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Original Article

Cost-Effectiveness research according to the type of catheter in the group of patients on routine hemodialysis program with permanent tunneled or temporary hemodialysis catheters

Kalıcı tünelli veya geçici hemodiyaliz kateteri ile rutin hemodiyaliz programında olan hasta grubunda kateter tipine göre Maliyet-Etkinlik araştırması

Asiye Asli Gozuacik Ruzgar*[1], Engin Akgul[2], Abdulkerim Ozhan[2], Hakan Ontas[3], Selim Durmaz[3], Cenk Aslan[4]

[1]Balıkesir Atatürk City Hospital Department of Cardiovascular Surgery, Balıkesir, TURKEY
[2]Kütahya Health Science University Department of Cardiovascular Surgery, Kütahya, TURKEY
[3]Aydın Adnan Menderes University Department of Cardiovascular Surgery, Aydın, TURKEY
[4]Prof.Dr. İlhan Varank ERH Department of Cardiovascular Surgery , İstanbul, TURKEY

Abstract

Aim: In this study, our aim was to conduct a cost/effectiveness research by determining the cost , in the patients who are in the routine hemodialysis program with a hemodialysis catheter, according to type of the catheter and the number of the days in which the catheters can be used actively.

Materiel and Methods: Between 2013 and 2020,patients with temporary hemodialysis catheters (Group 1 , n:81) and patients tunneled hemodialysis catheters (Group 2, n:205) were identified by scanning the hospital archive. The number of days in which the catheters were actively used was calculated according to the next catheter insertion or replacement date. Then, the permanent and temporary catheter fees paid by the government determined, according to the current Health Practices Communique (SUT) pricing that learnt from the hospital accounting department. Catheter cost per day was determined using the SPSS 22 program.

Results: In the analysis made according to demographic characteristics, no significant difference was found between the groups in terms of gender ($p=0.129$). When the mean age of the patients was examined, no difference was found between the groups ($p=0.085$). No statistical difference was found between the groups in comorbid conditions: diabetes, hypertension, and coronary artery disease ($p=0.219$, $p=0.129$, $p=0.822$). The patency period was significantly higher in group 2 ($p<0.001$). It was observed that the femoral ($p<0.001$) region was preferred most for Group 1 patients and the jugular region ($p<0.001$) for Group 2 patients as the placement site of the catheters. When the catheter cost per unit day was calculated, it was understood that Group 1 was significantly less costly ($p=0.031$).

Conclusion: Temporary hemodialysis catheters are cost/effective products compared to permanent tunneled catheters.

Keywords: Hemodialysis catheter cost/effectiveness, Temporary hemodialysis catheter, Permanent tunneled hemodialysis catheter, Jugular vein, Femoral vein

Corresponding Author*: Asiye Aslı Gozuacık Ruzgar, Balıkesir Atatürk City Hospital Department of Cardiovascular Surgery, Balıkesir, TURKEY
E-mail: drasli30@gmail.com
ORCID: 0000-0003-4273-6035
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Öz

Amaç: Bu çalışmamızda hemodiyaliz kateteri takılarak rutin hemodiyaliz programına dahil edilen hastaların kateterlerinin aktif kullanılabildiği günleri tespit edip, kateter maliyetlerinin de belirlenerek kateter çeşidine göre maliyet/etkinlik araştırması yapmayı amaçladık.

Gereç ve Yöntem: 2013-2020 tarihleri arasında geçici hemodiyaliz kateteri takılan hastalar (Grup 1) ve tünelli hemodiyaliz kateteri takılanlar (Grup 2) hastane arşivi taranarak tespit edildi. Bir sonraki kateter takılma tarihlerine göre kateterlerin aktif kullanıldığı gün sayısı hesaplandı. Ardından hastane muhasebe servisinden güncel sağlık uygulamaları tebliğine göre devletin kalıcı ve geçici kateterler için ödediği ücret tespit edildi. SPSS 22 programı kullanılarak gün başına düşen kateter maliyeti belirlendi.

