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Prevalence and risk factors of oral frailty in elderly cancer inpatients

A cross-sectional study

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Abstract

This study aimed to investigate the prevalence of oral frailty (OF) and identify factors associated with it among elderly cancer inpatients. A cross-sectional study was conducted in a tertiary hospital in Wuhu City, Anhui Province, China, between April 2024 and February 2025. OF was assessed using the oral frailty index-8. Additional assessments included the oral health assessment tool, physical frailty (geriatric-8), family support (family adaptation, partnership, growth, affection, and resolve index), nutritional risk, and hematological parameters (complete blood cell counts). Descriptive statistics were used to characterize the sample. Univariate and multivariate binary logistic regression analyses were performed to identify factors associated with OF. A total of 270 elderly cancer inpatients were included (mean age 69.8 ± 6.49 years). The prevalence of OF was 57.7%. In univariate analyses, higher platelet-to-lymphocyte ratio (PLR) and neutrophil-to-lymphocyte ratio (NLR), smoking history, denture use, xerostomia, physical frailty, poor oral health, and nutritional risk were significantly associated with OF (all $P < .05$). Stratified analyses indicated age-specific patterns: in patients <70 years, PLR, NLR, denture use, xerostomia, physical frailty, and nutritional risk were associated with OF; while in patients ≥70 years, NLR, denture use, xerostomia, physical frailty, oral health, and nutritional risk remained significant (all $P < .05$). Multivariable analysis identified smoking history, denture use, xerostomia, physical frailty, nutritional risk, and elevated PLR/NLR as independent factors associated with OF. OF was highly prevalent among elderly cancer inpatients. Several clinical, behavioral, and inflammatory factors were associated with its occurrence. However, as this was a cross-sectional study, causality cannot be inferred. Further longitudinal and multi-center studies are needed to confirm these associations and clarify their underlying mechanisms.

Abbreviations: NLR = neutrophil-to-lymphocyte ratio, OF = oral frailty, PLR = platelet-to-lymphocyte ratio.

Keywords: cancer inpatients, cross-sectional study, elderly, oral frailty, risk factors

1. Introduction

Against the backdrop of global population aging, age-related malignancies have become a critical public health concern. Epidemiological data indicate that in China, adults aged ≥60 years account for approximately 60% of all new cancer cases, and globally, the incidence of cancer among older adults is more than twice that of the general population.[1] Although advances in cancer diagnosis and treatment have improved survival, maintaining quality of life in elderly patients remains a major challenge.

Oral health is an essential component of overall health and quality of life.[2] In the context of aging, oral frailty (OF) has been proposed to describe progressive declines in oral function and hygiene, such as tooth loss, impaired chewing, and reduced oral care behaviors.[3] OF not only affects nutritional intake and communication but is also associated with physical frailty,[4] malnutrition,[5] falls,[6] aspiration pneumonia,[7] and increased mortality risk.[8]

This risk is particularly significant among cancer patients. Previous studies have reported a high prevalence of OF (up to 64.3%) in this population,[9] likely due to tumor-related factors and treatment-induced complications such as oral mucositis, xerostomia, and radiation-related caries.[10–12] However, OF remains underrecognized in oncology care.[13] Many patients seek oral care only after severe symptoms develop,[14–16] and healthcare providers often lack adequate training in oral health management.[17,18]

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In China, this issue may be further exacerbated by limited oral health service accessibility and uneven resource distribution.[19] Despite its potential impact on nutrition, treatment tolerance, and prognosis, OF among elderly cancer inpatients has received little attention. Most existing studies focus on community-dwelling older adults or nursing home residents, leaving a knowledge gap in hospitalized oncology populations.

Therefore, this study aimed to investigate the prevalence of OF and its associated factors among elderly cancer inpatients in China. By exploring potential determinants – including physical, nutritional, and inflammatory factors – this study seeks to provide evidence for early screening and comprehensive intervention strategies for this vulnerable group.

