

The Role Of Local Flap Reconstruction For Limb Salvage In Patients With Moderate To Severe Medial Arterial Calcification

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Introduction

- Medial arterial calcification (MAC) is a non-atherosclerotic arterial disease affecting small vessels, commonly seen in patients with diabetes, CKD, ESRD, and peripheral neuropathy.
- MAC can be identified using a simple pedal X-ray and scored via the validated Ferraresi system.
- High MAC scores have been linked to limb loss and poor revascularization outcomes in prior vascular literature.
- While MAC is gaining traction as a prognostic tool, its role in reconstructive outcomes remains underexplored.
- Local flap reconstruction offers a limb-preserving alternative to free flaps, especially in patients with significant comorbidity and vessel disease.
- This study evaluates whether MAC severity impacts outcomes in patients undergoing local flap reconstruction for limb salvage.

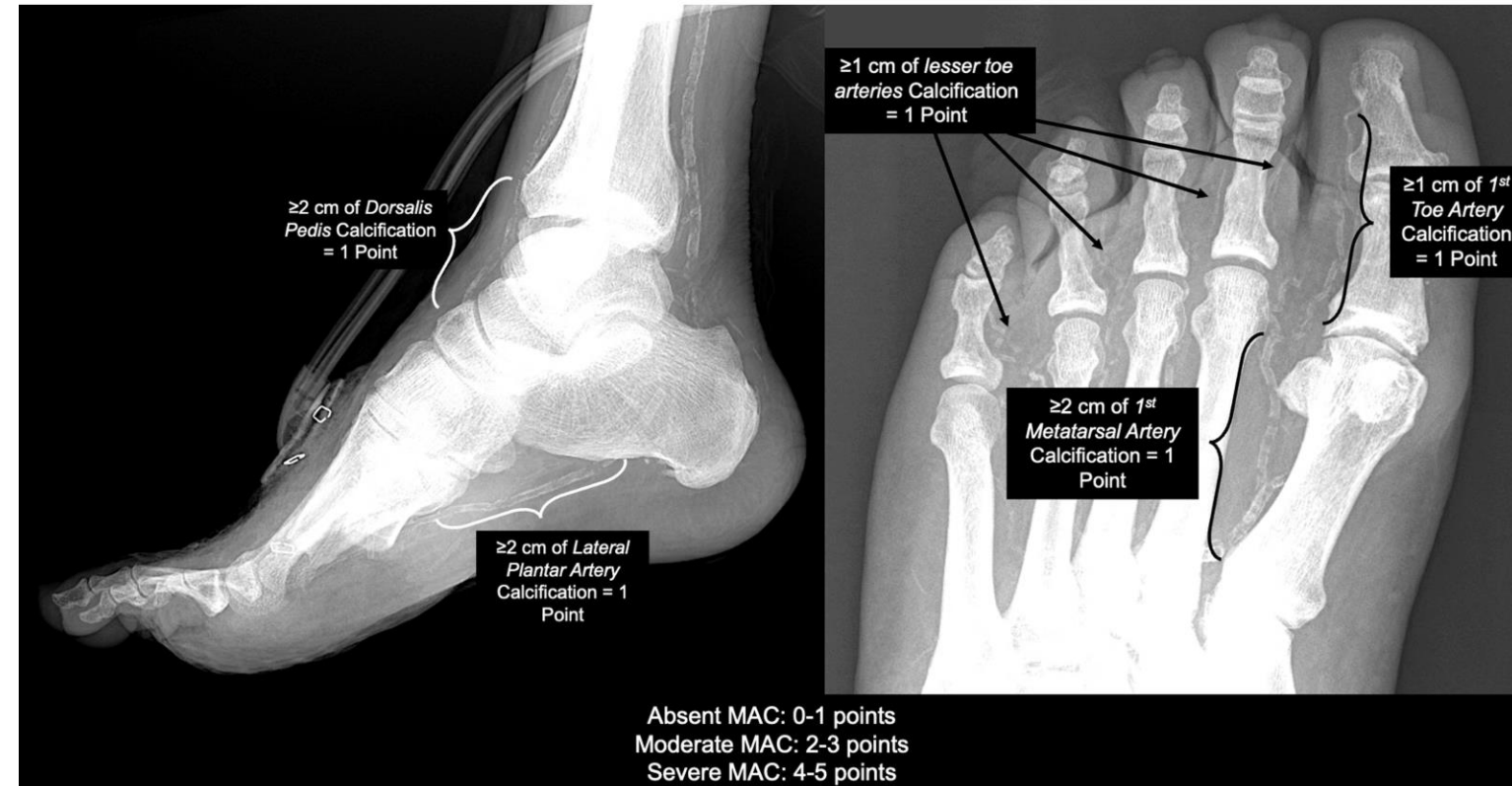
Objective

To assess whether moderate and severe MAC independently predict limb salvage failure, major limb events, reoperation, or mortality following local flap reconstruction.

Methods

- Retrospective review of 320 LE FTTs (2011–2024) at a tertiary limb salvage center.
- Patients stratified using the Ferraresi et al. MAC classification based on pre-op pedal X-rays
 - No MAC (0–1 calcified sites)
 - Moderate MAC (2–3 sites)
 - Severe MAC (4–5 sites)
- Primary outcomes:
 - Major amputation
 - Surgical reintervention
 - Post-op vascular intervention
 - Major adverse limb events (MALEs = amputation or reintervention)
 - Mortality

Results



Above. Pedal MAC Scoring System.

Vascular and Surgical Details

- Vascular intervention was more common in moderate and severe MAC (p=0.001).
- Pedicled flaps were more frequent in the absent MAC group (p=0.023); moderate/severe MAC patients more commonly received fasciocutaneous flaps (p=0.016).
- Wound size was similar across groups.

Clinical Outcomes

Immediate flap success: 97.8% (no difference by MAC group, p=0.811)

Limb salvage rate: 84.1% overall

- No significant difference by MAC group (p=0.803)

Major amputation:

- Absent: 14.4%
- Moderate: 19.8%
- Severe: 17.4% (p=0.803)

MALE rate:

- Absent: 39.4%
- Moderate: 53.1%
- Severe: 58.7% (p=0.067)

Podiatric reoperation:

- 35.6% (absent) vs. 40.6% (moderate) vs. 56.5% (severe), p=0.056

Ambulatory at follow-up:

- Severe MAC had highest non-ambulatory rate: 37.0% (p=0.037)

Mortality:

- Absent: 19.4%
- Moderate: 34.4%
- Severe: 32.6% (p=0.102)

On multivariate analysis, MAC was not independently associated with limb salvage, MALE, reintervention, mortality, or vascular intervention. Flap-related complications were also not predicted by MAC score.

Patient Characteristics:

182 patients underwent foot/ankle local flap reconstruction:

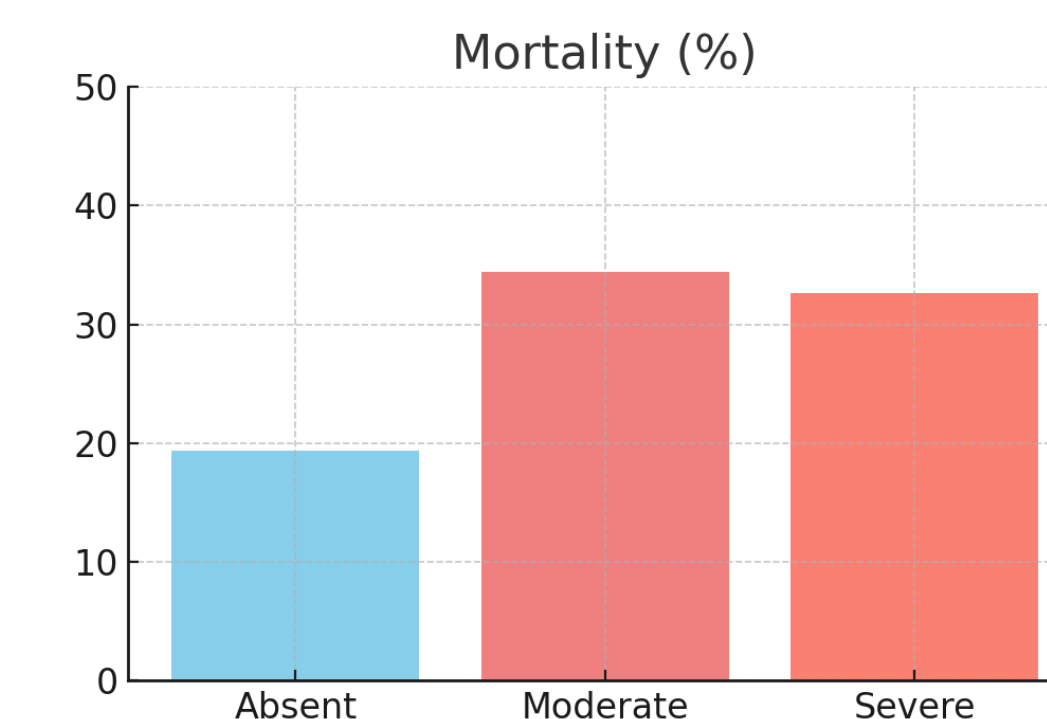
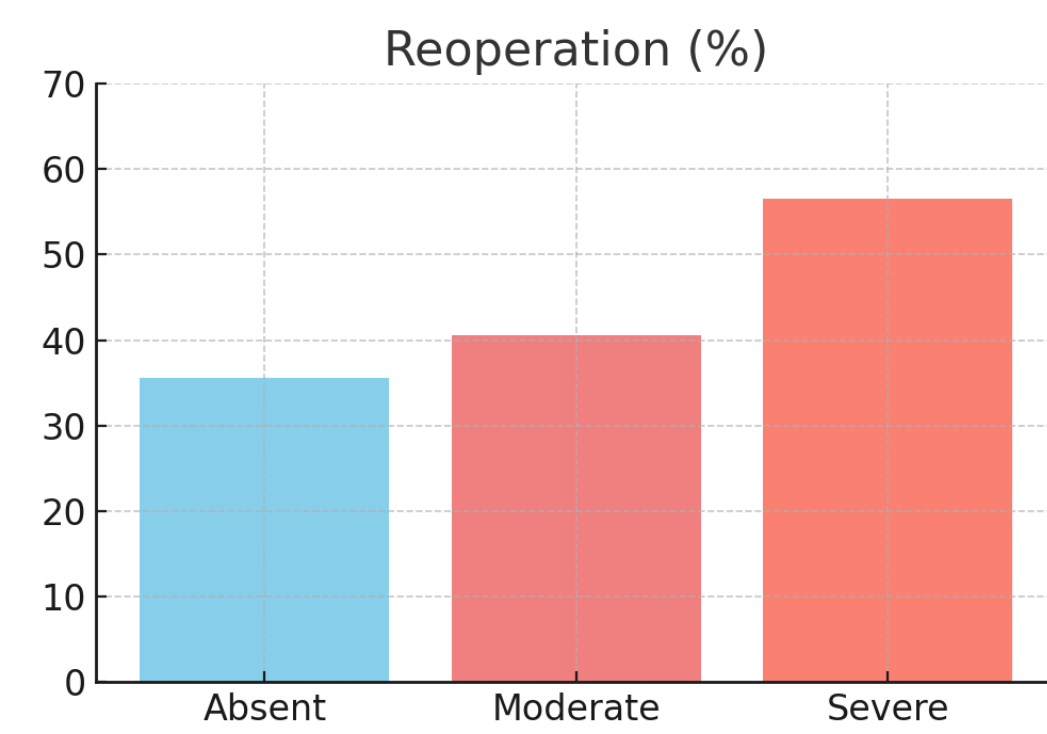
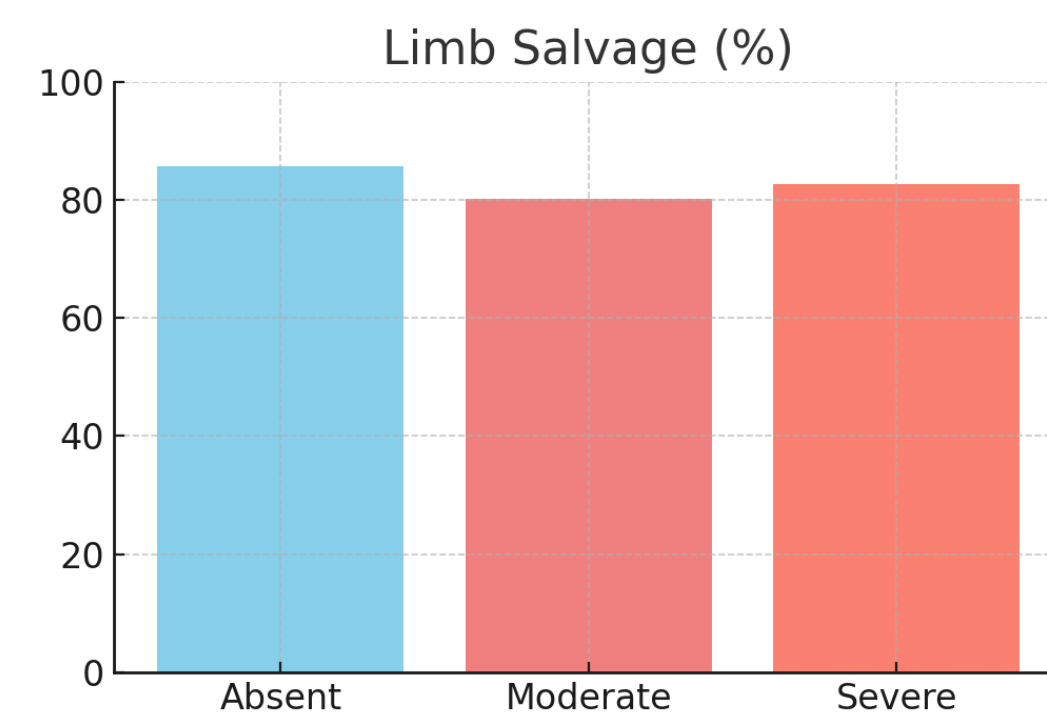
- Absent MAC: 57.1% (n=104)
- Moderate MAC: 17.6% (n=32)
- Severe MAC: 25.3% (n=46)

