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Endovascular retrieval of the embolized port-a-cath fragments: Interventional radiologic approach

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Abstract

Embolization of port-a-cath fragments, while uncommon, can lead to serious complications that demand prompt intervention. We report our single-center experience with percutaneous retrieval of embolized port-a-cath fragments, evaluating the feasibility and safety of endovascular techniques. This retrospective study included 10 patients (6 men, 4 women; aged 62–78 years) who underwent port-a-cath implantation at our institution between January 2017 and December 2021. All patients were asymptomatic, and embolized catheter fragments were incidentally identified on routine chest radiographs. Percutaneous retrieval was performed in all cases using the gooseneck loop snare. Demographic data, procedural details, and complications were recorded. Among 1,615 implanted catheters, 10 cases (0.6%) of embolization were identified, occurring either early (<30 days; 3 cases) or late (>30 days; 7 cases). The retrieval procedure was performed within 24 hours of diagnosis in all patients. The gooseneck loop snare technique was successfully employed in each case, achieving a 100% technical success rate. No procedure-related complications, including arrhythmias or vascular injury, were observed. Percutaneous endovascular retrieval of embolized port-a-cath fragments is a safe and highly effective technique. The gooseneck loop snare technique is the preferred method due to its high success rate and minimal risk. Prompt intervention is recommended regardless of the duration since embolization to prevent potential life-threatening complications.

Keywords: Embolization, endovascular techniques, port catheters

Introduction

Port-a-caths are essential implants for patients with oncologic diseases and are commonly used during chemotherapy infusions or parenteral feedings. The internal jugular vein is the most preferred access site for these catheters, and access site-related early (< 30 days) and late (> 30 days) complications should consistently be recognized by their physicians or nurse practitioners. Migration of the catheter fragments to the body parts such as the heart, hepatic veins, or pulmonary arteries, either as an early or a late complication, is one of the most devastating consequences relating to these devices [1-3]. Port catheter fragment embolization to the right atrium, right ventricle, or pulmonary artery carries significant clinical risk, with reported complications such as arrhythmias, pulmonary thromboembolism, and hemodynamic instability. Some series have documented complication rates as high as 71% [2,3]. The clinical outcome following venous catheter embolization may vary depending on the final location of the embolized fragment. According to recent studies, the mortality rate associated with catheter embolization has been reported to be approximately 1.8% [4]. Major surgeries would be required to overcome such possible life-threatening consequences, unless successful

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retrieval of the catheter fragment could be achieved.

Foreign bodies embolized to unwanted arterial or venous territories can be removed from this improper localization percutaneously using various devices, including the loop snare device. Surgery could be another option for these patients, but with plenty of risks, including the undesired morbidities or even mortality. The percutaneous technique to remove a foreign body is well known by the interventional radiologic community, considering its initial use by Thomas et al. and by Dotter et al. soon after [5,6]. The gooseneck loop snare is currently one of the most preferred devices for grasping a migrated device, whether from arterial, venous, or biliary access, with loop sizes ranging from 2 to 35 mm. There are also other variants of this device, such as the triple-looped versions from different brands, which have been preferred and successfully used by numerous interventionalists in various clinical settings. These devices are practical and easy to use, so once the appropriately sized device is selected, capturing the foreign body becomes straightforward for the practitioner. These foreign bodies should be immediately removed from the body upon recognition of this situation.

We present our institutional experience in the percutaneous retrieval of embolized port-a-cath fragments, highlighting the safety and effectiveness of this technique.

Material and Methods

This study was approved by the Institutional Human Research Ethics Committee of Ankara University Faculty of Medicine (Approval Number: I06-417-23 on 11 July 2023). All patients have their informed consent, and no information about the patients, other than age and sex, was recorded due to ethical considerations. This single-center cohort study included patients who underwent port-a-cath implantation at the interventional radiology unit of our institution between January 2017 and December 2021. All patients referred to our unit with catheter fragment embolization during this period were included. Patients in this study have different types of malignancies diagnosed, and port catheters were implanted considering their conditions. Demographic data of the patients, along with their presenting symptoms, were collected. The time intervals related to implantation and retrieval, the location of the embolized fragments, the retrieval technique, and complications were also recorded for each patient.

