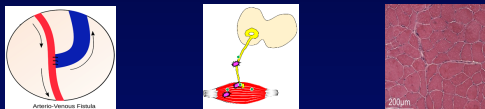


## Steal Syndrome: More Than a Blood Flow Problem



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Saturday, November 23<sup>rd</sup>, 2024 11:17-11:24 AM  
Session 112: Hemodialysis Access Induced Distal Ischemia

## Disclosures

- None

## Background

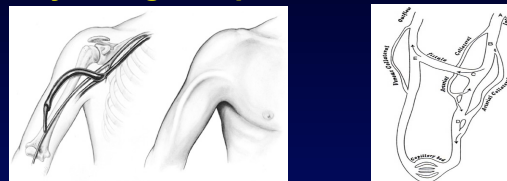
- ~480,000+ people in the U.S. are on hemodialysis
- 30-60% have some element of hand dysfunction but only ~5-10% undergo surgical remediation

Clinical spectrum of hand disability

paresthesia      weakness      pain      gangrene



## Physiologic Impact of Hemoaccess



- Low resistance circuit
- Distal perfusion variable, based on collaterals
- "Physiologic steal"

\*60%-80% of patients with ↓ digital pressure after brachial-based access

Scali & Huber Semin Vasc Surg. 2011;24(2):128-36

## Classification and Treatment

- SVS Reporting Standards – "Steal"

Grading Scheme for Access-related Hand Ischemia

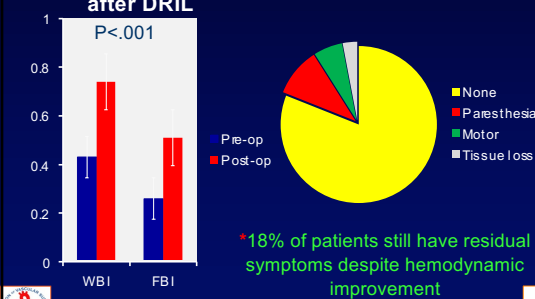
Grade	Symptoms	Management
0	No symptoms	None
1	Mild, cool extremity, few symptoms	None
2	Moderate, intermittent ischemia during dialysis	Surgery optional
3	Severe, ischemic pain at rest/tissue loss	Surgery mandatory

- Ligation (access or DRAL)
- Correct inflow stenosis
- Flow-limiting (e.g. "banding")
- Proximalization of arterial inflow (PAI)
- Revision using distal inflow (RUDI)
- Distal revascularization/interval ligation (DRIL)\*

## DRIL Outcomes

Hemodynamic Outcome after DRIL

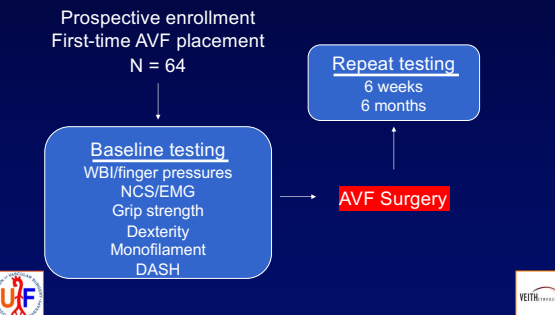
Residual Symptoms after DRIL



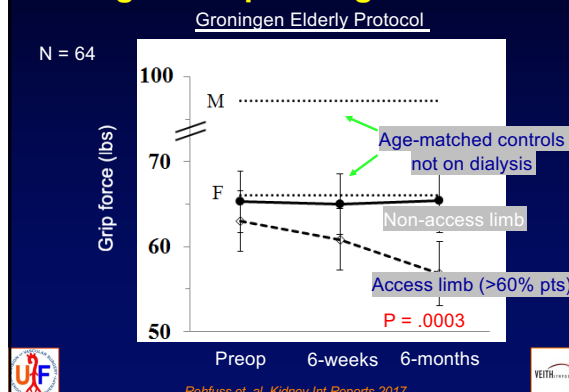
\*18% of patients still have residual symptoms despite hemodynamic improvement

Scali et al. J Vasc Surg. 2013;57:451

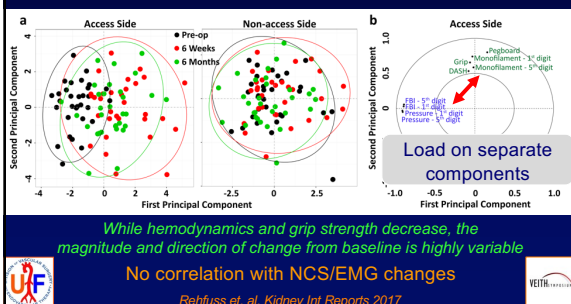
## Characterizing the Spectrum of Hand Dysfunction after AVF Surgery



