LETTER TO THE EDITOR: PREVENTING AIR EMBOLISM WITH PICC LINE REMOVAL

I read with interest your article “Reducing Risk of Air Embolism Associated with Central Venous Access Devices” in the Pennsylvania Patient Safety Advisory, June 2012. My concern with this document, and many others on the same topic, is that peripherally inserted central venous catheters (PICC lines) are lumped in with subclavian and internal jugular central venous catheters and tunneled catheters, when the risk of air embolism on removal is not at all the same.

In the 40 years since PICC lines have been in use, I cannot find a single report in the literature of an occurrence of air embolism following removal of a PICC line. If you have any instances of this occurring, I would be grateful if you could share this with me and encourage those involved to document these cases in the literature as evidence of the risk.

I work in a “Hospital in the Home” service, providing home infusion therapy, where PICCs are removed on the patient’s last day on the program. The dressing is not changed daily after removal, and the patient does not have to be observed for 30 minutes post removal. Patients are not put in the supine position for PICC removal.

I am finding it hard to justify implementing your recommendations.

I would be interested in your feedback on this issue.

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Editor’s Note

Thank you for your inquiry regarding the risks for air embolism and the steps recommended to prevent air embolism occurrence with PICC line removal. In response, Pennsylvania Patient Safety Authority analysts performed an additional review of the literature and an updated analysis of events reported to the Pennsylvania Patient Safety Reporting System (PA-PSRS) from June 2004 through December 2014. No reports of air embolism occurring with PICC line removal were found in the literature, nor were any such events reported through PA-PSRS.

PICC lines are classified as central venous access devices (CVADs) because their tip lies within a central vein, usually the superior vena cava, where venous pressure is usually lower than atmospheric pressure. This pressure gradient favors the ingress of air. However, the insertion/exit site for a PICC line is in a peripheral vein, where venous pressure is usually higher than atmospheric pressure. This pressure gradient favors the outflow of venous blood and not the ingress of air. If all precautions are taken to maintain a closed system during PICC line removal (i.e., all lumens capped and/or clamped), the potential for air ingress is minimal. Therefore, the CVAD-associated air embolism prevention methods outlined in the Advisory article would not apply to PICC line removal. The Authority thanks you for calling this to our attention and providing us the opportunity to make this clarification.

Authority analysts sought additional input from Bruce Hansel, ECRI Institute, because of his extensive experience investigating catheter-related problems, including air embolism.

External Reviewer Comment

Air embolism is diagnosed based on manifested signs and symptoms. Air embolism may occur with PICC line removal, but the amount of air may be so minimal that it does not produce symptoms. The absence of symptoms is not sufficient to ensure that no air has entered the vessel. However, this discussion centers on symptomatic embolism. Because a PICC line is a central venous catheter, it carries with it the same risk of air embolism while it is in place as other CVADs. However, because it is peripherally inserted, it presents negligible risk of symptomatic air embolism during removal.

In that regard, the precautions suggested in the Advisory article and recommended in the literature for removing CVADs are unwarranted for PICCs for two reasons: (1) the pressure gradient favoring air ingress is much lower at a peripheral site than at a more centrally located CVAD insertion site, and (2) the diameter of a PICC track through the tissue is smaller than that of most CVADs. Furthermore, when removing a peripheral catheter, supine or Trendelenburg is less favorable pressure-wise than a more favorable seated position with the arm at waist level. To prevent air ingress when removing a peripheral intravenous catheter, the exit site needs to be lower than the heart. The same measures used for removing short peripheral intravenous catheters should be applied to PICCs. However, a PICC site may be more likely to bleed after removal because it will have a larger and more mature track through the tissues than a short peripheral intravenous catheter.

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