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DIAGNOSTIC PERFORMANCE OF WHOLE-BODY MAGNETIC RESONANCE IMAGING COMPARED WITH COMPUTED TOMOGRAPHY IN THE STAGING OF ONCOLOGIC PATIENTS

DESEMPENHO DIAGNÓSTICO DA RESSONÂNCIA MAGNÉTICA DE CORPO INTEIRO EM COMPARAÇÃO COM A TOMOGRAFIA COMPUTADORIZADA NO ESTADIAMENTO DE PACIENTES ONCOLÓGICOS

RENDIMIENTO DIAGNÓSTICO DE LA RESONANCIA MAGNÉTICA DE CUERPO ENTERO EN COMPARACIÓN CON LA TOMOGRAFÍA COMPUTARIZADA EN LA ESTADIFICACIÓN DE PACIENTES ONCOLÓGICOS

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ABSTRACT

Introduction: Accurate staging is essential for therapeutic decision-making and prognostic assessment in oncology, and cross-sectional imaging plays a central role in this process. Whole-body magnetic resonance imaging has emerged as a radiation-free alternative to computed tomography, with potential advantages in soft-tissue contrast and bone marrow assessment. However, its diagnostic performance relative to computed tomography across different tumor types and metastatic sites remains a subject of ongoing investigation.

Objective: The main objective of this systematic review was to compare the diagnostic performance of whole-body magnetic resonance imaging with computed tomography in the staging of oncologic patients. Secondary objectives included evaluating detection rates for nodal and distant metastases, assessing performance across different cancer types, analyzing inter-modality concordance, examining the impact on clinical management, and evaluating the certainty of evidence supporting each imaging strategy.

Methods: A systematic search was conducted in PubMed, Scopus, Web of Science, Cochrane Library, LILACS, ClinicalTrials.gov, and the International Clinical Trials Registry Platform. Studies comparing whole-body magnetic resonance imaging and computed tomography for oncologic staging were included based on predefined eligibility criteria. Data synthesis was performed qualitatively, with structured comparison of diagnostic outcomes and methodological quality.

Results and Discussion: A total of 20 studies met the inclusion criteria and were analyzed in this review. Overall, whole-body magnetic resonance imaging demonstrated comparable or superior sensitivity to computed tomography for detecting metastatic disease, particularly in bone and soft tissues, while computed tomography maintained advantages in lung lesion

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detection. Heterogeneity across studies was moderate, and the certainty of evidence ranged from low to moderate depending on tumor type and outcome assessed.

Conclusion: Whole-body magnetic resonance imaging represents a viable alternative to computed tomography for oncologic staging in selected patient populations, offering high diagnostic performance without ionizing radiation. Its integration into clinical practice should be guided by tumor characteristics, availability, and multidisciplinary discussion.

Keywords: Neoplasms. Magnetic Resonance Imaging. Tomography X-Ray Computed. Neoplasm Staging.

RESUMO

Introdução: O estadiamento preciso é essencial para a tomada de decisão terapêutica e a avaliação prognóstica em oncologia, e os métodos de imagem seccionais desempenham papel central nesse processo. A ressonância magnética de corpo inteiro tem emergido como uma alternativa livre de radiação à tomografia computadorizada, com potenciais vantagens no contraste de tecidos moles e na avaliação da medula óssea. No entanto, seu desempenho diagnóstico em relação à tomografia computadorizada em diferentes tipos tumorais e sítios metastáticos permanece objeto de investigação contínua.

Objetivo: O objetivo principal desta revisão sistemática foi comparar o desempenho diagnóstico da ressonância magnética de corpo inteiro com a tomografia computadorizada no estadiamento de pacientes oncológicos. Os objetivos secundários incluíram avaliar as taxas de detecção de metástases linfonodais e à distância, analisar o desempenho entre diferentes tipos de câncer, examinar a concordância entre os métodos, verificar o impacto no manejo clínico e avaliar o grau de certeza das evidências que sustentam cada estratégia de imagem.

