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Case Report

# Spontaneous rupture of chemotherapy catheter diagnosed using chest X-ray oblique projections: An interventional radiology approach ☆

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ABSTRACT

Totally implanted central venous port systems are widely used to access central veins for patients needing long-term therapy. These devices have low rates of complications and are commonly used to administer medications like chemotherapeutic agents. Spontaneous rupture of a catheter segment is a rare mechanical complication, usually belatedly diagnosed and presenting with complications. We present a case of a spontaneously ruptured chemotherapy catheter diagnosed using a novel approach via oblique projections on chest X-rays and successfully removed using an endovascular approach.



## Introduction

In 1982, Niederhuber et al. introduced totally implanted central venous port systems; since then, these have been widely used for patients needing long-term access to central veins for prolonged therapy. The port system consists of a central catheter inserted into a cannulated vein attached to a port placed into a subcutaneous pocket. These devices have low rates of extravasation and infection and are commonly used to administer medications like chemotherapeutics agents [1].

*Abbreviations:* PA, Posteroanterior.

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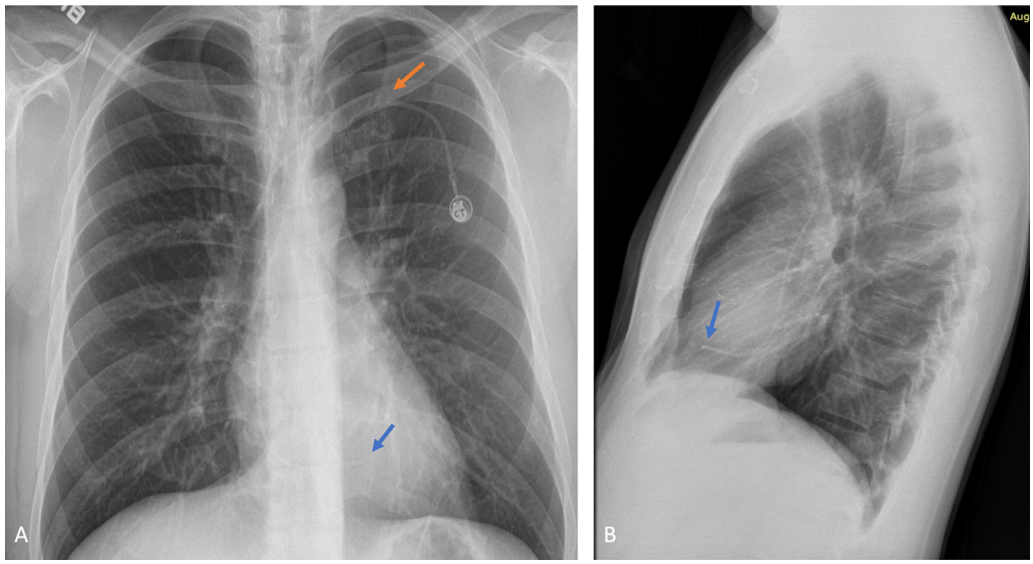


**Fig. 1 – Chest X-ray in PA (A) and lateral (B) projections showing an image suggestive of rupture of the chemotherapy catheter at the level of the left clavicle and the outer border of the first left rib (orange arrow). The distal segment of the catheter is lodged in the right ventricle (blue arrows).**

## Case report

A 43-year-old male patient with a history of rectal adenocarcinoma treated with surgery and chemotherapy administered via a left subclavian catheter with reservoir (Smart Port CT) arrived at the emergency department due to severe intermittent lancinating chest pain during the last 3 days associated with dyspnea and palpitations. The physical examination was unremarkable. An electrocardiogram, cardiac enzymes, complete blood count, renal function tests, and electrolytes were requested, showing no abnormalities. Chest X-rays in posteroanterior (PA) and lateral views were requested showing an image suggesting rupture of the chemotherapy catheter at the level of the left clavicle and the outer border of the first left rib; however, it was not clearly visualized in the lateral projection (Fig. 1). Therefore, additional right and left oblique projections were performed, showing the rupture of the chemotherapy catheter with its distal segment lodged in the right ventricle, confirming the diagnosis (Fig. 2).

A chest angiotomography was planned to rule out endothelization or thrombus surrounding the distal segment of the catheter; however, it was deferred because the patient was allergic to iodinated contrast; therefore, left subclavian vein ultrasound and transthoracic echocardiogram were performed instead, showing no alterations. The distal segment of the catheter was extracted via a right femoral vein interventional approach, using a pigtail catheter and snare loop system (Fig. 3). Complete extraction was confirmed via fluoroscopy. The proximal portion of the catheter was surgically removed, and the patient was discharged after a smooth recovery.

