# Nutritional therapy for patients with respiratory hypoxemic failure without a protected airway

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**Purpose of review**
Nutritional therapy is challenging in patients admitted to the ICU due to acute hypoxemic respiratory failure (AHRF) and candidates for oxygen therapy through noninvasive modalities, such as noninvasive ventilation (NIV) or high-flow nasal cannulas (HFNC). Nutritional status assessment, the definition of nutritional needs, routes and modes of administration, diet types, monitoring of food tolerance, complications and safety during ICU admission, and nutrition-focused outcomes are not well established in these patients and have not been specifically addressed in international ICU guidelines. This review will focus on the nutritional treatment of patients with AHRF without airway protection admitted to an ICU.

**Recent findings**
Oral nutrition, following swallowing tests, remains the preferred route for feeding these patients. However, the prevalence of insufficient feeding remains high, especially in those receiving NIV compared to HFNC modality. Artificial nutrition is used less frequently. Finally, trophic nutrition, either orally or via a nasogastric tube (NGT), has emerged as a new modality of nutritional treatment for these patients and has been shown to be safe and feasible.

**Summary**
Insufficient feeding appears to be the norm in ICU patients treated for AHRF with noninvasive ventilation modalities. New approaches, protocols, guideline updates, and more high-quality studies are needed.

**Keywords**
acute respiratory failure, high-flow nasal oxygen therapy, medical nutrition treatment, noninvasive ventilation, trophic feeding

## INTRODUCTION

Acute hypoxemic respiratory failure (AHRF) is a life-threatening condition and one of the main causes of admission to the ICU. Without rapid and appropriate treatment, it increases the risk of mortality in patients [1]. Today, all intensivists agree that the survival of mechanically ventilated patients depends on factors present at the start of mechanical ventilation, but also on the development of complications and the treatment of the patient in the ICU [2]. In addition to invasive mechanical ventilation (IMV), most ICUs around the world have other modes of ventilation and oxygenation available, such as non-invasive ventilation (NIV) with different external interfaces (mask or helmet) and high-flow nasal cannula (HFNC). HFNC may be preferable for patients who have difficulty tolerating masks or who are at lower risk of hypercapnia, while NIV remains the standard treatment for hypercapnic respiratory failure. It is important to note that patients treated with HFNC are better able to talk, eat, and clear respiratory secretions than those receiving NIV [3,4].

Given that HFNC and NIV are key therapeutic options for patients with AHRF, it is important to review the entire process, including nutritional assessment, choice of feeding route, and medical nutritional therapy options to be applied in terms of usefulness, feasibility, efficacy, and safety, all designed to meet the patient's nutritional needs. Unfortunately, the most recent ESPEN and ASPEN

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## KEY POINTS

- A nutritional assessment should be performed and the degree of malnutrition, if any, diagnosed when patients with acute hypoxemic respiratory failure (AHRF) are admitted to the ICU for treatment with noninvasive ventilation (NIV) or high-flow nasal cannulas (HFNC) and are about to start medical nutritional therapy.
- Oral nutrition following a swallowing test is the preferred initial medical nutrition therapy for these patients, but poor appetite, interface problems, and insufficient feeding are almost always the norm. Oral nutritional supplements (ONS) and "nothing by mouth" (NPO) orders should be carefully examined.
- Patients treated with NIV alone are more prone to malnutrition than those receiving HFNC oxygen therapy. They are also fed more inadequately compared to those fed after invasive mechanical ventilation. As NIV improves, so does nutritional intake.
- Following nutritional assessment and once the route of administration has been chosen, emphasis should be placed on limiting initial nutrient intake as this might preserve autophagy, ketogenesis and other potentially adaptive processes early in critical illness, in accordance with international guidelines. Consequently, diet administration should be increased progressively, aiming to reach targets after 3 days to 1 week after admission to the ICU.
- Early trophic feeding appears to be safe and feasible in these patients. It has also been shown to be associated with a 90-day mortality rate similar to or lower than that of other similar studies on trophic nutrition in ICU patients. Further research and new approaches are needed.

guidelines do not specifically address the medical nutritional treatment of patients with AHRF without airway protection [5–7], and this lack of recommendations needs to be addressed in the near future.

Therefore, this review highlights medical nutritional treatment options and their consequences in patients with AHRF, without airway protection, admitted to an ICU and undergoing noninvasive respiratory modalities NIV or HFNC.

