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Association Between Enteral Nutrition and the Incidence of Pneumonia in Critical Care Adults: A Literature Review

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Keywords

adults;
aspiration;
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Abstract

Background: To investigate the association between enteral feeding and the risk of pneumonia in critical care adult patients**. Methods:** An updated literature review of studies discussing between 2016 and 2023. CINAHL, Cochrane, Embase, PubMed, Scopus, and Web of Science databases were used to explore studies regarding our subject, and the association between enteral feeding and the risk of pneumonia in critical care adults. **Results:** Enteral nutrition (EN) has been linked to a significant reduction in pneumonia, as well as shorter ICU or hospital stays, and decreased mechanical ventilation duration in numerous studies. Conversely, pneumonia risk and other infections, as well as the fatality rate, have been found to increase with EN. Early initiation of EN within 48 hours, along with a low-calorie diet containing (< 600 Kcal/day) demonstrated a notable decrease in the occurrence of Ventilator-Associated Pneumonia (VAP) when contrasted with delayed EN and a high-calorie diet. EN was associated with a marked decrease in adverse events including aspiration pneumonia, emesis, and the escalation of respiratory support. **Conclusion:** EN is safe and effective in critically ill patients. Future research should investigate the monitoring of larger sample sizes to ascertain the most effective feeding methods in the intensive care unit.

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enteral nutrition;
feeding;
pneumonia;

Contents

1 Introduction

Pneumonia is a serious health concern since it has been connected to significant morbidity and mortality in patients. It is the primary infectious illness cause of death across the board in the entire world (Correia et al., 2017; Lewis et al., 2016). In critically ill patients, pneumonia may manifest as pneumonia contracted in the community (community-acquired pneumonia [CAP], hospital-acquired pneumonia [HAP]), or pneumonia connected to mechanical ventilation (ventilator-associated pneumonia [VAP]). Pneumonia survivors frequently experience significant sequelae such as altered lung function, a decline in mental and cognitive abilities, weakness and a reduction in motor function, and a loss of functional autonomy (Hiura et al., 2020; Pash, 2018). To increase the survival of critically ill patients, it is essential to make an accurate and early diagnosis of severe pneumonia.

For critically ill patients in the intensive care unit (ICU) who need mechanical breathing, enteral or parenteral feeding supplementation is crucial. To maintain gut integrity and intestinal permeability, enteral nutrition is the suggested feeding method for those with a functioning gastrointestinal (GI) tract (Lakananurak & Gramlich, 2020). To reduce inflammatory reactions and decrease the hypermetabolic status of the patients, guidelines on enteral nutrition in critical care settings recommend early enteral nutrition initiation, optimum delivery of prescribed nutrients, and strict glycemic control. Nutritional status deteriorates as a result of suboptimal nutrition delivery compared to predicted objectives, which is linked to worse patient outcomes such as lengthened hospital stays (LOS), greater rates of infection, multiple organ failure, and death (Savio et al., 2021).

Critically ill patients are more likely to experience a variety of eating intolerances, including abdominal distension, delayed gastric emptying, large gastric residual volumes (GRVs), diarrhea, and vomiting (Klompas et al., 2022; Segaran et al., 2016). Due to anticipated procedures, routine nursing attention, and physical therapy, meal disruptions are common in critical care environments, posing a challenge to achieving dietary objectives. Furthermore, due to increased hepatic gluconeogenesis and catabolic hormone release, critically sick individuals may also have higher glycemic fluctuation (Worthington et al., 2017). It is essential to implement a secure and efficient enteral feeding method to minimize potential hazards and complications while enhancing the delivery of nutrition to this particular patient population.

There are various methods for delivering enteral nourishment. The latest clinical nutrition guidelines from the European Society for Clinical Nutrition and Metabolism suggest continuous enteral nutrition (CEN) as the preferred method, involving the controlled hourly administration of nutrients over an extended period using a feeding pump (Vashi et al., 2017). Previous studies have shown that CEN may lower the risk of aspiration pneumonia and alleviate unpleasant GI symptoms. Other alternative enteral feeding approaches, such as bolus or intermittent enteral nutrition (IEN), involve providing larger amounts of feeds in short intervals of 4-6 hours,

which may be more effective in meeting nutritional targets and enhancing muscle protein synthesis (Lewis et al., 2016). However, there are still uncertainties about the optimal way to administer enteral nutrients to critically ill patients. However, there are still uncertainties about the optimal way to administer enteral nutrients to critically ill patients (Compher et al., 2022). Therefore, the present literature review aims to investigate the association between entreat feeding and the risk of pneumonia in critical care adults.

