

# Placement of long-term hemodialysis catheter (permcath) in patients with end-stage renal disease through external jugular vein

Ali Akbar Beigi, Ali Sharifi<sup>1</sup>, Hafez Gaheeri, Saeed Abdollahi<sup>1</sup>, Morteza Abdar Esfahani<sup>2</sup>

Departments of Vascular Surgery, <sup>1</sup>Surgery, <sup>2</sup>Cardiology, Isfahan University of Medical Sciences, Alzahra Hospital, Isfahan, Iran

## Abstract

**Background:** The number of patients with End-Stage Renal Disease (ESRD) has progressively increased in the population. Kidney transplantation is the specific treatment for such patients; however a majority of patients will require hemodialysis before kidney transplantation. The present study aims to investigate using the external jugular vein (EJV) for Permcath placement in these patients.

**Materials and Methods:** This descriptive and analytical study was conducted in Alzahra Medical Center, Isfahan, in 2012. Catheters were inserted by cutting down the right EJV. The patency rate and potential complications were studied. The obtained data was analyzed using SPSS 21.0.

**Results:** Out of 45 live patients, within three months of surgery, 40 patients (81.6%) had no complications and dialysis continued through Permcath. Permcath Thrombosis occurred in two patients (4.4%). Catheter infection led to the removal of it in one patient (2.2%) 1.5 months after surgery. And accidental catheter removal occurred in one patient.

**Conclusion:** Placement of the permcath in the external jugular vein can be a safe, uncomplicated, and reliable method for patients requiring hemodialysis, and can be a life-saving alternative in patients without accessible internal jugular vein.

**Key Words:** Access, patients with End-Stage Renal Disease, Permcath

## Address for correspondence:

Dr. Ali Sharifi, Alzahra Hospital, Department of Surgery, Isfahan University of Medical Sciences, Isfahan, Iran. E-mail: Sharifi331@yahoo.com

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## INTRODUCTION

Patients with End-Stage Renal Disease (ESRD) form a significant number of patients in the community, and kidney transplantation is the optimal treatment.

However, many of these patients (about 60%) are not good candidates for kidney transplantation. On the other hand, before transplantation, a majority of patients having the potential to receive a transplanted kidney also require the renal replacement therapy, that is dialysis.<sup>[1]</sup> The modern hemodialysis process was started in 1966, and was based on creating arteriovenous fistulae (AVF) so that enough blood flow could be provided for hemodialysis.<sup>[2]</sup>

To date, arteriovenous fistula (AVF), due to the possible long-term use and low-level complications, is known to be the best method to perform the process of chronic hemodialysis. In patients for whom providing

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AV fistulae is not possible, or who require dialysis during maturation of the AV fistula, the process helps to establish a hemodialysis catheter in the central arteries so that through an appropriate flow, being at least about 250 to 300cc per minute, the patient's blood is entered in hemodialysis machine.<sup>[3,4]</sup>

During the past decades, to insert vascular access for hemodialysis, the best method has been to use the internal jugular vein.<sup>[5,6]</sup> At present, in the Dialysis Outcomes Quality Initiative guidelines, the right internal jugular vein has been introduced as a preferred site for hemodialysis catheters.<sup>[7-10]</sup> The challenging issue is that, in each case, the number of usable veins is limited for catheter insertion and occlusion of the internal jugular vein after repeated use is a known complication. Therefore, it is necessary to find another catheter site with enough blood flow for dialysis. When due to the thrombosis, using the right internal jugular vein is not possible; a forward route can be using the internal jugular vein of the opposite side, but it can lead to left side thrombosis and subsequent deterioration of the upper limb venous drainage, as well as inability to make AV fistulae in the left upper extremity, if indicated.<sup>[11]</sup>

Using other sites including the subclavian or femoral veins for catheter insertion is accompanied with high complications. In addition there are reports of either translumbar or transhepatic catheter insertions that technically have a difficulty regardless of the high complication rates.<sup>[12-17]</sup>

Reports are very limited on the placement of a hemodialysis catheter via the external jugular vein.<sup>[18]</sup> No comprehensive report exists about Permcath insertion through the external jugular vein. Therefore, the present study aims to determine the outcome of Permcath insertion through the external jugular vein on patients with ESRD.

