



Patient Safety Notification

Air embolism associated with removal of Central Venous Access Devices



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The number of serious incidents relating to air embolism associated with the removal of Central Venous Access Devices (CVADs) reported on NIMS over a three-year period.*

**Although these events are rare, they can have catastrophic consequences for the patient and are preventable.*

‘The jugular vascular catheter was removed. The patient deteriorated. An air embolism was confirmed on MRI.’

Brief Summary from NIMS



Examples of factors relating to air embolism associated with removal of CVAD:

- Incorrect positioning of patient
- Inadequate supervision
- Lack of familiarity with task

Date of Issue:

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T +353 (0)1 238 4900

E stateclaims@ntma.ie

W www.stateclaims.ie

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Enhancing prevention of air embolism associated with the removal of Central Venous Access Devices

Air embolism can occur if a patient is incorrectly positioned during the removal of a CVAD. Although these events are rare, they can have catastrophic consequences for the patient and are preventable. Patients that survive an air embolism may have ongoing pulmonary, cardiac, or neurological impairments. The Clinical Risk Unit has noted the occurrence of serious incidents relating to the removal of CVADs and has prepared the following advice, in conjunction with the College of Anaesthesiologists of Ireland. Please note: This advice is based on available best practice guidelines and should be taken in consideration with further recommended reading.

Risk Considerations

A number of risk factors have been identified, which may contribute to an air embolism associated with the removal of CVAD:

- Incorrect positioning of patient prior to removal of CVAD
- Patients with high risk factors e.g. right-to-left shunt anatomy, including patent foramen ovale (PFO), atrial septal defect (ASD)
- Patient not adequately hydrated
- Device (connector and attachment) issues
- Inadequate training / experience in performing the procedure
- Lack of specific air embolism prevention protocols for CVAD insertion, management, and removal in policies and procedures
- Lack of provision of patient information about routine care, to include removal of the device

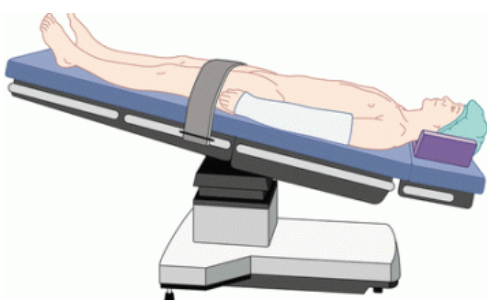


Figure 1: Trendelenburg Position⁵

Advice for Safe Practice

- Ensure **adequate training and supervision** of healthcare professionals managing CVADs
- Treat **hypovolemia and / or dehydration** prior to insertion and removal of the catheter
 - a) Confirm **correct patient positioning** prior to removal of CVAD: **a)** For jugular and subclavian sites, it is preferred to keep the patient in a supine position with their head down or Trendelenburg position (Figure 1) (15° head down)^{4,5} **b)** For the femoral location, the supine position is preferred¹
- Ask the patient to perform the **Valsalva maneuver** upon removal of the CVAD
- Once CVAD is removed, be alert to **signs and symptoms** of air embolism including dyspnoea, hypotension, chest pain, shortness of breath, reduced conscious level / unconsciousness, neurological deficits from transient ischemic attack or stroke and sudden cardiac arrest
- Use **equipment with safety features** that are designed to prevent air embolism e.g. vascular access catheters and caps with self-sealing one-way valves
- **Educate patients and families** on the risks of air embolism and associated complications, signs, and symptoms
- Ensure CVAD **policies and procedures** include prevention, recognition, and management of air embolism

References and further reading:

1. Patient Safety Movement (2020). Actionable Patient Safety Solutions (APSS): Air Embolism. Access [here](#)
2. McCarthy, C.J. et al (2016). 'Air Embolism: Practical Tips for Prevention and Treatment.' *Journal of Clinical Medicine*, 5(93). Access [here](#)
3. Clinical Excellence Commission, (2015). 'Clinical Focus Report: Central Venous Access Devices and Air Embolism'. Access [here](#)
4. Rajaram, S.S. and Dellinger, R.P. (2005). 'Positioning for central venous access'. *Seminars in Anesthesia, Perioperative Medicine & Pain*, 24(4): 211-213. Access [here](#)
5. Chapman, D (2020) 'Trendelenburg Position' Available at: <https://www.nursespost.com/nursing-considerations-trendelenburgs-position>

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