Socioeconomic Risks in Patients with Major Amputation Following Catheter Directed Thrombolysis for Acute Limb Ischemia: A Ten Year Single Institution Review

Aldaher, Z. DO, Karesh, E., Dhiman, A. MBBS, Mohsin, N. MD, Agarwal, G. MBBS, Soo Hoo, A.J. MD, El Shazly, O. MD, Jordan, W. MD, and Ierardi, R. MD

Medical College of Georgia at Augusta University, Department of Surgery, Division of Vascular and Endovascular Surgery

Disclosures

No disclosures to report 

Acute Limb Ischemia

- Vascular emergency caused by sudden arterial occlusion
- Incidence: **1-1.5 per 10,000 persons annually**
- Associated with high **morbidity** and **mortality**
- **Major amputation** rates reported between **10-30% at 1 year**

TABLE 1. RUTHERFORD CLASSIFICATION OF ACUTE LIMB ISCHEMIA

Rutherford Class	Sensory Impairment	Motor Impairment	Doppler Signals
Class 1 (No immediate threat)	None	None	Arterial: audible Venous: audible
Class 2a (Marginally threatened)	Minimal	None	Arterial: audible Venous: audible
Class 2b (Immediately threatened)	Involves forefoot with possible rest pain	Mild to moderate	Arterial: absent Venous: present
Class 3 (Irreversible ischemia)	Insensate	Severe, rigorous	Arterial: absent Venous: absent

Adapted from Gunawansa N. Atraumatic acute limb ischemia: clinical presentation, classification, assessment and management- a review. Int J Vasc Surg Med. 2017;3:046-052. doi: 10.17352/2455-5452.000029

Olinic DM et al. Acute Limb Ischemia: An Update on Diagnosis and Management. *J Clin Med.* 2019;8:1215.

Catheter Directed Thrombolysis for ALI

- **Catheter Directed Thrombolysis (CDT)** is a safe and effective alternative to open interventions for ALI (STILE, TOPAS and Rochester trials)
  - Similar limb salvage rate with less morbidity (75% amputation free survival at 6 months)
  - New and emerging technologies
  - Despite advances, limb loss remains common (10-30% w/n 1yr)
- Initial review: limited studies comparing Ultrasound Enhanced-CDT vs. Standard-CDT
- **Predictors of limb loss following CDT remain poorly defined**

Chait J et al. Ultrasound-accelerated vs multi-hole catheter-directed thrombolysis for acute limb ischemia. *Vasc Endovascular Surg.* 2019.
Ouriel K et al. Recombinant urokinase vs vascular surgery for acute arterial occlusion of the legs. *N Engl J Med.* 1998.

Socioeconomic Disparities in PAD

Prior studies demonstrate:

- Higher amputation rates in patients with greater neighborhood deprivation
  - Arya et al. –12% increased risk of major amputation in PAD as well as 37% higher amputation among AA
- **Limited access** to vascular care associated with **increased limb loss**
- **Socioeconomic status** strongly influences PAD outcomes
  - Henry et al- minorities, higher Area Deprivation Index (ADI), Medicaid status increased risk of amputation

Arya S et al. Race and socioeconomic status independently affect major amputation risk in PAD. *J Am Heart Assoc.* 2018.
Henry AJ et al. Socioeconomic and hospital predictors of amputation in CLI. *J Vasc Surg.* 2011.

Area Deprivation Index

Composite measure of neighborhood socioeconomic disadvantage

Includes:

Income

Education

Housing

Employment

Increasingly used to evaluate health disparities and surgical outcomes

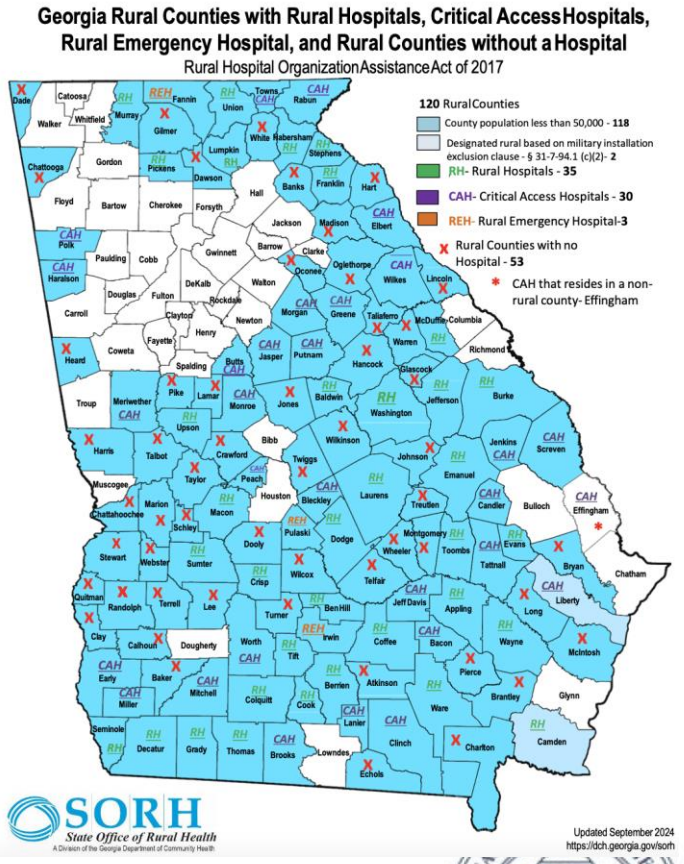
Kind AJH et al. Neighborhood socioeconomic disadvantage and 30-day rehospitalization. *Ann Intern Med.* 2014.