## FEEDING AHRF PATIENTS IN CLINICAL PRACTICE

Table 1 shows study design types and references; feeding modalities; nutritional requirements and intakes; prevalence of malnutrition; safety data; and alignment with ESPEN/ASPEN guidelines in the reviewed studies on NIV/HFNC.

First, let us analyze the two most recent reviews on this topic: an exploratory review and a narrative review.

### Nutrition management for critically ill adult patients requiring noninvasive ventilation: a scoping review [12]

In a recent exploratory review of 16 studies (7 published only as abstracts, three of which were randomized controlled trials: RCTs; another study was an unpublished doctoral thesis) evaluating 1803 adult patients who received NIV in an ICU between 1990 and November 2021. We have summarized their most relevant conclusions.

The authors state that this is the first exploratory review to identify the existing literature on the nutritional management of adult ICU patients requiring NIV. They also note that evidence in this field is limited, with only 16 studies published over the past 30 years. One of the main strengths of this review is the rigorous methodology used, which included independent study screening and data extraction by two authors with a strong understanding of how research translates into clinical practice. Among the study's limitations, the authors note that the conclusions and comparisons are restricted by the wide variability in methods used to collect and report both nutritional data and noninvasive ventilation (NIV).

Initially, they mainly discussed that the use of NIV poses several barriers to nutrient administration: if tracheal intubation is seriously contemplated, patients are usual kept fasted; oral intake administration may require temporary removal of most NIV interfaces; and the position of the enteral nutrition (EN) feeding tube may cause air leakage unless a mask with a special port for the NGT tube is available, all of which may further affect respiratory function. Although parenteral nutrition (PN) is a possible alternative, it is usually reserved for patients with severe malnutrition who suffer from gastrointestinal failure.

Three single-center RCTs were included (Tables 2 and 3 of Viner Smith's manuscript): two published only as abstracts, Gupta *et al.* and Pearson *et al.*, and one full manuscript by Zhang *et al.* The trials included 20, 83, and 92 patients, respectively. The Zhang study compared standardized EN with a high-protein, high-fiber oral diet in patients with COPD and acute respiratory failure and showed significant improvements in nutritional status and immune function with EN. Gupta's study compared HFNC with NIV in liver transplant recipients with AHRF and found that patients on NIV consumed 52% fewer calories despite oral or enteral feeding. Pearson's study compared nutrition delivery during helmet NIV vs. face mask NIV in ARDS and found no significant differences in enteral or oral intake between groups.

**Table 1.** Nutritional needs, intake and safety data and guidelines alignment on NIMV/HFNC studies in ICU patients

| Study. Authors and design | Year | Patients (*n*)/ feeding types (*n*) | NIMV/HFNC (*n*) | Protein needs/intake (g/day) | Energy needs/intake (kcal/kg/day /kcal/ day) | Underfeeding prevalence | Oral/EN intake safety | ESPEN/ASPEN guidelines alignment |
|---|---|---|---|---|---|---|---|---|
| Reeves *et al.* [8] Prospective; observational | 2014 | 36 / Oral: 75%; EN and PN:25% Intake days | 36/0 | 1.2 g/kg BW/63 ± 29 | 30/1434 ± 627 | 28 (78%) patients: < 80% needs | Oral: no aspirations | Limited |
| Kogo *et al.* [9] Retrospective; cohort | 2017 | 150 (107 enrolled)/ EN only (60) | 107/0 | 1.2 g/kg BW/Data not given | 25–30/Data not given | Data not given | Oral route excluded/ ↑airway complications (*P*= 0.03) | Limited |
| Terzi *et al.* [10] Retrospective; cohort (Outcomerea database) | 2017 | 1075/(oral only: 351; EN: 28; PN only: 74) | 1075/0 | Not given | Not given | 622 (57.9%): No nutrition | ↑Infection and 28 day-mortality: only EN vs. No nutrition ($p \leq 0.03$) | Limited |
| Chapple *et al.* [11] Pilot; prospective; observational | 2020 | 22: 19 assessed)/ (oral: 18 ONS: 2; NPO: 1; NP:1) | 3/8 (estimated) | 1.3 g/kg BW/32 [IQR: 20–53] | 25/754 (IQR: 464–1333) | 42 (5) % needs NIMV 50% less intake vs. HFNC | Feasible postswallow | Limited |
| Viner Smith *et al.* [12] Scoping review: 16 studies (7 abstracts) | 2022 | 1803 | Interface: No reported (n = 8); ≥ 1 type (n = 6) | Not quantified | Varied | 37–42% energy and 28–35% protein needs (5 studies) | Preferred with swallow checks | Limited |
| Reta-Pérez *et al.* [13▪] Prospective; multicenter; observational | 2024 | 149/(Trophic: Oral:110; EN: 36; mixed: 3) | 11/138 | 1.2–2 g/kg BW/50 (IQR: 25–50) | 20–30 (trophic 20–30%)/520 (IQR: 300–600) | Trophic nutrition | Safe with swallow assessment | Strong |
| Singer [14] Narrative Review | 2024 | 1228 (estimated): 16 studies | 700 /500 (estimated) | 1.3 g/kg BW | Indirect calorimetry/ 100% target: 5–7 days | NIMV preventing reintubation: <650 kcal/day. | Preferred with swallow checks | Strong |
| Deli *et al.* [15▪] Retrospective; cohort | 2025 | 220/oral: 142; artificial: 66; no feeding: 12) | 22/178 (each type only) | 89 ± 18 g/82% of target g/day | 1866 ± 30 kcal/day/ 84 ± 20.5% mean ± SD | 28 out of 71(39.4%) Inadequate intake: Oral feeding only: 61.8%. | Feasible, but 61.8% oral intake inadequate | Moderate |
| Page *et al.* [16] Cross-sectional quantitative survey | 2024 | 152 surveys/oral: 83; EN: 27; mixed:23; fluids: 14; no feeding: 5 | 152/0 | -/< 50% (78% respondents) | -/< 50% (74% respondents) | N/A | Factors considered: Ability swallow; patient alertness; time off NIV | N/A |
| Viner Smith *et al.* [17] Prospective, single-centre; observational | 2025 | 42/Inclusion: oral 36; EN:1; mixed: 1; no feeding: 4 | Inclusion: 37.8/4.8 (median % ICU stay) | N/A/Inclusion: 15.5 g; 7 days: 57.4 g | N/A/Inclusion: 386 kcal; 7 days: 1232 kcal | N/A | N/A | Strong |

