ΣΥΓΧΡΟΝΗ ΘΕΩΡΗΣΗ ΤΩΝ ΕΠΑΝΟΡΘΩΤΙΚΩΝ ΟΡΘΟΠΑΙΔΙΚΩΝ ΕΠΕΜΒΆΣΕΩΝ ΣΤΟ ΔΙΑΒΗΤΙΚΌ ΠΌΔΙ

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Ορθοπαιδικός Χειρουργός – Ορθοπαιδικός Παίδων

Κλινική "Άγιος Λουκάς", Θεσσαλονίκη
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Global age-standardized diabetes prevalence\textsuperscript{1}

From 4.3% in 1980 to 9.0% in 2014 in men and from 5.0% to 7.9% in women respectively

In 2010 it was the seventh leading cause of death in USA

Underlying cause in nearly 70,000 death certificates

Appeared in some location on a total of 234,000 death certificates

The annual incidence of foot problems amongst the diabetic population is just under 2%\(^1\)

In the United Kingdom Prospective Diabetes Study, 13% of patients at diagnosis had neuropathy of sufficient severity to put them at risk for foot ulceration\(^1\)

\(^1\) Boulton AM, The Diabetic Foot 2016
Risk factors for foot ulceration

➤ Peripheral neuropathy (somatic and autonomic)

➤ Peripheral Vascular Disease (PVD)

➤ Proximal and/or distal disease

➤ Past history of foot ulcers/amputation

➤ Other long-term complications

➤ End-stage renal disease (especially on dialysis)

➤ Post-transplant (including pancreas/kidney transplant)

➤ Visual loss

➤ Plantar callus

➤ Foot deformity

➤ Edema

➤ Ethnic background

➤ Poor social background
Pathway to Diabetic Foot Ulcer (DFU)\(^1\)

- ☑ complex

- ☑ involves the interaction of numerous factors

\(^1\)Boulton AM. The Diabetic Foot 2016
A Diabetic Foot Ulcer (DFU) will heal if:

❖ there is adequate arterial inflow to the foot

❖ every infection is appropriately and aggressively managed

❖ all pressure is removed from the wound and its margins

We tend to forget that patients with neuropathic or neuroischemic ulcers have “lost the gift of pain.”
Classification of Diabetic Foot Wounds (The University of Texas wound classification system)

<table>
<thead>
<tr>
<th>GRADE</th>
<th>STAGE</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>Pre-ulcerative lesions</td>
<td>Superficial wound No penetration</td>
<td>Wound penetrating tendon or capsule</td>
<td>Wound penetrating bone or joint</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>With infection</td>
<td>With infection</td>
<td>With infection</td>
<td>With infection</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>With ischemia</td>
<td>With ischemia</td>
<td>With ischemia</td>
<td>With ischemia</td>
</tr>
<tr>
<td></td>
<td>D</td>
<td>With infection and ischemia</td>
<td>With infection and ischemia</td>
<td>With infection ad ischemia</td>
<td>With infection and ischemia</td>
</tr>
</tbody>
</table>
Neuropathic plantar ulcers (UT 1A,1B,2A,2B)

- mostly at the plantar surface of the forefoot, DIP if clawing of toes is present
- in Charcot Neuropathy (CN) ulcers can develop even in the plantar mid-foot due to dropped cuboid bone

**Goals:**

- Debridement down to bleeding healthy tissue (removal of all callus tissue)
- Offloading (Total Contact Cast still regarded as the gold standard)
- Wound dressings important but few evidence supporting one is superior to another
Neuro-ischemic Ulcers (UT 1C,2C,1D,2D,3D)

- full vascular investigation and referral to vascular surgery team

- same treatment regime as to neuropathic ulcers, offloading can be safely used for non-infected ulcers

- if suspected infection use antibiotics. Casting used with extreme caution

- major outcomes following endovascular or open bypass surgery were similar amongst studies

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Gait parameters of people with diabetes-related neuropathic plantar foot ulcers.

Fernando ME, Crowther RG, Lazzarini PA, Sangla KS, Buttner P, Golledge J.
Shear and pressure under the first ray in neuropathic diabetic patients: Implications for support of the longitudinal arch.

Davis B, Crow M, Berki V, Ciltea D.
Vacuum Assisted Closure (V.A.C.)

