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REVIEW

Research Progress on Patients of Esophageal Cancer Complicated with Sarcopenia

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Abstract

Aims/Background The application of immunochemotherapy has significantly enhanced the quality of life and overall survival of patients with esophageal cancer. Sarcopenia, which is increasingly prevalent in these patients, markedly affects prognosis, but can be reversed by appropriate and effective treatment.
Methods The narrative review was conducted on PubMed using the keywords ("esophageal" or "esophagus" and "sarcopenia").
Results This article reviews the measurement, timing, and intervention strategies for sarcopenia in patients with esophageal cancer. It summarizes the evaluation indicators of skeletal muscle loss in these patients, analyzes the barriers to intervention for frailty among esophageal cancer patients, and proposes corresponding countermeasures.
Conclusion Patients with esophageal cancer often suffer from severe sarcopenia. Clinical intervention is crucial in addressing this issue.

Key words: sarcopenia; esophageal cancer; immunotherapy; intervention measures; evaluation indicators

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Introduction

Gastrointestinal tumours, particularly esophageal cancer, are prevalent malignancies with high global incidence and mortality rates, ranking among the top 10 cancers worldwide (Sung et al, 2021; Zhong et al, 2023). Recent trends indicate geographical variations in incidence, posing significant public health challenges (Qi et al, 2023). Therapeutically, patients with locally advanced resectable disease (staging cT3-4 or cN1-3M0) typically require neoadjuvant chemoradiotherapy, definitive chemoradiotherapy, or perioperative chemotherapy prior to surgery (Obermannová et al, 2022). For patients diagnosed at an advanced stage, the addition of immune checkpoint inhibitors has shown enhanced therapeutic efficacy (Shah et al, 2021). Sarcopenia, characterized by age-related decline in skeletal muscle mass and strength, along with decreased physical fitness and impaired muscle function, is prevalent among patients with esophageal cancer (Yuan and Larsson, 2023).

Esophageal cancer predominantly affects the elderly population (Bossi et al, 2021). Studies have demonstrated that esophageal cancer patients with sarcopenia

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often exhibit higher rates of local progression and poorer prognoses (Huang et al, 2020; Watanabe et al, 2022). The metabolic disturbances within the digestive system due to esophageal tumour invasion, compounded by the stressors of surgery, radiotherapy, and chemotherapy, contribute to a heightened risk of sarcopenia in this patient group (Srpcic et al, 2020). Factors leading to sarcopenia in patients with digestive tract tumours are more pronounced compared to those with other cancers.

Early identification and proactive intervention are crucial in mitigating adverse outcomes, enhancing quality of life, and alleviating societal healthcare burdens. However, there is a relative lack of focus on sarcopenia intervention for patients with recurrent esophageal carcinoma. This review consolidates domestic and international research on sarcopenia in esophageal carcinoma patients, aiming to provide healthcare professionals with insights and guidance for effective intervention strategies.

Sarcopenia is a progressive, systemic skeletal muscle disorder that significantly impacts patients' daily activities and recovery following surgery (Li et al, 2024). It is categorized into primary sarcopenia, primarily due to aging, and secondary sarcopenia, often resulting from inactivity, malnutrition, or chronic diseases (Elliott et al, 2017; Fielding et al, 2011). Other contributing factors include genetic predispositions, hormonal imbalances, and mitochondrial dysfunction (Marzetti et al, 2013). Muscle mass and function typically decline from middle age, reaching a nadir at 65 years and beyond, exacerbated by the global aging population. It is projected that the worldwide prevalence of sarcopenia will increase from 50 million in 2010 to 200 million by 2050 (Zhang, 2024).

