

Closed-loop flushing to restore patency of a citrate-locked dialysis catheter obstructed by intraluminal precipitates

Julita Orankiewicz, Dr Bartosz Sadownik
Medical University of Warsaw, II Department of Anaesthesiology and Intensive Care

Introduction

Trisodium citrate is widely used as a locking solution in hemodialysis catheters due to its anticoagulant and antimicrobial properties. Under certain conditions (such as prolonged stagnation, admixture with blood and infused drugs, or pH fluctuations) calcium-citrate complexes may destabilize, resulting in **precipitation and catheter obstruction**.

This may impair catheter function and pose a significant challenge, particularly in patients with limited vascular access.

Case Report

- 35-year-old female admitted to the ICU due to delayed graft function after kidney transplantation
- Required **CRRT**; severely limited vascular access (**DIVA 5**)
- Tunneled dialysis catheter inserted at the right venous angle
- Repeated surgeries → interruption of CRRT; catheter locked with **4% trisodium citrate**

• Why did calcium precipitates form?

- In vivo: citrate is diluted and rapidly metabolized → calcium-citrate complexes remain soluble
- In catheter lumen: high citrate concentration, stagnation, and slow mixing with calcium-rich blood → local supersaturation

Supersaturation → **crystal formation** → intraluminal accumulation → catheter obstruction



Figure 1. Calcium-citrate precipitates within the catheter lumen.

Management Strategy

Two-step approach proposed by the Vascular Access Team:

1. Closed-loop technique

- cautious saline flushing
- performed on a **closed limb**
- short, controlled cycles
- alternating forward-reverse flow

Result:

- **gradual restoration of patency**
- both lumens functional
- CRRT successfully continued.

2. Backup option (if ineffective):

- instillation of acidic solution (e.g. vancomycin)
- chemical dissolution of precipitate.

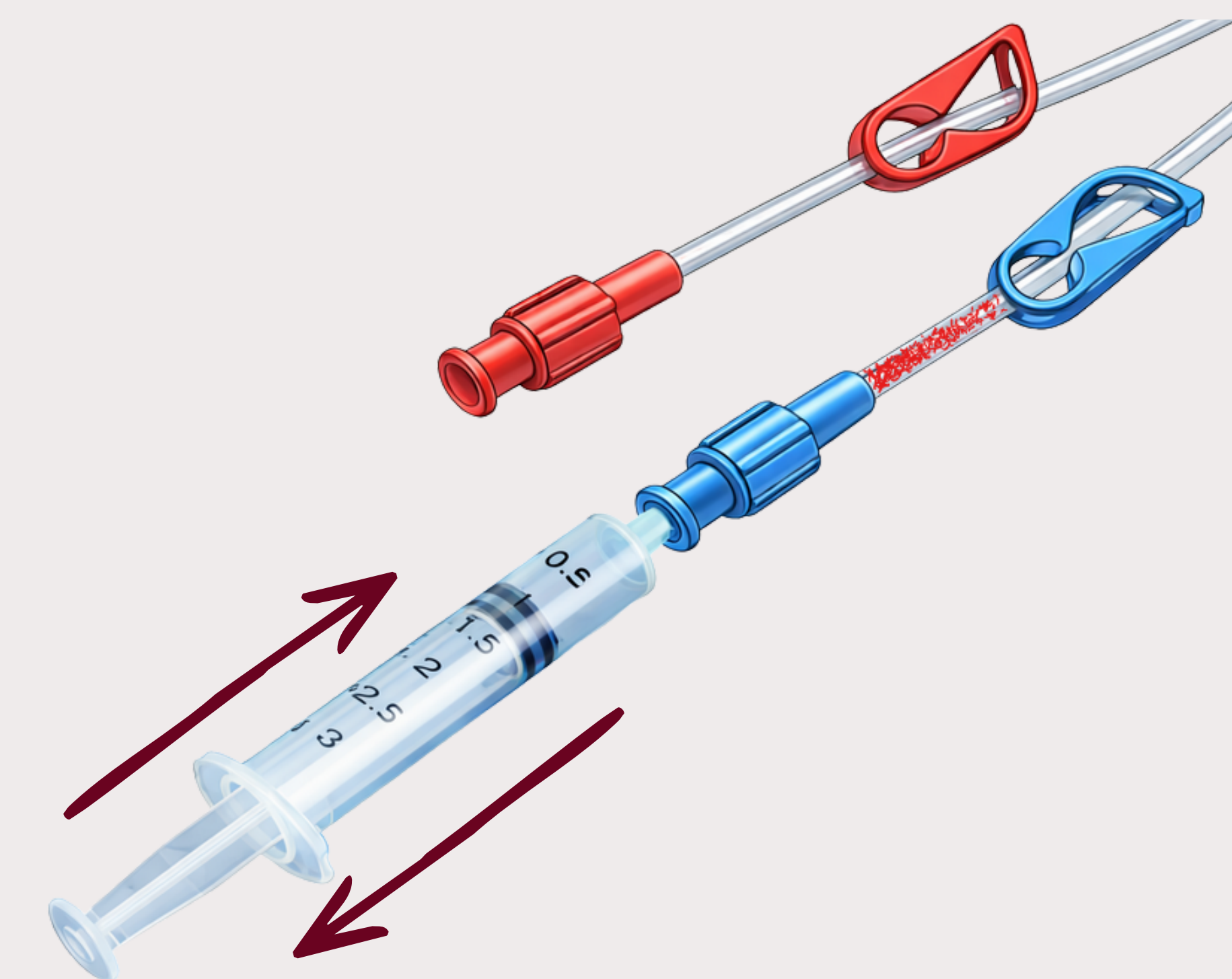


Figure 2. Closed-loop technique: controlled alternating forward-reverse flushing to restore catheter patency.

Conclusion

- Obstructed dialysis catheters do not always require replacement.
- In selected patients, salvage strategies are safe and effective.
- **Closed-loop flushing:**
 - simple
 - reproducible
 - minimally invasive.
- Particularly valuable in patients with limited vascular access.
- Early recognition of precipitation-related obstruction is key.

References

Grudzinski L, Quinan P, Kwok S, Pierratos A. Sodium citrate 4% locking solution for central venous dialysis catheters—an effective, more cost-efficient alternative to heparin. *Nephrol Dial Transplant*. 2007.

Shewdin et al. Systemic ionised calcium after 4% citrate lock. *Anaesth Intensive Care*. 2018.

Consent obtained from the patient. Images were created using ChatGPT.