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Original Research

NUTRITIONAL ASSESMENT IN ONCOLOGY OUTPATIENTS: A REVIEW OF SCREENING AND ASSESSMENT TOOLS

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ABSTRACT: Malnutrition and the associated phenotype of sarcopenia significantly compromise treatment tolerance, increase toxicity risk, and worsen overall survival in cancer patients. Given that the majority of oncological care occurs in the ambulatory setting, systematic nutritional assessment is a critical, mandated component of supportive care. This review synthesizes current evidence to evaluate the optimal screening and assessment tools suitable for routine use in outpatient oncology practice. A comprehensive narrative review was conducted, focusing on recent clinical guidelines and peer-reviewed literature concerning the validation and clinical utility of nutritional assessment instruments. Tools were analyzed across two tiers: Tier 1 (Screening) for feasibility and sensitivity; and Tier 2 (Comprehensive Assessment) for diagnostic accuracy regarding muscle loss and inflammation. The Malnutrition Screening Tool (MST) and Mini Nutritional Assessment Short Form (MNA-SF) emerged as the most practical and sensitive Tier 1 tools for general and geriatric oncology, respectively. For Tier 2, the Patient-Generated Subjective Global Assessment (PG-SGA) remains the gold standard. Crucially, the integration of objective measures—specifically Handgrip Strength and AI-assisted analysis of CT-derived Skeletal Muscle Index (SMI)—is essential for accurately diagnosing sarcopenia. Furthermore, the C-Reactive Protein/Albumin Ratio (CAR) is a powerful biomarker confirming the inflammatory drive of cachexia. Effective nutritional assessment mandates a structured, tiered approach. The reliance on advanced tools for objective body composition analysis is paramount for personalized care. Future efforts must focus on digitalizing this pathway, utilizing AI for automated sarcopenia detection, and ensuring robust resource allocation to oncology dietitians.

Keywords: Nutritional Assessment, Oncology Outpatient, Cancer Cachexia, Sarcopenia

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1. INTRODUCTION

Contemporary management of oncology patients mandates a paradigm where supportive care is intrinsically integrated with advanced antineoplastic strategies. Within this supportive framework, the evaluation of nutritional status holds paramount importance. Cancer-related malnutrition, frequently manifesting as the multifactorial Cancer Cachexia syndrome, impacts over 50% of individuals and functions as a major, independent predictor of adverse clinical outcomes [1].

The ambulatory care setting, where the majority of active treatment and surveillance occurs, is the primary nexus of modern oncologic practice. Ambulatory patients are at elevated risk for undiagnosed and untreated malnutrition, a factor that demonstrably compromises therapeutic efficacy and patient safety [2].

Recent consensus guidelines from key international bodies, including ESPEN and ASCO, unequivocally mandate systematic nutritional surveillance as a core component of cancer care, delineated into two stages: Tier 1 (Screening), the rapid identification of nutritional risk; and Tier 2 (Assessment), the comprehensive evaluation to establish a definitive diagnosis [1,2].

Literature spanning the last five years (2020–2025) has documented the critical relationship between nutritional status, particularly skeletal muscle integrity (sarcopenia), and treatment responsiveness. Sarcopenia is linked to diminished overall response rates (ORR) in Immunotherapy, heightened susceptibility to severe (Grade 3/4) toxicity due to altered drug pharmacokinetics of chemotherapy, and curtailed overall survival (OS) [3].

The objectives of this review are to: (1) Critically evaluate the performance and clinical validity of established Tier 1 and Tier 2 assessment tools tailored for routine outpatient application; and (2) Propose an evidence-based algorithm for the rigorous integration of nutritional assessment into contemporary outpatient oncology practice.