2 Materials and Methods

Method and Search Strategy

This updated systematic review complies with the PRISMA checklist guidelines for systematic reviews and meta-analyses (Liberati et al., 2009). CINAHL, Cochrane, Embase, PubMed, Scopus, and Web of Science were searched databases. The studies published between 2016 and 2023 were explored. The search process used different keywords, including "*enteral nutrition, feeding, association, aspiration, pneumonia, adults, and critical care*". These keywords were used in various combinations to find all the relevant articles. This initial exploration resulted in the revision of all titles.

Eligibility Criteria

Only papers focusing on the association between enteral feeding and the risk of pneumonia in critical care adult patients were included. Then, involved only original, English language studies reporting the association between enteral feeding and the risk of pneumonia in critical care adults after evaluating the abstracts of the articles. On the other hand, review articles and editor letters were not included. These articles were further examined to exclude duplicates, non-full-text articles, and articles with unsatisfactory content, such as overlapped or incomplete data [Figure 1] displays a detailed explanation of the search approach.

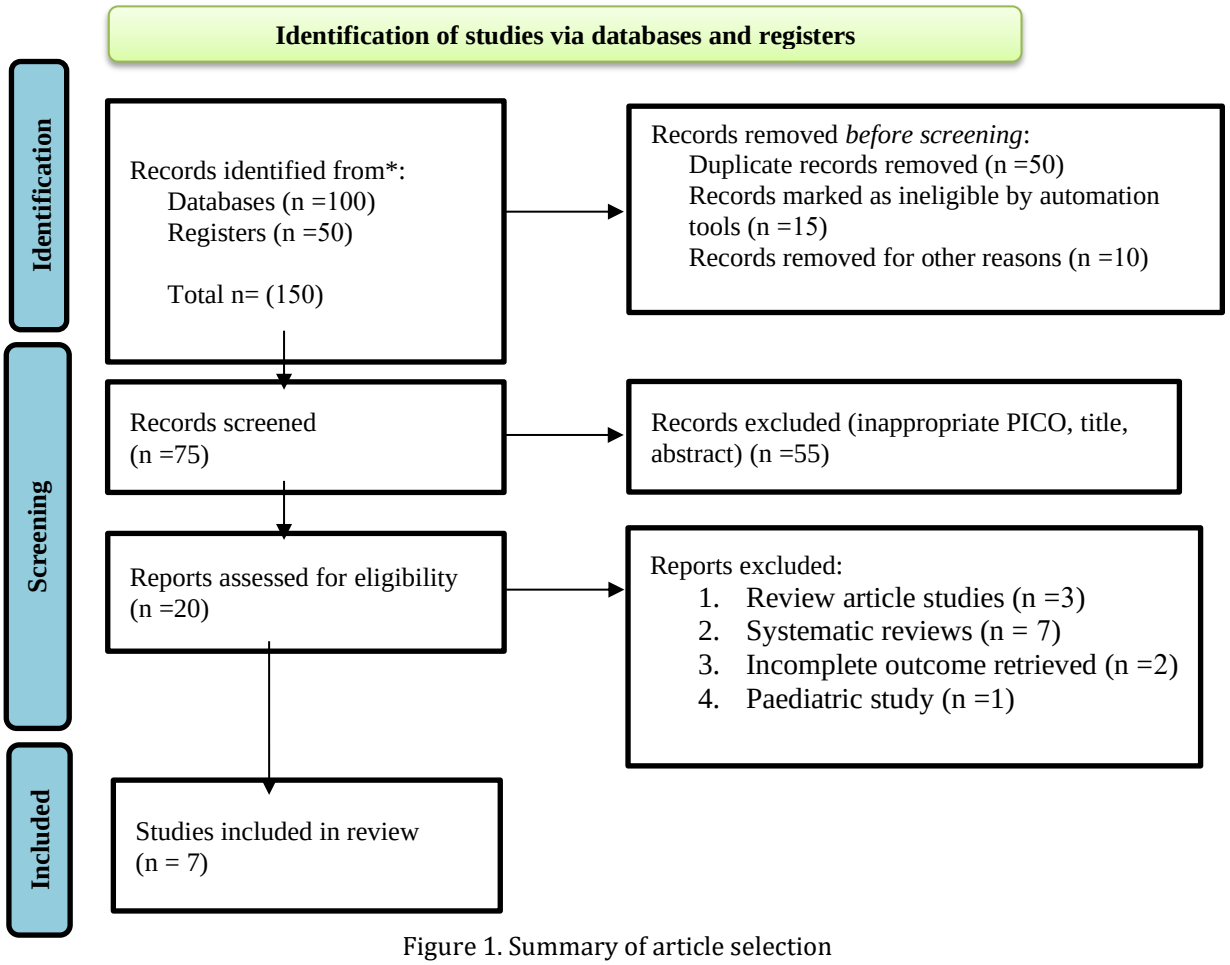

Figure 1. Summary of article selection

Data Reviewing and Analysis

The full text and abstracts of the articles were evaluated to extract the relevant data and transfer it to a pre-made Excel sheet. The chosen data were then amended in the Excel sheet, and the data were combined to summarize the data to facilitate data analysis.

