

Lower Extremity Peripheral Neuropathy

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Peripheral Neuropathy

- Many forms of neuropathy
 - MOST COMMON: Diabetic
- Diabetes and peripheral neuropathy
 - 12% at the time of
 - 50% after 25 years

Boulton, et al, *Med Clin North Am*, 82:209, 1998.

Vinik, *Clin Geriatr Med*, 15:293, 1999.

Pirat, *Diabetes Care*, 1:168, 1978.

Result of Diabetic Peripheral Neuropathy

- Motor Neuropathy →
 - Decreased strength of intrinsic foot muscles
- Sensory Neuropathy →
 - infection, ulceration, and amputation
 - balance problems

Attinger, et al, Grabbe and Smith's Plastic Surgery, 6th ed, 2007.
Akbari, et al, Clinical Management of Diabetic Neuropathy, 1998.
Simoneau, et al, *Diabetes Care*, 17, 1994.

Result of Diabetic Peripheral Neuropathy

- Ulceration:
 - 2.5% per year, 1 in 6 patients in lifetime
- 85% of amputations are preceded by nonhealing ulcers in patients with neuropathy
- Neuropathic pain medication

Frykberg, *Adv Wound Care*, 12:139, 1999.

Pecoraro, et al, *Diabetes Care*, 13, 1990.

DCCT Research Group, *Diabetologia*, 41:416, 1998.

Economics

- **\$132 billion (2002)**
- **Cost of treating diabetic neuropathic pain = 237 million/yr (2001 US \$)**



Hogan, et al, *Diabetes Care*, 26:917, 2003.

Wu, et al, *J Pain*, 7(6):399, 2006.

Economics

- **Incidence of ulceration = 12-25%**
- **Annual costs/pt with diabetic ulcer - \$14,000**



Boulton, et al, *Lancet*, 366:1719, 2005.

CDC. National Estimates on Diabetes, 2000-2001.
<http://www.cdc.gov/diabetes/pubs/estimates.htm>

Ramsey, et al, *Diabetes Care*, 22:382, 1999.

Economics

- **Cost/amputation \$20,000-\$60,000 annually**
- **82,000 amputations/yr**



Eckman, et al, *J.A.M.A.*, 273:712, 1995.

Morris, et al, *Diabetes Care*, 21:738, 1998.

Rice et al, *Diabetes Care*, 2013.

Peripheral neuropathy

- **“progress gradually”**
- **“neuropathic pain continues for life”**
- **“chronic progressive syndrome”**
- **“no treatment ... has been identified”**

Vinik, et al, *Diabetologia*, 43:957, 2000.

Daousi, et al, *Diabetic Medicine*, 23:1021, 2006.

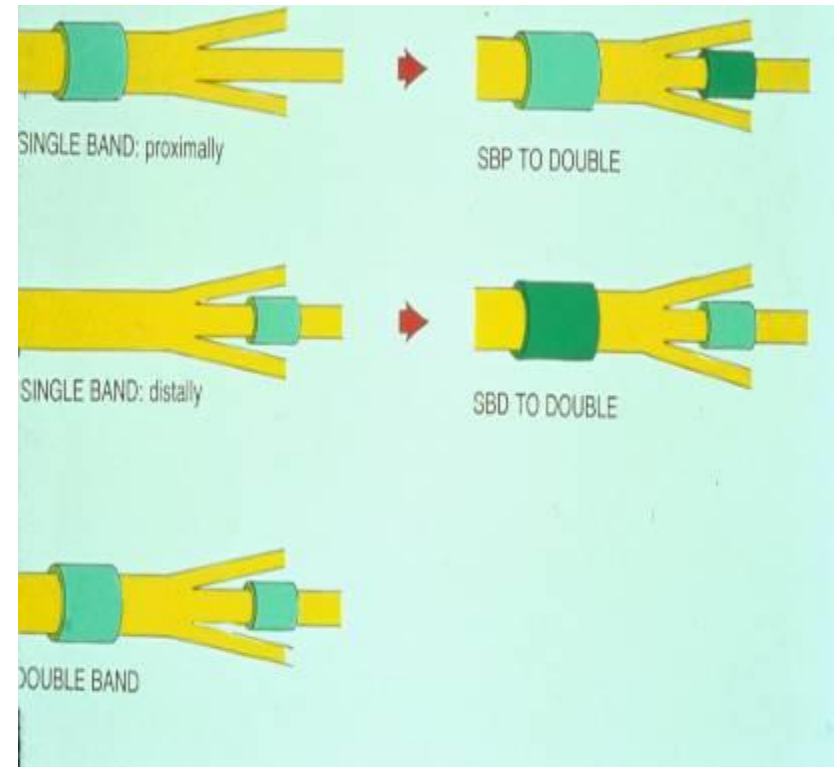
Sugimoto, et al, *Diabetes Metab Res Rev*, 16:408, 2001.

