Universitätsspital Basel | Orthopaedic Department | Kantonsspital Baselland Liestal ▲ Bruderholz ▲ Laufen | ORTHO TRAUMA Bruderholz

A new standardized algorithm to evaluate tibio-talar osteochondral lesions using SPECT/CT

Hassink G[1], Testa EA[2], Hügle T[3], Leumann A[3], Valderrabano V[3], Hirschmann MT[2]
[1]Faculty of Medicine, University of Basel, Switzerland
[2]Department of Orthopaedic Surgery and Traumatology, Kantonsspital Baselland Standort Bruderholz, Switzerland
[3]Department of Orthopaedic Surgery, University Hospital of Basel, Switzerland

Background

SPECT/CT has been recognized as an important part of diagnostics in patients with osteochondral lesions (OCL). SPECT/CT is a hybrid imaging modality which combines a 3D scintigraphy (SPECT) and computerized tomography (CT) into a single procedure. It shows a combination of metabolic data and structural information.

However, to date there is no standardized algorithm, which allows combined assessment for patients with OCL at the upper ankle joint. The purpose of the study was to set up a standardized localisation scheme, which could be used to anatomically localise and quantitatively measure the SPECT/CT tracer activity at the tibio-talar joint.

Materials and methods

Patients with OCL on the talus (n=16) with a diagnostic 99mTc-HDP-SPECT/CT, which were diagnosed on MRI by specialised orthopaedic surgeons and radiologists, were retrospectively included. Exclusion criteria among others were previous surgery or fractures on the talus. SPECT/CT images were analysed using a customised validated software which allows a 3D volumetric analysis of tracer activity. Absolute and relative values to specific reference regions representing the SPECT/CT tracer background activity were measured. The localisation scheme used for the talus consisted of 6 different regions (T1-T6) representing the talar chondral and subchondral bone. The measurements were done twice by two independent observers, blinded to clinical information, to evaluate the inter- and intra-observer reliability.

The tibial part of the upper ankle joint has not been measured within this protocol.

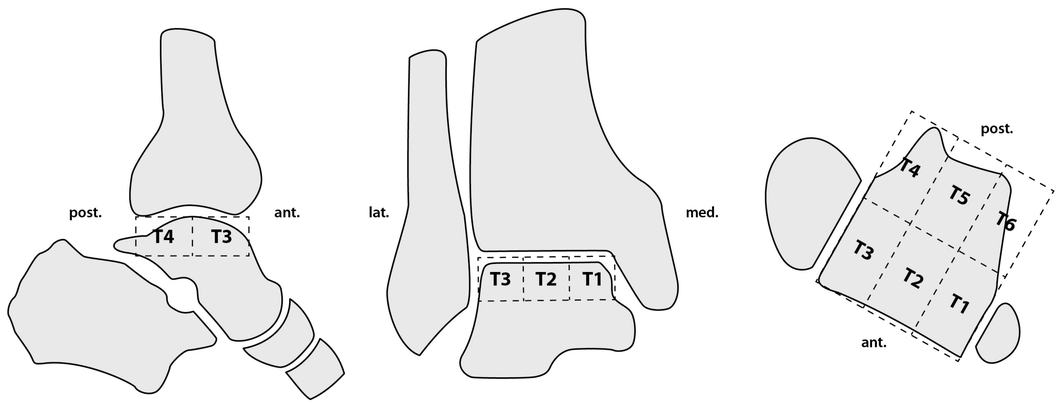

Figure 1:
The draft shows the "Talus Measurement scheme" that sub-divides the surface in 6 parts

Results

A standardized measurement protocol was elaborated and tested. Therefore, the talus was divided into 6 regions, 3 anterior (T1-3) and 3 posterior (T4-6) parts. T1 is the anterior-medial part of the talus. The other parts are numbered clockwise until T6, the posterior-medial talar part. The protocol was developed on the basis of biomechanical and clinical reflections found in OCL of the talus and the upper ankle joint.

