

Defining Osteonecrosis of the Scaphoid: A Retrospective and Systematic Review on Current Diagnostic Methods

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INTRODUCTION:

The scaphoid's retrograde blood supply leads to poor perfusion of the proximal pole secondary to fracture leaving it susceptible to irreversible osteonecrosis. Permanently necrosed bone has long been diagnosed through various imaging modalities and intraoperative findings. This systematic review aims to understand the variability and reliability of these diagnostic methods to accurately diagnose dead scaphoid bone tissue. We hypothesize that current methods of diagnosis are not always reliable nor accurate.

METHODS:

A comprehensive search of the literature was conducted including all studies up to November 2024. Studies were first screened by title and abstract followed by a full text review. Diagnosis method of end stage osteonecrosis were extracted and collected in a database. Additionally, a retrospective review of all patients at a single institution diagnosed with scaphoid proximal pole osteonecrosis secondary to scaphoid fracture from 2018 to 2024 was conducted. Diagnostic methods for necrosed bone were recorded. For all patients in the retrospective and systematic review, if a patient's necrosis resolved, it was coded as a misdiagnosis – not true irreversible bone death. We grouped patients by diagnostic method used to determine permanent necrosis.

RESULTS:

A total of 261 studies were screened with 27 final studies included in this systematic review. 18 (66.7%) studies diagnosed necrotic bone using magnetic imaging resonance (MRI), 2 (7.4%) studies used computed tomography (CT), 23 (85.2%) studies relied on absence of intraoperative punctate bleeding, and 3 (11.1%) utilized histological analysis. Using MRI, 28/225 (12.6%) cases had true irreversible bone death. For CT, 12/21 (57.1%) cases were true necrotic bone and for lack of intraoperative punctate bleeding, 48/356 (13.5%) were true necrotic bone. Histology had the highest accuracy with 13/19 (68.4%) cases being true permanent dead bone. 55 patients were included in the retrospective review. 42/55 (76.4%) patients were diagnosed by CT with 24/42 (57.1%) patients having true irreversible bone death. 13/55 (23.6%) patients were diagnosed with MRI. 5/13 (38.5%) of these patients had true osteonecrosis.

DISCUSSION AND CONCLUSION:

True osteonecrosis is irreversible bone death, meaning it should not have the ability to repair or heal itself. This systematic review highlights all diagnostic methods used for osteonecrosis have significant misdiagnosis rates. The retrospective portion of this review further supports this, specifically for MRI and CT. This emphasizes that as a field we do not have a proper way to diagnose irreversible necrotic bone which is vital to determine patient prognosis and guide treatment planning.

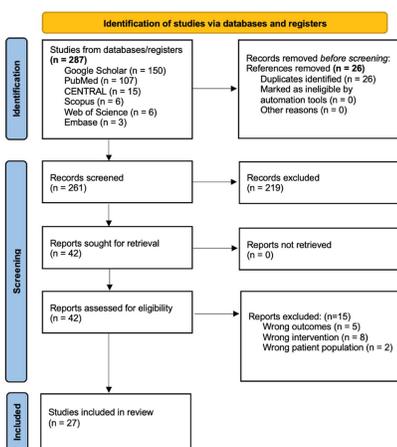


Figure 1: PRISMA flowchart illustrating study selection in this systematic review

	Diagnosed with Irreversible Osteonecrosis	Actual Irreversible Osteonecrosis (n,%)
<i>Systematic Review</i>		
MRI	225	28 (12.6)
CT	21	12 (57.1)
Lack of Punctate Bleeding Intraoperatively	356	48 (13.5)
Histology	19	13 (68.4)
<i>Retrospective Review</i>		
MRI	13	5 (38.5)
CT	42	24 (57.1)

MRI: magnetic resonance imaging, CT: computed tomography