Rathur & Boulton, *J Bone Joint Surg*, 87-B:1605, 2005.

Pathophysiology

Double Crush Hypothesis

- **More than one insult to nerve causes symptoms**

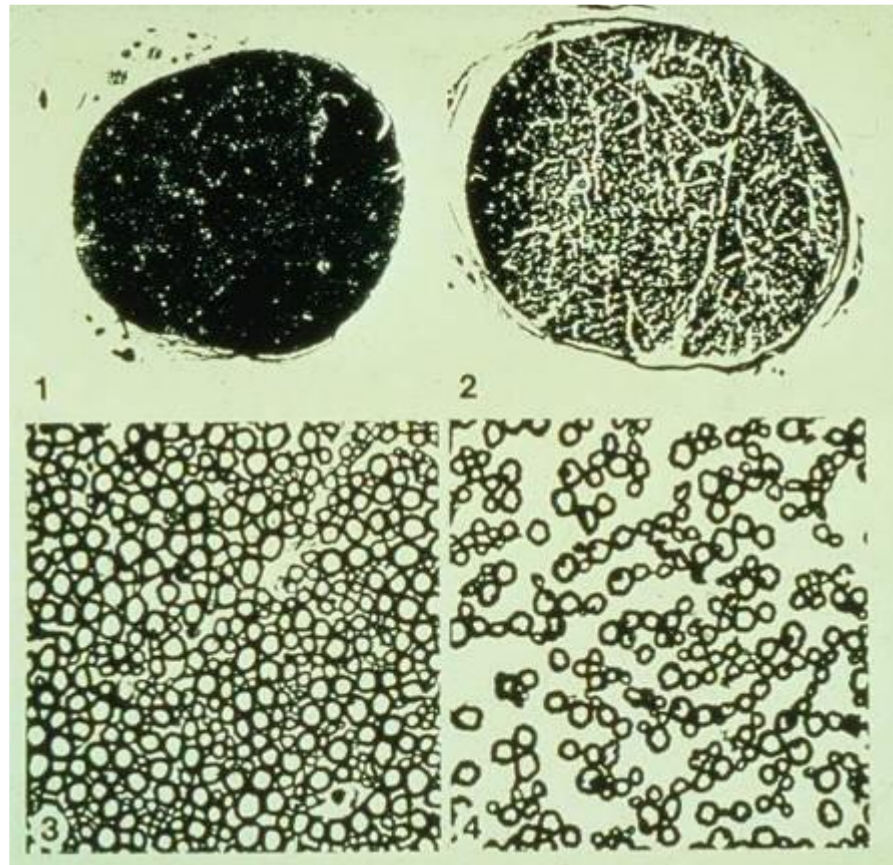


Upton & McComas, *Lancet*, 2: 395, 1973.

 Dignity Health Medical Group **Dellon & Mackinnon, *Ann Plast Surg*, 26(3):259, 1991.**

