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Original Article

Aspiration in Tube Feeding Method of Intermittent Drip Bag in the Intensive Care Unit and Trauma Patients

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Abstract

Introduction: Aspiration-induced pneumonia is responsible for 15-20% of hospital infections and a 39% increase in costs. Besides, it is one of the ten leading causes of death in the USA. It can be prevented by choosing the feeding method. This study aimed to assess the incidence of respiratory aspiration using the tube feeding method of intermittent drip bag.

Methods: This one group only post-test study was conducted on 36 ICU trauma patients. The patients were fed using the tube feeding method of intermittent drip bag for three days, each time with 150 to 300 cc liquid nourishing solution for 30 to 60 minutes with three-hour intervals. To detect respiratory aspiration, 0.5 cc of methylene blue 1% was added to 500 cc of the liquid. In case the patients needed suction, whenever the blue color of methylene blue was observed in the lung secretions during suction of the respiratory tube, incidence of respiratory aspiration was ascertained. The data were collected using Demographic information registration form and Clinical Information Registration Questionnaire. Then, the data were analyzed using SPSS V19 and descriptive and analytic statistics.

Results: The results revealed no incidence of respiratory aspiration via the tube feeding method of intermittent drip bag during three consecutive days.

Conclusion: The present study indicated no respiratory aspiration observed using the tube feeding method of intermittent drip bag, this method can be utilized in the centers that are not equipped with feeding pump. Moreover, using feeding bags instead of feeding pumps plays a key role in reducing related costs.

Keywords: Intermittent drip bag method, Respiratory aspiration, Tube feeding, Intensive Care Unit, Trauma.

Introduction

Feeding support is considered a vital component for patients in ICU [1] Due to the patients' disability for obtaining their nutritional needs, they are necessarily supported by artificial feeding carried out through enteral and parenteral methods [2-4] Studies have shown the benefits of enteral feeding over parenteral feeding [5, 6]. Overall, there are four methods in this type of feeding, namely internment bolus, internment drip, cyclic and continuous, which are administered using syringes, feeding bags, and feeding pumps [7-9]. Continuous feeding is done through a feeding pump. And flows in 24 hours at a speed of 20 to 50 ml. The cyclic feeding method includes feeding by feeding pump in less than 24 hours and usually between 8 to 24 hours, and the volume and speed of feeding can vary according to the patient's tolerance. Food is given to the patient for 40 to 60 minutes through a pump

or feeding bag under gravity in the intermittent feeding method. Alternative feeding with gravity is usually better tolerated during gastric feeding. In this feeding method, 240 to 720 cc of nutrients are given to the patient 4 to 6 times a day. Feeding is done for 4 to 10 minutes through a syringe with a volume of 240 cc in the bolus method [8]. Tube feeding may also have disadvantages, such as pneumonia [6, 9] that can be partially controlled by selecting the best feeding method [10, 11]. Studies have shown that the risk of pneumonia was four times higher in the patients with aspiration [12, 13]. Statistics also indicated that the incidence rate of aspiration-induced pneumonia was 7-62% in the patients fed by tube. Overall, the feeding method is considered a critical risk factor for pulmonary aspiration [14-16] . Although many studies have been conducted on feeding methods, there is still no consensus on the safest feeding method in critically ill patients [16, 17].

Feeding is commonly performed using syringes in many ICU cases. Syringe feeding is done in most cases at an inappropriate rate and pressure, which results in severe consequences, such as respiratory aspiration [18, 19]. On the other hand, in the drip feeding method using feeding bags, the rate and pressure of feeding solution are lower, and probably its consequences are less severe [18, 20].

Given the diversity of studies and the results, the question of which diet method is preferable for ICU patients is still unanswered. There is evidence of choosing the best feeding method that leads to fewer complications. It shows that researchers have not yet reached a theoretical consensus on this issue. This issue has become a controversial issue. Gastrointestinal nutrition has been used in patients in intensive care units for many years, and its policy, although periodically changing and updated, and although the body of evidence is growing, is controversial and uncertain. It's about choosing the best method. Despite the widespread use of intermittent and continuous tube feeding methods, it is still ambiguous to reasonable these methods. However, very little data is currently available to offer serious advice on choosing a particular procedure of gastrointestinal nutrition [1, 6, 13].

Objective: the present study aimed to determine the respiratory aspiration incidence rate in the intermittent drip feeding method using feeding bags.