Procedure

All procedures were performed by a single interventional radiology team (SB, ECC) with 10 and 40 years of procedural experience, respectively. Procedures were performed in supine position after local anesthetic injection (Lidon, TR) to the patient's femoral or jugular region with fluoroscopy guidance (Siemens, Erlangen, Germany). Femoral and jugular vein punctures were usually performed under ultrasound guidance (Sonosite, USA) using a 6F sheath (Terumo, Japan). A 5F or 6F diagnostic catheter (Simmons type 2, Boston Scientific, USA), manually trimmed at the distal tip as shown in Figure 1, along with a guidewire, was used to optimally approach the embolized fragment. Following that, most relevant sized (15-25 mm) gooseneck loop snare (Medtronic, USA) was selected by the interventionalist according to the vessel size to grasp the residue optimally. In a couple of cases a pig tail or Simmons type (1-2) catheter (Boston Scientific, USA) was used to manipulate and optimize the catheter fragment's position before snaring it. In the end, the embolized fragment was snared via 6F catheter and it was externalized from the femoral or jugular access with the sheath as a unit. All complications happened after the removal procedure were graded according to SIR Guidelines.

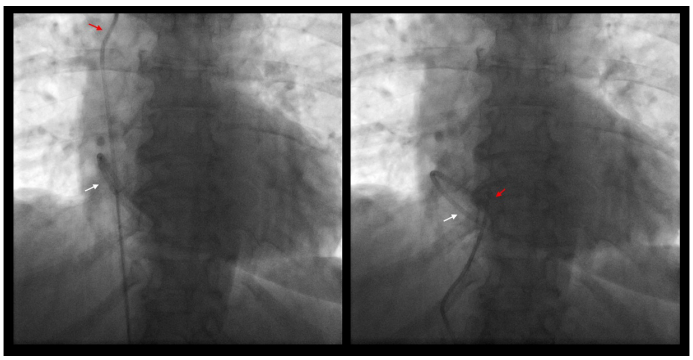

Figure 1. Plain radiographs show the embolized port catheter (white arrows) a modified Simmons type 2 diagnostic catheter with a manually trimmed distal tip (red arrows), which enhances maneuverability and allows precise navigation toward the dislodged fragment during endovascular retrieval.

Following that, most relevant sized (15-25 mm) gooseneck loop snare (Medtronic, USA) was selected by the interventionalist according to the vessel size to grasp the residue optimally. In a couple of cases a pig tail or Simmons type (1-2) catheter (Boston Scientific, USA) was used to manipulate and optimize the catheter fragment's position before snaring it. In the end, the embolized fragment was snared via 6F catheter and it was externalized from the femoral or jugular access with the sheath as a unit. All complications happened after the removal procedure were graded according to SIR Guidelines.

Results

A total of 1615 port implantations were performed, comprising 950 men (58.8%) and 665 women (41.2%). Of these, 10 patients [6 men (60%) and 4 women (40%); (62-78 years)] were treated for early [<30 days; 3 patients (30%)] or late [>30 days; 7 patients (70%)] catheter fragment embolization. All patients in this study were asymptomatic, and catheter fragmentation was incidentally detected on routine chest radiographs, upon which they were referred to our unit by their physicians. None of the patients showed any signs of arrhythmia or other embolism-related cardiac findings. Clinical and procedural data of 10 patients undergoing endovascular retrieval of embolized port-a-cath fragments are summarized in Table 1.

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Table 1. Clinical and procedural data of 10 patients undergoing endovascular retrieval of embolized port-a-cath fragments

Case number	Sex, Age (years)	Implantation to retrieval	Discovery of embolism to retrieval	Location	Method of retrieval/ Approach site
1	M, 62	58 months/Late	<1 day	SVC-RA	Snare/Right FV
2	M, 78	15 days/Early	<1 day	RA	Snare/Right FV
3	M, 67	10 months/Late	<1 day	L-MPA	Snare/Right FV
4	M, 63	5 months/Late	<1 day	RA	Snare/Right FV
5	M, 71	15 days/Early	<1 day	RA	Snare/Right FV
6	F, 68	2 months/Late	<1 day	SVC-RA	Snare/Right FV
7	M, 74	42 months/Late	<1 day	SVC-RA	Snare/Right FV
8	F, 70	10 days/Early	<1 day	SVC-RA	Snare/Right FV
9	F, 67	78 months/Late	<1 day	SVC-RA	Snare/Right FV
10	F, 65	78 months/Late	<1 day	SVC-RA	Snare/Right FV

