Indications for preventive surgery
Minisymposium 1: Preventive and Curative Surgery

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Objectives

- To discuss indications for elective surgery to corrected structural deformity or improve limited joint mobility in diabetes
- To discuss patient selection
Goals for preventive surgery

• Correct structural foot deformity - improve range of motion
• Heal a Recurrent or chronic foot ulcer
• Reduce the risk of
  • recurrence
  • infection
  • amputation
Goals for preventive surgery

- Selecting the right patient
- Selecting the right procedure
Primary prevention

• No evidence that primary prevention is effective
• The incidence of 1\textsuperscript{st} ulceration is low
• Sample size to show a benefit would be large

<table>
<thead>
<tr>
<th>Diabetic Foot Risk Classification</th>
<th>N = 1,666</th>
<th>Ulcer</th>
<th>Amputation</th>
<th>Hospitalization</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. No disease</td>
<td>2.0%</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2. Neuropathy</td>
<td>4.5%</td>
<td>0</td>
<td>1.0%</td>
<td></td>
</tr>
<tr>
<td>3. Neuropathy + deformity</td>
<td>3.0%</td>
<td>0.7%</td>
<td>1.8%</td>
<td></td>
</tr>
<tr>
<td>4. PAD</td>
<td>13.8%</td>
<td>3.7%</td>
<td>15.9%</td>
<td></td>
</tr>
<tr>
<td>5. Ulcer history</td>
<td>31.7%</td>
<td>2.2%</td>
<td>8.2%</td>
<td></td>
</tr>
<tr>
<td>6. Amputation history</td>
<td>32.2%</td>
<td>21.0%</td>
<td>50%</td>
<td></td>
</tr>
</tbody>
</table>

The surgical landscape....

- 2 RCTs
- 1 prospective study
- Retrospective cohort studies
- Retrospective comparison studies
- Limitations
  - Small studies
  - Often no vascular measures
  - Post-op care not defined

Goal is wound healing – not prevention
Safe...safer
High rate of healing
Lower rate of infection
Lower rate of re-ulceration
Biomechanics and Surgical Correction

Biomechanical deficit

- Hammer toe - claw toe
- Hallux rigidus
- Dislocated metatarsophalangeal joints
- Isolated metatarsal head ulcer
- Equinus
- Varus forefoot

Procedure

- Flexor tenotomies/ arthroplasty
- Arthroplasty, implants
- Pan metatarsal head resection
- Metatarsal head resection, osteotomy
- Achilles tendon lengthening
- Tibialis anterior tendon lengthening
Patient selection for preventive surgery

- After standard therapy has failed
- Recurrent foot ulceration
- Evaluate and emphasize the risk
- Adequate diabetes control
- Adequate perfusion
- Nutrition
- Tobacco and alcohol and drugs
- Living conditions/ social support
- Postural instability
What is the risk? Modifiable or not
The risk of infections is high?

- 247 DFU patients 27 month evaluation
  - 61% developed infection
  - 64% out-patient treatment and 36% hospitalized

- Surgical site infections are 3.6 X in diabetes
  - Diabetes 9.5% vs. 2.4%
  - Ulceration did not increase the risk of infection

Wukich DK et al Diabetes Care 2011 Oct 34: 2211-2213
### DFU RCTs 12 week studies with UT1A or Wagner 1 ulcers

<table>
<thead>
<tr>
<th></th>
<th>Amniotic tissue (N=97)</th>
<th>Neonatal fibroblasts (N=245)</th>
<th>Neonatal fibroblasts and dermis (N=208)</th>
<th>Platelet derived growth factor (20 week) (N=382)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healed (%)</td>
<td>62% v 21%*</td>
<td>30% v 18%*</td>
<td>56% v 38%*</td>
<td>50% v 35%*</td>
</tr>
<tr>
<td>Time to closure (days)</td>
<td>42 v 70 days*</td>
<td>Not stated</td>
<td>65 v 90 days*</td>
<td>86 v 127 days*</td>
</tr>
<tr>
<td>Infection (%)</td>
<td>18% v 36%*</td>
<td>19% v 32%*</td>
<td>22% v 32%</td>
<td>23% v 29% v 31%</td>
</tr>
<tr>
<td>Amputation (%)</td>
<td>not stated</td>
<td>5.5% v 12.6%*</td>
<td>6.6% v 15.6%*</td>
<td>Not stated</td>
</tr>
</tbody>
</table>

