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Nutrition therapy in non-intubated patients with acute respiratory failure: a narrative review

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Objectives. Non-invasive ventilation use is increasing in patients from acute respiratory failure. However, nutritional assessment and medical nutritional therapy are often missed and patients may be frequently underfed. This review evaluates the tools for nutritional screening and assessment, assesses the use of medical nutritional therapy in various techniques of non invasive ventilation and suggested tools to improve this therapy.

Methods, results. A review of the literature was performed to evaluate the tools available to define malnutrition and determine the energy needs of patients requiring non invasive ventilation. Energy and protein intake was assessed in 16 recent papers. High Flow Nasal Cannula Oxygen therapy and non invasive ventilation using mask were described and nutritional therapy determined in each condition.

The Global Leadership International Malnutrition Assessment seems to be the best assessment to be recommended. Energy expenditure is optimally obtained by indirect calorimetry. Patients with Non invasive ventilation are even more underfed than patients receiving High Flow Nasal Cannula Oxygen therapy.

Conclusions. A better determination of malnutrition, a more adequate energy requirement and an improved energy and protein administration are required in patients with acute respiratory failure treated with non invasive ventilation.

Key words: energy, protein, non invasive ventilation, high flow nasal cannula, enteral nutrition

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Introduction

In patients with acute respiratory failure, respiratory support options include non-invasive ventilation and high flow nasal cannula oxygen therapy (HFNC) [1]. However, when these procedures are used for a prolonged time, the question of “to eat or to breath” [2] or the indication of nutritional therapy is raised. In patients with pending indication of intubation or risks of aspiration, physicians are hesitating to encourage oral or enteral feeding. The apparent reluctance to provide nutritional support during NIV may have several explanations. NIV support may not always be successful in preventing the requirement for endotracheal intubation and predicting which patients will deteriorate may not be straightforward. Thus, a nil-per-os order is commonly given in the event that intubation will be subsequently required. The presence of a nasogastric tube (NGT) may result in air leakage and compromise the effectiveness of NIV. While this problem may be circumvented with special NIV masks with a port for NGT, these are not always available and are costly. Positive pressure ventilation through a face mask also results in the stomach being dilated with air. The consequent gastric distention may adversely affect diaphragmatic function, further compromising the respiratory condition and resulting in endotracheal intubation. Patients who are allowed to have an oral diet may deteriorate when they remove the NIV in order to eat, thus resulting in deranged respiratory function. NIV is also used to prevent reintubation after extubation. During this period, oral intake is known to be as low as around 650 kcal/day [3]. After extubation, swallowing disorders (SD) may impair the return to normal food intake and moderate/severe SD are associated with a higher rate of regurgitation, pneumonia, length of stay [4]. In this review we intent to describe tools to screen and assess malnutrition, show the nutritional facts related to lack of administration of nutritional adequacy in terms of energy and protein, elaborate about the obstacles and suggest a comprehensive approach to optimize nutrition in patients with non invasive ventilation (NIV) and high flow nasal cannula (HFNC) oxygen therapy.

Nutritional assessment

Malnutrition has been defined by the European Society for Clinical Nutrition and Metabolism (ESPEN) [5] and a recent Global Leadership Initiative on Malnutrition (GLIM) has been proposed [6] and validated in various conditions including intensive care patients [7]. Patients with acute respiratory distress are acutely ill and therefore according to the MUST or the NRS 2002 screening tools [8,9] are at risk of malnutrition. Following the GLIM assessment tool, there is a need for one phenotype and one etiological criteria to diagnose malnutrition (Fig. 1). This easy and quick approach allows the health professionals to defined the level of malnutrition of patients with respiratory failure. Patients that are recognized to suffer from moderate or severe malnutrition will require nutritional therapy.

