ORIGINAL ARTICLE

GROSHONG CATHETERS FOR LONG TERM CENTRAL VENOUS ACCESS; TWO YEARS EXPERIENCE FROM SINGLE CENTER

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ABSTRACT

OBJECTIVE: To evaluate the survival rate and main reasons of failure of tunneled central venous catheters (Groshong). **STUDY DESIGN:** Retrospective cross-sectional analysis. **PLACE OF STUDY:** Department of Interventional Radiology, Shifa International Hospital, Islamabad. **DURATION OF STUDY:** Two years (January 2010 to December 2011) **MATERIALS AND METHODS:** A retrospective analysis was carried out on 72 patients in whom Groshong catheters were placed and then followed from January 2010 to December 2011. The data was collected from hospital information system (HIS) and patient s medical record, and was analysed for different indicators such as catheter survival and main reasons of its failure. **RESULTS:** Of 72 patients, half of patients were lost to follow. Among the remaining half, 19 (52.7%) catheters achieved their desired function. Among remaining 17 catheters, 5 were removed due to blockage and 12 due to infection with infection rate of 0.46 per 1000 catheter days. The catheter survival rates according to Kaplan Meier analysis at 1, 3 and 6 month were 82%, 47% and 42% respectively. **CONCLUSION:** Groshong catheters can be used as vascular access for longer duration especially in oncology patients. Infection is commonest reason of their premature removal.

Keywords: Central venous access, tunneled catheters, Groshong catheter.

Introduction

Recent advances in treatment of different malignancies and chronic infections have increased the demand for long term venous access. Historically, much has changed since the early methods of multiple central venous access procedures and multiple scalp vein puncture. Experiments on animal venous system in evolution of catheters have been described in literature.[1] Fortunately, over the last few decades better devices have been developed for central venous access. Despite this advancement in catheters designs, the hazards associated with long term use of catheters have no end. Galloway defined long term as duration more than 6 weeks.[2] Due to increased occurrence of infection in nontunneled catheters due to continuation of skin puncture and venotomy sites, peripherally inserted central venous catheters came into use. Another advanced variety of catheters to circumvent the complications was tunneled catheter. Groshong catheter (Bard Access systems, Salt Lake City, UT) is a type of tunneled central venous catheter introduced in early 90s in the west. The unique feature of these catheters is a blind ending tip with a side facing valve just proximal to its tip. These features have been logically designed with an aim of providing a long term access catheter that has a biocompatible composition and can be placed in a large vein which allows adequate dilution of infused products, reduced pain, delay in the development of thrombosis, free aspiration of blood, prevention of infection and the liberty from cumbersome catheter care protocols

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requiring repetitive heparin flushes.[3] Due to these features the Groshong catheters have become a popular means of long term venous access.[4,5,6] Its practice in third world especially in Pakistan is negligible due to lack of awareness and lack of expertise for its placement. We have been using these catheters since 2007 in our institution and we report our experience in this study.

Material and Methods

A retrospective analysis was carried out on 72 patients in whom Groshong catheters were placed and then followed from January 2010 to December 2011. ERC approval was taken for this study. The data was collected from hospital information system (HIS) and patient s medical record, and was analysed for different indicators such as catheter survival and main reasons of its failure.

Groshongfi catheters have a proximal end with a built in Dacron retention cuff and a distal blind end with a Groshong valve on side. The valve is closed on neutral pressure and allows passage of lumen contents with negative or positive pressure. This prevents back flow of blood into lumen, minimizes chances of obstruction by blood clots obviating the need for locking by anticoagulants. The external part of the catheter is tunneled under the subcutaneous tissues. The cuff reduces the risks of dislodgement and infection by stimulation of fibrosis which holds the catheter in place and forms a mechanical barrier to bacterial colonization and migration. We used double lumen 9 Fr Groshong catheters in all patients.

All catheters were placed by interventional radiologists (AIR and MR) having experience of 8 and 1 years. Ultrasound guidance was used for venotomy and fluoroscopy for confirmation of catheter s position. All patients were prepped and draped in standard manner. Local anesthesia and conscious sedation were used in every patient. The vein was punctured with 19 G needle attached to syringe and guide wire passed through needle before its removal. Catheters were passed into vein via peel-away sheath. The tunnel was formed using tunneler provided in the kit. Position of these catheters was secured with non-absorbable sutures.

