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KINKING & UNCOILING OF GUIDEWIRE-A RARE & PREVENTABLE COMPLICATION- A CASE REPORT & SYSTEMIC ANALYSIS ON MEASURES TO PREVENT IT.

Anaesthesiology

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ABSTRACT

Central venous catheterization is usually performed by Seldinger's technique which involves threading of a guidewire over a needle after venous puncture. This method has multiple potential risks, but guidewire related risks are rare and if occurs can be lethal. Guidewire can cause complications like kinking, knotting, uncoiling and fracture. We experienced a case of right subclavian vein catheterization complicated by intravascular kinking and difficulty in removal of guidewire causing uncoiling which is quite rare. The patient recovered without any complications. This article describes the known complications during guidewire insertion and measures to avoid it.

KEYWORDS

central line, guidewire, uncoiling and kinking of guidewire

INTRODUCTION

Central venous catheters (CVCs) are cannulation devices designed to access the central venous circulation and are inserted via wire guidance (i.e.,via the Seldinger technique). In the emergent setting, CVCs are used to administer life-supporting fluids, potentially irritant drugs, blood products, and parenteral nutrition. Central venous catheterization is commonly performed by the Seldinger technique, which requires using guidewire. Guidewire-associated complications include kinking, knotting, looping, breakage, and fracture [2]. In this article we report an uncommon complication during CVC insertion associated with intravascular kinking of guidewire and difficulty in removing it causing uncoiling of the guidewire. There have only been a few rare reports of uncoiling of guidewires This article also describes the common complications during guidewire insertion and measures to avoid it. Thorough understanding of procedural complications and physical characteristics of the guidewire is vital to ensure patient safety when using the Seldinger technique for central venous cannulation. We have reviewed the relevant literature for guidewire design and structure,associated complications, and provide recommendations for safe use of guidewires.

Case Report:

A 25-year-old woman with a history of roadside accident of slip and fall from a two-wheeler presented to our emergency department with loss of consciousness decreased sensorium and nasal bleeding. After initial resuscitation a NCCT brain and cervical spine was done which showed Right frontoparietal acute sub dural hemorrhage with hemispherical infarct. She was planned for decompression craniotomy with duroplasty and bone flap. After informed consent and in view of prolonged ventilation and ICU stay, she was planned for elective tracheostomy and USG guided right subclavian vein catheterization.

Initially 2% Lignocaine was injected at the entry site in the right infraclavicular area. Then, the right subclavian vein was identified using an infraclavicular approach. A Seldinger-type central venous catheter set was used (Triple- Lumen Clear CVC Catheter Kit 7 Fr, 16 cm Catheter length with 0.035-inch guidewire diameter by New Tech Medical Devices). After initial venous backflow the guidewire was passed smoothly and the introducer needle removed. Then dilator was used, and central venous catheter was threaded over the guidewire with the distal port open. The guidewire was found coming out through the distal port and after holding the guidewire the catheter was threaded. Initially there was little resistance in removing the guidewire and moderate force was used which further caused more resistance and we found that the guidewire had started uncoiling which caused further difficulty in removal. Later with continuous force application we could luckily remove the guidewire en bloc. All three ports were checked and found patent and an immediate chest Xray revealed proper positioning without any complications. We found on examination of the guidewire that the J Tip had kinked and there was uncoiling with stretching of the guidewire as shown in Figure 2.

A postoperative chest x-ray taken in the post anesthesia care unit, and a follow-up film six hours later revealed no signs of hemothorax, or pneumothorax as shown in Figure 3. We experienced a case of left subclavian venous catheterization complicated by intravascular kinking, difficulty in withdrawal of guidewire and undue stretching of the guidewire.

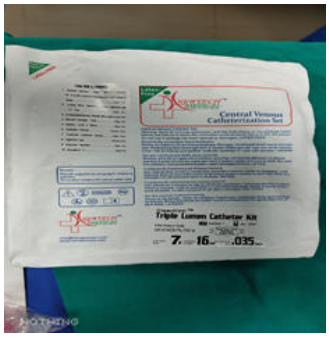

Figure 1 Showing central venous catheter set

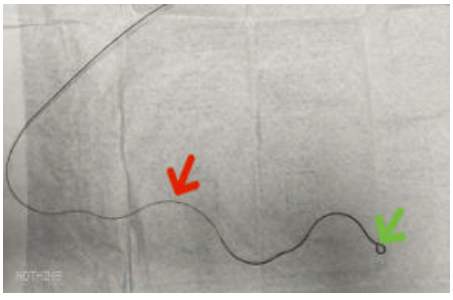

Figure 2- Green arrow shows kinking of guide wire, red arrow shows uncoiling of guide wire.

