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Case Report

"Trap technique": A new multimodal approach for the treatment of intracardiac foreign body retrieval ☆

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ABSTRACT

In medical practice, the retrieval of intravascular foreign bodies (IFBs) represents a challenge and often requires a multidisciplinary approach. We report a case of a 65-year-old male patient with a metallic guide wire extended from the right subclavian artery to the left ventricle. An interventional radiology team employed the "trap technique", with a combination of a retrieval device and angiographic catheters, which results crucial in this case. Proper device management and imaging assessment are essentil to the successful retrieval of IFBs. Further research is warranted to refine IFB retrieval techniques and evaluate long-term outcomes.

Introduction

Intravascular foreign bodies (IFBs) retrieval represents a unique challenge in medical interventions. IFBs could originate from various sources, such as central line fragments, catheter elements, embolization coils, and more [1]. An accurate history and imaging review is crucial to determine the size, shape, and location and the proper retrieval of a lost IFB. A multidisciplinary approach may be necessary for endovascular removal, highlighting the importance of collaboration with an anesthetic team for optimal patient care. Computed tomography (CT) is often the gold standard to detect IFBs, but several imaging methods are available [2].

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The Amplatz Nitinol gooseneck snare is the best device to retrieve IFBs, but in up to 25% of cases multiple techniques are needed for successful IFB removal [3]. Meticulous planning and execution play a pivotal role, especially in angles or positions of IFBs difficult to manage. Several factors could contribute to the loss of devices such as inadequate guide catheter support, vessel tortuosity, and calcification [4].

Our case report describes a case of a patient with a guide wire within the cardiovascular system, extending from the right subclavian artery to the left ventricle.

Case report

We report a case of a 65-year-old man, with a medical history of pancreatic cancer, treated with pancreaticoduodenectomy 6 months before. He was admitted to the emergency department, due to an episode of abdominal pain. During evaluation, a chest CT revealed an unexpected metallic guide wire placed between the origin of the right subclavian artery and the apex of the left ventricle (Fig. 1). We hypothesized that a metallic guidewire was inside the heart because blood pressure was measured invasively during the pancreaticoduodenectomy, using an intraarterial catheter and guidewire. The particular position of the guide wire could have generated symptoms such as arrythmias, but the patient did not show any cardiological symptoms.

Our interventional radiology team was employed for the removal of the wire. The exact location of the wire was detected using fluoroscopy.

After skin disinfection and under local anesthesia, we employed a bilateral femoral artery access consisting of an 8 French sheath introduced through the right side, and a 5 French sheath through the left side. A 5 French Simmons 1 catheter was placed into the ascending aorta from the right access, while a goose-neck catheter was opened into the aortic arch on the left side. The Simmons 1 catheter guided the metal guide wire into the subclavian artery, aiming to detach the catheter tip from the apex of the heart to avoid potential arrhythmias. The rotation of the Simmons 1 mobilized the metal guide, causing the end to become trapped in the loop of the gooseneck (Fig. 2).

The removal of the metallic guide wire causes the fracture of it into the infrarenal abdominal aorta. A 6 French sheath was introduced through the right femoral access, within the 8 French sheath, utilizing a coaxial system; to capture and retrieve the remaining fragments of the guide wire, placed in the subrenal abdominal aorta, we employed a GooseNeck catheter. The retrieved fragments were sent for bacteriological evaluation and it was proven that they were not infected.

No postprocedural severe complications were observed, indicating the success of the intervention.

Discussion

Intravascular foreign bodies (IFBs) can originate from different devices, such as central line fragments, guide wires, catheter fragments, embolization coils, inferior vena cava filters, coils, cardiac valve fragments, sheaths, pacing wires, occluder devices, and projectile fragments [5]. The etiology of IFB is categorized into 3 groups: device defects, inappropriate techniques, and patient-related factors [6].

Inadequate guide catheter/guide wire support, proximal vessel tortuosity, and vessel calcification represent risk factors that may lead to the loss of devices. A significant percentage of lost IFBs is related to operator technique or operator's lack of experience, while a modest percentage to equipment failure, stressing the importance of adequate education on the devices to avoid complications.

Among noninfectious complications after the insertion of implantable long-term access systems, catheter fracture represents a rare event. Research by Egglin et al. [7] disclosed that in up to 25% of cases, multiple retrieval systems or techniques (vascular sheath, guide wire, pigtail catheter, grasping forceps, and urinary stone baskets) may be used to remove IFBs. Despite being a widely used and versatile device, the Amplatz Nitinol gooseneck snare may induce cardiac arrhythmias during heart manipulation. Retrieval may pose challenges in specific cases due to the unique angle or position of the foreign bodies.

An accurate history, including a review of previous imaging, is essential to determine the object's size, shape, and current location and increase the probability of successful retrieval of lost IFBs [8].

Computed tomography (CT) is the investigative method of choice, despite radiation exposure, although plain film and fluoroscopy are commonly utilized. Identifying small catheter fragments on CT could be however challenging.

Endovascular removal of most devices is considered a safe procedure, but it needs a multidisciplinary team discussion because it may not always be appropriate [9]. Collaboration with the anesthetic team may be required to warrant adequate patient sedation/anesthesia.

In order to streamline the procedure, anticipating possible difficulties, optimizing patient position and preparation, warranting the availability of commonly used devices (snares, intravascular forceps, large sheaths, guide wires, shaped catheters, and balloons) in appropriate sizes are crucial. The IFB should undergo bacteriological evaluation after the retrieval, to prevent septic complications.