After approval from Institutional Review Board, patients were identified and data collected from hospital data base system and patient s medical record. The data was analysed for demographic variables and catheter related parameters including survival rate, reason of catheter failure and catheter infection rate. SPSS Statistical software (version 16) was used. Complication rates for infection and catheter occlusion were calculated as a rate per 100 catheter days. Because a significant number of catheters had to be removed because they were no longer needed, the mean duration values for the total catheters is underestimated if we wish to speak in effective terms of the mean duration that could be expected for a catheter before it has to be removed due to infection or blockage. This measurement is made possible by using the statistical tool of the Kaplan-Meier product limit method. For this analysis, the access survival was defined as the duration of catheter use till the time of removal. Failure was defined as catheter removal for suspected infection or mechanical malfunction. Censoring was performed for elective removal or loss to follow up. Statistical significance was assessed using log rank test whose p value less than 0.05 was considered significant. Median, range and standard deviations were calculated for age. Male to female ratio of patients was calculated. Frequency and percentages were calculated for underlying disease entities diagnosed in patients who underwent catheter insertion as well as for reasons for removal.

Results

The male and female ratio was equal in the study group. The demographic data and diagnosis of these patients are given in (Tab. 1). The commonest indication in these patients was long term intravenous access for chemotherapeutic agents for cancer patients accounting for 90.3% cases (n=65). Four catheters were used in bone marrow transplant patients (subset of chemotherapy), 2 for total parenteral nutrition and one for long term antibiotic use. Right internal jugular vein was used for catheters in 67 patients (93.1%) while in remaining 5 patient left internal jugular vein was used. Follow up was not available in half of the patients who were excluded in calculating variable outcomes. Among the remaining half, 19 (52.7%) catheters achieved their desired

Demographic Variables	
Total Number of patients	72
Male / Female	1
Age of patients	Mean= 44.5 yrs (Range= 13-78 yrs)
	Standard deviation 17.42

Diagnosis of patients

Diagnosis	Frequency	Percent
Acute Myeloid Leukemia	12	16.7
Acute Lymphoid Leukemia	12	16.7
Chronic Myeloid Leukemia	2	2.8
Chronic Lymphoid Leukemia	1	1.4
Lymphoma	2	2.8
Multiple Myeloma	2	2.8
Carcinoma Breast	8	11.1
Carcinoma Stomach	5	6.9
Carcinoma Colon	4	5.6
Carcinoma Lung	3	4.2
Carcinoma Ovary	4	5.6
Osteosarcoma	2	2.8
Others*	15	20.8

* This group had patients with rare malignancies and chronic infections.

Table 1: Diagnosis of patients undergoing catheter insertion

function. Among remaining 17 catheters, 5 were removed due to blockage. Another 12 were removed due to infection with infection rate of 0.46 per 1000 catheter days. (Tab. 2). Out of 12 catheter related infections, 4 patients had localized infection (at tunnel site) and remaining 8 patients had catheter related bacteremia. Among the bacteremic patients, Methicilline Resistant Staph. Epidermidis (MRSE) and Pseudomonas were common, each seen in 2 cases (total=4). The median catheter survival (as calculated according to Kaplan Meier analysis) was 95 days. The catheter survival rates at 1, 3 and 6 month were 82%, 47% and 42% respectively (Fig.1). No statistically significant difference in survival rates (significant < 0.05) was observed for gender of patients (0.286), choice of vein for catheter insertion (0.301) and group of malignancies (Hematological vs non-hematological) (0.090).

Reason of removal	Frequency	Percent
Lost to follow up	36	50
Catheters, achieved the desired function.	19	26.4
Catheter related Infection	12	16.7
Blockage of catheter	5	6.9

Infection was the commonest cause of premature removal of the catheters.