2. Materials and methods

2.1. Research design and participants

This study was approved by the Ethics Committee of the Second Affiliated Hospital of Wannan Medical College. A cross-sectional study was conducted between April 2024 and February 2025, employing a convenience sampling method to recruit older cancer patients from 3 tertiary hospitals in Anhui Province, China. The inclusion criteria were as follows: age ≥ 60 years; histopathologically confirmed cancer diagnosis; Barthel index score ≥ 60; and Mini-mental state examination score > 27, indicating intact communication and comprehension abilities. The following conditions were excluded from the study: active oral mucositis; head and neck malignancies; history of oral surgery within the preceding 6 months; and concurrent failure of vital organs such as the heart, lungs, liver, and kidneys. This study followed the STROBE guidelines.

2.2. Sample size calculation

The sample size was calculated using the formula $n_p = \frac{n_1}{1-R^2_{1,2,3,4,\cdots,p}}$, according to the pre-experiment, information $B = 0.48$, $P_0 = 0.35$, $P_1 = 0.58$, $P = .50$, $Z_1 - \alpha/2 = 1.96$, $Z_1 - \beta = 1.28$ were obtained. P_0 and P_1 were positive outcomes for $X = 0$ and $X = 1$, respectively. Taking physical weakness and denture use as the main research factors, R^2 values were 0.17 and 0.25, respectively. Considering the possible 10% dropout rate, the minimum sample size required was determined to be 237 people. The study ultimately recruited 270 participants, ensuring sufficient statistical power.[20]

2.3. Ethical considerations

This study was approved by the Ethics Committee of the Affiliated Stomatological Hospital of Anhui Medical University (Approval No. K2024013). All procedures were performed in strict compliance with the ethical principles outlined in the Declaration of Helsinki.

2.4. Study measures

2.4.1. Oral frailty. The primary outcome measure was the prevalence of OF among hospitalized geriatric oncology patients. In this study, the oral frailty index-8 (OFI-8) was utilized to evaluate the OF status of the investigated subjects. The OFI-8 scale was developed by Tanaka et al.[21] For the purpose of this research, we adopted the Chinese version developed by Chen et al. This instrument consists of 8 items that evaluate 5 key domains: function, denture use, mastication capacity, social participation, and oral health behaviors. The OFI-8 yields a total score ranging from 0 to 11, with a score of ≥4 indicating clinically significant OF. The high sensitivity of the OFI-8 renders it an effective instrument for identifying the risk of oral frailty. In the context of its local validation in China, the Cronbach's α coefficient of this scale was found to be 0.94.

2.4.2. Measurement of covariates sociodemographic and clinical characteristics. The sociodemographic characteristics of the patients included age, gender, marital status, place of residence, education level, type of health insurance, number of children, and average monthly personal income. Disease-related characteristics encompassed smoking history, alcohol consumption history, denture use, dry mouth, history of radiation therapy, chemotherapy exposure, and the presence of chronic diseases.

2.4.3. Oral health assessment. In this study, the oral health assessment tool was employed to evaluate participants' oral health status. The oral health assessment tool assesses 8 domains: lips, tongue, gingival tissue, saliva, natural teeth, dentures, oral cleanliness, and dental pain. The total score ranges from 0 to 16; a score below 3 indicates good oral health, while a score of 3 or higher suggests poor oral health (Cronbach's α = 0.875).

2.4.4. Family functioning. This study used the family adaptation, partnership, growth, affection, resolve index to assess patients' subjective satisfaction with family functioning. The family adaptation, partnership, growth, affection, and resolve index comprises 5 items covering 5 dimensions: family adaptation, partnership, growth, affection, and intimacy. This scale uses a 3-point (0–2) scoring system where "often" is assigned 2 points, "sometimes" is assigned 1 point, and "rarely" is assigned 0 points. The total score ranges from 0 to 10, with higher scores indicating better family functioning (Cronbach's α = 0.894).

