Four-dimensional CT-guided transcatheter removal of a fractured migrated catheter of a totally implantable venous access port

Kazushi Fujimoto,¹ Hajime Kasai,² Toshihiko Sugiura,² Koichiro Tatsumi²

► Additional material is published online only. To view please visit the journal online (<http://dx.doi.org/10.1136/bcr-2017-221445>)

¹Department of Medicine, School of Medicine, Chiba University, Chiba, Chiba, Japan
²Department of Respiriology, Graduate School of Medicine, Chiba University, Chiba, Chiba, Japan

Correspondence to

Dr Hajime Kasai,
daikasai6075@yahoo.co.jp

Accepted 10 July 2017

SUMMARY

Patients undergoing chemotherapy usually undergo placement of a totally implantable venous access port (TIVAP), but TIVAP catheter fracture is rare. We encountered a case where flushing the TIVAP catheter became impossible because of resistance. A 61-year-old woman underwent TIVAP placement. Although a chest X-ray revealed the fractured catheter had migrated into the right hilar area, the timing of the fracture was unclear. Four-dimensional computed tomography (4D-CT) showed that the tip of the fractured catheter was located at the anterior segmental artery of the right upper lobe and was immobile, with the remaining portion flapping with the blood flow. Transcatheter removal of the migrated catheter was judged to be possible and was performed successfully. 4D-CT may be useful as an appropriate approach in transcatheter removal of a migrated fractured catheter.

BACKGROUND

A totally implantable venous access port (TIVAP) is usually implanted in cancer patients undergoing intravenous chemotherapy, and the fracture and migration of a TIVAP catheter is a rare complication.¹ When the transcatheter removal of the fractured catheter is attempted, it may be useful to evaluate how the fractured catheter adheres to the vessel walls. However, there is no uniform consensus regarding the effectiveness of this evaluation. We present a case of transcatheter removal

of a migrated and fractured TIVAP catheter evaluated by four-dimensional computed tomography (4D-CT).

CASE PRESENTATION

A 61-year-old woman was diagnosed with ovarian cancer in June 2011. She underwent TIVAP implantation in the right infraclavicular region for access to the right subclavian artery for chemotherapy in April 2014 and a chest X-ray revealed the TIVAP was located in the optimal position ([figure 1A](#)). After the completion of chemotherapy, TIVAP was maintained by flushing with a heparin-lock flush solution every 3 months as an outpatient. In September 2016, TIVAP flushing became impossible because of resistance.

INVESTIGATIONS

A chest X-ray showed transection of the TIVAP catheter in the right subclavian area and the fractured catheter had migrated into the right hilar region ([figure 1B](#)). A chest CT revealed the migration of the TIVAP catheter into the right upper pulmonary artery along with thrombosis ([figure 2](#)). The latest chest CT scan obtained in December 2015 confirmed that the TIVAP catheter was in the optimal position. The timing of the catheter fracture was unknown. 4D-CT was performed to evaluate whether transcatheter removal of the migrated catheter was possible. 4D-CT showed that the tip of the fractured catheter was located at the anterior segmental artery of the right upper lobe and was

Figure 1 The chest X-ray before the fracture shows a totally implantable venous access port (TIVAP) catheter located in the right subclavian vein and the superior vena cava (triangle) (A). The chest X-ray after the fracture shows the catheter broken in the right subclavian area (thin arrow) and the fractured TIVAP catheter (bold arrow) migrated into the right hilar area (B).

Figure 2 Chest CT shows that the fractured totally implantable venous access port (TIVAP) catheter (triangle) had migrated into the right upper bronchial artery along with thrombus formation.

CrossMark

To cite: Fujimoto K, Kasai H, Sugiura T, et al. *BMJ Case Rep* Published Online First: [please include Day Month Year]. doi:10.1136/bcr-2017-221445

Figure 3 Four-dimensional CT of the posterior view shows that the tip of the fractured catheter was located in the anterior segmental artery of the right upper lobe and was immobile. The remaining portion was seen flapping with the blood flow.

immobile, with the remaining portion flapping with the blood flow (online supplementary video 1 and [figure 3A–I](#)). Because the fractured catheter was mobile, transcatheter removal of the migrated catheter was judged to be possible.

TREATMENT

Through a 9 Fr sheath, a 7 Fr Barman catheter was introduced into the right main pulmonary artery. Contrast injection into the right main pulmonary artery showed that the fractured catheter wedged into the superior pulmonary artery, and that its distal free end was in the right main artery. A 10 Fr 90 cm super arrow-flex sheath was used to cannulate the right main pulmonary artery. A 6 Fr 15 mm loop snare catheter (Amplatz Goose-neck snare) was introduced near to the fractured catheter and the distal free end of the fractured catheter was captured by the snare and removed successfully ([figure 4](#)).

OUTCOME AND FOLLOW-UP

One week after the transcatheter removal the remaining TIVAP portion was removed and no complication of the treatment has occurred since then.

DISCUSSION

The present case has two notable clinically relevant points. First, the fracture and migration of the TIVAP catheter is a rare complication and the timing of the occurrence is sometimes uncertain. Second, 4D-CT may provide useful information to determine the appropriate approach for transcatheter removal.