Energy and protein

Energy requirements are difficult to determine using predictive equations [10]. Many equations are over or underestimating the energy expenditure when compared to measured energy expenditure obtained by indirect calorimetry [11]. In almost all the diseases, predictive equations are inaccurate [12]. When NIV is used, energy expenditure may decrease when compared to spontaneous ventilation as described in Amyotrophic Lateral Sclerosis [13]. Indirect calorimetry is the gold standard for determination of energy requirements [14]. The technique can also be used when patients are receiving NIV [15]. HFNC O2 therapy does not allow indirect calorimetry measurements due to too high concentrations of FIO2. When energy target is determined, it is advisable to administer 30% of the energy target on day 1, 50% on day 2 and 70% on day 3, progressing to 100% around day 5 to 7 [14]. Protein administration should be increased progressively to reach 1.3 g/kg/d. Oral diet is preferred but if not achieving the target, oral intake should be replaced by enteral feeding or if not possible parenteral nutrition [14]. Over and underfeeding should be avoided, since both increase risks of complication and mortality. Prokinetics such as metoclopramide or erythromycin can be used to improve gastric emptying and tolerance of enteral feeding.

HFNC Oxygen therapy

In a survey exploring the attitudes of health professional regarding nutrition in patients treated with HFNC O2 therapy [16], in 284 patients, more than 80% had no nutritional protocol. Health professionals (84%) though that patients can be fed orally except in case of imminent intubation. Need for a swallow examination before eating was expressed in 46.7% of the cases but this number increased when a speech therapist felt it was necessary (77.7%). In an observational study performed in our unit in patients receiving HFNC O2 therapy