F: female; FV: femoral vein; L-MPA: left main pulmonary artery; M: male; RA: right atrium; SVC: superior vena cava

The prevalence of catheter dislodgement in our series is 0.6%. The time interval between port implantation and catheter fragment retrieval ranged from 0.3 to 78 months, with a mean of 27.4 ± 33.2 months. The median time was 7.5 months (IQR: 0.88–54.0). All patients underwent transcatheter retrieval within the first 24 hours following the detection of embolism. The gooseneck loop snare technique was utilized as the primary method in all patients, achieving a 100% success rate.

Following the retrieval procedures, all patients underwent immediate post-procedural chest radiography to confirm the complete removal of the catheter fragment and to evaluate for any procedure-related complications. No residual fragments or acute complications were observed in any case. During subsequent clinical follow-up, no patients reported new symptoms or required additional imaging. Furthermore, none of the patients were re-admitted to the hospital due to delayed complications related to catheter embolization or retrieval.

Discussion

In this study, we evaluated the feasibility and safety of percutaneous retrieval of port-a-cath dislodgements, based on our experience with 10 cases between 2017 and 2021. Our findings are consistent with the existing literature, demonstrating the successful percutaneous management of catheter embolizations with a high success rate and no complications.

Embolized catheter fragments were first documented in 1954 [7], and since then, the occurrence of this complication has been reported to range from 0.3% to 2.9% in adults [8,9]. Port-a-cath dislodgements are commonly linked to improper connection between the port and catheter, angulation abnormalities at the anastomosis site, and technical errors during implantation, such as bad catheter position or during removal [10]. While similar etiologies were observed in our study, the small sample size precluded a detailed categorization of the causes. Additionally, the wide range of dislodgement rates reported in the literature may be secondary to differences in the experience levels of the practitioners performing the procedures [10,11]. In our series, the prevalence of catheter dislodgement was 0.6%, which is at the lower end of the range reported in the literature. This relatively low complication rate may reflect the involvement of more experienced practitioners in our study.

In our series, all patients were asymptomatic at the time of diagnosis, and catheter embolization was detected incidentally on routine chest radiographs. This finding is in line with previous studies reporting that most cases of catheter fragment embolism remain clinically silent. For instance, Wang et al. noted that only one patient out of their entire cohort reported palpitations at the time of retrieval, while the rest were asymptomatic [12]. Similarly, Önal et al. observed that 6 out of 10 patients were asymptomatic, whereas the others presented with injection-site pain [3]. Although rare, symptoms such as palpitations, chest discomfort, dyspnea, or local swelling have been documented in the literature. In most instances, catheter malfunction—such as inability to inject fluids or aspirate blood—may be the first clue to embolization.

Procedural challenges during endovascular retrieval may include the absence of a freely mobile catheter tip, or fragments that are entrapped within the vessel wall, lodged in thrombosed segments, or that have migrated outside the vascular lumen. These conditions can significantly complicate catheter engagement and increase the risk of procedural failure or vascular injury. However, in our series, none of the fragments were deeply embedded or thrombosed, allowing successful retrieval in all cases without complication [12]. Although no catheter dislodgement-related complications were observed in our series of 10 patients, Fisher and Ferreyro [13] documented 16 deaths linked to catheter-related complications, such as arrhythmia, perforation, thrombosis, and infection, which occurred within a timeframe of 1 day to 1 year following catheter embolization in a cohort of 73 patients. While advances in modern practice have introduced more flexible materials, reducing these risks, it is recommended that percutaneous retrieval be attempted regardless of the duration since the port catheter was dislodged, given the potential life-threatening complications [12].

