## Minor Amputation Levels For Limb Salvage









Robert G. Frykberg, DPM, MPH, MAPWCA, FFPM(Glasg) Medical Director, DM Prevent Clinics Dubai Adjunct Professor, Midwestern University Phoenix, AZ USA



#### Author Disclosures:

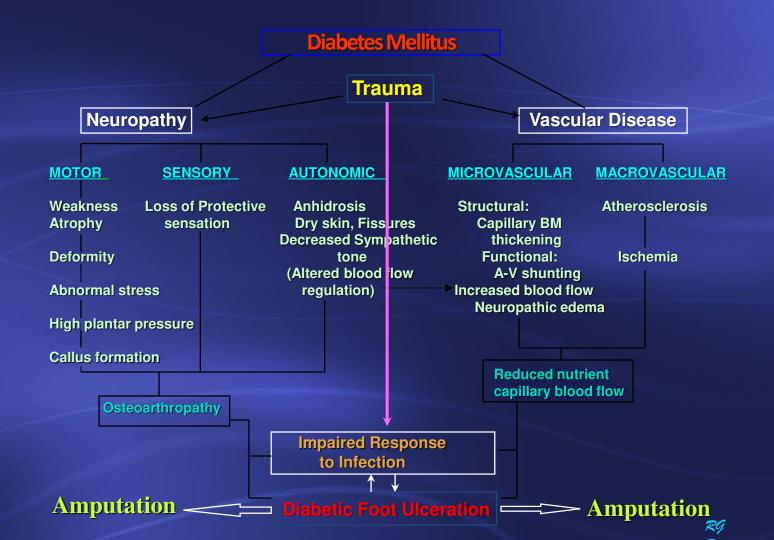
Nothing to disclose for this presentation

## "Diabetic gangrene has been increasing as a menace to my patients"



1869-1962

Elliott P. Joslin, M.D. "The Menace of Diabetic Gangrene" NEJM Vol 211:No 1;16-20, July 5, 1934



#### **Stairway to Amputation**



Wound

ICE ACTION OF

Lee Sanders, DPM

Injury

Infection





Gangrene

Opportunities for amputation prevention

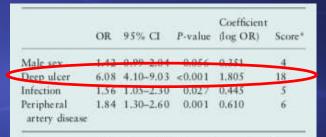
After Rogers 2010



High Risk Foot

Differences in minor amputation rate in diabetic foot disease throughout Europe are in part explained by differences in disease severity at presentation van Battum, Schaper, Prompers et al: Diabet Med:199 (2011)

- Eurodiale study, N=1232 patients with new DFU
   Followed up to 1 yr
- Results
  - 194 Minor amps (18%)



\*A score was attributed to each independent predictor by multiplying the logistic regression coefficient by 10 rounded to the nearest integer. For each patient, a disease severity score can then be computed by adding the scores of each of the four characteristics if present.

Independent predictors of minor amputation and scoring rule



Article: Complications Differences in minor amputation rate in diabetic fo

#### disease throughout Europe are in part explained by differences in disease severity at presentation

M. Dimondy Y., K. Holsenty, A. Browkark, D. Marris, ed., K. Margari, K. Margari, K. Margari, T. S. Holsenty, A. Browkark, D. Margari, and S. Kamar, Theorem 197, N. Borner, M. Grand, M. L. Gang, M. L. Gang, M. L. Gang, and M. K. San, And S. K. San, And S. K. San, San Fast, Theorem 197, 2010. A statement of the statement of th

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Assessing the Long-Term Outcomes of Minor Lower Limb Amputations: A 5-Year Study Uzzaman et al: Angiology 2011, 62(5) 365-371

- Retrospective study 126 *Minor amp* patient Mean age 70 yrs (92 Digits 14 ray 20 TMA)
   DM (group A) n=79 NDM (Grp B) n=47
- Overall 5 yr Mortality: 27% (37/126)
  - 58% of deaths in 1<sup>st</sup> year
  - Greater in NDM group (n.s.)



