similar features with our patient. They chose BRS over metallic stents mainly due to the concerns of the growth of the child that will accompany enlargement of the coronary arteries, and thus metallic stents will become undersized. Indeed, Oberhoffer et al. (10) demonstrated that both right and left coronary arteries grow up to five times in diameter from infancy to teenager. For our patient, we also considered BRS. However, owing to both recent reports of increased stent thrombosis with BRSs and health insurance-reimbursement problems, we selected metallic stents.

Conclusion

Percutaneous coronary intervention is safe and effective for the treatment of pediatric patients with atherosclerotic coronary artery disease.

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Video 1. IVUS showing complete stent apposition for both LAD and LMCA stents.

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A Port-A-Cath silent embolization to the left distal pulmonary artery: A novel percutaneous approach for a challenging case

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Introduction

Totally implantable venous access port devices have been commonly used to monitor hemodynamic parameters and to infuse medications, blood, other blood products, and fluids. They are also crucial for the chronic and acute care of patients with many diseases, namely for patients with cancer in need of long-term chemotherapy treatment. Nevertheless, several complications are associated with the use of these devices. One of these complications is catheter migration, most commonly to the pulmonary artery (PA), the right ventricle, and the right atrium (1, 2). One exceptional yet potentially severe complication in using this device for treatment and port catheter placement is the embolization of one of the parts of the device. However, since the majority of them are asymptomatic, the condition is usually not detected for a long time and is usually incidentally diagnosed. The embolization may lead to dangerous complications in the heart and lungs, such as cardiac arrhythmia, myocardial disorders, arterial rupture (in the heart or the lungs), thrombosis, perforations in the heart valves, pulmonary embolism, and endocardial infection. The initial intervention usually includes a

percutaneous approach, such as the loop snare techniques (3). We present a case report that includes a Port-A-Cath fracture and embolization of a part. In this case, these incidence rates were recorded by coincidence during a casual chest X-ray. We used a novel percutaneous retrieval approach for a challenging case in our center.

Case Report

A 46-year-old male patient had a lung cancer history of 2 years. He was admitted to the oncology clinic for chemotherapy regimen by using an implantable Port-A-Cath in the right subclavian vein. The device was installed in 2016. However, intravenous medication admission was impossible even though the access needle was applied accurately into the port reservoir. On anteroposterior chest radiograph, the catheter fractured and embolized to the left PA (Fig. 1a). He was clinically asymptomatic with no history of trauma or any other medical interventions since 2016. Thereafter, he was admitted to the interventional cardiology to percutaneously remove the embolized catheter part. He was referred to the cardiac catheterization laboratory. Then, an 8-French Judkins right catheter was inserted to the distal segment of the PA through the right femoral vein access (Fig. 1b, Video 1). Unfortunately, removal of the embolized catheter segment failed in several different interventional approaches, such as retrieval with single/multiple peripheral snares, simultaneously using a choice Floppy guide wire (Boston Scientific, USA) and Fielder-XT guide wire (Asahi Intecc Co., Ltd., Japan) using a 4×30 mm peripheral balloon (Boston Scientific), forming spirals around the catheter with a floppy guide wire, and retrieval by a biopsy forcep. After successive unsuccessful attempts, it was

