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Case report

A case of recurrent osteomyelitis due to retained micro-catheter after cerebral angiography

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ABSTRACT

Infections associated with healthcare manipulations, particularly bloodstream infections stemming from catheters and medical devices, significantly heighten the probability of vertebral osteomyelitis. The diagnosis of infective endocarditis (IE) frequently overlaps with vertebral osteomyelitis (VO). In cases where individuals are suspected of having hematogenous vertebral osteomyelitis and have an intravascular catheter or device, it is recommended to undertake blood culture collection. We present a case of a 39-year-old male with a history of interventional AVM embolization and cerebral angiography, experiencing recurrent vertebral osteomyelitis. No definitive source of infection had been found, and transthoracic echocardiography (TTE) yielded negative results for IE. In Trans Esophageal Echocardiography (TEE), a retained micro-catheter extending from the aortic arch to the inguinal artery was discovered. Although we cannot definitively attribute the source of the osteomyelitis to the retained micro-catheter, no episodes of infection have been reported ever since. This case underscores the need to enhance our approaches and guidelines related to operating protocols in the surgical setting. Improving these guidelines can prevent similar occurrences in the future, emphasizing the importance of continuous improvement in healthcare practices.

Introduction

The prevalence of vertebral osteomyelitis appears to be growing [1,2]. This could be due to a number of causes, including improved diagnostic techniques, aging and immunocompromised population, increased indwelling device use, and intravenous drug use [3]. This increased incidence rate will present a major challenge to healthcare systems, especially as demographic shifts lead to a higher population over 75. With the world's population aging rapidly, future healthcare policies need to address this burden [2]. Infections associated with healthcare settings, such as bloodstream infections related to catheters and devices, elevate the likelihood of vertebral osteomyelitis [4]. Hematogenous spread is a cause of the occurrence of vertebral osteomyelitis. Hematogenous vertebral osteomyelitis is associated with severe morbidity, such as prolonged antimicrobial therapy, recurrence risk, poor functional status, and paralysis [3]. The lumbar spine is the most prevalent site of pyogenic infection involvement, followed by the thoracic, cervical, and sacral regions [5]. Vertebral osteomyelitis is frequently linked to infections in distant sites, including urinary tract infections, infective endocarditis (IE), intestinal infections, and skin infections through the hematogenous pathway [6]. The rise in the occurrence of hematogenous vertebral osteomyelitis (HVO) among young patients is connected to the expanding population of intravenous drug users and endocarditis. Early diagnoses of these cases are typically challenging, as these patients are often managed for symptoms like fever, bone pain, and stiffness, potentially downplaying or concealing the presence of endocarditis [5]. The diagnosis of infective endocarditis (IE) may often coincide with vertebral osteomyelitis (VO). The absence of distinct clinical features and specific laboratory findings can pose a challenge in recognizing IE in patients with VO. Hence, clinicians, particularly spine surgeons and internal medicine physicians dealing with VO cases, must maintain a heightened awareness of IE to prevent overlooking this significant complication. Regular echocardiograms and multiple sets of blood cultures should be routinely conducted to ensure timely diagnosis and implement supportive therapy, which is crucial for minimizing morbidity and mortality [6]. Also, in individuals suspected

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of hematogenous vertebral osteomyelitis and having an intravascular catheter or device, it is advisable to collect blood cultures. Detecting endocarditis-related germs such as staphylococci or viridans streptococcus in the blood or vertebral tissue should trigger additional investigations like echocardiography and CT-guided vertebral biopsy. Timely identification and treatment of intravascular device-associated infection are essential to prevent potential spinal and other hematogenous spread [7].

Case presentation

A 39-year-old Iranian male was referred with recurrent osteomyelitis of the lumbar vertebrae for further evaluation. The patient had been experiencing repeated episodes of acute low back pain, accompanying fever, and chills over the past years. Previous treatments included multiple debridement surgeries and courses of antibiotics including clindamycin, levofloxacin, and rifampin. The most recent episode occurred a month ago.

The patient underwent multiple workups to find the source of the infection. Unfortunately, the blood culture is not available. Despite an extensive workup conducted by infectious diseases and internal medicine specialists to identify the infection source, the results proved inconclusive. Consequently, the patient underwent evaluation to rule out endocarditis. Initially, a transthoracic echocardiography (TTE) was performed and yielded normal results. Subsequently, trans-esophageal echocardiography (TEE) revealed a long wire-shaped mass originating from the aortic arch to the descending aorta (Fig. 1). The abdominal aorta displayed the wire-shaped foreign body, as well.

