Patterns Of Calcification In Below The Knee (BTK) Arteries: Implications For Atherectomy And Vessel Prep

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Conflicts of interest

• Jos C. van den Berg
  – No disclosures

• Jihad A. Mustapha
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Background

• The 1st step in successful therapy for tibial arteries: be aware of the fact that tibial arteries are different from all other arteries, especially coronary and SFA arteries

Calcification

• Intimal calcification leads to development of occlusive lesions (calcified atheroma)

• Medial calcification
  – Related to CKD and DM
  – Never leads to occlusion
  – Leads to stiffening of arterial wall that contributes/aggravates atherosclerotic lesions

Medial calcification

• Diffuse non-confluent microcalcifications
  – Dusty calcification IEL
  – Dusty calcification media
  – Combination

• Confluent
  – Lumpy calcification IEL
  – Sheet-like lumpy calcification
  – Sheet-like concentric calcification
  – Ossification/cartilaginous metaplasia

Early stage disease

Adaptive intimal thickening characterized by accumulation of SMC within a proteoglycan collagen matrix with the absence of Ca+ and absence of lipid, macrophage foams
Advanced disease-distal segment
Pathological intimal thickening, characterized by lipid pool that lacks SMC, still very rich in proteoglycan and lipid

Advanced disease-more proximal
Fibroatheroma characterized by a dense fibrous cap with macrophage located at the periphery of the necrotic core

Advanced disease-proximal cap
Thin cap fibroatheroma (TCFA) showing a necrotic core covered by a thin (42 µm) fibrous cap

Proximal to mid-calf lesions
Cholesterol crystals: mostly in the proximal to mid lesions can be associated with intimal calcification
Rupture characterized by disrupted fibrous cap and thrombus in continuity with the underlying hemorrhagic necrotic core. Note presence of punctate areas of calcification in the periphery of the necrotic core

Distal lesions
Fibrotic tissue: mostly in the distal tibials, can be associated with medial calcification
Healed plaque characterized by the underlying thin collagen rich fibrous cap (black arrow) over the necrotic core and a luminal healed thrombus consisting of smooth muscle cells surrounded by proteoglycan rich matrix (green)

Most important: plaque vs. CTO
Fibrous plaque characterized by collagen rich neointimal tissue with few smooth muscle cells but no lipid pool or necrotic core
CTO characterized by an occluded lumen showing an organized thrombus-rich in neo-angiogenesis surrounded by loose proteoglycan-rich neointimal tissue and few smooth muscle cells
Implications

- Type of lesion and composition are the main factors in determining the type of atherectomy device/vessel preparation
- Use those devices better in dealing with calcium proximally and those that are doing better in soft lesions distally

Conclusion

- Patterns of calcification in BTK arteries have implications for crossing of CTO's but also for the choice of the optimal atherectomy device or type of vessel preparation
- More data however needed to be able to fully implement this concept in daily practice