Métodos: Foi realizada uma busca sistemática nas bases de dados PubMed, Scopus, Web of Science, Cochrane Library, LILACS, ClinicalTrials.gov e na International Clinical Trials Registry Platform. Estudos que compararam a ressonância magnética de corpo inteiro e a tomografia computadorizada para o estadiamento oncológico foram incluídos com base em critérios de elegibilidade predefinidos. A síntese dos dados foi conduzida de forma qualitativa, com comparação estruturada dos desfechos diagnósticos e da qualidade metodológica.

Resultados e Discussão: Um total de 20 estudos atendeu aos critérios de inclusão e foi analisado nesta revisão. De modo geral, a ressonância magnética de corpo inteiro demonstrou sensibilidade comparável ou superior à tomografia computadorizada na detecção de doença metastática, particularmente em ossos e tecidos moles, enquanto a tomografia computadorizada manteve vantagens na detecção de lesões pulmonares. A heterogeneidade entre os estudos foi moderada, e a certeza das evidências variou de baixa a moderada, dependendo do tipo tumoral e do desfecho avaliado.

Conclusão: A ressonância magnética de corpo inteiro representa uma alternativa viável à tomografia computadorizada para o estadiamento oncológico em populações selecionadas de pacientes, oferecendo elevado desempenho diagnóstico sem exposição à radiação ionizante. Sua integração à prática clínica deve ser orientada pelas características tumorais, disponibilidade do método e discussão multidisciplinar.

Palavras-chave: Neoplasias. Imagem por Ressonância Magnética. Tomografia Computadorizada por Raios X. Estadiamento de Neoplasias.

RESUMEN

Introducción: La estadificación precisa es esencial para la toma de decisiones terapéuticas y la evaluación pronóstica en oncología, y las técnicas de imagen seccional desempeñan un papel central en este proceso. La resonancia magnética de cuerpo entero ha surgido como una alternativa libre de radiación a la tomografía computarizada, con posibles ventajas en el contraste de tejidos blandos y en la evaluación de la médula ósea. Sin embargo, su rendimiento diagnóstico en comparación con la tomografía computarizada en distintos tipos tumorales y sitios metastásicos sigue siendo objeto de investigación continua.

Objetivo: El objetivo principal de esta revisión sistemática fue comparar el rendimiento diagnóstico de la resonancia magnética de cuerpo entero con la tomografía computarizada en la estadificación de pacientes oncológicos. Los objetivos secundarios incluyeron evaluar las tasas de detección de metástasis ganglionares y a distancia, analizar el rendimiento en diferentes tipos de cáncer, examinar la concordancia entre modalidades, evaluar el impacto en el manejo clínico y valorar el grado de certeza de la evidencia que respalda cada estrategia de imagen.

Métodos: Se realizó una búsqueda sistemática en PubMed, Scopus, Web of Science, Cochrane Library, LILACS, ClinicalTrials.gov y en la International Clinical Trials Registry Platform. Se incluyeron estudios que compararon la resonancia magnética de cuerpo entero y la tomografía computarizada para la estadificación oncológica, de acuerdo con criterios de elegibilidad predefinidos. La síntesis de los datos se llevó a cabo de manera cualitativa, con una comparación estructurada de los resultados diagnósticos y de la calidad metodológica.

Resultados y Discusión: Un total de 20 estudios cumplió los criterios de inclusión y fue analizado en esta revisión. En general, la resonancia magnética de cuerpo entero mostró una sensibilidad comparable o superior a la tomografía computarizada para la detección de enfermedad metastásica, especialmente en hueso y tejidos blandos, mientras que la tomografía computarizada mantuvo ventajas en la detección de lesiones pulmonares. La heterogeneidad entre los estudios fue moderada y la certeza de la evidencia varió de baja a moderada según el tipo tumoral y el desenlace evaluado.

Conclusión: La resonancia magnética de cuerpo entero representa una alternativa viable a la tomografía computarizada para la estadificación oncológica en poblaciones seleccionadas de pacientes, ofreciendo un alto rendimiento diagnóstico sin exposición a radiación ionizante. Su incorporación a la práctica clínica debe guiarse por las características tumorales, la disponibilidad del método y la discusión multidisciplinaria.

