THE EFFECTS OF DIFFERENT NASO-GASTRIC TUBE FEEDING FLOW RATES ON GASTRIC MEAL TRANSFERENCE.

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Retained gastric residue is one of the most frequent complications found in naso-gastric tube fed patients. This problem also leads to abdominal discomfort and malnutrition. A correct feeding prescription is therefore needed. Nurses have direct responsibility for this matter. The purpose of this study is to compare the effects of different naso-gastric tube feeding flow rates between 3 ml/min and 10 ml/min on gastric meal transference in patients at Siriraj Hospital. Ten patients were selected to be the subjects of the study and were observed for gastric residual quantity by the investigator. The data was collected during February to March 2001 and analyzed by mean and percentage. Each subject was fed twice a day for 2 days by two different rates, at 3 and 10 ml/min in random order. The data was recorded during the daytime, by recording the amount of gastric residue at 4 hours after starting the feeding of each meal and the patients' complaints following each feeding.

In this study it was found in this study that the quantity of gastric meal transference after receiving the 10 ml/min rate was 99.55% greater than the quantity of gastric meal transference after receiving the 3 ml/min rate which was 84.19%. Bowel sounds after receiving the 10 ml/min rate was 7 times/min higher than the bowel sound after receiving the 3 ml/min rate which was only 3 times/min. There were no complications in both rates.

It is recommended that the flow rate of 10 ml/min should be implemented for paralytic naso-gastric tube patients. This feeding rate can also be implemented in other groups of naso-gastric tube patients.

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อริสรา สุขวัจนี : ผลของการให้อาหารทางสายให้อาหารที่มีอัตราการไหลที่ต่างกันต่อการเคลื่อนของอาหารผ่านกระเพาะอาหาร (THE EFFECTS OF DIFFERENT NASO-GASTRIC TUBE FEEDING FLOW RATES ON GASTRIC MEAL TRANSFERENCE) คณะกรรมการควบคุมสารนิพนธ์ : เพ็ญศรี ระเบียบ, M. S., อรพรรณ โตสิงห์, D.N.S. 51 หน้า
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ภาวะอาหารเหลือค้างในกระเพาะอาหารเป็นหนึ่งในภาวะแทรกซ้อนที่พบได้บ่อยในผู้ป่วยที่ได้รับอาหารทางสายให้อาหาร ปัญหานี้จะนำมาซึ่งความไม่สุขสบายภายในช่องท้องและภาวะทุพโภชนาการในผู้ป่วยอีกด้วย การให้อาหารทางสายให้อาหารที่ถูกต้องและเหมาะสมจึงเป็นสิ่งที่จำเป็น ซึ่งพยาบาลนับว่าเป็นบุคคลที่ต้องรับผิดชอบโดยตรงในเรื่องนี้ การศึกษาครั้งนี้ มีวัตถุประสงค์เพื่อเปรียบเทียบผลจากการให้อาหารด้วยอัตราการไหล 3 มล/นาที กับ 10 มล/นาที ต่อการเคลื่อนของอาหารผ่านกระเพาะอาหารในผู้ป่วยโรงพยาบาลศิริราชจำนวน 10 คน โดยใช้แบบบันทึกข้อมูลที่ผู้ศึกษาสร้างขึ้นเพื่อบันทึกจำนวนอาหารเหลือค้าง เก็บข้อมูลระหว่างเดือนกุมภาพันธ์ถึงมีนาคม 2544 วิเคราะห์ข้อมูลโดยการคำนวณค่าเฉลี่ยและร้อยละ ตัวอย่างแต่ละรายจะได้รับการให้อาหารด้วยอัตราการไหลที่แตกต่างกัน 2 อัตรา ในอัตราละ 2 มื้อเป็นเวลา 2 วัน และได้ทำการดูดวัดปริมาณอาหารเหลือค้างในกระเพาะอาหารหลังจากเวลาเริ่มต้นให้อาหารแต่ละมื้อนาน 4 ชั่วโมง พร้อมทั้งสังเกตภาวะแทรกซ้อนที่เกิดจากการให้อาหารแต่ละอัตราการไหล

จากการศึกษาพบว่าเมื่อผู้ป่วยได้รับการให้อาหารด้วยอัตราการไหล 10 มล./นาที ปริมาณอาหารที่เคลื่อนผ่านกระเพาะอาหารมีปริมาณ 99.55% ซึ่งเป็นปริมาณที่มากกว่าเมื่อให้ในอัตราการไหล 3 มล./นาที (84.19%) จำนวนเสียง Bowel sound หลังได้รับการให้อาหารด้วยอัตราการไหล 10 มล./นาที เป็น 7 ครั้ง/นาที มากกว่าจำนวนเสียง Bowel sound หลังได้รับการให้อาหารด้วยอัตราการไหล 3 มล./นาที ซึ่งเท่ากับ 3 ครั้ง/นาที และไม่พบภาวะแทรกซ้อนจากการให้อาหารทั้งสองอัตรา

ข้อเสนอแนะจากการศึกษา คือ การให้อาหารทางสายให้อาหารด้วยอัตราการไหล 10 มล./นาที ควรนำมาปฏิบัติกับผู้ป่วยที่ได้รับอาหารทางสายให้อาหารและมีการเคลื่อนไหวที่จำกัด นอกจากนี้การให้อาหารด้วยอัตรานี้ยังสามารถนำไปปฏิบัติกับผู้ป่วยที่ได้รับอาหารทางสายให้อาหารกลุ่มอื่นได้ด้วย

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CHAPTER I

INTRODUCTION

Background and Significance of the Study

Retained gastric residue is one of the most frequent complications found in naso-gastric tube feeding patients. From the statistical data of patients with naso-gastric tube feedings who were admitted to Ramathibodi Hospital, Bangkok, it was found that the incidence of retained gastric residue was 7.39% (Jittipun, S., 1979 : 59). This problem also led to abdominal discomfort and malnutrition. A correct feeding prescription is therefore needed. Nurses must be ones who have direct responsibility for this matter.

There was evidence to support that the accumulation of gastric residue in naso-gastric tube feeding patients was related to the duration of gastric emptying. The longer the duration of gastric emptiness, the greater the amount of gastric residue (Wechapas, S., 1977 : 153-4 ; Luckman & Sorensen, 1980 : 1389). In order to solve this problem, the strategies to promote gastric meal transferable is recommended.

In regular nursing practice, there is no definite rate for naso-gastric tube feeding among immobilized patients. However, the flow rate is usually adjusted to be as slow as it could be, for example, 3 ml/min. This result might lead to many problems. The slow flow rate of tube feedings yeilds a very tiny meal volume. This tiny meal volume cannot stimulate gastric squeeze effectively therefore peristalsis decreases and gastric meal transference also decrease. Retention of gastric residue frequently results in fermentation and might cause diarrhea. From the above reasons,

the investigator realizes the importance of promoting gastric meal transference in naso-gastric tube feeding patients by offering a proper gastric tube feeding flow rate.

The investigator decided to choose the 10 ml/min flowrate as compared with the 3 ml/min flow rate because the liquid meal for feeding (Isocal or Blenderized) could be controlled to flow in time. In accordance with the literature review, it was suggested that the proper gastric tube feeding flow rate for tube feeding patients should be at the rate of 10 ml./min. At this rate, it is believed that gastric meal transference would be increased (Griggs & Hoppe, 1979 : 485 ; Gramse, 1983 : 22 ; Brunner, 1984 ; 787 ; Jones, 1984 : 45).

Statement of Problem

1. Does the 10 ml/min naso-gastric feeding flow rate offer a quicker gastric meal transference than the 3 ml/min naso-gastric feeding flow rate?