2.4.5. Physical frailty. The geriatric 8 is a specialized tool for assessing frailty in elderly cancer patients. It consists of 8 key evaluation items: reduced food intake over the past 3 months, weight loss, mobility status, body mass index, polypharmacy, self-rated health status, neuropsychological problems, and age. The total score ranges from 0 to 17, with scores ≤14 indicating the need for further comprehensive frailty evaluation (Cronbach's α = 0.716).

2.4.6. Nutritional risk. Nutritional risk assessment was conducted using the Nutritional Risk Screening 2002 (NRS2002) scale.[22] This validated tool consists of 3 core components: disease severity, nutritional status impairment, and age. The total score ranges from 0 to 7, with scores ≥3 indicating clinically significant nutritional risk requiring intervention.

2.4.7. PLR and NLR. The platelet-to-lymphocyte ratio (PLR) and neutrophil-to-lymphocyte ratio (NLR) are widely recognized as systemic inflammatory biomarkers. NLR has been established as a predictive factor for radiotherapy-induced oral mucositis in patients with head and neck cancer,[23] which prompted us to hypothesize its potential association with OF. In this study, complete blood counts were obtained from routine blood tests conducted within 1 day prior to questionnaire administration. Fasting venous blood samples were collected using both EDTA-K2 anticoagulant tubes and standard gel separator tubes for hematological analysis. All blood testing was performed with a Sysmex XN-3100 automated hematology analyzer (Sysmex Corporation, Japan), following standardized protocols in certified public hospital laboratories.

2.5. Data collection and quality control

Data were collected through on-site paper questionnaires administered by trained researchers. Prior to the study, all data collectors completed standardized training and evaluation to ensure uniform administration procedures. For elderly participants who were unable to complete the questionnaires independently,

Table 1

Fundamental characteristics of the patients (N = 270).

Characteristic	Value
Age (yr), mean ± SD	69.8 ± 6.49
Sex, n (%)	
Male	150 (55.6)
Female	120 (44.4)
Marital status, n (%)	
Married	251 (86.6)
Divorced/widowed/unmarried	19 (13.4)
Residence, n (%)	
Urban	175 (64.9)
Rural	95 (35.1)
Education level, n (%)	
Junior high/high school	103 (38.1)
Higher education	7 (2.6)
Monthly income (¥), n (%)	
≤3000	167 (61.9)
3001–6000	88 (32.6)
≥6001	15 (5.5)
Medical insurance, n (%)	
Self-paid	13 (5.0)
Urban resident/employee	171 (63.3)
Commercial insurance	1 (0.4)
Rural cooperative	95 (35.2)
Number of children, n (%)	
0	16 (5.9)
1	107 (39.6)
≥2	147 (54.5)
Oral frailty, n (%)	
Present	156 (57.7)
Absent	114 (42.3)

SD = standard deviation.

trained staff assisted by reading each question verbatim, avoiding any leading phrasing. All questionnaires were reviewed immediately after completion to identify missing or inconsistent responses. A total of 280 questionnaires were distributed, and 10 were excluded due to significant logical inconsistencies or incomplete data, resulting in 270 valid responses (96.42% validity rate). To ensure accuracy, 2 researchers independently entered all data into EpiData 3.1 using predefined field types and logical skip patterns. Any discrepancies during data entry were resolved by referring back to the original questionnaires until agreement was reached. This dual-entry verification process ensured data integrity throughout the study.

2.6. Statistical analysis

A 2-stage process of "data management-statistical analysis" was adopted for data analysis in this study. First, EpiData 3.1 software was used for data entry and cleaning. Predefined field types and logical skip rules were set, and 2 researchers independently completed dual data entry. In case of data discrepancies during entry, the original questionnaires were reviewed and verified until a consensus was reached to ensure data integrity and accuracy. All subsequent statistical analyses were performed using R 4.2.3 software.