3 Results and Discussions

3.1 Result

Seven studies fulfilled the inclusion criteria (Lee et al., 2018; Mizuma et al., 2021; Su et al., 2018; Nakayama et al., 2020; Hamilton et al., 2021; Gaitanidis et al., 2022; Patel et al., 2016). They were all conducted retrospectively. The study involved 2063 adult patients in critical care units. A summary of the findings from these studies is presented in Table 1.

Lee and colleagues conducted a retrospective observational study on trauma adult patients admitted to the ICU. They found that the intervention group received a higher number of calories (94% vs. 75%), and protein (104% vs. 74%) compared to the control group. Additionally, they observed a significant correlation between early enteral feeding within 48 hours and a lower incidence of pneumonia, and a greater number of ventilator-free days within 28 days (Lee et al., 2018; Needham et al., 2005; Nolan et al., 2008). Mizuma et al. (2021), evaluated all individuals admitted within 14 days to determine the occurrence of stroke-associated pneumonia.

They discovered that delayed enteral feeding exceeding 48 hours could result in prolonged hospitalization (median of 13 days) and ICU stay (median of 2 days). Conversely, early enteral feeding was associated with a reduction in pneumonia infections among stroke patients (Mizuma et al., 2021). The research conducted by Su et al. (2018), revealed a lower incidence of premature VAP and VAP, decreased mechanical ventilation days, shorter ICU stay, and better prognosis in patients receiving early enteral nutrition. Nakayama and colleagues conducted a study on the early enteral nutrition provided to patients diagnosed with cardiovascular disease within 5 days of admission to the ICU. Their findings indicate that none of the subjects experienced aspiration pneumonia (Nakayama et al., 2020).

Furthermore, a study by Hamilton et al examined Adult ICU patients who were on enteral nutrition and had a risk factor for stress-related mucosal injury. The findings showed that patients in the pharmacologic prophylaxis with enteral nutrition (PPEN) group had a higher incidence of pneumonia (42.2% vs 15%, P=.0194). Nevertheless, there was no disparity between the groups when patients with pneumonia at admission were excluded (20.6% vs 10.5%, P=.5254) (Hamilton et al., 2021).

Conversely, enteral feeding was linked to a higher occurrence of pneumonia. A study by Gaitanidis et al. (2022), examined the differences between enteral and parental feeding in individuals suffering from acute pancreatitis. The findings indicated a heightened susceptibility to pneumonia and a higher fatality rate from infection among those receiving enteral feeding (Gaitanidis et al., 2022). A study by Patel et al. examined septic shock patients who were mechanically ventilated and admitted to the ICU and were initiated on enteral nutrition within 48 hours. Among the patients receiving less than 600 kcal per day, no cases of aspiration pneumonia were reported. In contrast, 6.7% of patients not receiving enteral nutrition and 7.2% of patients receiving more than 600 kcal per day developed aspiration pneumonia (Patel et al., 2016; Cunha, 2001).

3.2 Discussion

Nutrition support therapy plays a vital role in the care of critically ill patients. There are established guidelines that can be utilized to administer EN to improve overall patient outcomes (Singer et al., 2019; Heyland et al., 2003). EN has an immunomodulation effect, such as preserving the integrity of the gut mucosa, stimulating intestinal motility, thus reducing bacterial overgrowth, and may increase splanchnic blood flow. As a result, bacterial translocation from the gut may be prevented (Capurso et al., 2012). In an ICU setting, EN is the recommended primary choice for nutritional therapy unless there is a contraindication (Singer et al., 2019; Heyland et al., 2003).

