Assessing placement of nasoduodenal tube and its usefulness in maintaining nutrition in critically ill patients

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ABSTRACT

Nutritional supplements to the critically ill patients are one of the major issues to be discussed. Enteric feeding is advantageous over parentral feeding because it maintains gut integrity and prevents bacterial translocation. Small intestinal feeding shows significant beneficial results. Nasoduodenal tube placement and its confirmation by serial pH monitoring and by radiological examination was done; and time taken to reach duodenum was assessed. This study was done in 40 critically ill patients, who were divided into two groups (group 1 and Group2). Early enteric feeding via a nasoduodenal tube was found to be preferable with parentral therapy when there are no contraindications. Advantages of nasoduodenal tube feeding in critical ill patients were that feeding can be continued even in the absence of bowel sounds and passage of flatus. Insignificant complications were noted.

Keywords: Nasoduodenal tube, Enteral Feeding, cisapride, metoclopramide, pH.

INTRODUCTION

The concept of nutritional support has evolved over the past decade from the idea of simple delivery of calories and protein to metabolite resuscitation of organs .Recent research has shown that administration of specific nutrients can support gut integrity, minimize liver injury, improve gut, and liver blood flow; hasten wound healing, improve immune function, lower infection rates, and improve outcome.[1]

It has been demonstrated than enteral feeding decreased the atrophy of the luminal brush border of the gut and decrease bacterial translocation from the intestinal lumen to the blood stream.[2] The gastrointestinal tract is the route of choice for nutritional supplementation whenever possible. Small bowel feeding should be initiated with presence or absence of bowel sounds where as parental nutrition requires that hypertonic fluids be infused on a continuous basis. Hypertonic fluids are rapidly thromboses in the peripheral vein. If infused into the superior or inferior vena cava, however, the massive flow of blood at these sites dilutes the inflowing hypertonic solutions sufficiently to avoid thrombosis. Thus the technical success of parentral nutrition depends on the insertion and maintenance of a central venous catheter in the vena cava.

Tube feeding should be considered for patients who cannot or will not eat, for patients who have a functional gut and, and for whom a safe method of access is possible.[3] Conditions where tube feeding is considered include protein energy malnutrition, liver or kidney failure, coma or in patient who cannot chew or swallow (dysphagia) due to stroke, brain tumor or head injury. Patients who are receiving radiation therapy or chemotherapy treatments for cancer may also be candidates for tube feedings. Enteral feeding is associated with fewer complications and less expense than total parenteral nutrition, but it must be monitored carefully to avoid the complications noted by Chang and associates.[4] Appropriately monitored enteral feedings can be successfully administered into the small bowel of most postsurgical and trauma patients, including those who have undergone abdominal surgery and patients with pancreatitis.[5]

Tubes are passed through the nose to various points in the gastrointestinal tract and are named with reference to the location of the terminal end of the feeding tube. Advantages including avoidance of general anesthesia of surgical procedure and low incidence of complication and the disadvantages, risk of aspiration (less with nasoduodenal and nasojejunal[6]), X-ray confirmation of correct tubes placement required and suited only to short-term (less than 6 weeks) use.[7] Tube feeding is a mixture of regular foods which are blended with liquid to make a consistency which will pass through the tube.

Nutrition support should be initiated after 1-2 weeks without nutrient intake. Enteral feeding is preferable to
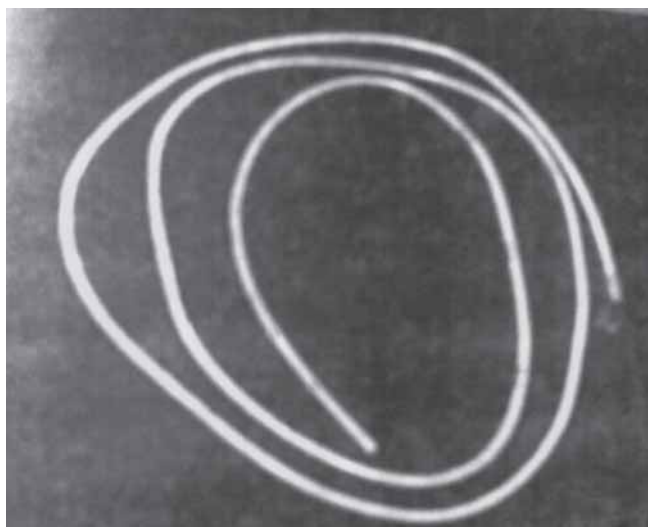
Fig. 1. Flexible silicon coated nasoduodenal tube