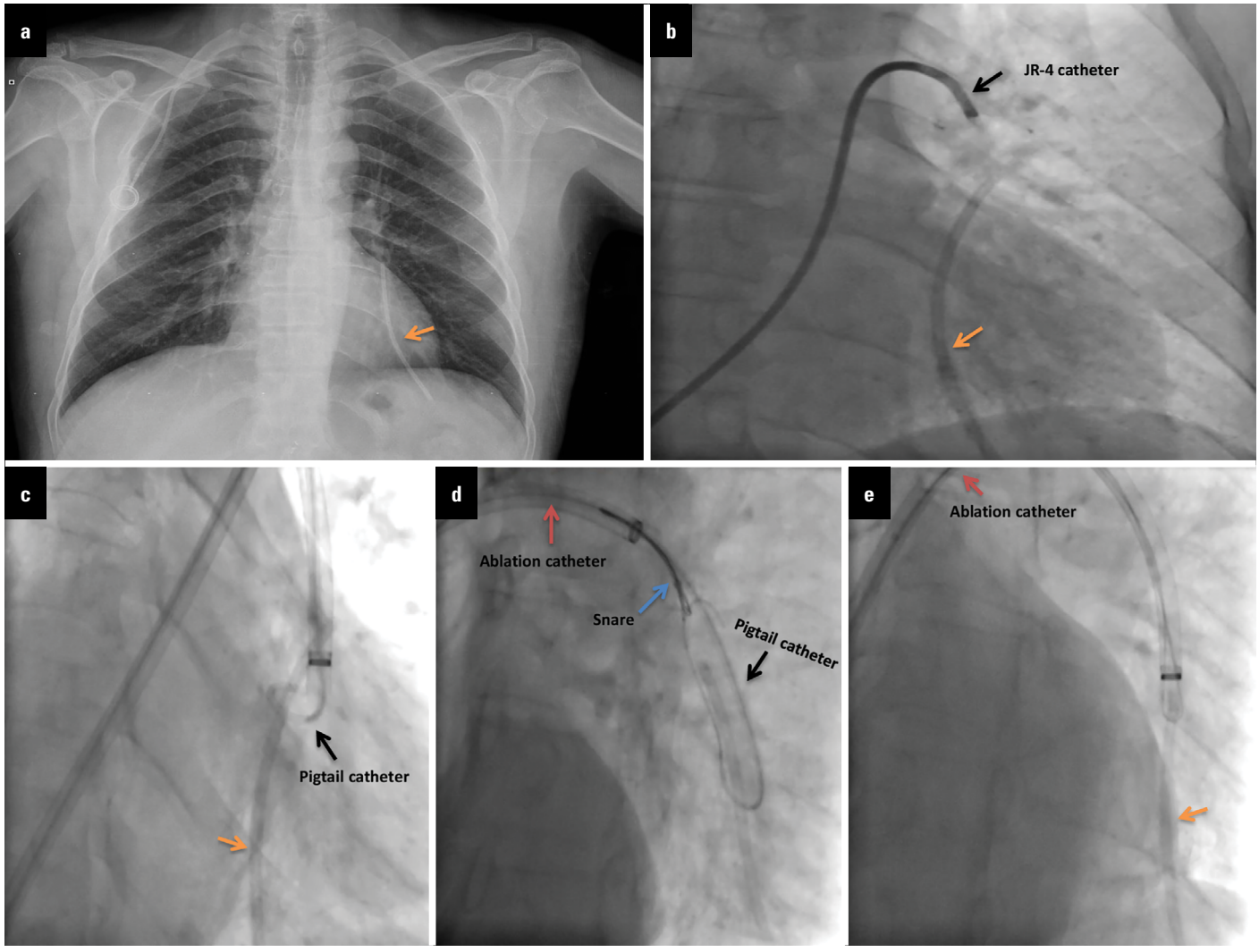

Figure 1. Chest X-ray depicts that the catheter fractured and embolized to the left PA (a) (yellow arrow). Sine fluoroscpic image indicates that an 8-French Judkins right catheter is inserted to the distal segment of the PA (b) (yellow arrow). Sine fluoroscpic images show that the embolized catheter (yellow arrow) is captured by the pigtail catheter (black arrow) (c, d). The embolized catheter (yellow arrow) is entrapped between the guide wire and the distal portion of the 14-French ablation catheter (red arrow) by the snare (e)

