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SYSTEMATIC REVIEW

COMPARISON OF ENTERAL AND PARENTERAL NUTRITION IN CRITICALLY ILL PATIENT OF INTENSIVE CARE UNIT: A SYSTEMATIC REVIEW

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Abstract

Background: The enteral nutrition (EN) is the first choice of nutritional support for critically ill patients. Despite the fact that the most common practice is choosing continuous EN, there is a controversy about which is the safest and most effective method of nutrition.

Aim: The aim of this systematic review was the analysis of the effect of EN compared to PN for patients that are hospitalized in ICUs, as a function of the cost and the time of hospitalisation, the hospital-acquired infections, complications and mortality.

Material and Methods: A systematic literature search was conducted in English and Greek language, of published articles during the past 5 years. Articles were unidentified in electronic databases of PubMed, Cochrane Library and latrotek using keywords. Grey literature was also taken involved. Finally, 4 studies were included in the systematic review, after the application of exclusion and inclusion criteria.

Results: Eight hundred thirty-eight articles (838) were recovered using keywords. The studies that were finally included and further analysed consisted of 2 systematic reviews and meta-analyses, one randomised clinical trial, a multicentre controlled randomised trial and a systematic review. The method of nutrition (enteral or parenteral) is not related to mortality. The EN is related to less blood bacterial infections and reduction in the time of hospitalization. On the other hand, it causes more gastrointestinal complications. On average, the cost of parenteral nutrition is higher than intestinal.

Conclusions: The EN is indicated to be the primary nutritional support of ICU-treated patients, with the advantage of reduced haematogenous infections and organ failure, beside the fact that it still is a challenging procedure. Critically ill patients are a heterogeneous group, in which each patient needs a personalised diet, depending on the diagnosis, the time spent in the ICU and the variety of possible complications.

Key words: : Enteral nutrition, parenteral nutrition, critically ill, ICU, intensive care.

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INTRODUCTION

In the general hospitalized population, malnutrition is thought to be common but underappreciated and insufficiently treated. Malnutrition has been recognized as a contributory factor to increased healthcare costs and a potential contributor to adverse outcomes in illness.^{1,2}

Nowadays, it is adequately proven that inappropriate nutrition methods to critically ill patients, along their catabolic phase, have negative consequences on the morbidity and mortality of the patient (due to injuries, sepsis, pancreatitis and various other factors). The nutritional support of such patients aims to the abatement of the catabolic phase and the provision of nutrients for better function of the patients' organisms. The commencement of the feeding, the amount of calories that will be given, the composition and the tract of feeding (enteral or parenteral) are decided, after several crucial factors are taken into account, such as previous illnesses, nutrition state, functionality or dysfunctionality of the digestive system, expected time of the patient being unfed and the needs that are relevant to proteins and calories, all of them depending on the severity and type of the disease.³⁻⁵

Obviously, as long as there is no previous record of malnourishment, the patients can survive 7 days without being fed, but it seems that early EN, even in small amounts, has positive effects, since it prevents intestinal vagal atrophy and the colonization of pathogens in the digestive system as well as reduces morbidity. Moreover, when the digestive system is functional, EN can be chosen as a method of feeding, preferred over PN, due to the former method's lower cost, its lack of morbidity, infections and metabolic complications. Nevertheless, there is a number of complications that could possibly occur if EN is applied such as vomiting, diarrhoea and also difficulty in achieving the calorie goals.^{1,6}

PN should not be applied too early, because it is more expensive, the patients need more frequent laboratory monitoring and is prone to more metabolic and infectious complications. On the other hand, the calorie goals are achieved more easily, it can be administered to patients that have a dysfunctional digestive system and it is the sole alternative for patients who cannot be entirely fed for more than 7 days.⁷⁻⁹

AIM

The aim of the present systematic review was the analysis of the effect of EN compared to PN for patients that are hospitalized in ICUs, as a function of to the cost and the time of hospitalisation, the hospital-acquired infections, complications and mortality.