parentral therapy provided there are no contraindications,[8] access can be obtained safely, and oral intake is not possible. In some patients combinations of enteral and parentral nutrition may be necessary to meet their nutritional needs.

Nutrients, either a special liquid formula or pureed food, are delivered through a tube directly into the gastrointestinal tract, usually into the stomach or small intestine, to promote tolerance enteral feeding should be initiated at rates of 50cc/hr in adults.[9] Most currently available formulas are isotonic (300mOsm/l) and are well tolerated at full strength when delivered into the stomach or small intestine. The rate of administration of isotonic formulas can usually be advanced in 20-25cc/hr increments every 8 hours .Regarding monitoring; routine nursing care includes checking gastric residuals every 4-6 hours in patients receiving gastric feeding and infusions. They are held for 1 hour, if gastric residual is more than (1.0-1.50) / hourly rate or more than 150 ml before bolus or intermittent feeding.

Formula from the tube can regurgitate in the esophagus and can be aspirated into the trachea and lungs causing aspiration pneumonia.[10] The placement of the tube should be checked frequently and the head end of the bed elevated during and after feeding to prevent the regurgitation of the solution. In case of normal result, patient may be able to transition back to normal diet of solid foods after short term supplementation with formula through a feeding tube.

In case of abnormal results i.e. if formula feedings are not tolerated by[1] the patients or are inadequate to meet his or her nutritional needs, the patient may need to receive nutrition through an intravenous line. Enteral feeding through nasoduodenal tube is useful in critically ill patients in the ICU because of patients underlying chronic and critical illness require frequent nutritional support, since cellular and organ function depends on adequate supply of nutrients for growth and division, enzyme production and activity, carbohydrate, fat and protein synthesis, muscle contraction and relaxation. Nutrients are also needed for more complex physiologic process such as wound repair, neuro-humoral secretion, immune function and gut integrity, regarding estimation of energy requirement. The Harris-Benedict equation derived from indirect calorimeter measurements provides a reasonable estimate of basal caloric requirement.[11]

For female BEE=655+(9.6 x wt)+(1.8 x ht)-(4.7 x age)

For male BEE =66 + (13.7 x wt) + (5 x ht)-(6.8 x age)

The goal of nutritional support in non depleted postoperative patients is to prevent excessive loss of lean tissue whereas in nutritionally depleted patients it is restoration of lean tissue with concomitant restoration of fat reserves.[12]

Calculated basal energy needs should be increased by 30.0% with sepsis. Most of the current literature suggests the majority of clinically ill patients require between 25 and 30 kcal/kg/day.[13] The exceptions to this are burns and trauma patients who may require 40-45kcal/kg/day.[14]

MATERIALS AND METHODS

40 patients were included in the study. All those patients who had passed flatus or demonstrated the presence of bowel sounds and who were admitted in the intensive care unit were included in this study. The patients were divided into two groups, group1 and group2. Each study group comprised of 20 patients who had passed flatus and/or demonstrated the presence of bowel sounds who were expected to need at least 24 hours of ICU stay. These patients were then randomly allocated to two groups.

Group1- received intravenous metoclopramide 10mg 10 minutes before insertion of the nasoduodenal tube.