Microscopic Damage from DM

NORMAL

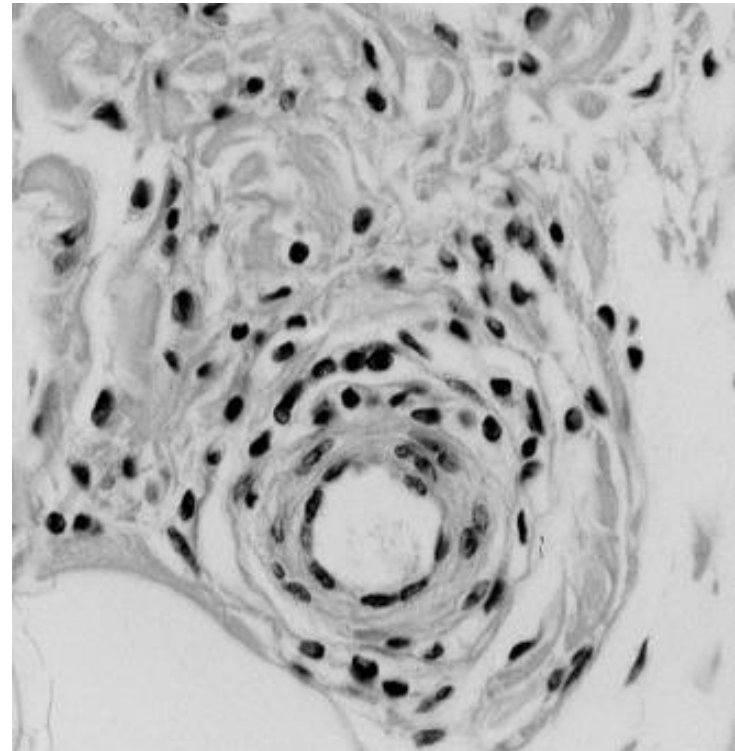
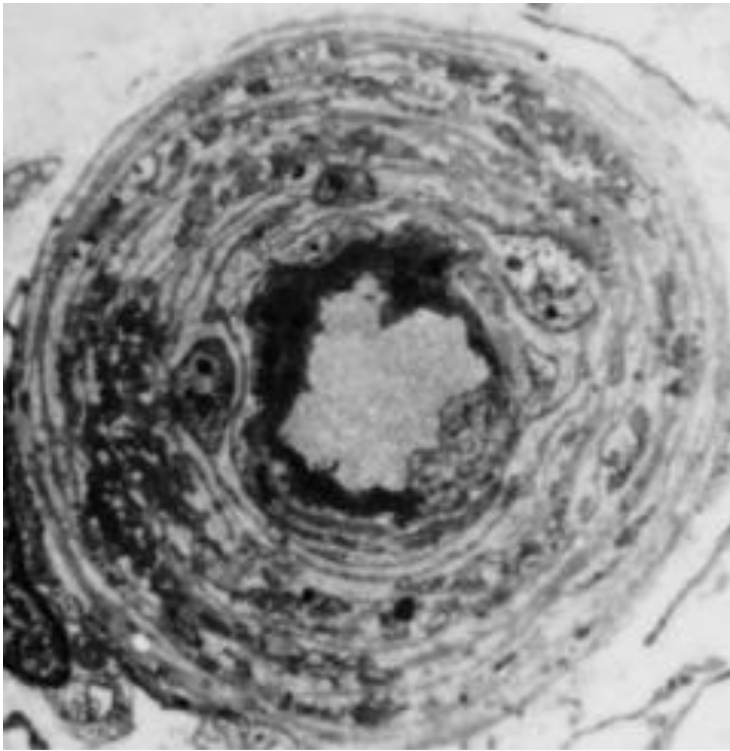


DIABETIC

Jakobsen, *Diabetologia*, 14:113, 1978.