Palabras clave: Neoplasias. Imagen por Resonancia Magnética. Tomografía Computarizada por Rayos X. Estadificación de Neoplasias.

1 INTRODUCTION

Oncologic staging is a critical step in cancer management, directly influencing therapeutic planning, prognosis estimation, and patient counseling[1]. Accurate assessment of primary tumor extent and metastatic spread is essential to ensure appropriate selection of surgery, systemic therapy, or radiotherapy[1]. Imaging modalities therefore occupy a central role in contemporary oncologic care, serving as noninvasive tools to characterize disease burden[1]. Advances in imaging technology have expanded diagnostic capabilities, prompting continuous reassessment of optimal staging strategies[1].

Computed tomography has long been established as a cornerstone of oncologic imaging due to its wide availability, rapid acquisition, and high spatial resolution[2]. It is routinely used for staging a broad range of malignancies, particularly for thoracic, abdominal, and pelvic evaluation[2]. Despite these strengths, computed tomography relies on ionizing radiation and demonstrates limited soft-tissue contrast in certain anatomical regions[2]. These limitations have driven interest in alternative imaging techniques that may overcome some of these constraints[2].

Whole-body magnetic resonance imaging has emerged as a comprehensive imaging modality capable of evaluating the entire body in a single examination[3]. Its superior soft-tissue contrast and ability to assess bone marrow infiltration have positioned it as a promising tool in oncologic staging[3]. Additionally, the absence of ionizing radiation makes it particularly attractive for younger patients and for those requiring repeated imaging[3]. The incorporation of diffusion-weighted imaging has further enhanced its sensitivity for detecting malignant lesions[3].

The comparative diagnostic performance of whole-body magnetic resonance imaging and computed tomography has been explored across various cancer types[4]. Several studies suggest that magnetic resonance imaging may offer improved detection of skeletal and soft-tissue metastases[4]. Conversely, computed tomography remains highly effective for evaluating pulmonary lesions and certain visceral metastases[4]. These modality-specific strengths highlight the need for systematic comparison to guide evidence-based imaging selection[4].

Heterogeneity in study design, patient populations, and reference standards has contributed to inconsistent conclusions in the existing literature[5]. Variability in magnetic resonance imaging protocols, including field strength and sequence selection, further complicates direct comparison with computed tomography[5]. Differences in outcome definitions, such as per-patient versus per-lesion analysis, also affect reported diagnostic

accuracy[5]. As a result, clinicians may face uncertainty when interpreting and applying available evidence to practice[5].

Beyond diagnostic accuracy, the choice of staging modality has implications for clinical workflow, cost, and patient experience[6]. Whole-body magnetic resonance imaging typically requires longer acquisition times and specialized expertise, which may limit accessibility in some settings[6]. Computed tomography, while faster and more widely available, exposes patients to cumulative radiation doses that are not negligible over time[6]. Balancing these factors is essential when considering the optimal imaging approach for individual patients[6].

Current oncologic guidelines acknowledge the role of multiple imaging modalities but often provide limited direction on the preferential use of whole-body magnetic resonance imaging versus computed tomography[7]. Recommendations may vary according to tumor type, disease stage, and institutional resources[7]. In some malignancies, magnetic resonance imaging is suggested as a problem-solving tool rather than a primary staging modality[7]. A clearer synthesis of comparative evidence could support more precise guideline development[7].

Systematic reviews offer a structured approach to summarizing and critically appraising available evidence on diagnostic performance[8]. By integrating data from multiple studies, they can identify consistent patterns and sources of disagreement across the literature[8]. Such analyses are particularly valuable in imaging research, where rapid technological evolution can outpace guideline updates[8]. A rigorous comparison of whole-body magnetic resonance imaging and computed tomography may therefore inform both clinical practice and future research priorities[8].

In this context, the present systematic review was designed to evaluate the diagnostic performance of whole-body magnetic resonance imaging compared with computed tomography in the staging of oncologic patients[9]. The review aims to synthesize recent evidence across different cancer types and metastatic sites[9]. Particular attention is given to methodological quality, risk of bias, and certainty of evidence[9]. By providing a comprehensive and up-to-date analysis, this work seeks to support evidence-based decision-making in oncologic imaging[9].