Table 2: Reasons for removal of catheters

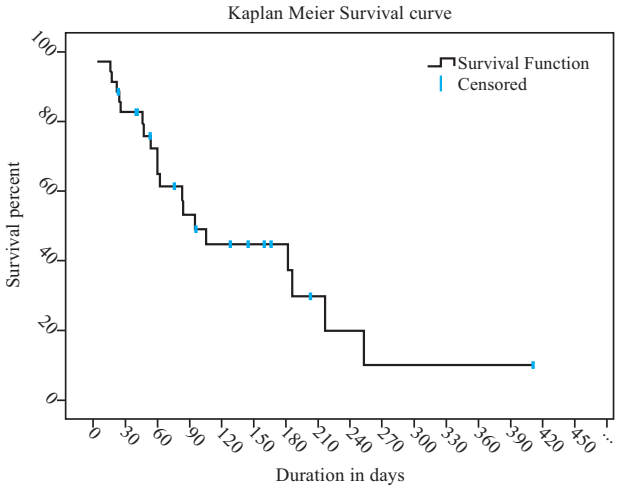

Figure 1: The stepped line in figure shows the catheter survival and vertical lines transecting the stepped line are showing Censored data.

Discussion

Long term venous access devices have been in use for the past few decades for different indications. Experience has brought to light the major complications associated with long term venous access which limit their durability comprising primarily of but not restricted to infection, catheter occlusion, leakage, catheter fracture, dislodgement and venous thrombosis.[7-8] Various devices have been developed in an effort of achieving a design which should be an ideal venous access device. An ideal catheter should be made of biocompatible material which allows adequate dilution of infused products, has reduced pain on injection, avoids development of thrombosis, has free aspiration of blood, and has low rates of infection and occlusion. Tunneled Groshong catheter is an effort to achieve these goals. Catheter related complications have been extensively studied. Tolar et al documents the complications associated with these catheters and has shown a predictable sequence of complications in 221 patients with Groshong catheters.[4] Catheter occlusion was one of the most common complications noted in this study.

A continuing debate is the choice of insertion site for central venous catheters (CVCs).[9] Majority of the catheters (93.1%) in our study population were placed in the right internal jugular vein while the remaining 6.9 % in the left internal jugular vein. Our results did not show any significant difference in outcomes of

the catheters inserted in these two different sites. This finding is in agreement with recent evidence which shows that central venous insertion and modality do not have any significant impact on either early or late complication rates.[9] Engstrom et al, however have reported statistically significant differences based on laterality in dysfunction and infection rates for catheters palced with tips in pericavoatrial region but not for right atrium.[10] On the other hand, there are studies which quote the internal jugular route as a better option in comparison to subclavian approach particularly in reference to thrombotic complications although chance of catheter infection remains equal in these two different venous accesses.[11] Some investigators claim in a review that transjugular route on right side should be used for venous access as it is associated with favorable results in terms of thrombosis.[12] Other authors have also assessed the outcomes of access via external jugular vein.[13] This issue has been left unresolved even in the latest CDC guidelines for prevention of intravascular catheter related infections where no recommendations have been given regarding optimal site of insertion for tunneled CVC.[14]

Venous thrombosis is an important complication associated with CVCs. One study mentions its occurrence in 40% of patients at autopsy while another study based on ultrasound findings document its incidence as 33 -67%.[14,15,16] In our study this could not be documented as catheterogram or ultrasound was not done in all patients.

Catheter related infection is one of the most common complications associated with long term venous access despite efforts to bring the infection rates down by measures such as antibiotic lock solutions, heparin flushes, clamping and valve designs. We have defined catheter related infection in accordance to the recent guideline of Infectious Disease Society of America (IDSA).[17] The infection rate is 0.035 to 0.13 per 100 catheter days, cited in other studies.[17,18,19] Overall infection rate in our population was 0.046 per 100 catheter days, which is falling in this range.

Another important complication is catheter mechanical malfunction seen in the form of catheter thrombosis or fibrin sheath formation. These two factors lead to catheter malfunction rate of 0.069-1.1 per 100 catheter days.[15,16,20,21] These underlying factors leading to catheter malfunction could not be assessed in our study however total malfunction rate was 0.02 per 100 catheter days.

Conclusion

Groshong catheters are a good choice for long term vascular access such as in oncology patients for chemotherapy, bone marrow transplant, TPN and even for prolonged course of antibiotics. Catheter related infection is the most common reason of their failure.

Conflict of Interest: None

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