Sarcopenia associated with malignant tumours, termed cancer-related sarcopenia, not only disrupts normal metabolic processes but also diminishes treatment efficacy, quality of life, and overall survival. A comprehensive study involving 81,814 patients across 280 studies reported an overall sarcopenia prevalence of 35.3% among different cancer types (Surov and Wienke, 2022). Esophageal cancer exhibited a particularly high prevalence of sarcopenia ($>$50%), surpassing that of head and neck squamous cell carcinoma (35%–50%), colorectal cancer, and hepatocellular carcinoma, where prevalence rates of low skeletal muscle mass were $<$35%. In curative settings, sarcopenia prevalence was 39.6%, increasing to 49.2% in palliative settings ($p < 0.001$) (Surov and Wienke, 2022).

Esophageal cancer poses unique challenges due to its impact on nutrient absorption, crucial for muscle maintenance and growth, resulting in a heightened incidence of sarcopenia. Studies have shown an average sarcopenia prevalence of 46.3% $\pm$ 19.6% (range: 14.4% to 81%) in esophageal cancer, with sarcopenia serving as a significant predictor of poor prognosis (Jogiat et al, 2022; Li et al, 2024).

Previous studies have indicated that the mechanisms underlying muscle loss differ between normal aging and cancer cachexia. In cancer cachexia, activation of nuclear factor κB signaling and the ubiquitin-proteasome system accelerates muscle atrophy (Xia et al, 2020). Patients with sarcopenia experience diminished nutritional and immune statuses due to muscle mass reduction, increasing their susceptibility to cancer (Singh et al, 2019).

Individuals with esophageal cancer are particularly prone to sarcopenia due to heightened catabolism, inflammatory responses, and other tumour-related characteristics. Treatment modalities such as chemotherapy, surgery, and immunotherapy further contribute to this vulnerability (Miyata et al, 2011). Cytokines produced by tumours, such as tumour necrosis factor and interleukin-6, play a role in promoting protein degradation and inhibiting protein synthesis, thereby exacerbating sarcopenia (Matsunaga et al, 2019).

The intricate relationship between esophageal cancer and sarcopenia is examined by the author, who primarily focuses on strategies for prevention and treatment within the clinical context of diagnosing and managing patients affected by both conditions.

Analysis of Different Diagnostic Criteria and Methods for Sarcopenia

Asian Sarcopenia Diagnostic Criteria

The consensus on sarcopenia established by the Asian Working Group for Sarcopenia (AWGS 2019) is based on criteria involving age-related muscle mass loss, combined with low muscle strength and/or diminished physical performance (Chen et al, 2020a). These criteria aid in diagnosing and categorizing the severity of sarcopenia. Specifically, possible sarcopenia is diagnosed when there is evidence of muscle mass loss (Chen et al, 2020a). Sarcopenia is diagnosed when either low muscle strength or low physical performance, in addition to muscle mass loss, is present. Severe sarcopenia is diagnosed when all three criteria (muscle mass loss, low muscle strength, and low physical performance) are met.

The specific diagnostic thresholds in this consensus are defined as follows: low muscle strength is indicated by grip strength $<$28 kg for men and $<$18 kg for women; low physical performance is defined as 6-meter walking speed $<$1.0 m/s, 5 chair stand tests $\geq$12 s, or Short Physical Performance Battery (SPPB) score $\leq$9. Muscle mass criteria are based on height-adjusted measurements, with Dual-Emission X-ray Absorptiometry (DXA) showing $<$7.0 kg/m^2 for men and $<$5.4 kg/m^2 for women, or bioelectrical impedance method results indicating $<$7.0 kg/m^2 for men and $<$ 5.7 kg/m^2 for women. Screening standards for sarcopenia include calf circumference $<$34 cm for men and $<$33 cm for women, or Simple Five-item Rating Questionnaire (SARC-F) result $\geq$4, or Sarcopenia Assessment Form (SARC-CalF) result $\geq$11.