2. RESEARCH METHODS

2.1. Study Design

A comprehensive narrative review was conducted. The literature search focused on clinical consensus guidelines and peer-reviewed literature published predominantly during the 2020–2025 window. Primary databases consulted included PubMed/MEDLINE and the Cochrane Library, using a combination of keywords: “Nutritional assessment”, “Oncology outpatient”, “Cancer cachexia”, “Sarcopenia”. Inclusion criteria focused on: (1) oncology outpatients, (2) validation studies of screening/assessment tools, and (3) consensus from international bodies (ESPEN, ASCO). Exclusion criteria included case reports and studies not available in English or Vietnamese. A total of 42 relevant articles were initially screened, from which 11 core studies were selected for in-depth synthesis.

2.2. Analysis of Assessment Tools

Tools were analyzed across two tiers based on their purpose and complexity. Tier 1 (Screening) tools were evaluated for their feasibility (speed, simplicity) and high sensitivity (typically 80%) in rapidly identifying nutritional risk. Tier 2 (Comprehensive Assessment) tools were analyzed for their diagnostic validity against gold standards, objectivity, and prognostic capability (predicting toxicity and survival).

3. RESULTS

3.1. Pathophysiology and Multitiered Assessment Framework for Cancer-Related Malnutrition

The clinical landscape of cancer-related malnutrition is characterized by a complex spectrum known as the cachexia-sarcopenia axis. Cancer cachexia is fundamentally a catabolic disorder driven by systemic inflammation and pro-inflammatory cytokine cascades, such as IL-6 and TNF-alpha, which induce a persistent hypermetabolic state. This process leads to the progressive loss of skeletal muscle mass, or sarcopenia, which has emerged as a critical independent prognostic factor. A significant finding in recent literature is the prevalence of the sarcopenic obesity phenotype, where patients exhibit severe muscle depletion despite having a normal or high Body Mass Index (BMI). This phenomenon highlights the inadequacy of traditional weight-based assessments in identifying patients at high risk of treatment toxicity and poor survival [4].

Regarding the primary screening phase (Tier 1), the selection of an optimal tool depends heavily on the specific patient cohort and the clinical workflow. The Malnutrition Screening Tool (MST) is widely recognized as the most feasible instrument for general oncology outpatients due to its unparalleled simplicity, boasting a high sensitivity of 80–95% and a completion time of under one minute. For the growing geriatric oncology population, however, the Mini Nutritional Assessment Short Form (MNA-SF) is superior, as it is specifically validated to identify frailty and cognitive impairments that directly impact nutritional status. While the Nutritional Risk Screening 2002 (NRS-2002) offers detailed risk stratification by incorporating disease severity, its complexity often limits its utility in high-throughput outpatient settings compared to the more streamlined MST [5-7].

Table 1. Comparison of Nutritional Screening and Assessment Tools in Oncology

Tool	Primary Target	Strengths	Limitations	Sensitivity	Time
MST	General Oncology	Rapid, simple, high patient compliance.	Does not assess muscle or function.	80–95%	< 1 min
MNA-SF	Geriatric (≥65y)	Includes frailty, mobility, and neuropsychological factors.	Too detailed for younger, fit patients.	89–97%	3–5 min
NRS-2002	Inpatients	Captures severity of disease stress.	Complex; less feasible for high-volume clinics.	60–85%	3–5 min
PG-SGA	Gold Standard (Tier 2)	Comprehensive; captures symptoms and physical exam.	Requires trained staff for physical assessment.	90–98%	10–15 min

Comprehensive assessment (Tier 2) requires the integration of subjective clinical data with objective physiological measures. The Patient-Generated Subjective Global Assessment (PG-SGA) remains the gold standard, providing a structured grading system that translates history and physical examination into a prioritized triage score. To supplement these findings, the assessment of the Skeletal Muscle Index (SMI) at the L3 vertebral level via CT scan has become the reference standard for diagnosing sarcopenia. This is further enhanced by Handgrip Strength (HGS) measurements, which provide a dynamic evaluation of muscle function and chemotherapy tolerance. Complementing these physical measures, the C-Reactive Protein/Albumin Ratio (CAR) serves as a potent biochemical surrogate for the systemic inflammation driving the cachectic process, allowing clinicians to confirm a severe catabolic state and mandate multimodal intervention [8-11].