Study Objective

Wellstar at Medical College of Georgia Serves as level 1 tertiary referral center

- **Primary institution of care within 100 mile radius**

To evaluate **socioeconomic and clinical predictors of major amputation** in patients undergoing CDT for acute limb ischemia.



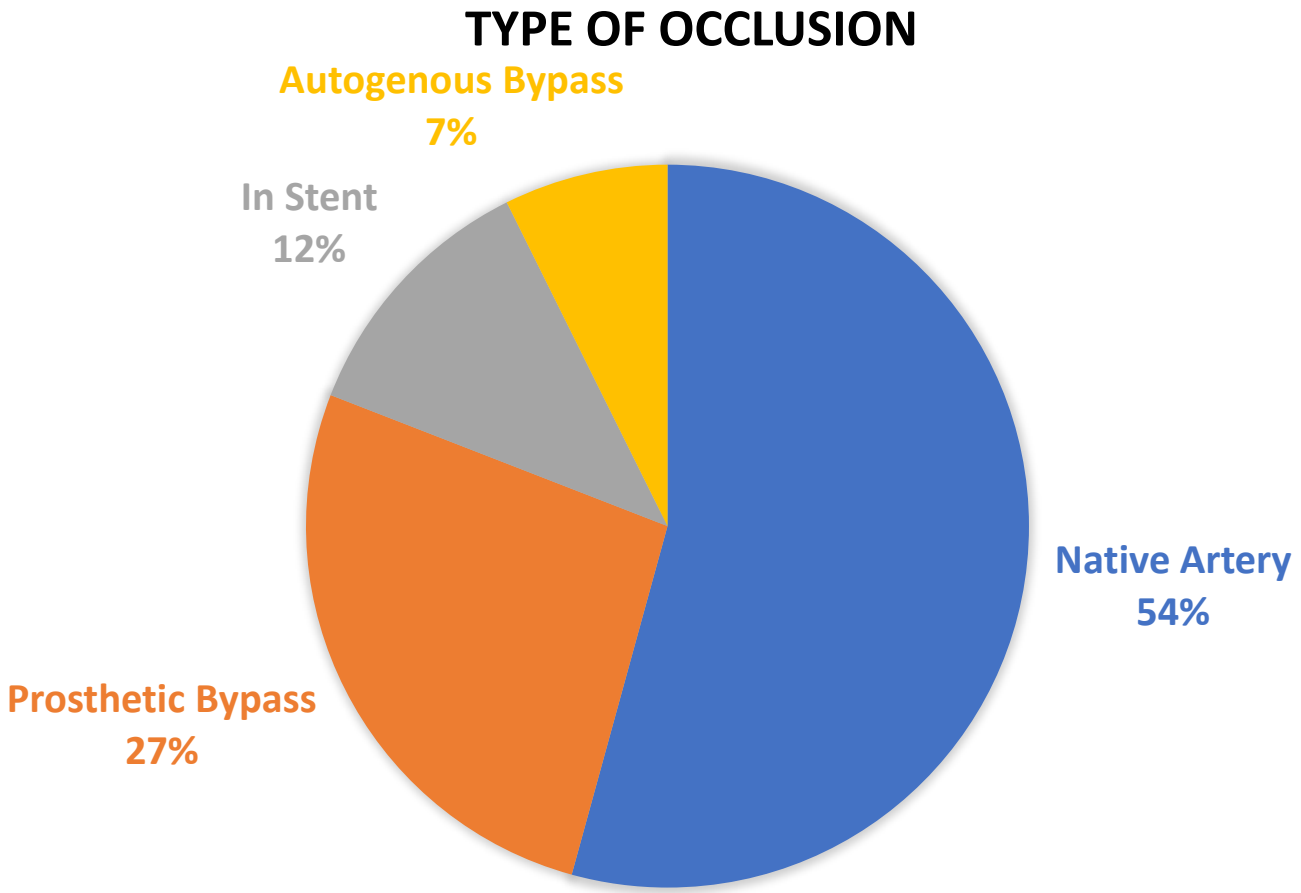
Study Design

- Retrospective single institution review (2014-2024)
- >18 y/o patients undergoing CDT for ALI
- Major exclusions:
  - Venous thrombolysis
  - Simultaneous CDT modalities
- Variables
  - Demographics
  - Socioeconomic factors
  - Clinical risk factors
- **Primary outcome**: Major amputation within 1 year following CDT

