■ PAPER ■

AN IV CATHETER FRAGMENTS DURING MDCT SCANNING OF HUMAN ERROR: EXPERIMENTAL AND REPRODUCIBLE MICROSCOPIC MAGNIFICATION ANALYSIS

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The use of intravenous catheters are occasionally complicated by intravascular fragments and swelling of the catheter fragments. We present a patient in whom an intravenous catheter fragments was retrieved from the dorsal metacarpal vein following its incidental CT examination detection. The case of demonstrates the utility of microscopy and multi-detector CT in localizing small of subtle intravenous catheter fragments as a human error. A case of IV catheter fragments in the metacarpal vein, in which reproducible and microscopy data allowed complete localization of a missing fragments and guided surgery with respect to the optimal incision site for fragments removal. These reproducible studies may help to determine the best course of action and treatment for the patient who presents with such a case.

Keywords: 3D imaging, Intravenous Catheter, Computed Tomography, Human Error

1. INTRODUCTION

Contrast material administration during multi-row detector computed tomography (MDCT) scanning is typically accomplished using a power injector, and the extravasation of contrast material is a potential complication when a mechanical power injector is used to rapidly inject large volumes of contrast. The commonest complications associated with the use of an IV catheter and a mechanical injector, are contrast extravasation [1], perivascular soft tissue swelling, and compartment syndrome [2].

Catheter fragments and embolism are both potentially serious complications associated with the use of an intravenous (IV) catheter for contrast media bolus injection, and may be followed by serious or lethal sequelae [3]. Traditionally, plain radiographs have been used to detect larger, radiodense objects, with CT used to localize smaller, less radiodense objects. More recently, the use of 3D MDCT has permitted the detection and accurate localization of smaller, relatively radiolucent objects [4].

This represents, to the best of our knowledge, a previously unreported complication of IV injection of contrast media. The present study our initial experiences with CT using a 16 MDCT for the evaluation of IV catheter fragments, in which microscopy proved valuable for localizing and retrieving an IV catheter fragments.

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2. SUBJECTS AND METHODS

2.1 Patient Selection and IV Catheter

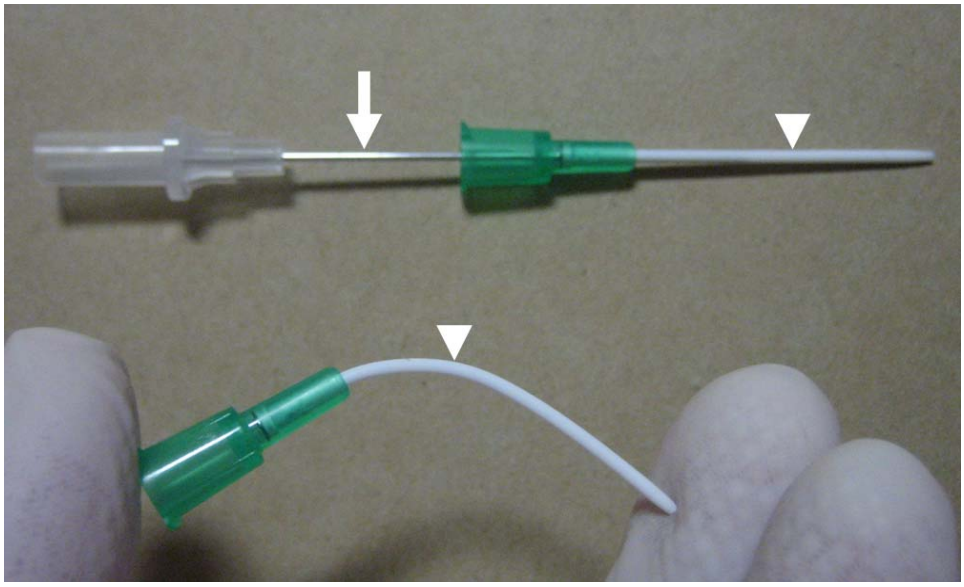
A 59-year-old-man with gastric cancer underwent MDCT scanning. Briefly, an 18-gauge Teflon IV catheter (diameter, 1.3 mm; length, 30 mm; BD IV Catheter; Becton Dickinson Korea, Seoul, Korea), was inserted into a dorsal metacarpal vein of the right hand by a registered nurse. A quick X-ray was taken and the surgeon cut into the patients hand, clamped and cut the vein and retrieved the IV catheter fragments.