European Diagnostic Criteria for Sarcopenia

In 2018, the European Working Group on Sarcopenia in Older People 2 (EWGSOP2) introduced a new consensus that emphasizes low muscle strength as the primary criterion for diagnosing sarcopenia, rather than solely relying on muscle mass loss. According to EWGSOP2, patients with low muscle strength are suspected of sarcopenia, and further assessment involving muscle mass and physical performance is necessary for confirmation (Tagliafico et al, 2022). Compared to the Asian Working Group for Sarcopenia (AWGS 2019), EWGSOP2 employs more stringent

cutoff values for muscle mass and physical performance: low muscle strength is defined as grip strength <27 kg for men and <16 kg for women, and low physical performance is defined as 6-meter walking speed <0.8 m/s (Zhang et al, 2023a). The differences in diagnostic criteria between AWGS 2019 and EWGSOP2 highlight challenges in clinical practice, particularly when applying guidelines across different regions. Despite these variations, both consensus groups agree on the fundamental importance of assessing muscle strength, mass, and physical performance in diagnosing sarcopenia.

Application of Radiomics in the Diagnosis of Sarcopenia

The diagnostic criteria for sarcopenia recommended by EWGSOP2 and AWGS2019 may not effectively evaluate patients who are paralyzed or critically ill and unable to cooperate with testing protocols. Common methods like DXA and bioelectrical impedance, used in research settings, are less utilized in clinical practice. Instead, emerging imaging technologies such as ultrasound, magnetic resonance imaging (MRI), and computed tomography (CT) offer distinct advantages for assessing muscle quality and quantity (Chianca et al, 2022).

Ultrasound, due to its ease of repeatability, portability, and lack of radiation, has garnered attention. However, consensus on optimal muscle groups and clinical cutoff values to represent total body muscle mass remains inadequate, although the quadriceps femoris is a frequently studied muscle group (Tagliafico et al, 2022). MRI, another radiation-free imaging modality, accurately measures skeletal muscle by differentiating fat and muscle through specialized sequences. Yet, its higher cost and longer acquisition time limit its widespread clinical adoption (Srpcic et al, 2020). Study has successfully employed MRI to assess sarcopenia in conditions such as rheumatoid arthritis by measuring thigh muscle cross-sectional areas (Salaffi et al, 2023).

CT, widely used for tumour staging and follow-up, offers reproducible segmentation capabilities without additional scans. CT can obtain only a single tissue component during segmentation through different thresholds (muscle tissue: –29 to +150 Hu, adipose tissue: –190 to –30 Hu) (Amini et al, 2019). Currently, the mainstream segment selection for diagnosing sarcopenia based on CT images is the third lumbar vertebra (L3). The skeletal muscle index (skeletal muscle area/height^2) is selected as a parameter to evaluate muscle mass. The cut-off value is 52 to 55 cm^2/m^2 for men, and 39–41 cm^2/m^2 for women (Amini et al, 2019). Different segments are selected, and the relevant cutoff values are also different. Whether it is ultrasound, MRI or CT, the cutoff value for measuring muscle mass has not yet reached a consensus, and most of them are in the research stage with few clinical applications. Radiomics is a technology that extracts a large amount of imaging information at high throughput from imaging examination methods, realizes tumour segmentation, feature extraction and model establishment, and conducts deeper mining, prediction and analysis of massive imaging data (Denison et al, 2015; Huang et al, 2017). CT images not only contain muscle mass and fat mass, but also contain a lot of other information that is difficult to identify with the naked eye, such as muscle fat infiltration, and morphological differences in muscle tissue (Anton et al, 2018). Although

these changes are difficult to distinguish with the naked eye, they can be reflected by extracting feature parameters of specific regions through radiomics and converting them into a quantified and digital radiomics feature parameter. Anconina et al (2022) used positron emission tomography/computed tomography (PET/CT) to extract characteristic parameters of muscle radiomics to build a relevant model to predict survival prognosis in patients with esophageal adenocarcinoma. However, most current studies directly try to make the leap from radiomic features to the diagnosis of sarcopenia, that is, to diagnose sarcopenia through a single skeletal muscle mass, lacking data related to muscle strength and physical performance, and directly use the imaging features of muscles (Amini et al, 2019; Li et al, 2024). Modeling will lead to overestimation of radiomics performance, thus affecting the results.

