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Complication after Positioning Tunneled Central Venous Catheter for Dialysis: A Case Report and Literature Review

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Abstract

Several manuscripts underline the importance to avoid primary malposition of hemodialysis central venous access but actually, there is not a standard for post-insertional control. In our clinical practice, we evaluate every day numerous central venous tip malposition that needed repositioning. For tunneled catheter, an unrecognized primary, but also secondary, malposition could generate awful side effects. This case report describes a hepatic injury secondary to an uncorrected hemodialysis catheter tip position. Briefly, we discuss about the methods to define a correct insertional procedure to guarantee a correct final tip position.

Keywords

Primary malposition; Hemodialysis central venous access; Central venous tip position; Tunneled catheter

Introduction

The prevalence of chronic kidney disease in last decades is increased and the recurrence of dialytic treatment has become the bridging therapy to kidney transplant. As described by National Kidney Disease Outcomes Quality Initiative guidelines [1], tunneled cuffed venous catheters are the better choice to perform hemodialysis looking forward arteriovenous surgical fistulae creation and eventually transplant procedure. It is important that the vascular access is effective to maintain an adequate extracorporeal depuration therapy [2] to provide high flow rate and prevent recirculation. Actually several devices are placed in various central veins for different indications in according to patient's health condition [3] and, as described by Dialysis Outcomes Practice Patterns Study (DOPPS) II (2002-2004), 18 %, 25 % and 33 % of chronically dialyzed patients in USA, Europe and Canada respectively have an haemodialysis vascular catheter inserted in a central veins [4]. For a correct management of these vascular devices, to achieve an optimal haemodialysis it is mandatory to consider not only post-insertion care but also an adequate insertional procedure [5,6], considering that a malposition of catheter tip influences the post-procedural quality care [7]. NICE guidelines underline that the ultrasound guide is an ideal aid during central venous access positioning to avoid arterial puncture, multiple attempts and pneumothorax. In literature there is consensus about cannulation procedures while the correct identification of the CVC (Central Venous Access) tip position is debated [8].The rate of catheter malposition described in literature is about 1,8 - 3,6 % for central venous access (9) (10) and greatly

increases for peripheral insertion [11]. The catheter tip should be ideally positioned in a large central vein at or near the Cavoatrial junction, maintaining a parallel course with his long axis [12,13].

The right internal jugular vein (RIJV) is considered by many physicians the preferred location for the CVC cannulation. This vein is 2.5 cm long and it's very close to the superior vena cava (SVC); that's why it's easier to place the tip in the right position reducing catheter misplacement [3][14]. RIJV is also considered the best vein for temporary hemodialysis catheters placement [15]. We experienced a case of a tunneled hemodialysis catheter misplacement in middle suprahepatic vein which caused a hepatic parenchyma damage in a patient with ESRD. The patient gave us a written consent to publish this case report.

Case Report

A 54 years old woman (BMI: 26,6 Kg/m2 77 Kg, 170 cm) was admitted in our hospital with a chronic uremic syndrome and she was posted for a tunneled hemodialysis catheter positioning in local anesthesia. The patient's vital signs during the procedure was monitored as usual in our hospital (heart rate, blood pressure and peripheral oxygen saturation). After local anesthesia a physician inserted a tunneled haemodialysis catheter in right internal jugular vein (RIJV) under ultrasound guidance. No resistance was detected during the insertion of the Seldinger wire that was interrupted when the ECG showed arrhythmia and the catheter tip was placed at 18 cm. No-pulsatile blood was aspired from any lumen and the catheter was tunneled. Postoperative chest radiograph showed a right-sided image of the catheter and the patient has been discharged at home. (fig. 1) Two months later she was re-admitted in our hospital to undergo an angio-CT due to a catheter malfunction; there were unsuccessful hemodialysis treatments and, supposing a thrombus on the catheter tip, the nephrologist required a CT (Computed tomography) scan control. The exam showed that the catheter was placed in middle suprahepatic vein (fig. 2a-2b), distally migrated from the previous post-insertional frontal chest thorax control. The CT also showed an hypoattenuation wedge shape area on the 4th, 7th and 8th hepatic segments without any alterations in hepatic injury biomarkers. For this reason, an interventional radiologist proceeded to remove the catheter under direct fluoroscopy (fig.3) to detect possible thrombus migration and a new temporary no-tunneled hemodialysis catheter was placed .The correct tip position was confirmed by direct fluoroscopy. Three days later the vascular surgeon performed an AV fistula surgery creation on the left arm. One month following the surgery, the patient underwent a follow-up ultrasound abdominal exam and abdominal CT and we found out that the hepatic parenchymal morphology was normal. (fig 4). Laboratory measurements revealed normal hepatic values. The patient was discharged without further complications and now is followed by a nephrologist.

