Medical - Surgical Nursing Journal 2016; 5(2): 42-50.

Published online 2016 October 17 Original Article

Evaluation of the effect of nasogastric intubation on gastrointestinal function after gastrectomy in gastric cancer patients

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ARTICLE INFO

Article history:

Received: 20 July 2016
Revised: 06 September 2016
Accepted: 10 September 2016

Key words:

Nasogastric intubation
Gastrointestinal function
Gastrectomy
Gastric cancer

ABSTRACT

Background: The optimal treatment strategy for patients with gastric cancer is gastrectomy. Typically, nasogastric intubation is used after this type of surgery to feed patients; however, there seems to be no unanimity of opinion on this topic. Therefore, this study aimed to evaluate the effect of nasogastric intubation on gastrointestinal function after gastrectomy in gastric cancer patients.

Methods: This clinical trial was conducted on gastric cancer patients, admitted to the general surgery department of Imam Reza Hospital in Mashhad, Iran in 2015. In total, 68 patients were selected through convenience and randomized sampling and divided into two intervention and control groups of 34 individuals. Nasogastric tube insertion was applied for the intervention group after the surgery. Patients of the study groups were fasted for three days after the surgery, which was followed by the removal of nasogastric tubes and initiation of oral feeding. Gastrointestinal function of all the participants was evaluated six hours after transferring to the ward up to seven days after the surgery on a daily basis using nausea and vomiting assessment tools and researcher-made questionnaire of gastrointestinal function. Data analysis was performed in SPSS version 16 using Fisher's exact test, Chi-square, Mann-Whitney U, repeated measures ANOVA and paired t-test.

Results: In this study, the severity of nausea and vomiting, the first time of passing gas and severity of flatulence Intensity were less observed in the control group, compared to the intervention group. Moreover, postoperative diet tolerance was higher in the patients of the control group, compared to the other study group ($P<0.05$).

Conclusion: According to the results of this study, nasogastric intubation can delay normal gastrointestinal function after gastrectomy. Therefore, it is not recommended to use this method after gastrectomy.

1. Introduction

The first and the second leading cause of mortality in developed and developing countries is Cancer. Moreover, Gastric cancer (GC) is the fourth most common cancer in the world.[1] Although, this disease is the third leading cause of mortality among Iranians, but it is the leading cause of cancer death in males and the second leading cause of cancer mortality in the Iranian woman.[2] The optimal treatment strategy for patients with gastric malignancy is timely gastrectomy.[3] Currently, in most cases after this surgery, nasogastric intubation is used for various purposes, such as feeding, drug delivery, decompression of the stomach following extensive gastrointestinal waste or obstructions.[4] On the other hand, it is believed that in surgical procedures such as gastrectomy due to activation of neural inhibition reflexes, release of neurotransmitters and inflammatory mediators as the result of anesthesia and surgical manipulation,[5] several physiological complications such as ileus inevitably take part.[6] Although there is no precise definition of ileus, but generally it could be defined as temporary disruption of gastrointestinal peristalsis post operation, along with other injuries; which clinically appears as loss of bowel sounds, inability

to pass gas or defecation, nausea, vomiting, abdominal bloating and stomach cramps.[5, 7]

In recent years, several methods have been used to prevent and eliminate postoperative ileus,[8] and controversies regarding usage of nasogastric intubation after surgery have been presented. For instance, study conducted in 1963 showed that not only routine use of nasogastric intubation after abdominal surgery is unnecessary, but it also causes specific problems such as sore throat, nausea, vomiting and pulmonary complications.[5, 9] However, in the past decades, the use of nasogastric intubation in many major abdominal surgeries such as gastrectomy in patients with gastric cancer in order to protect the anastomosis or prevent ileus after gastric resection is commonly recommended and implemented.[10] Because the surgeons believe that the use of nasogastric intubation until the recovery of bowel movements and gas, which typically takes about three days, prevents returning of the digestive secretions to the junction, and so decrease the abdominal bloating and prevent postoperative ileus.[11]

In nursing resources, the routine use of nasogastric intubation has been pointed out and it is believed that this method should be used as a preventative procedure on the night before the operation; because post-operation intestinal peristalsis due to anesthesia and visceral manipulation, are reduced or stopped for 24-48 hours. Intubation prevents vomiting, reduces pressure on the anastomosis and also prevents intestinal occlusion.[5,10]

According Wittbrodt et al. (2006), reported that nasogastric intubation reduces the gastric pressure and prevents vomiting and retention of gas and fluid in the jejunum, therefore abdominal bloating is minimized, reducing the chance of developing ulcer.[12] Daryaei et al. (2008) reported that patients without nasogastric intubation significantly experienced nausea, vomiting and severe emphysema after the surgery; however using nasogastric intubation has increased incidence of fever, atelectasis and pneumonia.[13]

