FLUOROSCOPIC AID IN NASODUODENAL TUBE INSERTION: SHOULD IT BE THE LAST CHOICE?

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ABSTRACT

Objective: The aim of this prospective and randomized study was to compare the methods used for the assessment of the nasoduodenal tube position in critically ill patients according to the success rate, time spent on successful placement and cost effectivity.

Methods: Sixty critically ill patients for whom enteral feeding with nasoduodenal tube (ND) was planned, were allocated randomly into 3 groups. The assessment of the location of the ND tube was done by auscultation of the loudest sound location over the right flank in group A, pH determination of the duodenal aspirate in group PH and fluoroscopic view in group F. The failure criteria was the placement of a ND tube in the stomach in all groups, the necessity of having more than two flat abdominal radiographs in group A and PH, the duration of fluoroscopy for more than 10 minutes in group F. The success rate, the time of successful placement and the total cost were determined and compared statistically by using analysis of variance and Fisher's Exact Test.

Results: The success rate was significantly higher in group F (95%). The time of successful placement was significantly shorter in group F (75.15 ± 5.32 min versus 147.95 ± 77.05 min in group A and 177.75 ± 154.84 min in group PH). There was no difference between groups regarding the total cost. A 25% false positive result was found in the PH group i.e. the tube was found to be in the stomach after the radiological evaluation although pH values were > 4.

Conclusion: For critically ill patients in whom enteral feeding is planned with ND, fluoroscopy should be preferred whenever possible for the placement of the ND tube because the success rate is higher, the placement is quicker and it is more cost-effective than the conventional methods.

Key Words: Enteral nutrition, Enteral tube insertion, Fluoroscopy.

INTRODUCTION

Tube feeding should be considered when a patient with a functional gut cannot or will not eat, and a method of access can be safely obtained. The ways of access are obtained by nasogastric or nasoenteric tubes. It was shown that feeding beyond the pylorus with nasoenteric tubes is associated with a significant reduction in gastroesophageal regurgitation and a trend toward less microaspiration (1). However, nasoenteric tube placement generates some difficulties. Spontaneous transpyloric passage of

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the standard feeding tubes after 24 hours is only 30% (2). To overcome these difficulties several manual techniques are developed for the ease of insertion. Zaloga (3), Heiselman (4) and Rujeles (5) developed some of these manual techniques which represent the easiest and least expensive way of gastrointestinal access as it is possible to insert them manually at the bedside in a blind manner. If blind placement is not possible, one may use radiologic assistance i.e. fluoroscopy for post-pyloric nasoenteric tube placement. The fluoroscopic method has good success rates when compared to manual placement techniques (6-8) but seems to be more expensive and time consuming than the other methods and requires transportation to the radiology unit. In this regard, it is reasonable to investigate the overall cost of all these methods and accordingly, this prospective, randomized study has been undertaken to compare the methods used for the assessment of nasoduodenal tube position in critically ill patients.

MATERIALS AND METHODS

The study was approved by our institutional ethic committee and each patient or blood relative gave written informed consent. 60 critically ill neurosurgical patients (operated for intracranial lesions or aneurysms) aged between 20-70 years, APACHE scores 6-24 and for whom administration of a nasoduodenal tube (Abbott Laboratories, 12 F, flexiflo, polyurethane, water – activated lubricant, radiopaque) was planned, were included in the study. The indications for enteral feeding were lack of gag reflex or GCS < 9. The presence of bowel sounds was required. Patients with a history of diabetes mellitus, hepatic or renal failure, spinal cord trauma, electrolyte imbalance, receiving dopaminergic or sedative agents were excluded from the study. All oral feedings or H2 receptor antagonists were stopped at least 6 hours before tube placement to ensure the presence of gastric acidity (9).