International Working Group of the Diabetic Foot (IWGDF):

“... with the possible exception of negative pressure wound therapy (NPWT) in post-operative wounds, there is little published evidence to justify the use of newer therapies" 

Skin grafting / flaps

Medial plantar flap
Authors' conclusions

Based on the studies included in this review, the overall therapeutic effect of skin grafts and tissue replacements used in conjunction with standard care shows an increase in the healing rate of foot ulcers and slightly fewer amputations in people with diabetes compared with standard care alone. However, the data available to us was insufficient for us to draw conclusions on the effectiveness of different types of skin grafts or tissue replacement therapies. In addition, evidence of long term effectiveness is lacking and cost-effectiveness is uncertain.
External fixation systems / Concept

Ilizarov

I. Bridging of bone defects
II. Pseudarthrosis
III. Acute osseous shortening
IV. Distraction osteogenesis
V. Fracture stabilization/ healing/ restoration
External fixation systems / Concept

Taylor Spatial Frame

Boeing© Flight Simulator
Masquelet Technique for Midfoot Reconstruction Following Osteomyelitis in Charcot Diabetic Neuropathy
A Case Report
May Fong Mak, FRCSEd(Ortho); Richard Stern, MD; Mathieu Assal, MD
Papineau technique

1) Blood supply

2) Desiccated bone graft

3) Desiccated bone graft

4) Granulation tissue

AO Foundation
Four-stage regimen for operative treatment of diabetic foot ulcer with deformity – Results of 300 patients

Martinus Richter MD, PhD*, Stefan Zech MD
Department for Foot and Ankle Surgery Hameln and Nuremberg, Germany

Goals:

- Plantigrade and loadable foot
- Functional amputation

Classification of the deformities.

<table>
<thead>
<tr>
<th>Type of deformity</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forefoot/isolated hallux valgus</td>
<td>68</td>
<td>20</td>
</tr>
<tr>
<td>Forefoot/hallux valgus &amp; claw toes</td>
<td>75</td>
<td>22</td>
</tr>
<tr>
<td>Forefoot others</td>
<td>27</td>
<td>8</td>
</tr>
<tr>
<td>Midfoot/flatfoot</td>
<td>53</td>
<td>16</td>
</tr>
<tr>
<td>Midfoot/cavus foot</td>
<td>25</td>
<td>7</td>
</tr>
<tr>
<td>Midfoot others</td>
<td>18</td>
<td>5</td>
</tr>
<tr>
<td>Hindfoot/varus deformity</td>
<td>25</td>
<td>7</td>
</tr>
<tr>
<td>Hindfoot/varus deformity</td>
<td>38</td>
<td>11</td>
</tr>
<tr>
<td>Hindfoot/equinus</td>
<td>14</td>
<td>4</td>
</tr>
<tr>
<td>Hindfoot others</td>
<td>69</td>
<td>21</td>
</tr>
<tr>
<td>Combined</td>
<td>99</td>
<td>30</td>
</tr>
</tbody>
</table>

1. Debridement (VAC, Ab)
2. Closure (Skin graft)
3. Unloading (Orthoses)
4. Correction (Arthrodeses)
### Amputations

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partial toe</td>
<td>Excision of any part of one or more toes</td>
</tr>
<tr>
<td>Toe disarticulation</td>
<td>Disarticulation at the MTP joint</td>
</tr>
<tr>
<td>Partial foot/ray resection</td>
<td>Resection of 3rd, 4th metatarsal &amp; digit</td>
</tr>
<tr>
<td>Transmetatarsal</td>
<td>Amputation through the midsection of all metatarsals</td>
</tr>
<tr>
<td>Syme’s</td>
<td>Ankle disarticulation with attachment of heel pad to distal of tibia</td>
</tr>
<tr>
<td>Long transfemoral (Below knee)</td>
<td>More than 50% tibial length</td>
</tr>
<tr>
<td>Short transfemoral (Below Knee)</td>
<td>Between 20% and 50% of tibial length</td>
</tr>
<tr>
<td>Knee disarticulation</td>
<td>Through knee joint</td>
</tr>
<tr>
<td>Long transfemoral (Above knee)</td>
<td>More than 60% femoral length</td>
</tr>
<tr>
<td>Transfemoral (above knee)</td>
<td>Between 35% and 60% femoral length</td>
</tr>
<tr>
<td>Short transfemoral (Above Knee)</td>
<td>Less than 35% femoral length</td>
</tr>
<tr>
<td>Hip disarticulation</td>
<td>Amputation through hip joint, pelvis intact</td>
</tr>
<tr>
<td>Hemipelvectomy</td>
<td>Resection of lower half of the pelvis</td>
</tr>
<tr>
<td>Hemicorporectomy/Translumbar</td>
<td>Amputation both lower limb &amp; pelvis below L4-L5 level</td>
</tr>
</tbody>
</table>

1. Toe amputation
2. Toe disarticulation
3. Digits transmetatarsal amputation
4. Proximal transmetatarsal amputation
5. Metatarsal disarticulation
6. Midtarsal disarticulation
7. Interdigital disarticulation

1. Above knee (transfemoral)
2. Through knee (knee disarticulation – Gritti Stokes)
3. Below knee (transstibial)
4. Ankle (ankle disarticulation – Symes)
5. Forefoot (transmetatarsal)
Improvements in foot care services by implementation of an interdisciplinary team

1. The incidence of major amputations fell (62%)
2. Total amputation rates also decreased (40%)
What’s next?

a) Supermicrosurgery – angiosomes
b) Combined methods/ techniques (Papineau + VAC therapy)
c) Sonication for biofilm
d) Weight bearing CT
“Put feet first”

Thank you!