Retrospective Review of CDT

68 patients	63.4% R2A	
Age	63 years	
Race	57% AA	
Insurance	65%	
Median ADI	83	**Substantial Socioeconomic Deprivation**

Retrospective Review

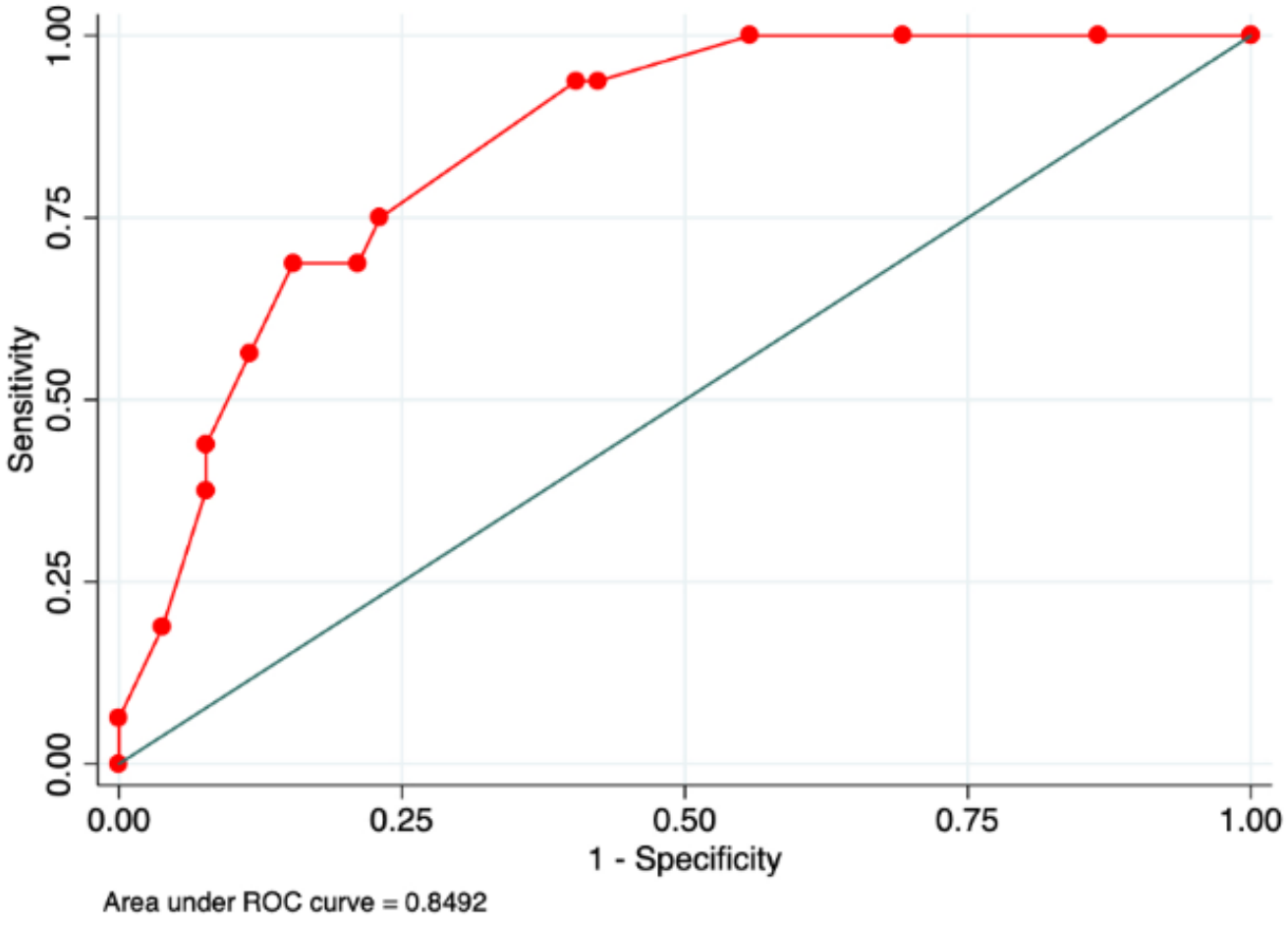


- By one year post intervention, **23.5% (n=16) had major amputations**
  - No difference in adverse events between S-CDT vs UE-CDT