In each patient the distance from the xiphoid to earlobe to nose was measured and marked on the tube. Patients were placed in a supine position with their heads elevated to 30° and a prelubricated, polyurethane nasoduodenal tube (10 F) with a stylet was inserted through the selected nostril and advanced into the stomach till the premarked distance was reached. All procedures were performed by a specialized anesthesiologist. The patients were allocated randomly into 3 groups. In the first group (group A) the tube was attached to a three-way stopcock and a 50 mL syringe. The tube was advanced 15-20 cm past the xiphoid-earlobe-nose mark while insufflating 50 mL air into the stomach. As the tube advanced, the change in the location of air bubbles was auscultated through the right flank. When the loudest sound at the possible location of the duodenum over the right flank was heard, the tube was left in place and taped. In the second group (group PH) the tube was again advanced 15-20 cm past the xiphoid-earlobe-nose mark until transpyloric sensation was felt as Rujeles (5) described, suction was applied to obtain a sample of the intestinal contents to be determined for its pH value with blood gas analysis system (IRMA SL, Diametric Medical, USA). If the pH value was > 4, the tube was left in place and fixed, otherwise it was withdrawn 15 cm and a second attempt was made. In the third group (group F) the tube was inserted under fluoroscopic view and when the tube entered the first part of the duodenum, it was fixed. After the procedure, all patients were given 10 mg metoclopramide i.v. to promote gastric motility and extreme right lateral decubitus position with the head in 0° elevation was given during 30 minutes to facilitate the entrance of the tube to post pyloric space. The place of all tubes was confirmed with a flat abdominal radiograph. In all groups the study continued until the tube was seen at least in the first part of the duodenum and the total time spent was recorded.

Failure criterias were as follows: Placement of the tube in the stomach in all groups, the necessity of having more than 2 abdominal radiographs in group A and PH, inability to obtain an intestinal content during suction or to obtain a pH value < 4 during two subsequent attempts in group PH and duration of fluoroscopy more than 10 minutes in group F.

All flat abdominal radiographs were evaluated by a physician who was unaware of the procedure used. The place of the tube was recorded.

The success rate, the total cost and the time of successful placement in all groups were recorded.

The time of successful placement was determined as the time spent from the beginning of the ND tube insertion until the decision made about the correct placement of the ND tube with flat abdominal radiograph in all groups.

Results were expressed as mean ± SD. Significance of differences was determined by using One way ANOVA , Tukey-Kramer Multiple Comparisons test was used to determine pairwise comparisons and binary data were analyzed with Fisher's Exact Test. $P < 0.05$ was considered significant.

RESULTS

The demographic characteristics of patients did not differ significantly between groups (Table I).

No complications such as pulmonary intubation, laryngeal spasm, uncontrolled bleeding in nose or throat or vomiting occurred in any group during the procedure.

In the fluoroscopy group, no complications such as desaturation or hemodynamic instability occured in any patient during transportation.

The success rate was significantly higher in the fluoroscopy group (95%) compared to others (Fig. 1).

The time of successful placement of the tube was significantly shorter in the fluoroscopy group (Table II).

There was no difference between groups regarding the total cost (Table III).

The cost of the methods was as follows: pH measurement 7.5 $, flat abdominal radiograph 10.6 $ and fluoroscopy 27.5 $. The total cost was calculated according to the number of radiographs needed.

We failed to obtain intestinal contents from the tip of the ND tube in 2 (10%) patients and in 5 (25%) patients radiological assessment showed that the ND tube was placed in the stomach although measured pH values were higher than 4.

Table I: Demographic characteristics of patients (mean±SD)

	Group A	Group PH	Group F
N	20	20	20
Age (year)	53.55 ± 17.28	56.10 ± 15.10	48.25 ± 17.70
Gender (M / F)	13 / 7	12 / 8	12 / 8
Weight (kg)	69.60 ± 9.40	67.15 ± 9.70	71.00 ± 11.60
Height (cm)	169.30 ± 12.30	169.30 ± 13.10	170.90 ± 12.40

A: auscultation; F: fluoroscopy; PH: pH value

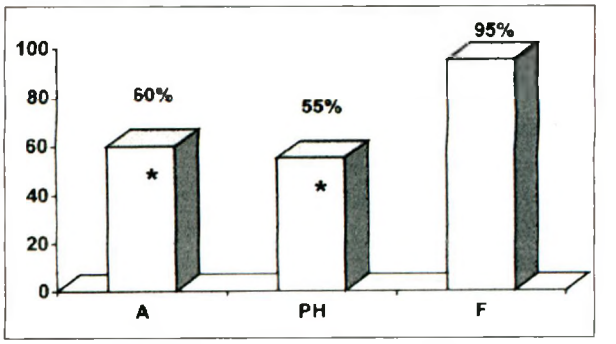

Fig. 1: Success rate
(*p<0.05 compared to group F)
A: auscultation; F: fluoroscopy; PH: pH value

Table II: Time to successful placement

	Group A	Group PH	Group F
Time (min)	147.95 ± 77.05*	177.75 ± 154.84**	75.15 ± 5.32

A: auscultation; F: fluoroscopy; PH: pH value
(*p<0.05 and **p<0.01 compared to fluoroscopy group)

Table III: Total cost

	Group A	Group PH	Group F
Cost ($)	27.06 ± 20.50	43.15 ± 35.00	38.10 ± 0.00

A: auscultation; F: fluoroscopy ; PH: pH value
(p>0.05)

DISCUSSION

According to the results of our study, in patients with decreased gag reflex or decreased GCS, fluoroscopic placement alone seems to be more successful and quicker than auscultation and pH measurement methods.

