SQU Med J, November 2011, Vol. 11, Iss. 4, pp. 519-521, Epub. 25th Oct 11
Submitted 14th April 11
Revision Req. 12th Jun 11, Revision recd. 10th Jul 11
Accepted 7th Sep 11

CASE REPORT

Complications of Central Venous Catheterisation

Breakage of guidewire-a disaster averted

Qutaiba A. Tawfic[1] Pradipta Bhakta,[1] *Jyoti Burad,[1] Pragyandipta Mishra,[2] Rajini Kausalya[1]

مضاعفات القسطرة الوريدية المركزية

كسر سلك الدليل – كارثة يمكن تجنبها

قتيبة توفيق، براديبتا بهاكتا، جيوتي بُراد، براجياناديبتا ميشرا، راجيني كوساليا

الملخص: قسطرة الوريد المركزي طريقة سريرية غازية واسعة الانتشار في الممارسة الطبية. وعلى الرغم من أنها إجراء آمن عندما تتم عبر توجيه الموجات فوق الصوتية، إلا أنه تحدث الصعوبات والمضاعفات حتى في أيدي ذوي الخبرة. نصف هنا الصعوبات التي واجهناها عندما انكسر سلك الدليل أثناء إدخال القسطرة الوريدية المركزية في مريض يعاني من مرض فقر الدم المنجلي.

مفتاح الكلمات: قسطرة، وريدية مركزية، فقر الدم المنجلي، حادث مؤسف، سلك الدليل، تقرير حالة، عُمان.

ABSTRACT: Central venous catheterisation (CVC) is a common bedside invasive procedure done in medical practice. Even though it is a safe procedure when done with ultrasound guidance, difficulties and complications do occur even in experienced hands. Here, we describe the difficulties encountered in the form of the breakage of the guidewire while inserting a CVC in a patient with sickle cell disease.

Keywords: Catheterisation, central venous; Sickle cell disease; Mishap, guidewire; Case report; Oman.

Patients with sickle cell disease (SCD) often experience degradation of their peripheral veins due to frequent hospital admissions for management of crises and the need for multiple central venous catheter insertion in the later part of their life. The standard Seldinger's technique for central venous catheter insertion is quick, simple and safe. More than 5 million central venous catheter insertions are performed yearly in the USA alone by physicians and nurses with different levels of experience yet the mechanical complication rate is below 10%.[1] Seldinger's technique uses a J-tip guidewire for insertion of the central venous catheter; the rare mechanical complications are looping, entrapment or disengagement of venous devices, breakage, embolism, cardiac perforation, tamponade and death.[2-4] We report such a mechanical complication in a SCD patient with special mention of the anticipated difficulties of central venous catheter insertion in patients who need multiple central venous cannulation.

Case Report

A thirty-one year-old female patient with SCD was admitted to the Intensive Care Unit at Sultan Qaboos University Hospital, Oman, with acute chest syndrome, shock and respiratory distress requiring a mechanical ventilation. She was prepared for central venous catheter insertion following failures to obtain good peripheral access. There were several marks and scar tissue on both sides of her neck and upper chest indicating multiple previous central venous catheter insertions.

The pre-procedure ultrasound revealed a good calibre right internal jugular vein in the upper neck, which became slight narrower when traced to the lower angle of Sedillot's triangle; it had an irregular outline with multiple collaterals. The picture was almost same on left side. The right internal jugular vein was selected for insertions of a 7.0 French triple-lumen central venous catheter using Seldinger's technique. After obtaining a good back-

[1]*Department of Anaesthesia & ICU, Sultan Qaboos University Hospital, Muscat, Oman;* [2]*Department of Anaesthesiology, Brookdale University Hospital Medical Centre, New York, USA.*

**Corresponding Author email: jyotiburad@yahoo.com*

flow of blood from an 18-Gauge introducer needle, a J-tip guidewire was advanced. The guidewire encountered mild resistance during insertion, which was overcome by manipulating and redirecting it. The introducer needle was removed and the skin dilator was passed over the guidewire after a small skin nick. There was significant resistance to the advancement of the dilator in the subcutaneous tissue. The skin incision was deepened and the tract was re-dilated with continuous firm pressure on the dilator. After successful dilatation, the central venous catheter was threaded over the guidewire with some resistance; a backflow of blood could be seen in the proximal two lumens confirming the correct position.