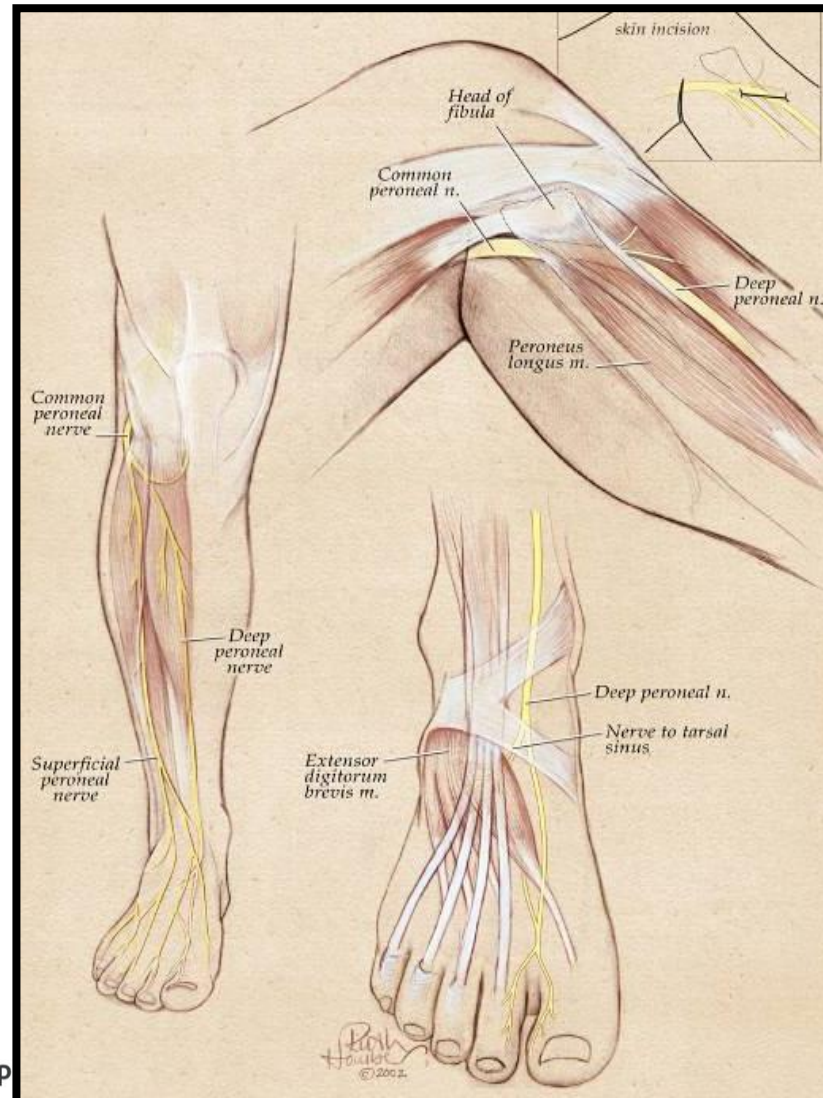
Blood Vessel Changes

Inflammation and scarring

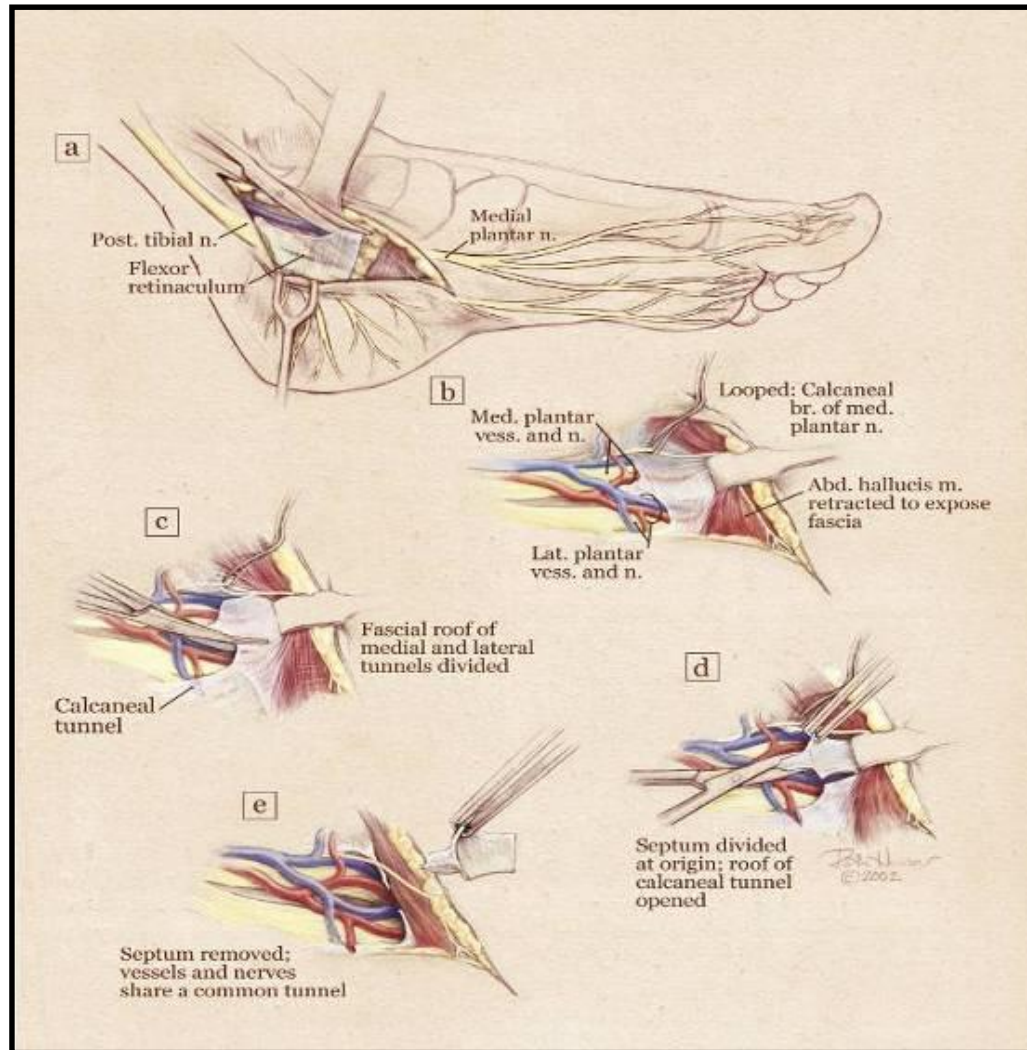


Sinnreich, et al, *Neurologist*, 11(2):63, 2005.

