Case Report

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Approach to The Occluded Permanent Hemodialysis Catheter

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ABSTRACT

Objective: Central venous catheterization (CVC) is a type of surgery that hemodialysis (HD) patients frequently undergo. Presently, permanent CVCs (pCVCs) are the alternative to vascular access for patients requiring long-term catheterization. Additionally, identification of the type of catheter has a great importance for the right intervention.

Our study aims: The aim was to discuss the identification procedure of an HD catheter, whether it is permanent or temporary, by presenting an HD catheter case done by CVC.

Case presentation: A 75-year-old female patient having a routine of 3 days/week HD treatment was admitted to the critical care unit. A nonfunctional HD catheter was present in the left subclavian vein. A new HD catheter was placed in the right subclavian vein and continuous renal replacement therapy with heparin was initiated. Radiography revealed an opacity with a size of around 3 cm detected at the tip of the nonfunctional catheter. The catheter was removed with an incision after an unsuccessful attempt of removal by pulling it out. Further investigation of the catheter revealed that it was occluded.

Conclusion: It is crucial to determine whether the catheter is temporary or permanent in order to do the right intervention and not to have unwanted consequences while removing a nonfunctional HD catheter.

Keywords: kidney failure, hemodialysis, catheter obstruction

ÖZET

Oklüze olmuş kalıcı hemodiyaliz kateterine yaklaşım

Amaç: Santral venöz kateterizasyon hemodiyaliz uygulanacak hastalarda sık uygulanan bir prosedürdür. Uzun süre hemodiyaliz ve kateterizasyon ihtiyacı olan hastalarda kalıcı santral venöz kateterizasyon vasküler erişim için alternatif bir yöntem olmuştur. Kateterin tipinin belirlenmesi doğru girişimin yapılabilmesi için büyük önem taşımaktadır.

Bu yazının amacı geçici ve kalıcı hemodiyaliz kateterizasyonunun uygulanma yöntemlerini tartışmaktır. Yetmiş beş yaşında, haftada 3 kez hemodiyaliz tedavisi alan kadın hasta, yoğun bakım ünitemize interne edildi. Sol subklavian vende non-fonksiyonel hemodiyaliz kateteri mevcuttu. Sağ subklavian vene yeni hemodyaliz kateteri yerleştirildi ve heparinli sürekli renal replasman tedavisi başlandı. Radyolojik incelemede non-fonksiyonel kateterin uç kısmında 3 cm uzunluğunda opasite tespit edildi. Kateter çekilerek çıkarılamayınca cilt insizyonu eşliğinde çıkarıldı. Sonrasında yapılan incelemede kateterin tıkanmış olduğu tespit edildi.

Sonuç: Geçici ve kalıcı non-fonksiyonel hemodiyaliz kateterlerinin çıkarılması sırasında doğru girişimin yapılması hayati önem taşımaktadır.

Anahtar kelimeler: böbrek yetmezliği, hemodiyaliz, kateter tıkanıklığı, santral venöz kateterizasyon

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Introduction

Central venous catheterization (CVC) is a necessary surgery that chronic hemodialysis patients frequently undergo. Although arteriovenous fistula (AVF) is the first choice for hemodialysis (HD), complications during vascular access may necessitate the CVC application (1). The first choice is the right internal jugular vein (superior vena cava; SVC); however, in cases of either emergency, critical illness or embolism in the internal jugular vein or intracardiac thrombosis, femoral veins can be used for CVC (2).

Currently, permanent CVCs (pCVCs) are preferred for patients requiring long-term dialysis and in case that arteriovenous access is not possible (3). Occlusion, a common

complication in pCVCs, leads to an insufficient dialysis dose and locational changes of the catheter, which may end up with rejection on the vascular site (3).

In this study, we discuss the procedure of identification of whether an HD catheter placed using the CVC method is permanent or temporary and how to treat an occluded permanent catheter, presenting a case of an HD catheter placed by the CVC method.

Case Report

A 75-year-old female patient receiving routine 3 days/week hemodialysis treatment due to congestive heart failure, hypervolemia, diabetic neuropathy, and end stage renal failure was admitted to the critical care unit because of pneumonia, and acute hemodialysis was required. A hemodialysis catheter present in the left subclavian vein was found to be nonfunctional. A new HD catheter was placed in the right subclavian vein, and continuous renal replacement therapy with heparin anticoagulation was initiated. Thorax radiography revealed that both catheters were intact (Figure 1). An opacity with an approximate size of 3 cm was observed at the tip of the nonfunctional catheter in the left subclavian vein. (Figure 2). The HD catheter in the left subclavian vein could not be removed by pulling out. Therefore, an incision was made in the skin at the projection of the catheter that was then removed (Figure 3). Eventually, the skin was sutured. At examination, the lumen of the catheter was seen to be occluded.

Figure 2: An opacity tip of the nonfunctional catheter.

Figure 1: Bilateral subclavian central venous catheter in the thorax radiography.