While withdrawing the guidewire through the distal lumen, some resistance was encountered. Gentle traction was of no avail; therefore, we advanced the guidewire for a few centimetres to release it from the central venous catheter. The guidewire was rotated by 90 degrees before its withdrawal was again attempted.[5] This time, the guidewire could be retracted few centimetres more. Again, some resistance was encountered; then, there was a sudden loss of resistance after which the guidewire came out.

After removal, we noticed that the J-tip portion was missing. Since we could not trace the J-tip, we removed the entire catheter. Fortunately, the J-tip was inside the catheter half protruding from the tip. Examination of the rest of the guidewire did not reveal any defect other than a sharp bend in the middle [Figure 1]. Later, chest fluoroscopy ruled out the possibility that any broken part of the guidewire had been left inside the patient.

Discussion

Repeated central venous catheter insertion in patients with SCD or those undergoing chemotherapy may have many undesirable consequences. They are at higher risk of thrombosis due to the primary disease and multiple venipuncture attempts, which may later lead to central vein stenosis.[6]

Stenosis of a vein at higher level in the neck can be diagnosed easily by pre-procedure ultrasound, but lower level stenosis may falsely dilate the internal jugular vein (IJV) in the neck luring the physicians to attempt forceful central venous catheter insertion. It will be difficult or impossible to insert the guidewire/central venous catheter depending on the degree of stenosis. Even after successful central venous catheter insertion, the risk of further stenosis and complete occlusion remains high. There is also a theoretical risk of cannulating the dilated azygos and hemiazygos veins if the stenosis is below their union with superior vena cava. This is difficult to diagnose in a chest radiograph unless a lateral view is done where it is seen as acute posterior angulation of central venous catheter tip.[7] Scars due to central venous catheter and mediport insertion may cause extensive fibrosis of the skin and subcutaneous tissue and may distort the vascular anatomy. It may pose significant problems when advancing the introducer needle, dilating the guidewire tract and also threading the central venous catheter over the guidewire.[7]

Ultrasound can be of great help in making a differential diagnosis in this type of patient with multiple previous attempts and anatomical abnormalities. Also ultrasound helps during the procedure in guiding the introducer needle for venous puncture as well as inserting the guidewire in such problematic patients. Even cine-ultrasound can be used to monitor the whole procedure in case a C-Arm is not available. Without ultrasound guidance, carotid artery puncture is very common in these patients due to their distorted anatomy.[9] It is difficult to judge how much force is optimum when dilating the tract and excessive force may kink or weaken the guidewire and potentially may puncture or shear the posterior wall of the vein. Therefore, even a good calibre vein seen in pre-procedure ultrasound does not guarantee an easy and successful cannulation in these patients.

Most physicians use the standard J-tip guidewire for central venous catheter insertion. This consists of a stainless steel core wound by a spring. Increased flexibility of the J-tip is obtained at the expense of potential weakness at the junction of the J-tip.[4] There are incidental reports of breaking of the J-tip of guidewire during forcible extraction.[3,7] Shimamoto and Arai described this as follows: "The guidewire was acutely bent between the first rib and clavicle as a plastic catheter over a needle was used to access the subclavian vein and the guidewire was introduced through the plastic catheter after removing the metal needle".[9] Lack of experience, improper technique and manufacturing defects have also been cited as the other causes of

