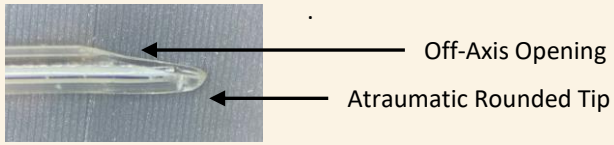
Optimizing Infusate Flow Patterns for Minimizing Vein Wall Trauma: An Exploratory Study with a Modified Off-Axis Catheter Tip Opening

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Purpose/Design

The vein wall is prone to injury during and after the insertion of a peripheral intravenous catheter (PIVC). Trauma arises from contact of the catheter tip with the vein wall and harm is compounded by the delivery of infusates and shear forces resulting in complications. A modified PIVC tip, with an off-axis opening, holds promise in redirecting infusions away from the vein wall and toward regions with heightened flow and hemodilution.



Methods

An exploratory retrospective observational analysis conducted at an E.D. comparing flow patterns of 2 PIVCs:

(10 each) PIVC 1: 1.16" 20g Autogaurd, Becton Dickinson

(18 each) PIVC 2: 1.45" 20g OspreyIV, SkyDance Vascular

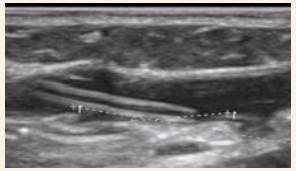
U.S. imaging during flushing were reviewed to determine vein parameters, catheter position, and flow patterns.

Outcomes comes included angle of the infusate leaving the catheter and catheter tip direction (position)

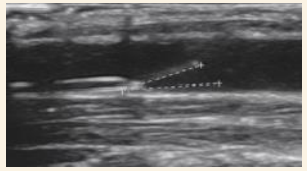
Results

Catheter tip direction was posterior towards the vein wall in 60.0% in PIVC 1 compared to just 11.1% in PIVC 2 (P=0.018). Angle of infusates flow away from the vein wall was 0.20 degrees (SD 0.63) in PIVC 1 and 7.61 degrees (SD 5.71) in PIVC 2 (P<0.001). The angle of infusates flow was 0 degrees in 90% of PIVC 1 compared to just 16.7% in PIVC 2 (P<0.001).

PIVC 1: Autogaurd



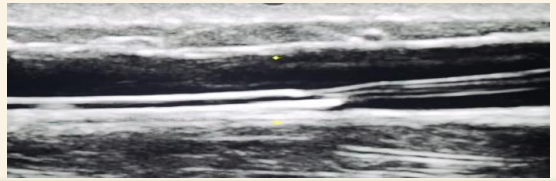
PIVC 2: OspreyIV



Conclusion

In this exploratory investigation, a PIVC with an off-axis aperture of the tip demonstrated a more acute angle of infusates flowing away from the vein wall than a traditional device with a central opening.

Shifting flow away from the vein wall may reduce mechanical insults to the vein and reduce complications.



Limitations

This study was conducted as part of a quality improvement project. While PIVCs were evaluated using a standard sonographic approach, there was no randomization or blinding and a small number of cases.

Second, while there are theoretical advantages of an off-axis aperature, the downstream complications of catheters were not assessed.

Finally, the US flow patterns assessed during flushing might not directly translate to the administration of other infusates, especially those administered at slower rates.