For continuous variables, those conforming to a normal distribution were described as $x \pm s$, while those with a non-normal distribution were expressed as (M [Q_1, Q_3]). Categorical variables were presented as (n [%]).

OF (defined as an OFI-8 score ≥ 4 indicating the presence of OF) was designated as the dependent variable. First, univariate analysis was conducted to screen out indicators with statistically significant differences ($P < .05$) from the candidate variables, which were then included as independent variables for further analysis.

Stratified regression analysis was employed to explore the factors associated with OF. The overall population was stratified by age into 2 subgroups: <70 years old and ≥70 years old. Binary logistic regression with the "Enter method" was performed separately for the overall population and each age subgroup to identify independent influencing factors of OF.

All statistical tests were 2-tailed, and a P-value <.05 was considered to indicate a statistically significant difference. The final results were presented as odds ratios (OR) with 95% CI.

3. Results

3.1. The participants' characteristics and prevalence of OF

In this study, a total of 270 elderly cancer patients were enrolled. Among them, 156 patients (57.7%) exhibited OF, while 114 patients (42.3%) did not. The age of the research participants ranged from 60 to 86 years, with a mean age of 69.8 ± 6.49 years. The majority of the participants were male (55.6%), married (86.6%), and had achieved a primary school education level (59.3%). More than half of the participants were urban residents (64.9%), and 61.9% had a monthly personal income of 3000 yuan or less. Additionally, 63.3% of the subjects were covered by urban resident medical insurance, and 54.5% had >1 child. Further statistical details of the study participants are presented in Table 1.

3.2. Univariate analysis for oral frailty (OF)

The results showed that in Table 2, for the overall population, the PLR and NLR levels in the OF group (group 1) were significantly higher than those in the non-frailty group (group 0), and there were significant differences in marriage, educational level, income level, smoking history, dentures, xerostomia, frailty judgment, oral health, and nutritional risk between the 2 groups (all $P < .05$). In the population under 70 years old, PLR, NLR, dentures, xerostomia, frailty judgment, and nutritional risk were significantly different between the 2 groups (all $P < .05$), while gender, marriage and other factors had no significant differences. In the population aged 70 and above, NLR, dentures, xerostomia, frailty judgment, oral health, and nutritional risk were significantly different between the 2 groups (all $P < .05$), while PLR, gender and other factors had no significant differences.

3.3. Binary logistic regression analysis of OF determinants

Table 3 indicated that in the overall population, smoking history, dentures, xerostomia, frailty judgment, nutritional risk, PLR, and NLR were risk factors for OF (all $P < .05$). In the population under 70 years old, dentures, frailty judgment, PLR, and NLR were significant risk factors (all $P < .05$). In the population aged 70 and above, dentures, xerostomia, and nutritional risk were risk factors for OF (all $P < .05$).

4. Discussion

This study investigated the risk factors for OF in hospitalized patients, with a focus on age-specific differences. The results revealed distinct associations between clinical indicators and OF across different age groups, providing insights into the heterogeneous nature of OF pathogenesis.

The prevalence of OF among hospitalized elderly cancer patients was 57.7%. This finding is in line with the results of Li et al (57.58%); however, it is considerably higher than that of elderly individuals in Chinese communities (33.8%) and those in Chinese aged care facilities (31.0%). The discrepancies might be due to the relatively high prevalence of physical frailty, sarcopenia, and malnutrition among hospitalized patients.[24] Additionally, cancer treatment can have negative impacts on oral health.[25] These results emphasize the need for targeted interventions for this vulnerable group. Current research

Table 2

Factors associated with oral frailty in elderly cancer inpatients: univariate analysis (N = 270).