The Impact of Sarcopenia on Different Treatments for Esophagus Cancer

Currently, the main therapeutic approaches for esophageal cancer encompass surgery, chemotherapy, immunotherapy, and radiation (Zheng et al, 2024). Esophagectomy is often recommended for patients with stage tumour in situ-T1AN0 (TIS-T1AN0) non-cervical circumference disease or other indications, particularly those who decline or are ineligible for endoscopic treatments. Surgical excision is advised for pT1b-2N0 non-cervical patients (Ajani et al, 2023). For individuals with advanced esophageal cancer, palliative chemotherapy is generally recommended, while neoadjuvant therapy is typically administered before surgery. Adjuvant chemotherapy is commonly used following surgical procedures. Immunotherapy, a newer treatment modality for esophageal cancer, has gained increasing attention in recent years due to its potential benefits. Sarcopenia has a certain impact on the treatment of esophageal cancer.

The Impact of Sarcopenia on Surgical Treatment of Esophageal Cancer

People with sarcopenia tend to have more severe postoperative complications (Elliott et al, 2017). Endoscopic submucosal dissection, a common procedure for early-stage esophageal cancer, has been shown to lead to more frequent adverse events in patients with sarcopenia, as defined by Common Terminology Criteria for Adverse Events (CTCAE) grade $\geq$2 (Panje et al, 2019).

For more invasive procedures like esophagectomy, a meta-analysis encompassing 14 studies demonstrated that preoperative sarcopenia significantly increases the overall risk of postoperative complications (Wang et al, 2020). The risk of serious complications (Clavien-Dindo grade $\geq$III), including pneumonia, obstruction, etc., does not increase the risk of postoperative delayed esophageal emptying, abdominal infection, and anastomotic leakage. Even in laparoscopic-assisted esophageal cancer surgery, sarcopenia remains a risk factor for short-term postoperative complications (Chen et al, 2022).

Due to the impact of surgery on the human body, it is easy to cause the loss of skeletal muscle in the human body (Wang et al, 2020). Sarcopenia is an independent risk factor for early complications after radical esophageal for cancer. A recent

study has shown that postoperative skeletal muscle loss is related to poor prognosis (Jogiat et al, 2023). After esophageal cancer surgery, the body undergoes stress and releases a large of inflammatory factors and free radicals, which prolongs the course of the patient's disease. Study comparing different surgical approaches for esophageal cancer have suggested that procedures aimed at preserving maximum esophageal capacity may minimize skeletal muscle loss (He et al, 2021).

Therefore, for patients with esophageal cancer combined with sarcopenia, under the premise of ensuring negative resection margins, they should try to choose a surgical procedure that preserves maximum esophageal capacity, which is helpful for nutrient intake and muscle preservation.

The Impact of Sarcopenia on Chemotherapy for Esophageal Cancer

Inflammatory mediators produced by tumour metabolism can trigger systemic inflammation, contributing to the development of skeletal muscle wasting in patients with esophageal cancer. When combined with sarcopenia, chemotherapy in these patients often results in heightened toxicity and reduced treatment effectiveness. Concurrently, chemotherapy agents may exacerbate skeletal muscle depletion, creating a detrimental cycle. The escalation of chemotherapy toxicity can necessitate dosage reductions and treatment delays, resulting in decreased chemotherapy tolerance.

A reasonable explanation for this phenomenon is that the choice of chemotherapy drug dose is usually related to the body surface area (height and weight), in which body mass includes muscle and fat, but fat content is difficult to measure compared with body mass. A study has shown that sarcopenic obesity is more predictive of chemotherapy toxicity than non-sarcopenic obesity (Benadon et al, 2020). Therefore, muscles have a better advantage than body mass.

Chemotherapy can improve the survival rate and quality of life of patients with locally advanced unresectable or metastatic esophageal cancer. Interestingly, sarcopenia may not directly impact survival or treatment-related toxicity in patients treated with certain chemotherapy regimens like Capecitabine and Oxaliplatin (CapOx) (Dijksterhuis et al, 2019). However, in the context of recurrent esophageal cancer, lower skeletal muscle mass correlates with higher incidence of severe adverse reactions during chemotherapy (Wang et al, 2022a).