## Discussion

The spontaneous rupture and migration of catheter segments are rare mechanical complications; when these happen, the fragments have been reported to migrate and lodge in several anatomic structures like the right side of the heart, the pulmonary artery, and, rarely, the internal jugular vein [2]. Diagnosing a ruptured catheter represents a challenge since these patients usually present unspecific symptoms or remain asymptomatic, leading to a late diagnosis and, usually, complications [2]. Ruptured catheters can be removed endovascularly using interventional radiology approaches or surgically [2]. In this manuscript, we present a case of a spontaneously ruptured chemotherapy catheter (Smart Port CT) diagnosed with a novel approach using oblique projections on chest X-rays and successfully removed endovascularly using a minimally invasive procedure.

The rupture of a chemotherapy catheter is a rare complication reported in 0.4% of cases, leading to potentially severe conditions such as catheter migration, embolization, or thrombosis [2]. Clinical presentation of ruptured catheters can range from asymptomatic (50%) to infraclavicular pain, arms paresthesias, palpitations, and prolonged infusion time [2,3]. Rupture of chemotherapy catheters usually occurs between the clavicle and the first rib, probably due to increased friction among these structures leading to the compression and fracture of the device; this event is called “pinch-off syndrome” [4].

Other factors associated with catheter rupture have been a matter of research; a study with 698 patients by Wildgruber et al. found that silicone catheters were more prone to rupture and disconnection, while polyurethane catheters had higher rates of infections and thrombotic complications [5]. Another study by Busch et al. included 2270 patients; they found that

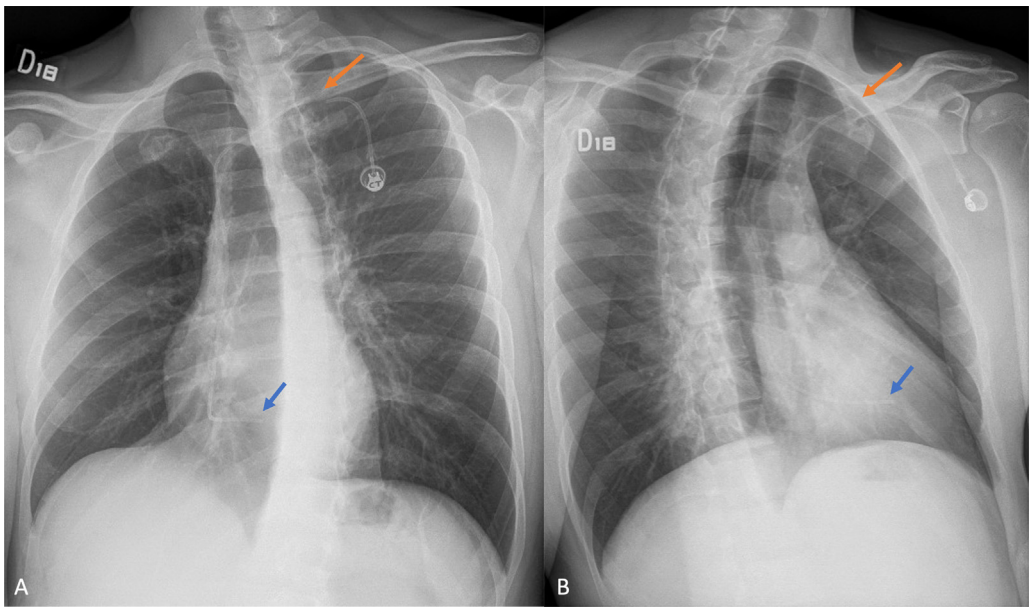


**Fig. 2 – Chest X-rays right (A) and left (B) oblique projections confirming the rupture of the catheter (orange arrows) with its distal segment lodged in the right ventricle (blue arrows).**