Bulgular: Demografik özelliklere göre yapılan incelemede gruplar arasında cinsiyet açısından anlamlı farklılık tespit edilmedi (p=0.129). Hastalardaki yaş ortalamasına bakıldığında gruplar arasında farklılık bulunmadı (p=0.085). Diyabet, hipertansiyon ve koroner arter hastalığı açısından yapılan değerlendirmede de gruplar arasında istatistiksel farklılık bulunmadı (p=0,219, p=0,129, p=0,822). Grup 2 de açık kalma süreleri anlamlı olarak yüksek idi (p<0.001). Kateterlerin yerleştirilme bölgesi olarak Grup 1 için en çok femoral (p<0.001), Grup 2 için ise juguler (p<0.001) bölgenin tercih edildiği görülmüştür. Birim gün başına düşen kateter maliyeti hesaplandığında ise Grup 1 in anlamlı oranda daha az maliyetli olduğu anlaşılmıştır (p=0.031).

Sonuç: Geçici hemodiyaliz kateterleri kalıcı tünelli hemodiyaliz kataterlerine göre maliyet etkin ürünlerdir.

Anahtar Kelimeler: Hemodializ katateri maliyet/etkinlik, Geçici hemodializ katateri, Kalıcı tünelli hemodializ katateri, Femoral ven, Juguler ven

Introduction

In patients with chronic renal failure (CRF); In order to perform the dialysis function that the kidneys cannot fulfill, either peritoneal dialysis should be performed or hemodialysis should be performed by taking the blood into the extracorporeal area. Arteriovenous fistulas (AVF), arteriovenous grafts (AVG) or hemodialysis catheters (HDC) are needed to filter the blood with devices outside the body. To be able to perform this process in a functional way, it is necessary to have a sufficient flow of blood[1].t is not a problem to reach this flow with the catheters in the appropriate position. Although AVF is recommended as primary vascular access way, catheters are also vital during the AVF maturation period. In addition, in elderly, debilitated patients, and in the presence of additional diseases such as heart failure, HDC becomes the leading actor for dialysis instead of AVF[2]. Considering the negative aspects of catheter use; catheter infections, dysfunction due to malposition, mortality and thrombosis can be considered[3].

As they are indispensable products for hemodialysis (HD) processes , HDC has shown great development in shape and structure over time . While temporary HDC (t-HDC) catheters are sufficient in case of acute renal failure or short-term hemodialysis need, permanent tunneled HDC (p-HDC) is recommended as a good option when longer-term use is needed at patients who are not suitable for AVF[4]. The difference between these catheters is not only physical, but also financial. In this study, our aim is to determine which of them is cost-effective by determining the number of days and total costs of using t-HDC and p-HDC.

Material and Methods

Study data were collected after local ethics committee approval was obtained. Patients who underwent HD by placing t-HDC and p-HDC between January 2013 and July 2020 were included in the study, t-HDC; was classified as Group1 and, p-HDC as Group 2. The effective working time of the catheters was determined by looking at the catheter revision date after the catheter was inserted. To be more clear, the patient's first catheter was January 13, 2013, and the catheter revision date was April 13, 2013, and it was accepted that the patient's catheter worked actively for 3 months between January 13 and April 13. Cases that were repeated or revised on the same day or who had never undergone HD after catheterization were not included in the study. The vascular region where the catheters were inserted, the type of the catheter, and the demographic characteristics of the patients were recorded. In addition, the cost of catheter materials and the intervention fee for this procedure were obtained from the accounting service of the hospital. Then, the average patency of the catheters and the costs of t-HDC and p-HDC catheters per day were calculated.