Anatomic Narrowing: 2nd Crush



Anatomic Narrowing: 2nd Crush

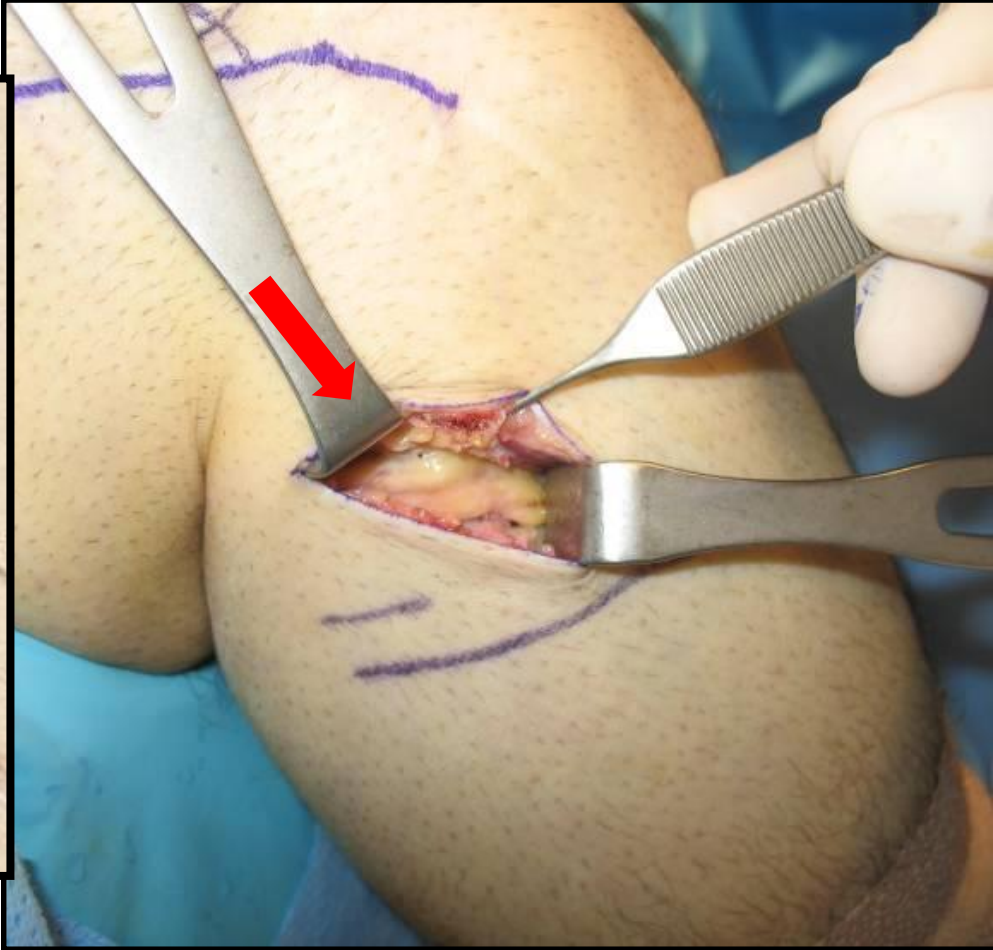
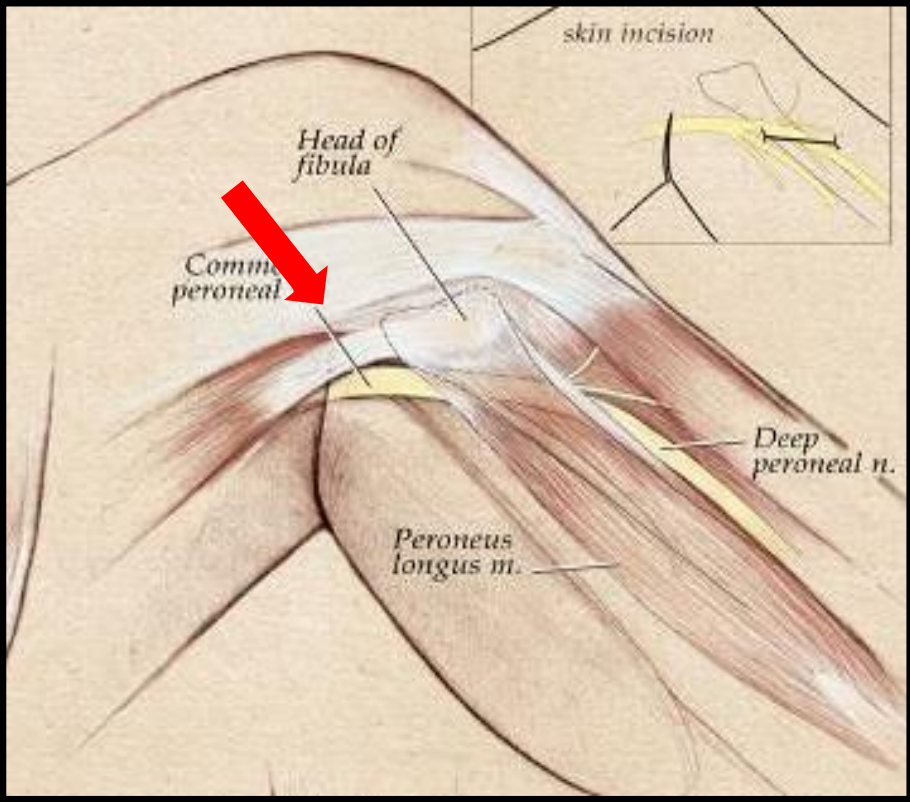


Who can have surgery?