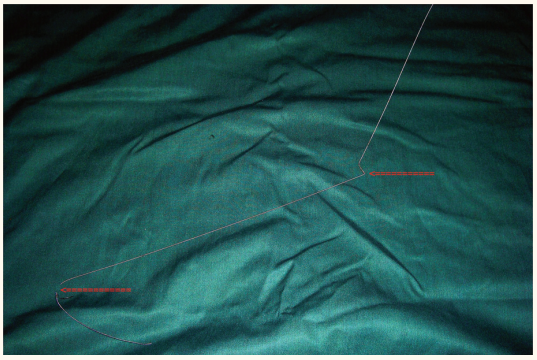

Figure 1: Broken guidewire with a sharp kink in the middle and unravelled external spring at the proximal end of broken J-tip.

breakage.[3,9] An improved guidewire design has even been recommended by few proponents in order to prevent such a complication.[3]

An experienced resident performed the central venous catheter insertion in our case and no manufacturing defect was found in the guidewire. We believe that difficult anatomy and improper technique were the main factors for the complication in our patient. Stenosis in the vein might have caused an acute angulation of the guidewire. Fibrotic tissue in the neck required excessive force for dilation that kinked and damaged the angulated guidewire. It became lodged in the central venous catheter during removal and broke off at the damaged point in spite of the application of only gentle force.

Thus it is always advisable to use some sort of imaging guidance like ultrasound or fluoroscopy during the whole procedure in problematic cases like this. Even ultrasound can be placed along the long axis of vein and dilator in case of difficult scarred tissue dilatation, as in our case, in order to keep the dilator and the lumen of the vein in view. Also, fluoroscopy should be used in conjunction with this to re-confirm the safety. If the guidewire gets lodged or damaged, the CVC and the guidewire should be removed completely and checked for integrity, but this technique entails re-puncturing the vein. To prevent this, the guidewire should be pushed a few centimetres to dislodge it from the sharp bevel of the introducer needle and then rotated by 90 to 180 degrees. This will straighten the J-tip against the tempered side of introducer needle without damaging it. With this manoeuvre, the guidewire can be withdrawn without disturbing the position of the introducer needle thus preventing re-puncturing the vein.

Conclusion

This case reminds of possible anatomical and iatrogenic venous deformities in patients requiring multiple central venous cannulations, such as patients with SCD or on chemotherapy. These can result in disastrous complications during CVC insertion if there is forcible dilatation of the scarred subcutaneous tissue. Routine use of ultrasound and fluoroscope guidance throughout the procedure can be of great help in avoiding such complications.

References

1. McGee DC, Gould MK. Preventing complications of central venous catheterization. N Engl J Med 2003; 348:1123–33.
2. Kusminsky RE. Complications of central venous catheterization. J Am Coll Surg 2007; 204:681–96.
3. Suzuki T, Ito K, Nishiyama J, Hasegawa K, Kanazawa M, Fukuyama H. Development of a safe guidewire. J Anesth 2006; 20:64–7.
4. Monaca E, Trojan S, Lynch J, Doehn M, Wappler F. Broken guide wire--a fault of design? Can J Anaesth 2005; 52:801–4.
5. Arya VK, Kumar A. Technique for retrieval of J-tip guide wire without withdrawing introducer needle during central venous cannulation by Seldinger technique. Anesth Analg 2004; 98:553–4.
6. Farrell J, Gellens M. Ultrasound-guided cannulation versus the landmark-guided technique for acute haemodialysis access. Nephrol Dial Transplant1997; 12:1234–7.
7. Asudani D, Wretzel S, Patel R, Stayman A. A judgment call. Cleve Clin J Med 2008; 75:690–1, 695.
8. Palepu GB, Deven J, Subramanyam M, Mohan S. Impact of ultrasonography on central venous catheter insertion in intensive care. Indian J Radiol Imaging 2009; 19:191–8.
9. Shimamoto T, Arai T. Breakage of a Seldinger spring guide wire during percutaneous catheterization of a subclavian vein. Masui 1997; 46:376–8.