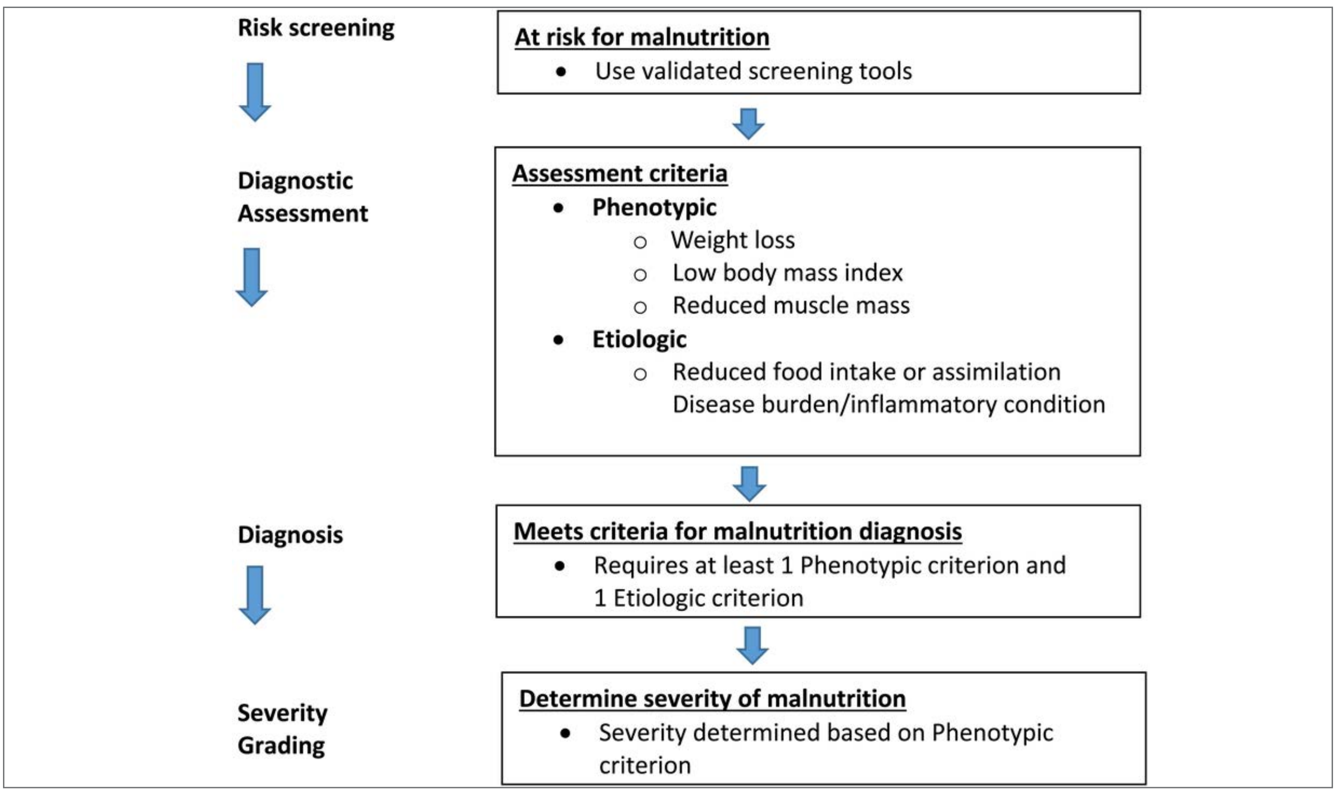

Figure 1. GLIM (Global Leadership Initiative on Malnutrition) assessment of malnutrition (from Cederholm et al., J Cachexia Sarcopenia Muscle 2019)

mainly after extubation, the energy and protein intakes were very poor regardless of the nutrition route of administration [17]. The fear of aspiration may explain this low nutritional intake. Recently a new enteral nutritional platform was developed using a nasaogastric tube equipped of sensors detecting reflux and preventing aspiration by the inflation of an esophageal balloon. This device was explored to determine the rate of massive and minor refluxes in patients receiving HFNC O2 therapy. In a first reported case report [18], we showed that the number of refluxes were much higher in patients with HFNC in comparison to a period of intubation and mechanical ventilation. We reached the same conclusions in a series of 10 patients, showing that HFNC was associated with a significant larger GRV [19]. A prospective randomized study showed that the use of this platform was associated with lower maximal and daily gastric residual volume but also with a decrease in length of ICU stay and length of ventilation [20].

NIV

In a large survey exploring the use of NIV in different countries [21], the rate varies from 3 to 62%. Frailty is associated with a larger use of NIV [22]. In 16 papers analyzed [23], the energy and protein intake was reported intake as a nutrition concept [24-29]: 2 reported on calorie intake only, concluding that patients receiving NIV in ICU consume < 1000 kilocalories (kcal)/day [24] and 52% less than those receiving high-flow nasal cannula therapy [27]. Three studies reported on calorie and protein intakes [24,27,29], all concluding that nutrition intake (calorie and protein) was inadequate (compared to estimated requirements) during NIV use. Jeong et al. reported no difference in nutrition adequacy between different modes of NIV (Bilevel Positive Airway Pressure or Continuous Positive Airway Pressure) [24], while Chapple et al. reported an increase in nutrition intake with decreasing respiratory support (NIV vs. nasal cannula vs. no oxygen therapy) [22]. The authors concluded that all the nutritional routes were used and that energy and protein targets were never achieved. In addition, patients supported with NIV had 50% less intake in comparison to HFNC.

A concern was raised regarding the risks of aspiration related to the administration of enteral feeding. In a prospective study comparing the routes of administration of medical nutritional therapy, Terzi et al. [28] enteral nutrition seem to be associated with an increase in mechanical ventilation and ventilated associated pneumonia. According to Kogo et al. [29], enteral feeding was associated with a prolonged stay in the hospital. A retrospective observational study showed that receiving enteral nutrition during NIV was associated with a significantly higher rate of airway complications (53 vs. 32%, $P = 0.03$) and longer NIV duration (16 vs. 8 days, $P = 0.02$) compared to patients who did not receive enteral nutrition. Failure of NIV to improve the patient is associated with increased mortality, explaining why physicians are reluctant to decrease the likelihood of success, for example, by prescribing enteral nutritional support.