	Total			<70			≥70		
Variables	**0 (n = 114)**	**1 (n = 156)**	***P***	**0 (n = 96)**	**1 (n = 33)**	***P***	**0 (n = 18)**	**1 (n = 123)**	***P***
PLR, M (Q_1, Q_3)	153.94 (113.70, 191.12)	185.94 (136.87, 283.37)	<.001	150.65 (112.80, 188.69)	193.29 (138.22, 274.28)	<.001	171.49 (131.51, 200.42)	185.60 (134.46, 286.96)	.117
NLR, M (Q_1, Q_3)	2.49 (1.89, 3.17)	3.63 (2.00, 5.74)	<.001	2.49 (1.90, 3.12)	3.29 (2.24, 5.05)	.014	2.62 (1.86, 3.38)	3.69 (1.99, 5.84)	.029
Gender, n (%)			.563			.652			.326
0	53 (46.49)	67 (42.95)		48 (50.00)	18 (54.55)		5 (27.78)	49 (39.84)	
1	61 (53.51)	89 (57.05)		48 (50.00)	15 (45.45)		13 (72.22)	74 (60.16)	
Marry status, n (%)			.004			.579			.247
1	112 (98.25)	139 (89.10)		94 (97.92)	31 (93.94)		18 (100.00)	108 (87.80)	
2	2 (1.75)	17 (10.90)		2 (2.08)	2 (6.06)		0 (0.00)	15 (12.20)	
Education (n [%])			.006			.528			.726
Primary school or below	55 (48.25)	105 (67.31)		43 (44.79)	18 (54.55)		12 (66.67)	87 (70.73)	
Secondary school	55 (48.25)	48 (30.77)		49 (51.04)	15 (45.45)		6 (33.33)	33 (26.83)	
College or above	4 (3.51)	3 (1.92)		4 (4.17)	0 (0.00)		0 (0.00)	3 (2.44)	
Monthly income (n [%])			.021			.487			.175
≤3000 RMB	63 (55.26)	104 (66.67)		51 (53.12)	18 (54.55)		12 (66.67)	86 (69.92)	
3000–6000 RMB	40 (35.09)	48 (30.77)		36 (37.50)	14 (42.42)		4 (22.22)	34 (27.64)	
≥6000 RMB	11 (9.65)	4 (2.56)		9 (9.38)	1 (3.03)		2 (11.11)	3 (2.44)	
Smoking history (n [%])			<.001			.167			.073
No	86 (75.44)	82 (52.56)		73 (76.04)	21 (63.64)		13 (72.22)	61 (49.59)	
Yes	28 (24.56)	74 (47.44)		23 (23.96)	12 (36.36)		5 (27.78)	62 (50.41)	
Denture use (n [%])			<.001			<.001			.010
No	101 (88.60)	65 (41.67)		88 (91.67)	16 (48.48)		13 (72.22)	49 (39.84)	
Yes	13 (11.40)	91 (58.33)		8 (8.33)	17 (51.52)		5 (27.78)	74 (60.16)	
Xerostomia (n [%])			<.001			<.001			.002
No	89 (78.07)	69 (44.23)		74 (77.08)	15 (45.45)		15 (83.33)	54 (43.90)	
Yes	25 (21.93)	87 (55.77)		22 (22.92)	18 (54.55)		3 (16.67)	69 (56.10)	
Physical frailty (n [%])			<.001			<.001			.007
No	54 (47.37)	16 (10.26)		47 (48.96)	2 (6.06)		7 (38.89)	14 (11.38)	
Yes	60 (52.63)	140 (89.74)		49 (51.04)	31 (93.94)		11 (61.11)	109 (88.62)	
Oral health (n [%])			<.001			<.001			.008
Good	42 (36.84)	127 (81.41)		33 (34.38)	27 (81.82)		9 (50.00)	100 (81.30)	
Poor	72 (63.16)	29 (18.59)		63 (65.62)	6 (18.18)		9 (50.00)	23 (18.70)	
Nutritional risk (n [%])			<.001			.001			<.001
No	99 (86.84)	69 (44.23)		81 (84.38)	19 (57.58)		18 (100.00)	50 (40.65)	
Yes	15 (13.16)	87 (55.77)		15 (15.62)	14 (42.42)		0 (0.00)	73 (59.35)	

Z: Mann–Whitney test, χ^2: chi-square test, -: fisher exact.