Our literature review indicates that early initiation of enteral nutrition within 48 hours can result in numerous benefits as supported by other studies, such as a lower rate of infectious complications, shorter ICU stays, and fewer days spent in the hospital (Harvey et al., 2014; Reignier et al., 2018). Patients receiving EN demonstrated a notable reduction in adverse events such as aspiration pneumonia, emesis, and the need for increased respiratory support. Additionally, they achieved improved nutritional targets, better clinical outcomes, shorter periods of high-flow nasal cannula (HFNC) and oxygen supplementation, as well as a decreased length of hospital stay and mechanical ventilation (Kreymann et al., 2006; Anker et al., 2006). The effectiveness of EN has been linked to a decreased risk of infection and a shorter duration of ICU or hospitalization in various research studies (Hilker et al., 2003; Liu et al., 2020). It was found that even within 5 days of the initiation of enteral nutrition (EN), as studied by Nakayama et al, there was a decrease in the incidence of aspiration pneumonia. Therefore, guidelines recommend enteral nutrition over parenteral nutrition (Guidelines, 2013).

A prospective observational study was conducted by Cintra et al on elderly patients with advanced dementia. The study revealed that the mortality rate at 3 months was 11.1% in the oral feeding group and 41.9% in the alternative feeding group ($p = 0.004$). By 6 months, the mortality rate had increased to 27.8% and 58.1%, respectively ($p = 0.012$). Furthermore, a higher incidence of aspiration pneumonia was observed in the alternative feeding group ($p = 0.006$) (Cintra et al., 2014). A meta-analysis conducted by Moore et al. (1992), indicated that EN groups had a significant reduction in septic complications observed among EN patients.

Parenteral nutrition was frequently administered in cases of acute pancreatitis to prevent pancreatic stimulation. Traditionally, it was thought that delivering nutrition near Treitz's ligament could activate the pancreas and exacerbate the condition of acute pancreatitis (O'Keefe et al., 2003). Approximately 60% of patients with acute pancreatitis exhibit gut barrier dysfunction. Hence, parenteral nutrition appeared to be the

optimal choice for providing sufficient nutritional support without stimulating the pancreas (Wu et al., 2014). Gaitanidis et al. (2022), demonstrated a significant decrease in infection and pneumonia cases among acute pancreatitis patients who received PN feeding, compared to those who received EN or other feeding methods. Additionally, patients who were administered PN had a lower mortality rate. Conversely, in three meta-analyses, enteral nutrition has been found to greatly lower the risk of infections, organ failure, and mortality in acute pancreatitis patients in comparison to parenteral nutrition (Yi et al., 2012; Al-Omran et al., 2010; Hsieh et al., 2019). Further studies are necessary to determine the optimal form and type for pancreatitis patients.

4 Conclusion

The current literature review has shown that enteral nutrition was associated with a reduced risk of aspiration pneumonia and overall infections in critically ill patients. It has been proven to be effective with no major complications. Early enteral nutrition not only protects the gastric mucosa but also decreases the incidence of pneumonia, shortens the duration of mechanical ventilation, reduces the length of ICU stay, and improves the prognosis. These observations strongly support the need for the prospective evaluation of the impact of early enteral nutrition in critically ill adult patients. Further research is required to assess the optimal nutritional approaches in critically ill patients.

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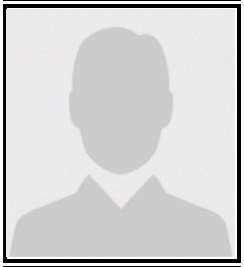

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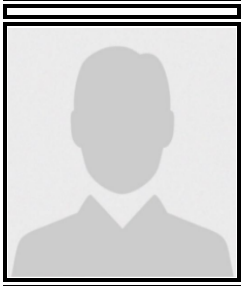

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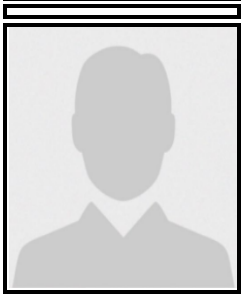

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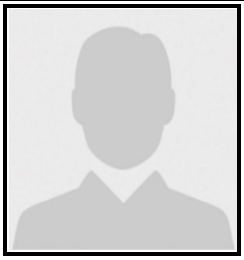

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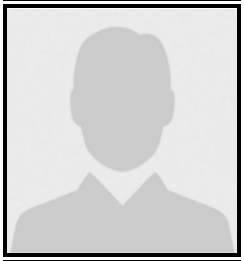

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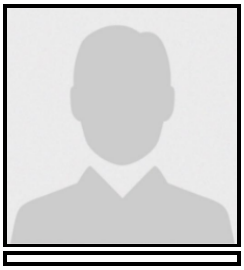

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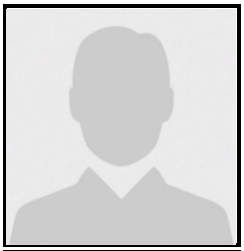

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