COMPARISON OF INTERNAL AND EXTERNAL JUGULAR VEIN PORT IMPLANTATIONS IN CHILDREN

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ABSTRACT

Purpose: *Ports are being used increasingly as an important adjunct to therapy for various reasons in children. In this report, we aimed to compare the survival of ports in relation to implantation site and age.* ***Method:*** *Data of port implantations from December 1994 to 1999 were analysed retrospectively. Implantation sites (external versus internal jugular vein), age of patient (5 vs. 5 years), and port removal due to complications were noted. Kaplan-Meier and log rank tests were used for cumulative survival analysis and comparisons between the groups.* ***Results:*** *Sixty-four ports were implanted in 59 children (age 8 months-16 years, average 7 years). One saphenous vein implantation was excluded. Implantation days totalled 21122 (average 330) days. Forty-five catheters (71%) were implanted via the external and 18 (29%) via the internal jugular veins. Average duration of implantation was 314 days in the external and 388 days in the internal jugular ports. Difference between the two groups was insignificant (p 0.05). Average port survival was 379 days in children under 5 and 274 days in children over 5 years of age, and this difference was insignificant statistically (p 0.05). For children younger than 5 years, there was no statistical difference in the survival of ports implanted via the external or internal jugular veins (p 0.05).* ***Conclusion:*** *Port systems are useful as an adjunct to therapy in children at any age. The implantation either via the external or internal jugular vein is convenient in relation to port survival. Internal jugular vein could be used reliably in children under 5 years of age, and in instances when external jugular vein could not be catheterized due to small vessel diameter.*

Key Words: *Port Implantations, External and Internal Jugular Veins, Children.*

INTRODUCTION

Permanent central venous access by means of ports has gained wide application in recent years as an important component of therapy for administration of various drugs including chemotherapeutics and antibiotics, blood and blood products, parenteral nutrition and to obtain blood samples in various situations in children and adults. Long-term central venous catheterization was introduced by Dudrick et al. in 1969, followed by Broviac-Hickman catheters used with a subcutaneous tunnel in 1973 (1-3). Central venous catheters with subcutaneously implanted ports have been commercially available since 1984 and have gained wide popularity with low infection rates, easy management and increased patient life quality (4).

Although various veins are used for catheter placement, jugular veins (internal and external) are preferable in the pediatric age group having lower incidence of thoracic duct and caval vein injury and ease in echocardiographic follow-up (5-7).

In this study, failure-free duration of use of port catheters implanted via the external and internal jugular veins were compared retrospectively in relation to patient age and implanted vein.

PATIENTS AND METHODS

Sixty-four ports were implanted in 59 children, 32 girls and 27 boys, aged between 8 months-16 years (average 7 years) from December 1994 to December 1999 (Table 1).

Table 1: Diagnoses of patients with port implantations

Disease	Number of Patients
Acute Lymphoblastic Leukemia	43
Acute Myelocytic Leukemia	6
Rhabdomyosarcoma	2
Burkitt's Lymphoma	2
Neuroblastoma	1
Ewing's sarcoma	1
Osteosarcoma	1
Astrocytoma	1
Short Bowel Syndrome	2
Total	**59**

Preoperative assessment included determination of complete blood count, prothrombin time, partial thromboplastin time and thrombocyte count. Erythrocyte and thrombocyte suspensions and fresh frozen plasma were transfused as needed. All implantations were made under general anesthesia, except in two patients. The implantation site was cleansed with 10% polividoniodide and draped. Catheters were placed percutaneously in three and using cut-down procedures in the rest of the patients. Catheterizations were mainly carried out via the external, internal jugular veins or saphenous vein. The locations were checked by chest X-rays obtained in the operation table following the procedures. The system was washed with saline solution containing 100 IU heparin/ml using a noncoring needle. When the catheters were in use, the drapes were changed once in three days and when not in use, they were washed with heparinized saline once in a week. Catheter sepsis was investigated with catheter and blood cultures. Catheter thrombus and rupture were detected by radiographs obtained with contrast material injection through the port system. In instances of thrombus, 1.5-2 ml of streptokinase (5000 IU/ml) was used in an attempt to reopen catheter lumens. Port systems were removed under general or local anesthesia.