PA - pulmonary artery

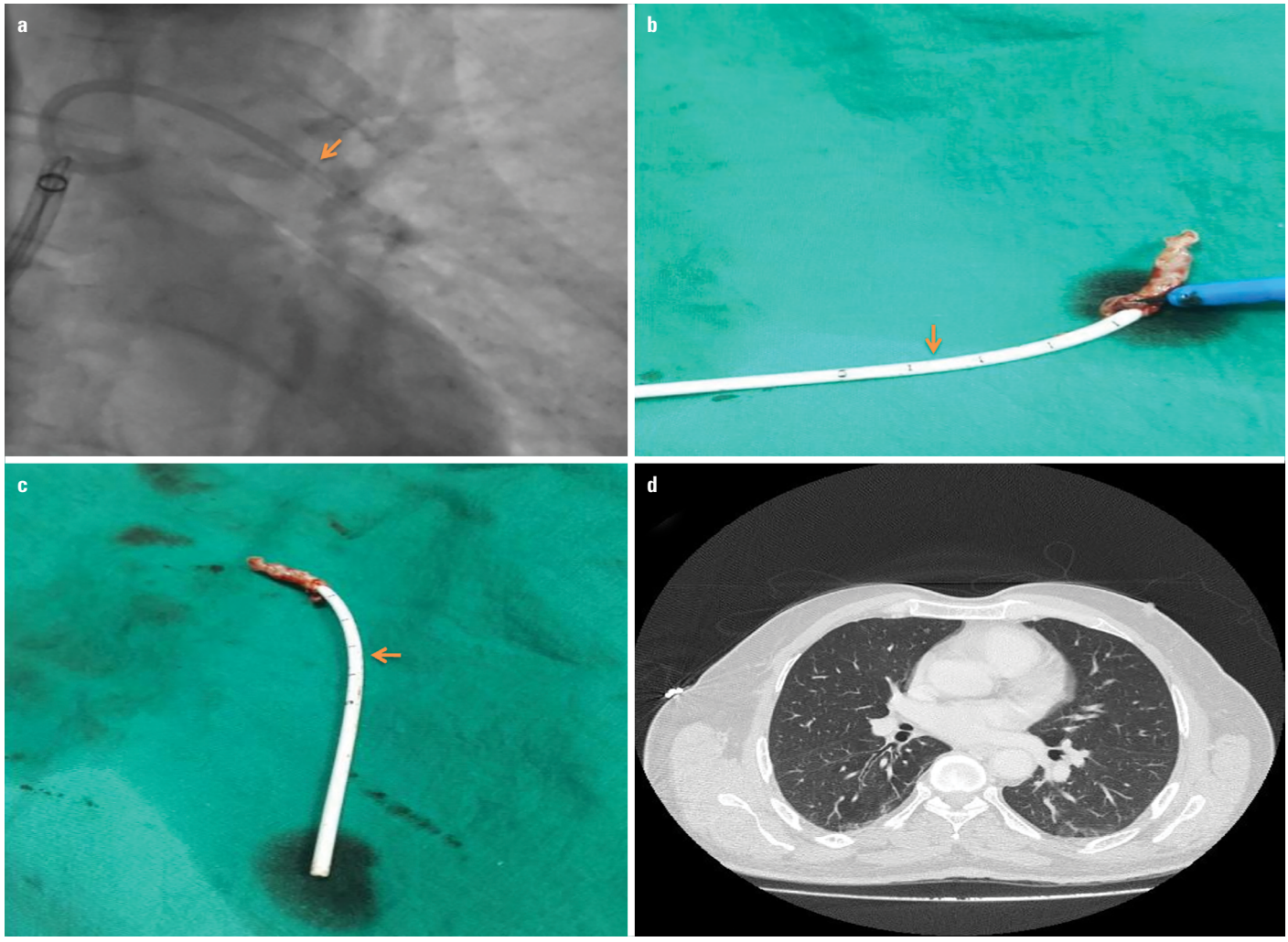

Figure 2. The embolized Port-A-Cath (yellow arrow) is entrapped between the snare and the distal portion of the 14-French ablation catheter (a). Macroscopic images of the embolized Port-A-cath (yellow arrow) (b, c). Thorax computed tomography shows that there is no acute pulmonary pathology (d)

thought that the distal part of the catheter could be endothelialized or adhered to the wall of the PA. Thereafter, the 8-French sheath was replaced with a 14-French sheath. An ablation catheter was advanced to the PA, and a 5-French pigtail catheter was advanced through the ablation catheter. An easier maneuvering would be achieved with the end of the ablation catheter. The pigtail catheter was inserted exactly over the embolized catheter. Thereafter, a 0.38-inch hydrophilic guide wire (Boston Scientific) was advanced from inside the pigtail catheter, and the tip of the pigtail catheter was straightened. The wire was retracted suddenly to allow the pigtail catheter to be folded over the embolized catheter. After proving from different fluoroscopic angles that the embolized catheter was captured by the pigtail catheter, a 0.35-inch hydrophilic guide wire (Boston Scientific) was passed through the pigtail catheter (Fig. 1c and 1d, Videos 2 and 3). The guide wire advanced from the pigtail catheter was captured by the snare and externalized to make a loop (for pigtail catheter) through the 14-French ablation catheter. The two ends of the hydrophilic guide wire were pulled back, and the embolized catheter was entrapped between the guide wire and the distal portion of the 14-French ablation catheter by the snare. The entire system was slowly retracted (Fig. 1e, Video 4), and the Port-A-Cath was successfully removed (Fig. 2a-2c, Videos 5 and 6). The follow-up thorax computed tomography (CT) did not indicate any acute pulmonary pathology (Fig. 2d). He was discharged and doing well for 4 months.

