Correlating Deep Vein Thrombosis in Femoral and Below Segments to Venous Leg Ulcer Incidence: Insights from a Retrospective Analysis

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Background

Edema and skin changes

Eberhardt and Raffetto,Circ, 2005.

Venous leg ulcer

Mouawad, JVS Cases Innovations and Techniques, 2022.

- **Post –thrombotic syndrome (PTS) occurs in up to 50% of patients** following acute DVT[1]
- **Venous leg ulcers (VLUs)** occur in up to 20% of CVD patients, with **more aggressive presentation in those with PTS**[2-3]
- Estimates suggest 70 – 80% of leg ulcers stem from deep venous disease, with **VLU wound care totaling nearly $5B annually in the US**[4-6]
- **Despite high PTS rates, anticoagulation (AC) is the standard of care for DVT**, as new advanced therapies have yet to show benefit over AC[7-10]
- **Advanced therapies are only recently recommended for use in select, iliofemoral DVT** .[11-13]
- **We evaluate initial thrombus locations in DVT-related VLU patients and estimate long-term costs in a hypothetical model.**

Methods

1. **The retrospective cohort consists of VLU patients identified to have a preceding DVT** event by ICD-10-CM codes, imaging, and chart review
   - Median initial DVT event occurred 07/2020 (IQR: 06/2018 – 01/2022)
   - Median time to VLU onset was 466 days (IQR: 51-1190)
2. **The model estimates costs** in a hypothetical cohort of 100 patients progressing **from initial DVT through long-term VLU care**
   - Inputs derived from published literature
   - Costs estimated based on expected health status across three phases of disease progression
   - All-cause mortality is accounted for at each model step
   - Treatment effectiveness at avoiding VLUs is unknown and treated as a variable

Results

Retrospective cohort data

Aim 1: We retrospectively analyze the anatomic location of preceding DVT events in current VLU patients at our single, high-volume center.

*Thrombus location at initial DVT event in **N=73** patients that later developed VLUs*

Disease Characteristic	N (%)
DVT side	
Bilateral	20 (27.4)
Left	30 (41.1)
Right	23 (31.5)
DVT location	
Ilio-fem-pop	4 (5.5)
Isolated fem-pop	**43 (58.9)**
Fem-pop-below-the-knee	**11 (15.1)**
Isolated below-the-knee	15 (20.5)
Venous segment involvement	
Iliac	4 (5.5)
Common femoral	31 (42.5)
Superficial femoral	34 (46.6)
Popliteal	45 (61.6)
Gastrocnemius	2 (2.7)
Tibial-peroneal trunk	1 (1.4)
Soleal	2 (2.7)
Posterior Tibial	6 (8.2)
Peroneal	2 (2.7)

Long-term economic model

Aim 2: We model and estimate the long-term costs associated with **ACs or advanced therapy (ADV)** at the initial DVT event in a hypothetical patient cohort (n=100).

Model design

Phase 0. Initial DVT event

VLU manifestation

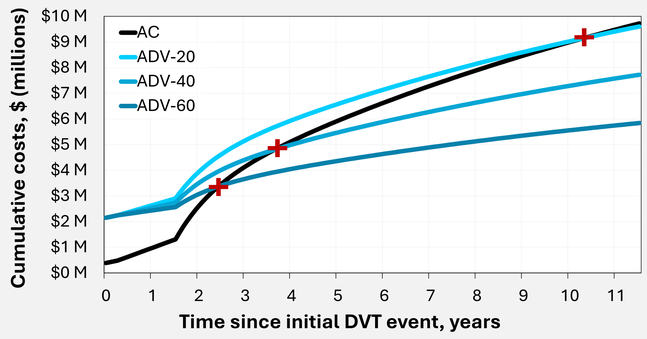
Disease Progression	Modeled costs
Phase 1. 3 months *AC regimen*	**1.** Hospitalization and DVT treatment **2.** 3-month AC regimen
Phase 2. 15 months *Period of Worsening CVD*	**1.** Continued AC **2.** Compression **3.** Rehospitalization
Phase 3. 10 years *Long-term VLU wound care*	**Markov state model,** *with monthly iterations* **1.** Static VLU **2.** Healed VLU **3.** Recurrence

Model assumptions

Phase 0	Patients are at high-risk for worsening CVD and VLU
Phase 1	Initial DVT is treated with AC or advanced therapy (ADV)
Phase 1	A 3-month AC regimen follows initial DVT treatment
Phase 2	A portion of patients treated with ADV will require no further care following Phase 1
Phase 2	Remaining patients enter a period of worsening CVD
Phase 3	At the end of Phase 2, remaining patients develop a VLU and enter wound care for a 10-year period

Estimated long-term costs with AC or Advanced therapy in 100 patients

Estimated costs of DVT and subsequent VLU



If ADV is 20% effective at avoiding VLUs:
- Cost beneficial by 10.3 years
- Costs $118k less at model completion

If ADV is 40% effective at avoiding VLUs:
- Cost beneficial by 3.7 years
- Costs ~$2M less at model completion

If ADV is 60% effective at avoiding VLUs:
- Cost beneficial by 2.5 years
- Costs ~$3.9M less at model completion

Conclusions

- DVT-related VLUs at our center **commonly exhibit significant thrombus involvement in femoral or lower veins** at time of DVT
- Timely and effective DVT treatment could curb the extensive costs linked to long-term CVD-related complications

Results emphasize the need for the community to:

1. Identify a method to properly select DVT patients at high-risk for chronic complications like PTS and VLUs
2. Establish advanced DVT treatment methods that are proven to effectively reduce risk of CVD progression

[1]Kahn et al., Ann Int Med, 2008. [2]Gloviczki and Yao, AVF Guidelines, 1996. [3]Labropoulos et al., JVS, 2008. [4]Berggvist et al., JVS, 1999. [5]Nelson and Adderley, BMJ Clin Evid, 2016. [6]Kolluri et al., Vasc Med, 2021. [7]Jaff et al., Circ, 2011. [8]Mazzolai et al., Euro Heart J, 2018. [9]Ortel et al., Blood Advances, 2020. [10]Stevens et al., CHEST, 2021. [11]Vedantham et al., JVIR, 2023. [12]Douketis et al., Am J Med, 2001. [13]Yamaki et al., EJVES, 2011.

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