ASPEN, American Society of Nutrition and Metabolism; BW, body weight; EN, enteral nutrition; ESPEN, European Society of Nutrition and Metabolism; HFNC, high-flow nasal cannulas; IMV, invasive mechanical ventilation; IQR, interquartile range; N/A, not applicable/available; NIVM, noninvasive mechanical ventilation; NPO, nil per os ("nothing per mouth"); ONS, oral nutritional supplements; PN, parenteral nutrition.

None of the studies analyzed addressed validity or drew conclusions about which screening or assessment tools can be used in patients with NIV. Indirect calorimetry (IC) is the universally accepted gold standard for determining resting energy expenditure. IC measurements are performed using a specific device through a canopy or connected to a ventilator. To ensure the reliability of the measurements, certain conditions must be met, including an $FiO_2 \leq 0.7$, hemodynamic stability, a respiratory rate less than or equal to 35/min or stable mechanical ventilation, and no air leaks. However, when patients are on HFNC therapy, IC measurements cannot be performed due to the excessively high $FIO_2$ concentrations used. The study authors highlighted the lack of IC assessments in this population and the inadequacy of the energy levels to be achieved in the studies analyzed.

The key concept identified in this scoping review was the route of nutrition during NIV. Although no optimal feeding route was identified, oral feeding or fasting was prescribed more frequently than artificial nutrition, and studies relying solely on oral intake reported inadequate nutritional provision. Only five studies evaluated the amount of protein and calories consumed by patients, concluding that it was low and insufficient to meet the study targets.

Viner Smith, *et al.* concluded that there was no agreement on the preferred route for feeding these patients and that more studies are needed, particularly those focusing on the impact of nutrition during NIV on clinical outcomes, to develop clinical practice recommendations on the subject [12].

## Nutrition therapy in nonintubated patients with acute respiratory failure: a narrative review [14]

A narrative review of the literature based on 16 recent studies to evaluate tools for diagnosing malnutrition and determining energy and protein requirements and medical nutritional therapy in each condition. Seven of 16 studies were included in the previous review [12].

This review highlights the Global Leadership International Malnutrition (GLIM) assessment tool, which allows for quick and easy assessment of the presence and degree of malnutrition in patients with AHRF [18].

The IC was also noted as the gold standard method for determining the energy requirements of patients admitted to the ICU. Although it may be valid for patients on NIV, it was noted that it cannot be used in those receiving oxygen via HFNC, which is currently the most common form of oxygen therapy for these patients.