The cumulative survival of catheters in relation to complications resulting in catheter removal placed either via the external or jugular veins were compared using the Kaplan-Meier survival analysis test. Catheter removal due to patient loss or to cessation of the therapy was censored. Also compared were cumulative survival of catheters implanted in patients younger or older than five years of age. The statistical analysis of cumulative survival was studied with log rank test. $p<0.05$ was considered significant.

RESULTS

The duration of implantation of the ports totalled 21,122 days (average 330 days); ranging from 7 to 1631 days. General infection rate was 15%, and thrombus rate was 11%. The incidence of catheter related sepsis was found to be 0.04 per 100 days.

Excluding the saphenous vein catheter, 63 internal and external ports were compared with each other from various aspects. Of the jugular catheters, 45 (71%) were implanted via the external and 18 (29%) via the internal jugular veins, most were implanted from the right side (Table 2). Thirty-eight of the catheters were removed due to various reasons, as documented in Table 3, and 25 of them are still in use. Average duration of implantation was 314 (7-966) days in the external and 388 days (11-1631) in the internal jugular port systems. The difference in cumulative survival between the two groups was not significant statistically

Table 2: Vessels used for catheter placement.

Vein of catheterization	Number
Right external jugular	34
Left external jugular	11
Right internal jugular	15
Left internal jugular	3
Left saphenous	1
Total	**64**

Table 3: Complications resulting in catheter removal.

Reason of Removal	Internal jugular	External jugular	Total
Cessation of therapy	1	6	7
Loss of patient	3	8	11
Infection	4	4	8
Catheter Rupture	0	2	2
Skin necrosis	1	3	4
Catheter dislodgement	1	1	2
Catheter thrombus	1	3	4
Total	**11**	**27**	**38**

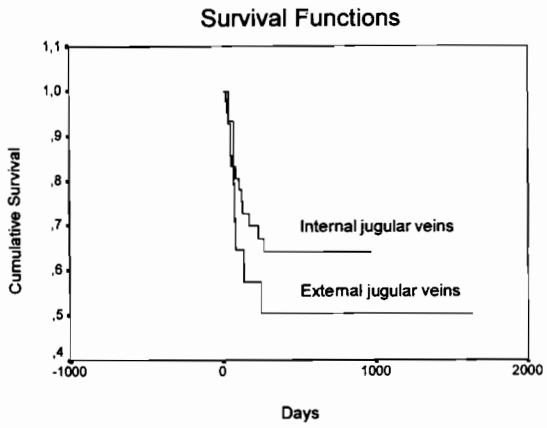

Fig. 1: The cumulative survival curves of port systems implanted via the external and internal jugular veins.

($p>0.05$) (Fig. 1).

Forty-eight percent (n=15) of 31 the ports implanted in children under five years of age and 19% (n=6) of the 32 in children over five years of age were removed due to complications; however, cumulative survival between these two groups was not statistically different ($p>0.05$).

When patients younger than five years of age were compared with relation to whether the catheter iinplantation was done via the external or internal jugular veins, catheter survival was also similar ($p>0.05$).

DISCUSSION

Long-term central venous catheters have become a part of therapeutic management of children with various clinical entities, most of whom consist of hematology-oncology patients. Consistent with the literature, leukemia patients comprise 77% of the present series (Table 1). Port implantations could be applied at any age with the advantages of lower infection rates, obstruction and dislodgement. Because they do not change the body image, the port systems are favored moslty by adolescents (8). The ease and effectivity in their use in the anesthesia or heavy sedation of pediatric radiotherapy patients with an intensive treatment protocol has also been reported (9). Open surgical catheterizations are preferred by most of the pediatric surgical departments over percutaneous procedures due to general agreement that they are more complication-free and reliable (10). In our series, all implantations were done using the cut-down technique except in three adolescent patients.

External jugular veins are used more frequently for catheterization than the internal jugular veins due to easy accessibility. However, because of the branching of the vein or due to angulation in the entrance into the subclavian vein the catheter could be placed peripherally rather than centrally. This risk of malposition is low in the internal jugular vein (10). In the present series, 71 % of the port catheters were implanted via the external jugular vein. The rate of malposition determined by chest radiographs was 24 % in external jugular catheterizations whereas it was only 5 % in the internal veins. Catheter misplacement has been reported as the most common complication in a review paper (10).

