Towards improved detection of bone metastases on CT scans with the use of a novel artificial intelligence software

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Introduction

- In oncology, timely and accurate detection of bone metastases on computed tomography (CT) scans is essential for optimal management and improved outcomes of patients [1, 2]
- Identifying and reporting bone metastases on CT scans is a complex and time-intensive process that places a significant burden on radiologists
- Artificial intelligence (AI) could become a valuable tool to support radiologists in the detection of bone metastases during their routine workflow

How does a novel AI software compare to radiologists in detecting bone metastases on CT scans?

Methods

Data Collection:
- Retrospective collection of CT exams from clinical practices in France, Brazil, and the US
- Patients ≥ 15 years old with or without bone metastases

Ground Truth:
- Ground truth established by two expert musculoskeletal radiologists
- Discrepancies were resolved by a third senior radiologist
- Radiologists had access to past and follow-up CT scans, if available

AI Software:
- BoneCT (Gleamer, Paris, France) is an AI-based solution trained to detect osteolytic and sclerotic bone metastases on CT scans that cover the thoracic, abdominal and pelvic regions

Annotation Task:
- Two musculoskeletal radiologists and two general radiologists were enrolled in the study
- Their task was to annotate bone metastases on all CT scans with limited clinical information

Statistical Analyses:
- Patient-wise ROC analysis: ability to identify at least one lesion in patients with metastases
- Lesion-wise FROC analysis: ability to identify and locate all metastases

Results

Category	Total Number
Patients (Mean Age)	249 (71±14 years old)
Female / Male Patients	95 / 154
Patients With / Without Bone Metastases	133 / 116
Patients With / Without Primary Cancer	191 / 58

Table 1. Patient demographics in the study dataset

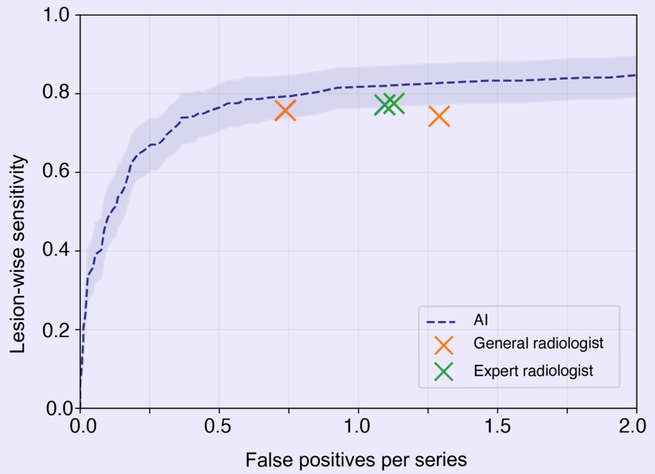


Figure 1. FROC curve representing the AI vs. the readers' performance in detecting bone metastases

All presented results were computed for bone metastases ≥ 20mm

Patient-wise results

- AUC AI: 0.95 [0.88, 0.99]

Lesion-wise results (Figure 1)

- Sensitivity AI: 82% [77%, 87%] for 1.0 false positive per series
- Sensitivity Readers: 76% [70%, 82%] for 1.1 false positives per series

Analysis per lesion type

- Better performance of readers for osteolytic than for sclerotic lesions (p = 0.029)
- Better performance of the AI for osteolytic than for sclerotic lesions (p = 0.0024)

Conclusions

- Patient-wise performance of the AI highlights promising use as triage tool
- Good lesion-wise performance of the AI comparable to that of radiologists, hinting at its potential value as an aid in clinical routine

References

[1] Coleman, 12 (2006) 6243-6249

[2] Carter et al., 13 (2024) 483-496