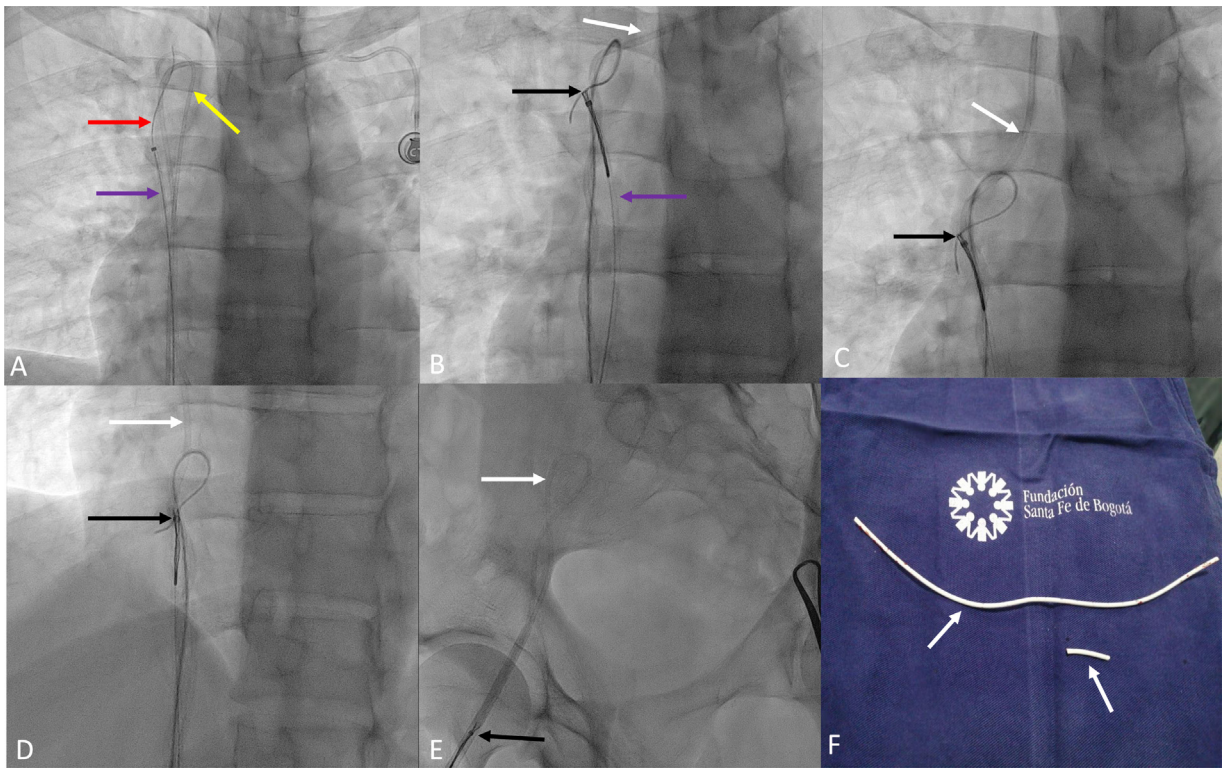


**Fig. 3 – Fluoroscopy guided procedure depicting the sequential process to remove the distal segment of the catheter (A-F). Images showing the distal segment of the chemotherapy catheter (white arrows), pigtail catheter (yellow arrow), guidewire (red arrow), guiding catheter (purple arrows), and snare loop (black arrows).**

silicone catheters presented a 3.35% rate of rupture, while polyurethane catheters showed only a 0.06% rate [6]. Our patient had a silicone reservoir catheter, which presented a spontaneous rupture associated with pinch-off syndrome. So far, no correlation between the type of chemotherapy administered and catheter rupture has been established [7].

In our case, the PA chest X-ray showed an image suggestive of the catheter rupture; however, it was not clearly visualized in the lateral projection, raising doubts as to whether the findings represented a kink of the catheter in the PA view; therefore, additional right and left oblique projections aided to confirm the rupture. Oblique projections have been used to visualize intravascular devices better [8]; however, to our knowledge, this is the first time that oblique projections have been used to confirm the diagnosis of a ruptured totally implanted central venous port system; these projections provided better visualization of the device margins, giving additional information regarding its integrity.

The time of rupture of the catheter in our case was unknown; therefore, it could have been surrounded by thrombus or collagen tissue with endothelial cells ("endothelization" also called "fibroblastic sheath"), difficulting the extraction of the device and raising the risk for thrombus embolization or cardiac arrhythmias [9,10]. For these reasons, a chest angiotomography was planned; however, the patient was allergic to the available contrast agent, for which a left subclavian vein ultrasound and transthoracic echocardiogram were alternatively performed. The use of ultrasound to diagnose catheter endothelization has been described in the literature, showing different ultrasonographic appearances, ranging from hyperechogenic to hypoechogenic sheaths surrounding the catheter [11].