Statistical Analysis

Descriptive statistics for continuous variables were expressed as mean, standard deviation, minimum and maximum values, while categorical variables were expressed as numbers and

percentages. Continuous variables were evaluated with Student-t test for homogeneously distributed parameters and Mann-Whitney U test for non-homogeneous parameters. The data showing homogeneous distribution are the mean and standard deviation, the data without homogeneous distribution are the median and 25.-75. are given as percentile values. Chi-square test was used to determine the relationship between groups and categorical variables, they are given as numbers and percentages in the tables. The statistical significance level was taken as 0.05 in the calculations and the SPSS 22 statistical package program was used for the calculations.

Results

Demographic characteristics of the patients are shown in Table 1. When the table was examined, it was seen that while there was no difference between genders in t-HDC catheter insertion in our center, p-HDC was used at a higher rate in women. When the concomitant diseases were examined, it was understood that both groups had similar characteristics. When the vascular structures used for catheter entry are examined, mostly the femoral vein ($p<0.001$) for t-HDC, it was determined that the jugular vein was used for p-HDC ($p<0.001$). This result is not surprising given that the catheter must extend into the right atrium for p-HDCs to be functional for a long time. It is also possible that especially the jugular vein was preserved for p-HDC, and the subclavian vein for future AVF, and the femoral vein was used more for t-HDC.

Table 1: Demographic characteristics of patients

GROUPS	GROUP 1 (n=81)	GROUP 2 (n=205)	p
GENDER M/F	39/42	119/86	0.129
AGE	66,9 ± 14,4	63,6 ± 14,6	0.085
ACTIVE USAGE PERIOD OF THE CATHETER,(DAYS)	22 (7 – 66)	147 (27 – 465)	<0.001
DM (%)	48 (%59,3)	105 (%51,2)	0.219
HT (%)	42 (%51,9)	86 (%42,0)	0.129
CORONARY ATHERY DISEASE (%)	26 (%32,1)	63 (%30,7)	0.822
JUGULER VEIN (%)	31 (%38,3)	141 (%68,8)	<0.001
FEMORAL VEIN (%)	39 (%48,1)	37 (%18,0)	<0.001
SUBCLAVIAN VEIN (%)	11 (%13,6)	26 (%12,7)	0.839
ANTIPLATALET USE (%)	36 (%44,4)	81 (%39,5)	0.445
CATHATER COST PER DAY (TURKISH LIRA/DAYS)	14.9 ±26.1	32.3 ±81.8	0.031
CATHATER COST (TURKISH LIRA)	105	640	-

When looking at the patency times between catheters, it is seen that p-HDC is used statistically longer than t-HDC, since long-term use is expected ($p<0.001$). However, when the number of days in which the catheters are used actively and the unit cost per day are compared, it is seen that temporary catheters are more cost effective ($p<0.031$).

Discussion

The main methods for vascular access in the application of hemodialysis in patients with chronic renal failure are as follows; these are temporary hemodialysis catheters, permanent tunneled catheters, arterio-venous grafts (AVG) and autologous arterio-venous fistulas (AVF), which are recommended to be chosen as the first choice. However, it has been shown that the risk of infection, mortality and morbidity is higher with catheters[5] . Therefore, NKF-KDOQI (National Kidney Foundation Kidney Disease Outcomes Quality Initiative) recommends AVFs to be the first choice for vascular Access [6]. P-HDCs have been shown to provide high-output blood flow during hemodialysis[7]. In a study, it was found that the flow of t-HDCs was statistically lower than p-HDCs[7]. High flow of blood; It helps hemodialysis to be more effective. Despite these advantages, the insertion of p-HDCs is more difficult and requires experience. The most common adverse events for p-HDC are catheter-related infection and catheter dysfunction[5]. Dysfunction; it may be due to early malposition, or it may occur due to thrombus that occurs in late period. Although the cuffs of p-HDCs provide both the fixation of the catheter to the tissue and resistance to infection, they cannot completely prevent these events[5]. T-HDCs are shorter than p-HDCs and do not contain cuffs. They are easier to place. Even if they provide a lower flow rate, they provide sufficient blood flow for hemodialysis as long as there is no malposition[8].