Methods

The current study is a one group-onlyposttest study to determine the respiratory aspiration incidence rate in intermittent drip feeding method using feeding bags among the patients admitted to ICU, and trauma. This study was conducted on 36 patients admitted to general ICU, neurology ICU and Trauma wards of educational hospitals of Guilan, Iran, for 4 months. Before initiation of the study, approvals from the Ethics Committee of Guilan University of Medical Sciences (Ethics code: 10229) and Iranian Registry of Clinical Trials (Clinical trial number: IRCT201009214787N1) were secured. The patients who met the criteria were enrolled in the study after obtaining consent from their legal guardians.

Based on the study by Hasanzadeh and considering power=90%, p=0.02, and d=0.05, a 32-subject sample size was determined for the study [11]. Yet, considering the loss rate of 15%, the sample size was increased to 36 subjects. The inclusion criteria were as follows: hospitalization in ICUs and trauma ward, not having the a history of allergy to methylene blue, not suffering from renal problems, lack of deficiency in G6PD enzyme [21], being 15-65 years old, Glasgow Comma Scale (GCS) $\leq$ 9 [22], having respiratory tubes (endotracheal tube and tracheostomy), having a connection to ventilators [23], Synchronized Intermittent Mandatory Ventilation (SIMV) ventilation mode, using the Positive End Expiratory Pressure (PEEP) of 3 to 7 and Pressure Support (PS) of 10 to 15 and nasogastric feeding. Likewise, all patients had to be in the same condition receiving sedative drugs. Even so, the patients were excluded from the study in case of discharge, transfer, change of feeding

mode, severe digestive effects, and any record of sensitivity to methylene blue.

Demographic information registration form and Clinical Information Registration Questionnaire were used for data collection. This questionnaire was extracted from the instrument developed by Hassanzadeh (2002) [11]. To determine the content validity of the questionnaire, it was given to four anesthesiologists of Guilan University of Medical Sciences and 11 faculty members of Shahid Beheshti School of Nursing and Midwifery, Rasht city, Iran. Then, their comments and suggestions were collected and the necessary revisions were applied. The reliability of the questionnaire was calculated using the kappa agreement coefficient and was equal to 89%. The data gathering form consisted of two parts. The first one included the patients' demographic information that was filled out by the researcher. This part also involved feeding information. The second section contained information related to the feeding method of the research units during the three Consecutive days.

The sampling process started at 9:00 A.M. each day and ended at 9:00 A.M. the third day. The volume of liquid nourishing materials was determined according to the doctor's order. Once the samples were selected, and the gavage process was initiated for the patients seven times a day with 3-hour intervals (each takes 30 to 60 minutes) through the entire study period. It must be noted that the 3:00 A.M. gavage was not performed since the patients were fasting because of the morning tests. Through the gavage operation, 150 to 300 cc of the liquid feeding material was fed via gavage through a feeding bag attached to the serum facility at the minimum height of 12 inches above the patients' stomach using the gravity force. All the feeding bags were changed after 24 hours. Before performing each feeding process, the gastric residual volume was examined, and in case it exceeded 100 cc, the feeding process was interrupted, and the patient was removed from the study. On top of that, the cuff pressure of the respiratory tube was measured and adjusted at 25 mmHg. The patients were in a 30° head-bed position and one hour after application gavage.

To detect respiratory aspiration, 0.5 cc of methylene blue %1 solved in 500 cc of the feeding material was added by the researcher to all the solutions prepared by the hospital kitchen. In case the patients needed suction, whenever the blue color of methylene blue was observed in the lung secretion during suction of the respiratory tube by the researcher's assistant, the incidence of respiratory aspiration was determined.

This study was approved by the Ethics Committee of Guilan University of Medical Sciences, Guilan, Iran (code: 10229). After receiving a recommendation letter from the authorities of the university and faculty, the researchers entered the research environment and explained the objectives and importance of the study to the related authorities, patients, and their legal custodians, and reassured them about the confidentiality of their information, and afterward obtained their written informed consent for their participation. The subject participants were ensured that can leave the research study anytime, and their privacy was respected and protected during the entire process.

The collected data were entered into a computer, encoded, and analyzed by descriptive and inferential statistics using the SPSS statistical software (v. 19). To study the normal distribution of the data, the Kolmogorov-Smirnov test was applied. Additionally, the chi-square test was used to assess the relationship between respiratory aspiration and age, gender, level of consciousness, airway type, airway size, diagnosis, and nasogastric tube size. What is more, the variations of gavage duration and the gastric residual volume in different trials were evaluated using repeated-measures ANOVA. After determining the significance of the results of Mochly test, the results of Greenhouse-Geisser, Huynh-Feldt, and lower bound were reported. As no significant difference was found among the results of these three tests, the Greenhouse-Geisser test was the dominant method utilized by the early works [24] wherein the present

study researchers also based the reports of their results.

