Current Status of Endovascular Therapies for Critical Limb Ischemia

Bulent Arslan, MD
Associate Professor of Radiology
Director, Vascular & Interventional Radiology
Rush University Medical Center
bulent_arslan@rush.edu
• Percutaneous angioplasty was Dr. Dotter’s landmark contribution to medicine.

• He also introduced concepts of percutaneous arterial stenting and stent grafting by placing a coil-spring graft into femoral artery of a dog.

• He pioneered the techniques of low dose fibrinolysis with injection of streptokinase directly into an occluding thrombus.

• He developed loop snare catheter for intravascular foreign body retrievals.

• He developed tissue adhesives for vascular occlusions and organ ablation.

Charles Theodore Dotter: The Father of Interventional Radiology
First angioplasty-1964
• Her rest pain improved immediately and soon after her ulcer healed.

• Follow up angiograms at 3 weeks and 6 months showed continued patency

• Mrs Shaw died of congestive heart failure 3 years later “still walking on my own feet”
Endovascular medicine landmarks

- Dr Palmaz invented the first commercially available stent.
- Dr Gruntzig performed the first coronary angioplasty.
- Both radiologists!
- Up to end of 1990s most arterial interventions performed by interventional radiologists.
- Early 2000s vascular surgery and then cardiology started performing peripheral arterial interventions.
Currently all three specialties perform peripheral endovascular procedures.

I would like to think IRs will be able to provide you with the best outcomes but your concern should be to find the best specialist around you at least to get a second opinion.

If optimal care is provided to every patient, there would be enough patients to treat for all three specialties to the extent of their abilities.

Once a “foot” is amputated, it is not coming back.
Tip of the iceberg

- Foot Wound
  - CLI
    - 25% die
    - 30% amputation
      • Half die within 2-4 yrs
  - Major Co-morbidities
    - MI, Stroke, ESRD, Death
  - Multidisciplinary Approach
Endovascular Revascularization:

• Restore adequate flow for wound healing
  – “Straight Line Flow”
    • Unobstructed flow from Aorta to the foot
      – At least one tibial artery
      – As many tibial arteries as possible
  – “Angiosome Concept”
    • Tailored reperfusion of the affected tissue bed

• Do Not ‘Trash any vessels’

• Goal is to have a palpable pulse at the level of the ankle
Tools of the Trade

- Sharps
- Wires
- Catheters
- Balloons
- Stents
- Atherectomy Devices
- Many Others
Wires - gets you to your target working together with catheters
Balloons
Stents
Atherectomy
Technique

- Access an artery
  - CFA or Brachial Artery
  - Popliteal, Tibial, Radial Arteries
- Locate the obstruction
- Cross the obstruction with a wire
Wire Across Lesion
Device Across Lesion
Right Device(s) for the Right Lesion
Techniques

- Angioplasty (plain old, drug coated, scoring, high pressure, cutting, cryo, etc)
- Stents (Bare, covered, drug coated, bioabsorbable, etc)
- Atherectomy (excisional, rotational, orbital, etc)
Rush Experience

• All endovascular tools available
• Two interventional radiologists with over 575 limbs treated during the past 4 years for CLI
• 5 technical failures (% 99.1 procedural success rate)
Assessment of safety of a single vessel runoff “peroneal artery access” during the subintimal arterial flossing with antegrade-retrograde intervention (SAFARI) in critical limb ischemia (CLI)

Z. Bhatti, U.C. Turba, B. Arslan

Vascular and Interventional Radiology, Rush University Medical Center, Chicago, IL

Distinguished oral abstract award at SIR 2015
A new technique in complex chronic total occlusions: puncture through a subintimally placed microsnare with a reentry device from the true lumen to achieve through and through antegrade-retrograde access

B. Arslan, J.C. Tasse, K. Wepking, U. Turba

Radiology, Rush University Medical Center, Chicago, IL

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• Below the ankle revascularization in the setting of CLI
• B. Arslan, M Ozen, U. Turba
• Radiology, Rush University Medical Center, Chicago, IL
• SIR 2017 oral presentation
• Performed a retrospective review of all lower extremity arterial revascularizations by interventional radiology in our institution between 2012 to 2016.

• Among them all patients who underwent revascularization for critical limb ischemia were identified.

• Patient demographics, co-morbidities and Rutherford stages were reviewed.