M = median, NLR = neutrophil-to-lymphocyte ratio, PLR = platelet-to-lymphocyte ratio, Q_1 = first quartile, Q_3 = third quartile.

indicates that age is a factor affecting oral weakness, which is associated with physiological changes and disease complications brought about by aging.[26–29] This directly increases the risk of tooth loosening and even tooth loss, further driving the development of OF. Moreover, elderly patients typically experience a dual decline in physical[30] and cognitive[31] functions. The deterioration of physical abilities may make it difficult for them to perform complex oral cleansing actions, while the decline in cognitive function can affect their compliance and ability to maintain oral health, thus accelerating the onset of OF.

Smoking is an independent influencing factor for OF in the overall sample. This finding may be attributed to the long-term harmful effects of tobacco components on oral tissues. For example, nicotine can exert detrimental effects on the gingiva, thereby leading to the development of periodontal diseases,[32] including tooth mobility, oral ulcers, halitosis, and pigmentation. These consequences can trigger OF. Moreover, nicotine can disrupt the balance of the oral microbiota and impede the repair of oral tissue mucosa,[33] further exacerbating oral tissue degeneration and functional decline in elderly cancer patients who are already vulnerable to oral health impairment due to tumor-related factors. Therefore, medical professionals should strengthen the provision of effective smoking cessation guidance for smoking patients and assist them in quitting smoking. This approach aims to improve the success rate of smoking cessation among patients, enhance oral health, and reduce the incidence of OF.

Denture use emerged as a robust risk factor for OF across all age groups, with the highest OR observed in patients <70 years old (OR = 26.959, 95% CI: 5.222–139.181, $P < .001$). This may be attributed to younger patients having longer exposure to denture-related oral changes, such as alveolar bone resorption and microbial colonization,[4,34] allowing for substantial cumulative damage to occur.[35] In patients ≥70 years old, dentures still posed a significant risk (OR = 5.369, 95% CI: 1.419–20.308, $P = .013$), but the lower OR might reflect ceiling effects of age-related oral dysfunction. A study involving 368 cancer patients undergoing chemotherapy supports this finding.[9] Some patients also stated that they avoid eating hard foods after getting dentures. The reduction in dietary diversity limits patients' nutrient intake, which can lead to a decline in

Table 3

Binary logistic regression analysis of factors associated with oral frailty.

	Total		<70		≥70	
Variables	***P***	**95% CI**	***P***	**95% CI**	***P***	**95% CI**
Marry status	.418	2.103 (0.349–12.676)				
Education	.387	0.58 (0.169–1.99)				
Income	.480	0.663 (0.212–2.074)				
Smoking history	.002	3.695 (1.626–8.398)				
Denture use	<.001	18.275 (7.164–46.618)	<.001	26.959 (5.222–139.181)	.013	5.369 (1.419–20.308)
Xerostomia	.006	3.044 (1.368–6.774)	.130	2.711 (0.745–9.858)	.042	5.385 (1.062–27.301)
Physical frailty	.026	3.126 (1.15–8.5)	.007	18.37 (2.239–150.716)	.377	1.892 (0.46–7.786)
Oral health	.065	0.456 (0.197–1.051)	.066	0.275 (0.069–1.091)	.938	1.056 (0.264–4.222)
Nutritional risk	.018	3.041 (1.207–7.66)	.405	0.543 (0.129–2.288)	.006	3.101 (1.677–5.342)
PLR	.040	1.006 (1–1.012)	.021	1.011 (1.002–1.021)		
NLR	.037	1.238 (1.013–1.514)	.045	1.362 (1.006–1.843)	.222	1.304 (0.852–1.994)

NLR = neutrophil-to-lymphocyte ratio, PLR = platelet-to-lymphocyte ratio.

the body's immune function and speed up the development of OF.[36] Consequently, oncology medical staff should strengthen the oral assessment of elderly patients using dentures, perform regular maintenance and cleaning of dentures, and stress the significance of a diverse diet.

