As standard renal replacement therapies could not be used due to the blood pressure (BP) levels, we tried another depurative technique. The ECMO system haemofilter was used as dialysis membrane (1.4 m² poly-ethersulfone membrane; Cobe cardiovascular, Mirandola, Italy). Dialysis fluid was provided by two 5 l bags suspended above the patient (Figure 1). A ‘Y’ tube system was used to deliver a kalium-free dialysate (Na 140 mmol/l, bicarbonate 34 mmol/l). To control dialysis flow speed, two plastics locks provided by the manufacturer alternatively closed and opened the system. From the filter, another ‘Y’ tube collected the drainage fluid in two 5 l bags below the patient. Each bag was weighed, using an electronic newborn scale, to calculate the ultrafiltration volume. A ‘Y’ line returned the blood from the ECMO: the main branch directly to the patient and the other to the haemofilter. The dialysis flow was maintained at 291 ml/min for 2 h and decreased to 83 ml/min for 3 h (mean flow 166 ml/min). Patient’s net balance throughout the procedure was zero and temperature 35.5°C. After 5 h, BP increased to 76/45, pH to 7.4, kaliemia decreased to 6.2 mmol/l, lactate to 8.5 mmol/l and bicarbonate remained stable. In the absence of a positive fluid balance, improvement of kaliemia was attributed to dialysis. Improvement of BP could be due to the decrease in potassium levels and the slightly lower core temperature [5]. Lactate decrease was probably due to a better tissue perfusion, rather than a dialytic effect [6]. Gravity dialysis could then be changed to conventional CRRT. In summary, the technique of continuous dialysis by gravity using the ECMO filter could be a therapeutic option in critically unstable patients, unable to tolerate CRRT and requiring urgent management of electrolytic disturbances (Figure 2).

Conflict of interest statement. None declared.

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Does a fibrin sheath formed around a catheter embolize upon removal of the catheter?

Sir, Central venous catheters (CVC) are commonly used in haemodialysis patients. Encasement of the catheter by a fibrin sleeve is a well known complication which can interfere with catheter function and prevent effective haemodialysis [1]. These sleeves do not come with the catheter upon removal, but remain in the vein. Although millions of CVC are inserted and removed every year, there are few clinical reports describing what happens to the sleeve remaining inside the venous lumen upon removal [2,3]. We conducted a prospective study to assess whether fibrin sheath formed around a short-term haemodialysis catheter embolizes or not during removal of the catheter.

The study was approved by the institutional review board, and informed consent was obtained from all patients before the procedure. Forty consecutive patients [25 women (63%), 15 men, mean age 58 ± 21 years] with a short-term haemodialysis catheter were evaluated for presence of pericatheter fibrin sheath and possible embolization upon
removal of the catheter. We included patients with non-tunnelled catheters, because this was the most frequently used catheter type at our dialysis centre. All catheters were removed because of the establishment of other working accesses.

The short-term catheters were 11.5F 15–20 cm long stiff polyurethane catheters (Duo-flow catheter, Medcomp, Harleysville, PA, USA). All procedures were performed with a digital subtraction angiography unit. The patients were monitorized by pulse, blood pressure and oxygen saturation during and immediately after the procedure. The catheter was checked for patency and pulled back 4–5 cm proximally. Ten millilitre of non-ionic contrast media (Ultravist, Schering, Berlin, Germany) was then slowly injected, while digital subtraction images were obtained. This first step of the procedure was to diagnose the presence of fibrin sheath around the catheter and ensure filling of the sheath with contrast media. Fifteen millilitre of non-ionic contrast media was then injected manually, while the catheter was slowly removed and serial digital angiographic images without subtraction were obtained. The acquisition of images was continued 2–3 s after removal of the catheter. For each case, presence of pericatheter fibrin sheath and possible embolization upon removal of the catheter were evaluated. Oxygen saturation of patients before, during or immediately after removal of the catheter was recorded. Patients were asked if they felt any pain, anxiety or shortness of breath during or immediately after catheter removal.

A total of 25 out of 40 consecutive patients (63%) had fibrin sheath formation around the catheter. Contrast media filled around the catheter to diagnose the presence of fibrin sheath in these 25 patients, but cleared immediately in six of them. There were 19 patients for the assessment of possible fibrin sheath embolization (Figure 1). The catheters were placed in the internal jugular vein and dwell time ranged from 12 to 48 days (mean, 29 days). Fibrin sheath embolization was not observed or documented by venography in any patients. Patients did not have symptoms or signs of pulmonary embolism. Venography showed that the sheath remained adherent to the vein wall at the catheter insertion site.

Fibrin sheath formation is seen in up to 76% of short- or long-term CVC by pull-back venography [4,5], but the rate reaches 100% in experimental studies after 1 week of placement [6]. It starts as early as 24 h after insertion of the catheter [3,6] which becomes encased along its entire length within 5–7 days. The sheath begins as a thrombus containing some fibrin in the first few days and transforms to a cellular-collagen tissue after 1 week [6,7]. At this stage, the sleeve material is mostly smooth muscle cells with a small amount of fibrin. The sleeve remnant permanently attaches to the vein wall and its detachment seems unlikely.

Fibrin sheath was debated to cause embolization during or after removal of a CVC, but there are few reports [2,3,8,9] that document its embolization. Brismar et al. [2] reported pull-back venography findings of 60 CVCs. The fibrin sheath mostly remained adherent to the vessel wall at the catheter insertion site upon removal, but on several occasions, the thrombus adherent to the fibrin sheath or the whole sheath detached from the vessel wall and was carried away by flowing blood. Three patients experienced pulmonary embolism documented with lung scintigraphy [2]. Winn et al. [8] reported a patient who had documented pulmonary embolism immediately after completion of a fibrin sheath stripping procedure. Rockoff et al. [9] reported fatal pulmonary embolism upon removal of a CVC in a 1-year-old child. Contrary to these rare findings, our study supports the hypothesis based on experimental studies that the fibrin sheath is firmly attached to the vein wall at the catheter insertion site and does not embolize upon removal. The fate of these sleeves whether cleared by the body’s thrombolytic activity or embolized into the pulmonary arteries after a while is not known.

Our study suffers the drawback of a small patient population from which a scientific conclusion is not possible. Pulling back the catheter might have dislodged some portion of the fibrin sheath before the second injection, which we did not have control of. Pulmonary embolization was only assessed with venography and pulmonary scintigraphy was not done. Therefore, it is possible that some clinically silent emboli could have gone unnoticed. This study showed that fibrin sheath formation is a very frequent finding and the sheath around the catheter seems to be firmly attached to the vein wall and does not embolize into the pulmonary arteries upon removal of the catheter.

Conflict of interest statement. None declared.
Serum phosphorus and the risk of progression of chronic kidney disease

Sir,

We read with interest the recent paper by Voormolen et al. [1], describing an association between higher serum phosphorus levels and faster decline in renal function, in 432 patients with advanced chronic kidney disease (CKD). The authors contend that their study is the first to describe such an association in a large number of pre-dialysis CKD patients.

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