In this review, they suggested a comprehensive approach to optimize nutrition in patients with NIV and HFNC oxygen therapy, noting that patients with NIV appear to receive less nutrition intake than those receiving HFNC therapy.

When these respiratory modalities are not as short-lived as we expected, the dilemma of "eating or breathing" arises, along with the indication for medical nutritional therapy in patients at higher risk of intubation and its related complications. It is therefore not surprising that absolute fasting is often prescribed. As also discussed above in relation to NGT leaks, if special masks are not used, gastric distension due to positive pressure ventilation and intermittent disconnections of the mask interface to feed patients orally can further impair respiratory function, especially in patients treated with a NIV modality.

Oral feeding is mentioned as the preferred route, but if the target is not achieved, it is suggested to replace oral intake with EN or, if necessary, PN. In an article regarding a survey on feeding practices during HFNC oxygen therapy [19▪], it was noted that only 46.7% of responders indicated the need for a swallowing test before eating, and as expected, this figure rose to 77.7% when the speech therapist completed the survey. The survey was conducted by the Division of Respiratory Care at Rush University, Chicago. In total, 307 professionals from 14 countries responded, most from the United States ($n=266$; 86.6%). Most worked in academic or teaching hospitals and were primarily physicians, advanced practice providers, or speech-language pathologists.

Singer *et al.* [14] suggested that if swallowing was unsafe, EN could be administered and NIV applied, and in cases with a very high risk of aspiration, postpyloric EN could be considered or, if not possible, temporary PN during swallowing training after NGT removal [20].

They concluded that screening and assessment (GLIM) are mandatory and that providing sufficient energy and protein is a challenge in these patients [18].

We agree that the GLIM assessment is necessary, quick, and easy to perform. Oral nutrition is preferred, whether exclusive, trophic, or supplemented with ONS, but if this is not possible, EN or PN should be considered, always taking into account refeeding syndrome, especially if severe malnutrition is present upon admission to the ICU.

Older manuscripts that remain important to consider include three key articles on this topic, which are essential given the limited medical literature available. As expected at the time, all three studies were conducted exclusively with NIV [8–10].

### Energy and protein intakes of hospitalized patients with acute respiratory failure receiving noninvasive ventilation [8]

Reeves *et al.* measured the energy and protein intake of patients with ARF, most of whom had chronic obstructive pulmonary disease (COPD), admitted to an ICU or pulmonary unit in an Australian hospital, who started on NIV and received standard hospital nutritional care. In 36 patients, over a total of 283 days of intake, 75% orally, 28 out of 36 patients had <80% of estimated requirements. Although no distinction was made between oral and artificial nutrition, oral intake was associated with poorer nutritional intake. One limitation of the study was that 44% of intake days were excluded due to incomplete data.

It was concluded that patients with acute respiratory failure requiring NIV often had inadequate oral intake, especially with increasing duration of noninvasive ventilation and in the early stages of their hospital admission. The study highlights the prevalence of malnutrition in COPD patients who developed ARF and were fed primarily by oral route.

### Enteral nutrition is a risk factor for airway complications in subjects undergoing noninvasive ventilation for acute respiratory failure [9]

In a retrospective cohort study of 150 patients admitted to the ICU or an intermediate care unit of a respiratory department due to AHRF who received NIV for more than 48 h. Of these, 107 subjects who were unable to eat orally were retrospectively analyzed. EN was not associated with mortality. However, the rate of airway complications was significantly higher, and the median duration of NIV was significantly longer in patients receiving EN than in those who did not receive it. The authors recommended that EN be carefully considered in these patients.

This study excluded patients who tolerated the oral route and focused on patients receiving EN and its associated complications, which they considered significantly higher at that time. They focused on safety and did not collect data on protein and energy intake. Feeding outcomes were not evaluated.

### OUTCOMEREA study group. Initial nutritional management during noninvasive ventilation and outcomes: a retrospective cohort study [10]

This is a multicenter retrospective observational cohort study based on a prospective database from 20 French ICUs, published in 2017 (OUTCOMEREA research group). Adult medical patients who received NIV for more than two consecutive days were included and divided into four groups: no nutrition, oral nutrition only, EN only, and PN only. It should be noted that of the 1075 patients recruited, the majority, 622 (57.9%), received no nutrition, and 351 (32.7%) received oral nutrition only. In addition, very few received PN only (6.9%) or EN (2.6%) but were more frequently associated with the need for invasive MV. No data was provided on protein and energy requirements and intake. In terms of safety issues, it was also observed after the data were adjusted for potential confounding factors that EN (compared to no nutrition) was associated with significantly higher 28-day mortality and a significantly greater need for IMV, as well as a significantly lower number of days without ventilation after 28 days. It was concluded that nearly three-fifths of patients receiving NIV fasted for the first two days and that lack of feeding or insufficient feeding was not associated with mortality.