Foreign bodies lodged in the heart must be removed as quickly as possible to avoid potential complications [3,7]. The best way to achieve this is through a minimally invasive approach under fluoroscopy guidance using catheters and snare loops, as done in this scenario with excellent results; however, the proximal segment of the catheter and its port were surgically removed because the port was sutured to the fascia.

An internal jugular vein approach can reduce the rupture rate of catheters, by decreasing the friction between the clavicle and the first rib, and avoiding the pinch-off syndrome [3]. Extreme angulation in chemotherapy catheters has been reported as a risk factor for rupture, probably due to an increased mechanical tension; angulation can be reduced by utilizing ultrasound during the catheter implantation, allowing for better visualization of the catheter route, and avoiding kinks [12]. Lastly, the catheter should be flushed gently using a 10 ml syringe because smaller syringes induce more significant pressure, increasing the risk of rupture [3].

## Conclusions

Catheter rupture is a rare yet potentially lethal complication; thus, it must be promptly recognized. Although PA and lateral chest X-rays can be used to diagnose catheter fractures, we propose using oblique projections to assess better the integrity of endovascular devices by providing a complemental visualization of their margins. The removal of chemotherapy catheters may require a multidisciplinary approach.

## Patient consent

Informed consent was obtained from the patient.

## REFERENCES

[1] Machat S, Eisenhuber E, Pfarl G, Stübler J, Koelblinger C, Zacherl J, et al. Complications of central venous port systems: a pictorial review. Insights Imaging 2019;10(1):1–12. doi:10.1186/s13244-019-0770-2.
[2] Doley RP, Brar P, Chaudhary S, Bedi R, Swami AC, Wig JD. Port catheter fracture and migration in Internal Jugular Vein. Am J Case Rep 2012;13(1):14–16. doi:10.12659/AJCR.882293.
[3] Ko SY, Park SC, Hwang JK, Kim SD. 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(1):1–4. doi:10.1186/s13019-016-0450-y.
[4] Lin CH, Wu HS, Chan DC, Hsieh CB, Huang MH, Yu JC. The mechanisms of failure of totally implantable central venous access system: analysis of 73 cases with fracture of catheter. Eur J Surg Oncol 2010;36(1):100–3. doi:10.1016/j.ejso.2009.07.011.
[5] Wildgruber M, Lueg C, Borgmeyer S, Karimov I, Braun U, Kiechle M, et al. Polyurethane versus silicone catheters for central venous port devices implanted at the forearm. Eur J Cancer 2016;59(1):113–24. doi:10.1016/j.ejca.2016.02.011.
[6] Busch JD, Vens M, Mahler C, Herrmann J, Adam G, Ittrich H. Complication rates observed in silicone and polyurethane catheters of totally implanted central venous access devices implanted in the upper arm. J Vasc Interv Radiol 2017;28(8):1177–83. doi:10.1016/j.jvir.2017.04.024.
[7] Filippou DK, Tsikkinis C, Filippou GK, Nissiotis A, Rizos S. Rupture of totally implantable central venous access devices (Intraports) in patients with cancer: report of four cases. World J Surg Oncol 2004;2(1):36. doi:10.1186/1477-7819-2-36.
[8] Yamao K, Hachiya H, Kusa S, Miwa N, Sato Y, Hara S, et al. Individualized left anterior oblique projection based on pigtail catheter visualization facilitates leadless pacemaker implantation. J Arrhythmia 2021;37(3):676–82. doi:10.1002/joa3.12540.
[9] Passaro G, Pittiruti M, La Greca A. The fibroblastic sleeve, the neglected complication of venous access devices: a narrative review. J Vasc Access 2021;22(5):801–13. doi:10.1177/1129729820951035.
[10] Sood S, Srinivasan S. Retrieving embolized peripherally inserted central catheter—a novel two step technique. Radiol Case Rep 2022;17(3):531–6. doi:10.1016/j.radcr.2021.11.044.
[11] Mogi N, Nakagawa M, Matsumae H, Hattori A, Shimohira M, Shibamoto Y. Fibrin sheath of a peripherally inserted central catheter undepicted with gray-scale (real-time B-mode) ultrasonography: a case report. Radiol Case Rep 2018;13(3):537–41. doi:10.1016/j.radcr.2018.02.016.
[12] Yip D, Funaki B. Subcutaneous chest ports via the internal jugular vein. A retrospective study of 117 oncology patients. Acta Radiol 2002;43(4):371–5. doi:10.1034/j.1600-0455.2002.430405.x.