On the other hand Koukouras et al. (2001) reported that nasogastric intubation can cause moderate to severe discomfort in 70% of the patients and significantly postpone the return of normal gastrointestinal function. So early removal of nasogastric intubation after the surgery and early oral feeding, can cause faster return of gastrointestinal function after surgery and increase patient's comfort.[14] Studies by Li et al. (2011) and Lei et al. (2004) suggest that in the majority of elective abdominal surgery, postoperative nasogastric intubation is not necessary after the surgery.[15, 16] Although, the results of study by Pacelli et al. (2014) showed that nasogastric intubation can accelerate the return of normal gastrointestinal function.[17]

As mentioned earlier, despite the significance risk and local and international prevalence of gastric cancer, the findings of studies in this field have been inconsistent and usability of gastric intubation for the patients is not already clear. The current study was conducted with the aim to determine the effect of nasogastric intubation on gastrointestinal functions in patients with gastric cancer after gastrectomy.

2. Methods

2.1. Design

The present study was conducted as a clinical trial and the study population consisted of the patients who were referred to general surgery department of Imam Reza (AS) hospital in Mashhad in 2014.

2.2. Participants and setting

In this study, The sample size of the study, based on the study by Fazel et al. (2010)[18] and based on "comparing two independent samples" sample size formula ($\alpha=0.05$, $1-\beta=0.8$, $Z_{1-\beta}=0.84$, $Z_{1-\alpha/2}=1.96$, $\mu_2=2.46$, $\mu_1=3.10$, $S1=0.85$ and $S_2=0.60$) was calculated as 21 patients. To ensure and take into account the potential drop-out rate, 68 patients were participated in the study.

Patients were selected using randomized convenience sampling method; and with employing table of random numbers they were divided into two intervention and control groups of 34. Random allocation was performed in a way that at first, the numbers from zero to nine were assigned by lot into two groups: group one with catheterization and group two without catheterization. The blind selection of the starting point of the table of random numbers was done; then sequence of numbers after that point according to division numbers was an indication for the sequence of qualified individuals in the group.

Inclusion criteria were as follow: 1) indication for total or subtotal gastrectomy, 2) not suffering from chronic diseases such as renal failure, diabetes, hepatic disease, 3) no history of upper gastrointestinal bleeding and intestinal polyps. Exclusion criteria included accidental removal of nasogastric intubation after surgery and uncontrollable post-operative complications such as bleeding and infection.

2.3. Instruments

The data collection tools included demographic characteristic forms, tools for analyzing the nausea and vomiting after surgery and questionnaire made by researcher to survey the gastrointestinal function. Demographic characteristic forms contained 6 questions about age, gender, marital status, type of diet and surgery.

Assessment tool for postoperative nausea and vomiting was designed in 1996 by Marley. This tool includes a 10 cm line which the severity of nausea is checked and measured by the patient on the horizontal line. This line starts with score zero which is an indication of no nausea and vomiting, and ends with a score of 10 which is an indication of severe nausea and vomiting.[19] The frequency of vomiting was also recorded by asking the patients. This tool in different Persian studies including Firoozbakht and et al. (2012) have been used.[20] Reliability of this tool in the present study was confirmed by test-retest, and with the participation of 10 volunteers which were not part of the study; moreover correlation coefficient of reliability of this tool was calculated as r =0.8.

A questionnaire designed by the researcher examined the validity and reliability of gastrointestinal function in three parts including the first gas passing, flatulence intensity and diet tolerance. In this questionnaire, the first gas passing was recorded by questioning each patient. To assess the severity of flatulence, the abdomen circumference was measured. In order to measure the flatulence intensity of the patients, they were asked to stand so their abdominal circumference in the area below the umbilicus using a tape measure were measured and recorded by the researcher. Patients were interviewed about their diet tolerance and liquid intake, and their answers were recorded as Yes or No. The validity of the tool were assessed and approved through content validity by ten members of the Faculty of Nursing and Midwifery of the School of Medicine, from Mashhad University of Medical Sciences. Reliability of this tool through test-retest with the participation of 10 patient volunteers, were studied in two trials and confirmed (r =0.84).

2.4. Data Collection

For patients in the intervention group immediately after surgery, nasogastric tube was placed by an anesthesiologist, and for three days after the surgery this tube remained in place; but in the control group, after the completion of surgery, nasogastric tube was not inserted.