Dysphagia

Dysphagia can occur after extubation and defined by the inability to transfer food from the mouth to the stomach. The incidence may vary: 3-62% after extubation. This impairment of a part of physical, cognitive and psychological health status disturbances. Since this impairment is frequent, it should always be suspected after extubation and speech therapist should be invited and if required, a flexible endoscopic evaluation should be performed. In a study screening dysphagia in 933 extubated patients, 116 were found with dysphagia [30]. Baseline neurologic disease, emergency admission, days on mechanical ventilation and high APACHE II scores were independent risk factors. Indication for NIV is discussed in dysphagic patients. In one hand Terzi et al. showed that enteral feeding may be associated with increased complication when applied in patients receiving NIV. In another study carefully evaluating NIV and breathing -swallowing interplay in COPD patients, abnormal breathing -swallowing interactions were improved with NIV [31]. This was confirmed by others [32], suggesting that CPAP alleviates the risk of aspiration in COPD patients. We suggest that if swallowing is proven unsafe, EN could be administered and NIV could be applied. In cases with a very high aspiration risk, postpyloric EN or, if not possible, temporary PN during swallowing training with removed naso-enteral tube can be performed. Macht et al. [4] compared outcomes of patients suffering from mild moderate and severe dysphagia and demonstrated that rate of pneumonia, reintubation and mortality was significantly increased in moderate/severe dysphagia following extubation. This dysphagia was even aggravated in the elderly population [33].

In patients with Amyotrophic Lateral Sclerosis requiring a percutaneous endoscopic gastrostomy (PEG), NIV has been used to permit the safe PEG placement [34]. In the patients who develop severe dysphagia, PEG is inserted and has shown to increase the tracheostomy free survival (6 months versus 2 months in the patients not having PEG). BMI at the time of diagnosis and of PEG influenced the hazard of death significantly [35]. In acute care, PEG can be considered after 30 days of hospitalization and placement of PEG and tracheostomy simultaneously has been shown to be safe [36]. However, there is an uncertainty about the long term benefits for certain patients [37].

Conclusions

In conclusion, screening and assessment (GLIM) is mandatory. Providing energy and protein in sufficient level is challenging. The health professionals should use oral and if not possible enteral nutrition cautiously. If doubt, use parenteral nutrition. New technologies may provide an increased safety and efficacy.

Conflict of interest statement

PS received honoraria for lectures and/or grants from Abbott, Baxter, Fresenius-Kabi, Nestle, Nutrition. PS acts as a consultant for ART Medical.

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Authors' contribution

PS did all the contribution for this review.

Ethical consideration

This review did not require ethics committee approval.

References

1 Grasselli G, Calfee CS, Camporota L, et al ESICM guidelines on acute respiratory distress syndrome: definition, phenotyping and respiratory support strategies. Intensive Care Med. 2023;49(7):727-759. https://doi.org/10.1007/s00134-023-07050-7

2 Singer P, Rattanachaiwong S. To eat or to breathe? The answer is both! Nutritional management during noninvasive ventilation. Critical Care. 2018;22:27. https://doi.org/10.1186/s13054-018-1947-7

3 Peterson SJ, Tsai AA, Scala CM, et al. Adequacy of oral intake in critically ill patients 1 week after extubation. J Am Diet Assoc. 2010;110:427-433. https://doi.org/10.1016/j.jada.2009.11.020

4 Macht M, Wimbish T, Clark BJ, et al. Postextubation dysphagia is persistent and associated with poor outcomes in survivors of critical illness. Crit Care. 2011;15:R231. https://doi.org/10.1186/cc10472

5 Cederholm T, Bosaeus I, Barazzoni R, et al. Diagnostic criteria for malnutrition e An ESPEN consensus statement. Clin Nutr 2015;34:335-340. https://doi.org/10.1016/j.clnu.2015.03.001

6 Cederholm T, Jensen GL, Correia MITD, et al. GLIM criteria for the diagnosis of malnutrition - A consensus report from the global clinical nutrition community. J Cachexia Sarcopenia Muscle 2019;10(1):207-217. https://doi.org/10.1002/jcsm.12383

7 Theilla M, Rattanachaiwong S, Kagan I, et al. Validation of GLIM malnutrition criteria for diagnosis of malnutrition in ICU patients: an observational study. Clin Nutr. 2021;40(5):3578-3584. https://doi.org/10.1016/j.clnu.2020.12.021

