugular Vein	2	8
Subclavian Vein	2	8
Ultrasound Guided insertion	25	100
Technical success	25	100
First attempt insertion	23	92
Multiple attempts required	2	8

Local skin infection, wound dehiscence was noted in one child of age 5 years old. After conservative management, there was no improvement and the port was visible with complete wound exposure. We shifted the child back to the operation room for re-exploration to check for any infection focus locally, we found no source of infection, and the port site looked healthy and clean. After thorough povidone wash and excising the skin of previous incision, the wound was closed with ethilon 3-0 by running technique. Later the wound healed well, and the port is being used without any complications till date.

Mechanical problems like port hub twist, catheter displacement, catheter fracture, catheter breakage, leakage from catheter without any displacement were not observed in our study. One child after 248 days when he came for chemotherapy, after chemo, heplock solution was not flushed at the end of the procedure due to which, the catheter got thrombosed and led to chemoport removal.

Table 3: Intraoperative Complications:

Intraoperative Complications	Number (n)	Percentage (%)
Number Of Complications	1	4%
Arterial Puncture	1	4%
Bleeding/Hematoma	0	0%
Transient Arrhythmia	0	0%
Pneumothorax/ Hemothorax	0	0%

Table 4: Postoperative Complications:

Post Operative Complications	Number (n)	Percentage (%)
1) Infection	2	4.5%
2) Wound Dehiscence	1	4%
3) Reservoir rotation	0	0%
4) Drug extravasation	0	0%
5) Skin Necrosis	0	0%
6)Thrombosis	1	4%
7) Rotation Of Chamber	0	0
Overall Complications	4	16%

DISCUSSION:
Pediatric oncology patients need frequent chemotherapy, blood drawing for various investigations, blood transfusions, higher antibiotic coverage during their neutropenic phase, and even nutritional support in palliative phase. To address all these and reduce pain, discomfort and anxiety of not just pediatric patients but even their parents, chemoport insertion addresses all these conditions.

Niederhuber et al introduced the currently used port system in the year 1982.[5] Alexander et al[6] in their study showed tunneled central catheters have 5-7 times higher rate of catheter related infections compared to totally implanted chemoports which are better cosmetic, and less painful.[7,8] . Though the overall cost of chemoport insertion is higher in comparison to indwelling catheters and central line, if we look up at total overall cost in terms of infections, maintenance, long term usage chemoport turns out to be better cost effective on long term basis.

Acute leukemia accounted for the most common indication of 96% compared to lymphoma and solid tumors. Most other studies also showed leukemia to be the most common indication due to its higher incidence in pediatric malignancy.[9,10,11]

Our study reported no intraoperative complications such as arterial puncture, pneumothorax, bleeding and hematoma. This nil intraoperative complications could be achieved due to vein localisation by ultrasound and catheter tip confirmation using C-arm technique. Associated mechanical complications like rotation of port, port disconnection were nil intraoperatively compared to other cohort studies.[12]

Infections could be related to immunocompromised state, host factors,

chemoport maintenance and number of days of usage. In our study Port associated blood stream infection accounted for 0% in early infections and 4.5% in late infections. In different case studies the infection rate accounted for 3%-7.5%. Our hospital infection rate is similar to other previous studies[13,14,15] and slightly on the lower side. Among the three infections two species were gram positive cocci ,Staphylococcus epidermidis and the other organism isolated was Burcholderia cepacia which is gram negative bacilli. To our notice all three infections happened in a span of the same month. These infections were noticed in the age group > 2 years and after a period of 30 days in gram positive cocci infection. The other infected port with Burcholderia Cepacia was in a 3 year old girl where she had fever spikes after 10days of insertion. Fever and chills were noticed after giving medications or intravenous fluids through the chemoport line along with redness at the suture site. Blood culture report showed growth of Burcholderia cepacia. This pediatric patient had congenital biliary atresia and underwent liver transplant. Post transplant she was on immunosuppressant drugs, steroids which led to further immunocompromised state making them more susceptible to infections. For gram positive cocci we had chosen vancomycin lockup therapy for a period of 3 days along with systemic antibiotics for all three infected ports. All three ports were salvaged and were used for next infection after our blood culture report showed no growth.

The additional risk factors which Araouji et al [15] and Narducci et al [16] in their study showed additional risk factors which could lead to higher infections and mechanical complications were the site of insertion and location of the tip of the catheter. They showed insertion in the internal jugular vein than subclavian vein are associated with less number of morbidity in terms of infection and mechanical complications. So based on previous literature and depending on prognostic factors we preferred internal jugular vein as site of insertion, unless indicated for subclavian vein. Since we had inserted a subclavian vein in only one case we could not assess significant findings or difference in significance of site of insertion.