2. Does the 10ml/min naso-gastric feeding flow rate offer a stronger gastric squeeze than the 3ml/min naso-gastric feeding flow rate?

3. Does either the 10 ml/min naso-gastric feeding flow rate cause complications ?

Conceptual Framework

Pathophysiologic concepts regarding gastric movement for gastric meal transference is used to illustrate the conceptual framework of this study. The efficiency of this process depends on meal volume, that will push on the gastric wall and cause a squeezed stomach. This leads to gastric juice gland secretion. Gastrin hormone secretion and medulla motivation increases both frequency and strength of

gastric squeeze. The meal will be pushed against the pyloric sphincter and will be transfered to the duodenum. Therefore, a quick feeding (10 ml/min) will increase gastric pressure for transfering the meal through the pyloric sphincter while a slow feeding (3 ml/min) cannot induce gastric pressure for transfering the meal through the pyloric sphincter. Also, it can be concluded that patients who receive a quicker feeding rate (10 ml/min) will show less amount of gastric residue than ones who receive a slower feeding rate (3 ml/min) (Figure 1).

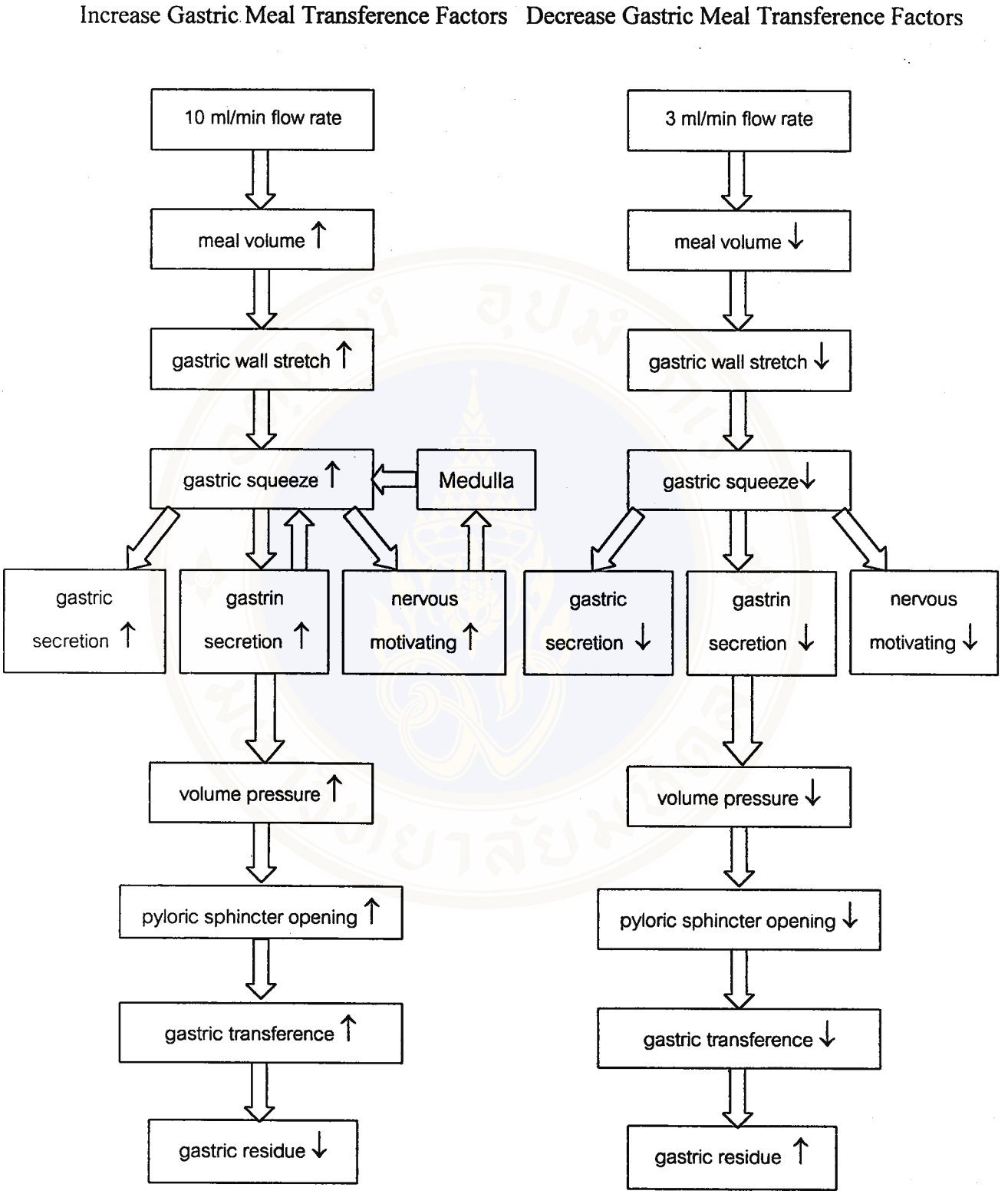

Figure 1 : The conceptual framework of 3 ml/min and 10 ml/min flow rates on gastric meal transference.

Purposes of the Study

The purpose of this study was to study the effects of different naso-gastric tube feeding flow rates on gastric meal transference and the complications from these flow rates.

Scope of the Study

This study was to compare the 10ml/min naso-gastric tube feeding flow rate to the 3ml/min naso-gastric tube feeding flow rate on gastric meal transference in immobilized naso-gastric tube feeding patients. The participants in this study were immobilized naso-gastric tube feeding patients who were admitted to the medical wards of Siriraj Hospital, Bangkok.

Expected Outcomes and Benefits

1. To improve the naso-gastric tube feeding technique for patients.

2. To encourage nurses to realize the significance of nursing intervention for gastric residue prevention in naso-gastric tube feeding patients.

3. The intervention from this study can be used as a guideline for nursing practice in regard to naso-gastric tube feeding patients.

4. The intervention in this study can be modified and used in another groups of patients who require naso-gastric tube feeding.

Definition of Terms

The definition of terms in this study are given as follows :

1. Naso-gastric tube feeding refers to feedings through a naso-gastric tube by giving a certain amount of liquid diet (Isocal). In this study, the means for naso-gastric tube feeding was feeding by a commercial enteral feeding set which the rate and the amount of liquid diet can be accurately controlled.

2. Gastric residue refers to the gastric content drawn by a 50ml. glass syringe after a 4-hour feeding.

3. Gastric meal transference refers to the quantity of meal transference calculated by minusing the quantity of meal feeding with the quantity of gastric residue after a 4-hour feeding.

4. Naso-gastric feeding complications refer to gastrointestinal complications observed in the feeding time of each different flow rate such as diarrhea, aspiration and vomiting.

CHAPTER II

LITERATURE REVIEW

This study focused on the effects of different naso-gastric tube feeding flow rates on gastric meal transference in naso-gastric tube patient who were admitted to the medical ward, Siriraj Hospital, Bangkok, Thailand. The investigator reviewed the related literature and research on the following topics :

1. Patients who reguire naso-gastric tube feeding.
2. Naso-gastric tube feeding methods and remarks.
3. Naso-gastric tube feeding complications.
4. Naso-gastric tube food formulas.
5. Gastric meal transference.
6. Content condition.
7. Gastric meal transference factors.
8. Naso-gastric tube feeding flow rate research.

1. Patients who require naso-gastric tube feeding.

Naso-gastric tube feeding is a measure to offer meals for patients who cannot consume food orally. Patients who require naso-gastric tube feeding include :

1.1 Patients with alternation of consciousness : These patients cannot help themselves to eating because of cerebral nervous system dysfunction. They need help in activities of daily living which include feeding. These patients such as

cerebrovascular disease, Renal failure or Heptatic failure. (Griggs & Hoppe, 1979 : 485 ; Skidmore, 1980 : 287).