Results

The mean age of the study participants was 45 years. Also, most of the participants were female, and the most common endotracheal tube size was 7.5. Not to mention, the length of the nasogastric tube was 16 in the majority of the participants. Nonetheless, none of the participants had size 14 nasogastric tubes. Further, half of the study subjects were diagnosed with intracranial hemorrhage and some with other disorders. Additionally, the participants' mean consciousness level was 5±1.72, the mean PEEP and PS values of the ventilator system were 3.4±1.73 and 10±1.54, respectively (Table 1).

The mean feeding times in the first, second, and third 24 hours were 46.21±3.21, 46.05±2.88, and 46.78±2.77 minutes, respectively (Fig. 1). Also, the participants' means of gastric residual volume in the first, second, and third 24 hours were 6.94±4.22, 7.02±3.67, and 6,66±3.69 cc, respectively (Fig. 2).

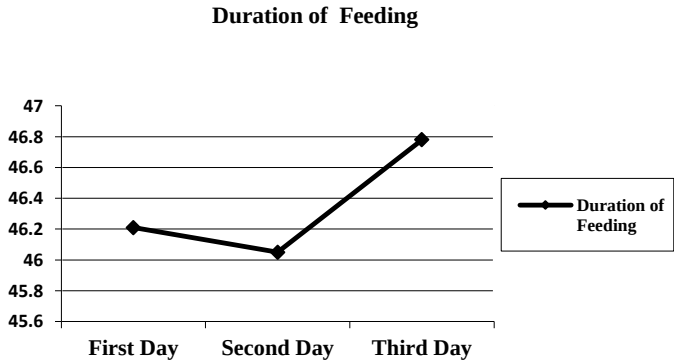

Figure 1: The mean feeding time of the research participants during the three successive days.

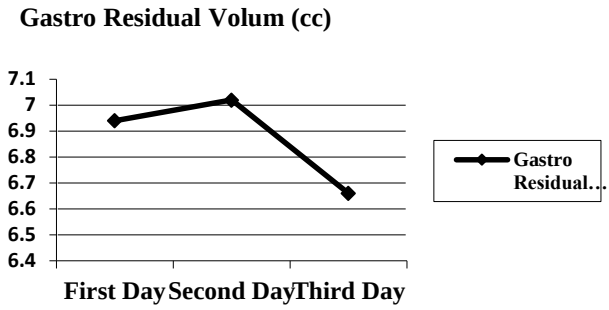

Figure 2: The mean gastric residual volume of the research participants during the three successive days

Table 1: Demographic and clinical characteristics

Diagnosis	N (%)
Intracranial hemorrhage	18 (50)
Cerebrovascular attack	6 (16.66)
Brain tumor	3 (8.21)
Abdominal pain	2 (5.62)
Multiple trauma	2 (5.62)
Peritonitis	5 (13.85)
Sex	
Female	19(52.79)
Male	17(47.21)
NGT	
18FR	5 (13.89)
16FR	31(86.11)
14FR	0(0)
Artificial airway	
Endotracheal tube	30(83.29)
Tracheostomy	6(16.71)
Size of artificial airway	
7	7(19.46)
7.5	18(50)
8	11(30.54)
Age(year)	45(13.97)[a]
GCS	5 (1. 72)[a]
PS	10(1.54)[a]
PEEP	3.4(1. 73)[a]
Feeding Times(minute)	
First 24 hours	46.21±3.21
Second 24 hours	46.05±2.88
Third 24 hours	46.78±2.77
[a] Mean (SD) GCS, Glasgow comma scale; PS, pressure support, PEEP, positive end expiratory pressure	

Considering methylene blue records in the patients' airway secretions, no incidence of respiratory aspiration was observed among the patients in the first, second, and third 24 hours.

Repeated-measures ANOVA was used to survey the participants' means of feeding time and gastric residual volume at different time points. Regard to the significance of the Mochly test results (p=0.001), the Greenhouse-Geisser correction test was applied to the research data, revealing no significant difference among the patients' means of feeding time (p=0.83) and gastric residual volume (p=0.95) at various trials. Results showed that the incidence of respiratory aspiration in subjects in three consecutive days was zero. Likewise, the results of the chi-square test indicated no significant relationship between the risk of respiratory aspiration with age, gender, level of consciousness, airway type, airway size, nasogastric tube size, and diagnosis.

