



# A COMPARISON OF TRUE-VOLUME ANALYSIS TO CONVENTIONAL METHODS OF EVALUATION IN OSTEOCHONDRAL LESIONS OF THE TALUS

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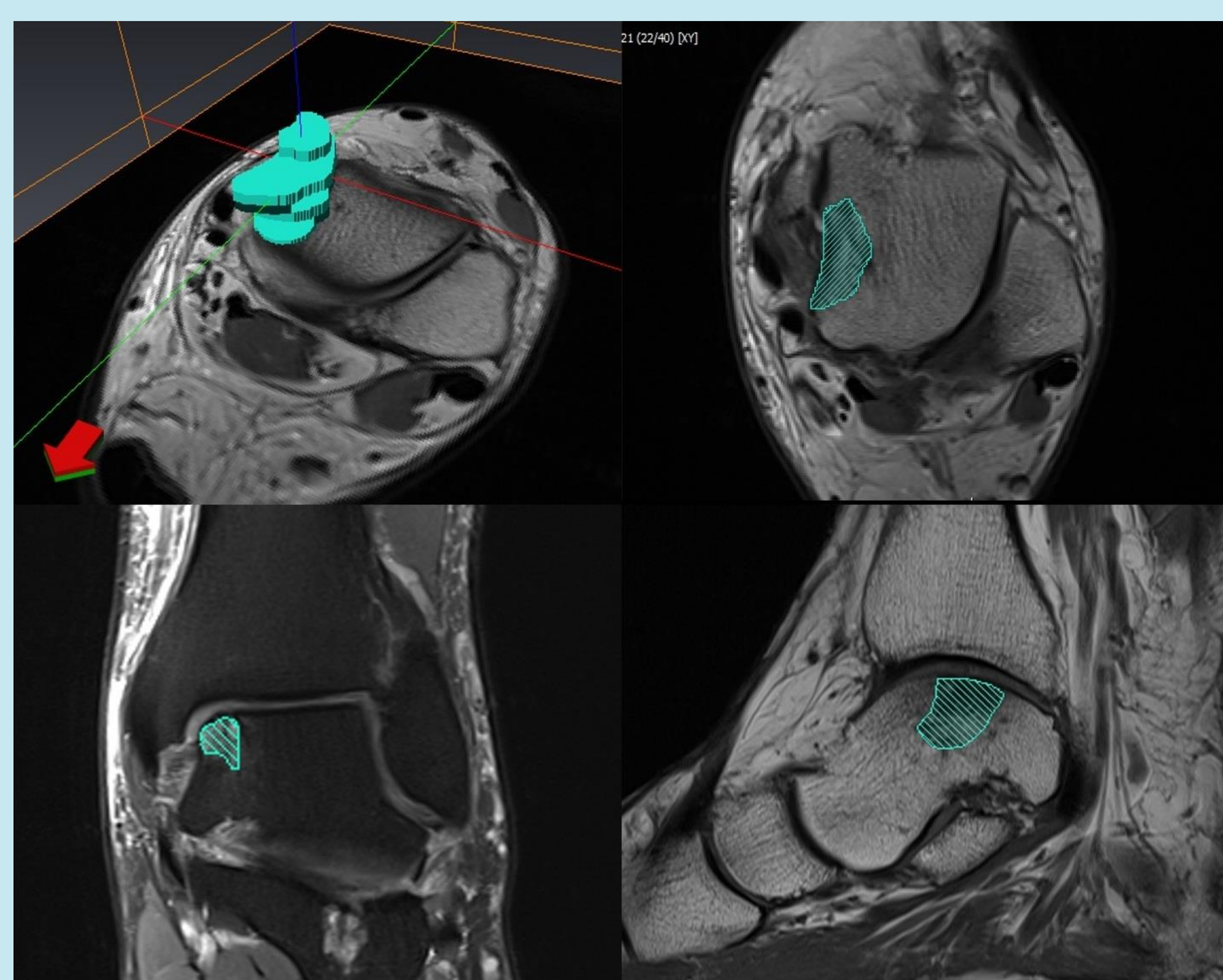
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## Objectives