According to previous studies, the reported success rates for percutaneous retrieval of intravascular foreign bodies range

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between 71% and 100% [14]. Similarly, in our series, all catheter fragments were successfully retrieved using percutaneous techniques, demonstrating a 100% technical success rate and highlighting the effectiveness of these methods. Various techniques and devices can be employed for the retrieval of intravascular foreign bodies, such as gooseneck loop snares, baskets, hook catheters, deflecting wires, grasping forceps, and balloon catheters [10]. The gooseneck loop snare technique is defined in the literature as the preferred method for retrieving intravascular foreign bodies due to its high success rate and low complication risk [3,12,15,16]. Additionally, Bessoud et al. [17] reported that if a gooseneck loop snare fails, the likelihood of success with alternative devices is low. Based on this evidence, we employed the gooseneck loop snare as the primary technique in all patients in our study, achieving successful retrieval in each case without any complications. Figure 2 illustrates the technique in practice, showing how the embolized catheter tip was captured and retrieved through femoral access. Unlike the cardiac arrhythmias reported in other studies [15,18], no clinically significant episodes were observed in our cases, possibly due to the controlled procedural environment.

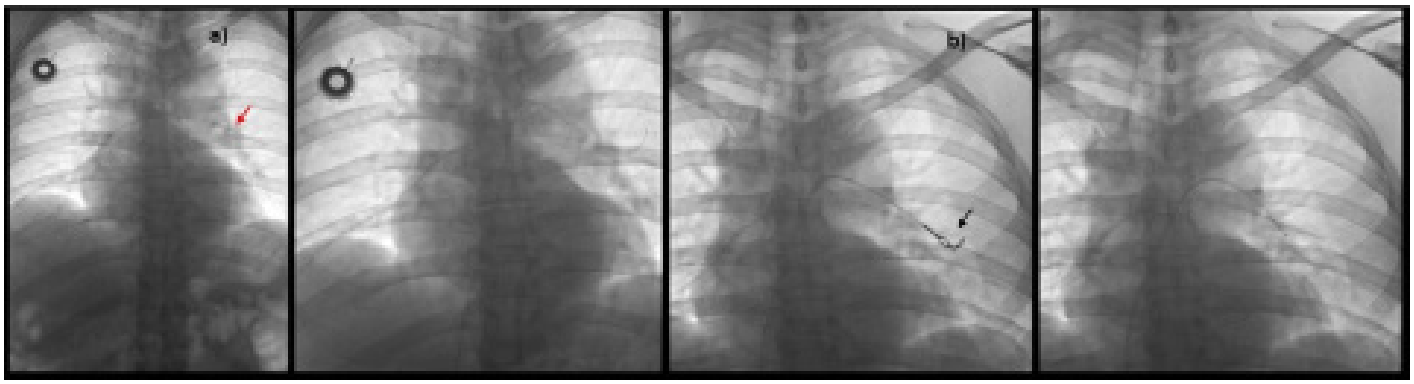

Figure 2. Endovascular retrieval of a dislodged port catheter using the gooseneck loop snare technique. a) A plain radiograph demonstrates the embolized catheter fragment extending from the right ventricle to the left main pulmonary artery (red arrow). b) The displaced proximal tip is caught with a gooseneck loop snare (black arrow) introduced via femoral venous access, enabling successful retrieval of the fragment.

Our study has some limitations that should be acknowledged. First, the small sample size of 10 patients reduces the statistical power and limits the ability to draw broader conclusions. Second, the absence of a control group prevents direct comparison with alternative techniques or management strategies. Thirdly, the reliance on retrospective data collection from clinical records may have introduced limitations, such as incomplete documentation. Lastly, the lack of long-term follow-up data means that potential delayed complications or outcomes may have been overlooked.

To conclude, port-a-cath embolization can be safely managed with appropriate techniques and an experienced team. Although our study was limited by a small sample size, the consistent technical success observed reinforces the feasibility of this approach. Further prospective, multicenter studies with larger patient cohorts are warranted to validate these findings and to assess long-term outcomes following catheter fragment retrieval.

Conclusion

In conclusion, our findings support the existing literature and demonstrate that percutaneous endovascular retrieval of embolized port catheter fragments is a safe, feasible, and highly effective approach. Given its minimally invasive nature and high technical success rate, this technique should be considered the first-line option in clinical practice.

Conflict of Interests
The authors declare that there is no conflict of interest in the study.

Financial Disclosure
The authors declare that they have received no financial support for the study.

Ethical Approval
This study was approved by the Institutional Human Research Ethics Committee of Ankara University Faculty of Medicine (Approval Number: I06-417-23 on 11 July 2023).

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