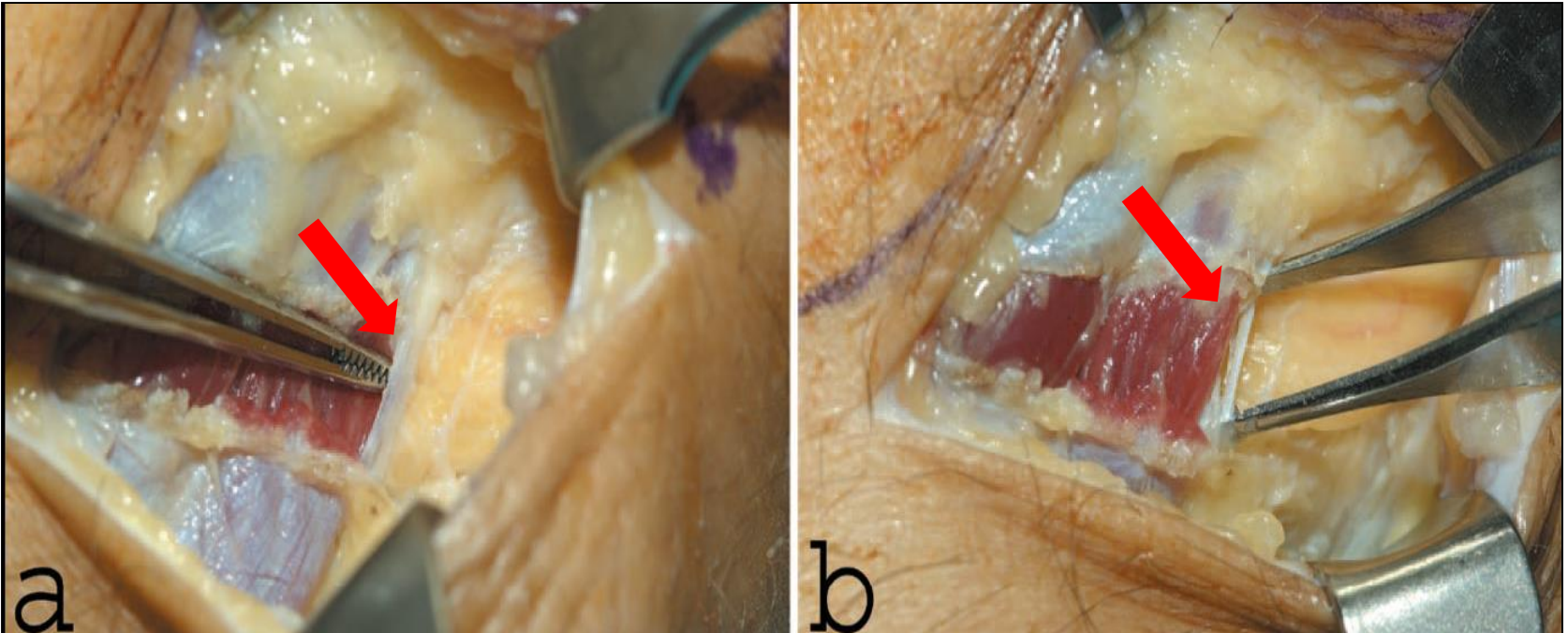
- Symptomatic
- Documented neuropathy
 - History
 - PSSD vs NCS
- Good glycemic control
- Not responsive to conservative Tx
- No Charcot's changes or pedal edema
- Adequate circulation
- POSITIVE TINEL SIGN