Discussion

The present study indicated that none of the research participants experienced respiratory aspiration during the three consecutive days. Early studies showed that the incidence of respiratory aspiration was higher in the tube feeding method of intermittent bolus (86.5%) compared to intermittent drip (13.5%)due to the fact that feeding speed can increase bloating and distension of the stomach, which cause to increasing the incidence of respiratory aspiration (12, 24). On the other hand, some other studies have demonstrated no difference between bolus and continuous tube feeding methods regarding the incidence of respiratory aspiration [1, 13, 18] that is probably because of meticulous techniques, careful monitoring, strict patient matching, and conservative amounts of diet employed in both situations [6, 17].

Despite that, the results of some studies were different from those of the present study. For instance, MacC Lave et al. (2005) on trauma patients hospitalized in ICUs showed that tolerance of the nutrient materials was higher in the patients receiving bolus method using a syringe in comparison to those undergoing the continuous process [25]. In that study, the patients were fed with percutaneous endoscopic gastrostomy (PEG), gastric, and nasogastric tubes, and two groups were not matched in this respect. Thus, better food tolerance in the intermittent bolus group might be attributed to the position of the patients fed through PEG tubes in this group because this method reduces the incidence of aspiration in patients [26].

Notwithstanding, Bowling et al. (2008) conducted a study on the effect of continuous and bolus feeding methods on gastroesophageal reflux and gastric emptying in healthy volunteers and indicated no significant difference between these two methods for duration of gastric emptying and pulmonary aspiration [27] . The lack of difference between bolus and continuous feeding methods regarding gastro-esophageal reflux indicated that both methods were equally safe for the risk of aspiration [6, 17, 18, 27].

Conclusion

Due to the lack of respiratory aspiration in the intermittent drip feeding method, this method can be used as a standard feeding method in intensive care and trauma wards and reduces the risk of aspiration. However, due to the different results in this field, more research is needed to determine the safest method of nutrition, and comparing it with other methods is suggested.

Limitation

This study had some limitations. The first limitation was its small sample size, so more comprehensive works are recommended to be conducted on larger sample sizes in several other locations. The second limitation was related to the diagnose of pulmonary aspiration. Still, the pepsin method has been suggested to the diagnosis of respiratory aspiration due to its high sensitivity. though it was not done in this research because of the lack of the necessary equipment. The absence of a control group was also another concern about this work.

Consequently, another study is recommended to be conducted on two groups for a closer look.

Implications for Practice

This method can be applied in health centers that are not equipped with feeding pumps. Using feeding bags instead of feeding pumps also results in a considerable decrease in expenditures.

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Conflict of Interest Disclosures

None declared.

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Authors' Contributions

Noushin Mousazadeh, Tahereh Khaleghdoost Mohammadi, designed the study and analyzed the data. Hamideh Hakimi and Maryam Dehghani gathered and interpreted the data. Sadra Ashrafi, and Maryam Dehghani wrote the whole manuscript and Sadra Ashrafi also revised it carefully. All autthors confirmed the final edited version of the manuscript.

Ethical Statement

The current study was approved by Guilan University of Medical Sciences and registered in the Iranian Registry of Clinical Trials No. IRCT201009214787N1. Although patients' participation in the research was voluntary, and they informed written consent was obtained from them.

References

1. Ichimaru S, Amagai T. Intermittent and bolus methods of feeding in critical care. Diet Nutr Crit Care. 2015;2:533-48.
2. Jabbar A, McClave SA. Pre-pyloric versus post-pyloric feeding. Clinical nutrition. 2005;24(5):719-26.
3. Potter PA, Perry AG, Kerr JC, Wood MJ. Canadian fundamentals of nursing: Mosby/Elsevier Canada; 2009.
4. Wilson S, Madisi NY, Bassily-Marcus A, Manasia A, Oropello J, Kohli-Seth R. Enteral nutrition administration in a surgical intensive care unit: achieving goals with better strategies. World Journal of Critical Care Medicine. 2016;5(3):180.
5. Scurlock C, Mechanick JI. Early nutrition support in the intensive care unit: a US perspective. Current Opinion in Clinical Nutrition & Metabolic Care. 2008;11(2):152-5.
6. Sheng L, Yin L, Peng D, Zhao L. From best evidence to best practice: enteral nutrition from continuous nasal feeding in stroke patients. International Journal of General Medicine. 2020;13:927.
7. Allaire J, Thompson WO, Cash BD, Galt DJ. A quality improvement project comparing two regimens of medication for colonoscopy preparation. Gastroenterology Nursing. 2004;27(1):3-8.
8. Ichimaru S. Methods of enteral nutrition administration in critically ill patients: continuous, cyclic, intermittent, and bolus feeding. Nutrition in Clinical Practice. 2018;33(6):790-5.
9. Metheny NA. Preventing respiratory complications of tube feedings: evidence-based practice. American Journal of Critical Care. 2006;15(4):360-9.
10. Fang Y, Ma Y, He H, Chen T, Zhu J. Preventive Strategies for Feeding Intolerance in Patients with Severe Traumatic Brain Injury in China: An Online Cross-Sectional Survey. 2021.
11. Hasanzadeh H, Alikhani M, Seidoshohadaei M, Hosseini F. Comparative study of two methods of tube feeding in neurosurgical patients. Iran journal of nursing. 2002;15(32):88-92.
12. Metheny NA, Clouse RE, Chang Y-H, Stewart BJ, Oliver DA, Kollef MH. Tracheobronchial aspiration of gastric contents in critically ill tube-fed patients: frequency, outcomes, and risk factors. Critical care medicine. 2006;34(4):1007.
13. Mosazadeh S, Khaleghdost T, Hasavari F, Lili EK, Dehnad A. Comparing the incidence of respiratory aspiration between two tube feeding methods of intermittent bolus and intermittent drip bag. Iranian Journal of Critical Care Nursing. 2012;5(1):11-6.

