

Semi-quantitative CT assessment of fracture healing: How many and which CT reformats should be analyzed?

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Abstract

Purpose: To assess how many and which CT reformats of long bone non-unions should be analyzed to best approximate the analysis of a larger number of CT reformats obtained in the three orthogonal planes.

Method: We used 29 CT examinations of tibial or femoral non-unions to obtain 87 stacks of 7 CT reformats each in the coronal (n = 29), sagittal (n = 29) or transverse (n = 29) planes. Two independent radiologists scored two fracture sites on each CT reformat by using a Tomographic Union Score (TUS) (1: no callus, 2: non-bridging callus; 3: bridging immature callus; 4: bridging remodeled callus). The reference standard was the mean of the three TUS calculated from the cortical scores obtained on all the sagittal, coronal and transverse CT reformats. We determined the agreement (intra-class correlation coefficient (ICC) between the reference standard and 33 models combining one to seven CT reformats from one to three planes. The three best models were compared following a resampling procedure by a Wilcoxon's signed rank test.

Results: Three models combining two (mid-coronal and mid-sagittal), three (mid-coronal, mid-sagittal and mid-transverse) or four (two paramedian coronal and sagittal) CT reformats had the highest ICC (ICC $\geq$ 0.89) for both observers. After resampling, the model combining the two paramedian sagittal and coronal CT reformats statistically outperformed the two other models.

Conclusion: Semi-quantitative analysis of the two paramedian sagittal and coronal CT reformats is an acceptable alternative to the analysis of more numerous reformats.

Keywords: Bone; CT; Fracture; Non-union.