Surgical Technique

CPN Decompression



CPN Decompression



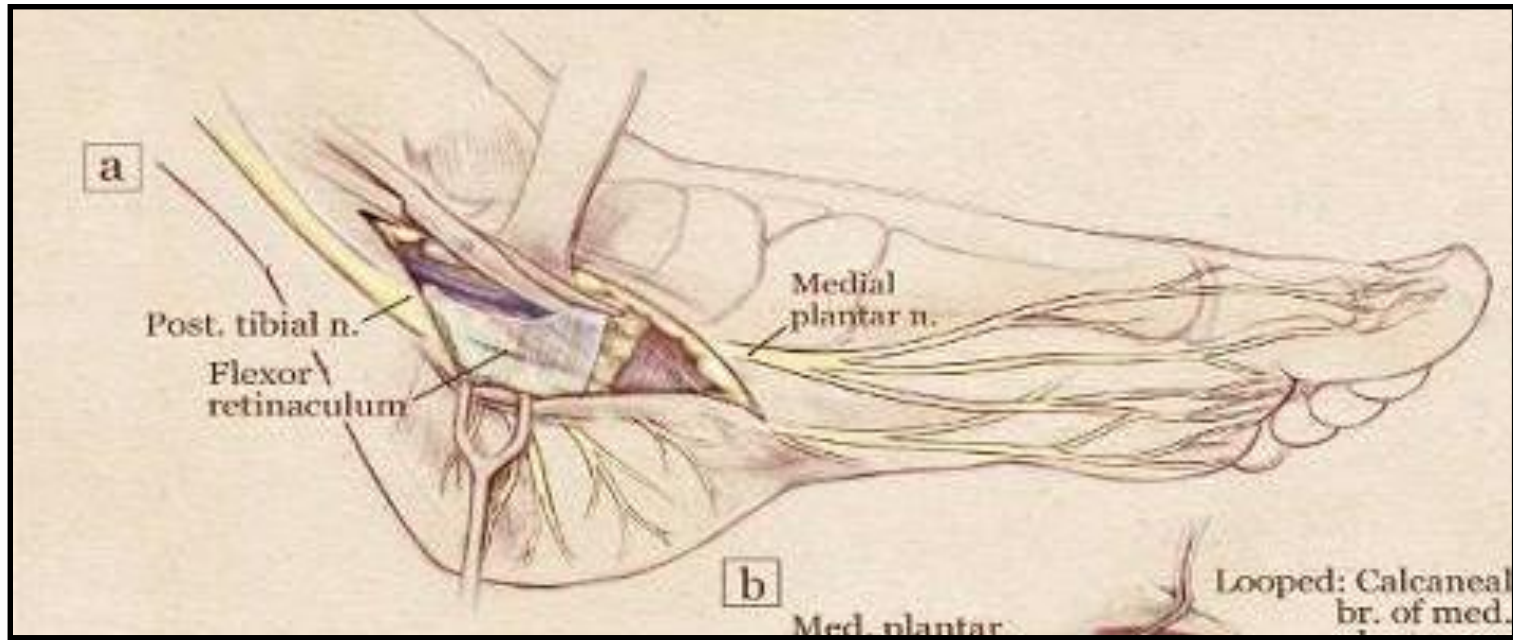
DPN Decompression



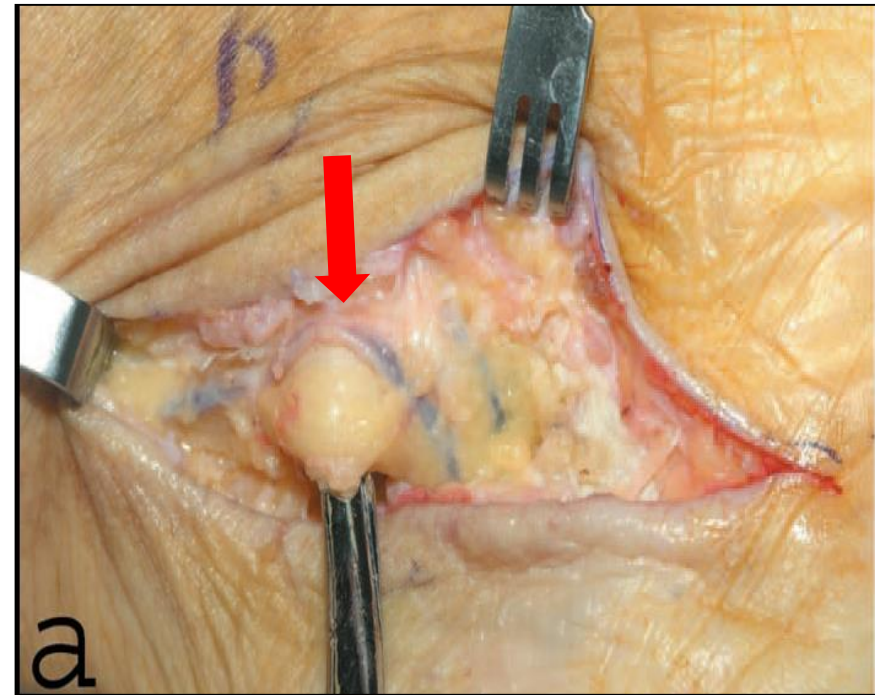
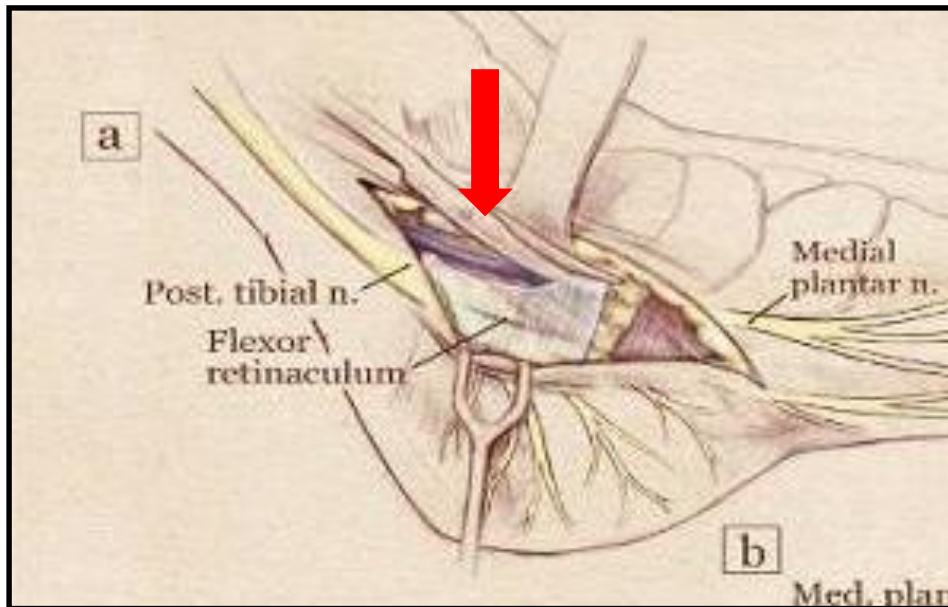
DPN Decompression