A catheter fracture with subsequent migration is a rare complication after TIVAP implantation.¹ Long-term stress, neck movement, and compression by backpacks and necklaces are considered potential causes of TIVAP catheter fracture.² It is reported that placing a TIVAP catheter in the internal jugular vein has fewer complications than placing it in the subclavian vein.³ However, other studies have reported no difference in the frequency of complications between placing a TIVAP catheter in the internal jugular vein and that in the subclavian vein.⁴ In this case, fracture of the TIVAP catheter occurred in the subclavian area. Flushing with a heparin-lock flush solution is a method for preventing increased internal pressure due to thrombus formation in the TIVAP, and it is recommended to perform these flushes monthly. In this case, flushing with a heparin-lock flush solution was performed every 3 months. Therefore, thrombotic occlusion could have contributed to the fracture of the TIVAP catheter.

TIVAP catheter fracture has potentially severe complications and can lead to arrhythmia, septic shock, thrombosis, and cardiac arrest. Therefore, it is important to remove the fractured catheter as soon as possible. Ko *et al* reported that, when a fractured TIVAP catheter is observed, one should evaluate the fractured fragment and remove it via an endovascular approach to avoid complications.²

4D-CT can be used to evaluate the hemodynamics of the vasculature or the motion of organs, in addition to morphology.⁵ In this case we performed 4D-CT to clarify the positional relationship between the vessel wall and the catheter in detail, and to evaluate whether transcatheter removal could be performed.

Figure 4 Pulmonary arteriography shows that the fractured totally implantable venous access port (TIVAP) catheter (triangle) was located at the anterior segmental artery of the right upper lobe (A). X-ray shows the snare (arrow) grasping the tail of the fractured TIVAP catheter (triangle) (B). Photograph showing the fractured TIVAP catheter retrieved from the right upper bronchial artery (C).

This was because we were uncertain of the timing of the fracture and there was a risk of the fractured catheter adhering to the right pulmonary artery wall. If the fractured catheter had been adherent to the vessel wall, we could not have hooked a snare to the fractured catheter and a thoracotomy would probably have been needed in this patient. Contrast-enhanced CT was an essential examination before transcatheter removal. In addition to contrast-enhanced CT, 4D-CT can be performed minimally invasively. In this case, 4D-CT revealed that the tip of the fractured catheter was immobile and the remaining portion was flapping (especially in [figure 3G and H](#)). This finding suggested that the remaining portion had mobility. Therefore, 4D-CT made it possible to determine the best methods for transcatheter removal of the fractured fragment.

Learning points

- ▶ The fracture and migration of the catheter of a totally implantable venous access port (TIVAP) is a rare complication and it is important to remove it as soon as possible to prevent further complications.
- ▶ The timing of TIVAP catheter fracture is sometimes unknown.
- ▶ Four-dimensional CT (4D-CT) can clarify the positional relationship in detail between a fractured catheter and the vessel wall adjacent to it, and can help in judging whether or not transcatheter removal is possible.

We here describe a case of transcatheter removal of a migrated fractured TIVAP catheter evaluated by 4D-CT. In cases of TIVAP catheter fracture with an unknown onset, 4D-CT may be useful to evaluate whether the catheter has adhered to the pulmonary arterial wall and to determine the optimal approach for transcatheter removal of the migrated fractured catheter.

Contributors KF is the guarantor of this manuscript and contributed to writing and reviewing of the entire manuscript. HK and TS contributed to image analysis and critical review of the manuscript. KT contributed to critical review of the manuscript.

Competing interests None declared.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

© BMJ Publishing Group Ltd (unless otherwise stated in the text of the article) 2017. All rights reserved. No commercial use is permitted unless otherwise expressly granted.

REFERENCES

- 1 Yildizeli B, Laçın T, Baltacıoğlu F, *et al.* Approach to fragmented central venous catheters. *Vascular* 2005;13:120–3.
- 2 Ko SY, Park SC, Hwang JK, *et al.* Spontaneous fracture and migration of catheter of a totally implantable venous access port via internal jugular vein—a case report. *J Cardiothorac Surg* 2016;11:50.
- 3 Wu CY, Fu JY, Feng PH, *et al.* Catheter fracture of intravenous ports and its management. *World J Surg* 2011;35:2403–10.
- 4 Nagasawa Y, Shimizu T, Sonoda H, *et al.* A comparison of outcomes and complications of totally implantable access port through the internal jugular vein versus the subclavian vein. *Int Surg* 2014;99:182–8.
- 5 Ohno Y, Koyama H, Matsumoto K, *et al.* Differentiation of malignant and benign pulmonary nodules with quantitative first-pass 320-detector row perfusion CT versus FDG PET/CT. *Radiology* 2011;258:599–609.

Copyright 2017 BMJ Publishing Group. All rights reserved. For permission to reuse any of this content visit <http://group.bmj.com/group/rights-licensing/permissions>.
BMJ Case Report Fellows may re-use this article for personal use and teaching without any further permission.

Become a Fellow of BMJ Case Reports today and you can:

- ▶ Submit as many cases as you like
- ▶ Enjoy fast sympathetic peer review and rapid publication of accepted articles
- ▶ Access all the published articles
- ▶ Re-use any of the published material for personal use and teaching without further permission

For information on Institutional Fellowships contact consortiasales@bmjgroup.com

Visit casereports.bmj.com for more articles like this and to become a Fellow