For neoadjuvant chemotherapy, sarcopenia has been proposed as a predictor of dose-limiting toxicity in esophageal cancer treatment (Panje et al, 2019). Among Asian populations, postoperative adjuvant chemotherapy has shown to enhance survival rates, while this benefit is less clear in non-Asian populations. Low muscle mass in esophageal cancer patients has been associated with increased toxicity from chemotherapy drugs like fluorouracil, potentially leading to suboptimal dosing and outcomes. Chemotherapy drugs can cause muscle mass loss (especially in men), leading to poor survival prognosis (Benadon et al, 2020). Nivolumab is a checkpoint inhibitor pathway inhibitor and one of the targeted therapeutic drugs for esophageal cancer (Kato et al, 2019; Ikeda et al, 2024). Studies have shown that advanced esophageal cancer patients with lower skeletal muscle mass have shorter

progression-free survival (PFS) after receiving immune checkpoint inhibitors (Ohm and Abdel-Rahman, 2023; Takenaka et al, 2021).

The Impact of Sarcopenia on Survival Prognosis of Esophageal Cancer

Although significant progress has been achieved in the multimodal treatment of esophageal cancer, its survival prognosis remains grim due to its high recurrence rate. Survival prognosis is typically categorized into three main types: overall survival (OS), progression-free survival (PFS), and disease-specific survival (DSS). Studies have indicated that sarcopenia serves as an independent risk factor for poor survival prognosis among esophageal cancer patients. A meta-analysis revealed that patients with esophageal cancer and low muscle mass exhibited significantly lower OS (hazard ratio (HR) = 1.81) and DSS (HR = 1.58) (Borggreve et al, 2020). Similarly, findings from another study underscored the association of low muscle mass with OS (HR = 2.02) and PFS (HR = 1.97) in solid cancers (Takenaka et al, 2021). Thus, esophageal cancer patients diagnosed with sarcopenia face a particularly unfavorable survival prognosis.

Treatment Methods for Esophageal Cancer Combined with Sarcopenia

Exercise therapy and nutritional therapy have emerged as the primary and extensively researched interventions for sarcopenia (Zhang et al, 2023b). Individuals diagnosed with esophageal cancer frequently encounter muscle wasting throughout the course of tumour advancement or during the diagnostic and therapeutic phases, a phenomenon that has been linked to unfavorable prognostic outcomes (McSweeney et al, 2023). Therefore, for patients facing esophageal cancer accompanied by sarcopenia, regardless of the treatment modality used, integrating exercise therapy and nutritional therapy is recommended for comprehensive management.

Exercise Therapy for Esophageal Cancer Combined with Sarcopenia

Research indicates that exercise plays a crucial role in improving and treating sarcopenia by enhancing muscle mass, strength, and physical performance (Huddy et al, 2018). Specifically, resistance training (RT) has been shown to have a significant positive impact on muscle mass (Beckwée et al, 2019). A meta-analysis comparing various exercise modes for sarcopenia demonstrated that RT is more effective than whole body vibration training (WBVT) in improving muscle strength and physical performance (Lu et al, 2021). Similarly, other studies highlighted the benefits of RT, showing improvements in body composition, grip strength, walking speed, knee extension strength, and the get-up test, although it did not significantly impact skeletal muscle mass or leg muscle volume (Chen et al, 2021; Wang et al, 2022b).

Aerobic training is also one of the currently commonly used exercise modes. Moderate aerobic exercise can improve muscle strength, but its effect is limited (Wang et al, 2022b). RT improves muscle strength and physical performance in patients with sarcopenia by increasing muscle protein synthesis and muscle fiber size

(Denison et al, 2015). In general, mixed training, that is, RT combined with aerobic training, is recommended to treat sarcopenia, which can better increase muscle mass, muscle strength, and physical performance than a single training method (RT, WBVT, or aerobic training). Mixed training also has significant disadvantages, including susceptibility to injury and poor compliance. Further research is needed to reach a consensus on how to provide esophageal cancer patients with sarcopenia with more standardized exercise therapy.