8 Stratton RJ, Hackston A, Longmore D, et al. Malnutrition in hospital outpatients and inpatients: prevalence, concurrent validity and ease of use of the ‘malnutrition universal screening tool’ (‘MUST’) for adults. Br J Nutr. 2004;92(5):799-808. https://doi.org/10.1079/bjn20041258

9 Kondrup J, Rasmussen HH, Hamberg O, et al. Ad Hoc ESPEN Working Group. Nutritional risk screening (NRS 2002): a new method based on an analysis of controlled clinical trials. Clin Nutr. 2003;22(3):321-36. https://doi.org/10.1016/s0261-5614(02)00214-5

10 Bendavid I, Lobo DN, Barazzoni R, et al. The centenary of the Harris-Benedict equations: how to assess energy requirements best? Recommendations from the ESPEN expert group. Clin Nutr 2021;40:690-701. https://doi.org/10.1016/j.clnu.2020.11.012

11 Zusman O, Theilla M, Cohen J, et al. Resting energy expenditure, calorie and protein consumption in critically ill patients: a retrospective cohort study. Crit Care. 2016;20:36. https://doi.org/10.1186/s13054-016-1538-4.

12 Zusman O, Kagan I, Bendavid I, et al. Predictive equations versus measured energy expenditure by indirect calorimetry: a retrospective validation. Clin Nutr. 2019;38:1206-1210. https://doi.org/10.1016/j.clnu.2018.04.020.

13 Georges M, Morélot-Panzin C, Similowski T, et al. Noninvasive ventilation reduces energy expenditure in amyotrophic lateral sclerosis. BMC Pulm Med. 2014,14:17. https://doi.org/10.1186/1471-2466-14-17.

14 Singer P, Blaser AR, Berger MM, et al. ESPEN guideline on clinical nutrition in the intensive care unit. Clin Nutr. 2019;38:48-79. https://doi.org/10.1016/j.clnu.2018.08.037

15 Slirala W, Noponen T, Olkkola KT, et al. Validation of indirect calorimetry for measurement of resting energy expenditure in healthy volunteers undergoing pressure control non invasive ventilation support. J Clin Monit Comput. 2012;26(1):37-43. https://doi.org/10.1007/s10877-011-9331-z

16 Charlton ME, Peterson SJ, LaGorio LA, et al. A Survey of Feeding Practices During High-Flow Nasal Cannula Oxygen Therapy. Respir Care. 2023;68(9):1229-1236. https://doi.org/10.4187/respcare.10469

17 Zerbib O, Rattanachaiwong S, Palti N, et al. Energy and protein intake in critically ill people with respiratory failure treated by high-flow nasal-cannula oxygenation: an observational study. Nutrition. 2021;84:111117. https://doi.org/10.1016/j.nut.2020.111117

18 Kagan I, Hellerman-Itzhaki M, Neuman I, et al. Reflux events detected by multichannel bioimpedance smart feeding tube during high flow nasal cannula oxygen therapy and enteral feeding: First case report. J Crit Care. 2020;60:226-229. https://doi.org/10.1016/j.jcrc.2020.08.005

19 Hellerman Itzhaki M, Hosen S, Kagan I, et al. The effect of mechanical ventilation compared to High Flow Nasal Cannula on gastric residual volume and reflux events using novel automated technology. Clin Nutr ESPEN 2023;54;534.

20 Kagan I, Hellerman-Itzhaki M, Bendavid I, et al. Controlled enteral nutrition in critical care patients - A randomized clinical trial of a novel management system. Clin Nutr. 2023;42(9):1602-1609. https://doi.org/10.1016/j.clnu.2023.06.018

21 Polok K, Fronczek J, Artigas A, et al. COVIP Study Group. Noninvasive ventilation in COVID-19 patients aged ≥ 70 years-a prospective multicentre cohort study. Crit Care. 2022;26(1):224. https://doi.org/10.1186/s13054-022-04082-1

22 Chapple LS, Gan M, Louis R, et al. Nutrition-related outcomes and dietary intake in non mechanically ventilated critically ill adult patients: A pilot observational descriptive study. Aust. Crit. Care 2020;33:300-308. https://doi.org/10.1016/j.aucc.2020.02.008

