



Malnutrition as a Determinant of Impaired Quality of Life in Neuroendocrine Tumor Patients: A Single-Center Cohort

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ABSTRACT

Introduction

Neuroendocrine tumors (NETs) constitute a heterogeneous group of neoplasms, often associated with chronic symptoms and digestive disorders that can impair nutritional status and quality of life (QoL). The objective of this study was to evaluate the relationship between nutritional status and quality of life in patients with NETs.

Methods

We conducted a retrospective observational study including patients with histologically confirmed NETs, followed in our oncology department between March 2016 and March 2021. Nutritional assessment was based on body mass index (BMI), recent weight loss, and serum albumin levels. Quality of life was evaluated using the EORTC QLQ-C30 questionnaire. Clinical, pathological, and therapeutic data were collected from medical records.

Results

A total of 40 patients were included, with a median age of 54.72 years (range: 25–86 years). The male-to-female ratio was 0.74. Gastroenteropancreatic NETs accounted for the majority of cases (90%), followed by pulmonary NETs (10%). Malnutrition or nutritional risk was identified in 38% of patients. Significant weight loss (>10% over 6 months) was observed in 32.5% of cases, while hypoalbuminemia was found in 19% of patients. Patients with metastatic disease or functional NETs showed a higher frequency of nutritional impairment. Global quality of life scores were significantly lower in malnourished patients compared to well-nourished patients. The symptoms most impacting quality of life were fatigue, anorexia, diarrhea, and impaired physical functioning.

Discussion

Our findings confirm the high prevalence of malnutrition in patients with NETs, consistent with the literature. This nutritional impairment is particularly marked in metastatic and functional forms, and is associated with a significant deterioration in quality of life. The association between malnutrition and specific symptoms (fatigue, anorexia) underscores the importance of systematic nutritional assessment.

Conclusion

Malnutrition is frequent in patients with neuroendocrine tumors and appears to be strongly associated with impaired quality of life and reduced therapeutic tolerance. Early nutritional screening and multidisciplinary management should be systematically integrated into the therapeutic strategy for NET patients.



Keywords: Neuroendocrine tumors; malnutrition; quality of life; **hypoalbuminemia**; supportive oncology; nutrition

INTRODUCTION

Neuroendocrine tumors (NETs) are a heterogeneous group of neoplasms originating from diffuse neuroendocrine cells, which can arise in various organs such as the pancreas, lungs, and gastrointestinal tract [1]. Although often indolent, NETs are associated with chronic symptoms—such as diarrhea, flushing, and hormonal imbalances—which can significantly affect patients' nutritional status and quality of life (QoL) [2]. Malnutrition is a common complication in cancer patients, particularly those with advanced or functional NETs, and has been linked to reduced therapeutic tolerance, increased toxicity, and poorer survival outcomes [3].

Despite the growing recognition of the importance of nutritional care in oncology, little is known about the specific impact of malnutrition on QoL in NET patients. This study aimed to evaluate the relationship between nutritional status and QoL in a cohort of NET patients, with the goal of identifying high-risk subgroups and highlighting the need for early nutritional intervention.

METHODS

Study Design and Population

We conducted a retrospective observational study including patients with histologically confirmed NETs, followed in our oncology department between March 2016 and March 2021. During the study period, 56 patients were initially screened. Of these, 16 patients were excluded due to incomplete medical records (specifically missing EORTC QLQ-C30 questionnaires or nutritional data) or loss to follow-up, leaving a final cohort of 40 patients for analysis. Missing data were handled by complete case analysis; no imputation was performed. The study was approved by our institutional review board (IRB number: 3572).

Nutritional Assessment

Nutritional status was evaluated using: • Body Mass Index (BMI) • Recent weight loss (percentage over 6 months) • Serum albumin levels

Patients were classified as malnourished or at nutritional risk if they met at least one of the following criteria, based on the European Society for Clinical Nutrition and Metabolism (ESPEN) guidelines [3]:

- BMI < 18.5 kg/m²
- Weight loss > 10% in 6 months
- Albumin < 3.5 g/dL

Patients meeting none of these criteria were classified as well-nourished. These thresholds were selected as they are widely validated cut-offs strongly associated with clinical deterioration and increased morbidity in oncology.

Quality of Life Assessment

Quality of life was measured using the EORTC QLQ-C30 questionnaire, a validated tool for assessing QoL in cancer patients. Scores were transformed into a 0–100 scale, with higher scores indicating better QoL.

Data Collection

Clinical, pathological, and therapeutic data were extracted from medical records. Variables included age, sex, tumor site, stage, functional status, and treatments received.



Statistical Analysis

Descriptive statistics were used to summarize patient characteristics. Continuous variables were expressed as median and range, while categorical variables were presented as frequencies and percentages. The Mann-Whitney U test was used to compare QoL scores between malnourished and well-nourished patients. A p-value < 0.05 was considered statistically significant. Statistical analyses were performed using SPSS version 25.0.

Ethical Considerations

This study was an analysis of anonymized patient data. As the research involved no direct intervention or modification of standard patient care, formal approval from an ethics committee was not required in accordance with institutional and national guidelines for observational studies. All patient data were anonymized prior to analysis to protect confidentiality.

RESULTS

Patient Characteristics

A total of 40 patients were included, with a median age of 54.72 years (range: 25–86 years). The male-to-female ratio was 0.74. The detailed baseline characteristics, including specific primary tumor sites, histological grades, metastatic sites, and treatment categories, are summarized in Table 1.

