A Change In Direction For Haemodialysis Access?

Catheter Survival In Antegrade Vs Retrograde Tunnelled Haemodialysis Catheters (THDCs)

Lachlan White[1], Mahmoud Amer[2]

[1]University of Auckland Medical School, Auckland, New Zealand.
- Email: lwhi235@aucklanduni.ac.nz
- With thanks to Prof. Janak de Zoysa and Dr Zhengiang Wu for their support

[2]Te Whatu Ora/Health New Zealand, Taranaki, New Zealand
- Email: mahmoud.amer@tdhb.org.nz



Background (*Novel research*)

AV fistula is the preferred HD access, but often not feasible

- THDCs often used as temporary 'bridging' vascular access due to immediate usage, however have higher rates of dysfunction, infection and other complications (1,2)
- In 2024, 83% of patients started dialysis in Australia/NZ with a central venous catheter (3)

Catheter longevity is important - multiple THDCs reduces future vascular access options (4)

Two THDC types - antegrade and retrograde. Lack of comparative data for outcomes between types.

Retrograde catheters theoretically have multiple advantages over antegrade catheters, including more accurate tip positioning (references)

- Catheter tip position in the right atrium (RA) or cavoatrial junction (CAJ) is associated with reduced risk of dysfunction compared to tip position in the superior vena cava (SVC) (5,6)

Aim

To assess whether THDC type (antegrade vs retrograde) is associated with catheter survival

Hypothesis

Retrograde THDCs have longer catheter survival (due to better tip positioning)



Taranaki Region, New Zealand
Population: 130,300 (2025)

Methods

199 THDCs inserted at Taranaki Base Hospital between 1 May 2010 and 24 November 2025

→ **51 Antegrade THDCs**

→ **148 Retrograde THDCs**

48 additional THDCs in database excluded*

Exclusion criteria
- Age <18 years
- THDC inserted elsewhere
- THDC type unable to be determined radiologically

Retrospective audit:
Demographic, catheter-specific and follow-up data for each insertion collected

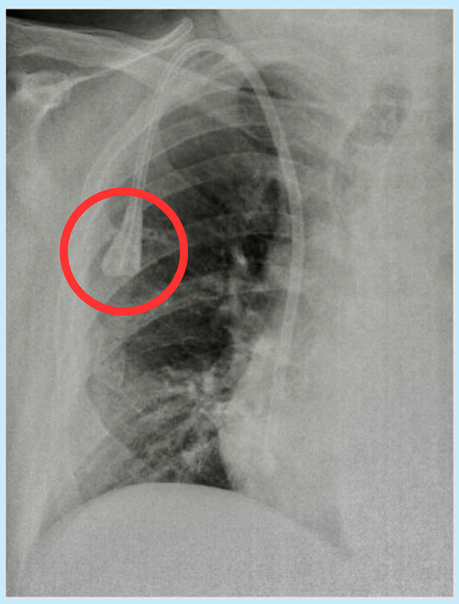
Primary outcome:
Catheter survival (*time from insertion until removal due to dysfunction*)

Statistical analysis

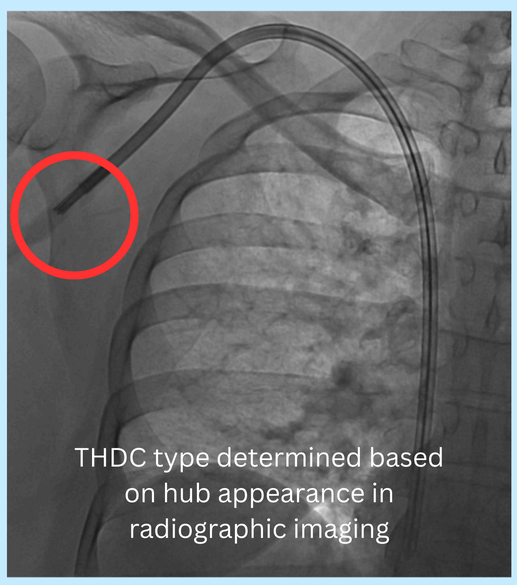
Overall median survival
- *Uncensored, unadjusted*

Kaplan-Meier analysis + log-rank test
- *Censored for removal reasons other than dysfunction, unadjusted*

Cox proportional hazards model
- *Censored, adjusted for demographic and catheter-specific variables*