Multivariable Predictors of Major Amputation

	Univariate		Multivariable	
Variable	**OR (95% CI)**	**P-value**	**OR (95% CI)**	**P-value**
Age	0.97 (0.93-1.01)	0.20		
Female Sex	1.75 (0.55-5.52)	0.34		
White Race	1.24 (0.40-3.87)	0.71		
Insured	0.88 (0.28-2.82)	0.83		
ADI (Reference Quartile 1: ≤ 66)				
Quartile 2: 66-82	0.65 (0.16-2.72)	0.56	0.18 (0.02-1.20)	0.07
Quartile 3: 83-92	0.12 (0.01-1.16)	0.06	0.03 (0.001-0.39)	**0.008**
Quartile 4: > 92	0.61 (0.14-2.76)	0.52	0.30 (0.05-1.86)	0.19
Hypertension	2.33 (0.47-11.67)	0.30		
Diabetes	4.95 (1.48-16.60)	**0.01**	10.44 (2.18-49.98)	**0.003**
Hyperlipidemia	1.16 (0.35-3.87)	0.80		
CAD	1.12 (0.33-3.78)	0.85		
Smoking	0.32 (0.07-1.37)	0.13		
CVA	3.78 (0.68-20.90)	0.13		
CHF	3.86 (1.06-13.99)	**0.04**	4.32 (0.89-20.96)	0.06
CKD	3.78 (0.68-20.90)	0.13		

Model Performance: ROC Curve



- AUC = 0.85, 95% CI: 0.65–0.92
  - **Indicates strong predictive discrimination**

Interpretation

- **Major amputation** occurred in **23.5%** of patients at one year
- This rate is consistent with previously reported outcomes following CDT
- Notably, this occurred despite a cohort with **high socioeconomic deprivation (median ADI 83)**

Key Findings

- **Diabetes** is the strongest predictor of limb loss following CDT
- **CHF** may increase amputation risk
- Socioeconomic deprivation **did not** consistently predict limb loss

Traditional clinical risk factors may play a larger role than neighborhood disadvantage alone

Limitations

- Single-institution study
- Retrospective design
- Small sample size
- Area-level socioeconomic measurement

Further multicenter studies are needed

Conclusions

- Nearly **1 in 4 patients** undergoing CDT for ALI experienced **major amputation at 1 year**
- **Diabetes** remains the dominant predictor of limb loss
- **The role of socioeconomic disadvantage appears more complex than previously described**
- Future works
  - Multicenter studies
  - Assess distance to hospital and follow up
  - Risk factor management following CDT

Thank you!

Questions?

Zackery Aldaher, DO

Medical College of Georgia

General Surgery PGY-3

Surgical Education and Simulation Research Fellow

256-404-8348

zaldaher@augusta.edu

Works Cited

1. Olinic DM, Stanek A, Tătaru DA, Homorodean C, Olinic M. Acute limb ischemia: An update on diagnosis and management. *J Clin Med.* 2019;8(8):1215. doi:10.3390/jcm8081215.
2. Chait J, Aurshina A, Marks N, Hingorani A, Ascher E. Comparison of ultrasound-accelerated versus multi-hole infusion catheter-directed thrombolysis for the treatment of acute limb ischemia. *Vasc Endovascular Surg.* 2019;53(7):558-562. doi:10.1177/1538574419861768.
3. Ouriel K, Veith FJ, Sasahara AA, for the TOPAS Investigators. A Comparison of Recombinant Urokinase with Vascular Surgery as Initial Treatment for Acute Arterial Occlusion of the Legs. *N Engl J Med*. 1998;338(16):1105-1111. doi:10.1056/NEJM199804163381603
4. Arya S, Binney ZO, Khakharia A, et al. Race and socioeconomic status independently affect risk of major amputation in peripheral artery disease. *J Am Heart Assoc.* 2018;7(2):e007425. doi:10.1161/JAHA.117.007425
5. Henry AJ, Hevelone ND, Belkin M, Nguyen LL. Socioeconomic and hospital-related predictors of amputation for critical limb ischemia. *J Vasc Surg.* 2011;53(2):330-339.e1. doi:10.1016/j.jvs.2010.08.077.
6. Kind AJH, Jencks S, Brock J, et al. Neighborhood socioeconomic disadvantage and 30-day rehospitalization: a retrospective cohort study. *Ann Intern Med.* 2014;161(11):765-774. doi:10.7326/M13-2946.
7. Aldaher, Z. DO, Patel, M, Munagapati, S., Doddala, B., Agarwal, G. MBBS, Jordan, W. MD, El Shazly, O. MD. Comparative Outcomes of Infusion Catheter-Directed Thrombolysis and Ultrasound-Enhanced Catheter Directed Thrombolysis in Acute Limb Ischemia: A 10-Year Single Institution Retrospective Analysis. *Annals of Vascular Surgery*. 2025 Dec 20:125:33–39. doi: 10.1016/j.avsg.2025.12.013.