1.2 Dysfunction of swallow organ, such as patients who have injury of face and jaws, myoma in oral cavity or throat, oral mucositis, wound operation of head, throat or have tracheaostomy tube. (Gordon, 1982 : 78).

1.3 Weakness of swallow muscle, such as paralytic patients or Myasthenia gravis patients. (Brunner, 1984 : 773).

2. Naso-gastric tube feeding methods and remarks.

Three methods and remarks for naso-gastric tube feeding.

2.1 Bolus feeding is quickly feeding with 50 ml. glass syringe, 40-80ml/min. The benefit of this type of feeding is it will save time because nurses can observe flow feeding themselves and be suitable for ambulated patients who can perfrom self tube feeding. The method of bolus feeding is also un-complicated. However, there are some limitations of bolus feeding. The great amount of gastric meal volume from bolus feeding may induce sudden gastric wall expansion and stimulate gastric nerve-receptors. Then the stomach produce a strongly squeeze which may lead to stomachache, diarrhea, vomiting and aspiration (Hymsfield & Andrew, 1985 : 4363). Besides this some patients may have quickly great gastric meal transference that makes them become dizziness, vomiting, weary and confusion. This symptom is called "Dumping syndrome" (Metheny,1985:47-50;Tosakulkaew,C., 102).

2.2 Intermittent feeding is hanging enteral feeding set of meal as intravenous fluid by gravity. The slow rate takes 20-60 min/time for 4-6 times/day and patients should be received not greater than 300 ml/time. The benefit of this type

of feeding is patients can move their body while receiving a meal feeding, especially rehabilitated patients. It will save nurses' time and energy, without holding the glass syringe. Patients receive a meal feeding on a time schedule because nurses will have adequate time to attend to them. The limitation of this feeding is if nurses give a very slow rate or more than 1 hour/feeding for each meal. There will be a separation of feeding meal which will occlude the enteral feeding tube. Therefore, the meal cannot flow. This problem might lead to fermentation of the feeding meal or might lead to a delayed feeding. (Tunpaijit, W., 1977 : 99 ; Konstantinies & Shronts, 1983 : 1317).

2.1 Continually feeding is hanging an enteral feeding set of meal to provide continuous flow of a feeding meal for a very long time of about 16-24 hours. The feeding flow rate is very slow at 1-2 ml/min by infusion pump controller. The benefit of this type of feeding is it is suitable for patients who have serious problems with digestion such as partial gastrectomy, gastric ulcer, and maldigestion patients. A little of the meal will flow slowly into the stomach and it does not irritate the stomach ulcer or the surgical ulcers in the stomach. However, hanging a meal for a long time might cause fermented meal from bacterial catamination. In addition, this meal separation and meal viscosity may cause a blockage of meal flow. Nurses should examine the patient every half an hour (Griggs & Hoppe, 1979 : 485 ; Jones, 1984 : 43-6). Patients can not move their body and lie down because they have to maintain a high head position, which is very uncomfortable for them.

3. Naso-gastric tube feeding complications.

It can be concluded from review research and literature related to naso-gastric feeding that there are many complications of naso-gastric tube feeding.

3.1 Diarrhea. Diarrhea is the problem that is most frequent and commonly found in patients with naso-gastric tube feeding. (Gormican & Liddy, 1973 : 72-5) The etiology of diarrhea in naso-gastric tube feeding include :

3.1.1 Bacterial contaminated meal. Bacterial contaminated meal is the major cause of diarrhea among naso-gastric tube patients (Anderson, 1986 : 704 ; Hoppe, 1980 : 80). Nurses should be careful for cleanliness during feeding such as hand washing, not touching the inside of enteral feeding set, avoid hanging the meal with enteral feeding set for over 6 hours and not feeding over a 24-hour-prepared meal. The study of Fason (1967) (cited in Anderton, 1983) about the meal in disposable feeding bags showed that the left over meal over 24 hours had $1.7X10^6$ bacteria/ml, including with klebsella, E. Coli, enterobacter, proteus, psudomonas aeruginosa and moraxella. Anderton suggested that environmental temperature of more than 20-25 $^{\circ}C$ is suitable for bacterial growth. Feeding for a long time causes bacterial growth in body temperature. If the flow of the mens is blocked and causes a separated meal, the viscosity of the meal is left at body temperature 37$^{\circ}C$ which is suitable for bacterial growth (Anderton, 1983: 433). Nurses should be aware of this problem.

3.1.2 Thick blendable meal. Anderson (1986) argued that thick blendable meal causes diarrhea, because there is a diffusion of water from plasma which has osmolarity of 300 mOsm to meal feeding, which has an osmolarity more than plasma. The stomach and intestines have more water and the water is not reabsorbed by the intestine. It increases gastrointestinal movement and leads to diarrhea (Anderson, 1986 : 704).

3.1.3 A quick feeding. From an experiment in 10 volunteers between 20-35 years of age and 3 feeding rates (30, 60 and 85 ml/min) it was found that the feeding with the rate of 85ml/min had a significant effect on gastrointestinal movement. It increased gastrointestinal movement. (Heitkemper, 1977 : IA).

3.1.4 Lactose in feeding formula usually induces diarrhea. The regular feeding formula usually contains lactose. This nutrients needs the enzyme "lactase" to digest. Commonly, patients who are over 60 years old do not have the enzyme " lactase", and they are prone to diarrhea after a feeding them with a lactose feeding formula (Tunpaijit, W., 1977 : 91).

3.1.5 Deep naso-gastric tube insertion. The end of the tube is inserted into the duodenum instead of the stomach, causing dumping syndrome. (Gormicar & Liddy, 1973 : 72)

3.1.6 Medications such as antacids have ingredients of magnesium and aminophylin. Medications for heart disease such as quinidine and propanolol can cause diarrhea. (Tunpaijit, W., 1977 : 92).

3.2 Fluid and electrolyte imbalance. This is caused by diarrhea or receiving a thick blendable meal. Dehydration should be a concern in elderly patients and unconscious patients which have uremia and electrolyte imbalances. Kubo's (1976) study in 121 naso-gastric feeding patients, 48 female 73 male, 14-90 years of age, found that after these patients received a meal feeding for 343 days, 14 cases had sodium in their blood of more than 145 mEq/L, but 44 cases had sodium in their blood of less than 130 mEq/L (Standard level is 130-145 mEq/L). Most patients (25%) had signs of dehydration with uria and nitrogen in blood (BUN) about 65-82 mg% in 65% of the patients, which is called azotemia of the tube feeding syndrome (Kubo, 1976 :

913-15). It is necessary to add fluid to release body waste products (Brunner, 1984 : 773).

3.3 Aspiration. It is always caused by vomiting, sudden gastric expansion, inproper patients' position, and inproper feeding methods, Aspiration is also found in patients with damaged swallowing and diminished gag reflex (Hill, 1981: 85). Aspirated pneumonia is a sequelae of feeding aspiration, and also found as a major cause of death (Taylor, 1982 : 50). From Taylor's (1982) study, 13 patients, 19-64 years old, 5 cases received intermittent feedings, 7 cases received continuous feeding, and the last one received intermittent feedings for 7 days and changed to receive continuous feedings for 15 days. He found that 17% of intermittent feeding patients had aspiration and then had aspiration pneumonia. However, this evidence was in 25% of the continuous feeding patients (Taylor, 1982 : 54).