3.2. The "Screen-Refer-Assess-Intervene" Pathway: A Multimodal Clinical Framework for Cancer Malnutrition

To operationalize the evidence discussed, a structured "Screen-Refer-Assess-Intervene" clinical pathway is proposed, transitioning from universal risk identification to specialized multimodal care.

The initial phase, Tier 1 (Universal Screening), is designed for rapid execution by nursing staff or medical assistants during routine outpatient visits. For the general oncology population, the Malnutrition Screening Tool (MST) is the preferred instrument due to its high feasibility and sensitivity. However, for patients aged 70 years and older, the Mini Nutritional Assessment Short Form (MNA-SF) must be utilized to capture age-specific vulnerabilities such as frailty and cognitive decline. It is recommended that this screening be repeated at every followup visit or at minimum 4-week intervals to ensure that early nutritional deterioration does not go undetected [5-7].

Upon the identification of nutritional risk—defined as an MST score of 2 or an MNA-SF score of 11 - the patient enters Tier 2 (Comprehensive Assessment). This phase is led by a Registered Dietitian (RD) and shifts toward diagnostic precision. Clinical stratification is achieved using the Patient-Generated Subjective Global Assessment (PG-SGA) to categorize the severity of malnutrition (Stages A, B, or C). This subjective data is then bolstered by objective metrics to confirm sarcopenia, specifically through Handgrip Strength (HGS) to evaluate muscle function and the analysis of the Skeletal Muscle Index (SMI) at the L3 level via AI-assisted CT imaging. Furthermore, the C-Reactive Protein/Albumin Ratio (CAR) is assessed as a critical biochemical surrogate to determine the intensity of systemic inflammation driving the catabolic process [8-11].

The final phase, Step 3 (Multimodal Intervention), involves the development of a personalized care plan tailored to the specific findings of the Tier 2 assessment. Nutritional therapy focuses on meeting high protein requirements, ranging from 1.2 to 1.5 g/kg/day, supplemented with Eicosapentaenoic Acid (EPA/Omega-3) to modulate the inflammatory response. To counteract muscle atrophy (sarcopenia), these nutritional interventions are integrated with structured physical activity, combining resistance training with aerobic exercise. Continuous monitoring and reassessment are mandatory, ideally synchronized with each chemotherapy cycle, to ensure the intervention is adjusted based on the patient's evolving clinical status and therapeutic tolerance [1-2].

4. DISCUSSION

4.1. Paradigm shift from BMI to Objective Body Composition and Functional Assessment

The findings of this review underscore a necessary paradigm shift in oncology from a reliance on BMI to a structured, tiered nutritional assessment framework. The "BMI paradox" remains a significant barrier in clinical practice, as the presence of sarcopenic obesity often masks critical muscle loss, leading to inaccurate chemotherapy dosing and increased Grade 3/4 toxicities. The integration of AI-assisted SMI analysis from routine diagnostic CT scans represents a transformative breakthrough in this regard, making objective body composition analysis a scalable and routine clinical test. By automating the segmentation of muscle mass, healthcare providers can identify sarcopenia early, even in patients who appear well-nourished by traditional standards.

The choice of screening tools must be strategically aligned with the patient's age and the clinical environment to ensure maximum sensitivity. While the MST is ideal for rapid, universal screening integrated into electronic health records, it must be replaced by the MNA-SF in geriatric settings to capture the nuances of age-related frailty. Furthermore, the discussion of nutritional status must move beyond mere calorie intake to address the underlying inflammatory drive. The use of CAR as a biomarker, in conjunction with functional tests like HGS, provides a comprehensive view of the patient's biological reserve. This holistic perspective is essential for developing a multimodal intervention strategy that combines high-protein nutrition, omega-3 fatty acids for inflammation modulation, and resistance exercise to preserve physical function.

Ultimately, the successful implementation of these guidelines requires a rigid "Screen-Refer-Assess-Intervene" protocol. Oncology centers must prioritize the digital integration of screening tools and the allocation of specialized resources to Registered Dietitians. By shifting toward an automated and objective assessment model, clinicians can move from reactive treatment of malnutrition to proactive, personalized care. This transition is vital not only for improving treatment tolerance and quality of life but also for optimizing the overall survival outcomes of cancer patients in the modern therapeutic era.

