

Peripheral intravenous catheter insertions comparing capillary, notched, and grooved needle flashback designs (Original Research)

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Purpose/Design

Peripheral IV catheters (PIVCs) are used in over 90% of hospitalized patients, yet first-attempt success remains low. Multiple attempts increase complications, costs, and patient dissatisfaction. This study evaluates newer flashback needle technologies to determine their impact on first-stick success and overall insertion performance compared to existing catheter designs.

Methods

This two-phase study evaluated four PIVC designs. In Phase One, experienced nurses performed 12 simulated insertions, analyzed via video for first-stick success. Phase Two surveyed nurses and purchasing agents to assess insertion materials, definitions of success, and the costs of first-attempt failure. All data were anonymized and ethically reviewed.

Results

In 192 simulated insertions, grooved needle flashback catheters with thin-tipped bevels had the highest success and lowest double punctures. Nurses often misjudged insertion success. Survey data showed high confidence despite frequent failures. Repeated attempts added estimated cost over \$35,000 annually in supply and labor per nurse.

Perception Vs Reality Table

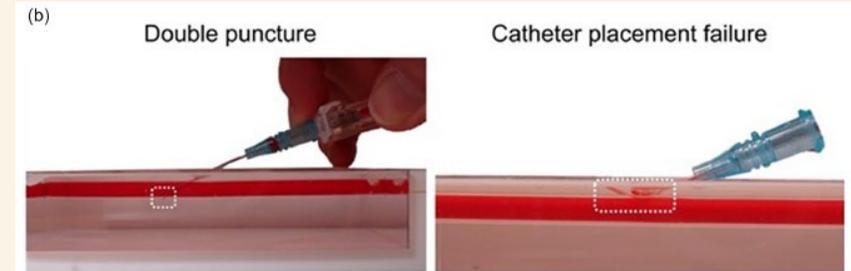
	Event	Capillary	Notched	Grooved	Grooved + Thin Bevel	Total
1	Double puncture	7 (15%)	5 (10%)	2 (4%)	3 (6%)	17 (9%)
2	Misconception	6 (86%)	3 (60%)	2 (100%)	3 (100%)	14 (82%)
3	Catheter failure	5 (10%)	6 (13%)	4 (8%)	0 (0%)	15 (8%)
4	Misconception	3 (60%)	4 (67%)	2 (50%)	0 (0%)	9 (60%)
5	Catheter success	36 (75%)	37 (77%)	42 (88%)	45 (94%)	160 (83%)
6	Misconception	3 (8%)	7 (19%)	6 (14%)	5 (11%)	21 (13%)

Disclosures/IRB

The study followed ethical guidelines from the American Association for Public Opinion Research and was exempt from IRB review under DHHS regulations, as it involved unregulated behavioral observation and met federal criteria for human subject research exemptions. NM is an employee of PICC Excellence receiving research funding from Terumo Medical Corporation.

Limitations

This small, simulation-based study used a convenience sample, limiting generalizability. Findings may be influenced by selection bias and the Hawthorne effect. Although independently conducted, manufacturer sponsorship is noted. Larger, real-world studies are needed to validate these results.



Conclusion

PIVC success is influenced by needle design and flashback visibility. This study showed that grooved flashback technology with a thin-tipped bevel significantly improved first-stick success (94%) with zero failures. These findings suggest potential clinical and economic benefits from adopting enhanced flashback needle designs in practice.