When there is aspiration, patients always cough, have high fever, dyphnea, and an irregular heart rate. Because of weakness and unconsciousness, patients are at risk to have pneumonia from aspiration (Jones, 1984 : 43). This complication can be prevented by having patients lie in a fowler's position with their head level 45°- 60° during the feeding and for 1 hour after the feedings (Coyle & Arbit, 1978 : 50). It is important to observe for the flatulent sign and drawn gastric residue before each feeding (Griggs & Hoppe, 1979: 485; Hill, 1981: 85).

3.4 Nausea, vomiting, and flatulent. If during a naso-gastric feeding from retained gastric residue, it should be stopped and postponed for 1-2 hours (griggs & Hoppe, 1979 : 485).

3.5 Malnutrition. There are 2 types of malnutrition.

3.5.1 Undernutrition. Patients with naso-gastric tube feeding are at risk to lose body-weight (Hill, 1981 : 85). If the meal formula has low vitamins and low calories, patients will have malnutrition. There are 3 factors that cause malnutrition among naso-gastric tube feeding patients, Firstly, from too slow gastric meal transference (60 ml./hr.) which was found among 7.39% of patients with naso-gastric tube feeding. Secondly, undernutrition or undercalories of the feeding formula which was found among 3.58% of patients with naso-gastric tube feeding. Lastly the medical prescription to stop feeding some treatment such as operation or other invasive investigation procedures (Jittipun, S., 1979 : 9).

3.5.2 Overnutrition. Naso-gastric tube feeding may also lead to overnutrition. Patients who confined to bed usually reqire only 2,000 calories per day. However, in some settings, bed-ridden patients receive naso-gastric tube feedings of more than 2,000 calories per day which may cause overnutrition (Tunpaijit, W., 1978 : 107 ; Posawun, P., 1984 : 198).

3.6 Emotional problem. Patients receiving naso-gastric tube feedings for a long time lack motivation in taste or swallowing because they do not see, smell and swallow the meal (Griggs & Hoppe, 1979 : 487 ; Bernard, 1984 : 563).

4. Naso-gastric tube food formulas

Naso-gastric tube food formulas be easy to digest, have easy absorbtion, and rich in vitamins (Krause & Mahan, 1979 : 707). Besides, naso-gastric tube food formulas should have characteristics as follows :

4.1 Rich of nutrient needed by patients (Krause & Mahan, 1979 : 707).

4.2 Having protein, carbohydrate, and fat, each 100 calories have 15-20% protein, 40-45% carbohydrate, and 35% fat (Gormican & Liddy, 1973 : 73).

4.3 Having suitable osmolarity, blood osmolarity stable at 300 mOsm. (Brunner & Suddarth, 1984 : 777 ; Kubo, 1976 : 813). Some formulas have an osmolarity of more over than 400 mOsm. (Anderson, 1986 : 705). These should be kept at a slow rate for diarrhea avoidance. In same content of Metheny (1985) who reported that giving high osmolarity food should be kept at a slow rate at 25-30 ml/hr (Metheny, 1985 : 48), but Winborn (1977) disagreed with this reason. He concluded that the meal osmolarity is not concerned with diarrhea (Winborn, 1977 : IA).

4.4 Meal formulas should be 1 calorie/ml, not more than 1.5 calories/ml because it may cause dehydration (Gormican & Liddy, 1973 : 73).

4.5 Cleaness without contamination. Anderton (1983) recommended to Gill's study (1971) and Broom's study (1981) that salmonella and gram positive bacteria were found in the meal during preparation (Anderton, 1983 : 426). The meal feeding should not be hanging for longer than 6-8 hours (Jones, 1984 : 46).

4.6 Suitable viscosity of meal. If high viscosity, the meal can not flow through the naso-gastric tube easily. Elia (1984) found that viscosity of the meal is related to meal flow rate but it does not relate to meal temperature (Elia, 1984 : 166).

There are 3 types of naso-gastric meal formula, as follows :

1. Milk base formula. It has milk products which presently should not be given to lactose intolerant patients because they lack the lactase enzyme (Tunpaijit, W., 1977 : 94).

2. Blenderized formula. This is the favorite to give to patients because it have calories and enough nutrients enough for patients' needs. It is convenient to prepare and has a low cost. It is prepared by blending meats, vegetables, fruits, eggs, oil, salt and sugar with an electric blender (Tunpaijit, W., 1977 : 94).

3. Commercial formula. It is produced by the food industry. It is convenient to give to patients but it has a high cost (Koustantinides & Shront, 1983 : 1315).

5. Gastric meal transference

When the meal falls into the stomach, the meal volume pushes the gastric wall which has 3 layers, longitudinal outer, circular middle, and oblique inner (Sukawat, S., 1980 : 426). Having different gastric muscle walls causes gastric squeeze, which motivates parietal cells for hydrochloric acid secretion (pH 0.8), and it motivates chief cells for pepsinogen secretion (pH 1-1.2). These enzymes will digest protein inside the stomach (Sukawat, S., 1980 : 454).

Gastric squeeze will motivate parasympathetic nervous fibers of the gastric wall send to the medulla in the brain and it causes more gastric squeeze. The gastric gland will increase the gastric secretion (Tosokulkaew, C., 1998 : 72).

Gastric squeeze motivates G-cells of the antrum part and pyloric part of the gastric wall to secrete gastrin hormone. Gastrin hormone will motivate parietal cells to and chief cells to secrete hydrochloric acid and pepsinogen, which increases gastric wall squeeze. Besides, gastrin hormone effects pyloric sphincter relaxation. A meal in the stomach will be pushed into the duodenum for intestinal absorption (Wechapas, S., 1977 : 169).

Gastric meal transference starts as soon as the meal comes into the stomach in a few minutes. The greater the volume of the meal, the more gastric meal transference. Regular meals with semisolid texture will transfer in 3.5-4.5 hours but liquid meals will transfer out of the stomach faster. If the greater volume of the meal

accumulates the more gastric meal transference. It is believed that the factor which control gastric meal transference is gastric wall tension (Wechapas, S., 1977 : 153-4).

6. Content condition

After the meal mixes with gastric juices, it becomes liquid and can be easily pushed through the pyloric sphincter into the duodenum. Carbohydrates which are digested from the alpha-amylase enzyme in saliva, it will be inhibited by acid gastric juices. However this enzyme can act in the stomach for about half an hour and then the carbohydrate will be digested by the alpha-amylase enzyme from the pancreas. protein will be digested by pepsin enzyme, which digests collagen fibers of muscle cells. It digest the collagen fibers until tender and these fibers will be broken by gastric squeeze. Fat is not soluble in water. It forms a larger fat drop in the stomach and will be broken to little drops by gastric squeeze which increases surface for gastric lipase digestion (Tosakulkaew, C., 1998 : 220-31).

7. Gastric meal transference factors.

The following are the factors that influence gastric meal transference.

7.1 Type of meal. Liquid meal is transfered out of the stomach faster than a solid meal. Carbohydrates are transfered out of stomach faster than protein and fat. Fruity juice and chocolate is transfered slowly (Sirihongthong, W. & Posri, C., 1984: 278). Glucose which has 505 mOsm. osmolarity make a 3 times slower transference than 33 mmol. (Sodiumcitrate is in equal quantities) (Erskine & Hunt, 1981 : 339).

7.2 Meal quantity. A large quantity will accumulate gastric meal transference because gastric wall tension controls gastric meal transference (Luckman & Sorensen, 1980 : 1389).

7.3 Meal quantity in the duodenum. When there is a meal in the duodenum, reflex action will inhibit gastric contraction and cause slow gastric meal transference. Hunt & Macdonald (1954) compared the quantity of gastric meal transference in 2 times an found that the second rate of meal transference was more than the first one (Hunt & Macdonald, 1954 : 472). In 1980 Erskine and Hunt studied 10 volunteers and found that the greater the quantity of the meal caused greater quantity of meal transference (Erskine & Hunt, 1981 : 340). Sirihongthong and Posri's (1984) study of 15 unconscious naso-gastric tube feeding patients found that the time of the meal feeding did not effect gastric meal transference (Sirihongthong, W. & Posri, C.,1984 : 286).

