ampicillin, cefotaxime and ceftazidime [5]. Finally, biofilm formation can be enhanced in *Escherichia coli* [5]. If it were the case that disinfectant-detergents based on BAC are still used for cleaning of flexible endoscopes, I would expect the biocidal compound to be present at (probably) low concentration on various materials of the flexible endoscope. The persistent presence of BAC on the plastic may reduce the susceptibility of surviving nosocomial pathogens to biocidal agents and selected antibiotics and may even enhance *P. aeruginosa* biofilm formation [6]. This is an aspect that may be worth further evaluation in the future.

Conflict of interest statement
None declared.

Funding sources
None.

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Available online 6 August 2018

https://doi.org/10.1016/j.jhin.2018.08.002

Fibrin sheath infections can be safely and successfully treated with percutaneous vacuum-assisted thrombectomy

Sir,

Central venous catheters (CVCs) have become commonplace in modern clinical practice. Despite their myriad benefits, they are associated with a host of complications, of which thrombosis (2—26%) and infection (5—26%) are the most common [1]. Catheter-related bloodstream infections (CRBSIs) are well-studied, and have high rates of morbidity and mortality which pose a significant burden to health systems. We present the case of a patient with infection of a retained catheter-related fibrin sheath, a rarely described form of CRBSI, who was successfully treated with percutaneous vacuum-assisted thrombectomy.

A 43-year-old woman with a past medical history of end-stage renal disease on haemodialysis presented to our hospital complaining of fevers for three days. Of note, she had a tunnelled CVC to be used for haemodialysis placed eight months prior to admission; her clinical course after catheter placement was uncomplicated and was free of any previous infection. On arrival, her physical examination was significant for a temperature of 39.3°C as well as erythema and oedema over the site of her tunnelled CVC on her right chest wall. Given her toxic appearance, she had urgent and immediate removal of her CVC on the day of her arrival, and she was treated with empiric vancomycin and cefepime. Blood cultures drawn at the time of arrival returned positive for meticillin-susceptible *Staphylococcus aureus* (MSSA) on day 2 of admission, and her antibiotic treatment was transitioned to cefazolin.

Transthoracic echocardiogram (TTE) was obtained to evaluate endocardial involvement, and was unremarkable without any vegetations, however transoesophageal echocardiogram (TOE) showed a highly mobile tubular mass in the right atrium originating from the superior vena cava (SVC) (Figure 1). A follow-up computed tomography venogram revealed septic emboli in the right upper and right lower lobes of her lungs, and confirmed a retained fibrin sheath in the right brachiocephalic vein and SVC; she was started on empiric anticoagulation with heparin infusion. Two sets of blood cultures were drawn daily since her arrival at hospital, and all remained positive for MSSA until they eventually cleared after five days of antibiotic therapy.

Despite resolution of bacteraemia, the provider care team remained concerned that the fibrin sheath should be removed to reduce embolic risk and achieve source control. After multidisciplinary discussion, our patient had successful removal of her fibrin sheath with a percutaneous vacuum-assisted thrombectomy device on day 12 of hospitalization. She was discharged home to complete a six-week total course of cefazolin,

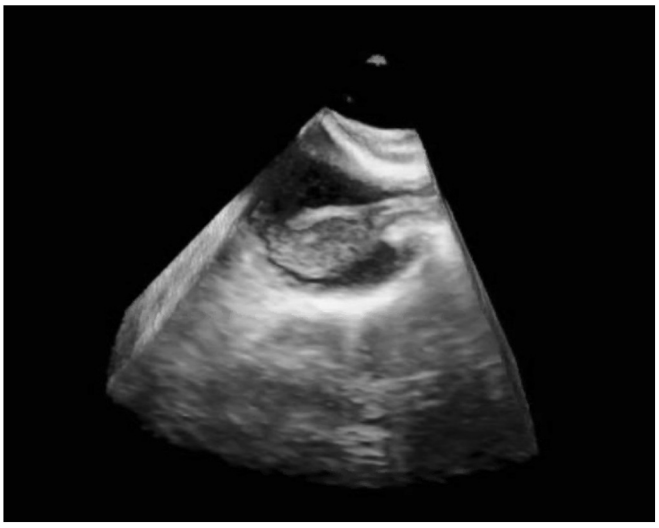

Figure 1. Fibrin sheath seen in the right atrium during transthoracic echocardiogram long-axis view (three-dimensional image).

as well as therapeutic warfarin. At three-month follow-up, she remained well without any infectious signs or symptoms.

Fibrin sheaths generally remain clinically silent and do not cause pain, redness, or swelling as is common for mural vaso-occlusive thrombi; thus they often go undetected and are probably far more common than we currently suspect [2]. They are typically composed of varying levels of fibrin, laminin, collagen and fibronectin [3]. Fibrinogen and laminin serve as a binding site for candida and *S. aureus*, and this probably promotes their adherence and colonization [4]. Coagulase-negative staphylococci (CNS) more avidly bind to fibronectin, of which fibrin sheaths are also abundant [4]. Furthermore, CNS typically synthesize a layer of glycocalyx, commonly referred to as a biofilm, which further promotes their ability to colonize catheters [4]. These factors probably explain how fibrin sheaths promote CRBSI, and why *S. epidermidis*, *S. aureus* and *Candida albicans* comprise the vast majority of CRBSI pathogens.

We present the case of a patient with a tunnelled CVC and persistently positive blood cultures who was found to have a rarely described diagnosis of fibrin sheath infection. Importantly, the vegetation was not seen on TTE, but only on TOE; a review of previous case reports suggests that this was the experience of others, suggesting that TTE is not sensitive in detecting this entity [5—8]. Additionally, our patient was found to have retained a fibrin sheath despite removal of her CVC; previous case reports have similarly described retention of fibrin sheaths after catheter removal, sometimes for many months [5]. Our patient eventually had convalescence after use of antimicrobial therapy, but also required percutaneous thrombectomy for source control and to reduce the risk of further embolization.

Practitioners should be aware of several characteristics of fibrin sheaths, including that they are common and can serve as a nidus of infection, can persist for months after catheter removal, can be highly mobile and cause embolic phenomena, and that they may be difficult or impossible to detect via TTE. To the best of our knowledge, our case report may also be the first to describe the use of a vacuum-assisted thrombectomy device to retrieve a fibrin sheath.

Conflict of interest statement
The authors have no conflicts of interest to declare.

Funding sources
None.

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Available online 11 October 2018

https://doi.org/10.1016/j.jhin.2018.10.003