Discussion

In literature many authors describe uncommon events after central venous catheter insertion. Our case report, according with previous manuscript [16], gives emphasis to the hemodialysis catheter malposition risks. The main concept is that the hemodialysis catheter tip has to be finally positioned in the superior vena cava, the cavoatrial junction or in the upper right atrium [17]. Some exceptions for right atrial tip placement may exist for the optimal performance of hemodialysis catheters. [13,18] As revealed by fig. 1, the catheter tip is in right atrium but fig. 2b shows the tip migration to inferior vena cava. For radiologists it is difficult to describe correctly the right mediastinal border merely observing

frontal chest thorax x-ray [19] in particular to define a correct vascular access insertion. Actually the techniques commonly used to obtain an adequate tip position are "blind" based on anthropometric data and operator experience and many reports refer the uncorrected tip positioning and its related side effects. There are many differences in catheter positioning procedures and in literature there is a lack of data to define the misplacement rate which is about 63% referring to peripherally inserted central venous access [11,20,21] while for tunneled hemodialysis catheter is between 5-8% [7]. Several guidelines have been published [12,17,22,23] about a correct tip positioning but actually there isn't a real common view about this item. As well as primary dislocations during insertional procedure, we have to consider secondary migration of catheter tip. The central venous catheters (long term or short term) are not static [24,25]; patient movements and respiratory forces are the main factors leading to tip relocation.

The principal complications of a malposition are flow limitation with impossibility to perform an adequate hemodialysis, thrombus formation, cardiac rupture and vessel perforation. Weber at al [7] have recently reported, a malposition hemodialysis catheter rate about 6% in a sample of one hundred one patients with a high risk jugular left side insertion. Some misplacements are very common, others are rare and more dangerous [26] and require an early recognition. A bedside chest radiograph (CXR) is the commonest method in clinical practice to verify the CVC tip's position. Radiologists and anesthetists recognize the junction of superior vena cava (SVC) with the right atrium (RA) by using radiographic landmarks [27]. The 20-47% of confirmed CVC tip position is wrong due to the different radiograph beam angles with the patient [28,29] and only the 14% of the CVCs reported as intra-atrial are really in right atrium [30]. For these reasons, several studies have been published to demonstrate the better evaluating method to identify a correct tip position; for tunneled catheters, the most efficient method is a direct fluoroscopic control [31].

Obviously, not all hospitals have an operating theatre with radiological devices or a dedicated radiological suite to control a correct position of central venous accesses but their use is recommended for long-term catheters as hemodialysis tubes. It is confirmed that bedside CXR is not enough by itself for the evaluation of CVCs tip position and that radiological control confirms only an evident post procedural misplacement or related complications as pneumothorax [30]. Actually, there are several possibilities to check the correct tip position [32]. The electrocardiographic P- Wave change is a reproducible technique and feasible in many settings [33]. Introduced since 1980's it is a method that, analyzing the P- wave amplitude changes, arises the correct position at cavoatrial junction in proximity of nodus sinus. The success rate is very high [34] and several publications confirm its role in prevent x-ray side effects maintaining the same effectiveness. As all techniques, some factors could generate misunderstandings; in particular, catheter insertion routes and basal P-Wave amplitude are the major factors that could influence sensitivity and specify [35] and for these reasons, the accuracy is linked with an optimal lead connection that improves signal transduction. The ultrasound techniques are employed not only during insertion procedures but also in post procedural confirmation and in particular, trans-esophageal echocardiography in infant and children is considered a good alternative to detect a tip malposition [36].

In our case report the patient has not developed long-term complications, thanks to the hepatic parenchyma that has an optimal regenerative rate.

In conclusion, it is clear that actually it's impossible to position a long-term catheter, as hemodialysis one, based exclusively on x-ray confirmation. In our opinion it is necessary to establish intra-hospital guidelines about correct tip position, in front of the several published indications; in addition, it appears necessary to use a direct fluoroscopic control during insertional procedure. For tunneled catheters, it is mandatory an exhaustive radiological control when they become less performing, before their use.

Figures

Figure 1: Shows the initial catheter tip position (frontal chest thorax).

Figure 2: (a) Multiple CT scan shows the malposition of catheter tip in middle suprahepatic vein with a wedge shape area. **(b)** Coronal vision of the catheter tip in middle suprahepatic vein.

Figure 3: Cavography.

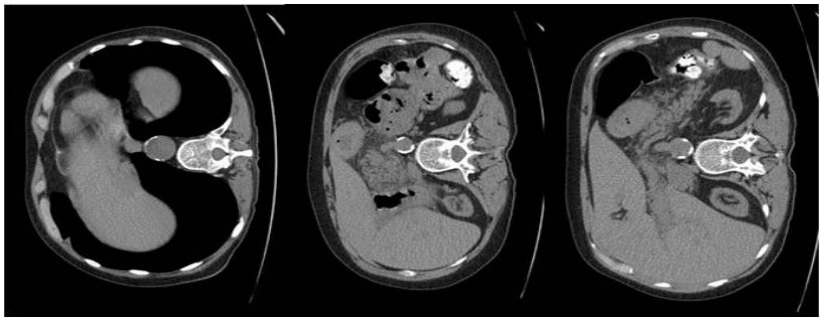

Figure 4: Multiple CT scan shows the complete regression of wedge shape area in hepatic parenchyma.

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