The loop snare is configured as the principal choice for IFB removal [10]. Its design facilitates manipulation by allowing the loop to emerge at a 90° angle to the catheter. Nitinol's shape memory properties offer kink resistance to the wire. Various snare devices present different features and sizes, but all are based on a movable Nitinol wire loop passing through a catheter. Snares are safe devices, relatively atraumatic, and effective with a high success rate of IFB retrieval, even when manipulated by less experienced operators.

IFB retrieval shows success rates over 95% in most case series [11], while 60% to 71% of untreated patients report death or serious complications, such as extravasation and dislocation, catheter leakage, thrombophlebitis, sepsis, arrhythmia, myocardial injury, bacterial endocarditis, vessel occlusion, ischemia, and cardiac perforation.

The initial method to retrieve IFBs is often represented by the proximal grab technique, which utilizes only one snare of an appropriate size for the vessel, delivered through a

Fig. 1 – Computed tomography angiography (CTA) image with coronal maximum intensity projection (MIP) reconstruction view show the presence of a guide wire located between the origin of the right subclavian artery and the left ventricle (arrow).

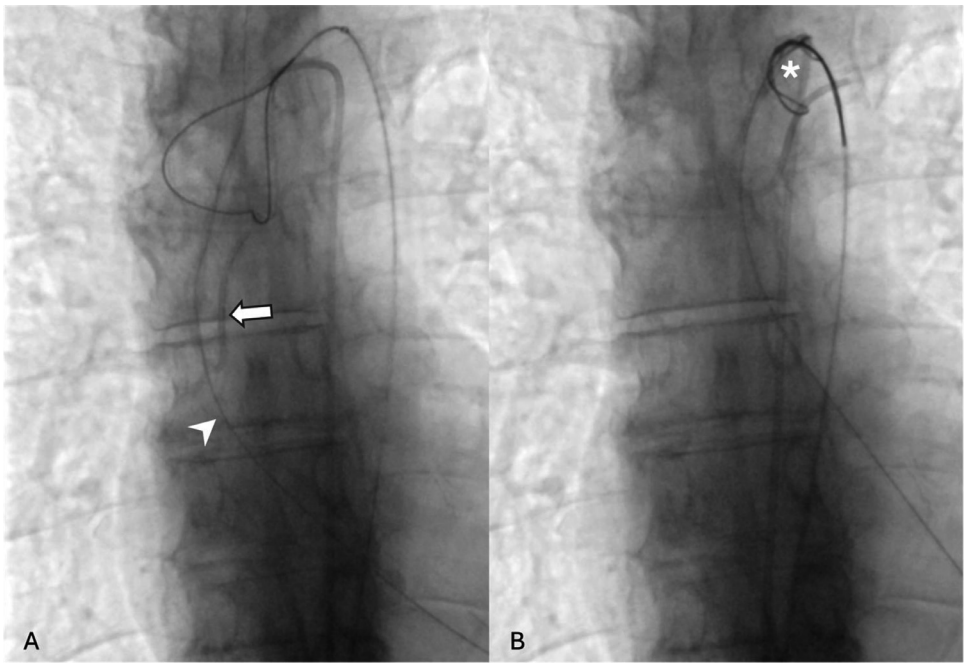

Fig. 2 – Images shows (A) a Simmons 1 catheter (arrow) which mobilized the metal guide wire (arrowhead) (B) and the distal end of the metal guide wire trapped in the loop of the gooseneck (star).

straight guide catheter (typically 4F or 6F) [1]. Once in position in the target vessel, the snare is opened and the IFB could be trapped and subsequently retrieved back to the sheath. This technique may be successful if the IFB shows a free end for grasping; in other cases, alternative approaches could be required.

In our case report, during the preoperative planning, it was found that the use of only the GooseNeck catheter would not have been helpful, because the guide was placed in tension between the right subclavian artery and the cardiac apex. Attempting proximal retrieval in the subclavian artery posed a high risk of intimal flap due to the important contact between the guide tip and the vessel wall, increasing the potential risk of dissection. On the other hand, pursuing distal retrieval at the level of the cardiac apex could generate arrhythmias [12]. We chose to associate the use of an angiographic catheter and a GooseNeck catheter, targeting the midsection of the guide. Specifically, with the Simmons 1 catheter, we applied traction to the midsection of the guide, which was then wrapped around the angiographic catheter and introduced into the GooseNeck catheter. This technique has been called by us the "trap technique".

Conclusions

This case report delineates a unique and complex scenario of IFBs' retrieval, specifically a metallic guide wire extending from the right subclavian artery to the left ventricle. Successful retrieval of the wire and its fragments needed a multidisciplinary approach, involving interventional radiology, and anesthetic teams. In most cases, percutaneous retrieval of IFBs could be feasible, decreasing the morbidity and mortality linked with surgical intervention. We considered the advantages and limitations of different retrieval devices and techniques. The "trap technique", which associates a retrieval device and an angiographic catheter (Gooseneck catheter and Simmons 1, in our case), resulted in being effective and safe, and essential to retrieve IFBs located in otherwise inaccessible areas.

This case emphasizes the importance of correct management of endovascular devices. A scrupulous review of radiographic images is also required to detect and retrieve IFBs, especially in complex and urgent scenarios.

Further research is imperative to assess the long-term outcomes and determine optimal strategies for IFB retrieval.

Patient consent

The present is to declare that the patient gave his informed and full consent for the publication, reproduction, broadcast and other use of photographs, recordings and other audiovisual material of himself (including of his face) and textual material (case histories) during the writing and publication of the case report "Trap technique": a new multimodal approach for the treatment of intracardiac foreign body retrieval".

The patient declared, in consequence of granting this permission, that he has no claim on the ground of breach of confidence or any other ground in any legal system against authors and their agents, publishers, successors, and assigns in respect of such use of the photograph(s) and textual material (case histories).

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