Co-morbidities that cannot be modified

- Sensory & Autonomic Neuropathy
- Peripheral vascular disease
- Venous stasis

- 2060 consecutive patients
- Preoperative glucose level ≥140 mg/dL
- HgbA1c ≥8%
- 64 surgical site infections - 3.1%.
- Multivariate regression for infection

  **Neuropathy**  OR: 4.84  95% CI: 1.4 to 16.4
  **HgbA1c ≥8%**  OR: 2.75  95% CI: 1.2 to 6.3

Co-morbidities that cannot be modified

Eurodiale study

- 1,229 consecutive patients
- Neuropathy 86%
- Infection 58%
- PAD- 49% - 32% of the ABPIs were >1.2

Risk of not healing increased with PAD and infection

Prompers L: Diabetologia 2008 May;51(5):747-55
Unmet needs

• Assessment of functional perfusion
• Glucose control
Assessing perfusion

- Ankle brachial index
- Toe pressures
- Teo waveforms
- Toe brachial pressures
- Transcutaneous oxygen
- Skin perfusion pressure
- Hyper spectral imaging
Following Flap Desaturation - Saturation

- Distal end of flap distressed but for the most part remains viable.

McFarlane flap model
What is the best predictor of healing?

• Recent history of healing
- Glucose monitoring
  - Pre-operative
  - Peri-operative
  - Post-operative period

### Peri-operative glucose targets in national guidelines

<table>
<thead>
<tr>
<th>Group</th>
<th>Target (noncritically ill patients)</th>
<th>Publication year</th>
</tr>
</thead>
</table>
| Joint British Diabetes Societies For NHS Diabetes (26) | 6–10 mmol/L (108–180 mg/dL) target  
4–12 mmol/L (72–216 mg/dL) acceptable                                                               | 2012             |
| AACE/ADA/Endocrine society (25)            | <140 mg/dL (7.8 mmol/L) and a random BG of less than 180 mg/dL (10.0 mmol/L)  
Consider lower targets in those with previously tight control                                      | 2009             |
| Canadian Diabetes Association (27)         | **Fasting 5.0-8.0 mmol/L (90–144 mg/dL)**  
Random <10 mmol/L (if safely achievable)                                                            | 2013             |
| The Association of Anaesthetists of Great Britain and Ireland (56) | 6–10 mmol/L (108–180 mg/dL) target (intra-operatively)  
6–12 mmol/L (108–216 mg/dL) acceptable                                                            | 2015             |
Glucose control and complications

- 348 consecutive after foot and ankle surgery
- Retrospective study

<table>
<thead>
<tr>
<th>Blood glucose</th>
<th>≥200 mg/dL</th>
<th>&lt; 200 mg/dL</th>
<th>Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>N=348</td>
<td>N=176</td>
<td>N=172</td>
<td></td>
</tr>
<tr>
<td>Infection</td>
<td>11.9%</td>
<td>5.2%</td>
<td>Odds Ratio2.45</td>
</tr>
</tbody>
</table>

Sweet and Sour: Impact of Early Glycemic Control on Outcomes in Necrotizing Soft-Tissue Infections

• N=151 Retrospective cohort of necrotizing soft tissue infections

• **Early glucose control** <150 mg/dL for > 2 days vs. poor control

• **No differences**
  - Number debridements
  - Amputation
  - Length of stay
Conclusion

• No evidence to support surgery for primary prevention
• Aim of most studies is wound healing
• Prevention is a happy bonus
• Patient selection is pivotal
• Modifiable risk factors
• Understanding the risk = informed consent