23 Viner Smith E, Ridley EJ, Rayner CK, et al. Nutrition Management for Critically Ill Adult Patients Requiring Non-Invasive Ventilation: A Scoping Review. Nutrients. 2022;14(7):1446. https://doi.org/10.3390/nu14071446

24 Jeong S. Nutritional Care Practice in the Patients Receiving Non-Invasive Positive Pressure Ventilation (NIPPV) Therapy in an Intensive Care Unit (ICU). Master’s Thesis, Flinders University, Adelaide, SA, Australia, 2017.

25 Reeves A, White H, Sosnowski K, et al. Energy and protein intakes of hospitalised patients with acute respiratory failure receiving non-invasive ventilation. Clin. Nutr. 2014;33:1068-1073. https://doi.org/10.1016/j.clnu.2013.11.012

26 Arnaout M, Marincamp A, Reffiena M, et al. Systematic evaluation of intakes in patients receiving non invasive ventilation. The starve study. Intensive Care Med. Exp. 2015;(Suppl. 1):A827.

27 Gupta S, Govil D, Srinivasan S, et al. High flow nasal cannula (HFNC) as an alternative to noninvasive ventilation (NIV) in acute respiratory failure (ARF) in immunosuppressed patients-an Indian post liver transplant experience. Intensive Care Med Exp. 2016;4.

28 Terzi N, Darmon M, Reignier J, et al.; OUTCOMEREA study group. Initial nutritional management during noninvasive ventilation and outcomes: a retrospective cohort study. Crit Care. 2017;21(1):293. https://doi.org/10.1186/s13054-017-1867-y

29 Kogo M, Nagata K, Morimoto T, et al. Enteral Nutrition Is a Risk Factor for Airway Complications in Subjects Undergoing Noninvasive Ventilation for Acute Respiratory Failure. Respir Care. 2017;62:459-46rzi7. https://doi.org/10.4187/respcare.05003

30 Zuercher P, Schenk NV, Moret C, et al. Risk factors for dysphagia in the ICU patients after invasive mechanical ventilation. Chest 2020;158;1983-1991. https://doi.org/10.1016/j.chest.2020.05.576

31 Terzi N, Herve N, Dumanowski E, et al. Non invasive ventilation and breathing – swallowing interplay in chronic obstructive pulmonary disease. Crit Care Med 2014;42:565-573. https://doi.org/10.1097/CCM.0b013e3182a66b4a

32 Hori R, Ishida R, Isaka M, et al. Effects of non invasive ventilation on the coordination between breathing and swallowing in patients with chronic obstructive pulmonary disease. Int J Chronic Obstr Pulm Dis 2019;1485-1494. https://doi.org/10.2147/COPD.S205543

33 Tsai MH, Ku SC, Wang TG, et al. Swallowing dysfunction following endotracheal intubation: Age matters. Medicine (Baltimore). 2016 Jun;95(24):e3871. https://doi.org/10.1097/MD.0000000000003871

34 Sancho J, Servera E, Chiner E, et al. Non invasive respiratory muscle aids during PEG placement in ALS patients with severe ventilatory impairment. J Neurol Sci 2010;297:55-59. https://doi.org/10.1016/j.jns.2010.06.022

35 Fasano A, Fini N, Ferraro D, et al. Percutaneous endoscopic gastrostomy, body weight loss and survival in amyotrophic lateral sclerosis: a population-based registry study. Amyotr Lat Scler Frontotemp Degen 2017;18:233-242. https://doi.org/10.1016/j.jns.2010.06.022

36 San LC, Ravirasmi J, Tammi T, et al. Enteral feeding timing and outcome after simultaneous tracheostomy and PEG placement in the ICU. Crit Care 2014;42:A1445-A1446.

37 Welbank T, Kurien M. To PEG or not to PEG that is the question. Proceedings Nutr Soc 2021;80:1-8. https://doi.org/10.1017/S002966512000703X