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Case report

Staphylococcus aureus mediastinitis due to subclavian vein perforation and catheter-related-infection

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ABSTRACT

In rare cases the implantation or use of a port-a-cath can be complicated by venous perforation or catheter-related infection. We describe a patient with these two complications resulting in *Staphylococcus aureus* mediastinitis. Removal of the device and prolonged antibiotic therapy cured the infection.

Introduction

Central venous catheters are widely used. To deliver chemotherapy, the use of a port-a-cath (PAC) is recommended. Complications such as venous perforation or catheter-related infection (CRI) may occur in this context; however, the combination of these two events is exceptional.

We describe a patient undergoing treatment for metastatic cancer of the left breast who presented with acute infectious mediastinitis secondary to left subclavian vein perforation and *Staphylococcus aureus* CRI.

Case presentation

A 58-year-old woman presented to the emergency department with a three-day history of fever and chills. She had a history of cancer of the left breast with metastatic recurrence. Three weeks prior, chemotherapy had been initiated with targeted therapy combining paclitaxel, pertuzumab and trastuzumab. A positron emission tomography (PET) was performed before initiation of treatment (Fig. 1A) as well as a contrast-enhanced scan of the chest, abdomen and pelvis (Fig. 2A). A PAC had been implanted at the left subclavian vein. Two weekly courses of chemotherapy had been administered with no significant adverse reactions. Due to PAC rotation and malposition, operative surgical revision had been performed one week prior and chemotherapy was held.

On admission the patient complained of chest pain and dyspnea that had progressed over three days. Clinical examination revealed a temperature of 39 °C and tachycardia (110 beats). The skin at the port-a-cath chest wall site was erythematous and tender. Laboratory evaluation revealed a normal complete blood count and an elevated C-reactive protein (CRP) of 97.2 mg/L. Two blood cultures were collected from the PAC and two from a peripheral site. Empiric therapy with intravenous daptomycin 10 mg/kg daily was initiated.

On the second day of hospitalization, methicillin-susceptible S. aureus (MSSA) was recovered from all blood cultures. Blood cultures drawn from the peripheral site became positive two hours after those drawn from the PAC, indicating a CRI. The PAC was surgically removed and sent for culture, pus was noted in the area at the time of removal. Antibiotic therapy was changed to continuous infusion cloxacillin at a dose of 12 g every 24 h due to the possibility of infective endocarditis. However, no signs of endocarditis were observed on a transthoracic cardiac ultrasound. The culture of the PAC also grew MSSA, with the same antibiogram.

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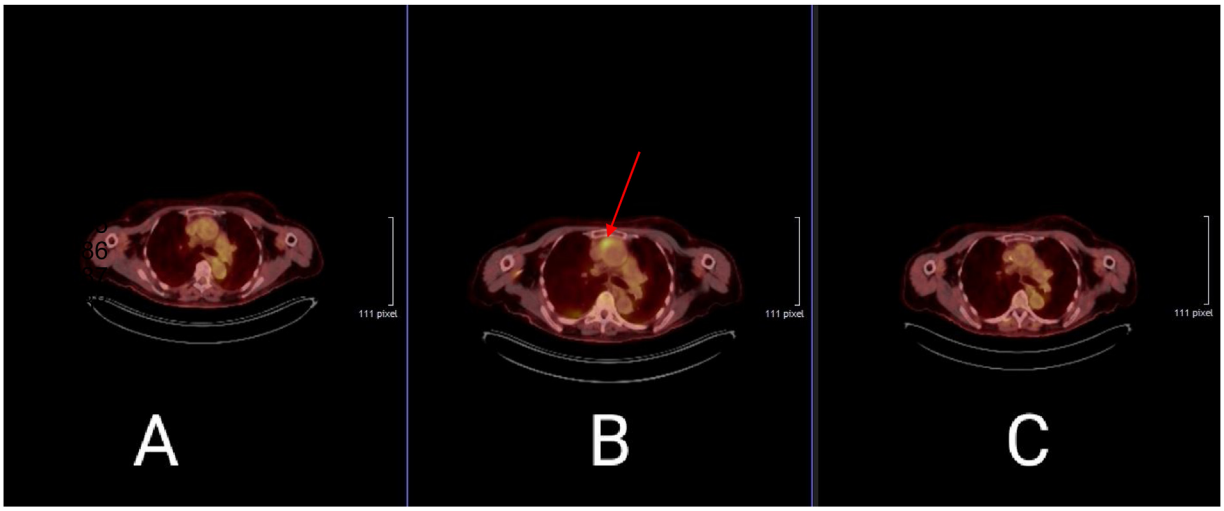

Fig. 1. PET scan.
A) Before the infectious episode.
B) At the time of the infection, showing the anterior mediastinal uptake (red arrow).
C) At the end of the antibiotic treatment.