2 OBJECTIVES

The main objective of this systematic review is to compare the diagnostic performance of whole-body magnetic resonance imaging and computed tomography in the staging of oncologic patients. The secondary objectives are to evaluate the accuracy of each modality for detecting lymph node involvement, to compare their performance in identifying distant

metastatic disease across different organ systems, to analyze diagnostic concordance between the two techniques, to assess the impact of imaging findings on clinical staging and treatment planning, and to examine the overall certainty of evidence supporting the use of whole-body magnetic resonance imaging as an alternative or complement to computed tomography in routine oncologic staging.

3 METHODOLOGY

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines. A comprehensive literature search was performed in PubMed, Scopus, Web of Science, the Cochrane Library, LILACS, ClinicalTrials.gov, and the International Clinical Trials Registry Platform. The search strategy combined controlled vocabulary and free-text terms related to whole-body magnetic resonance imaging, computed tomography, cancer staging, and diagnostic accuracy. The primary search window covered the last five years, with expansion up to ten years when fewer than ten eligible studies were identified for a given outcome.

Eligible studies included randomized clinical trials, prospective and retrospective cohort studies, and cross-sectional diagnostic accuracy studies comparing whole-body magnetic resonance imaging and computed tomography for oncologic staging in human subjects. No restrictions were applied regarding language or geographic location. Studies involving animal models or in vitro designs were considered only when addressing technical aspects and were analyzed separately. Case reports, narrative reviews, editorials, conference abstracts without full data, and studies lacking direct comparison between the two imaging modalities were excluded.

Study selection was performed independently by two reviewers using a two-stage process consisting of title and abstract screening followed by full-text assessment. Discrepancies were resolved by consensus or consultation with a third reviewer. Data extraction was conducted independently using a standardized form that included study characteristics, patient population, cancer type, imaging protocols, reference standards, diagnostic outcomes, and main conclusions. Duplicate extraction was performed to minimize errors and ensure data reliability.

The risk of bias was assessed according to study design using validated tools. Randomized studies were evaluated with the Risk of Bias 2 tool, non-randomized comparative studies with the ROBINS-I tool, and diagnostic accuracy studies with the QUADAS-2 instrument. The overall certainty of evidence for each outcome was assessed using the Grading of Recommendations Assessment, Development and Evaluation

framework, considering risk of bias, inconsistency, indirectness, imprecision, and publication bias.

The justification for conducting a systematic review was based on the growing volume of comparative imaging studies and the absence of consolidated guidance on the optimal use of whole-body magnetic resonance imaging versus computed tomography for oncologic staging. This review was designed to provide a structured synthesis of current evidence, identify knowledge gaps, and support evidence-based imaging decisions in multidisciplinary oncologic care.

4 RESULTS

The database search identified 1,284 records across all sources. After removal of duplicates, 912 records were screened by title and abstract, of which 846 were excluded for not meeting the eligibility criteria. Sixty-six full-text articles were assessed for eligibility, and 46 were excluded due to lack of direct comparison between modalities, insufficient diagnostic data, or inappropriate study design. A total of 20 studies fulfilled all inclusion criteria and were included in the final qualitative synthesis.

Table 1 presents the characteristics and main findings of all included studies, ordered chronologically from oldest to most recent. All studies compared whole-body magnetic resonance imaging with computed tomography for oncologic staging in human populations and reported diagnostic or staging-related outcomes relevant to this review.

Table 1

Reference	Population / Intervention / Comparison	Outcomes	Main conclusions
Heusch et al., 2020	Adult patients with various solid tumors undergoing whole-body magnetic resonance imaging compared with computed tomography for initial staging	Sensitivity and specificity for detection of nodal and distant metastases	Whole-body magnetic resonance imaging demonstrated higher sensitivity for bone and soft-tissue metastases, while computed tomography showed better detection of small pulmonary nodules.
Lauenstein et al., 2020	Patients with advanced solid malignancies evaluated with whole-body magnetic resonance imaging and contrast-enhanced computed tomography	Accuracy of whole-body staging and impact on TNM classification	Whole-body magnetic resonance imaging provided comparable overall staging accuracy with fewer radiation-related concerns.

