

Factors influencing peripheral venous catheter longevity: flushing technique, syringe volume, and intraluminal pressure.

An in vitro observational study

Introduction

Proper flushing of peripheral venous catheters (PVCs) is vital for maintaining patency, ensuring device longevity, and preventing complications. International guidelines recommend 10 mL syringes to minimize intraluminal pressure and the pulsatile (push-pause) technique to create turbulence for debris removal. This study evaluated the relationship between syringe choice and resulting intraluminal pressure, and whether prior training influences these clinical behaviors.

Methodology

An in vitro study involved 97 participants (nurses, physicians, and students). Participants were asked to flush a standard PVC under simulated clinical conditions using 0.9% NaCl. Different styles and sizes of syringes were offered. Syringe volume and flushing technique were recorded. Intraluminal pressure was measured in real time via a concealed sensor to minimize observation bias (Hawthorne effect). Data were analyzed to explore associations between choices and outcomes and to assess the impact of prior professional training.

Results

Analysis revealed a direct association between equipment choice and safety-related parameters. While 87% (n=84) selected a 10 mL syringe, 13% (n=13) used 2–5 mL syringes, which were associated with higher median pressures. Prior training (49.5%) was significantly associated with correct syringe choice but did not show a significant association with pressure management or flushing technique. Only 5.2% (n=5) utilized the pulsatile method, and 2.1% (n=2) used a “mixed” technique. The highest recorded peak pressure reached 25.0 psi and was predominantly observed among less experienced participants.

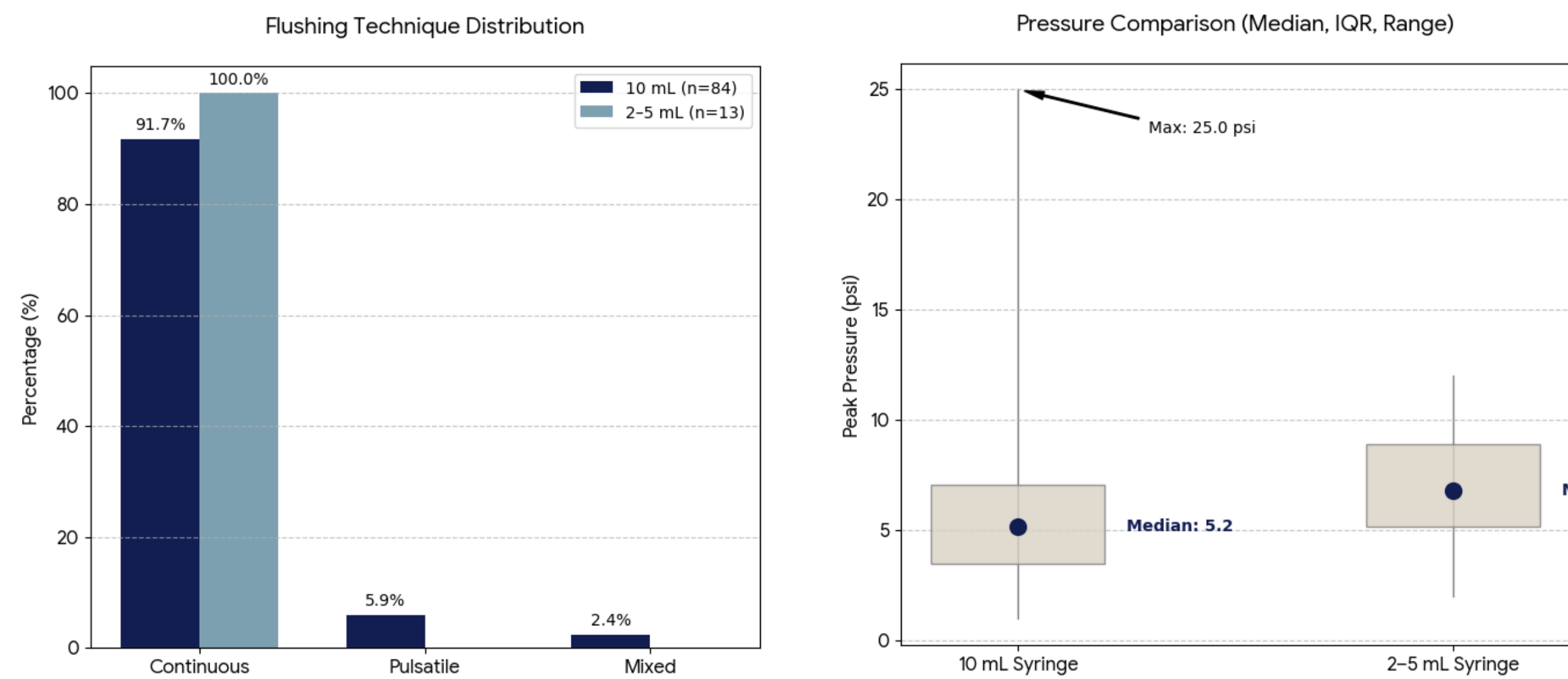


Table 1. Distribution of flushing parameters and recorded pressures (n=97)

Parameter	10 mL Syringe (n=84)	2–5 mL Syringe (n=13)	Total (n=97)
Flushing Technique			
- Continuous (Laminar)	77 (91.7%)	13 (100%)	90 (92.8%)
- Pulsatile (Push-Pause)	5 (5.9%)	0 (0%)	5 (5.1%)
- Mixed	2 (2.4%)	0 (0%)	2 (2.1%)
Peak Pressure (psi)			
- Median (Range)	5.2 (1.0–25.0)	6.8 (2.0–12.0)	5.4 (1.0–25.0)
- IQR (25th–75th)	(3.5–7.1)	(5.2–8.9)	(3.8–7.5)

Conclusion

While adherence to the 10 mL syringe recommendation is high, a substantial gap remains in the application of pulsatile flushing skills. Training appears to improve equipment selection but does not consistently translate into safe pressure control, as reflected by high peak pressure readings (up to 25.0 psi).

A limitation of this study was the lack of data on positive-pressure technique during disconnection; future research should incorporate this parameter for a more comprehensive assessment. These findings support a shift toward simulation-based training emphasizing flushing dynamics to improve catheter longevity and patient safety.