A transoesophageal ultrasound performed one week after admission revealed no evidence of endocarditis. The patient's blood cultures were rapidly sterilized. However, despite ten days of antibiotic therapy, a persistent inflammatory syndrome was observed with fever and elevated CRP reaching a plateau of 50 mg/L. There were no focal findings on clinical examination to suggest uncontrolled infection. A contrast-enhanced scan of the chest, abdomen and pelvis (Fig. 2B) identified a thrombosis in the left subclavian vein associated with anterior mediastinal infiltration suggestive of mediastinitis. Myocardial PET scan (Fig. 1B) revealed thrombophlebitis. There was no evidence of endocarditis.

Given these findings, a second reading of radiographs following the surgical revision of the PAC, demonstrated that the tip of the catheter was located outside of the left subclavian vein in the mediastinum, a finding not noted on the prior reading (Fig. 3).

Expert opinion was sought from a regional referral center for infectious diseases. The case was reviewed by a multidisciplinary panel and the consensus was that the patient had acute S. aureus mediastinitis due to procedure-related venous perforation and CRI. A decision was taken to continue the high-dose intravenous cloxacillin for a total of six weeks in combination with oral levofloxacin (750 mg/24 h) for six weeks. Her inflammatory improved rapidly with this regimen. Six weeks after starting the treatment, the patient was changed to oral levofloxacin and clindamycin to provide coverage for possible mediastinal osteomyelitis.

Targeted therapies were resumed after completion of intravenous cloxacillin therapy given peripherally. Follow-up PET CT showed absence of residual infectious focus (Fig. 1C). Regression of the mediastinitis was observed on follow-up chest CT (Fig. 2C). Paclitaxel therapy was resumed after placement of a right subclavian PAC and the completion of the oral clindamycin and levofloxacin.

Discussion

Acute mediastinitis is a rare and fatal infection. The condition is frequently described following heart surgery where it can trigger anterior infections. It can also be caused directly by injury, sternal osteomyelitis, oesophageal wound, or indirectly but by propagation where it triggers posterior necrotising mediastinitis. Rarely, mediastinitis can be spontaneously spread by hematogenous dissemination. In the literature, one similar case of acute infectious mediastinitis secondary to the implantation of a central venous catheter, the perforation of the superior vena cava and a CRI has been described [1].

Our patient was diagnosed with treatment-related acute infectious mediastinitis secondary to a CRI following traumatic perforation of the left subclavian vein. The combination of these two complications is very unusual. The frequency of jugular venous puncture as a complication of implanting a central venous catheter using ultrasound guidance is report at 1 % [2]. In a meta-analysis of more than 200 prospective studies, the risk of catheter-associated with bacteremia in patients with PACs is 0.1/1000 catheter days [3].

Our patient had received adjuvant radiation therapy to the left breast and axilla, five years prior to metastatic recurrence. Although arterial complications secondary to radiation therapy are widely described in the literature [4], little is known of the impact of radiation on the venous system. However, venous thrombosis in the radiated area has been reported [5]. In addition, radiation-induced fibrosis of healthy tissues is one of the potential late-onset complications of radiation therapy [6]. Despite involving a large vessel and the administration of very low doses, the left brachiocephalic venous trunk was located in the area of radiation. It is thus hypothesised that this adjuvant radiotherapy may have triggered changes to the vessel enhancing the likelihood of venous perforation and thrombosis.

Rare cases of mediastinitis caused by chemotherapy extravasation have been reported in the literature [7]. In these cases, the origin of the mediastinitis was chemical, irritative and non-infectious. Blood cultures from periphery and PAC were sterile.

When infectious acute mediastinitis is diagnosed based on the criteria of the Centers for Disease Control and Prevention [8], the collection of a mediastinal sample for culture is not necessary for diagnosis. In our patient, her mediastinal infection was almost certainly due to MSSA in view of the clinical and microbiological findings.

The role and utility of PET scans in the diagnosis of mediastinitis is unknown. In one case of descending necrotising mediastinitis [9] the uptake of the mediastinal infiltrate on the PET scan was intense.