7.4 pH level of the meal which is transfered into the duodenum. A strong acid meal causes enterogastric reflex which inhibits gastric movement. Gastric meal transference will slow down (Tosakulkaew, C., 1998 : 199).

7.5 Enterogastrone hormone level. Fat causes this hormone to be secreted the from duodenal wall and inhibit gastric movement. Gastric meal transference will be slowed down and the gastric gland can not secrete gastric juice (Brunner & Suddarth, 1984 : 757 ; Luckman & Sorensen, 1980 : 1389).

7.6 Secretin hormone level. Secretin hormone is secreted from the duodenal wall. It inhibits gastric squeeze but the gastrin hormone activates gastric movement. It is accumulates gastric meal transference (Luckman & Sorensen, 1980 : 1388 ; Brunner and Suddarth, 1984 : 757).

7.7 Gastric reflex action. Athough gastric meal transference is controlled by the first part of the duodenum, the end part of duodenum has ileogastric reflex action when it is full. The meal motivates the anus (anogastric reflex) that effects the gastric meal transference to slow down (Tosakulkaew, C., 1998 : 201).

7.8 Meal temperature. Taylor (1982) recommended the study of William and Walike in that monkeys found that meal temperature had an effect to gastric movement in only the first 6 minutes (Taylor, 1982 : 49). Bateman (1982) found that orange juice of 12°C 500 ml could be transfered out of stomach at 250±35.1 ml or 50% in 5 minutes. Orange juice at 37°C at an equal quantity was transfered out of the stomach at 307±25.8 ml or 61.4% ($p<0.05$) (Bateman, 1982 : 461). Kagawa (1980) found that 2 out of 6 volunteers had stomach cramps and diarrhea after they received a meal at 8-11°C of meal for 6-9 hours. There was no evidence in the meal at 36-39°C and 23-26°C. He concluded that meal temperature was not a significant effect to gastric movement, meal gastric transference and complications. However, cold meals for feeding should wait until its temperature is equal to room temperature (23-26°C) or should be given at a slow rate at 8 ml/min (Kagawa, 1980 : 270 -80).

7.9 Too fast of a rate. This causes many complications such as diarrhea, stomach cramps or aspiration pneumonia. It effect patients' nutrition and patients' rehabilitation (Heitkemper, 1977 : IA). Elia (1984) studied the factors that effect meal flow rate and found that the meal flow rate was related to the pressure of the length and width of naso-gastric tube feeding. The tube's width that was 1-1.2 mm. could double the meal flow rate, where as the tube's width that increased to 1-2 mm. could increase the meal flow rate 10 times (Elia, 1984 : 156-66).

7.10 Position and head level of patients. Right tilt position effects gastric meal transference faster because the stomach has a structure like a J, the right lesser curventure distances cardiac sphincter to pyloric sphincter is shorter than the left greater curventure. Antrum is the lower part near pyloric sphincter so that meal was transfered to the duodenum faster than left-side position (Sukawat, S., 1980 : 426-54 ; Sirihongthong, W. & Posri, C., 1984 : 279).

7.11 Age. Evan (1981) studied 11 people between 78-86 years old and 7 people between 22-31 years old. He found that age is a significant factor that effects gastric meal transference ($p<0.001$). The younger people used 49.7 minutes but the older used 123.2 minutes (Evan, 1981 : 230). Brauer, Slavin and Marlett (1981) found that there was no difference in gastric meal transference between the younger and the older (Brauer, Slavin & Marlett, 1981 : 1061).

7.12 Medication. When medications are given with a meal, it increases meal osmolarity. A small meal can be absorbed and long gastric residue effect slows drugs' action. Sedative drugs suppresses the cerebral central nervous system which causes a slow gastrointestinal squeeze. Antibiotic drugs which are produced from bacterial protein can damage gastric acid. Salty drugs will naturalize gastric acid (Smith, 1985 : 39).

7.13 Other factors, such as diabetes makes the autonomic nervous system disturbance, which depresses gastrointestinal movement and the patients can have nausea, vomiting and stomachache (Funnell & Mc Nitt, 1986 : 268).

8. Naso-gastric tube feeding flow rate research.

Heitkemper (1977) found that the suitable flow rate for naso-gastric tube feeding is 30-60 ml/min, not 85 ml/min flow rate in meal feeding which has a quantity of more than 350 ml.(Heitkemper, 1977 : IA). He also found that the frequency and strength of gastric squeeze will increase after receiving a meal feeding in 6-12 minutes at about 3-4 times/min. After half an hour stomach squeeze was about 8 times/min and 10 times/min after receiving a meal for 42-48 minutes (Heitkemper, 1977 : 71-87).

Gramse (1983) and Brunner (1984) suggested that a 200-300 ml meal should be given to patients in 10-15 minutes (Gramse, 1983 : 22 ; Brunner, 1984 : 787). As the same, Jones (1984) suggested that 300-400 ml should be given to patients in 20-30 minutes (Jones, 1984 : 45).

Hunt and Macdonald (1954) experimented with 3-17 volunteers for several times for gastric meal transference. He found that it had 3 periods. The first period is after being receiving the meal in 15 minutes. The quantity of meal transference was related to the quantity of meal feeding. The second period was the rate of gastric meal transference that slowed down and it was very slow in the third period. It could be explained that in the first period gastric meal transference is the fastest because it did not receive nerve signs from the duodenum which inhibits antrum squeeze. The antrum squeezes 3 times in the first hour and decrease to 2 times 3 hours later. It the last period of gastric meal transference, it is very slow because of little gastric squeeze can not push the meal out of the stomach. He explained that the reason for low gastric meal transference in the last period is because carbohydrates, protein and fat activate receptors in the duodenum which causes nerves to inhibit gastric squeeze (Hunt & Macdonald,1945: 74).

From the investigator's experience, it was found that in 5 naso-gastric tube feeding patient, 78-85 years old, patients received a meal in the first hour, gastrointestinal movement (bowel sound) was 7 times/min, and then in the second hour, the bowel sounds decreased to 4 times/min. The quantity of gastric meal transference decreased from 70 ml/hr in the first hour to 40 ml/hr in the second hour.

It can be concluded that the suitable naso-gastric meal feeding flow rate should be 10 ml/min rate. In addition, there are several factors that effect gastric meal transference. Therefore, naso-gastric tube feeding for patients should be without complications. This very important for increasing the efficiency of digestion absorbtion. Nursing care for naso-gastric tube feeding has several actions concerning such as fluid meal preparation, proper size of naso-gastric tube, drug preparation, proper feeding methods and patients' position. Meal flow rate is one factor for naso-gastric feeding care and it does not conclude that how many flow rates are suitable to increase the capability of gastric meal transference. There are only a few studies, therefore the investigator was interested in studying the effects of different naso-gastric tube feedings in patients in order to search for the best naso-gastric feeding care.

CHAPTER III

MATERIALS AND METHODS

Study Design

This clinical study was aimed at evaluating the effects of different naso-gastric tube feeding flow rates on gastric meal transference, with the comparison of 2 flow rates, 3 ml /min rate or 300 ml. of meal feed in 2 hours and 10 ml./min rate or 300 ml. of meal feed in 0.5 hours.

Population and Sampling

The population were naso-gastric tube feeding patients who were admitted in the medical wards of Audsadang Building, Department of Medicine, Siriraj Hospital. The 10 samples were selected purposively via the following inclusion criterias:

1. Male or female, 70-80 years, with limited activity.
2. No evidence of gastrointestinal dysfunction or gastrointestinal operation.
3. Receiving Isocal 300ml./time, 4 times/day by naso-gastric tube feeding No.14 and inserted at a depth of 45-55 cm.

