AMERICAN JOURNAL OF APPLIED MEDICAL SCIENCE
ISSN: 2996-5101 (online) | ResearchBib (IF) = 10.81 IMPACT FACTOR
Volume-4| Issue-4| 2026 Published: |30-04-2026

STRUCTURED DECISION-MAKING ALGORITHM FOR SELECTING IMAGING MODALITIES IN ONCOLOGY: COMPARATIVE EVALUATION OF MSCT, MRI, AND PET/CT

https://doi.org/10.5281/zenodo.19994875

Guzal Bakirovna Mamedova
Deputy Director of the Center for Pediatric Hematology, Oncology and Clinical Immunology
Fayzieva Nozima Avazbek qizi
Independent Researcher, Center for Pediatric Hematology, Oncology and Clinical Immunology

Abstract

This study focuses on the development and validation of a structured decision-making algorithm for selecting appropriate imaging modalities in oncological patients. The proposed approach integrates key diagnostic parameters, including sensitivity, specificity, and the clinical applicability of each method in tumor detection, staging, and treatment monitoring.

A total of 284 patients with different tumor localizations were analyzed. The findings indicate that the use of an algorithm-based strategy enhances diagnostic accuracy, minimizes redundant imaging procedures, and improves the overall efficiency of the diagnostic process. The results emphasize the importance of systematic and evidence-based decision-making in modern radiological practice.

Introduction. Contemporary oncological diagnostics is fundamentally dependent on advanced imaging technologies such as multislice computed tomography (MSCT), magnetic resonance imaging (MRI), and positron emission tomography combined with computed tomography (PET/CT). Each modality provides specific diagnostic advantages while also having inherent limitations.

In routine clinical practice, however, the selection of imaging techniques is frequently inconsistent and largely influenced by individual clinical preferences rather than standardized protocols. This often results in duplication of examinations, increased healthcare expenditures, delays in establishing a diagnosis, and additional burden on patients.

The absence of a clearly defined algorithm for imaging selection is particularly problematic in oncology, where diagnostic precision directly determines staging accuracy and subsequent therapeutic strategy. Therefore, the development of a

AMERICAN JOURNAL OF APPLIED MEDICAL SCIENCE
ISSN: 2996-5101 (online) | ResearchBib (IF) = 10.81 IMPACT FACTOR
Volume-4| Issue-4| 2026 Published: |30-04-2026

structured and rational approach to imaging selection is essential for improving both clinical outcomes and resource utilization.

Relevance. The increasing complexity of oncological diagnostics and the rapid expansion of imaging technologies underline the necessity for optimized diagnostic strategies.

The widespread availability of high-cost modalities, particularly PET/CT, requires a justified and rational approach to their application. At the same time, excessive or inappropriate use of imaging leads to inefficient allocation of healthcare resources and increased financial нагрузка.

Furthermore, the lack of unified practical guidelines contributes to variability in diagnostic decision-making and inconsistency in patient management. Under these conditions, the creation of an algorithm that combines clinical indications with diagnostic performance characteristics is of particular importance.

Materials and Methods

A retrospective analytical study was conducted using data from oncological patients examined between 2022 and 2024.

The study included 284 patients, of whom 136 were male (47.9%) and 148 female (52.1%). The age range varied from 21 to 74 years.

Patients were grouped according to tumor localization:

- lung tumors — 72 cases
- abdominal tumors — 64 cases
- pelvic tumors — 58 cases
- brain tumors — 42 cases
- bone tumors — 48 cases

The following imaging modalities were evaluated:

- MSCT — 284 examinations
- MRI — 198 examinations
- PET/CT — 126 examinations

Diagnostic effectiveness was assessed in relation to three principal clinical tasks:

1. detection of primary tumors
2. tumor staging
3. monitoring of treatment response

Clinico-morphological verification served as the reference standard.

Sensitivity, specificity, and overall diagnostic accuracy were calculated. Additionally, the incidence of redundant imaging studies and their impact on diagnostic timelines were analyzed.