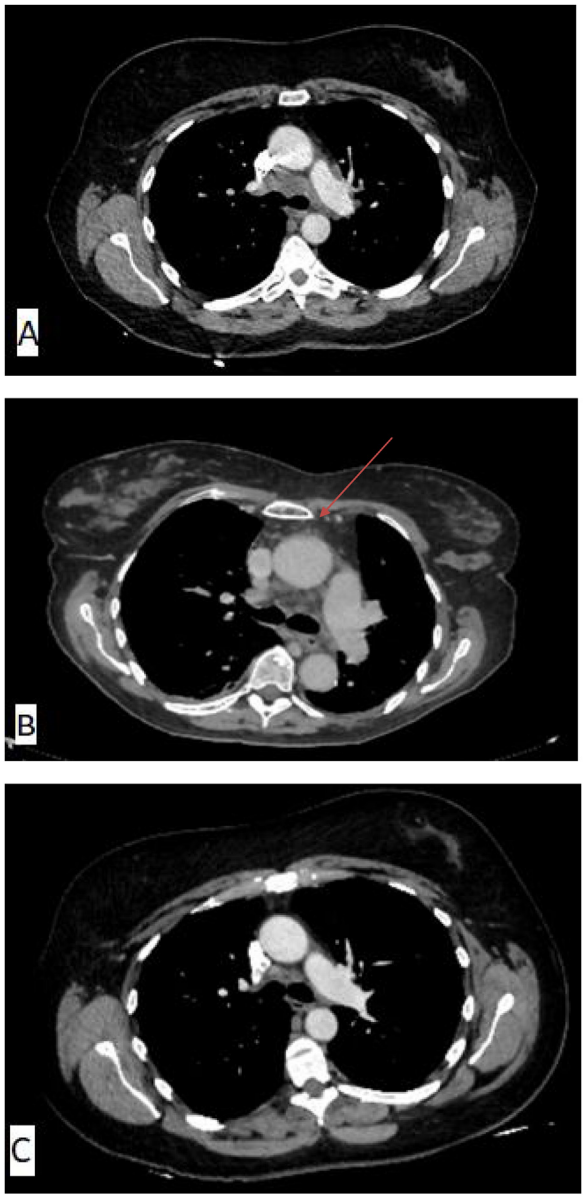

Fig. 2. Contrast-enhanced chest scans.
A: scan before the start of the oncology treatment.
B: scan performed at the time of the infection, showing anterior mediastinal infiltration (red arrow).
C: disappearance of anterior mediastinal uptake, persistence of adenopathies in the paratracheal area.

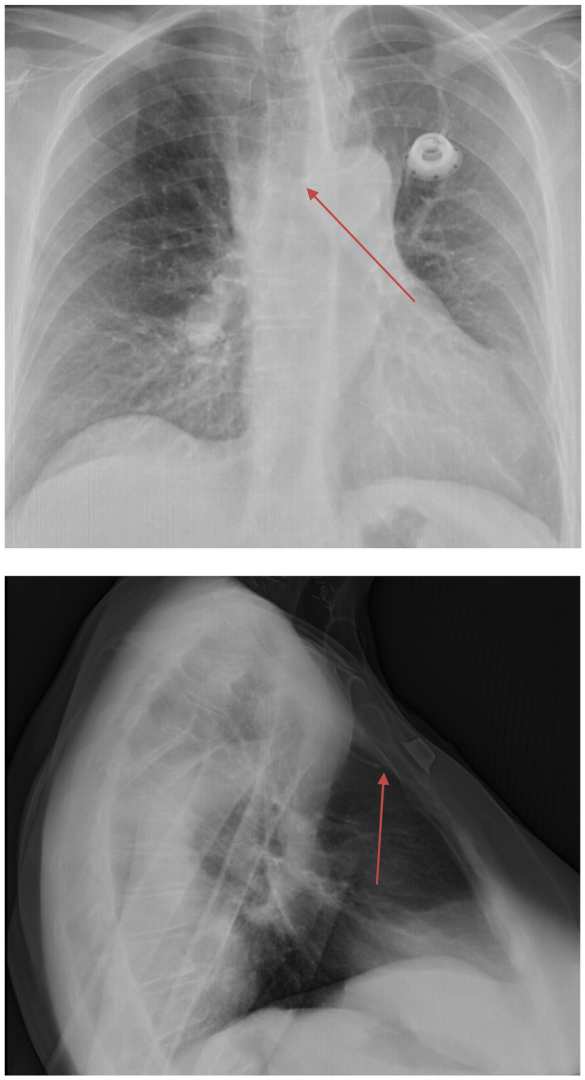

Fig. 3. Frontal and profile chest x-rays showing the extremity of the intra-mediastinal and extra-vascular PAC (red arrows) (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article).

However, in our patient, the mediastinal infiltration was absent. We can hypothesize that the lack of uptake was related to ten days of effective antibiotic therapy in our patient.

Empiric broad-spectrum antibiotic therapy of mediastinitis should be initiated as soon as possible while awaiting blood or mediastinal culture results. Therapy is prolonged initially at least three weeks of intravenous therapy followed by oral therapy for three weeks [10].

These recommendations also apply to mediastinitis following heart surgery. In our patient, empiric daptomycin that provided coverage for S. aureus (the most likely pathogen) was initiated in the setting of CRI, followed by a change to cloxacillin when susceptibility results were available. High dose cloxacillin was used due to the concern for endocarditis. There is no consensus on the length of antibiotic therapy. It is possible that a shorter course of therapy would have been equally effective in our patient.

While infectious mediastinitis was the reason for suspending targeted cancer therapy for six weeks and chemotherapy for 12 weeks, it did not appear to have any clinical consequences. Six months after this complication, our patient continues to receive targeted maintenance therapies and her response is still complete.

Conclusion

We describe the second case of infectious mediastinitis secondary to venous perforation and CRI. The combined complications of venous perforation and CRI leading to mediastinitis are extremely rare but should be given consideration and investigated based on clinical presentation.

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Author agreement statement

All authors 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 is responsible for communicating with the other authors about progress, submissions of revisions and final approval of proofs.

Declaration of Competing Interest

The authors declare that they have no conflict of interest.

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