### Nutrition-related outcomes and dietary intake in nonmechanically ventilated critically ill adult patients: a pilot observational descriptive study [11]

Chapple *et al.*, in another very small single center, prospective, observational, study, involving only nineteen patients in the initial and subsequent data collection, but interesting, in critically ill adult patients not on mechanical ventilation, in which nutritional data were collected only during the first three days of the study period. Eighty-four percentage of patients were well nourished upon admission to the ICU. As shown in Table 1, protein and energy intake was well below estimated requirements during the study period. In addition, NIV patients had lower caloric and protein intake than those receiving HFNC. They also noted that most patients received oral feeding exclusively, rather than artificial nutrition therapy, and only two patients received oral nutritional supplements.

They concluded that these patients had lower than expected energy and protein intake, largely due to lack of appetite or unknown barriers. Furthermore, although they quantified nutrition-related outcomes and the feasibility of bedside techniques, the small sample size and short duration of the study were insufficient to analyze these changes.

### Trophic nutrition in ICU patients undergoing high-flow oxygen therapy and/or noninvasive mechanical ventilation: the nutritrophic study [13"]

This prospective, observational study was conducted across 10 ICUs in Spain. It aimed to evaluate 90-day

mortality, tolerance, side effects, and infection rates in ICU patients with AHRF who received trophic enteral or oral nutrition using a high-protein diet while on HFNC or NIV. The rationale for the study focused on starting with low, slowly increasing amounts of protein and calories to help preserve autophagy and reduce catabolism. In this context, trophic nutrition was considered useful in balancing the prevention of malnutrition with safety, including pulmonary aspiration. A total of 149 patients were recruited, and ultimately all but 11 of them were treated with HFNC. A total of 110 patients received oral trophic feeding, 36 patients received trophic EN, and 3 received mixed feeding. Protein intake was significantly higher in survivors, and trophic nutrition was discontinued in only ten patients (14.9%) due to feeding-related complications. No significant differences in the development of new infections were observed according to the route of nutrition administration.

They concluded that early trophic feeding administered to patients with AHRF requiring noninvasive ventilation proved to be safe and feasible and with few dietary and infectious complications in the context of mortality comparable to that of similar studies in ICU patients receiving enteral trophic nutrition.

Compared to other recent studies on feeding ICU patients with noninvasive ventilation [11,15▪], the above study adds the novelty of using trophic nutrition and provides more robust data on infectious complications and tolerance. Furthermore, its trophic approach is more consistent with ESPEN/ASPEN guidelines [5–7] than previous studies reporting higher intake from the outset, following admission to the ICU [8,10].

## Nutritional adequacy in critically ill adults receiving noninvasive ventilation: a descriptive cohort study [15▪]

Deli *et al*. recently published a single center, prospective study of 220 ICU patients who received NIV for three or more consecutive days, most of them with HFNC oxygen (80.9%). Interestingly, they separated the cohort into two groups: patients who received NIV exclusively (NIV only; $n=107$) and those who first received IMV and were extubated and subsequently ventilated noninvasively (post-IMV group; $n=113$). Most patients (64.5%) received oral nutrition exclusively; 30.0% received artificial nutrition treatment, and 5.5% received no nutrition. Energy and protein requirements were estimated, and applying the GLIM criteria, 16.3% of the cohort was found to be severely malnourished at admission.

The provision of EN was quite low and, as expected, significantly more frequent in the post-IMV group, while exclusive oral nutrition was significantly more frequent in the NIV-only group. In addition, most patients receiving exclusive oral nutrition had inadequate intake (61.8%). On the other hand, inadequate energy and protein intake was observed in almost 40% of patients receiving artificial nutrition. They concluded that most critically ill patients receiving NIV received only oral nutrition, which was inadequate in most cases. Patients receiving NIV represent a nutritionally at-risk population, and future studies are needed to understand the barriers to oral intake and the feasibility, safety, and efficacy of EN.

Interestingly, only 23.3% of their patients received ONS during NIV, with slightly higher provision in the post-IMV group ($P=0.7$). As noted, an opportunity to improve oral intake was clearly missed.