The exclusion criterias were as follows:

1. Quantity and/or formula of the meal feeding was changing.
2. Having complications that may affect the meal flow rate during this study, for example, diarrhea and vomiting.

The study was conducted from February 10 to March 31, 2001.

Setting

The setting in this study was Audsadang 6th floor (North) which was a medical ward of Siriraj Hospital, Bangkok, Thailand. This ward was selected to be a study site because the protocal of naso-gastric tube feeding in this ward was relevant to the study's protocal.

Instruments

The instruments of this study are composed of :

1. Interventional instruments which included:

1.1 Enteral feeding set, naso-gastric tube No.14, 50 ml. glass syringe, thermometer, stethoscope, tray, gauze, plaster, Vaseline, intravenous stand and oral care set.

1.2 Isocal 300 ml. with the temperature of 36-38°C (The temperature of the meal before feeding).

Naso-gastric tube feeding management protocol which had the steps as follows: (Appendix D)

1. Clean the oral cavity, insert naso-gastric tube, No. 14, at a depth of 45-55 cm. Record gastric residue before feeding. Suction tracheaostomy tube in some cases.

2. Set patient's position on their right with their, head level at 30°.

3. Hang the enteral feeding set of Isocal.

4. Adjust the clamp of enteral feeding set to release meal flow in time. (either 3 ml./min or 38 drops/min or 10 ml /min or 150 drops/min.)

5. Record bowel sounds at one minute after the feeding was started and for half an hour.

6. 2 hours after starting the feeding, change the patient's position to another position. (either to a dorsal lying position or to a left-side lying position).

7. 4 hours after starting the feeding the investigator recorded gastric residue by drawing it out with a glass syringe. The gastric residue was then measured and a record was made.

2. Data collection instruments included:

2.1 General data, which was used to obtain some basic personal information including: gender, dianosis, capable movement, type of formula and temperature, size of naso-gastric tube and depth insertion, medications and vital signs (Appendix C).

2.2 A daily assessment tool for gastric meal transference and bowel sound recording which developed by the investigator (Appendix C). Determination of content validity and appropriacy was by consultation with three experts who were experts in gastrointestinal nursing from the medical and surgical departments of the Faculty of Nursing, Mahidol University. (Appendix C).

Data Collection

Data collection was started after the permission from the Faculty of Graduate Studies, Mahidal University, was given according to the following steps:

1. Permission to collect data was requested by submitting the documents from the Faculty of Graduate Studies, Mahidol University to the Dean of the Medical

Faculty, the Director of Nursing, the Head of Medical Nursing, Siriraj Hospital, Mahidol University.

2. In selecting the patients, the investigator checked the medical records of admitted patients to identify immobilized naso-gastric tube feeding patients which follows the inclusion criteria.

3. To protect the human rights of the patients. The investigator contacted all the patients' surrogates and explained the purpose, the study protocol and the benefits of this study (Appendix B). After attaining informed consent, the patients were then enrolled into the study. All 10 patients were assigned to receive 3 ml./min meal flow rate and 10 ml./min meal flow rate for their feedings for 2 days. In order to randomly assign the treatment protocol, the feeding flow rate (either 3 ml./min or 10 ml./min.) were drawn before the feeding time of each experiment day. If the 3 ml./min. flow rate was first drawn, the patient received the first feeding at the 3ml./min. flow rate and he or she then received the second feeding of that day at the 10 ml./min flow rate. The other two feedings of the day depended on the routine care of the ward. On the second day of the study, the feeding flow rate was drawn again as the first day in order to select the flow rate for patient. After a patient received two feedings in the second day the data was collected and the study was ended. The meal gastric transference and bowel sounds of the patients were assessed 2 times daily for 2 days by the investigator and any details were recorded in the daily assessment tool.

Protection of the Patient's Human Rights

The human rights of the patients were protected by explaining the details and the aims of this study and asking for the cooperation from the patients' surrogates.

They had a right to make their own decision whether to participate in this study. If they did not, they could cancel or withdraw from the study at any time. The data taken from the patients were kept confidential. After insuring that the patients' surrogate understood how their rights were to be protected, the investigator could then start the intervention. (For further details of the human rights protection procedure, see Appendix B).

Data Analysis

The data from intervention were analyzed by using a statistical method.

1. General data were presented by raw data in table 1 chapter IV.

2. Data of quantity of gastric meal transference from two different flow rates were analyzed by mean percentage and presented in table 2 chapter IV.

3. Data of bowel sound after being received two different flow rates were analyzed by mean and presented in table 3 chapter IV.

CHAPTER IV

RESULTS

The results of this study are presented into two parts:

The demographic data and clinical characteristics of patients. (Table 1)

It was found that patients in this study were composed of 5 males and 5 females with an age range from 70-79 years. All of them were immobilized and confined to bed. Four patients were suffering from COPD with pneumonia, 4 had cerebral heamorrhage, 1 was paralysised and 1 was suffering from senile dementia and was admitted to the hospital because of sinusitis (Table 1).

Table 1. Demographic and clinical characteristics of patients (N = 10).

Patient No.	Diagnosis	Gender	Age (years)	Movement capability
1.	Intracerebral heamorrhage	male	77	immovable
2.	Pneumonia	female	70	"
3.	COPD	male	79	"
4.	Basal ganglia heamorrhage	male	71	"
5.	COPD with tracheaostomy tube	female	71	"
6.	CHF and pneumonia with tracheaostomy tube	male	78	"
7.	Maxillary and frontal sinusitis	female	72	"
8.	Paralysis	female	75	"
9.	CVA	female	73	"
10.	Acute cerebral embolism	male	73	"

The comparison of the percentage of gastric meal transference between the feeding flow rate of 3 ml /min and 10 ml /min.

It was found in this study that while the patients were fed with 10 ml/min flow rate 6 of them had 100% gastric meal transference and 4 showed nearly 100% (98.21-99.64%) of gastric meal transference. On the other hand, while being fed with 3 ml/min flow rate all the patients had gastric meal transference of less than 87.86% (range = 75.81-87.86, $\overline{X}$ = 84.19, SD = 0.14). It is interesting to note that one patient who had 75.81% of gastric meal transference while he was fed with 3 ml/min flow rate, showed a dramatic increased in gastric meal transference (98.21%) when he was fed with 10 ml/min flow rate. It was found that the mean percentage of gastric meal transference while using the feeding flow rate of 10 ml /min was greater than the mean percentage of gastric meal transference while using the feeding flow rate of 3 ml /min (Table 2).

Table 2 The mean percentage of gastric meal transference after receiving 3 ml./min rate and 10 ml /min rate for naso-gastric feeding (N = 10).

Patient No.	Mean percentage of gastric meal transference (%)							
	Flow rate 3 ml /min				Flow rate 10 ml /min.			
	Day 1	Day 2	$\overline{X}$	SD	Day 1	Day 2	$\overline{X}$	SD
1	87.00	88.00	87.50	0.5	99.50	98.00	98.75	0.75
2	82.50	83.92	83.21	0.71	98.36	99.50	98.93	0.57
3	88.22	87.50	87.86	0.36	100.00	100.00	100.00	0
4	75.12	76.50	75.81	0.69	98.92	97.50	98.21	0.71
5	84.50	82.30	83.40	1.1	100.00	100.00	100.00	0
6	83.78	85.50	84.64	0.86	100.00	100.00	100.00	0
7	87.50	86.14	86.82	0.68	99.28	100.00	99.64	0.36
8	79.00	81.00	80.00	1.0	100.00	100.00	100.00	0
9	88.00	86.00	87.00	1.0	100.00	100.00	100.00	0
10	84.94	86.50	85.72	0.78	100.00	100.00	100.00	0
Mean percentage total	84.05	84.33	84.19	0.14	99.60	99.50	99.55	0.05

The comparison of the mean of gastric squeeze (bowel sound) between the feeding flow rate of 3 ml /min and 10 ml /min.

