Distal Micro-Embolization During Complex Endovascular Procedures – The Underestimated Threat

Peter A. Schneider, MD
University of California San Francisco

Acknowledgement:
Jill Sommerset, RVT
John Rundback, MD
Steven Kum, MD
Miguel Montero-Baker, MD

Peter A. Schneider Disclosures

Consulting:

Surmodics, Medtronic, Boston Scientific, Phillips, Cagent, Acotec, Abbott, Endologix, Shockwave, Silk Road, Healthcare Inroads, Inari, BD

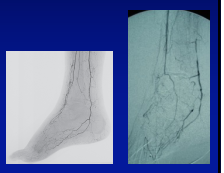
Small Artery Disease Is Common

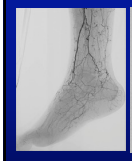
TABLE III.—*Prevalence of lesions and lesion severity across arterial districts in 1915 limbs.*

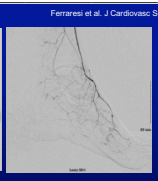
Parameter	Stenosis	Occlusion	Any disease
Dorsalis pedis*	262 (15.3%)	381 (22.3%)	643 (37.6%)
Lateral plantar*	329 (19.2%)	663 (38.8%)	992 (58.0%)
Medial plantar*	269 (15.7%)	567 (33.2%)	836 (48.9%)
Small foot arteries**	271 (16.5%)	143 (8.7%)	414 (25.2%)

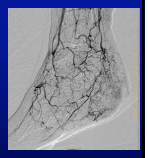
Data are presented as number of cases (percentage).
*Base, N.=1711 legs with the study of big foot arteries; **base, N.=1640 legs with the study of small foot arteries.

Ferraresi et al. J Cardiovasc Surg 2018;59:655





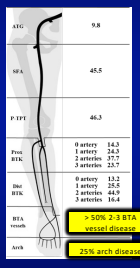


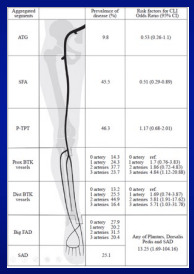


Severity of Runoff Disease Has Changed Due to Diabetes and Renal Failure

Kim and Schneider. J Endovasc Ther 2020

Small Artery Disease is Common and Is a Major Risk Factor for CLTI





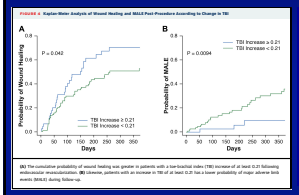
Angiographic evaluation of 1915 Limbs

Any plantar/DP + SAD at ***high*** risk for developing CLTI:
Odds Ratio 13

Ferraresi et al. J Cardiovasc Surg 2018;59:655
Slide modified from S Kum

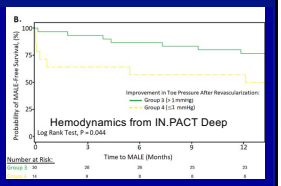
No Improvement in Foot Perfusion Leads to More Amputation

Minimal or No Improvement in TBI= Poor Wound Healing and Higher MALE



TBI increase <0.21:
Wound healing only 50% at 1 year

Toe Pressure Not Improved= Lower MALE-Free Survival

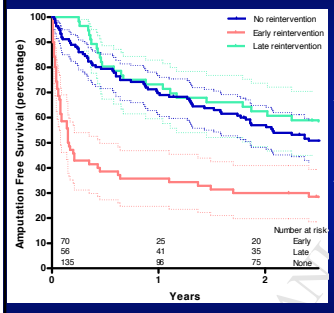


Intervention does not provide improvement in toe pressure:
MALE-Free Survival = 50% at 1 year

Non-Target Lesion Ischemia Is More Common

Reed et al. JACC Cardiovasc Interv 2017;10:2451
Hammad et al Catheter Cardiovasc Interv 2017;90:986