Table-1: Demographic data of patients

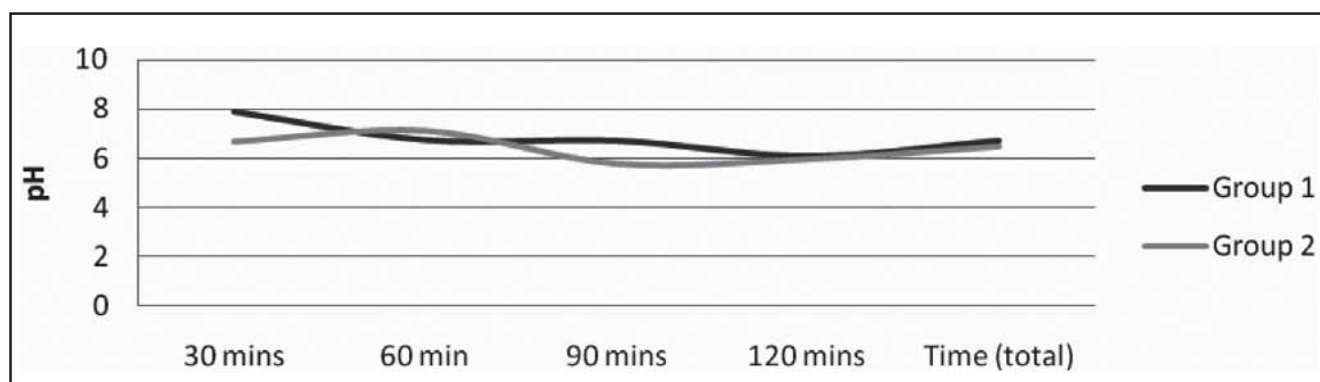| Parameters	Group-1 (no 20)	Group-2 (no 20)	P-value
Age (yrs) Mean ± SD	29.5 ±15.45	26.60 ±12.69	0.557
Weight (Kg) Mean ± SD	51.05 ±7.66	55.35 ±12.34	0.193
Height (Cm) Mean ± SD	153.00 ±11.35	156.50 ±11.35	0.241
BMI Mean ± SD	21.72 ±2.30	22.29 ±2.22	0.429

Fig. 2. Comparison of pH and the time taken to reach the duodenum in the two groups

Group2- received tablet cisapride 10 mg via nasogastric tube 2 hours before insertion of the nasoduodenal tubes.

The nasoduodenal tubes were inserted by supervision of consultants with more than 5 years experience in the ICU. They did not know which group the patient belonged to. Another house officer who was not being aware of the motility agent used then assessed the time required for the tube to reach the duodenum.

Method of insertion of nasoduodenal tube:
Flexible silicon coated 8-10 FG nasoduodenal tube (**Error! Reference source not found.**) was inserted in right lateral position through one of the nostrils and advanced through the pharynx and esophagus to about 50 cm. Then 50 ml of air was injected and the tube was advanced along the greater curvature of the stomach to as close to the pylorus as possible. About 4-5 mm of nasoduodenal tube was let free and fixed at the nose. It was assumed that peristalsis propelled the tube into the duodenum. Passage of tube into the duodenum was confirmed by either radiologically or by the assessment of aspirate from the tube for pH. It was assumed that the tube was in the duodenum if the pH was more than 5.

Table-2: Time taken to reach in duodenum as assessed by change in pH

Time	Groups	n.	Mean (SD)	P-value
Total	1	20	6.74±0.83	0.39
	2	20	6.49±0.93	0.39
30 Minutes	1	2	7.90±0.15	0.17
	2	6	6.69±1.03	0.13
60 Minutes	1	6	6.77±0.44	0.34
	2	6	7.12±0.75	0.35
90 Minutes	1	8	6.74±1.02	0.09
	2	5	5.81±0.63	0.06
120 Minutes	1	4	6.12±0.40	0.81
	2	3	5.99±0.75	0.83

Monitoring
1. Time taken for tube tip to reach duodenum.
2. Influence of intravenous metoclopramide or Tab cisapride given before insertion.
3. Change of gastric pH was estimated hourly by aspirating the gastric/ duodenal contents through the nasally inserted nasoduodenal tube by the ICU nurse and by another independent observer and then noted.
4. The allocated independent observer noted all these parameters.