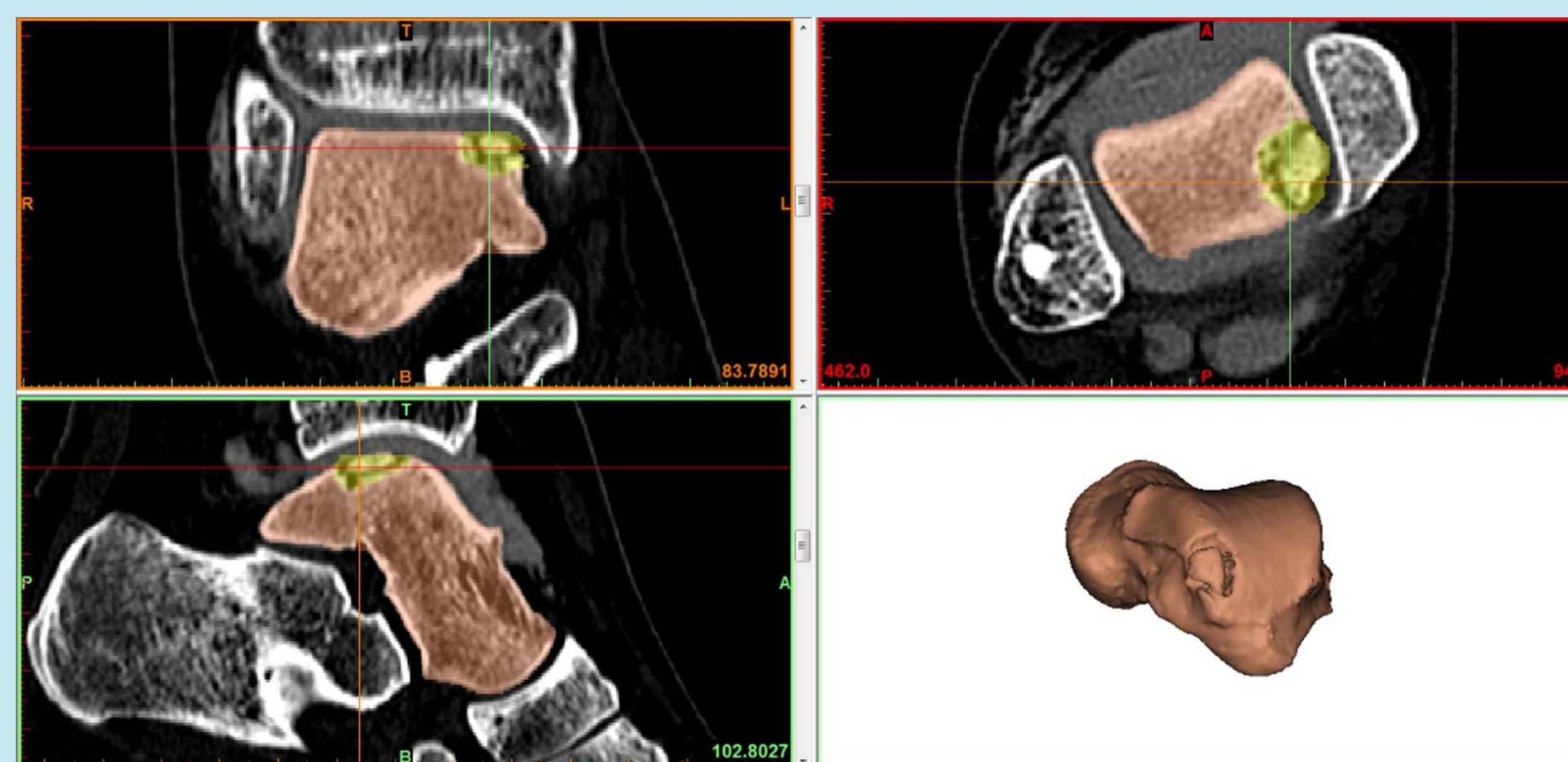
Evaluation of cystic lesions warrants advanced imaging to accurately assess the size and morphology of osteochondral lesions of the talus (OLT). Orthopedic surgeons often overestimate the size and misinterpret the morphology of the OLTs when evaluating them through conventional methods. The purpose of this study was to evaluate the utility of MRI as a modality for calculating true-volumes of OLTs using volume analysis of 3D reconstructed images. These reconstructions were compared to CT true-volumes and conventional methods for estimating osteochondral lesion size.