Previous studies[17,18] showed the next important indication for port removal were mechanical complications. Mechanical complications include rotation of chamber, disconnection of chamber, improper size selection. We had nil complications in our study due to proper handling and correct size selection by our experienced staff. The next well known complication in pediatric chemoport is catheter thrombosis. This complication is common because thromboembolic risk is higher in malignancy and mechanical factors include catheter material, size, lumen and number of ports.[19] .We had one pediatric kid for port removal for which thrombosis was the indication. This pediatric kid had come for fourth chemotherapy, after hubner needle insertion, irritable child removed hubner needle. There was delay or time lag between insertion and heparin flush which led to thrombosis and finally led to chemoport removal.

Wound dehiscence occurred in one case. Colin Muncie [20] in his study discussed the potential complications for wound dehiscence amongst which age, gender, malnutrition, chemoport use within 1 week, steroids usage and subcuticular closure to be the risk factors. Amongst these risk factors we had 4 significant risk factors: age of 3 years, steroids , chemo was started 48 hours post procedure and we followed subcuticular closure. To avoid this complication we have made a few changes: usage of chemoport after 1 week of insertion, withheld steroids 1 week prior to chemoport placement and closure of skin with simple running suture. Following these few changes, wound dehiscence complications were not observed thereafter.

A major limitation of our study is being single center study with low volume which is limiting generalization of the data. One more limitation could be still following up on cases for a longer period and accessing data on catheter working days and late complications over the long run. Multicentre studies over the long run can overcome these limitations experienced in our study. The main strength of our study is disengagement of safety and efficacy of its use in Lower middle Income countries. This gives strength to the usage of more chemoports cost effectively, safely even in resource poor countries.

CONCLUSION:

Pediatric chemoport insertion is a safe, effective, and reliable method for long term venous access in children undergoing chemotherapy. With appropriate patient selection, ultrasound guidance, and meticulous technique, complications can be minimized, leading to improved treatment delivery and patient quality of life.

REFERENCES:

1) Beck O, Muensterer O, Hofmann S, Rossmann H, Poplawski A, Faber J, Gödeke J. Central Venous Access Devices (CVAD) in Pediatric Oncology Patients-A Single-Center Retrospective Study Over More Than 9 Years. Front Pediatr. 2019 Jun 25;7:260. doi: 10.3389/fped.2019.00260. PMID: 31294007; PMCID: PMC6603206.
2) Aparna S, Ramesh S, Appaji L, Srivatsa K, Shankar G, Jadhav V, Babu N. 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;4(3):143-5. doi: 10.4103/2278-330X.173179. PMID: 26942147; PMCID: PMC4756491.
3) Laporte-Amargos J, Sastre E, Bergas A, Pomares H, Paviglianiti A, Rodriguez-Arias M, Pallares N, Badia-Tejero AM, Pons-Oltra P, Carratalà J, Gudiol C. Increasing Gram-Negative Catheter-Related Bloodstream Infection in Cancer Patients. Pathogens. 2023 Feb 1;12(2):228. doi: 10.3390/pathogens12020228. PMID: 36839500; PMCID: PMC9963750.
4) Beck O, Muensterer O, Hofmann S, Rossmann H, Poplawski A, Faber J, Gödeke J. Central Venous Access Devices (CVAD) in Pediatric Oncology Patients-A Single-Center Retrospective Study Over More Than 9 Years. Front Pediatr. 2019 Jun 25;7:260. doi: 10.3389/fped.2019.00260. PMID: 31294007; PMCID: PMC6603206.
5) Abdul-Rauf A, Gauderer M, Chiarucci K, Berman B. Long-term central venous access in patients with sickle cell disease. Incidence of thrombotic and infectious complications. J Pediatr Hematol Oncol. 1995 Nov;17(4):342-5. doi: 10.1097/00043426-199511000-00011. PMID: 7583391.
6) Alexander N. Question 3. Do Portacaths or Hickman lines have a higher risk of catheter-related bloodstream infections in children with leukaemia? Arch Dis Child. 2010 Mar;95(3):239-41. doi: 10.1136/adc.2009.176545. PMID: 20308343.
7) Krul EJ, van Leeuwen EF, Vos A, Voûte PA. Continuous venous access in children for long-term chemotherapy by means of an implantable system. J Pediatr Surg. 1986 Aug;21(8):689-90. doi: 10.1016/s0022-3468(86)80388-8. PMID: 3746603.
8) Babu R, Spicer RD. Implanted vascular access devices (ports) in children: complications and their prevention. Pediatr Surg Int. 2002 Jan;18(1):50-3. doi: 10.1007/s003830200011. PMID: 11793064.
9) Aparna S, Ramesh S, Appaji L, Srivatsa K, Shankar G, Jadhav V, Babu N. 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;4(3):143-5. doi: 10.4103/2278-330X.173179. PMID: 26942147; PMCID: PMC4756491.
10) Chandrasekaran A, Somasundaram J. Surgical placement of totally implantable venous access device-an institutional experience. Indian J Pediatr. 2014 Sep;81(9):866-70. doi: 10.1007/s12098-013-1183-8. Epub 2013 Aug 14. PMID: 23943575.
11) Institute of Medicine (US) and National Research Council (US) National Cancer Policy Board. Childhood Cancer Survivorship: Improving Care and Quality of Life. Hewitt M, Weiner SL, Simone JV, editors. Washington (DC): National Academies Press (US); 2003. PMID: 25057670.
12) Bawazir O, Banoon E. Efficacy and clinical outcome of the port-a-cath in children: a tertiary care-center experience. World J Surg Oncol. 2020 Jun 19;18(1):134. doi: 10.1186/s12957-020-01912-w. PMID: 32560722; PMCID: PMC7305599.
13) Radhakrishna V, Radhakrishnan CN, Rao RCS, Kireeti G. Chemoport-A Savior in Children Who Require Chronic Venous Access: An Observational Study. Vasc Specialist Int. 2019 Sep;35(3):145-151. doi: 10.5758/vsi.2019.35.3.145. Epub 2019 Sep 30. PMID: 31620400; PMCID: PMC6774434.
14) Mermel LA, Allon M, Bouza E, Craven DE, Flynn P, O'Grady NP, Raad II, Rijnders BJ, Sherertz RJ, Warren DK. Clinical practice guidelines for the diagnosis and management of intravascular catheter-related infection: 2009 Update by the Infectious Diseases Society of America. Clin Infect Dis. 2009 Jul 1;49(1):1-45. doi: 10.1086/599376. Erratum in: Clin Infect Dis. 2010 Apr 1;50(7):1079. Dosage error in article text. Erratum in: Clin Infect Dis. 2010 Feb 1;50(3):457. PMID: 19489710; PMCID: PMC4039170.
15) Araújo C, Silva JP, Antunes P, Fernandes JM, Dias C, Pereira H, Dias T, Fougo JL. A comparative study between two central veins for the introduction of totally implantable venous access devices in 1201 cancer patients. Eur J Surg Oncol. 2008 Feb;34(2):222-6. doi: 10.1016/j.ejso.2007.04.003. Epub 2007 Jun 12. PMID: 17566692.
16) Deshpande KS, Hatem C, Ulrich HL, Currie BP, Aldrich TK, Bryan-Brown CW, Kvetan V. The incidence of infectious complications of central venous catheters at the subclavian, internal jugular, and femoral sites in an intensive care unit population. Crit Care Med. 2005 Jan;33(1):13-20; discussion 234-5. doi: 10.1097/01.ccm.0000149838.47048.60. PMID: 15644643.
17) Ignatov A, Hoffman O, Smith B, Fahlke J, Peters B, Bischoff J, Costa SD. An 11-year retrospective study of totally implanted central venous access ports: complications and patient satisfaction. Eur J Surg Oncol. 2009 Mar;35(3):241-6. doi: 10.1016/j.ejso.2008.01.020. Epub 2008 Mar 10. PMID: 18329836.
18) Mansfield SA, Staszak J, Murphy AJ, Talbot L, Abdelhafeez A, Prajapati H, Gold R, Maller V, Proctor K, Davidoff AM, Williams RF. Impact of insertion site on complications in central venous access devices. Pediatr Surg Int. 2023 Feb 11;39(1):118. doi: 10.1007/s00383-023-05399-w. PMID: 36773111.
19) Ho C, Spry C. Central Venous Access Devices (CVADs) and Peripherally Inserted Central Catheters (PICCs) for Adult and Pediatric Patients: A Review of Clinical Effectiveness and Safety [Internet]. Ottawa (ON): Canadian Agency for Drugs and Technologies in Health; 2017 Apr 27.
20) Muncie C, Herman R, Collier A, Berch B, Blewett C, Sawaya D. Wound complications after chemo-port placement in children: Does closure technique matter? J Pediatr Surg. 2018 Mar;53(3):572-575. doi: 10.1016/j.jpedsurg.2017.10.044. Epub 2017 Oct 13. PMID: 29113679.