Investigations and laboratory parameters
1. Confirmation of the placement of the tube was done radiologically.
2. Aspiration of gastric content was done every hour to check for gastric pH through nasoduodenal tube.

Exclusion criteria:
1. Patient with acute pancreatitis.
2. Patient with major abdominal surgery.
3. Patient with absence of bowel sound.
4. Intolerance to enteral feeding.

Statistical analysis
The date was collected from each patient and analyzed statistically at the end of the study using student's t-test and Fischer exact test.

OBSERVATION AND RESULTS
Forty critically ill patients were included in our study, their ages between 13-65 yrs, patients with mean age of group 1 as 29.25±15.45 SD and those of group 2 were 26.60±12.69 SD years. The mean weight of group 1 was 51.05±7.66 and in group 2 was 55.35±12.34. The mean height of group 1 was 153.00±6.63 and in group 2 was 156.50±11.35. The mean body mass index (BMI) of group 1 was 21.72±2.20 and of those in group 2 was 22.29±2.22 (Table-1).

The duration of stay in ICU for patients in group 1 was more than in group 2. However, this difference was statistically not significant.

Table-3: Total time taken to reach the duodenum

Parameters (min)	Groups	n.	Mean (SD)	P-value
Total time taken to	1	20	81.00±27.70	0.164
reach the duodenum	2	20	67.50±32.10	0.163

At 30 minutes after the insertion of the nasoduodenal tube two patients of group 1 had a mean pH of 7.90±0.15 and group 2 had 6.69±1.03. At 60 minutes, group 1 had 6.77±0.44 and group 2 had 7.12±0.75. At 90 minutes, group 1 had 6.74±1.02 and group 2 had 5.81±0.63. At 120 minutes, group 1 had 6.12±0.40 and group 2 had 5.99±0.75. Lastly, a total of 20 patients in group 1 had mean pH of 6.74±0.83 and 20 patients in group 2 had 6.49±0.93 (Table-2 and Fig. 2).

And the total time taken to reach in duodenum in group 1 was 81.00±27.70 and in group 2 was 67.50±32.10. So the average time taken to reach the duodenum was 60-90 minutes in both groups (P-value 0.18) (Table-3).

Five patients of group 1 had tip of the nasoduodenal tube in duodenum and in group 2, only 3 were in duodenum. (Tabke-4 and Fig. 3).

Out of the 40 patient, 15 of group 1 and 11 of group 2 were discharged. Four patients of group 2 left against medical advice (LAMA) for various reasons and 5 of each group died in ICU.

DISCUSSION

Adequate nutrition is essential to replace the nutrients used to meet the energy needs of tissues and to repair tissues being catabolized. In critically ill patients, nutrition is an essential part of treatment. The majority of critically ill patients require between 25-30kcal/kg/day The main advantage of small bowel feeding is that the presence of bowel sounds and the passage of flatus or stool are not necessary to begin post-pyloric enteral feeding.

In our study there were no significant variations in age, sex, height, weight, and body mass index among the study population. The length of stay in the ICU was comparable in both the groups. The time taken to reach the duodenum was observed by recording the pH. In group1, out of 20 patients two patients had nasoduodenal tube in duodenum within 30 minutes and in group2, six patients had nasoduodenal tube in duodenum. Overall in eight out of forty patients (20.0%), the nasoduodenal tube had reached its target destination. In group 1, eight patients had nasoduodenal tube in the duodenum at 90 minutes; and in group 2, five patients had nasoduodenal tube in the duodenum. In group 1 maximum no of patients had nasoduodenal tube in the duodenum

(45.0%). At the end of one and half hours, 33/40 patients had nasoduodenal tube in the place. In group 1 four patients have nasoduodenal tube in the duodenum at 120 minutes and in group 2 three patients had nasoduodenal tube in the duodenum. Only in seven patients it needed two hours for the nasoduodenal tube to reach the duodenum. The mean time taken to reach the duodenum was (as assessed by change in pH to more than 5) was 81.00± 27.70. The minimum time taken to reach the duodenum was 30 minutes (2/20) while the maximum taken was two hours (4/20). In 14/20 patients (70.0%), the nasoduodenal tube reached its destination within 1-1 ½ hours with the use of unweighed tubes.