The long-term use of the port systems is frequently associated with infectious and mechanical complications. In this series, 31% of the port systems had to be removed because of complications, excluding the ones due to patient loss or cessation of the therapy (Table 3). The rate of complications resulting in catheter removal encountered in the ports placed via the external jugular veins was 28 % whereas that of the ones placed via the internal jugular veins was 38%. The most frequent complication seen was infection followed by various other mechanical complications. Although the complication rate was higher in the internal jugular group, no significant difference was found with the survival analysis. In one study, catheter replacement due to port-related bloodstream infection was reported to be prevented without removal in 78% of patients which must be considered in the management of port patients in our further

practice as well (11). More serious complications such as pneumo- or hemothorax did not occur because almost all of the catheters were implanted by the cut-down technique, so we advocate the use of this technique in port implantations.

The removal rate of catheters due to complications has been reported to be higher in infancy (12). In our series the removal rate was also higher in patients younger than five years with a mean age of 2.9 years (48 % vs. 19 %); however, survival rates did not differ in relation to age. We could not find any difference in the survival rates of ports in children under five years of age in relation to placement via the internal or external jugular veins ($p>0.05$). This statistical lack of difference might be considered when catheterization through the external jugular vein could not be performed due to smaller diameter of the vessel.

The data analyses in this series of ports revealed that catheterization using the internal or external jugular vein does not effect the port survival. Although surgical approach and visualization is easy, catheterization via the external jugular vein could be difficult and prove to be fruitless in infancy due to smaller diameter of the vessel. In this instance, we suggest catheterization of the internal jugular vein, although it is technically more demanding. It should also be noted that the external vein carries a greater risk of malposition and consequent complications.

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REFERENCES

1. Dudrick SJ, Wilmore DW, Vars HM, Rhoads J. Can intravenous feeding as the sole means of nutrition support growth in the child and restore weight loss in an adult? Ann Surg 1969; 6: 974-981.
2. Broviac J, Cole B, Scribner B. A silicone rubber atrial catheter for prolonged parenteral alimentation. Surg Gynecol Obstet 1973; 136 : 602-606.
3. Hickman R, Buckner C, Clift R. A modified right atrial catheter for access to the venous system in marrow transplant recipients. Surg Gynecol Obstet 1979; 148: 871-875.
4. Backer AD, Vanhulle A, Otten J, Deconinck P. Totally implantable central venous access devices in pediatric oncology - Our experience in 46 patients. Eur J Pediatr Surg 1993; 3 : 101-106.
5. Kohli-Kumar M, Rich AJ, Pearson ADJ. Comparison of saphenous versus jugular veins for central venous access in children with malignancy. J Pediatr Surg 1992; 27: 609-611.
6. Agarwal KC, Ali Hahn MA, Falla A. Cardiac perforation from central venous catheters: Survival after cardiac tamponade in an infant. Pediatrics 1982; 73: 333-338.
7. Tocino IM, Watanabe A. Impending catheter perforation of superior vena cava, radiographic recognition. AJR 1986; 146: 487-490.
8. Ross MN, Haase GM, Poole MA, Burrington JD, Odom LF. Comparison of totally implanted reservoirs with external catheters as venous access devices in pediatric oncologic patients. Surg Gynecol Obstet 1988; 167: 141-144.
9. Bozkurt P, Ekinci A, Köse Y, Dikmen Y. Pediyatrik radyoterapi anestezisinde kalıcı port kullanımı. Türk Anesteziyoloji ve Reanimasyon Cemiyeti Mecmuası 1994; 22: 245-248.
10. Albanase CT, Wiener ES. Venous access in pediatric oncology patients. Semin Surg Oncology 1993; 9: 467-477.
11. Rubin LG, Shih S, Shende A, Karayalcin G, Lanzkowsky P. Cure of implantable venous port-associated bloodstream infections in pediatric hematology-oncology patients without catheter removal. Clin Infect Dis 1999; 29: 102-105.
12. Ross P, Ehrenkranz R, Kleinman CS, Seashore JH. Thrombus associated with central venous catheters in infants and children. J Pediatr Surg 1989; 24: 253-256.