Lack of Clinical and Hemodynamic Improvement Prompts Early Reintervention (<3months)



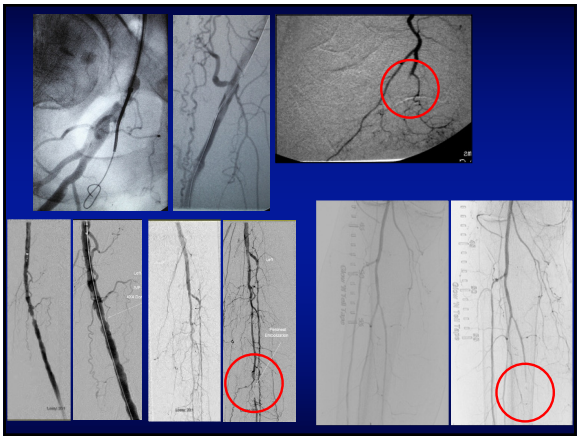
Reintervention required in 32%

Early (<3months) in 48% of those requiring reintervention

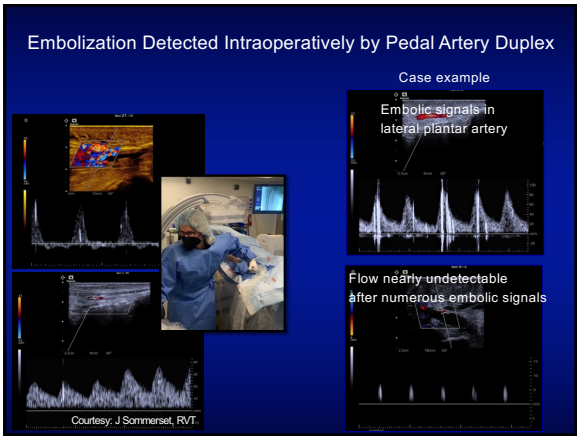
15% of all CLTI patients underwent early reintervention:
AFS 36% at one year

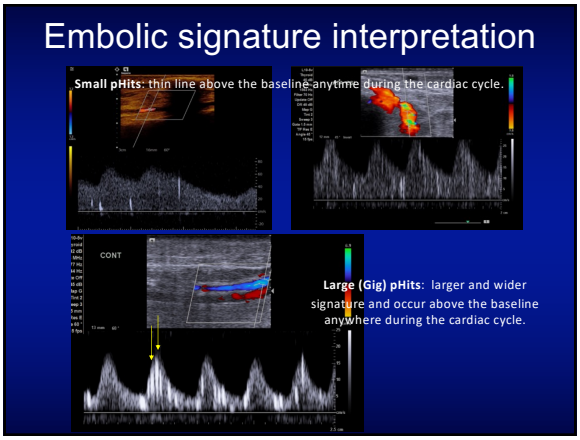
Klaphake et al. Ann Vasc Surg 2018

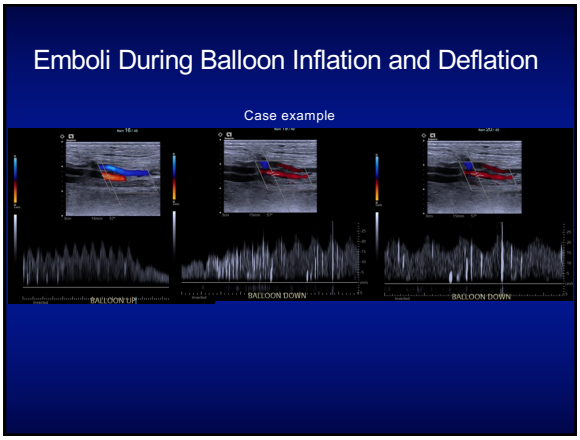
Non-target lesion ischemia is a cause of early reintervention.