## Change in Grip Strength after AVF



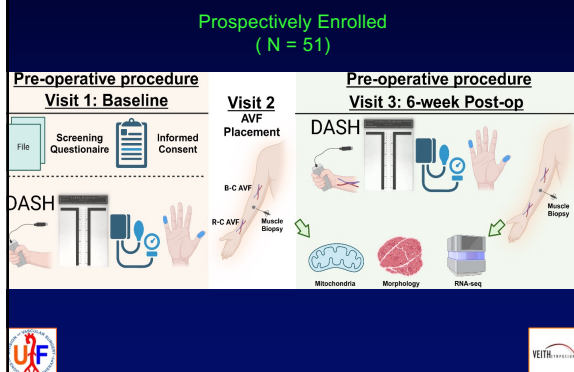
## Poor Correlation Between Hemodynamics & Biomechanical Outcomes



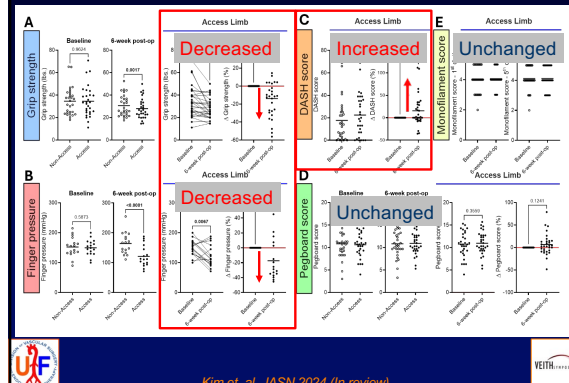
## Unanswered Questions

- What is the Mechanism for 'Steal Syndrome'?  
*'Ischemia' or 'Blood Flow/Pressure' Problem = oversimplification*
- Why do hemodynamic changes correlate poorly with the incidence and degree of hand disability observed?
- What is the contribution of skeletal muscle and peripheral nerves to 'Steal Syndrome'?

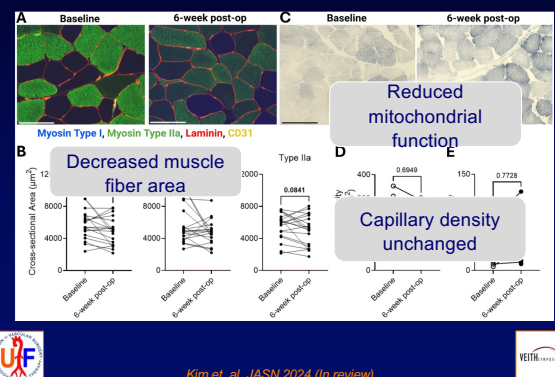
## Mechanistic Insights into HAIDI



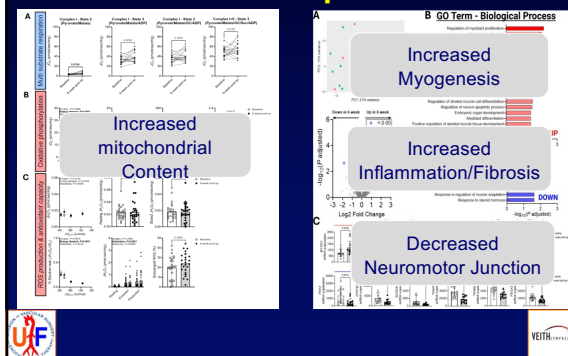
## Change in Hand Function after AVF



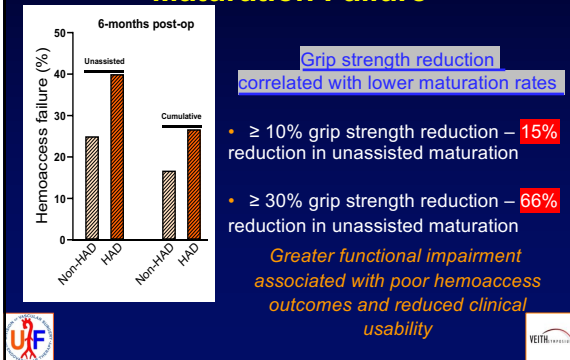
### Change in Skeletal Muscle after AVF



### Gene Expression in Skeletal Muscle & Neuromotor Endplate after AVF



### Impact of Hand Dysfunction and AVF Maturation Failure



### Conclusions

- Hemodialysis associated hand dysfunction has a variety of causes including ischemia and neuromuscular perturbations.
- AV-access placement results in significant decreases in distal hand perfusion that correlates poorly with objectively measured hand dysfunction.
- Relative contribution and maladaptive neuromuscular dysfunction surrounding hemoaccess placement plays a key role in the observed phenotype.
- Pre-emptive therapies to bolster mitochondrial function and neuromotor end-plate function may potentially reduce phenomenon of 'steal syndrome'.

### Thank You

