RADIOLOGICAL PROTOCOL

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FOOT

VALOR IMPLANT

Radiological protocol TC - Foot

The basic requirement for digital surgical planning is a high-quality computed tomography scan with clear and well-defined bone edges. These qualities are essential for the correct design of personalised instruments and implants.

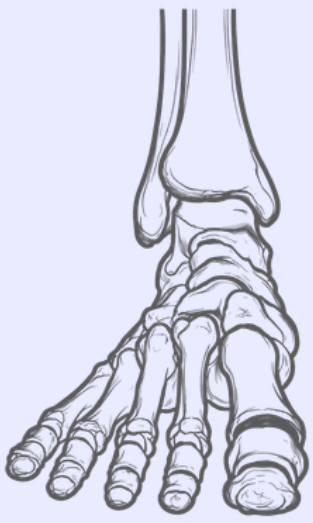
Indications:

This protocol is indicated for personalised surgical planning studies in ankle arthrodesis procedures, where acquisition of the distal tibia and ankle is required. Acquisition is performed unilaterally, unless otherwise indicated by the surgical team.

Recommendations:

The X and Y centres should be not modified between scans, nor should the table be raised or lowered between slices. The scan should be performed using the same field of view and reconstruction centre.

Acquisition:

Topogram	Include from the distal third of the tibia to the entire foot 
Field of view (FOV)	Adjust the FOV so that no anatomical region is cut off, ensuring the entire foot is included
Matrix	512 x 512

Detector collimation	1.25 mm
Pitch	≤ 2
kVp	90 or 120 if the patient is obese or has metal implants
Automatic exposure control	Activado
Rotation time	≤ 1 s

Reconstruction:

Multiplanar reconstruction (MPR)	Reconstruction of the complete study in all three planes
Reconstruction algorithm	Soft tissue/moderate algorithm. Do not use the bone algorithm. Use a single window
MPR slice thickness	1.25 - 1.50 mm
Slice increment	1.25 - 1.50 mm, continuous slices

Appendix - Reduction of metal artefacts (MAR) and noise

Objective

Minimise artefacts from prostheses, screws, or osteosynthesis hardware in the region of the distal tibia, ankle, and foot, while preserving diagnostic image quality of bone and soft tissues, and enabling reconstructions suitable for 3D planning and STL export.

Acquisition settings (add without modifying the original ROI)

Parameter	Recommended	Notes / Justification
Region	From the distal third of the tibia to the entire foot, including any metallic material	Prevents implant truncation
kVp	140 kVp (fallback 120 kVp)	Reduces beam hardening from metallic materials
mA / AEC	Automatic with an upper limit 20–30% above standard	Compensates for increased noise due to MAR and high kVp
Rotation time	0.5-1.0 s (prioritise 0.5 s)	Minimises motion artefacts
Pitch	0.6-1.0 (recommended 0.8)	Balance between coverage and resolution
Collimation/slice thickness	≤0.625 mm	Isotropy for MAR and 3D reconstructions
FOV	Centred on the tibia and foot axis, ensuring complete inclusion of the metallic material’	Prevents the prosthesis from being located at the detector edge

Patient position	Supine, feet in a neutral position, geometrically centred	Centring the metal reduces asymmetrical streaks

ALWAYS generate paired series with and without MAR.

- Reference (without MAR): Soft/moderate kernel, FBP or mild IR; slices 0.6 mm / 0.4 mm increment.
- MAR activated: Soft/moderate kernel + manufacturer algorithm (iMAR/O-MAR/Smart MAR/ SEMAR).
- DECT / Spectral (if available): VMI 100–140 keV (save at least 100, 120, and 140 keV); consider 70 keV for soft tissues if artefact saturation is absent.
- 3D volume (planning): Use the series without MAR, isotropic 0.6 mm, intended for STL export.

Post-processing and verification

- Check bone and soft tissue windows; confirm cortical continuity near metal..
- If streak artifacts persist, increase VMI keV (120 → 140 keV) and/or compare with the series without MAR.
- Confirm implant centering and absence of truncation before sending to PACS.
- Always export STL from the series without MAR (MAR can alter geometries).

Console setup sheet

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Name: ORTO_[ANKLE]_MAR
 kVp: 140 (fallback 120)
 mA (AEC): ON, upper limit +20–30%
 Rotation: 0.5–1.0 s
 Pitch: 0.8 (≤1)
 Collimation: 0.6 mm (recon 0.6 / inc. 0.4)
 Kernels: B40s (soft) + B70f (bone)
 Series:
    1) Standard IR (B70f)
    2) MAR ON
    3) VMI 100–140 keV (if DECT)
    4) 3D export (without MAR)

FOV: 120–160 mm centred on the foot
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