AMERICAN JOURNAL OF APPLIED MEDICAL SCIENCE
ISSN: 2996-5101 (online) | ResearchBib (IF) = 10.81 IMPACT FACTOR
Volume-4| Issue-4| 2026 Published: |30-04-2026

The algorithm was formulated based on statistical analysis of diagnostic performance, expert consensus, and principles of clinical decision-making.

Results

Diagnostic effectiveness

The results demonstrate that the diagnostic value of imaging modalities varies depending on tumor localization and clinical objectives.

Primary tumor detection

MSCT showed high sensitivity (85–88%) in lung and abdominal malignancies, making it the preferred initial diagnostic tool in these cases.

MRI proved to be more effective in evaluating soft tissues and central nervous system tumors, with sensitivity reaching up to 91%.

Tumor staging

PET/CT demonstrated the highest diagnostic performance in staging, with sensitivity up to 94% and specificity up to 92%, particularly in detecting distant metastases.

Treatment monitoring

MRI and PET/CT were found to be more informative for assessing treatment response, especially in tumors with complex anatomical or metabolic characteristics.

Redundant imaging

In the absence of a structured algorithm, redundant imaging procedures were identified in 23% of cases.

These included:

- repeated MSCT without new clinical indications
- unnecessary MRI following sufficient CT data
- unjustified use of PET/CT

Such redundancy resulted in prolonged diagnostic timelines, increased costs, and additional radiation exposure.

Proposed Algorithm

The developed algorithm follows a stepwise decision-making framework:

1. **Initial clinical assessment**
   - evaluation of symptoms and suspected tumor localization
2. **Selection of primary imaging modality**
   - MSCT for thoracic and abdominal tumors
   - MRI for CNS and soft tissue lesions
3. **Staging procedures**
   - PET/CT for detection of systemic disease and metastases
4. **Follow-up evaluation**

- MRI or PET/CT depending on tumor characteristics and treatment type

5. **Prevention of redundant studies**

- avoidance of repeated imaging without new clinical indications

This approach ensures a rational distribution of diagnostic resources and improves the efficiency of patient management.

Discussion

The findings of the present study support the necessity of structured approaches in oncological imaging.

Differences in diagnostic performance among imaging modalities emphasize the importance of selecting appropriate methods based on specific clinical scenarios rather than routine practice.

The high proportion of redundant examinations observed highlights a systemic issue associated with the absence of standardized protocols. The proposed algorithm offers a practical solution by introducing a clear and consistent framework for decision-making.

These results are aligned with current international trends promoting evidence-based imaging and efficient resource utilization in healthcare systems.

Conclusions

A structured algorithm for selecting imaging modalities in oncological patients has been developed and validated.

Its implementation leads to improved diagnostic accuracy, reduction of unnecessary imaging procedures, and more efficient clinical decision-making.

The proposed approach can be recommended for routine use in oncological practice.

REFERENCES:

1. World Health Organization. (2020). *WHO report on cancer: Setting priorities, investing wisely and providing care for all*. Geneva: WHO.
2. National Comprehensive Cancer Network. (2024). *Clinical Practice Guidelines in Oncology*. Available at: NCCN.org.
3. European Society for Medical Oncology. (2022). *ESMO Clinical Practice Guidelines for diagnosis, treatment and follow-up of cancers*.
4. American College of Radiology. (2023). *ACR Appropriateness Criteria®*. Reston, VA.
5. Society of Nuclear Medicine and Molecular Imaging. (2022). *Procedure Standard for FDG PET/CT Imaging in Oncology*.

AMERICAN JOURNAL OF APPLIED MEDICAL SCIENCE
ISSN: 2996-5101 (online) | ResearchBib (IF) = 10.81 IMPACT FACTOR
Volume-4| Issue-4| 2026 Published: |30-04-2026

6. Fletcher J.W., Djulbegovic B., Soares H.P. et al. (2008). Recommendations on the use of 18F-FDG PET in oncology. *Journal of Nuclear Medicine*, 49(3), 480–508.

7. Jadvar H. (2016). FDG PET in oncology: Basics and clinical applications. *Journal of Nuclear Medicine*, 57(Suppl 1), 144S–149S.