Figure 3: Occluded lumen of the central venous catheter.

Discussion

The most common late complications in HD catheters are thrombotic occlusion, fibrin sheath formation, and infections (4). The catheter lumen thrombus and fibrin sheath formation manifest with an inability to achieve the desired flow rate during dialysis. Upon identification of the problem, the first procedure is to reverse the tips of the catheters to the dialysis machine and apply thrombolytic treatment. In case of failure of these procedures, the catheter is replaced with a new one with the help of a guide wire. If the fibrin sheath formation is the main reason preventing catheter function, the old catheter should be removed and the fibrin sheath should be disrupted with an angioplasty balloon, and then a new catheter can be placed (5).

As defined by the National Kidney Foundation Kidney Disease Outcomes Quality Initiative (KDOQI), optimal HD access should offer a decent blood flow for the recommended dialysis regimen, allowing for a long and healthy life with a low incidence of mechanical and infectious obstacles (6).

Insertion of a double-lumen catheter into a central vein may be a suitable approach for hemodialysis (7). Extended use of short-term catheters, e.g. for more than three weeks, known as non-tunneled, non-cuffed catheters, may lead to an increase in the patients' infection rate. The best use of these catheters is in emergency dialysis patients, as well as during the maturation of the vascular access (8). However, catheterization of the patients in need of long-term catheters should be conducted by using catheters with felt or Dacron cuffs (9). Advantages of the long-term tunneled catheters are their ability to increase the blood flow and to improve the dialysis dosage manipulation (8), and if the production material of the catheters is silicone or Carbothane, lower bacterial adherence, decreased infection incidence, as well as lower central vessel stenosis are reported compared to the short-term catheters (8).

Occlusion of the catheter is defined as the difficulty of fluid infusion or removal; it can be either partial or complete. Several factors contribute to the occlusion of the catheter, such as blockage secondary to the formation of a fibrin sheath or thrombus, mechanical occlusion due to malpositioned or twisted catheters (10), and the precipitation of drugs (4). Thrombus is stated as the most common reason for CVC occlusion in HD patients (3) accounting for 25% of the occlusions (4). In order to eliminate the mechanical occlusion, chest X-ray imaging is recommended. Adhesion of a fibrin sheath, consisting of fibrinogen, albumin, coagulation factors, and lipoproteins, around the outside of catheter tip begins within the first 24 hours of the insertion of the catheter (11). The interaction between white blood cells, coagulation factors and platelets, and the fibrin sheath elevates the promotion of the sheath (11). Adhesion of collagen to the smooth muscle cells of the venous wall is followed by the migration towards the tip of the catheter during the following weeks (11). Depending on the patients' profile of coagulation factors, inherited and acquired traits, the formation rate varies. Overwhelming coagulation against the fibrinolytic system may lead to accumulation of thrombi in the catheter. Catheter-related thrombus is categorized depending on the location of the thrombi: According to the thrombus being located on the external part of the catheter or in the catheter lumen, the thrombus is classified as extrinsic or intrinsic, respectively (12).

The risk factors associated with thrombotic occlusion of the catheter were described by a small number of research group; however, data are limited concerning populations undergoing dialysis (13). Studies describing these risk factors indicated that volume depletion, hypotension, hypercoagulability, vascular wall trauma, a poorly positioned catheter, drug infusion, parenteral nutritional status, diabetes, femoral vascular site, time on dialysis, time of catheterization, presence of exit site infection, and lock therapy are among them (13). On the other hand, it has been indicated that the consequences of thrombotic occlusion include CVC-related infections, pulmonary embolism, and post-thrombotic syndrome (3).

CVC thrombus is usually treated with the infusion of 0.9% sodium chloride, heparin, or thrombolytic agents including tissue plasminogen activator (14), reteplase (15), alteplase, or urokinase (16). Saline infusion may be chosen as it is the most cost-effective treatment for CVC blockage; however, the possibility of loosening the thrombi up with the application should be kept in mind (3).

In case of replacement of the occluded permanent catheter with a new one, the surgical approach to remove the catheter involves some risks because the catheter tightly adheres to the vessel wall due to the build-up of fibrin (17). Forceful removal of the catheter may result in catheter fragmentation, embolism, or lethal vessel or right atrium tears (17). By using Hong's technique, involving balloon dilatation leading to an enlargement of the catheter lumen and stretching of the

catheter wall, therefore, the fibrin connections are broken and the removal of the catheter is facilitated (18).

Conclusion

In this report, we presented a case with an occluded permanent HD catheter due to thrombus and discussed the identification and intervention approaches. We concluded that before any intervention, it is crucial to identify the complication causing the obstruction and whether the HD catheter is permanent or temporary.

Contribution Categories	Name of Author
Follow up of the case	M.C., M.S.S., S.D.
Literature review	K.E., S.D., M.S.S., M.C.
Manuscript writing	K.E., M.S.S., M.C.
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