Antegrade



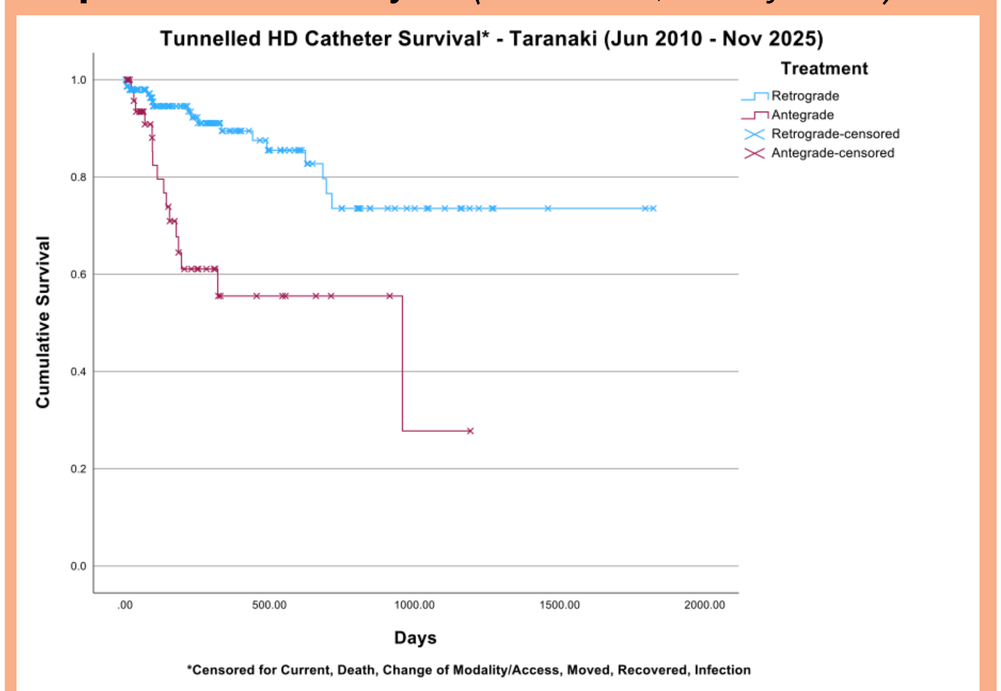
Retrograde

Primary Results

Overall median survival *(uncensored, unadjusted)*

	Antegrade (n=51)	Retrograde (n=148)	p value
Median survival (IQR)	147 (56-306)	248.5 (93-537)	0.012

Kaplan-Meier analysis *(censored, unadjusted)*



Log-rank test: p<0.01

Cox proportional hazards model *(censored, adjusted)*

- **Catheter type (Retrograde vs Antegrade):**
  - **HR = 2.74 (95% CI 0.70-10.70), p=0.15**

Secondary Results

Cox proportional hazards model

- Exchange Type (New Puncture vs Railroad):
  - HR = 3.08 (95% CI 1.14-8.32), p=0.027
- Tip Position (Right Atrium vs Superior Vena Cava):
  - HR = 14.76 (95% CI 1.89-115.44), p=0.01

Dialysis adequacy

- Mean URR:
  - Retrograde: 65.4% vs Antegrade 56.8%, p<0.01

Safety

- Infection rates:
  - Retrograde: 8.1% vs Antegrade 7.8%, p=1.00
- 30-day mortality:
  - Retrograde: 4.7% vs Antegrade 2.0%, p=0.68

Demographic and catheter-specific variables

Antegrade and retrograde groups differed significantly in:
- Age
- Ethnicity
- Insertion site
- Indication
- Previous vascular access
- Fluoroscopy use
- Proceduralist type

Hence, importance of adjustment

Conclusions

Antegrade THDCs demonstrated shorter observed catheter survival than retrograde THDCs, however this association was not statistically significant after multivariable adjustment

SVC tip position and railroad exchange were associated with increased dysfunction

Retrograde THDCs demonstrated higher mean URR than antegrade THDCs

No significant difference in infection or 30-day mortality between catheter types

Discussion

Study likely underpowered to detect significant difference in primary outcome

Wide CIs reflect limited precision in effect size

Similar distribution of exchange type and tip position between THDC types
- Independent predictors of catheter survival

Tip position known to be most important factor influencing dialysis adequacy (7)
- **Similar distribution of tip position between THDC types suggests this result unlikely to be due to tip position alone**

Implications

Though this is the largest study to date, evidence remains equivocal

Larger multi-centre or registry-based studies could provide sample size needed to clarify comparative outcomes

Retrograde insertion may be considered in select patients anticipated to require prolonged THDC use

Nephrology training programmes should maintain competency in both techniques

References

1) Abdelfattah M, Mohamed E, Kader A, Abbas R, Shorbgy M. Comparative Study between Arteriovenous Fistula and Tunneled Hemodialysis Catheter in Dialysis Efficiency. Al-Azhar Int Med J. 2024 Oct 31;5.
2) Fry AC, Stratton J, Farrington K, Mahna K, Selvakumar S, Thompson H, et al. Factors affecting long-term survival of tunnelled haemodialysis catheters—a prospective audit of 812 tunnelled catheters. Nephrol Dial Transplant. 2008 Jan 1;23(1):275–81.
3) Richards K, Davies C, Bateman S, Chen J, Clayton P, Forcey D, et al. 48th Report, Chapter 9 [Internet]. Adelaide, Australia: Australia and New Zealand Dialysis and Transplant Registry; 2025.
4) Adwaney A, Lim C, Blakey S, Duncan N, Ashby DR. Central Venous Stenosis, Access Outcome and Survival in Patients undergoing Maintenance Hemodialysis. Clin J Am Soc Nephrol CJASN. 2019 Mar 7;14(3):378–84.
5) Engstrom BI, Horvath JJ, Stewart JK, Sydnor RH, Miller MJ, Smith TP, et al. Tunneled Internal Jugular Hemodialysis Catheters: Impact of Laterality and Tip Position on Catheter Dysfunction and Infection Rates. J Vasc Interv Radiol. 2013 Sep;24(9):1295–302.
6) Sohail MA, Vachharajani TJ, Anvari E. Central Venous Catheters for Hemodialysis—the Myth and the Evidence. Kidney Int Rep. 2021 Oct 11;6(12):2958–68.
7) Iman Y, Bamforth R, Ewhrudjakpor R, Komenda P, Gorbe K, Whitlock R, et al. The impact of dialysate flow rate on haemodialysis adequacy: a systematic review and meta-analysis. Clin Kidney J. 2024 Jul 1;17(7):sfae163.