The patient mentioned a history of cerebral angiography and AVM embolization 13 years prior, conducted due to an intracerebral hemorrhage related to an arteriovenous malformation (AVM).

Therefore, a thoracoabdominal CT scan was scheduled. The sagittal view of the CT scan showed a wire-shaped enhancement extending from the aorta to the inguinal artery (Figs. 2 and 3).

The diagnosis pointed towards a retained microcatheter in the aorta, prompting surgical intervention to remove the microcatheter. However, only a portion of the microcatheter was successfully removed during the procedure (Fig. 4). The remaining was covered by the endothelium of the aorta and was impossible to detach. The micro-catheter was considered as a possible source of the infection. However, the micro-catheter was not sent for culture. And there are no reports of vertebral osteomyelitis relapse on his ninth-month follow-up.

Discussion

In this study, we encountered a case of retained micro-catheter from the aortic arch to the inguinal artery. Due to recurrence of vertebral osteomyelitis, we considered the retained micro-catheter as a possible

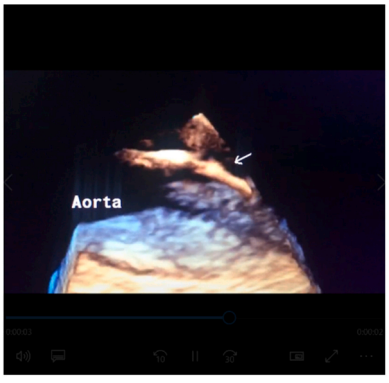

Fig. 1. Wire-shaped mass (arrow) in the thoracic aorta in Trans-esophageal echocardiography.

Fig. 2. Thoracic section of wire-shaped enhancement in sagittal view of the thoracoabdominal CT scan.

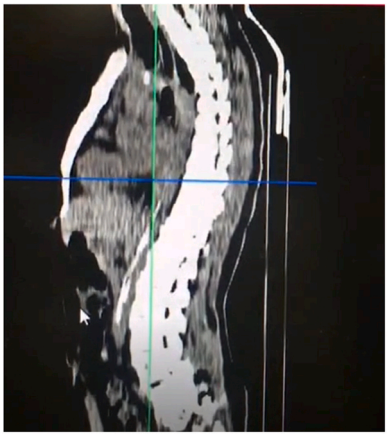

Fig. 3. Abdominal section of wire-shaped enhancement in sagittal view of the thoracoabdominal CT scan.

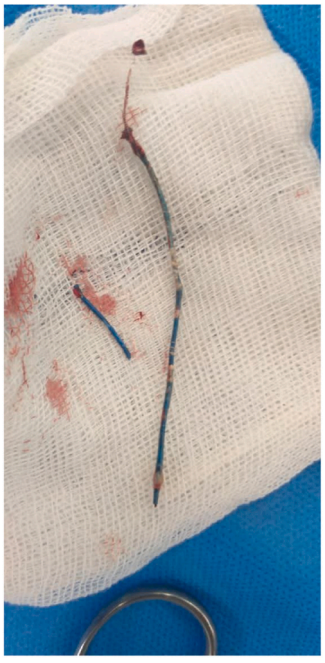

Fig. 4. Segments of the removed microcatheter.

source of infection leading to recurrent osteomyelitis of the lumbar vertebrae.

The frequency of infections associated with intravascular devices as the primary infection site in hematogenous vertebral osteomyelitis is rarely discussed. Limited research has been conducted on cases of recurrent osteomyelitis linked to intravascular devices [7,8]. Pigrau et al. evaluated health-care-associated hematogenous pyogenic vertebral osteomyelitis. One-third of these cases of hematogenous pyogenic vertebral osteomyelitis were associated with healthcare, and a third of these were specifically attributed to catheter-related infections, hence possibly preventable [8].

Renz et al. conducted a study on 67 patients with hematogenous vertebral osteomyelitis resulting from intravascular device-associated infection. Of these cases, 67 % were traced back to intravenous catheters, while 33 % were linked to implantable cardiovascular devices. The study identified the causative microorganism in 94 % of patients, with Staphylococcus species being the most frequent. The intravenous catheters were primarily associated with chemotherapy (44 %), parenteral nutrition (44 %), and hemodialysis (22 %). Implantable subcutaneous port systems, long-term catheters, and cardiac implantable electronic devices were most frequently involved. The study also noted that infective endocarditis was more prevalent in patients with cardiovascular devices compared to those with intravascular catheters [7]. There were also few studies regarding vertebral osteomyelitis in hemodialysis patients [9–11].