4.2. Stratification by Patient Subgroups and Disease Stage

The clinical utility of these tools must be tailored to specific patient cohorts. In early-stage cancer, the priority is the prevention of early muscle loss; here, the MST serves as an efficient "red flag" system for routine monitoring. Conversely, in advanced or metastatic disease, the high prevalence of refractory cachexia necessitates immediate Tier 2 assessment using PG-SGA and CAR to guide aggressive multimodal support. Furthermore, the geriatric population requires a distinct approach. Age-related sarcopenia often overlaps with cancer-related muscle wasting. The MNA-SF is superior in this group as it accounts for polypharmacy, dementia, and reduced mobility—factors that significantly impact nutritional intake but are often overlooked by general screening tools.

4.3. Feasibility in Resource-Limited Settings

Implementing a "gold standard" framework presents challenges in Middle-Income Countries, where specialized oncology dietitians are often scarce. In settings where AI-assisted CT analysis or specialized software is unavailable, clinicians should adopt pragmatic surrogates. Simple anthropometric measures, such as Calf Circumference (CC) and Handgrip Strength (HGS) using inexpensive dynamometers, offer high reliability for diagnosing sarcopenia at a low cost. Additionally, utilizing the PG-SGA Short Form, which patients can complete in the waiting room, can significantly reduce the professional workload while maintaining diagnostic sensitivity.

5. CONCLUSION

The systematic assessment of nutritional status must follow a structured, two-tiered model. While the MST provides high feasibility for universal screening (Tier 1), its subjective nature fails to capture sarcopenia in patients with sarcopenic obesity. The critical step towards optimizing care is the mandatory integration of objective measures (Tier 2).

The use of AI-based SMI analysis from existing CT scans is a transformative step, removing the logistical burden of manual diagnosis and allowing RDs to focus their expertise immediately on personalized intervention planning [16]. When combined with functional assessment (HGS) and confirmation of inflammatory drive (CAR), the RD possesses a highly accurate clinical picture [9].

The primary mandate for oncology centers now lies in the effective implementation of these guidelines. This necessitates a rigid "Screen-Refer-Assess-Intervene" protocol. Screening tools must be seamlessly integrated into the electronic health record (EHR) with mandatory completion. Furthermore, strategic resource investment in Oncology Dietitian Time and consistent staff training are essential to ensure that timely assessment translates into effective, aggressive nutritional intervention [1].

Effective nutritional assessment mandates a structured, two-tiered approach. Tier 1 must utilize the highly feasible MST (or MNA-SF for geriatrics) for universal risk identification. Tier 2, led by the RD, must integrate gold-standard subjective data (PG-SGA) with cutting-edge objective analysis, specifically Handgrip Strength and AI-assisted CT-derived Skeletal Muscle Index (SMI), alongside key inflammatory biomarkers such as the CAR [8-9].

The primary mandate for oncology centers now lies in prioritizing the seamless digital integration of screening tools and automated body composition analysis (via AI) into the EHR, coupled with adequate resource allocation to the specialized oncology dietitian team. Proactive management of malnutrition and sarcopenia is critical to maximizing patients' tolerance for modern therapies, safeguarding their quality of life, and ultimately optimizing their overall clinical outcomes. While advanced technology like AI-CT represents the future, the immediate priority for oncology centers in diverse economic settings is to ensure that no patient goes unscreened. A flexible model that adapts Tier 1 tools (MST/MNA-SF) to the patient's age and Tier 2 tools (PG-SGA/HGS) to the center's resources is the most viable strategy for optimizing clinical outcomes.

In conclusion, nutritional assessment must be individualized: the MST is recommended for routine monitoring in early-stage patients, while the MNA-SF is essential for the geriatric population. For those with advanced disease, a comprehensive Tier 2 assessment (PG-SGA, HGS, and CAR) is mandatory to guide palliative and supportive care

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