An Observational Comparative Effectiveness Study of a Breakaway Device in Pediatic and Adult Peripheral Venous Access

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Introduction

Peripheral intravenous catheters (PIVCs) are essential in both pediatric and adult care, yet nearly half fail before therapy completion due to mechanical complications such as dislodgement, infiltration, and phlebitis. These failures interrupt therapy, increase costs and workload, and cause distress for patients and families. Breakaway devices address this by intentionally separating when a damaging force is place on the line; upon separation, valves close to prevent fluid loss, pump alarms are triggered, and prompt clinical response is enabled without catheter replacement. Despite their potential to reduce mechanical complications, evidence across adult and pediatric populations remains limited.

Breakaway device Figure 1

Methods

This pre–post observational clinical and economic study was conducted across three inpatient units at a 300-bed community hospital, from October–December 2025. Eligible patients were ≥2 weeks of age with a peripheral IV receiving continuous infusion. Unit nurses applied the breakaway device (SafeBreak, Lineus Medical) to enrolled patients. Outcomes for the intervention cohort (n=161) were compared to a retrospective control cohort (n=470) from the same units (December 2024–February 2025).

The primary endpoint was IV complication rate; secondary endpoints included device separation events, nursing time, hospital length of stay, and cost avoidance. Group differences were assessed using two-proportion z-tests with chi-square confirmation; complication subtypes were summarized descriptively. Economic outcomes were evaluated from the hospital perspective using IV restart supply costs, with net cost avoidance calculated after device acquisition costs.

Results

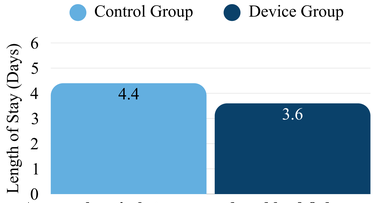
Control (n=470) and intervention (n=161) cohorts were analyzed (pediatric age n = 39, 24.2%), with similar baseline characteristics. The primary outcome showed IV complication rates of 48.7% in the control cohort versus 4.3% in the intervention cohort, representing a 91.2% relative reduction. Secondary outcomes included 32 device separations (19.9%), with catheter integrity preserved in all cases. Mean replacement time for the breakaway device (5.13) was 23 minutes shorter than IV restart (28.2 minutes), resulting in more than 80 nursing hours saved. Mean catheter dwell time in the device group was 3.1 days compared to 2.9 days in the control group, reflecting a 0.2 increase (6.9% increase). Active infusions were present in 27 separation events, with no medication waste reported. Gross cost savings were approximately $1.02M, with net hard cost avoidance of ~$905,901 after device costs. Nurse satisfaction was high (9.6/10 overall; 9.9/10 following separation events).

Results

Summary of IV Complication

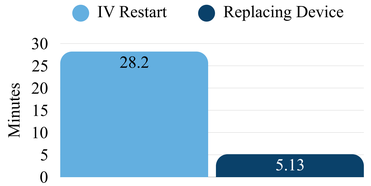
Complication Type	Control Group (n = 470)	Device Group (n = 161)	Complication Rate Reduction
Dislodgement	54 (11.5%)	4 (2.5%)	**78.30%**
Infiltration	104 (22.1%)	1 (0.6%)	**97.30%**
Phlebitis	19 (4.0%)	2 (1.2%)	**70.00%**
Leaking	106 (22.6%)	0 (0.0%)	**100%**
Any complication	**229 (48.7%)**	**7 (4.3%)**	**91.20%**

Average Length of Stay



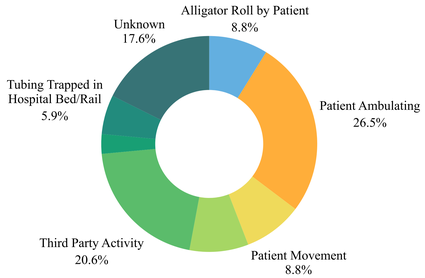
Average hospital stay was reduced by 0.8 days.

IV Restart and Device Replacement Times



Time to replace a device was 23 minutes less than the time to perform an IV restart

Cause of Separation of Breakaway Device



Projected Annual Cost-Benefit Analysis

Facility size	278 beds
Estimated annual peripheral IVs placed	17,237
Historical complication rate	48.70%
Cost per complication at facility	$124
Annual cost of IV complications (baseline)	$1,051,852
Total annual device cost (20,799 units at $5.50)	$114,395
Device complication reduction	91.20%
Gross savings (without device expense)	$1,020,296
Net projected annual savings (with device expense)	$905,901

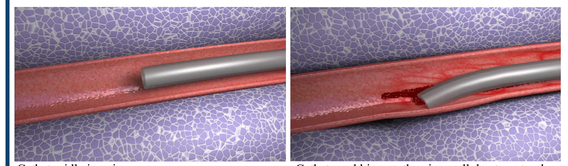
Conclusion

Implementation of the breakaway device was associated with a 91.2% reduction in IV complications versus historical controls ($p<0.001$). Catheter integrity was preserved in 100% of separation events, with no IV restarts or medication waste reported. These clinical benefits were accompanied by a 0.8-day reduction in hospital length of stay, approximately 23 minutes of nursing time saved per separation event, and an annualized net cost savings of 905,901. Collectively, these findings support breakaway devices as both a clinically effective and economically sound strategy in vascular access care.

Discussion

This is the first evaluation of breakaway technology in peripheral IVs across both pediatric and adult populations. Mechanical forces transmitted to the catheter tip contribute not only to dislodgement but also to complications such as phlebitis and infiltration. The observed separation rate of 19.9% exceeded prior adult randomized data (16.7%), likely reflecting reduced line awareness in pediatric patients. The control complication rate (~46%) is consistent with published meta-analytic estimates. Nursing satisfaction was high for both placement and post-separation replacement, supporting feasibility and scalability. Limitations include a single-center design and use of a retrospective control. Reduced IV complications and shorter length of stay translated into meaningful cost savings, with direct implications for patient outcomes and operational efficiency. These findings support consideration of breakaway devices as a systems-level intervention in vascular access, warranting further study to define their role in best practices.

IV Catheter Idle vs. Line with Force Figure 2



Catheter idle in vein

Catheter rubbing on the vien wall due to extrnal force

1. Helm, R.E., et al., Accepted but Unacceptable: Peripheral IV Catheter Failure. Journal of Infusion Nursing. 2016; 38(3): 189-203.
2. Panza, G., Steere, L. and Steinberg, A. (2022) 'A new force-activated separation device for the prevention of peripheral intravenous restarts', Journal of Infusion Nursing, 45(2), pp.74–80.