14. Ardehali SH, Fatemi A, Rezaei SF, Forouzanfar MM, Zolghadr Z. The effects of open and closed suction methods on occurrence of ventilator associated pneumonia; A comparative study. Archives of academic emergency medicine. 2020;8(1).
15. Mamun K, Lim J. Role of nasogastric tube in preventing aspiration pneumonia in patients with dysphagia. Singapore medical journal. 2005;46(11):627.
16. Patel JJ, Rosenthal MD, Heyland DK. Intermittent versus continuous feeding in critically ill adults. Current Opinion in Clinical Nutrition & Metabolic Care. 2018;21(2):116-20.
17. Lee J, Kwok T, Chui P, Ko F, Lo W, Kam W, et al. Can continuous pump feeding reduce the incidence of pneumonia in nasogastric tube-fed patients? A randomized controlled trial. Clinical Nutrition. 2010;29(4):453-8.
18. Nasiri M, Farsi Z, Ahangari M, Dadgari F. Comparison of intermittent and bolus enteral feeding methods on enteral feeding intolerance of patients with sepsis: a triple-blind controlled trial in intensive care units. Middle east Journal of digestive diseases. 2017;9(4):218.
19. Wang Y, Zhu W, Luo B-r. Continuous feeding versus intermittent bolus feeding for premature infants with low birth weight: a meta-analysis of randomized controlled trials. European journal of clinical nutrition. 2020;74(5):775-83.
20. Mosazadeh S, Khaleghdoost Mohammadi T, Hasavari F KNLE, . Study the chance of respiratory aspiration in intermittent bolus tube feeding in ICU and Trauma ward patients. Journal of Holistic Nursing And Midwifery. 2011;21(2):40-6.
21. Gibson HA. Using mnemonics to increase knowledge of an organizing curriculum framework. Teaching and Learning in Nursing. 2009;4(2):56-62.
22. Maurya I, Pawar M, Garg R, Kaur M, Sood R. Comparison of respiratory quotient and resting energy expenditure in two regimens of enteral feeding–continuous vs. intermittent in head-injured critically ill patients. Saudi journal of anaesthesia. 2011;5(2):195.
23. Komiya K, Ishii H, Kadota J-i. Healthcare-associated pneumonia and aspiration pneumonia. Aging and disease. 2015;6(1):27.
24. Plichta SB, Kelvin EA, Munro BH. Munro's statistical methods for health care research: Wolters Kluwer Health/Lippincott Williams & Wilkins; 2013.
25. McClave SA, Lukan JK, Stefater JA, Lowen CC, Looney SW, PJ M. Poor validity of residual volumes as a marker for risk of aspiration in critically ill patients. Crit Care Med. 2005;33(2):329-32.
26. McClave SA, Gualdoni J, Nagengast A, Marsano LS, Bandy K, Martindale RG. Gastrointestinal dysfunction and feeding intolerance in critical illness: do we need an objective scoring system? Current gastroenterology reports. 2020;22(1):1-8.
27. Bowling TE, Cliff B, Wright JW, Blackshaw PE, Perkins AC, Lobo DN. The effects of bolus and continuous nasogastric feeding on gastro-oesophageal reflux and gastric emptying in healthy volunteers: a randomised three-way crossover pilot study. Clinical Nutrition. 2008;27(4):608-13.