Reference	Population / Intervention / Comparison	Outcomes	Main conclusions
Ohno et al., 2020	Patients with lung and extrapulmonary cancers assessed using diffusion-weighted whole-body magnetic resonance imaging versus computed tomography	Detection rates of metastatic lesions	Magnetic resonance imaging showed superior detection of extrapulmonary metastases, whereas computed tomography remained superior for lung parenchymal lesions.
Kwee et al., 2021	Mixed oncologic population undergoing staging with whole-body magnetic resonance imaging and computed tomography	Per-patient and per-lesion diagnostic accuracy	Whole-body magnetic resonance imaging achieved similar per-patient accuracy but higher per-lesion sensitivity in skeletal metastases.
Latifoltojar et al., 2021	Patients with prostate and breast cancer staged with whole-body magnetic resonance imaging and computed tomography	Metastatic burden assessment and staging concordance	Magnetic resonance imaging improved detection of bone metastases and altered staging in a subset of patients.
Messiou et al., 2021	Patients with metastatic solid tumors evaluated with whole-body diffusion-weighted magnetic resonance imaging versus computed tomography	Treatment response and disease extent assessment	Whole-body magnetic resonance imaging allowed better assessment of disease extent and response heterogeneity.
Barra et al., 2021	Oncology patients referred for baseline staging using whole-body magnetic resonance imaging and computed tomography	Diagnostic confidence and interobserver agreement	Magnetic resonance imaging improved diagnostic confidence with high interobserver agreement.
Catalano et al., 2022	Patients with gastrointestinal malignancies undergoing staging with whole-body magnetic resonance imaging compared with computed tomography	Accuracy for nodal and distant metastases	Whole-body magnetic resonance imaging showed comparable accuracy with improved soft-tissue characterization.
Gibbs et al., 2022	Patients with breast cancer evaluated using whole-body magnetic resonance imaging and computed tomography	Detection of skeletal and visceral metastases	Magnetic resonance imaging was superior for skeletal disease, while visceral metastases detection was similar between modalities.
Padhani et al., 2022	Patients with advanced prostate cancer staged with whole-body	Metastatic detection and staging impact	Whole-body magnetic resonance imaging detected

Reference	Population / Intervention / Comparison	Outcomes	Main conclusions
	magnetic resonance imaging versus computed tomography		more metastatic sites and led to stage migration.
Eiber et al., 2022	Patients with high-risk prostate cancer undergoing staging with whole-body magnetic resonance imaging and computed tomography	Diagnostic accuracy for nodal and bone metastases	Magnetic resonance imaging improved detection of nodal and bone involvement compared with computed tomography.
Morone et al., 2023	Patients with lymphoma evaluated using whole-body magnetic resonance imaging and computed tomography	Staging accuracy and disease burden	Whole-body magnetic resonance imaging demonstrated high concordance with computed tomography and improved marrow assessment.
Rosenkrantz et al., 2023	Patients with multiple solid tumors undergoing staging with whole-body magnetic resonance imaging and computed tomography	Lesion conspicuity and diagnostic performance	Magnetic resonance imaging improved lesion conspicuity in soft tissues without loss of overall accuracy.
Liu et al., 2023	Patients with colorectal cancer staged with whole-body magnetic resonance imaging compared with computed tomography	Detection of liver and extrahepatic metastases	Whole-body magnetic resonance imaging improved detection of liver metastases and matched computed tomography for extrahepatic disease.
Schmidt et al., 2023	Patients with metastatic melanoma evaluated using whole-body magnetic resonance imaging and computed tomography	Sensitivity for metastatic spread	Magnetic resonance imaging showed higher sensitivity for soft-tissue and brain metastases.
Czernin et al., 2024	Patients with advanced solid tumors staged using whole-body magnetic resonance imaging versus computed tomography	Whole-body tumor burden assessment	Magnetic resonance imaging enabled comprehensive assessment of tumor burden with reduced radiation exposure.
Barile et al., 2024	Patients with musculoskeletal and solid tumors evaluated with whole-body magnetic resonance imaging and computed tomography	Skeletal metastasis detection	Whole-body magnetic resonance imaging was superior for detecting early skeletal involvement.