2.2 Reproducible Microscopic Magnification Analysis

The image is directed into an optical microscope of the connection tears shape in IV catheter fragments. Under an optical microscope analysis (OAM 24SR, × 40 magnification, Dongwon EnC, Sungnam, Korea) the process and condition are carefully inspected. The photograph shows of the connection tears shape in IV catheter fragments.

3. RESULTS

Intravenous or IV enhancement is the administration of fluids directly into the vein. It can be administered intermittently in boluses, or it can be given in a continuous IV injection. The IV catheter composed of needle and catheter. IV catheter is initially placed in the vein with the assistance of a needle. The needle is removed, leaving a soft, flexible catheter behind. Needle composed of a sharp-pointed tip (Fig. 1).



A

B

Fig. 1. The IV catheter composed of needle and catheter. A, IV catheter is initially placed in the vein with the assistance of a needle (arrow). The needle is removed, leaving a soft, flexible catheter (arrowhead) behind. B, Needle composed of a sharp-pointed tip (arrow) and catheter (arrowhead).

A

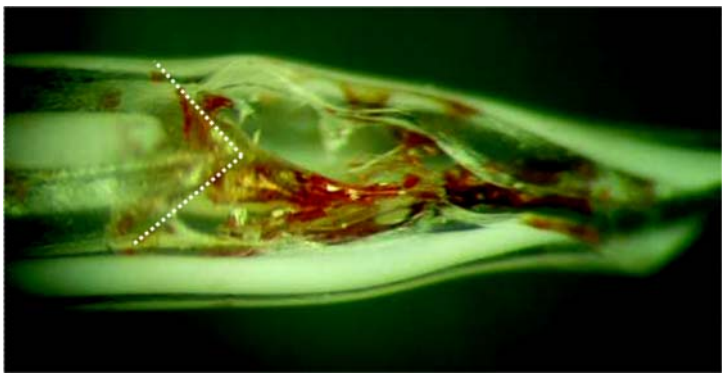


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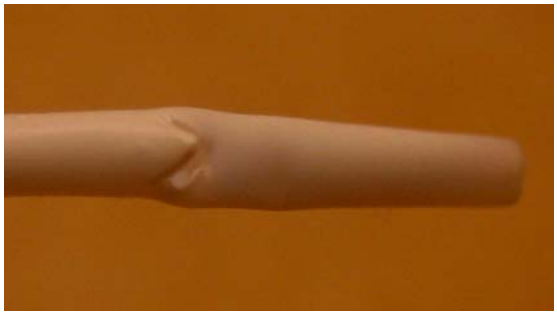
Fig. 2. A, Photograph shows of the two tears of the IV catheter fragments (below) and the body part (upper) both are irregular shape. Microscope magnification (× 40) of the connection tears shape in IV catheter. B, Microscopic magnification (× 40) of the tears shape in IV catheter fragments.

In one patient, the fragments IV catheter was located dorsal metacarpal vein. Surgical removal was decided. Prior to the surgery, ultrasonography was performed again for the surface marking on the basis of the information of MDCT scanning image. The patient was referred to the vascular surgery service and the fragments were successfully via a minimal incision. The remnant sheath, located parallel to the metacarpal vein, was removed without any complications. There is a catheter fragments in the right dorsal metacarpal vein. The IV catheter two ends of the 7 mm IV catheter fragments of retrieved from the dorsal metacarpal vein and 25 mm fragments IV catheter show that both are with blood identified. The two tears of the IV catheter fragments and the body part both are irregular shape. Microscope magnification (× 40) of the connection tears shape in IV catheter. Microscopic magnification (× 40) of the tears shape point in IV catheter fragments (Fig. 2).