Tarsal Tunnel Decompression



Tarsal Tunnel Decompression



Does it work??



Outcomes

- 2 reports of this surgery with patient with a previous ulcers/amputation history
 - 1st study reported no recurrences of ulcerations (11 with previous ulceration and 6 with previous amputation)
 - 2nd study reported 1 recurrence of ulceration. (13 with previous ulceration, total 26)

Wieman, et al, Ann Surg, 221:660, 1995.

Chafee, Plast Reconstr Surg, 106:813, 2000.

Prospective Series

<i>STUDY</i>	<i>N</i>	<i>ULCERS</i>		<u><i>RESULTS (%)</i></u>		
		<i>AMPS</i>	<i>PAIN</i>	<i>SENS</i>	<i>U/A</i>	
(2005) Valdivia	60	0	0	87	86	0
(2005) Rader	49	0	0	90	75	0
(2006) Maloney	95	0	0	86	83	0
(2006) Siemionow	33	0	0	91	75	0

Changing the Natural History of Diabetic Neuropathy: Incidence of Ulcer/Amputation in the Contralateral Limb of Patients With a Unilateral Nerve Decompression Procedure

Oscar Aszmann, MD, Patsy L. Tassler, PhD,† and A. Lee Dellon, MD‡*

- 50 pt
- 4.5 year followup
- Operated Extremity: 0 ulcerations, 0 amputations
- Non-op extremity: **12 ulcerations, 3 amputations**

Prevention of Ulceration, Amputation, and Reduction of Hospitalization: Outcomes of a Prospective Multicenter Trial of Tibial Neurolysis in Patients with Diabetic Neuropathy

A. Lee Dellon, M.D., Ph.D.^{1,2} Vickie L. Muse, R.N., B.S.N., C.D.E.² D. Scott Nickerson, M.D.³ et al*

- Prospective series 628 pt, multiple centers, JRM 2013
- No history ulcer → 0.2% rate new ulcerations
- History of ulcer → 3.8%
- Amputation in 1 limb → 0.2%
- Hospitalization for foot infection → 0.6%

Prevention of Ulceration, Amputation, and Reduction of Hospitalization: Outcomes of a Prospective Multicenter Trial of Tibial Neurolysis in Patients with Diabetic Neuropathy

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- Problems...
 - 38 surgeons, “same” technique
 - 1 year follow up “at least”
 - No surgical details given...
 - No Control

My Practice

- Team approach
- Patient compliance
- Nerve studies
- Patient education
- Surgery NOT for everybody
- All factors controlled → success 80/20

Thanks!



So...

- With decompression, it might be argued that:
 - Increased patient awareness
 - Improved glycemic control
 - Improved foot care
- Unilateral decompression of lower extremity peripheral nerves
 - Assumptions:
 - glycemic levels would be the same in each lower extremity
 - foot care would be given equally to both feet
- Ulceration or amputation equally likely to occur in each foot?