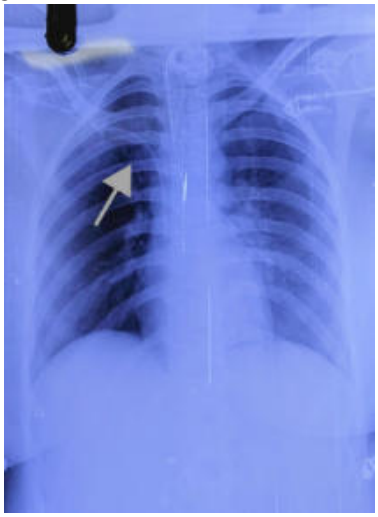

Figure 3 shows post procedure Chest X ray with white arrow pointing to CVC in place.

DISCUSSION

In order to understand the mechanism by which we faced difficulty in removing the guide wire a slight briefing into the design of guidewire. Guidewire is made of a single inner filament and a surrounding coiled wire. The coiled wire is designed as a helix to form a tunnel for the inner wire and provides elastic properties. J-shaped curvature is achieved by flattening the round core and is made approximately 2.5 cm from the tip, which provides flexibility at the J-shaped tip. But this causes an area of structural weakness at the junction of the rounded and flattened segments and may be an area of potential breakage.[2]

Complication	Ethology behind the complication	Management
1.Cardiac arrhythmias and cardiac conduction abnormalities	Due to guidewire touching the endocardium	Pulling out the guidewire backwards [1]
2.Kinking or looping of guidewire	Due to excessive application of force while threading the guidewire	Intermittently moving the wire gently in and out as the dilator is being advanced through the subcutaneous tissue [2]
3. Tip breakage of guidewire	Due to pulling back the guidewire when the insertion was against resistance and the guidewire have passed the bevel of the needle[2]	careful retraction of the wire through the needle is an option or to withdraw the wire and needle as a single unit[3]
4. Inadvertent intravascular insertion of guidewire	Due to lack of proper training and supervision of the procedures	Holding on to the proximal tip of the wire and if this complication happens, use of interventional radiology techniques is the preferred method for removal[4]
5. Perforation of veins or heart chambers	Due to excessive force application while guidewire is being introduced	Treatment of a serious perforation may necessitate the insertion of a chest tube or an emergent thoracotomy [5,6]
6. Entrapment of guide wire into intravascular devices like IVC filter	Due to forceful insertion	Xray examination under fluoroscopy and removal with the help of interventional radiology techniques.[7]

Measures To Avoid This Complication-

There are two parts in the sequence of the Seldinger technique that are potentially important in preventing the kinking of the wire. First, during insertion of the wire through the needle no resistance should be encountered, and the wire should pass freely, without any force into the vein. To avoid shearing, the wire should not be pulled back through the needle once it has passed the bevel. Second care should be exercised when passing the dilator over the wire. Forcing the dilator in a direction that diverges from the path of the wire can result in kinking the wire and potentially cutting out through the vein with possibly fatal consequences. [8]

Knotting of the wires is almost exclusively described in the literature following the subclavian approach, although it has also been described once during attempted femoral vein cannulation. [9] This could be due to the fact that the path of the subclavian vein is not straight, as it loops over the first rib to descend into the superior mediastinum. Further to this, there is a pinch area between the clavicle and the first rib, which can impede the anterograde threading of the wire and might contribute to looping and knotting. We suggest that the following pre- cautions may reduce the risk of complications. First, special care should be taken in known cases of altered anatomy or where previous cannulation has occurred at the same site. On encountering any resistance, the guidewires should not be advanced. The guidewire and needle should be withdrawn as an assembly to prevent the cutting and shearing of the wire by the sharp needle tip. After more than one attempt, the integrity of the wire should be rechecked. A suffi- ciently large skin incision should be used in order to thread the dilator and the line over the wire smoothly to prevent kinking of the wire at the skin. One end of the guidewire should always be always held by the operator to minimize the risk of loss in the blood vessel. Some manufacturers allow use of the straight end of the wire on insertion; but in general, this is not recommended. If the wire is fixed, force should not be applied to remove it. This might result in separation of the coil and the core resulting in fracture of the wire. Finally, if minimal to moderate force needs to be applied then forceps should be used to grasp the wire in a way that the outer coil and the inner core are grasped together, and separation does not occur.

This article aims to discuss all the possible complications associated with guidewire during central venous catheter insertion and the possible measures to manage them.

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