Reproducible of microscopy analysis photograph shows used of needle punching the IV catheter connect of IV catheter. Connection tears shape in IV catheter. Punched with catheter using the sharply needle. Reproducible connection tears shape of IV catheter (Fig. 3).

Reproducible microscope magnification (× 40) of the connection tears shape in IV catheter fragments. A reproducible microscopic magnification (× 40) of the broken shape in IV catheter fragments (Fig. 4).

A



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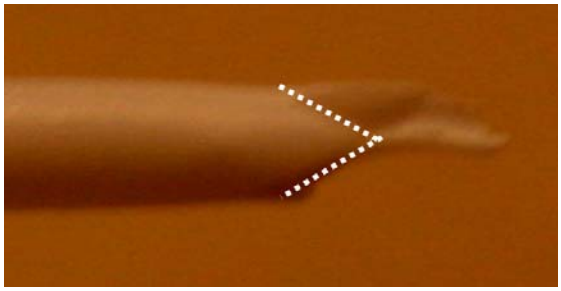
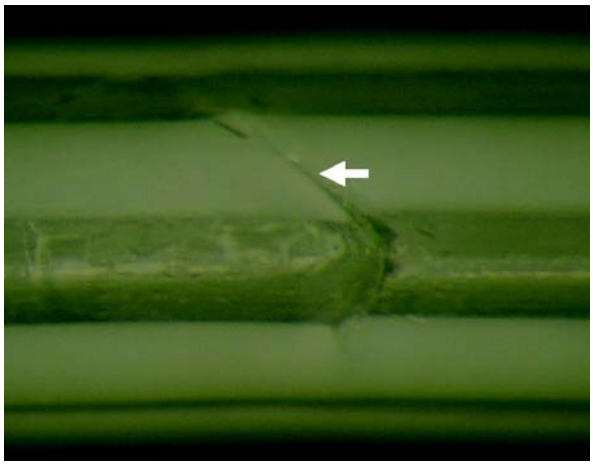
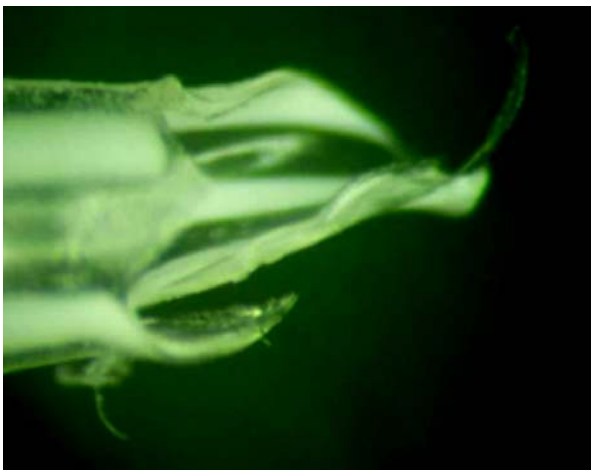


C

Fig. 3. Reproducible analysis photograph shows used of needle punching the IV catheter connect of IV catheter. A, Connection tears shape in IV catheter. B, Punched with catheter using the sharply needle. C, Reproducible connection tears shape of IV catheter.



A



B

Fig. 4. Reproducible of microscopy analysis shows used of the IV catheter connect of IV catheter fragments. A, Reproducible microscope magnification (× 40) of the connection tears shape (arrow) in IV catheter. B, Reproducible microscopic magnification (× 40) of the tears shape in IV catheter fragments.

4. DISCUSSION

The complications caused by the venous injection of contrast media are unpredictable and usually occur unexpectedly. The IV Catheter fragments and pulmonary embolism are both potentially serious complications associated with the use of an IV catheter for contrast material bolus injection, and may be followed by serious accidents. In the CT units as in other department, risk situations can arise out of human error. The patient in the case reported here required the insertion of metacarpal venous catheters in order to administer contrast media. This study showed that these human errors would lead to greater systematic errors if not caught [5].

