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Case Report

Tunneled Femoral Venous Catheters as the Final Glimmer of Hope for a Nephrologist in a Suburban Dialysis Centre Dealing with Multiple Vascular Access Failure

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Abstract

Exhaustion of lifelines in hemodialysis patients is a vexing problem for interventional nephrologists. While larger veins of the neck provide the immediate source of lifeline, they also get blocked because of repeated cannulations, thus jeopardising the feasibility of inserting tunneled catheters too in the long run. When arteriovenous fistulas fail and when the patient becomes unaffordable to meet the cost of peritoneal dialysis in a setup where vascular experts aren't available for arteriovenous graft or shunt creation, it becomes a great challenge for the treating nephrologist. Tunneled catheters through femoral veins, though have been talked about a lot, haven't gained popularity worldwide and are never a preferred choice in lieu of arteriovenous grafts or shunts. We hereby publish two such cases of successful tunneled femoral catheter inserted 15 months before for one patient and 12 months before for the other that continue to function successfully till date.

Keywords: *Vascular Access Failure in Suburban Centres; Tunneled Femoral Venous Catheterization*

Introduction

Hemodialysis is the life saving modality for end stage renal disease patients. Large veins, mainly the jugular system and rarely the subclavian system form the major source of immediate vascular access for dialysis patients. Long term vascular access is mainly through arterio-venous fistulas (AVF) on the non-dominant arm. Though they provide the major access, it becomes a cumbersome issue when the same goes for complications including primary and secondary failure, infection, aneurysm and the risk of rupture, thrombosis, venous hypertension, precipitation of cardiac failure due to the high output etc [1]. AV grafts are also not free of complications [2] and due to repeated cannulations, the possibility of tunneled catheter through the neck too, becomes bleak for such hapless individuals. AV shunts are not easy to create and require a vascular cohort of great expertise to get constructed and do not function for the desirable period most of the time. And when the patient is not a transplant candidate unaffordable for peritoneal dialysis either, the nephrologist really finds himself in soup.

Case Report

Two patients whose lifelines were completely exhausted including multiple AV fistula failures and occluded neck veins, who weren't affordable for CAPD (continuous ambulatory peritoneal dialysis and who were not transplant candidates were chosen for this tunneled femoral catheter insertion.

The area from the abdomen up to the whole thigh was completely cleaned and draped. A symmetrical double-tipped palindrome catheter of longest available length, nearly 72 cm in total and up to 55 cm from the tip to the cuff was chosen. This was to ensure the adequate attainment of length to achieve a good flow. Though other types of tunneled catheters like split-tip type and staggered-tip type are available, palindromic type was preferred to other types as in various studies the former was found to offer good flow, reduced recirculation and with a lower rate of catheter dysfunction when compared to the other types. The length and the entry point for the tunnel creation were tentatively marked. Femoral vein was located as per the routine method. Adequate local anaesthesia was given, C-Arm was used for the guidance and strict aseptic precautions was employed. A subcutaneous tunnel was created in the abdominal wall, nearly 12 - 14 cm lateral to the umbilicus with the cuff embedded within 2 cm of the tunnel's entry point. The vein was serially dilated with 12 Fr and 14 Fr sized dilators and with the help of a 16 Fr valved pull apart sheath and introducer, the catheter was slowly pushed inside with the 'sequential pull-peel-push' technique. Catheter was locked with gentamicin plus heparin lock and the position of the tip and the catheter as a whole was confirmed with C-Arm and Plain CT scout film as well (Figure 1).

Figure 1: *CT scout film showing the catheter, its course upto the tip.*

The tunnel was kept away from the umbilicus and sutured so as to avoid any acute angulation of the catheter at the groin exit (Figure 2).

Figure 2: *Image showing the position of the catheter tunnel and its relation to the umbilicus.*

Patients were taught to maintain proper and meticulous hygiene and to avoid extreme flexions of the right hip joint. Gentamicin and heparin lock was given every time without fail. We were able to maintain the durability of the catheters with such measures.

The patients' characteristics are tabulated in table 1, while the catheter characteristics and outcomes are tabulated in detail in table 2.

	Patient 1	Patient 2
Age	55	48
sex	male	male
Number of fistula failures	Three	Two
Socio-economic status	poor	poor
Transplant prospect	nil	nil
Occluded major veins	Both jugular veins upto brachiocephalic trunk	Both jugular veins
Time of insertion of the tunneled femoral catheter	February 2019	April 2019
Type of the catheter used	Palindrome	palindrome
Dimensions of the catheter used	72 cm length in total and 55 cm from the tip to the cuff, 14.5 Fr and 4.8 mm diameter	Same as for patient 1.