Additionally, xerostomia was a prominent risk factor in older patients (OR = 5.385, 95% CI: 1.062–27.301, $P = .042$), likely due to age-related salivary gland atrophy[37] and medication side effects,[12] which impair oral mucosal integrity and microbial balance.

Our findings demonstrate that physical frailty was strongly associated with OF in patients <70 years old (OR = 18.37, 95% CI: 2.239–150.716, $P = .007$), possibly indicating that premature physical decline in younger patients correlates with accelerated oral function loss. In contrast, physical frailty did not significantly predict OF in older patients (≥70), suggesting that other age-related comorbidities may dominate in this group. Related studies have shown that physical frailty can lead to a reduced frequency of effective social activities, thereby decreasing the opportunities for verbal communication.[38] Moreover, it can cause a decline in the movement of oral and maxillofacial muscles and the tongue in patients.[39] Furthermore, oncological treatment may induce physical frailty, resulting in a reduced self-care ability of the body.[40] This, in turn, affects patients' self-maintenance of oral health.[41,42] Collectively, these factors contribute to the deterioration of oral health. Notably, the incidence of physical frailty among elderly oncological patients (41.8%) is substantially higher than that among community-dwelling elderly individuals (4.5%). These findings emphasize the urgent need for a comprehensive assessment of this vulnerable population and the implementation of targeted intervention strategies, including promoting social activities, providing assistance with oral care, and integrating physical and oral exercises,[43] to mitigate the development of OF.

Optimal oral health status served as a protective factor against OF in the overall population (OR = 0.456, 95% CI: 0.197–1.051, $P = .065$), though the trend was stronger in younger patients (OR = 0.275, 95% CI: 0.069–1.091, $P = .066$). This highlights the importance of proactive oral care in preventing OF, particularly in individuals with preexisting oral health issues. Clinically, these findings emphasize the need for age-tailored interventions: younger patients may benefit from early screening for inflammatory markers and denture management, while older adults require integrated nutritional support and xerostomia management. Moreover, oral health is also important for maintaining normal language function. By facilitating social engagement and improving communication with others,[44] it is possible to reduce the incidence of OF. Consequently, Medical staff should encourage patients to participate in social activities to promote oral health.

Nutritional risk showed age-dependent associations with OF: it was a significant risk factor in patients ≥70 years old (OR = 3.101, 95% CI: 1.677–5.342, $P = .006$) but not in younger groups ($P = .405$). This may reflect the compounded impact of age-related anorexia, malabsorption, and tumor-related cachexia in older adults. Evidence from previous research suggests that nutrition plays a mediating role between OF and physical frailty among elderly hospitalized patients. Consistent with this, other studies have reported that individuals with poor oral health are 2.76 times more likely to develop malnutrition.[5] This phenomenon may be due to the decline in oral muscle function among the elderly, which often leads to chewing difficulties. Consequently, the variety of food intake is reduced, potentially resulting in malnutrition.[45] Additionally, tumor treatment-related anorexia[46] further exacerbates the reduction of patients' nutritional intake. Therefore, it is necessary to strengthen the assessment and support of the nutritional status of elderly hospitalized cancer patients. Measures should be taken to alleviate the adverse gastrointestinal reactions caused by tumor treatment. Collaborating with the nutrition team to develop personalized nutritional support plans can improve patients' nutritional status and prevent the progression of OF. It should be noted that the sample size of this study may have limited the accurate estimation of nutritional risk (95% confidence interval [CI]: 0.98–11.39).