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Minor amputation in patients with diabetes mellitus and severe foot ulcers achieves good outcomes Svensson et al: Journal of Wound Care, June 2011

- N=410 consecutive minor amps (309 pts) in defined DM Swedish population over 25 yr period
   Median age 73 (32-93) yrs
  - 94% with deep infection (39%) and /or gangrene (55%)
  - 61% with severe PAD or CLI
  - 19% died before healing
- Results
  - 79% of surviving pts healed below ankle level
    - Median healing time 26 (2-250) weeks
    - 21% required re-amputation above ankle
  - None of the analyzed parameters *excluded* healing at below ankle level





#### Minor amputation in patients with diabetes mellitus and severe foot ulcers achieves good outcomes

research

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#### **Indications for Diabetic LEA**

- Fulminant infection / Chronic osteomyelitis
- Gangrene or chronic ulceration
- Extensive tissue loss
- Non-reconstructable ischemia
- Severe deformity or instability

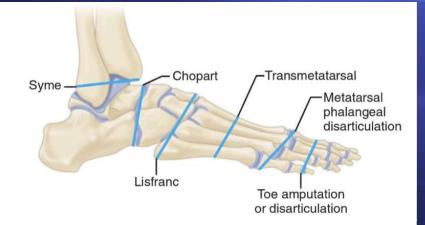




#### Foot / Leg Sparing Amputations

- Lesser toe
- Hallux
- Ray (1<sup>st</sup> and lesser)
- Transmetatarsal (TMA)
- Chopart's
- Boyd
- Pirogoff
- Syme's





#### Foot / Leg Sparing Amputations

#### Lesser toe Amputations

- Intraphalangeal
- Joint disarticulation

#### Indications

- Gangrene of toe not involving MTP joint
- Osteomyelitis
- Recalcitrant ulcer in presence of ischemia



#### Foot / Leg Sparing Amputations

- Hallux Amputations
  - Intraphalangeal
  - Joint disarticulation
- Indications
  - Gangrene of Hallux not involving MTP joint
  - Osteomyelitis
  - Recalcitrant ulcer in presence of ischemia





Three-Year Morbidity and Mortality Rates After Nontraumatic Transmetatarsal Amputation Adams, Edinger, Weintraub, Pollard: J Foot Ankle Surg (2018) 967–971

Retrospective chart review: TMA 3/ 2007 to 1/ 2012 (n = 375)

- 3-year mortality, proximal limb amputation, and lack of healing.
   Results:
- 136 (36
- 138 (36
- 83 (22.
- Nonpal
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  - Deat
- ESRD (a



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#### Transmetatarsal Amputation (TMA)

#### Popularized by McKittrick: Ann Surg 1949









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- Healing rates between 50% and 74%
- Postoperative Complications as high as 87%

Sanders 2007 Younger 2009 Boffeli 2016

#### **Rear Foot Amputations**

- Lisfranc's
- Chopart's
- Pirogoff







Transmetatarsal

Chopart

Fig. 6. Transmetatarsal and midfoot amputations; levels of amputation. (From Sanders LJ. Transmetatarsal and mid-foot amputations. Clin Podiatr Med Surg. 1997;14(4):741, with permission from Ebevier Science).

Lisfranc

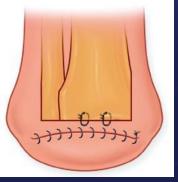
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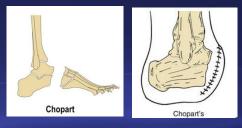
Chang 1994 Sanders 1997 Pinzur 2003 **Evans 2011** 



Figure 2. Lateral view of the skin incision showing the outline of the portion of the talus to be excised. C. calcaneus; T, talus; F, fibula; B, tibia.







### **Chopart Amputation**





- Reserved for extensive tissue loss of forefoot
- Osteomyelitis of forefoot, midfoot
- Resection of forefoot at Midtarsal Joint
  - Talo-Navicular Joint and Calcaneo-cuboid joint
  - Requires a fairly long plantar flap
  - <u>Must</u> perform Achilles Tenotomy / Tenectomy
    - Avoid severe ankle equinus
- Must use Prosthesis/ Ankle Foot Orthosis

















Chang et al JVS 1994 Faglia et al: JFAS 2016

# SUMMARY

- Minor amputations are critical components of care for the acute or chronic diabetic foot
- Infection, gangrene, and osteomyelitis with or without ischemia most frequent indications
- Frequently staged procedures (to control infection) and often need revision





#### "... it has been forced upon me that gangrene is not Heaven-sent but is earth-born."



Elliott P. Joslin, MD "The Menace of Diabetic Gangrene" NEJM 211:16-20, 1934

## **Thank You!**



May 22 - 25, 2019

World Forum - The Hague - The Netherlands

# Robert G. Frykberg, DPM, MPH, MAPWCA

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DMPREVENT Improving Outcomes. Changing Lives.