## MATERIALS AND METHODS

The study is a descriptive–analytical study conducted in the Alzahra Medical Center, Isfahan, in 2012. Patients with ESRD, who are candidates for Permcath insertion and have an external jugular vein with a minimum diameter of 5 mm in the normal mode or during the Valsalva maneuver, have been enrolled in the present study. Imaging investigations, such as ultrasound, are not used to determine the location and characteristics of the venous system.

In the present study, 12.5 F × 28 cm cuffed catheters (CardioMed Company) were used. Placement of

the Permcath was done under sedation and local anesthesia. The appropriate position of the catheter's tip was confirmed by live fluoroscopy and was modified if needed. After surgery, the chest X ray was performed to diagnose the possible complications in all patients.

After discharge, the patients were visited every month, for three months, and evaluated for long-term complications and functions of the catheters. The reason for selecting such a time interval for evaluation of catheters was that, in most cases, an interval of two or three months was needed for maturation of the AV fistulae. All data were collected and finally analyzed by SPSS 21.0.

## RESULTS

Forty-nine eligible patients who enrolled in the study (46.9% male) were examined and underwent Permcath insertion through the external jugular vein. The mean age of the patients was  $61.7 \pm 16.2$  years with a range of 14 and 83 years. Fifteen patients (30.6%) did not have a previous history of dialysis, while there was the previous history of chronic dialysis, with a mean of  $3.6 \pm 3.4$  years in 34 patients (69.4%).

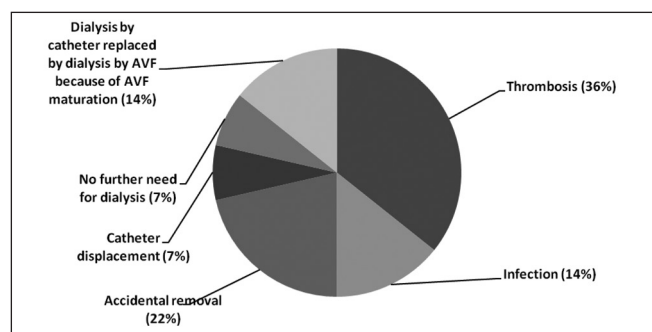
There was no previous history of Permcath insertion in 20 patients (40.8%), while out of the other 29 patients (59.2%), 18 cases (62.1%) had a history of Permcath in the right internal jugular vein. Also, in three patients (10.3%), Permcath was already present in the left internal jugular vein and eight patients (27.6%) had a history of Permcath insertion done through the internal jugular vein on both sides, and due to catheter dysfunction during that period, these catheters were removed due to various reasons.

In 13 patients (26.5%), there was a previous history of AVF placements, which due to various reasons had lost their function and it was not possible to continue dialysis via the AV fistula.

The Permcath was inserted in the left external jugular vein in one patient and in another patient it was placed in the right external jugular vein. In 47 patients (95.9%), the Permcath was easily introduced in the first attempt and the control was done with live fluoroscopy in the Operating Room, and it revealed that the catheter had been placed in the correct position. Only in two patients, due to partial venous obstruction, on account of previous central catheters, it was necessary to insert the catheter through manipulation of a guidewire under fluoroscopic guidance, but finally, the catheter was placed appropriately.

Postoperative CXRs showed no acute complications including hemothorax, pneumothorax or catheter dislodgment in the studied patients.

Three months after catheter insertion, two patients died within the first month of surgery and two other patients died two months after surgery. The performance of Permcath was suitable during the period they were alive and the cause of death was not catheter-related. In the 45 patients who were living three months after surgery — in the performed follow-up — no complications associated with Permcath were observed in 40 patients (81.6%) and dialysis was continued through Permcath without any limitation. Permcath thrombosis occurred in two patients (4.4%) during the first three months after operation, therefore, in one patient, in whom thrombosis had occurred two months after surgery, the path was opened by injecting streptokinase on the Permcath lumens, after which successful hemodialysis continued. In the other case where thrombosis had occurred after 1.5 months and led to the lack of appropriate blood flow, the catheter did not open after use of streptokinase, and hence, was replaced by another catheter. In one patient (2.2%), 1.5 months after surgery, catheter infection occurred, which led to catheter removal. During this period, in one patient, there was accidental removal of the catheter, and in another case, its displacement was also due to stretching the catheter. In the follow-up performed in patients one year after surgery, five patients (10.2%) had died due to causes that were not associated with Permcath complications. Forty-four patients were living after one year. After one year, dialysis was continued in 30 patients (68.2%) successfully, while in 14 patients (31.8%), due to some reasons, the Permcaths were extracted. In Figure 1, the frequency of causes leading to Permcath extraction has been shown. During this period, the patients' Permcaths had an average appropriate performance of  $10.8 \pm 2.8$  months.