Kalafarentzoes et al divided pH into three groups: placebo metoclopramide treatment after tube placement and metoclopramide before tube placement.[15] Using an 8 FG tube, intravenous metoclopramide administered 10 minutes before the tube passage resulted in a 90.0% success in a recent study done by Seifert *et al* comparing weighed vs. non-weighed 8 FG tubes.[16] 10mg of metoclopramide was given as an intravenous bolus[17] ten minutes before tube placement. The combination of pre-insertion metoclopramide treatment and unweighted tubes was significantly better.

For the confirmation of the correct placement of the nasoduodenal tube after 2-4 hours of pH confirmation, X-ray abdomen in supine position was done in ten patients, (five from each group). It was found that in group 1, all patients had tip of nasoduodenal in duodenum, while in group 2 only three patients had their nasoduodenal tube in the duodenum. In two patients, the nasoduodenal tube did not reach the duodenum possibly because of procedural failure. The tube repeatedly coiled inside the esophagus (radiologically confirmed), accounting for its non progression into the duodenum. Only ten patients were taken in our study for radiological confirmation because of technical limitations.

Seifert et al had reported in his study that on radiological examination at four hours 84.0-86.0% unweighed nasoduodenal tube passed into the duodenum as

Fig. 3. X-Ray showing the tip of the nasoduodenal tube in the duodenum

Table-4: Radiological confirmation (fisher exact test)

Parameters	Group-1 (No-5)	Group-2 (No-5)	P-value
Radiologically present	5	3	0.22

compared to 36% of weighted tube.[16] In our study in 70.0% of our patients, the unweighed nasoduodenal tubes passed into the duodenum.

In a retrospective study, Gutierrez *et al* found that of 448 patients referred for 882 fluoroscopically guided tube placements during a period of more than one year; the tube was placed distal to the third portion of the duodenum in 86.0%.[17] Three patients with known cardiomyopathy died of arrhythmias, and one patient had a tube malpositioned in the tracheobronchial tree for a major complications rate of 0.4%

Ten years ago, there was a general consensus among critical care medicine physicians that enteral feeding was superior to total parenteral nutrition.[18,19] However, the pendulum has recently swung back to the middle, with most recent recommendations advising early total parenteral nutrition if the patient's gut function is inadequate. The complication rates for total parenteral nutrition and total enteral nutrition are similar.[20]

The present study was carried out in forty critically ill patients who were admitted in the intensive care unit, BPKIHS. Twenty patients received injection metoclopramide 10 mg intravenously 10 minutes before tube insertion. Other 20 patients received tablet cisapride via nasogastric tube 2 hours before insertion of the nasoduodenal tube to improve gut motility for easy passage of nasoduodenal tube to duodenum.

The following conclusions were noted in our study

1. Most often, the time taken for the nasoduodenal tube to reach the duodenum was approximately 60-90 minutes.

2. In spite of having absent of bowel sounds, feeding could be continued via nasoduodenal and the feeding were tolerated. This helped to maintain optimum nutrition without having to take recourse to cost by parentral formulation.

3. One episode of diarrhea was noted in one patient.

In conclusion, it is recommended that early enteral feeding via a nasoduodenal tube preferable with parentral therapy when there are no contraindications. Advantages of nasoduodenal tube feeding in critical ill patients were that feeding can be continued even in the absence of bowel sounds and passage of flatus. Insignificant complications were noted.

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