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# Endoscopy versus fluoroscopy for the placement of postpyloric nasoenteric tubes in critically ill patients: A meta-analysis of randomized controlled trials☆

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ABSTRACT

*Introduction:* Early postpyloric nasoenteric nutrition is considered an accepted method of nutritional support in critically ill patients. Both endoscopy and fluoroscopy placement of postpyloric nasoenteric tubes (PNTs) have the highest percentages of placement success rate. We aimed to evaluate the differences in efficacy and safety between endoscopy and fluoroscopy methods for the placement of PNTs in critically ill patients.
*Method:* We searched MEDLINE, Embase, and electronic databases of Cochrane Central Register of Controlled Trials. We included randomized controlled trials comparing endoscopy and fluoroscopy placement of PNTs in critically ill patients. Two reviewers assessed the quality of each study and collected data independently. We performed the meta-analysis with Cochrane Collaboration RevMan 5.3.
*Results:* Three randomized controlled trials involving 243 patients were included. There were no significant differences in the placement success rate (RR, 0.99; 95% CI, 0.93, 1.06; $z = 0.20$, $P = .84$,) or procedure time (standardized mean difference, −0.08; 95% CI, −6.93, 6.77; $z = 0.02$, $P = .98$) between the 2 groups. No severe complications (digestive tract hemorrhage, perforation, respiratory problems, hemodynamic instability, or death) were noted in the three studies. There was a slight difference in the incidence of minor complications (RR, 8.12; 95% CI, 1.07, 61.53; $z = 2.03$, $P = .04$) between the 2 groups.
*Conclusions:* Endoscopy and fluoroscopy placement of PNTs can be accurately and safely performed in critically ill patients. Endoscopy may be at least equally as safe as fluoroscopy for the placement of PNTs.


## 1. Introduction

Enteral nutrition (EN) is the most common method used for nutritional support in critically ill patients [1]. Compared with parenteral nutrition (PN), EN can maintain the integrity of the intestinal mucosa, the intestinal mucosal barrier, and immune function [2,3]; has a lower morbidity rate; and reduces direct and indirect medical costs. EN should be initiated within 24 to 48 hours of admission to the intensive care unit after the patient is hemodynamically stable [4].

To deliver EN, the method of EN must be considered. EN via nasogastric tube is, and has been in the past, the main method of administering nutrition to intensive care unit (ICU) patients. However, there are also many patients who do not tolerate nasogastric nutrition, especially those with large gastric residual volumes, gastroparesis, or severe gastroesophageal reflux disease. Postpyloric nasoenteric nutrition (PNN) via a postpyloric nasoenteric tubes (PNT) is useful for resolving these problems [5,6]. A recent meta-analysis including 1496 patients from 20 studies showed that PNN reduces the risk of gastric retention and aspiration pneumonia, can achieve the needs of a higher energy requirement, and is superior to NG nutrition in critically ill patients [7]. Therefore, for those critically ill patients who are intolerant to NG nutrition, PNN is a superior route of nutrition.

Research on the placement methods of PNTs is becoming increasingly more important. Currently, there are several methods for the placement of PNTs [8,9], including bedside, fluoroscopic, and endoscopic techniques. The success rates of these methods are variable, and they may have significantly different complications.

Bedside placement of PNTs is used in many hospitals. Several methods using special techniques for the blind bedside placement of PNTs have been reported, including air insufflation, electromagnetic navigation, and the use of metoclopramide or domperidone [10]. However, the blind bedside methods are time consuming and have varied success rates (27.3%-88%) [11–13]. The success of blind bedside placement of PNTs relies mainly on personal experience and efficiency. It is difficult to judge whether the PNT has been placed through the pylorus without direct or indirect visualization. Radiographic confirmation of the PNT position is required.

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Fluoroscopic PNT placement has been reported in many studies with success rates of more than 90% [14,15]. This placement method does not require additional sedation. Endoscopic PNT placement also has a high success rate. A study by Boulton-Jones et al [16] in 2004 showed that under endoscopy guidance, the placement success rate was over 90%, without severe complications. The application of ultrathin endoscopy is becoming increasingly more popular, and it can be used safely in critically ill patients [17,18]. Therefore, fluoroscopic or endoscopic techniques for PNT placement are the most effective methods when local conditions are appropriate. However, these techniques also have some disadvantages. Regarding the fluoroscopic method, most hospital centers cannot perform this procedure at the bedside. Therefore, patient transportation to a radiology site is required. Intrahospital transportation of critically ill patients is associated with an adverse effect rate of up to 70% [19]. In addition, fluoroscopy exposes patients and staff to radiation. Regarding the endoscopic method, the techniques are often complicated and have a significant learning curve [20].