It was found in this study that the frequency of gastric squeeze while using feeding flow rate of 10 ml /min was higher than the frequency of gastric squeeze while using feeding flow rate of 3 ml./min (Table 3)

Table 3 The mean of the frequency of gastric squeeze (bowel sound) after receiving 3 ml /min rate and 10 ml./min rate for naso-gastric tube feeding (N = 10).

Patient No.	Mean of gastric squeeze (bowel sound) (times/min.)					
	Flow rate 3 ml /min.			Flow rate 10 ml./min		
	Day 1	Day 2	$\overline{X}$	Day 1	Day 2	$\overline{X}$
1	3	1	2	8	6	7
2	2	2	2	7	5	6
3	5	3	4	9	7	8
4	2	4	3	6	6	6
5	6	4	5	7	7	7
6	2	2	2	6	8	7
7	3	3	3	9	11	10
8	5	3	4	5	7	6
9	3	5	4	6	8	7
10	2	2	2	7	7	7
Mean total	3.3	2.9	3	7	7.2	7

Complications

It was found in this study that there was no complications such as diarrhea, aspiration, and vomiting in both rates of naso-gastric tube feeding.

In conclusion, the results of this study revealed that the 10ml./min. naso-gastric tube feeding flow rate offers a quicker gastric meal transference than the 3 ml /min. naso-gastric tube feeding flow rate. In addition, the 10 ml /min. naso-gastric tube feeding flow rate offers a stronger gastric squeeze than the 3 ml /min. naso-gastric feeding flow rate.

CHAPTER V

DISCUSSION

The purpose of this study was to compare the effects of naso-gastric tube feeding flow rate between 3 ml /min and 10 ml/ min on gastric meal transference in immobilized patients who were admitted to the medical wards, at Siriraj Hospital. This discussion will present the reason that feeding with the 10 ml/min rate offers greater gastric residue than the 3 ml./min rate. Feeding with the 10 ml/min rate offers higher calories than the 3 ml./min rate. Feeding with the 10 ml/min produce no complication.

Feeding with the 10 ml/min rate offered a less gastric residue than the 3 ml/min rate.

The results of this finning can be explained. Feeding with 10 ml./min increases gastric squeeze frequency. In this study it was found that the frequency of gastric squeeze after receiving a feeding with 10 ml /min flow rate for ½ hour was 7 times/min higher than the frequency of gastric squeeze after receiving feeding with 3 ml /min flow rate (Table 3. Chapter IV). In accordance with Heitkemper (1977) who found that the frequency and strength of gastric squeeze will increase after receiving a meal feeding in 6-12 minutes of about 3-4 times/min. After half an hour the stomach squeezed about 8 times/min. and 10 times/min after receiving a meal in 42-48 minutes (Heitkemper, 1977 : 71-87). After receiving a faster rate the quantity of the meal that flows into the stomach is greater than the slower rate in equal time. The volume of the fast meal flow rate activated gastric wall tension to squeeze and

push the meal out of the stomach greater than the slow rate (Wechapas, S., 1977 : 153 - 4).

An increase in gastric squeeze frequency effected an increase in gastric meal transference. From this study, it was found that the mean percentage of gastric meal transference after receiving the 10 ml/min rate which had a high frequency of gastric squeeze was 99.55% greater than the mean percentage of gastric meal transference after receiving the 3 ml/min rate which had a low frequency of gastric squeeze which was 84.19% (Table 2 Chapter IV).

The other reason can be explained that why the 10 ml/min rate caused the quantity of gastric meal transference greater than the 3 ml/min rate is the time difference of gastric meal transference in the two different rates. Receiving the 3 ml/min rate, of 300 ml. of meal the meal would be finished in 2 hours. There will be 2 hours for gastric meal transference before the next feeding. But receiving the 10 ml/min rate, of 300 ml of meal, the meal would be finished in 0.5 hour and then there will be 3.5 hours for gastric meal transference before the next feeding. The time of rest for gastric squeeze of the quicker flow rate is longer than the time of rest for gastric squeeze of the slow rate. This evidence is related to the quantity of gastric residue. The greater the gastric meal transference, the lower the gastric residue.

It can be concluded that the paralytic naso-gastric tube feeding patients who received a feeding with 10 ml./min flow rate has gastric residue less than the patients who received a feeding with 3 ml/min flow rate. In accordance with Heitkemper (1977) who found that the suitable flow rate for naso-gastric tube feeding is 30-60 ml/min Heitkemper, (1977 : IA) and Jones (1984) suggested that 300-400 ml should be given in 20-30 minutes (Jones, 1984 : 45). In the same way, Gramse (1983) and

Brunner (1984) suggested that 200-300 ml of meal should be given to patients in 10-15 minutes (Gramse, 1983 : 22 ; Brunner, 1984 : 787).

Feeding with the 10 ml/min rate offered higher calories than the 3 ml/min rate.

From this study the patients who received 10 ml./min flow rate feeding had no gastric residue but patients after receiving 3 ml/min flow rate feeding had a mean of gastric residue of 47 ml /time. In only one day they had a gastric residue of 188 ml. or 188 calories. Patients should receive 1200 calories per day, but not in the patients which received 3 ml/min flow rate they receives only 1,012 calories per day. There patients lost 188 calories per day. This evidence effected them in that they did not have enough calories for their needs. In accordance with Hansen (1984) who found that if the patients lose 5-10% of calories which they need per day, they will lose their body weight in 10-21 days (Suadee, W., 1990 : 47). Albumin will be produced a little. Antibodies and lymphocytes will also be produced a little. There patients will lose autoimmune system. They will be at risk to have a severe infection and can easily have pressure sores (Suadee, W., 1990 : 14 ; 47 ; 61 ; 69). It can be concluded that the immobilized naso-gastric tube feeding patients after receiving a feeding with 10ml/min rate receives adequate calories greater than receiving a feeding with 3 ml/min rate.

In addition, it found from this study that after receiving the 10 ml./min. flow rate in 3 hours, there was no gastric residue. The liquid meal could be transferred from the stomach in 3 hours. In use case of patients who receive 10 ml/min flow rate feeding, the number of meals can be added.

Feeding with the 10 ml/min flow rate produce no complications.

It is believed that a quick feeding causes patients to aspirate, to have diarrhea and causes stomach intolerance (Tosakulkaew, C., 1998 : 102). However it is a fact that the quicker feeding encourages gastric squeeze by pushing the liquid meal out of the stomach through the pyloric Sphincter. There is no gastric residue, which causes aspiration or flatulence. However these complications were not found in this study. It can be concluded that the immobilized naso-gastric tube feeding patients receiving feeding 10 ml./min. flow rate has no complications or unwanted sequels. There is an explanation for this finding. The greater amount of gastric meal volume form the 10 ml/min flow rate feeding increases gastric meal volume does not induce sudden gastric wall expansion and does not stimulate gastric nerve-receptors. Therefore, the stomach does not produce a strong squeeze which leads to diarrhea, vomiting and aspiration.