Many bedside insertion techniques for the passage of nasoenteric tubes beyond the pylorus

in critically ill patients are available. One of them is a "blind" approach with auscultation technique (hearing the progression of the loudest sound locations from left to the right abdomen). The success rate of this technique is reported to be low in many studies (10,11) as well as in our study (60%). Furthermore if inadvertent placement into the lower portion of the esophagus takes place, the sounds may mislead the clinicians (12).

pH guided technique developed by Zaloga, Heiselman and Rujeles (3-5) is another method for the insertion of the nasoduodenal tube. Many studies enrolled to evaluate its efficacy concluded that pH measurement technique is successful only if it is used in the combination with another technique. For example, Metheny et al (13) stated that pH test strip used in combination with a bilirubin test strip improved the ability to differentiate between gastric and intestinal tube placement. The same authors, in another study, concluded that pH measurements in conjunction with determinations of trypsin and pepsin enzyme concentrations in feeding aspirates help to predict the tube position (14). We used pH measurement without a combination with another method and similar to these studies our success rate was low (55%). This method can give false positive results when the tube is misplaced into the lungs as the high pH of samples such as 7.87 obtained from the tip of nasoduodenal tube can be misinterpreted (14). So, it is possible to feed the lungs. We did not have this complication in our study but we had false positive results of about 25 % in PH group. H2 receptor antagonist agents increase gastric fluid pH and this may lead to misinterpretation of the tube position. For this reason we discontinued H2 receptor antagonists 6 hours before the procedure. So false positive results may not be due to the use of these agents but we did not know whether these patients had pyloric insufficiencies causing higher gastric pH values because of the regurgitation of intestinal contents. It is obvious that pH measurement technique when used alone is not reliable in critically ill patients.

Fluoroscopical techniques have also been used and found successful in placing nasoduodenal tubes in patients for whom aspiration risk is high (15). In a retrospective study the tube was fluoroscopically placed distal to the third portion of the duodenum in 86.6% (16). Our success rate was 95% in the fluoroscopy group and this difference in the incidence may be due to the target place of the tube as we planned to place the tube in the first portion of the duodenum whereas in the study of Gutierrez (16) it was planned to be placed in the third portion. Also in the study of Huerta (17) it is advised that nasoenteric tubes should be placed with the guidance of fluoroscopy as the caloric delivery is quicker when compared with the blind technique.

The most important point in all techniques is that proper placement of the tube must be absolutely verified before feeding begins. This verification is usually done by taking a flat abdominal radiograph. One exception for this is the fluoroscopy technique since the place of the nasoduodenal tube is already confirmed during the procedure.

The low success rate of any technique leads to increased radiation exposure for the patient himself as well as for the other patients in the ward and especially for the ICU staff. Beside this untoward effect, multiple plain abdominal radiographs increase the cost of the procedure and consume time. In our study we did not find any significant differences between groups regarding the total cost even though we took an additional abdominal radiograph in the fluoroscopy group as the number of radiographs needed was higher in the pH and auscultation groups.

Another method, endoscopic nasoenteric tube placement has been recently investigated (18,19). This technique has some limitations because the tube may migrate back into the stomach during the withdrawal of the scope, thus it still requires the confirmation with a radiograph.

The use of electromagnetic technique has also been investigated (20). In the study of Kearns (20), the success rate was found to be high, but the tube was accepted to be in place if it was just below the diaphragm. They did not intend to place it in the duodenum.

In overall, the time of successful placement of the tube was longer than it was found in other resembling studies. This delay may be explained

by the difference in time spent for taking portable radiographs in different intensive care units.

Fluoroscopic placement of the nasoduodenal tubes is the preferred method when other attempts fail. According to the results of our study we recommend using fluoroscopic placement of the nasoduodenal tubes in a specific group of critically ill patients such as patients with decreased gag reflex or decreased GCS in the first order, because it is a time saving, successful, and cost-effective method. Furthermore, these advantages combined with low complication risk and less exposure to radiation as there is no necessity for abdominal radiographs, leaves its single disadvantage to be the requirement of transportation of these patients to the radiology unit.

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