Diabetes, Lower-Extremity Amputation, and Death Hoffstad, Mitra, Margolis :Diabetes Care 2015:1852–1857

- Longitudinal cohort study : The Health Improvement Network (THIN).
   N=416, 434 6,566 (1.6%) LEA 77,215 Deaths
- Primary exposure was LEA : outcome was all-cause death
- All cause death after an LEA (vs No LEA) :
  - HR 2.37 (2.27, 2.48) Fully adjusted





lie at any LEA.. " Minor amputation in patients with diabetes mellitus and severe foot ulcers achieves good outcomes Svensson et al: Journal of Wound Care, June 2011

- N=410 consecutive minor amps (309 pts) in defined DM Swedish population over 25 yr period Median age 73 (32-93) yrs
  - 94% with deep infection (39%) and /or gangrene (55%)
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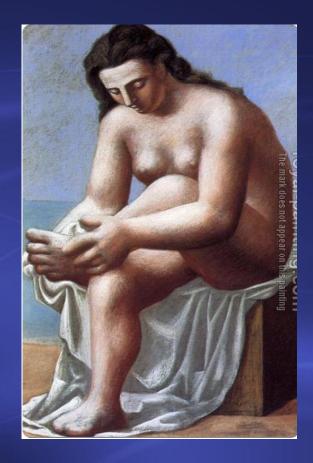




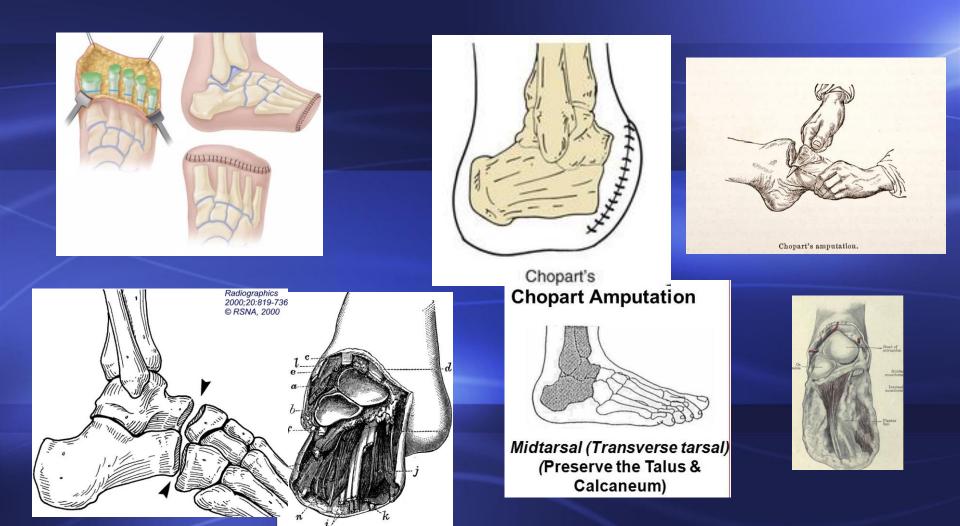


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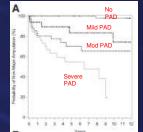
#### Long Term Prognosis of Diabetic Foot Patients and Their Limbs

Morbach, Furchert, Groblinghoff et al: Diabetes Care 35:2021, 2012

• 10 yr prospective f/u of 247 DFU patients without prior major amputation in a single German diabetes center

Mean age 68.8 yrs, DM duration 15.7 yrs, 87.5% T2DM
 Results:

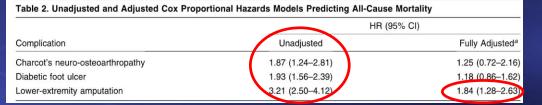
- A first major amputation occurred in 38 patients (15.4%)
- All but one of these pts had evidence of PAD at entry
  - − 51.4% had severe PAD [ankle- brachial pressure index  $\leq$  0.4]).
- Multivariate Predictors of first major amputation: (HR, [95% CI])
  - Age (per year) 1.05 [1.01–1.10]
  - Hemodialysis 3.51 [1.02-12.07]
  - PAD 35.34 [4.81–259.79]



#### Foot Complications and Mortality Results from Translating Research Into Action for Diabetes (TRIAD)

L McEwen, K Ylitalo, M Munson, W Herman, J Wrobel: JAPMA 106(1): 7-14, 2016

- Prospective Observational Study N=6,992 DM pts.
- 10 years of follow-up (2000-2009)



ORIGINAL ARTICLES

Foot Complications and Mortality Results from Translating Research Into Action for Diabetes (TRI

> Laura N. McEwen, PhD\* Kelly R. Yiltalo, PhD\* Michael Munson, DPM\* William H. Herman, MD, MPH\* James S. Wrobel, DPM, MS\*

pround: We adopt to study the impact of too complications on 10-year munitally endent of index demographic and biological risk factors in a recally and sconomically diverse managed care population with access to high-quality medical

Atthete: We studied 0,000 patients with diabetes in Transisting Research into Action or Diabetes (TRIAD), a prospective observational study of diabetes care in managed are. Tool corprications were assessed using administrative claims date. The National health index was seerched for deaths across 10 years of follow-up (2003-2009).

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eclasions: In this managed-care population with access to high-quality motical care, A remained a robust independent predictor of montality. The association was propert in man and differed by race. (J Am Podiatr Mac Assoc 106(1): 7-14, 2018)

Dishetes related for complications have a substan- ial effect on motifulity, multiplication, and health-care expenditures, <sup>12</sup> Charon's neuro-sensoral complexity amputation ( $(2A)^{12}$ have all been associated with mortality. It is not clear what the independenc combination of each of these compli-	cations is to all cause mortality in people with diabetes. Mentification of diabetic patients with first at risk, combined with perventive cause, can prevent LEA, and improved cardiovancular risk farture manage- ment can improve long terms survival. <sup>12</sup> Patients with diabetes receiving care from managed-care organizations have access to preventive care and
The findings and more/neares in this report are them of the students and do not accessraphy proposed the terms of the heading paperson. "Supersonset of Element Medicuse, Delwass of Medulinas, Ann Anne Merger, and Dahotes, Disnovering of Medulinas, Ann Anne Adves, M. Corresponding author: Laures, McKleven, FOA, Disnovery of Meducas, 1000 Yatii IS, Jacon Meduli, Laur Arthor, M. Glinto (Feasili Interpretinged author).	review very good dialecto-related processes an intermediate occurses of care. <sup>10</sup> As a result, raise and ethnic minorities with dialectors server in the lower runs of LDA than similar populations will be access to care. <sup>10,10</sup> The objective of the present study was to extens these provises studies by examining the impact of foot controllectories on 30-tweet study was to extens these provises studies by examining the impact of foot controllectories on 30-tweet metally indexes

ournal of the American Podiatric Medical Association - Vol 106 - No 1 - January/February 201

CN= 55 (1%) DFU = 205 (3%) LEA = 101 (1.4%)



Long Term Prognosis After Healed Amputation in Patients with Diabetes Larsson et al: CORR, 1998

> Although healing minor amputations takes 3 x longer than major amps, the long term results are more favorable than are those for patients who undergo major amputation



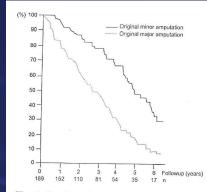
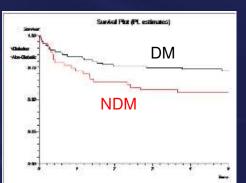


Fig 1. Survival after index amputation. n = number of patients.