MATERIAL AND METHODS

We searched for articles that included randomised controlled clinical trials and non-randomised trials, prospective and retrospective cohort studies, systematic reviews and meta-analyses of clinical trials. The articles that were searched were published bilingually (in both Greek & English) during the last 5 years and included the key words "*enteral nutrition, parenteral nutrition, intensive care unit, critically ill*". The databases used were: PubMed, Biomed Central, Cochrane Library and Iatrotek.

The criteria in the selection of the studies were the following:

- Trials where the sample consists of adult patients, who are hospitalised in ICUs.
- Studies that were published in the last 5 years.
- Studies that analyse the topic searched and their subject is relevant to EN and PN.

In addition, we applied the following exclusion criteria:

- Studies that the sample were infants or children, aged less than 18 years old.
- Studies that are not eligible, due to no free access.

The flow chart shows the strategy of selecting the systematic review studies. (Figure 1).

RESULTS

A total of 838 studies were recovered after the use of keywords. Out of the 838 studies, 522 were excluded due to the fact, that were not published during the last five years, with another 237 also being discarded, because the sample did not consist of adult patients. 79 studies were evaluated further, with 44 of them being as it was not possible to retrieve the full text of the article. Lastly, 31 studies because the title and the synopsis were not relevant to the topic we were studying.

The studies that were eventually included and analysed in the

current systematic review are 2 systematic reviews and meta-analyses of randomized controlled clinical trials, a multicentre controlled randomized study and a systematic review.

Zhang et. al at a meta-analysis of 23 randomized controlled studies, concluded that patients that are fed with EN had more digestive complications ($P < 0.00001$), while patients receiving PN had more bactericides ($P = 0.001$). In addition, the time of hospitalization of these patients with EN was minimised (8 studies) and the mortality rate was decreased. Finally, PN was associated to increased chances of occurrence of intestine ischemia and pseudo-obstruction of the colon.

In another systematic review, Lewis et. al included 23 randomised trials and 2 quasi-randomised trials, with a total number of 8816 patients hospitalised in ICUs, determining that the feeding method does not play a crucial role in the occurrence of pneumonia as a complication nor does it affect mortality. EN seems to reduce sepsis, while PN is not a strong factor that prolongs the period of hospitalisation of ICU patients. Lastly, it is unclear whether PN reduces the symptoms of vomiting because the results were insufficient.¹¹

Furthermore, a meta-analysis conducted by Elke et. al on 18 articles highlighted the fact that the use of PN increases the infection complications ($P = 0.004$), the period of hospitalisation in ICU and the hospital ($P = 0.0003$). However, the intake of the required calories is easier with PN which is more expensive compared to EN, but EN is easier accessible. ($P = 0.003$).¹²

A randomised controlled study, funded by the National Institute for Health Research in the UK, stated that mortality rate in patients with EN and PN bore a small difference, with a number of 409 and 339 deaths respectively ($P = 0.57$). Nevertheless, it was observed that patients receiving intestinal feeding suffered from side effects, including vomiting and hypoglycaemia, twice as frequently as those with parenteral ($P < 0.001$), ($P = 0.006$). Lastly, the cost per patient receiving PN was higher, compared to EN with £28,354 and £26,775 respectively.¹³

The methodology and outcomes of the articles included in the current systematic review are summarised in Table 1.

DISCUSSION

Based on the findings of the current study, it is suggested that

the provision of EN is preferable, since it significantly reduces the respiratory infections and the hospitalisation period in the ICU. Feeding via EN contributes to the sustainability of the gastroenterological tube, since not only does it aid digestion, but it also enhances immunity. Nevertheless, certain limitations do exist in the use of this method, as it could possibly lead to extensive hypothrepsia.