Nutritional Therapy for Esophageal Cancer Combined with Sarcopenia

Nutritional therapy plays a crucial role in managing skeletal muscle loss and improving prognosis, offering advantages such as enhanced compliance and tolerance compared to exercise therapy. Oral nutritional supplements (ONS) are recommended for esophageal cancer patients with sarcopenia, providing nutrient-dense, energy-dense liquids that can be consumed as beverages or added to food (Arends et al, 2017). A study has shown that ONS enriched with immunomodulatory substances such as arginine, nucleotides, and omega-3 fatty acids 5 to 7 days before surgery can significantly improve the nutritional status of patients and improve patient prognosis (Chen et al, 2020b). Research on the effect of oral ONS after esophageal cancer surgery showed that esophageal cancer patients who received ONS supplementation after discharge had less skeletal muscle loss, higher tolerance to chemotherapy, and better quality of life (Ashok et al, 2020).

In cases where patients are unable to eat adequately for more than 1 week or fail to meet 60% of their energy requirements for 1 to 2 weeks, artificial nutrition interventions such as enteral nutrition (EN) or parenteral nutrition (PN) are necessary (Arends et al, 2017). Both EN and PN can improve muscle status and further improve prognosis by improving the patient's nutritional level, but PN can affect the gastrointestinal tract, such as reducing brush edge hydrolase, microvilli height and nutrient transporter activity, and bacterial translocation (Jiang et al, 2003). Therefore, EN is more in line with physiological conditions than PN and has more advantages than PN in the perioperative period. Only when EN cannot be performed or EN cannot obtain sufficient nutrition, PN should be given as early as possible.

Recent attention in the perioperative nutritional management of esophageal cancer has focused on immuno-nutrients such as glutamine, omega-3 fatty acids, nucleotides, and arginine. The first two are mainly passed through the intestines. The external route is PN, and the latter two are easily obtained through EN. Glutamine can enhance muscle protein synthesis and reduce sarcopenia losses. A study has shown that glutamine improves the gastrointestinal mucosal barrier function and increases the levels of MMP-2 and MMP-9. These two substances can affect the progression of esophageal cancer. Omega-3 fatty acids are a type of polyunsaturated fatty acids, mainly found in fish oil. Omega-3 fatty acids can reduce inflammatory responses and regulate immune responses by reducing inflammatory factors (Zhang et al, 2023b). Study has shown that omega-3 fatty acids can improve postoperative enteral nutrition tolerance and reduce postoperative complications, but another study showed that there is no correlation between the two (Makay et al, 2011). Studies have shown that daily supplementation of essential amino acids, whey pro-

tein and vitamin D can increase or maintain skeletal muscle mass and maintain low body mass, help accelerate muscle recovery and growth, and improve exercise performance (Cereda et al, 2022; Li et al, 2024). Essential amino acids and whey protein are crucial for muscle anabolism, while vitamin D supports bone health and muscle growth (Cereda et al, 2022).

Discussion

The incidence of sarcopenia is significantly underestimated among individuals with esophageal cancer (Li et al, 2024). Pathological changes in the upper digestive tract caused by esophageal cancer, such as obstruction, clinically manifest as dysphagia, leading to conditions like hunger and negative nitrogen balance, which are key direct contributors to sarcopenia (Napier et al, 2014). Advanced age, often seen in esophageal cancer onset, is a major neurological or endocrine factor contributing to sarcopenia (Yang et al, 2022). Additionally, esophageal cancer patients commonly experience comorbidities such as cardiovascular and cerebrovascular diseases, as well as neurogenic muscular atrophy, which can serve as causes or initiating factors for sarcopenia (Zhu et al, 2023).