• Among these patients, interventions involving recanalization of below ankle branches were identified.
• All below ankle interventions with or without additional treatment levels were reviewed for complications, technical and clinical success.

• There were 33 patients with below ankle interventions and Rutherford 5 and 6 disease.

• Mean follow up was 13 months (2 to 27 months).
## Patient baseline characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients</td>
<td>33</td>
</tr>
<tr>
<td>Age</td>
<td>65.4 (41-97)</td>
</tr>
<tr>
<td>Male Gender</td>
<td>21 (%67)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>28 (%84)</td>
</tr>
<tr>
<td>Renal disease</td>
<td>21(%64)</td>
</tr>
<tr>
<td>Diabetes</td>
<td>23(%70)</td>
</tr>
<tr>
<td>Concomitant interventions</td>
<td>Value</td>
</tr>
<tr>
<td>----------------------------</td>
<td>-------</td>
</tr>
<tr>
<td>Ant-post Tibial arteries</td>
<td>16</td>
</tr>
<tr>
<td>Femoro-popliteal</td>
<td>2</td>
</tr>
</tbody>
</table>
• Technical success rate for below ankle recanalization attempts was 97%.

• All minor amputations were planned prior to the revascularization procedures.

• There were 11 amputations (7 toe, 3 metatarsal, 1 below knee).
Results

• Four of the toe amputations were prior to arterial intervention, 3 toe and 3 metatarsal amputations were within one week after the intervention.

• Single below knee amputation was performed 4 months after the revascularization procedure.

• Our limb salvage rate, defined as "preservation of ankle joint" was 97% in this patient group.
Heal ulcer - can’t go through PT
Below-the-ankle Angioplasty is a Feasible and Effective Intervention for Critical Leg Ischaemia

M.F. Abdelhamid a,*, R.S.M. Davies a, S. Rai a, J.D. Hopkins b, M.J. Duddy b, R.K. Vohra a

a Vascular Surgery Department, University Hospital Birmingham NHS Foundation Trust, Solihull Oak Hospital, Birmingham, UK
b Interventional Radiology Department, UH, Birmingham, UK

Revascularization of Tibial and Foot Arteries: Below the Knee Angioplasty for Limb Salvage

Marco Manzi, Luis Mariano Palena and Giacomo Cester
Interventional Radiology Unit, Policlinico Abano Terme, Padua, Italy

Below-the-ankle Angioplasty and Stenting for Limb Salvage: Anatomical Considerations and Long-term Outcomes

Konstantinos Katsanos · Athanasios Diamantopoulos · Stavros Spiliopoulos · Dimitris Karnabatidis · Dimitris Stiablis
60 yo right great toe non-healing ulcer
Non healing right forefoot/great toe ulcer
84 y/o 1\textsuperscript{st} toe gangrene
61 yo 2\textsuperscript{nd} and 3\textsuperscript{rd} toe gangrene
• 67 year old male with CAD s/p CABG and stents, HTN, DM2, HLD, OSA on CPAP, and bilateral lower extremity PVD. He has previously had RLE stents placed. Patient with multiple prior LLE angiograms; most recently 6/26/2017 with angioplasty of the PTA and SFA. Patient with BL foot ulcers.

• Patient presents 7/14/2017 for repeat LLE angiogram for non-healing foot ulcers
Non healing ulcer if the 3rd and 4th digits
Percutaneous arterial intervention (Endovascular Treatments) is invented by interventional radiology.

It is constantly progressing. Today we can treat arteries that we once thought were untreatable, such as the pedal arteries.

There are many vascular specialists who think if a patient is diabetic with below knee disease “amputation is only option”.

In our practice 70% of our patients are diabetic with below knee disease and we have over 90% limb salvage rates.
Conclusion

- Unique day to day experience of interventional radiologists with catheters and wires allows hem to adopt and improve on endovascular techniques to achieve higher technical success rates.
- Critical Limb Ischemia management requires a multidisciplinary approach just like a podiatric surgeon who primarily manages the ulcer/gangrene, a skilled endovascular specialist is a key component.
- Level/Quality of endovascular care will directly reflect on to your wound healing and amputation rates.
- Further collaboration between IR and Podiatry would help to improve limb salvage rates.
• Thank you for your attention!

• Bulent_arslan@rush.edu