A
B
More Complex Disease=More Risk of Emboli

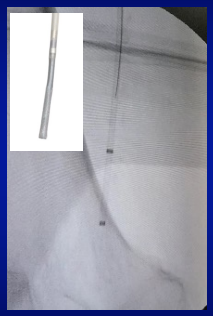

Embolization Detected Intraoperatively by Pedal Artery Duplex
Case example
Embolic signals in lateral plantar artery
Flow nearly undetectable after numerous embolic signals
Courtesy: J Sommerset, RVT


Embolic signature interpretation
Small pHits: thin line above the baseline anytime during the cardiac cycle.
CONT
Large (Gig) pHits: larger and wider signature and occur above the baseline anywhere during the cardiac cycle.


Emboli During Balloon Inflation and Deflation
Case example
BALLOON UP
BALLOON DOWN
BALLOON DOWN

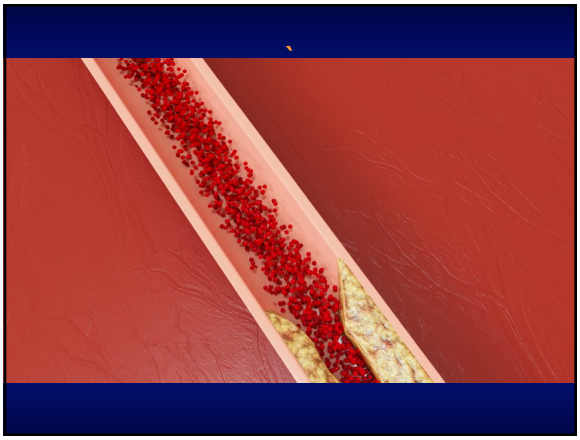
75 yo F R5 non-healing 4th ray amputation

Popliteal stenosis
Single vessel peroneal runoff with proximal occlusion



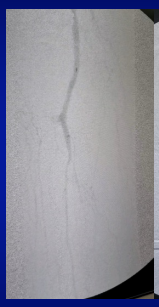
Proximal protection

Cessation of antegrade flow: Aspiration for flow reversal

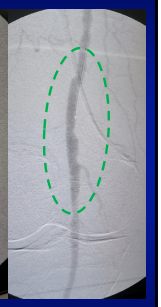


1.25 micro orbital atherectomy crown

Popliteal DCB peroneal PTA



Completion angiogram

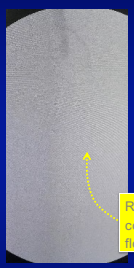


No deployment site injury

INTERVENTION

65 yo M R5 at hallux amp site and medial plantar wound and tibal CTOs

Device deployment



Retrograde collateral flow

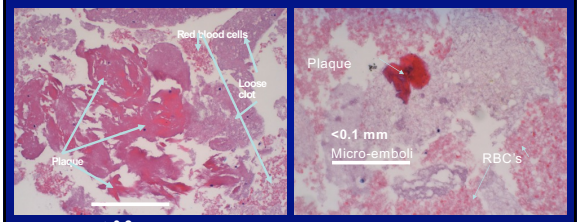
Cessation of antegrade flow

Aspiration and flow reversal

Popliteal deployment site after removal → no injury

Pedal runoff → no emboli

Embolic Material Removed



Embolization and Micro-Circulatory Injury

- **Angiographic Cut-off**
- **No/Slow Flow**
- **Perfusion Deficits**
- **Loss Of Wound Blush**
- **No Hemodynamic Improvement from Intervention**
- **Early Reintervention**
- **Delayed Wound Healing**
- **Unplanned Amputation**

Non-target Lesion Ischemia Due to It Embolization

Conclusion

- Embolization is more common and is doing more damage than we think.
- Sensitive embolic detection methods may help us find ways to prevent the microcirculatory damage and poor outcomes caused by embolization.
- Proximal embolic protection with flow cessation and aspiration is one potential solution.

Distal Micro-Embolization During Complex Endovascular Procedures – The Underestimated Threat

Peter A. Schneider, MD
University of California San Francisco