Table 1: *Showing the patients' characteristics. CRBSI: Catheter Related Bloodstream Infection.*

Complications during insertion	Nil	Nil
Antibiotic and anticoagulant lock	Gentamicin (1.5 mg/ml) and heparin (1000 U/ml)	Same as patient 1
Minimum flow achieved during dialysis	300 - 350 ml/min	300 - 350 ml/min
Number of episodes of CRBSI	Two	one
Organisms isolated	Vancomycin sensitive enterococcus, *Staph aureus*	*Staph aureus*
Treated with antibiotics	Yes	Yes
Whether catheter salvaged	Yes	Yes
Catheter durability till date	Yes functioning	Yes, functioning

Table 2: *Catheter characteristics and outcomes.*

Discussion

Multiple vascular access failure in a dialysis patient is probably the most enigmatic topic and an exasperating issue of serious concern for a nephrologist [3]. Most of the dialysis centres in sub-urban localities of India offer dialysis under government sponsored insurance schemes that offer this life saving treatment at free of cost. While hemodialysis is most often covered under such schemes, the exorbitant cost of peritoneal dialysis is never fully met and such poor people might have to cough out a huge part of their savings every month to meet the expenses. Most of such suburban centres do not have facilities for endovascular surgical correction of a blocked AV fistula, AV

graft or shunt creation. Much to one's chagrin, the long litany of waiting lists for deceased donor transplantation and the nonavailability of a live donor adds on to the pain.

The readily available internal jugular vein offers the temporary and immediate lifeline for hemodialysis, the repeated cannulations of what almost always leads to jugular, innominate or superior vena caval thrombosis [4].This jeopardizes the further possibility of using tunneled catheters through the same route [5].The first choice of catheter insertion should be the right internal jugular vein followed by the left one [6]. Femoral veins are used only when the need of hemodialysis is supposed to be less than a week or when the patient is having severe pulmonary edema making the cannulation of the jugular vein difficult.

The increased incidence of complications and failures seen with AV fistulas partly due to increased longevity of patients observed with dialysis [7] and the non-availability of AV grafts,shunts readily, their associated complications of thrombosis, infections [8] and the technical and demanding expertise needed in correcting blocked fistulas through the endovascular routes, led to the concept of evolution of tunneled catheters via the femoral route.

The concept of tunneled femoral catheters dates back to the mid 90's when the challenge of difficult vascular access began to emerge and started burgeoning. George X. Zaleski, Brian Funaki., *et al* [9], in their study of 3 year experience on 41 tunneled femoral catheters observed a technical success of placement of 100%. A 180-day primary and secondary patency rate of 55% and 61% respectively was observed. Average time of function per intervention was 61 days. They concluded that tunneled femoral catheters are a better choice for those with complete exhaustion of vascular access.

Assem M. Herzallah, Mohamed T. Y. Madkour., *et al*. [10] in their study of 17 end stage renal disease patients with exhausted vascular access observed a mean period of 10 months of catheter patency and a maximum of 14 months. The most common cause of catheter removal was catheter related septicaemia. None of them developed any late bleeding or thrombosis. Faecal contamination was a constant issue of embarrassment with femoral catheters, especially with the short term untunneled types [11]. This could be obviated by the proper creation of a tunnel and the use of a cuffed catheter that reduced the risk of infections manyfold, they substantiated. 'The properties, advantages, demerits and the methods to obviate the disadvantages are tabulated below, in table 3'.

	Advantages	Disadvantages	Comments
1	Probably the last choice when all the other lifelines have been exhausted.	Risk of faecal contamination and sepsis are high	Patients should be taught of proper hygiene.
2	Best suited at suburban centres where personnel of surgical expertise for AV grafting, AV shunting and endovascular correction of blocked AV fistulas are not available.		
3	Much inexpensive when compared to CAPD.	Might compromise the possibility of placing the graft on the right side, if the patient were to be transplanted at a later date.	To prefer the left femoral vein if he is a future transplant candidate.
4	Offers a better cosmetic advantage.		
5	Circumvents the possibility of developing superior vena caval syndrome seen with obstructed jugular tunnels.	Risk of deep vein thrombosis.	Use of proper dose of regional anticoagulation and anticoagulant lock.
6	Offers better blood flow during dialysis owing to the larger length and diameter of the catheter used.	Tunnel contamination/colonisation/infection by perineal organisms.	To confirm every time that the cuff is beneath the tunnel. Proper cleaning and hygienic handling of the catheter during dialysis.

Table 3: *Tunneled femoral catheters: advantages, disadvantages and the methods to obviate the demerits.*
CAPD: Continuous Ambulatory Peritoneal Dialysis.

Conclusions

While large central neck veins provide the immediate source of hemodialysis for many, their occlusions occurring sequentially due to repeated cannulations poses a great challenge for the nephrologists. This compromises the further possibility of creating AV fistula or using tunneled catheters via the neck veins. While on one side creation of AV grafts and shunts require vascular experts who by all practical purposes are not available at suburban institutions all the time, CAPD imposes a great financial burden on the patient and his family on the other. To obviate these disadvantages, femoral vein can be cannulated through a properly created tunnel and can serve as a long term source for offering hemodialysis and shall be a potential bridge before renal transplantation. For those who are transplant candidates, it would be prudent if left sided femoral vein is used. Selection of a catheter of sufficient length, embedding the cuff properly within the tunnel, properly advising the patient to maintain perineal hygiene and proper hygienic handling of the catheters during dialysis including the correct dose of anticoagulant and antibiotic lock shall all increase the durability of the tunneled femoral catheter.

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