In this particular case, the device was unintentionally left due to an interventional error. There has been a growing preference for utilizing endovascular embolization in managing large intracranial arteriovenous malformations (AVMs). Retention and adherence of endovascular micro-catheters are rarely encountered complications in the embolization of AVMs using glue or ethylene-vinyl alcohol copolymer [12]. This can be due to gluing the micro-catheter tip or entanglement of the micro guidewire tip with intravascular devices [13]. The growing volume of complex endovascular procedures and their expanded applications has raised the likelihood of unintended intraoperative fragmentation and the retention of catheters and sheaths [14]. The occurrence of vascular catheters, surgical devices, and drainage tube retention during the insertion process were seen in different procedures [15]. In a 2019 study, a total of 1156 contributing factors were detected regarding this matter, with the most common occurrences falling within the categories of human factors, leadership, and communication. Most of the reported incidents resulted in harm categorized as unexpected additional care or an extended stay. There were a total of 308 events related to Unintended Retained Foreign Objects (URFOs), involving instruments (102), catheters and drains (52), needles and blades (33), packing (30), implants [14], specimens [6], and various other items (71) [16]. This discovery was mostly made 39.3 % after the patient's discharge from the hospital. In 76.7 % of the documented cases, the resulting harm was classified as unexpected additional care or an extended hospital stay [15].

Two studies highlighted the complication of retained micro-catheters resulting in distal ischemia during AVM embolization [12, 17]. In the literature review conducted by Maharaj et al., they identified additional complications, such as pseudoaneurysm, infarct, cellulitis, and migration into subcutaneous tissue [12] Koo et al. reported two cases of retained wire into the thoracic cavity following endovascular neurointervention, one with right lung parenchymal hemorrhage due to direct lung parenchymal piercing and the other with pneumothorax [13].

Also, the occurrence of iatrogenic injuries to the heart has risen, attributed to the increased accessibility and progress in interventional cardiology, particularly in catheter-based diagnostic and therapeutic procedures. The incidence is higher, especially with debulking devices and the migration of guide wires. A study reported a case involving a retained catheter in the main pulmonary artery resulting from the insertion of a central venous catheter. The patient presented in an anxious state one hour after the catheter was removed [18]. Current operating protocols in the operating room do not address the possibility of unintentionally retained catheters and wires during endovascular treatments. Rather than traditional in-service training, a study conducted by Endicott et al. mentioned a new visual reference display of standard endovascular components to improve staff's capacity to spot device fragmentation during the index procedure [14].

A general strategy to prevent retained surgical items is to track all items used during a procedure at the end of the procedure. Soft skills such as ethics, accountability, communication, and teamwork are irreplaceable for achieving optimal results. Healthcare organizations must create policies and procedures based on the latest recommendations, ensuring that all perioperative staff are accountable for adopting, implementing, and reviewing their assigned practices [19].

This study demonstrated that the present guidelines for preventing retained microcatheters are insufficient and that healthcare organizations should consider developing new guidelines.

Conclusion

While we cannot definitively attribute the retained micro-catheter as the source of infection, it is evident that incidents of unintended retained foreign objects can lead to various complications. We strongly recommend improving our approaches and guidelines related to operating protocols during vascular interventions to prevent such complications in the future.

Limitation

This study faced several limitations, mainly due to multiple hospital admissions of the patient, which resulted in incomplete data regarding blood cultures and performed surgeries. The fragmentation of medical records among different hospitals and specialists made it difficult to collect full information, perhaps resulting in data gaps.

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Ethical approval

There is no ethical approval required for this descriptive report.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Author Agreement Statement

We the undersigned declare that this manuscript is original, has not been published before and is not currently being considered for publication elsewhere. We confirm that the manuscript has been read and approved by all named authors and that there are no other persons who satisfied the criteria for authorship but are not listed. We further confirm that the order of authors listed in the manuscript has been approved by all of us. We understand that the Corresponding Author is the sole contact for the Editorial process. He/she is responsible for communicating with the other authors about progress, submissions of revisions and final approval of proofs.

CRediT authorship contribution statement

Ahmad Mirdamadi: Visualization, Supervision, Project administration, Data curation, Conceptualization. **Niloofar Mirdamadi:**

Writing – review & editing, Writing – original draft, Visualization, Validation.

Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work the author(s) used open AI chat (GPT chat) in order to enhance English writing and English grammar. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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