The mean age of the patients included in our study was, 66 years old in Group 1 ,and 63 in Group 2. When the studies examining the catheters in the literature were evaluated, it was seen that the age range was similar[7,9]. This situation has led us to the opinion that the average age of patients with end-stage renal disease is concentrated in the 6th decade. Considering that cardiovascular diseases also increase in advanced ages[10], it can be said that this is an expected result. It is an inevitable fact that end-organ damage caused by hypertension and diabetes is one of the major factors in these results.

In our study, while the number of male patients was higher in the t-HDC group, the number of female patients was higher in the p-HDC group. We believe that patients' preferences for vascular access are effective in this statistically insignificant

difference. This is inconsistent with some studies. It has been reported in the literature that female patients have a statistically higher rate of t-HDC implantation[11]. Studies have reported that AVF maturation takes longer in women than in men[12]. The fact that p-HDC is used instead of t-HDC in the transition period for AVF in the center where the study was conducted may be an explanatory reason for this situation, which contradicts the literature.

It has been stated in previous studies that DM causes end-stage renal disease[13]. There are studies showing that at least half of patients with DM also have CRF[13]. Likewise, it has been reported that hypertension causes end-organ damage and is highly associated with CRF[14]. Studies have been conducted showing that CRF with coronary artery disease is quite prominent and contributes to mortality[15]. In the literature, there is no study about the type of catheter that is especially recommended for patients with CRF, CAD, DM or HT. In our study, no statistically significant difference was found between the preferred catheters in patients with CAD, HT or DM.

When the sites where the catheters were implanted were evaluated, it was seen in the literature that the right jugular vein was most preferred for p-HDC, and the right jugular vein was primarily recommended for p-HDC[7,16,17]. In our study, it was seen that the right jugular vein was mostly used for p-HDCs. When compared with the t-HDC group, it was determined that this situation was statistically significant. The advantages of the right jugular vein are that there is no angle when joining the right jugular vein with the vena cava, the catheter tip is placed in the right atrium, the catheter's flow rate increases, and the surrounding tissues are less likely to close the catheter ostium with the effect of vacuum.

For t-HDCs, the femoral vein was mostly used in our clinic. Considering the reasons why lower extremity veins are preferred primarily for t-HDC in our center; t-HDC can be placed by many different clinics, but it is known that p-HDC is inserted only by cardiovascular surgeons. Other clinics may prefer the femoral region to reduce possible complications.

In addition, subcalvian veins are not preferred primarily, considering that the AVFs that will be planned later will not mature due to vascular injury in the vein where the catheter is placed. When we look at the literature, it is understood that the subclavian veins are mostly used for t-HDCs[7,18]. We think that this situation, which is in conflict with the literature, depends on the priorities in the clinical practice and treatment protocol.

Considering the catheter patency rates, it was determined that the active use period of p-HDCs was 147 days on average. This period is consistent with the literature data[20]. It is stated that this period is approximately one month for t-HDC[20,21]. In our study, t-HDCs were used actively for an average of 22 days. These results are also compatible with the literature.

Since the main subject of our study is cost-effectiveness, the number of days in which the catheters are used actively and the invoice payments made by the government for the catheters were compared. In the statistical calculation, it was seen that the daily cost amount was statistically significantly lower than the p-HDC, according to the number of days in which t-HDCs were actively used. In other words, it has been understood that t-HDCs are more cost/effective. No study has been found in the literature on this subject.

Conclusion

In the study, t-HDCs were found to be more cost/effective. Therefore, it will be more cost/effective to prefer and use t-HDC rather than p-HDC in the need for a catheter and in the bridging time interval until the AVF matures.

Ethics approval

This study was approved by the local ethics committee of Health Sciences University Dr. Suat Seren Chest Diseases and Chest Surgery Training and Research Hospital (approval number: 49109414-604.02).

Declaration of conflict of interest

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