On the contrary, critically ill patients fed with PN recovered faster and achieved their calorie goals. Last but not least, a smaller number of the aforementioned patients had symptoms of diarrhoea and vomiting, than the number of patients fed with EN.¹⁰

Lewis et. al came to the conclusion that PN is a strong factor to prolong the time of hospitalisation of critically ill patients in ICU. In a small number of trials, it was noted that the combination of both EN and PN can reduce the mortality rate among patients.¹¹

Taking all of the above into account, no difference was observed with respect to mortality rates between the two methods of nutrition. EN compared to PN led to significant reduction of infectious complications and the hospitalisation period in ICU, with no significant effect on the latter and mechanical ventilation. Yet, the positive impact of the treatment with EN, at infectious morbidity and hospitalisation in ICU could be attributed to the variance of the calories intake between the patients fed with EN and those fed with PN.¹¹

Limitations of studies

In the studies analysed, there was heterogeneity in the sample of patients with regards to the ration of hospitalisation in the ICU. It should also be noted that the studies reviewed and included in the current review were only in English and Greek, possibly excluding related work written in another languages. Access to databases was also restricted to those freely accessible and permitted by academic institutions.

CONCLUSIONS

From existing literature, it seems that enteral feeding is less costly than parenteral. It reduces the risk of infections and possibly the length of time patients stay in the ICUs. The intake of

the necessary amount of calories is not sufficiently achieved and has more gastrointestinal side effects than parenteral nutrition (vomiting, diarrhoea).¹⁴

According to the guidelines proposed by European Society of Intensive Care medicine (ESICM) and American Society of Parenteral and Enteral Nutrition (ASPEN), it seems that HS should be the primary nutritional support for patients treated in ICUs, with the benefit of less bloodstream infections and organ failure. After all, it is a process that remains a challenge. These patients are a heterogeneous group, each requiring a personalised dietary recommendation, depending on the diagnosis, the length of stay in the ICU, and the complications they might experience.^{6,15}

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ANNEX

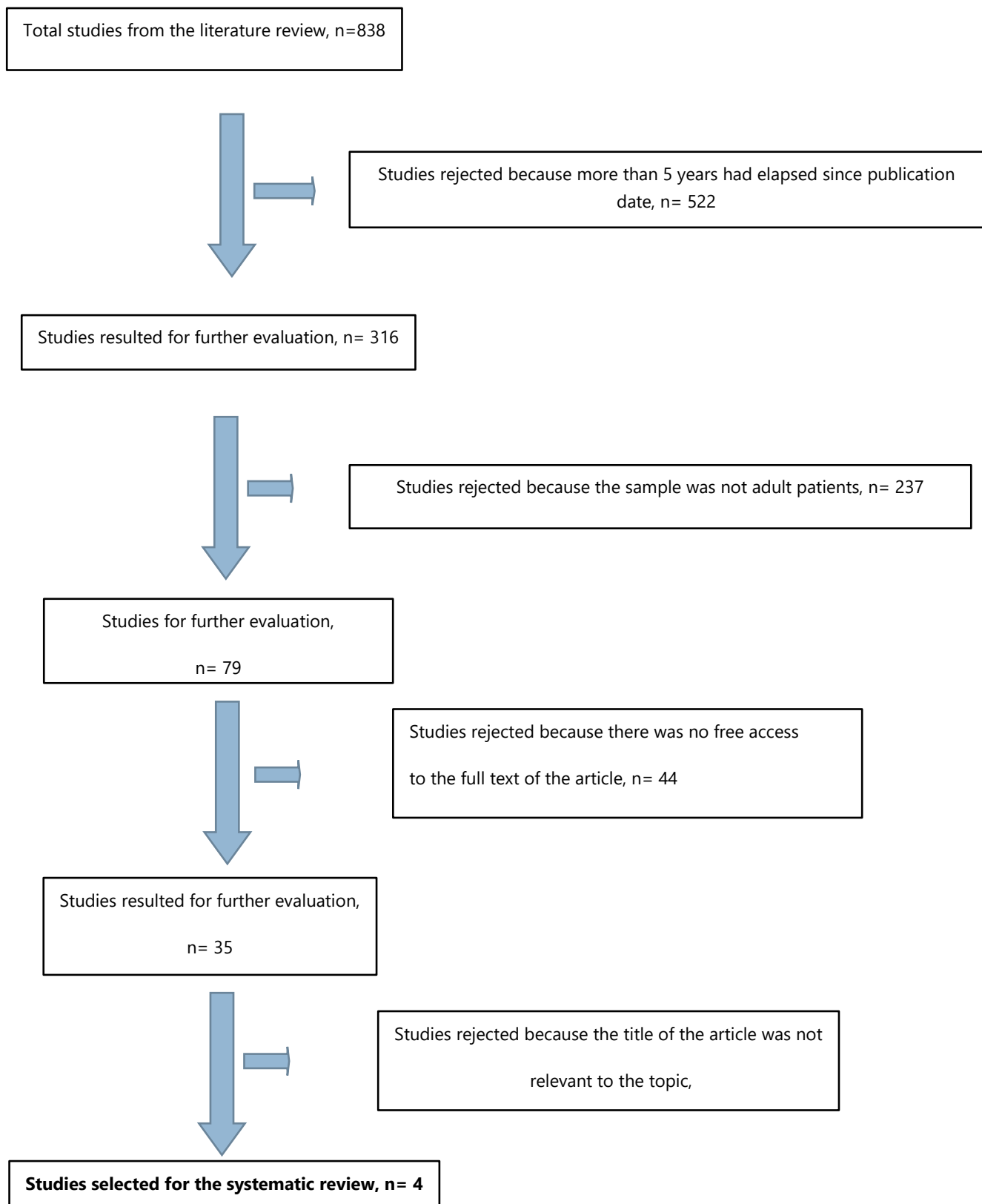
FIGURE 1. Flow chart displaying the steps conducted for the review.