CHAPTER VI

CONCLUSION

Summary of this Study

This project was aimed at evaluating the effects of different naso-gastric tube feeding flow rates on gastric meal transference, by comparing 2 flow rates of 3 ml./min rate or 300 ml. of meal feed in 2 hours with 10 ml./min rate or 300 ml. of meal feed in 0.5 hour., on gastric meal transference. The population were the immobilized naso-gastric tube feeding patients whom were admitted in the medical wards at Siriraj Hospital. The data were recorded between February 10 to March 31, 2001, by purposive selection, and by collecting the data by using the daily assessment tool during intervention. The results are as follows :

The results were categorized as follows:

1. The population were composed of 5 males and 5 females with an age range from 70-79 years. All of the patients were immobilized and confined to bed.

2. The quantity of gastric meal transference after receiving the 10 ml./min rate was 99.55% greater than the quantity of gastric meal transference after receiving the 3 ml./min rate which was 84.19%.

3. The bowel sounds after receiving the 10 ml./min rate was 7 times/min, higher than the bowel sounds after being receiving the 3 ml./min rate which was 3 times/min.

4. There were no complications from naso-gastric tube feeding fromeither rate.

Implications and Recommendations

This study demonstrates that naso-gastric tube feeding with 10 ml/min flow rate can improve gastric meal transference in naso-gastric tube feeding for patients. Evidence obtained from this study encourages the nurses to realize the significance of nursing intervention for prevention of retained gastric residue in naso-gastric tube feeding patients. The intervention used in this study can be used as a guideline for nursing practice in regard to naso-gastric tube feeding patients because it had been proven in this particular study for it effectiveness. Also, the intervention in this study can be modified and used in other groups of patients. This finding suggests numerous implications for nursing practice as follows :

1. The result form this study can be utilized as a guideline for naso-gastric tube feeding in paralytic patients..

2. The protocal of naso-gastric tube feeding should include a preparation program for family care-givers of paralytic patients of other groups of patients who require naso-gastric tube feeding after hospital discharge.

Implication for Further Studies

1. To study the comparison of right-side position and left-side position in patients who receive the 10 ml/min naso-gastric tube feeding flow rate on gastric meal transference..

2. Study the effects of different meal temperatures in patients who receive the 10 ml/min naso-gastric tube feeding flow rate on gastric meal transference.

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APPENDIX

Appendix A

The List of Experts

In the study of "The Effects of Different Naso-Gostric Tube feeding Flow Rates On Gastric meal Transference.", the involved study instruments were tested for their validity. Following is the list of experts who tested the study instruments :

1. Assoc. Prof. Wilaisaree Sirihongthong
   Department of Surgical Nursing
   Faculty of Nursing
   Mahidol University
2. Assoc. Prof. Dr. Pongsri Srimoragot
   Department of Surgical Nursing
   Faculty of Nursing
   Mahidol University
3. Assist. Prof. Dr. Jongjit Saneha
   Department of Medical Nursing
   Faculty of Nursing
   Mahidol University

Appendix B

Protection of the Patient's Rights

My name is Ms. Arissara Sukwatjanee. I am a graduate student in the master degree program of nursing in adult nursing, Faculty of Nursing, Mahidol University. The aim of this thematic paper is to study the effects of different naso-gastric tube feeding flow rates on gastric meal transference in patients at Siriraj Hospital. You are the most important person to provide me with the information. I believe this information will be useful to improve the nursing service system in the medical wards.

Your relative is invited to participate in this study by receiving naso-gastric feeding with 10 ml/min rate and 3 ml/min rate twice a day for 2 days. The gastric meal transference and the bowel sounds will be assessed by investigator twice a day. All this information will be confidential and will be presented in a table. The name of your relative will not appear in the report or in any other place. It is your choice whether to participate in the study, and your decision will not affect to the quality of care you relative receives in the intervention. Even during the study, your relative can withdraw from the study anytime.

Thank you for your participation

.....

(Ms. Arissara Sukwatjanee)

Appendix C

เครื่องมือในการศึกษา

แบบบันทึกข้อมูลการให้อาหารทางสายให้อาหาร แบ่งออกเป็น 2 ส่วนดังนี้

ส่วนที่ 1 ข้อมูลทั่วไป

1. ผู้ป่วยรายที่.....เพศ.....อายุ.....ปี
2. โรคที่ได้รับการวินิจฉัย.....
3. ความสามารถในการเคลื่อนไหวร่างกาย.....
4. ชนิดอาหาร.....อุณหภูมิของอาหารก่อนให้.....C^0
5. ขนาดสาย NG เบอร์.....ใส่ลึก.....ซ.ม.
6. ยารับประทานที่ได้รับ.....
7. สัญญาณชีวิต (Vital signs) T.....^{0}ซ, P.....ครั้ง/นาที, BP.....มม.ปรอท

ส่วนที่2 บันทึกรายวัน : แบบบันทึกปริมาณอาหารที่ค้างอยู่ในกระเพาะอาหารและปริมาณอาหารที่ส่งผ่านออกจากกระเพาะอาหารจากการให้อาหารด้วยอัตราการไหลที่แตกต่างกัน 2 อัตราและภาวะแทรกซ้อนที่พบ

วันที่ของการทดลอง	เวลามื้ออาหาร	ปริมาณอาหารและน้ำที่ได้รับ (ม.ล.)	อัตราการไหลของอาหาร		ปริมาณอาหารค้างในกระเพาะอาหารก่อนให้อาหาร (มล.)	ปริมาณอาหารค้างในกระเพาะอาหารหลังให้อาหาร 4 ช.ม. (มล.)	ปริมาณอาหารที่ออกจากกระเพาะอาหารหลังให้อาหาร 4 ชม. (มล.)	เสียง bowel sound หลังเริ่มต้นให้อาหาร ½ ชม. (ครั้ง/นาที)	ภาวะแทรกซ้อนที่พบ
			10 มล./นาที	3 มล./นาที					
1	8.00 น.								
ว.ด.ป.....	12.00 น.								
2	8.00 น.								
ว.ด.ป.....	12.00 น.								

Appendix D

Nursing guideline for prevention of retained gastric residue in naso-gastric tube feeding patients.

Objective : To prevent the retention of gastric residue in naso-gastric tube feeding patients with limited activity.

Definition of terms :

Retained gastric residue refers to gastric content drawn by 50 ml.glass syringe after a 4-hour feeding.

Gastric meal transference refers to the quantity of meal transference calculated by minusing the quantity of meal feeding with the quantity of gastric residue after a 4-hour feeding.

Naso-gastric tube feeding refers to the feeding by a commercial enteral feeding set.

Equipment and supplies

1. Isocal or Blenderized 300 ml. with the temperature of 36-38° C
2. Enteral feeding set
3. Naso-gastric tube No.14
4. 50 ml. glass syringe
5. Stethoscope
6. Tray and jug
7. Gauze, lubricant and plaster

8. Stand for hanging enteral feeding set
9. Oral care set

Procedure :

1. Consider the naso-gastric tube feeding patients, over 60 years with limited activity, and who have no evidence of gastrointestinal dysfunction or gastrointestinal operation.
2. Set patient's position on their right-side with their, head elevation up to 30 degrees.
3. Clean the oral cavity, insert naso-gastric tube at the depth of 45-55 cm. and test the position of the naso-gastric tube in the stomach by using a stethoscope.
4. Draw gastric residue before feeding with a 50 ml. glass syringe.
5. Hang the enteral feeding set of Isocal or Blenderized meal.
6. Adjust the clamp of the enteral feeding set to release the meal flow in half an hour or 150 drops/min.
7. Two hours after starting the feeding, change the patient's position to another position (either to dorsal lying position or to a left-side lying position).

Indication : No gastric residue at 4 hours after starting the feeding. No complications or unwanted sequelaes.

BIOGRAPHY

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DATE OF BIRTH	15 November 1962
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INSTITUTIONS ATTEND	Boromrajchonanee Chonburi, 1981-1985
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