Severe MAC patients had significantly higher:

- Charlson Index: 6.7 vs. 4.6 (p=0.001)
- Diabetes: 95.7% (p<0.001)
- CKD: 71.7% (p<0.001)
- ESRD: 39.1% (p<0.001)
- Neuropathy: 93.5% (p<0.001)

Also more likely to have:

- Prior transplant (p<0.001)
- Ipsilateral amputation (p=0.002)
- Lower albumin and hemoglobin (p<0.05)



Discussion

- Nearly 50% of patients undergoing local flap reconstruction had moderate or severe MAC — underscoring its clinical relevance in the reconstructive population.
- Despite increased comorbidity (e.g., DM, ESRD, neuropathy), limb salvage and flap success were comparable across MAC groups.
- No MAC group demonstrated statistically higher flap-related complications, MALEs, or mortality — challenging assumptions that MAC precludes successful reconstruction.
- These findings contrast with vascular literature (e.g., Ferraresi et al.), where MAC predicted worse outcomes in revascularization cohorts.
- Local flaps may offer a physiologic advantage in MAC patients:
 - Lower operative burden
 - Shorter ischemia time
 - No microvascular anastomosis
- Importantly, MAC predicted longer hospital stays and more intensive follow-up, highlighting the need for multidisciplinary coordination.
- MAC remains a useful risk stratification tool — not for exclusion, but for identifying patients who require aggressive pre-op optimization and realistic goal-setting.
- In institutions without microsurgical resources, local flaps represent a viable limb salvage option even in high-MAC populations.

Conclusion

MAC severity should not preclude local flap reconstruction for limb salvage. While patients with severe MAC have high systemic disease burdens, local flaps remain a safe and effective option when integrated into a multidisciplinary care model.

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