



ORIGINAL ARTICLE

## Enteral nutrition volume is not correlated with lower respiratory tract infection in patients on mechanical ventilation

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Received 15 June 2016; accepted 27 September 2016

### KEYWORDS

Enteral nutrition;  
Mechanical ventilation;  
Ventilator-associated pneumonia;  
Gastrointestinal tract;  
Proton pump inhibitors

### Abstract

**Objective:** To evaluate the effect of enteral nutrition volume, gastrointestinal function and the type of acid suppressive drug upon the incidence of lower respiratory tract infections in critically ill patients on mechanical ventilation (MV).

**Design:** A retrospective secondary analysis was carried out.

**Setting:** The Intensive Care Unit of a University Hospital.

**Patients or participants:** Patients  $\geq 18$ -years-old expected to need MV for more than four days, and receiving enteral nutrition by nasogastric tube within 24 h of starting MV.

**Interventions:** We correlated enteral nutrition volume administered during the first 10 days, gastrointestinal function and the type of acid suppressive therapy with the episodes of lower respiratory tract infection up until day 28. Cox proportional hazards ratios in univariate and adjusted multivariate models were used. Statistical significance was considered for  $p < 0.05$ .

**Main variables of interest:** Lower respiratory tract infection episodes.

**Results:** Sixty-six out of 185 patients (35.7%) had infection; 27 patients had ventilator-associated pneumonia; and 39 presented ventilator-associated tracheobronchitis. Uninfected and infected groups were similar in terms of enteral nutrition volume ( $54 \pm 12$  and  $54 \pm 9$  mL/h;  $p = 0.94$ ) and caloric intake ( $19.4 \pm 4.9$  and  $19.6 \pm 5.2$  kcal/kg/d;  $p = 0.81$ ). The Cox proportional hazards model showed neurological indication of MV to be the only independent variable related to infection ( $p = 0.001$ ). Enteral nutrition volume, the type of acid suppressive therapy, and the use of prokinetic agents were not significantly correlated to infection.

**Conclusions:** Enteral nutrition volume and caloric intake, gastrointestinal dysfunction and the type of acid suppressive therapy used were not associated to lower respiratory tract infection in patients on MV.

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## PALABRAS CLAVE

Nutrición enteral;  
Ventilación  
mecánica;  
Neumonía asociada a  
ventilación mecánica;  
Tracto  
gastrointestinal;  
Inhibidores de la  
bomba de protones

## El volumen de nutrición enteral no se correlaciona con las infecciones del tracto respiratorio inferior en pacientes con ventilación mecánica

### Resumen

**Objetivo:** Valorar el efecto del volumen de nutrición enteral, la función gastrointestinal y el tipo de protección gástrica en la incidencia de infección respiratoria del tracto inferior en pacientes críticos con ventilación mecánica (VM).

**Diseño:** Análisis secundario retrospectivo.

**Ámbito:** La Unidad de Cuidados Intensivos de un hospital universitario.

**Pacientes o participantes:** Pacientes con edad  $\geq 18$  años que se espera que precisen de VM durante  $> 4$  días y reciban nutrición enteral en las primeras 24 h.

**Intervenciones:** Correlacionamos el volumen de nutrición enteral administrado durante los primeros 10 días, la función gastrointestinal y el tipo de protección gástrica con los episodios de infección pulmonar del tracto inferior hasta el día 28. Utilizamos el modelo de regresión de Cox. Un valor de  $p < 0,05$  fue considerado estadísticamente significativo.

**Principal variable de interés:** Episodios de infección del tracto respiratorio inferior.

**Resultados:** Sesenta y seis de los 185 pacientes (35,7%) presentaron infección, 27 pacientes neumonía y 39 traqueobronquitis. Los pacientes no infectados e infectados fueron similares en el volumen de nutrición enteral ( $54 \pm 12$  y  $54 \pm 9$  mL/h;  $p = 0,94$ ) y aporte calórico ( $19,4 \pm 4,9$  y  $19,6 \pm 5,2$  kcal/kg/d;  $p = 0,81$ ). El modelo de regresión de Cox mostró que la causa neurológica de VM fue la única variable independiente asociada con infección ( $p = 0,001$ ). El volumen de nutrición enteral, el tipo de protección gástrica y la función gastrointestinal no se correlacionaron significativamente con la infección.

**Conclusiones:** El volumen y aporte calórico de nutrición enteral, la disfunción gastrointestinal y el tipo de protección gástrica no se asociaron a la infección del tracto respiratorio inferior en pacientes con VM.

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## Introduction

Current guidelines recommend early normocaloric (80–100% of daily estimated energy expenditure) enteral nutrition as standard of nutritional care in critically ill patients receiving invasive mechanical ventilation.<sup>1,2</sup> Although the appropriate caloric and protein intake to be provided to critically ill patients remains unclear,<sup>3</sup> recent studies showed that a closer to recommended enteral nutrition intake (also known as full nutrition) given during the early phase of intensive care unit (ICU) stay was associated with a favorable outcome.<sup>4–6</sup>

However, in the ICU setting, full enteral nutrition requires large amounts of enteral nutrition (greater than 85 mL/h)<sup>7</sup> and can induce gastrointestinal dysfunction, expressed by feeding intolerance and/or paralysis of lower gastrointestinal tract: This can be due to different factors, such as mechanical ventilation, use of sedatives, opiates, muscle relaxants and vasopressors.<sup>8</sup> Feeding intolerance represents a key factor in the pathogenesis of lower respiratory tract infection, which is favored by the early use of enteral nutrition and the routine use of acid suppressive drugs to prevent gastric hemorrhage by increasing gastric pH and promoting bacterial overgrowth.<sup>7–12</sup>

The exact role of normocaloric enteral nutrition in acquired infections remains controversial. Whilst a recent study found a direct relationship between the volume of enteral nutrition and the lower respiratory tract infection,<sup>13</sup>

a recently published meta-analysis demonstrated no difference in the risk of acquired infections between patients receiving normocaloric or hypocaloric enteral nutrition.<sup>14</sup>

Therefore, the aim of this study was to evaluate the effect of the volume and caloric intake of enteral nutrition given, the gastrointestinal function and the type of acid suppressive drug on the incidence of lower respiratory tract infection in critically ill patients with mechanical ventilation.

## Patients and methods

### Patients

This was a retrospective secondary analysis of a previously published study that recorded the volume of enteral nutrition given and evaluated the gastrointestinal function in critically ill patients with mechanical ventilation.<sup>15</sup> The study was conducted in a mixed adult ICU from October 2012 to September 2013. For the current study, we specifically recorded in these patients the episodes of lower respiratory tract infection that occurred more than 48 h after initiating mechanical ventilation until day 28 post-ICU admission. Patients 18 years of age or older were eligible for enrolment in the study if they were expected to need mechanical ventilation for more than 4 days and if they were receiving enteral nutrition by nasogastric tube within 24 h of starting

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