Table 1: Baseline Characteristics of the Study Population (n=40)

Variable	n (%)
Age (years)	
Median (range)	54.72 (25–86)
Sex	
Male	23 (57.5)
Female	17 (42.5)
Specific tumor primary site	
Small intestine	16 (40.0)
Pancreas	12 (30.0)
Stomach	5 (12.5)
Lung	4 (10.0)
Other / Unknown primary	3 (7.5)
Histological grade	
G1 (Ki-67 ≤ 2%)	14 (35.0)
G2 (Ki-67 3-20%)	18 (45.0)
G3 (Ki-67 > 20%)	8 (20.0)
Disease stage	
Localized	12 (30.0)
Metastatic	28 (70.0)
Metastatic sites (among metastatic patients, n=28)	
Liver only	15 (53.6)
Peritoneum only	1 (3.6)
Bone	2 (7.1)
Multiple sites	10 (35.7)
Functional status	



Non-functional	24 (60.0)
Functional	16 (40.0)
Current major treatment category	
Surgery alone (under surveillance)	10 (25.0)
Somatostatin analogs	14 (35.0)
Systemic chemotherapy	10 (25.0)
Targeted therapy / PRRT	6 (15.0)

Nutritional Status

Malnutrition or nutritional risk was identified in 38% of patients. Significant weight loss (>10% over 6 months) was observed in 32.5% of cases, while hypoalbuminemia was found in 19% of patients. Patients with metastatic disease or functional NETs had a higher frequency of nutritional impairment (Table 2).

Table 2: Nutritional Status by Disease Characteristics

Variable	Malnourished n (%)	Well-nourished n (%)
Overall	15 (38)	25 (62)
Metastatic disease	13 (46.4)	15 (53.6)
Functional NETs	9 (56.3)	7 (43.7)
Non-functional NETs	6 (25.0)	18 (75.0)

Quality of Life

Global quality of life scores were significantly lower in malnourished patients compared to well-nourished patients (median: 53.3 vs. 76.7; $p < 0.01$). The symptoms most impacting QoL were fatigue, anorexia, diarrhea, and impaired physical functioning (Figure 1).

DISCUSSION

Our findings confirm the high prevalence of malnutrition in NET patients, consistent with previous studies [4, 5].

It is important to acknowledge the limitations of serum albumin as a sole nutritional marker. Hypoalbuminemia in cancer patients is often multifactorial; while it reflects severe nutritional depletion, it is also a negative acute-phase reactant strongly influenced by systemic inflammation and disease severity. Therefore, low albumin levels in our cohort likely represent a combination of true nutritional deficit and inflammation-driven cachexia rather than isolated starvation. This overlap underscores that albumin should be interpreted alongside inflammatory markers (such as CRP) when available, to distinguish between simple malnutrition and cancer-related cachexia.

Malnutrition was particularly common in patients with metastatic disease or functional NETs, likely due to increased metabolic demands and hormonal disturbances [6]. The significant association between malnutrition and lower QoL underscores the importance of nutritional assessment in routine clinical practice.

The relationship between malnutrition and symptoms such as fatigue and anorexia highlights the need for a multidisciplinary approach, including nutritional support and symptom management [7]. Early intervention may improve QoL and enhance tolerance to systemic therapies.

LIMITATIONS

This study has several limitations, including its retrospective design and small sample size. Prospective studies with larger cohorts are needed to validate these findings and evaluate the impact of nutritional interventions on QoL.



CONCLUSION

Malnutrition is a frequent and underrecognized challenge in NET patients, strongly associated with impaired quality of life and reduced therapeutic tolerance. Early nutritional screening and multidisciplinary management should be systematically integrated into the therapeutic strategy for NET patients. Future studies should focus on developing targeted nutritional interventions to improve outcomes in this population.

Conflicts of interest

The authors declare no conflicts of interest related to this article.

Financial declaration

This study received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Informed consent

This study had an anonymized patient data. As the research involved no direct intervention or modification of standard patient care, formal approval from an ethics committee was not required in accordance with institutional and national guidelines for observational studies. All patient's data were anonymized prior to analysis to protect confidentiality and treated according to the Algerian national guidelines

Authors' contributions

Conceptualization: Sihem BENSALÉM, Abdelaziz AMMARI, Assia BENSALÉM; **Methodology:** Sihem BENSALÉM; **Software:** Abdelaziz AMMARI, Rahma DJOUABI, Zineb BAAZIZ; **Validation:** Sihem BENSALÉM, Abdelaziz AMMARI, Assia BENSALÉM; **Formal Analysis:** Sihem BENSALÉM; **Investigation:** Sihem BENSALÉM, Abdelaziz AMMARI, Rahma DJOUABI, Zineb BAAZIZ, Assia BENSALÉM; **Resources:** Sihem BENSALÉM, Abdelaziz AMMARI, Rahma DJOUABI, Zineb BAAZIZ; **Data Curation:** Sihem BENSALÉM, Abdelaziz AMMARI, Assia BENSALÉM; **Writing - Original Draft Preparation:** Sihem BENSALÉM, Abdelaziz AMMARI, Rahma DJOUABI, Zineb BAAZIZ; **Writing - Review & Editing:** Sihem BENSALÉM, Abdelaziz AMMARI, Rahma DJOUABI, Zineb BAAZIZ, Assia BENSALÉM; **Visualization:** Sihem BENSALÉM; **Supervision:** Sihem BENSALÉM, Abdelaziz AMMARI; **Project Administration:** Assia BENSALÉM; **Funding Acquisition:** Not applicable.

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