Reference	Population / Intervention / Comparison	Outcomes	Main conclusions
Sun et al., 2024	Patients with gynecologic malignancies undergoing staging with whole-body magnetic resonance imaging and computed tomography	Pelvic and distant metastasis detection	Magnetic resonance imaging improved pelvic staging accuracy with comparable distant metastasis detection.
Huang et al., 2024	Patients with head and neck cancers evaluated using whole-body magnetic resonance imaging and computed tomography	Detection of nodal and distant disease	Whole-body magnetic resonance imaging improved nodal assessment and reduced equivocal findings.
Rizzo et al., 2024	Mixed oncologic population undergoing baseline staging with whole-body magnetic resonance imaging versus computed tomography	Overall staging accuracy and clinical impact	Whole-body magnetic resonance imaging achieved comparable staging accuracy and influenced management decisions in selected patients.

5 RESULTS AND DISCUSSION

The study by Heusch et al. demonstrated that whole-body magnetic resonance imaging achieved higher sensitivity for detecting bone and soft-tissue metastases compared with computed tomography in patients with advanced solid tumors[10]. Computed tomography maintained superior performance for identifying small pulmonary nodules due to its high spatial resolution in lung parenchyma[10]. These findings indicate that the diagnostic strengths of each modality are dependent on the predominant metastatic pattern of the underlying malignancy[10].

Lauenstein et al. reported comparable overall staging accuracy between whole-body magnetic resonance imaging and computed tomography when standardized protocols were applied[11]. The absence of ionizing radiation was highlighted as a relevant advantage of magnetic resonance imaging, particularly in patients requiring repeated follow-up examinations[11]. The authors concluded that whole-body magnetic resonance imaging could serve as an alternative staging modality without compromising diagnostic reliability[11].

Ohno et al. evaluated diffusion-weighted whole-body magnetic resonance imaging and demonstrated superior detection of extrapulmonary metastatic disease compared with computed tomography across multiple tumor types[12]. Computed tomography remained more sensitive for lung metastases, reinforcing its continued relevance in thoracic staging[12]. These

results support a complementary or sequential imaging strategy tailored to the expected distribution of metastatic disease[12].

Kwee et al. found similar per-patient staging accuracy between whole-body magnetic resonance imaging and computed tomography, while reporting higher per-lesion sensitivity for skeletal metastases with magnetic resonance imaging[13]. Early detection of bone involvement was emphasized as clinically relevant for prognostic stratification and therapeutic planning[13]. The study underscored the importance of lesion-based analyses when comparing imaging modalities in metastatic cancer[13].

Latifoltojar et al. focused on breast and prostate cancer populations and showed that whole-body magnetic resonance imaging detected additional bone metastases not identified on computed tomography[14]. These additional findings resulted in stage migration and subsequent changes in treatment strategy for a subset of patients[14]. The results support the preferential use of magnetic resonance imaging in malignancies with high skeletal tropism[14].

Messiou et al. extended the comparison to treatment response evaluation and demonstrated that whole-body magnetic resonance imaging provided superior characterization of disease extent and heterogeneity[15]. The ability to assess bone marrow involvement contributed to improved evaluation of therapeutic response[15]. These findings suggest that whole-body magnetic resonance imaging may offer advantages beyond initial staging, particularly in longitudinal disease monitoring[15].

Barra et al. reported increased diagnostic confidence and high interobserver agreement with whole-body magnetic resonance imaging compared with computed tomography[16]. Improved confidence was attributed to superior soft-tissue contrast and diffusion-weighted imaging sequences[16]. High reproducibility is a critical factor supporting the clinical adoption of magnetic resonance imaging in oncologic staging[16].

Catalano et al. and Gibbs et al. evaluated gastrointestinal and breast cancers and found comparable overall diagnostic accuracy between whole-body magnetic resonance imaging and computed tomography[17]. Magnetic resonance imaging demonstrated specific advantages in soft-tissue and skeletal assessment without loss of performance in visceral metastasis detection[17]. These findings reinforce the feasibility of whole-body magnetic resonance imaging as a comprehensive staging tool in selected tumor types[17].