TABLE 1. Characteristics of the studies investigating the feeding methods in ICU.

| AUTHORS, DATE, COUNTRY | AIM OF STUDY | STUDY DESIGN | SAMPLE | DATA COLLECTION | RESULTS |
|-------------------------------|--|---|--|--|---|
| Zhang et. al, 2018, China. | Analysis of the effect of EN compared with EN in ICU patients. | Systematic review and meta-analysis of randomised controlled trials. Descriptive statistics. | 6478 patients hospitalized in ICUs over 18 years of age. | Systematic review of 23 randomized trials published by February 2018 | The method of feeding (enteral or parenteral) is not related to mortality. Enteral feeding is associated with less bacteraemia and shorter hospitalization, but has more gastrointestinal complications. |
| Lewis et. al, 2018, UK. | Assessment of the effects of EN versus PN as well as the combination of the latter on mortality in ICU patients until the 28th day of hospitalization. | Systematic Review. Descriptive statistics | 8816 polytrauma patients in an emergency situation or with postoperative complications hospitalized in ICUs. | 23 surveys. RCTs and 2 quasi-randomized studies. | There is little evidence as to which of the two feeding methods is best in terms of mortality. In a small number of studies it has been found that a combination of both feeding modes reduces mortality. |
| Elke et. al, 2016, Canada. | Assessment of the effect of EN and PN on ICU patients. | Systematic review and meta- analysis Descriptive statistics | 3347 patients over 18 years of age hospitalized in ICU. | 18 RCTs studies published from 1980 to 2016. | The use of MS increases the complications of infections. Getting the required calories is easier with the PN, but it has higher costs and easier access to the EN. |
| Harvey et. al, 2016, UK | Assessment of the effect of early EN compared to PN, in terms of 30-day mortality and cost | Multicentre controlled randomized study. Statistical analysis of data using Stata / | 2400 adult patients hospitalized in ICU within 36 hours. PN n = 1200 and EN n = 1200. | Randomized controlled trial of parallel groups. Integration with the Intensive Care Na- | There was no significant statistical difference in mortality between patients with HS and PN. On |

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|--|---------------|------------------|--|--|--|
| | relationship. | SE version 13.0. | | tional Audit & Re- search Center (ICNARC). | average, the cost of MS is higher than EN. |
|--|---------------|------------------|--|--|--|