Discussion

One exceptional yet potentially vital complication in implantable Port-A-Cath is fracture and distal embolization toward the heart, with an estimated occurrence rate of 0.2% to 2.9% (4). Certain mechanisms are effective in the pathogenesis of embolization. One highly common catheter trauma cause is chronic compression of the device between the first rib and the clavicle, also known as the pinch-off syndrome. Previous reports show the occurrence of this incidence at 75.6% (5). Other potential causes include damage during the insertion procedure, catheter impingement, structural weakness, catheter erosion and

stretching, catheter rupture, traction on the extravascular portion of the device by the chest wall soft tissues, and the possibility that the connection of the device has been locked inaccurately (2, 5). In our case, the fact that the device was damaged indicates the probability of the above-mentioned pinch-off syndrome as the responsible mechanism, followed by the possibility of incorrect locking of the connection and structural weakness. Fracture and/or migration of a chemoport catheter show a variety of clinical manifestations, including chest discomfort, cough, dyspnea, and palpitations (6). Additionally, intravascular embolization of port catheters may remain undiagnosed for prolonged periods due to mostly asymptomatic nature and, consequently, usually diagnosed incidentally. However, embolized catheter fragments can induce serious cardiovascular and infectious complications. Morbidity and mortality after the embolization of the catheter may vary based on the location of the embolized segments. The morbidity/mortality rate [the mortality rate is approximately 1.8% worldwide (1)] was reported to be at the highest rate when the fragments locked in the right heart. The rates were lower when the segments lodged in the PA and were at the lowest rate when they lodged in the peripheral veins or vena cava (2). Hence, in our case report, we decided to remove the embolized intravascular catheter fragments from the left distal PA immediately after diagnosis. If there is a suspicion of catheter damage on follow-up, it should first be evaluated by chest X-ray. This also provides information about the localization of the embolized catheter fragment. As in the present case, minimally invasive imaging techniques, such as thorax CT, may be used to exclude the additional chest pathology associated with the catheter. Percutaneous intervention or surgery is a mainstay of treatment. Wire snares are used in the percutaneous retrieval methods to remove intravascular foreign bodies. The advantages of this method include its safety, simplicity, and effectiveness (7). The loop snare technique has been reported to have high success rates with minimal complications (6). The most popular devices for these procedures are goose neck-loop snares (8, 9).

Conclusion

In this case, the initial attempt to retrieve the catheter with a snare was unsuccessful. This was followed by several other unsuccessful attempts through different techniques. We finally managed to capture the catheter by taking advantage of the pigtail's ability to curl on itself. The following key points must be taken into consideration when using a snare loop with a pigtail catheter: the fragments must not be kept in a chamber, but in a vessel, while one end of the fragment should be free in one of the two. In addition, it must be proven from different fluoroscopic angles that the embolized catheter was captured by the pigtail catheter. This novel technique may be a practical tool for the retrieval of intravascular fractured catheters, and interventional cardiologists may take advantage of this technique so that they may use a pigtail catheter when they feel the need to loop in similar circumstances.

Informed Consent: Written informed consent was obtained from the patient for the publication of this case report and the accompanying images and videos.

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Video 1. An 8-French Judkins right catheter is inserted to the distal segment of the PA.

Video 2, 3. After proving from different fluoroscopic angles that the embolized catheter is captured by the pigtail catheter, a 0.35-inch hydrophilic guide wire is passed through the pigtail catheter.

Video 4. The embolized catheter is entrapped between the guide wire and the distal portion of the 14-French ablation catheter by the snare. The entire system is slowly retracted.

Video 5, 6. The catheter is successfully removed.

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