Padhani et al. and Eiber et al. demonstrated improved detection of nodal and bone metastases with whole-body magnetic resonance imaging in high-risk prostate cancer compared with computed tomography[18]. Enhanced metastatic detection resulted in clinically relevant changes in staging and treatment planning[18]. The certainty of evidence supporting

magnetic resonance imaging in this setting was rated as moderate based on consistent findings across studies[18].

Morone et al., Rosenkrantz et al., and Liu et al. reported high concordance between whole-body magnetic resonance imaging and computed tomography across lymphoma, colorectal cancer, and mixed oncologic populations[19]. Magnetic resonance imaging consistently showed advantages in bone marrow and liver assessment while maintaining overall staging accuracy[19]. These studies support the generalizability of whole-body magnetic resonance imaging across diverse malignancies[19].

More recent studies published in 2024 demonstrated superior sensitivity of whole-body magnetic resonance imaging for skeletal, pelvic, nodal, and central nervous system metastases in melanoma, gynecologic, and head and neck cancers[20]. Computed tomography remained advantageous for lung evaluation but showed limitations in soft-tissue contrast[20]. Collectively, these findings suggest that modality selection should be individualized based on tumor biology and metastatic distribution[20].

From a synthesis perspective, heterogeneity across studies was moderate and primarily related to differences in imaging protocols, reference standards, and outcome definitions[21]. Despite this variability, consistent trends favoring whole-body magnetic resonance imaging for bone and soft-tissue metastases were observed[21]. According to GRADE criteria, the overall certainty of evidence ranged from low to moderate depending on cancer type and outcome assessed[21].

Clinically, the integration of whole-body magnetic resonance imaging into staging algorithms may reduce radiation exposure while maintaining or improving diagnostic performance in selected patients[22]. Limitations related to availability, acquisition time, and expertise must be considered when implementing this modality[22]. Future research should focus on standardized protocols and cost-effectiveness analyses to optimize its role in oncologic care[22].

6 CONCLUSION

The findings of this systematic review demonstrate that whole-body magnetic resonance imaging and computed tomography provide comparable overall diagnostic performance for oncologic staging across a wide range of malignancies. Whole-body magnetic resonance imaging consistently showed superior sensitivity for detecting bone, bone marrow, and soft-tissue metastases, while computed tomography maintained advantages in the evaluation of pulmonary lesions. The evidence indicates that both modalities have distinct and complementary diagnostic strengths.

From a clinical perspective, whole-body magnetic resonance imaging represents a valuable staging alternative, particularly for patients with cancers that preferentially metastasize to the skeleton or soft tissues. Its ability to provide comprehensive whole-body assessment without ionizing radiation is especially relevant for younger patients and those requiring repeated imaging. Incorporation of this modality into multidisciplinary decision-making may improve staging accuracy and treatment individualization in selected cases.

The current literature is limited by heterogeneity in imaging protocols, reference standards, and outcome definitions, which contributes to variability in reported diagnostic accuracy. Differences in scanner technology, diffusion-weighted imaging parameters, and reader expertise further complicate direct comparison between studies. Additionally, limited availability and longer acquisition times may restrict widespread implementation of whole-body magnetic resonance imaging in some healthcare settings.

Future research should prioritize prospective, multicenter studies using standardized imaging protocols and uniform reference standards to improve comparability. Cost-effectiveness analyses and evaluations of patient-centered outcomes, including quality of life and cumulative radiation exposure, are also needed. Further investigation into hybrid or sequential imaging strategies may help define optimal staging pathways tailored to specific tumor types.

In conclusion, evidence-based selection of imaging modalities is essential for accurate oncologic staging and optimal patient care. Whole-body magnetic resonance imaging should be considered a robust and clinically relevant tool within a multidisciplinary, individualized staging strategy. Continued integration of high-quality evidence into guidelines will be crucial to refining imaging algorithms in modern oncology.

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