In the overall population, PLR and NLR were significant risk factors for OF (OR = 1.006, 95% CI: 1.000–1.012, $P = .040$; OR = 1.238, 95% CI: 1.013–1.514, $P = .037$), indicating that systemic inflammation contributes to OF development. This aligns with previous findings linking inflammatory markers to oral tissue degeneration and functional decline. Notably, in patients <70 years old, PLR and NLR showed stronger associations (OR = 1.011, 95% CI: 1.002–1.021, $P = .021$; OR = 1.362, 95% CI: 1.006–1.843, $P = .045$), possibly reflecting the cumulative effect of inflammation on oral health over time. In contrast, among patients ≥70 years old, NLR did not reach statistical significance ($P = .222$), suggesting that other age-related factors may override inflammatory impacts in older populations. They are also recognized as relevant predictive factors for the progression and prognosis of inflammatory diseases and tumors.[47,48] Emerging evidence suggests that the underlying mechanism connecting oral health and frailty may be mediated through the inflammatory pathway.[49] The onset of periodontitis has been firmly established to be associated with systemic inflammatory factors.[50] From a pathophysiological perspective, the systemic inflammatory response can affect oral function through multiple mechanisms. Firstly, elevated levels of inflammatory markers, including tumor necrosis factor-α, interleukin-6, and C-reactive protein, can lead to a reduction in muscle mass, thus affecting oral muscle function.[51] Secondly, the inflammatory microenvironment can disrupt the composition of the oral microbiota,

increasing the susceptibility to oral infections. These findings are in line with our hypothesis that inflammation plays a key role in the development of OF. However, further investigations are needed to clarify the exact mechanisms involved.

To our knowledge, evidence on the association between systemic inflammatory markers – PLR and NLR – and OF in elderly cancer inpatients has been scarce. Previous studies have primarily focused on community-dwelling older adults or non-cancer populations, with limited data available in oncology settings. By integrating hematological indicators with multidimensional geriatric assessments, this study provides new evidence suggesting that systemic inflammation may play a role in the development of OF among hospitalized cancer patients. These findings indicate that PLR and NLR could serve as practical, cost-effective indicators for identifying individuals at higher risk of OF, though further large-scale and longitudinal studies are warranted to validate these associations.

5. Limitations

This study has several limitations. First, its cross-sectional design precludes causal inference between the examined factors and OF; longitudinal studies are needed to clarify temporal relationships. Second, data were collected from hospitalized elderly cancer patients in 3 tertiary hospitals within a single province (Anhui, China). This sampling framework may limit generalizability due to regional socioeconomic and healthcare differences, as well as the specific characteristics of hospitalized patients – such as greater disease severity, treatment intensity, and care dependence – compared with community-dwelling individuals. Third, several covariates, including smoking history, xerostomia, and nutritional risk, were self-reported. These subjective assessments are inherently prone to recall bias and social desirability bias, which may lead to under- or overestimation of certain associations. Fourth, professional stomatologists did not conduct standardized oral examinations, potentially resulting in misclassification of oral conditions. Finally, although systemic inflammatory markers were associated with OF, the underlying biological mechanisms remain unclear. Future research should include multi-regional, multi-level samples, incorporate dentist-led oral assessments and objective clinical measures, and adopt longitudinal designs to clarify causal pathways.

6. Conclusion

This study revealed that OF is significantly associated with multiple clinical factors in elderly tumor inpatients, with distinct age-related differences. Univariate analysis (Table 2) showed that PLR, NLR, denture use, xerostomia, physical frailty, nutritional risk, and oral health status were significantly different between OF and non-OF groups, particularly in patients <70 and ≥70 years old. Binary logistic regression (Table 3) identified smoking history, denture use, xerostomia, physical frailty, nutritional risk, PLR, and NLR as independent risk factors for OF in the overall population. Notably, denture use and inflammatory markers (PLR, NLR) were stronger predictors in <70-year-olds, while xerostomia and nutritional risk dominated in ≥70-year-olds. Optimal oral health showed protective effects across age groups. These findings highlight the need for age-tailored OF screening protocols and multidisciplinary interventions, including inflammatory marker monitoring, denture care, nutritional support, and oral function maintenance, to improve oral health outcomes in elderly tumor patients.

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