The risk of sarcopenia during esophageal cancer treatment is significantly underestimated. Surgery remains a cornerstone in current esophageal cancer management, with subtotal esophagectomy being the primary surgical approach for esophageal squamous cell carcinoma, a prevalent type in China (Zhu et al, 2023). However, postoperative complications, such as anastomotic leak, conduit necrosis, chyle leak, and recurrent nerve palsy, pose substantial challenges and contribute to the difficulty in achieving complete cures (Edmondson et al, 2023).

Esophagectomy also impacts crucial functions like cough reflex, strength, and the ability to prevent aspiration and swallow effectively (Edmondson et al, 2023). Mitigating respiratory complications is crucial in reducing postoperative mortality rates among esophageal cancer patients (Bossi et al, 2021). Sarcopenia significantly contributes to, induces, or exacerbates pulmonary complications, underscoring its role as a critical etiological factor (Bossi et al, 2021).

Moreover, while preoperative chemotherapy, chemoradiotherapy, and their combinations improve long-term treatment outcomes for esophageal cancer, they also introduce various adverse effects, thereby increasing treatment-related risks for patients. Therefore, it is reasonable to assert that the risk of sarcopenia during the course of esophageal cancer treatment is greatly underestimated.

Nutritional management is paramount throughout the entire treatment process for esophageal cancer patients. Addressing the inherent dysphagia and employing enteral tube feeding beyond obstructive sites represent significant advancements in treatment (Mohapatra et al, 2022). Ensuring adequate calorie and protein intake is crucial throughout the entire process to counteract preoperative sarcopenia (Rogeri et al, 2021). Despite the widespread promotion and application of postoperative nutritional support, there remains a serious neglect of managing nutrition, protein intake, weight, and muscle mass during the preoperative treatment phases.

Furthermore, comprehensive fitness training and integrated cardiopulmonary exercises are essential components in overcoming and improving sarcopenia (Minnella et al, 2018). It is essential to recognize prevalent clinical shortcomings such as prioritizing treatment over rehabilitation, focusing on surgical interventions rather than internal medicine, and emphasizing primary diseases at the expense of secondary complications. Addressing these issues requires ongoing clinical attention and incremental improvements to enhance long-term survival outcomes and elevate the quality of life for patients.

Conclusion

In conclusion, esophageal cancer presents a heightened susceptibility to sarcopenia-related complications compared to other malignancies, largely due to diminished nutritional intake. Study consistently shows a significant association between sarcopenia, esophageal cancer prognosis, and the adverse effects of diagnosis and treatment, including postoperative complications (Li et al, 2024). Therefore, it is imperative for healthcare providers to prioritize the assessment and management of sarcopenia in esophageal cancer patients.

While diagnostic techniques for sarcopenia have evolved, ranging from traditional manual assessments to machine learning algorithms, further research is needed to refine these methods. Both exercise therapy and nutritional interventions have proven effective in mitigating sarcopenia among individuals with esophageal cancer. Future investigations should focus on developing more tailored and impactful intervention strategies for sarcopenia.

Key Points

- Sarcopenia is highly prevalent in patients with esophageal cancer and significantly impacts patient prognosis. However, it can be reversible with proper and effective treatment. Patients with sarcopenia experience reduced nutritional and immune status due to decreased muscle mass, thereby increasing cancer risk.
- The author examines the complex relationship between esophageal cancer and sarcopenia, focusing primarily on prevention and treatment strategies within the context of managing both conditions. The impact of sarcopenia on different treatments for esophageal cancer is also explored.
- Sarcopenia is identified as an independent risk factor for survival in colorectal cancer patients, and addressing sarcopenia can potentially improve the prognosis of these patients. Both exercise therapy and nutritional interventions have been shown to improve prognosis by mitigating skeletal muscle loss.

Availability of Data and Materials

All the data of this study are included in this article.

Author Contributions

PPF, and XFX both made substantial contributions to the concept and design of the review. PPF drafted the manuscript. Both authors contributed to the important editorial changes in the manuscript. Both authors read and approved the final manuscript. Both authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

Not applicable.

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Conflict of Interest

The authors declare no conflict of interest.

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