

The influence and efficacy of Catheter to Vein Ratio (CVR) technology on the incidence of deep vein thrombosis (DVT) for Peripherally Inserted Central Catheters (PICCs).

Megan Nicholas, Clinical Nurse, Infectious Diseases Unit, Royal Brisbane and Women's Hospital.

Peter Groom, Nurse Unit Manager, Infectious Diseases Unit, Royal Brisbane and Women's Hospital.

Stacey Llewellyn, Biostatistician, QIMR Berghofer Medical Research Institute.



Introduction:

- In September 2017, at the Royal Brisbane and Women's Hospital, the Infectious Diseases Day Therapy Unit introduced innovative technology which included a catheter-to-vein-ratio (CVR) tool that enable the proceduralist to determine the vein diameter and the percentage that the catheter inhabits.
- Sharp et al.[1] have demonstrated PICCs inserted into veins with CVR >45% were 13 times more likely to develop deep vein thrombosis (DVT). After the introduction of the CVR tool with new technology the unit adopted the CVR directive ($\leq 45\%$) to align with best practice in the reduction of DVTs.
- The objective of this research is to determine the efficacy and influence of ultrasound with CVR technology; on DVT rates with a comparison to previous practices in the unit.

Method:

- Retrospective observational comparative data analysis of excel database.
- A logistic mixed effect model was used to assess the association of study period (pre and post CVR technology implementation) on the incidence of developing a DVT.

PICC Insertion: Associations between PICC insertion characteristics and DVT incidence

	Overall	No DVT	DVT	p-value
	n=2,603	n=2,560	n=43	
Period, n (%)				0.002
Pre	1,273 (48.9%)	1,262 (49.3%)	11 (25.6%)	
Post	1,330 (51.1%)	1,298 (50.7%)	32 (74.4%)	
PICC Type (n=2,587), n (%)				0.046
Dual lumen	1,229 (47.5%)	1,202 (47.2%)	27 (62.8%)	
Single lumen	1,358 (52.5%)	1,342 (52.8%)	16 (37.2%)	

Results:

- **74.4%** of all DVTs occurred in the post-intervention period. The DVT incidence was significantly higher in the post-intervention period with incidence of **2.41%** (95% CI: 1.65 – 3.38%), compared to the pre-intervention period with incidence of **0.86%** (95% CI: 0.43 -1.54%).
- Higher Incidence of DVT was found for Dual lumen PICC (62.8%) than a Single lumen PICC (37.2%, $p=0.046$),
- A higher proportion of patients who developed DVT had more than one PICC insertion than those patients who did not develop a DVT (31.7% vs. 13.9%), ($p=0.005$).
- No statistical difference in the length of dwell between the pre 17.0 (8.0-36.0) and post-intervention period 16.0 (8.0-37.0)($p=0.66$).

Conclusion:

- The analysis of data found the results to be inconsistent with current research and literature in the influence and efficacy of CVR technology in the reduction of DVT rates. These results direct the author to further analysis and research to understand the significance of the findings.
- The data substantiated the repeated findings that the gauge of the catheter can influence the risk of DVT.[1]
- Analysis indicated more than one PICC insertion increases risk of DVT 2-fold.
- Confounding factors may play a significant role in the unexpected results. Vessel selection, malignancy, history of DVT, serious illness and comorbidities have all been found to increase the risk of DVT [2, 3]. Additionally, changes in best practice and management of DVT over the 4-year period may have influenced the reason for removal and thus the data results. Finally, the exclusion of patients from the database that had been discharged or transferred to another facility (with the PICC insitu) may have impacted the data analysis.

Implications:

- A more complete and extensive analysis of the data is required to determine the prevalence and significance of the patient cohorts on the incidence of DVT.
- Further research is required on the incidence of DVT and the influence of CVR technology, and the optimal percentage ratio for reduction in DVT rates.

References

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