**Figure 1:** The frequency of causes leading to Permcath extraction after one year

In 29 patients (59.2%), there was a previous history of using Permcath and their Permcaths had been removed due to thrombosis, infection or replacement, and by participating in the present study, the Permcath was introduced from the external jugular vein. In the performed follow-up, a patient had died two months after surgery, but the catheter performance was satisfactory during these two months. Of the remaining 28 patients, in 25 patients (89.3%) dialysis was continued without a problem after three months, however, in the other three patients (10.7%), the catheter was removed in two cases following thrombosis and in one patient due to infection. In 25 patients, optimal catheter performance was observed after three months. After one year of surgery, the optimal performance still continued in 18 patients (72%), while due to thrombosis, the catheter got disabled in the other seven patients (28%) and was extracted in four patients, and the cause of extraction was infection, displacement, and accidental extraction in three other patients. In these patients who had a previous history of Permcath, the average time that the catheter had an optimal performance was  $10.6 \pm 3.0$  months.

## DISCUSSION

Despite the development of methods such as peritoneal dialysis, the most commonly used treatment is still renal replacement therapy by hemodialysis. When performing hemodialysis, it is necessary to have sufficient access to blood flow, so that the patient's blood with appropriate flow can be provided to the dialysis machine, and thus, a good quality dialysis can be performed. For access to blood with a sufficient flow, the preferred method is to establish an AV fistula. In this method, anastomosis is made between the artery and vein and a part of the high-pressure flow of the artery is led to the vein and causes its expansion and provides access to the blood flow.

Following placement of the AV fistulae, at least two months are required for them to become mature and achieve the necessary capability to be used for dialysis. While in some cases, the lack of suitable vessels for AVF and in some others due to complications of these fistulae, such as, thrombosis or bleeding, it is impossible to do dialysis through the fistulae. In such a clinical setting long-term central venous catheters are used for hemodialysis. Permcaths made from softer material, which leads to less endothelial damage, and therefore, will be less associated with the possibility of thrombosis.

What is important about using these catheters is the limited number of available sites that have a

possibility of inserting them. As it has been mentioned previously in the guidelines, the best location for placement of these catheters is the internal jugular vein.<sup>[5,6]</sup> If using the right internal jugular vein is not possible due to thrombosis, the possible method can be using the internal jugular vein of the opposite side. Subsequently, thrombosis of the left internal jugular vein can lead to the inability of establishing further AV fistulae or grafts.

In cases where it is not possible to use the catheter in the internal jugular vein of patients, using the external jugular vein on both sides can be a lifesaving method for them. Specifically, in the Vascular Surgery Ward of the Alzahra Hospital, Isfahan, our experiences indicate that in many cases the stenosis of the internal jugular vein has been largely in the vein itself, after the previous placement of a dialysis catheter, however, the path of the external jugular vein to the superior vena cava does not have a significant stenosis and the feasibility of passing the catheter is easily possible through this vein. During catheter placement from the external jugular vein, after exploring the vein and catheter placement in it as also the vein proximal ligation, the relationship between the proximal and distal is destroyed by cutting the vein, and through this action, it is easily guided on the superior vena cava along the desired path, creating an appropriate angle. In addition, by using live fluoroscopy at the end of surgery, placing of the catheter in an appropriate place is ensured and placing it in an inappropriate place is avoided too. In our study, we realized that it was only in two patients where after our first attempt to embed the catheter it was in an inappropriate place, and its modification required a guide catheter using guidewire under fluoroscopy visibility, in the other cases, catheter placement in the appropriate place occurred in the first attempt and was confirmed through live fluoroscopy and there was no need to use a guidewire or fluoroscopy.

## CONCLUSION

Our findings reveal that placement of the Permcath in the external jugular vein can be a safe, less complicated, and reliable method for patients requiring hemodialysis. Meanwhile, the method can be considered as a lifesaving alternative in patients with non-accessible internal jugular veins.

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