## Nutrition practices in critically ill adults receiving noninvasive ventilation: a quantitative survey of Australian and New Zealand intensive care clinicians [16]

Between August 29 and October 9, 2022, a quantitative cross-sectional online survey was distributed to medical and nursing staff in Australia and New Zealand with 12 months of ICU experience through professional organizations using purposive snowball sampling. Surveys conducted using purposive snowball sampling substantially limit the inferential validity of the results. This approach introduces selection biases and dependence between observations, and makes it difficult to estimate sampling error, which means that the findings must be interpreted as descriptive and exploratory.

A total of 152 surveys were analyzed in this study: 71 (47%) from nursing staff, 69 (45%) from medical staff, and 12 (8%) with incomplete demographic data. The oral route was the most used ($n=83$, 55%) and was also considered the safest by 29 respondents (21%). Most respondents (n = 106, 78%) reported that patients achieved <50% of energy goals, while gastric EN was considered the most likely to achieve goals ($n=55$, 40%). The main barriers included the risk of aspiration (64%), fasting for intubation (62%), and nutrition being a lower clinical priority (54%). Facilitators included evidence-based guidelines and EN tubes compatible NIV interfaces (both 57%).

The authors concluded that, although ICU staff considered nutrition during NIV to be important, there is no clear consensus on the optimal treatment. Oral intake was the most used method, while gastric EN was considered the most effective for achieving objectives, with no agreement on the safest or preferred route.

Notably, "nil nutrition" was the least reported approach, contrasting with a large observational study in which 57.9% of NIV patients received no nutrition [10]. This discrepancy suggests a gap between clinician perceptions and actual practice, potentially reflecting reporting bias or greater survey participation by clinicians with a specific interest in nutrition.

### Nutrition intake, muscle thickness, and recovery outcomes for critically ill patients requiring noninvasive forms of respiratory support: a prospective observational study [17]

This small, single-center, prospective observational study examined adult ICU patients recruited within 48 h of commencing HFNC or NIV. The aim was to quantify changes in muscle thickness, nutrition intake, and recovery outcomes. The primary outcome was change in quadriceps muscle layer thickness (QMLT) measured by ultrasound. Secondary outcomes included 24-h energy and protein intake to day 7, handgrip strength, functional capacity (Barthel Index), and quality of life (EQ-5D-5L) at day 90.

Primary outcome data were available for 28 of 42 patients and showed a reduction in QMLT over 7 days. In contrast, nutrition intake and handgrip strength increased significantly, while functional capacity was similar at baseline and day 90. Quality of life remained impaired at day 90. The authors concluded that ICU patients receiving HFNC/NIV experience early muscle loss and reduced quality of life.

The discordance between declining muscle thickness and improving handgrip strength likely reflects early illness-related fatigue affecting baseline strength measurements rather than true muscle recovery. Nutrition intake increased over time but appeared lower in patients receiving NIV compared with HFNC.

Overall, this well conducted, hypothesis-generating study provides early evidence of muscle wasting and impaired quality of life in HFNC/NIV patients, but its small, single-center design means the findings require confirmation in larger, multicenter studies.

## CONCLUSION

Previous and recent studies on ICU patients with AHRF treated with some form of noninvasive mechanical ventilation have shown that energy and protein intake is lower in patients receiving exclusively oral nutrition and appears to be more severe in those receiving NIV compared to those receiving HFNC. In this context, EN is often initially avoided due to concerns about airway complications and accelerated initiation of endotracheal intubation and mechanical ventilation. However, supplemental PN (SPN) is used more often, whereas exclusive PN is less common and is mainly reserved for patients with severe malnutrition at admission. Fasting is a common practice, and oral nutrition remains the preferred route, following a nutritional assessment that typically uses GLIM criteria. However, insufficient feeding appears to be the norm, and there is a clear need for diet optimization with early progressive implementation in accordance with international guidelines and the use of ONS, new protocols, and new approaches, as demonstrated by the use of trophic nutrition.

Finally, bedside ultrasound assessment of skeletal muscle – including measurements of muscle quantity, quality, shear wave elastography, and microvascularization imaging – represents a noninvasive approach for evaluating nutritional status and monitoring acute changes over time. The relationships between these ultrasound-derived parameters and metabolic biomarkers, routes of nutritional support, and functional recovery outcomes – during and after nutritional interventions such as trophic feeding or oral nutritional supplementation (ONS) – remain insufficiently understood and warrant further investigation in this patient population.

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### Conflicts of interest

*There are no conflicts of interest.*

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