Therefore, for endoscopic and fluoroscopic placement of PNTs, which method is better? To answer this question, in the present study, we performed a meta-analysis of randomized controlled trials to compare the efficacy and safety between endoscopy and fluoroscopy for the placement of PNTs in critically ill patients.

## 2. Materials and methods

### 2.1. Data sources and search strategy

To identify relevant articles, we searched MEDLINE, Embase, electronic databases of Cochrane Central Register of Controlled Trials, and the references from relevant articles. We selected all relevant articles published from inception to August 2015. The following keywords in different combinations were used: "nasojejunal or nasoenteric or postpyloric" and "feeding or nutrition" and "endoscopy" and "fluoroscopy" and "critically ill patients". These keywords were used as both medical subject heading terms and text words, and articles were limited to randomized controlled trials (RCTs). The language was limited to English. No limits on sample size, gender, or place of study origin were entered in the search.

### 2.2. Study selection

The titles and references from selected articles were examined closely and were determined to be suitable for potential inclusion in the study. For inclusion in the meta-analysis, we selected publications using the following selection criteria: (1) RCTs; (2) hospitalized critically ill patient population; (3) comparison between endoscopy and fluoroscopy placement of PNTs; and (4) evaluation of placement success rate, procedure time, and complications. The primary outcome was success rate, and the secondary outcome was at least one of the following variables: procedure time and complications. Studies were excluded if they were case-only studies or review articles, retrospective studies, letters, comments, case reports, or duplicate publications. All analyses were based on previously published studies; thus, ethical approval and patient consent were not required.

### 2.3. Data extraction and Quality assessment

Two independent reviewers (Haiyan Yin and Xiaoling Ye) screened the titles and abstracts using a structured data abstraction form, which resulted in high and satisfactory interobserver agreement. Any

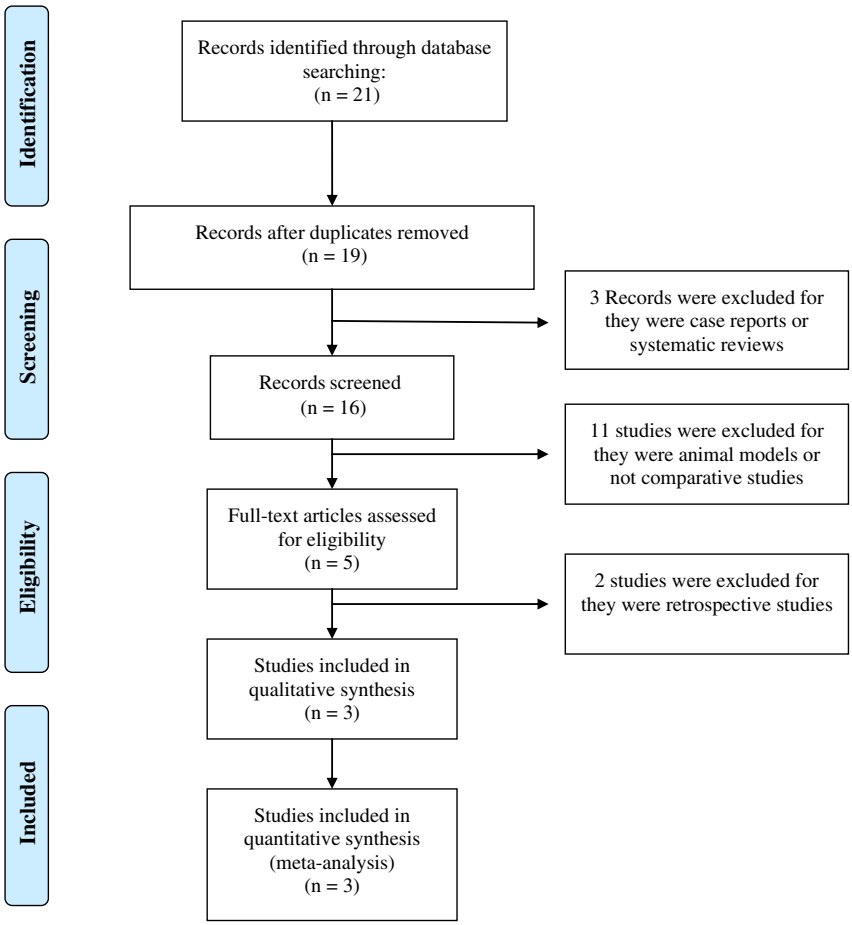


**Fig. 1.** PRISMA flow diagram of the study selection process.