	Intra Observer 1			Intra Observer 2			Inter R1 - R2		
	ICC	Lower	Upper	ICC	Lower	Upper	ICC	Lower	Upper
Ratio TR1	**1.00**	0.99	1.00	**1.00**	1.00	1.00	**0.99**	0.98	1.00
Ratio TR2	**0.99**	0.98	1.00	**0.99**	0.98	1.00	**0.98**	0.94	0.99
Ratio TR3	**0.98**	0.95	0.99	**1.00**	0.99	1.00	**0.98**	0.95	0.99
Ratio TR4	**0.96**	0.90	0.99	**0.94**	0.83	0.98	**0.94**	0.84	0.98
Ratio TR5	**0.97**	0.92	0.99	**0.93**	0.81	0.97	**0.98**	0.93	0.99
Ratio TR6	**1.00**	0.99	1.00	**0.99**	0.97	1.00	**0.94**	0.84	0.98

Table 1 shows excellent intra- and inter observer correlations for every single part of the Talus evaluated (val. Min. 0.93 – val. Max. 1.00)

Additionally a correlation between the different talar parts was detected ($p<0,05$). T1 and T6 on the anterior and posterior side of the medial talar part, as well as T2 and T5 or T3 and T4 on the lateral talar part, have similar values in the measurements. The biggest difference in the tracer uptake is between T1 and T3 as well as between T6 and T4 with a higher uptake in the medial parts (T1 and T6).

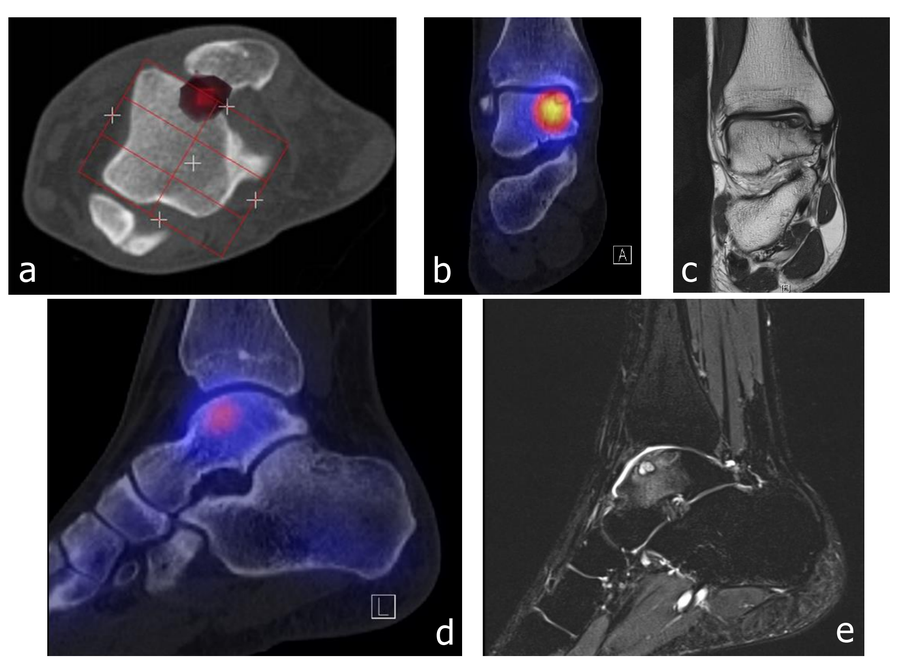

Figure 2:
OCL on the talus dome. a) Suddivision through the «Talus-Schema» in IntroSpect v.2.0, b,c,d,e) Different projections (coronal and sagittal) of the OCL in MRI and SPECT-CT.

Conclusion

The presented standardized SPECT/CT algorithm is clinically feasible and could help to better understand the complex pathology of OCL at the talus. Major potential benefit is the assessment of the subchondral bone plate, which cannot be sufficiently evaluated using MRI. Although measures of the tibia have not been done, this protocol can help to quantify the tracer activity of SPECT/CT. In further studies the tibia should be included in the measurement protocol to point out the SPECT/CT activity in the tibial part of the upper ankle joint.

The correlation found between the different parts of the talus (T1-T6) is corresponding to the clinical findings that OCL is mostly found in the medial part of the talus.

The method described here showed excellent inter- and intra-observer (min 0.93 - max 1.00).