Assessing the Long-Term Outcomes of Minor Lower Limb Amputations: A 5-Year Study Uzzaman et al: Angiology 2011, 62(5) 365-371

- Retrospective study 126 *Minor amp* patients Mean age 70 yrs (92 Digits 14 ray 20 TMA)
- DM (group A) n=79 NDM (Grp B) n=47
  - PAD 42 (53%) vs 10 (21%) p=.02
    Renal Failure 9(11%) vs 2 (4%) p=.04
  - Renarranule 9(11%) vs 2 (4%) p-.04
  - Re-amp 11 (14%) vs 30 (64%) p= .02
  - Revascularized 35 vs 37 (n.s.)
- Overall 5 yr Mortality: 27% (37/126)
  - 58% of deaths in 1<sup>st</sup> year
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Minor Lower Limb Amputatio A 5-Year Study	head of the second s
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Mohammed Mohsin Uzzaman, MBBS, MRCS, Amir Kambal, FRCS, DIC, MEd, and Syed Tal	
Abstract Core an weak assess the long-term sections for mixer fore considered group, B-47 patients, Argoginess were required (************************************	rs were divided into 2 groups, diabetic (group A: 79 patients) a in 45 patients is group A compared with 31 patients in group spatiations compared with 30 patients is group 8 ( $\theta = 02$ ). The overall 5-year mortality was 27%, with 58% of dea test have high mortality and reintervencion rates. Adequate a
Keywords toe, transmetatarsal, amputation, minor amputation, outcome,	narth Landon
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#### Stopping antibiotics after surgical amputation in diabetic foot and ankle infections—A daily practice cohort A Rossel, D Lebowitz, K Gariani et al: *Endocrinol Diab Metab.* 2019

- **Objective:** The appropriate duration of antibiotic therapy for diabetic foot infections (DFI) after surgical amputations in toto is debated. There are discrepancies worldwide.
- Results:

We followed 482 amputated DFI episodes for a median of 2.1 years after the index episode.

- The DFIs predominately affected the forefoot (n = 433; 90%).
- We diagnosed osteomyelitis in 239 cases (239/482; 50%).
- In total, 47 cases (10%) were complicated by bacteremia, 86 (18%) by abscesses and 139 (29%) presented with cellulitis.
- Surgical amputation involved the toes (n = 155), midfoot (280) and hindfoot (47).
- Overall, 178 cases (37%) required revascularization.
- After amputation, the median duration of antibiotic administration was 7 days (interquartile range, 1-16 days).
- In 109 cases (25%), antibiotics were discontinued immediately after surgery.
- Overall, clinical failure occurred in 90 DFIs (17%), due to the same pathogens in only 38 cases.
- In multivariate analysis, neither duration of total postsurgical antibiotic administration (HR 1.0, 95% CI 0.99-1.01) nor immediate postoperative discontinuation altered failure rate (HR 0.9, 0.5-1.5).
- **Conclusion:** According to our clinical pathway, we found no benefit in continuing postsurgical antibiotic administration in routine amputation for DFI.
- In the absence of residual infection (ie, resection at clear margins), antibiotics should be discontinued.

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ORIGINAL ARTICLE	WILEY Enderination Diabete

Stopping antibiotics after surgical amputation in diabetic foot	
and ankle infections—A daily practice cohort	

Anne Rossel <sup>1,2</sup>   Dan Lebowitz <sup>1,2</sup>   Karim Gariani <sup>1,2,3</sup>   Mohamed Abbas <sup>2,4</sup>	L
Benjamin Kressmann <sup>2,5,6</sup>   Mathieu Assal <sup>5,7</sup>   Philippe Tscholf <sup>6,6,8</sup>	
Dimitrios Stafylakis <sup>5.6</sup>   Iker Uçkay <sup>2.4.5.6.8</sup>	

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Territori Control Program, Geneva University Heightab, Geneva, Butterdand	ski, we conducted a cluster controlled Cox regression and esis. Minimum follow-up
<sup>1</sup> Debopunds Surgery Service, Denna University Heightyk, Geneve, Switzerland	was 2 months. Results: We followed 452 amputated DPI episodes for a median of 2.1 years after the
*Christe Dathway of Datastic Foot Interactions, General Datastic Violantian, General, Serbouland	Index episode. The DFIs predominately affected the forefoot (n = 433; 90%). We di- aground asteomyst Sis in 239 cases (229/482; 50%). In total, 47 cases (32%) were
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Respire University Haraphic Zurich, Switzerland	(47). Overall, 178 cases (37%) required revises arisation. After angutation, the me-
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