## Methods

With IRB approval, an institutional radiology database was queried for patients with cystic, OLTs that had undergone and failed microfracture and compatible CT and MR scans between 2011 and 2016. Five lesions, which were previously analyzed and described in the literature using CT true-volume, were selected for evaluation. 10 orthopedic surgeons independently estimated the volume of these 5 OLTs via standard CT and MR. Then 3D reconstructions were made and true-volume (TV) analysis measurements of each OLT were generated. The percent change in volumes from CT and MR approximations were compared to TVs determined from 3D reconstructive analysis.



**Figure 1.** An illustration 3D reconstruction taken from magnetic resonance imaging (axial, sagittal and coronal views).



**Figure 2.** CT An illustration of 3D reconstruction taken from computed tomography views (axial, sagittal and coronal). The osteochondral lesions of the talus are highlighted.

Talus OCD #	V <sub>rec</sub> via MR (mm <sup>3</sup> )	V <sub>cyl</sub> via MR (mm <sup>3</sup> )	V <sub>cone</sub> via MR (mm <sup>3</sup> )	MTV via 3D Reconstruction (mm <sup>3</sup> )
1	2516 ± 36.0	6319 ± 59.6	2085 ± 19.7	1366.1
2	1223 ± 17.0	2977 ± 32.5	983 ± 10.7	870.1
3	3028 ± 18.0	7005 ± 35.0	2312 ± 11.5	1299.6
4	1982 ± 1.5	5522 ± 3.8	1822 ± 1.3	1156.2
5	3117 ± 4.7	8510 ± 5.5	2808 ± 1.8	1551.6

**Table 1.** OLT Volume measurements and comparison to MR TV

Talus OCD #	MRI MTV via 3D Reconstruction (mm <sup>3</sup> )	CT MTV via 3D Reconstruction (mm <sup>3</sup> )
1	1366.1	870.5
2	870.1	392.3
3	1299.6	348.6
4	1156.2	1004.2
5	1551.6	1416.4

**Table 2.** True volume comparison of the same 5 osteochondral lesions of the talus using MRI and CT.

	Average Percent Change (%)		
	V <sub>rec</sub> vs. MTV	V <sub>cyl</sub> vs. MTV	V <sub>cone</sub> vs. MTV
MRI TV	86	374	56
CT TV	303	864	285

**Table 3.** A comparison of percent change between volume approximation and true volume in lesions using MRI and CT.

## References

- Walley KC, Gonzalez TA, Callahan R, et al. The Role of 3D Reconstruction True-Volume Analysis in Osteochondral Lesions of the Talus : A Case Series. 2018. doi:10.1177/1071100718771834.

## Results

The volume calculated by conventional measurements on CT and MR scans grossly overestimated the size of the OLTs. The volume calculated using conventional methods versus CT and MR scans overestimated the size of the OLTs by 285-864% and 56-374% respectively when compared to 3D true volume analysis of those CT and MR scans. The percent increase between observer measurements and CT MTV was significantly greater than the percent increase between observer measurements and MRI MTV in V<sub>rec</sub>, V<sub>cyl</sub>, and V<sub>cone</sub> (238%, p<.001; 490%, p<.001; 229%, p<.001) respectively. MRI true volume overestimates the size of lesions with respect to CT true volume analysis (p<.05), however, it is still an improvement from conventional methods.

## Conclusions

Our results demonstrate that in the case of both CT and MR, conventional methods of OLT evaluation grossly overestimates the size of the lesion. Further, our findings determine that while MR TV analysis is an improvement over conventional methods, it is still inferior to evaluation via CT TV. We attribute much of the discrepancy between CT TV and MRI TV analysis to the larger slice width used in standard MRI protocols. Revision surgery in patients with large cystic osteochondral lesions of the talus require additional assessment due to their nature and reduced success following the initial failed procedure. 3D true-volume provides surgeons additional morphometric assessment which may help surgeons improve surgical outcomes. Therefore, we recommended 3D TV analysis of cystic lesions to help clinicians in preoperative planning to improve the success rate of their procedures.