Bolus iodinated contrast media injections have become the norm for CT angiography and multi-phasic CT scans, and a power injector and IV catheter are frequently used to deliver contrast materials [6]. The intravenous catheter used in the present case was made of polytetrafluoroethylene (Teflon) and its surface was coated with barium sulfate five stripes. A very sharp needle bevel may shear the catheter with minimal retraction or manipulation of the catheter during insertion. Here, we report a case of the sheared catheter during the metacarpal vein bolus injection and the subsequent surgical removal of its remnant.

Fortunately, catheter fragments is a rare complication of IV catheter insertion, especially in peripheral veins, and if it occur several imaging modalities, such as, plain radiography, ultrasonography or CT can be used to detect residual fragments [7]. Plain radiography is commonly used in emergency departments in cases of IV

fragments involvement [8], although in most cases of catheter fragments, distal catheter fragments can be localized by plain radiography and successfully removed via minor incisions. However, if the fragments is small (< 1 cm), it may not be easily detected by radiography [9].

In our patient the retained fragments of catheter could not be seen on plain X-ray or CT scan [10]. Such inability to visualize a catheter fragments has been reported elsewhere [11] and in that case ultrasound was ultimately successful in locating the catheter fragments. Management options for a broken and retained catheter are determined by the potential for infection and local injury. The present IV catheter fragments case has shown, when the catheter sheath is cut during the IV cannulation, it is necessary to check the location of the retained IV catheter fragments in the IV injection site of contrast media first of all, and then to measure and compare the blood circulation of the affected wrist and hand [12].

5. CONCLUSIONS

In conclusion, we describe a case of IV catheter fragments in the metacarpal vein, in which reproducible and microscopy data allowed complete localization of a missing fragments and guided surgery with respect to the optimal incision site for fragments removal. These reproducible studies may help to determine the best course of action and treatment for the patient who presents with such a case.

REFERENCES

1. Powell CC, Li JM, Rodino L, Anderon FA. A new device to limit extravasation during contrast-enhanced CT. Am. J. Roentgenol. 2000;174:315-318.
2. Benson LS, Sathy MJ, Port RB. Forearm compartment syndrome due to automated injection of computed tomography contrast material: Case report. J. Orthop. Trauma 1996;10:433–436.
3. Shannon FL, McCroskey BL, Moore EE, Moore FA. Venous bullet embolism: rationale for mandatory extraction. J. Trauma 1987;27:1118-1122.
4. Gschwind CR. The intravenous foreign body: A report of 2 cases. J. Hand Surg. 2002;27A:350-354.
5. Leunens G, Verstraete J, Van den Bogaert W, Van Dam J, Dutreix A, Van der Schueren E. Human errors in data transfer during preparation and delivery of radiation treatment affecting the final result: garbage in, garbage out. Radiother. Oncol. 1992;23(4):217-222.
6. Yoo BG, Kweon DC, Lee JS, Jang KJ, Yang SH, Kim YS. Comparison radiation dose of z-axis automatic tube current modulation technique with fixed tube current multi-detector row CT scanning of lower extremity venography. J. Radiat. Protect. 2007;32(3):123-133.
7. Gabelmann A, Kramer S, Gorich J. Percutaneous retrieval of lost or misplaced intravascular objects. Am. J. Roentgenol. 2001;176:1509-1513.
8. Vadlamani P, Dawn B, Perry MC. Catheter fragments and embolization from totally implanted venous access ports. Angiology 1998;49:1013-1016.
9. Weiss CR, Fishman EK. Multidetector 3D CT of pulmonary embolism of a peripheral intravenous line. Emerg. Radiol. 2005;11:247-249.
10. Kweon DC, Yoo BG, Yang SH, Kim JG. Findings of an intravenous catheter fragments in the vein using the 3D image reformations of MDCT. Korean J. Med. Phys. 2006;17:167-172.
11. Gulcu N, Karaaslan K, Kandirali E, Kocoglu H. Detection of a retained epidural catheter fragment. Reg. Anesth. Pain Med. 2006;31:589-590.
12. Lee SY, Na HS, Kim MH, Kim CS, Jeon YT, Hwang JW, Do SH. A sheared catheter fragment in the wrist after arterial cannulation attempt: a case report. Korean J. Crit. Care. Med. 2010;25(2):118-121.