Every morning, from six hours after the arrival of patients from recovery room to the surgery department, until the seventh day after the surgery, the severity of nausea, number of vomiting episodes and other gastrointestinal function including the first passage of gas, flatulence intensity, in both the intervention and control groups were evaluated on a daily basis by the researcher using the questionnaires. The diet tolerance was assessed from the fourth day post-operation and by start of the oral feeding.

To assess the severity of nausea, by presenting the aforementioned instrument to the patient, he was asked to show by finger the severity of nausea; in addition the number of vomiting episodes was recorded by questioning the patient. For determining the first passage of gas, every morning the patient was questioned. For measuring the severity of flatulence, abdomen circumference were measured and recorded by the researcher as mentioned earlier. In order to assess the patient's diet tolerance after the surgery as instructed by the physician, patients in both groups were kept fasting for three days, during which time three liters of saline (dextrose 5 mmol, 10 ml potassium chloride, 75 ml sodium chloride 75 ml) on a daily basis was infused. All patients one day after operation, as ordered by their physician were encouraged to walk with assistance; and the nasogastric tube in the 4th day after the surgery was removed by the nurse, in the morning.

From the 4th day after the operation, in case of the absence of nausea and vomiting, a limited liquid diet (water and tea), about 500 to 1000 ml (about 2-4 graded glasses) was started as ordered by the physician. In the absence of nausea, vomiting, abdominal bloating and diet tolerance on the fifth day after surgery, full liquid diet (soup, juice, etc.) was started and intravenous fluids were discontinued. In case of diet intolerance, the previous diet was continued until tolerated. As soon as the full liquid diet was tolerated, from the sixth day, a regular diet would be started. If conventional diet was tolerated (lack of nausea, vomiting, abdominal bloating and defecation) the patient was discharged from the hospital in the morning of the seventh day; but in case of diet intolerance the patient would remain admitted and under observation. In this study the length of admission did not exceed seven days.

In order to complete the diet tolerance form, on the fourth day after the surgery (at the start of limited liquids diet) graded glasses were given to the patient (to help patients to start the diet) and in all visits, by recording the feedbacks on how to start a diet, the effectiveness of the trainings was ensured. After interviewing and questioning the patients, diet tolerance forms were completed by the researcher.

2.5. Ethical considerations

The ethical considerations that should have been taken into account included obtaining the approval of the ethics committee of Mashhad University of Medical Sciences and receiving written informed consent from all patients in the study. Study objectives were explained for all participants that were eligible to participate in the study. After coordinating with the surgeon to ensure his attendance and readiness for the surgery, the patient was transferred to the operating room. Surgeries for all the patients participating in the two groups were performed by one surgeon.

2.6. Statistical analysis

Data were analyzed using descriptive indices, Fisher's exact and Chi square tests to compare the two groups in terms of qualitative variables; independent t-test was used to compare the two groups in terms of Normal quantitative variables; Mann–Whitney U test was used to compare the two groups in terms of non-normal quantitative variables; and analysis of variance with repeated measures was used to evaluate the differences in the severity of nausea and from operation day to the seventh day post-operation between the two groups; in addition paired t-test was used to compare the intensity of nausea and flatulence in the days after the surgery with SPSS version 16.

3. Results

During the study, nasogastric tube was accidentally removed from two patients in the intervention group and eventually the study was followed with 66 patients. Other demographic characteristics of the participants are illustrated in Table 1. According to this table, no significant differences were observed between the variables in the study groups.

According to diagram 1, in any days after the surgery until the seventh day, there were no statistically significant differences of the mean and standard deviation of the severity of nausea between the intervention and control groups. Mean of nausea intensity from the first day until the seventh day in the control group had a statistically significant reduction (P=0.0034). Paired t-test results showed that the nausea intensity in the control group on the second day compared to the first day (p<0.001), on the third day compared to the first day (p<0.001), on the fifth day compared to the first day (p=0.003), on the day six compared to the first day (p<0.001) and on the seventh day compared to the first day (p=0.025) have been significantly reduced.

Although the severity of nausea in the patients on the fourth day in comparison to the first day has been decreased, but this reduction was not statistically significant (p=0.162). In the intervention group the severity of nausea has decreased, but this reduction was not statistically significant (Diagram 1). In terms of frequency of vomiting, from the day of surgery until the seventh day after surgery, there was no statistically significant difference between the two groups. (Table 2)

The first postoperative passage of gas in most patients of the intervention group (53.1%) with mean of 3.0 ± 0.6 days and for the majority of patients in the control group (61.8%) with a mean of 6.0 ± 8.2 days occurred on the third day. Independent t-test results also showed no significant difference between the two groups. (p=0.279)

According to diagram 2, between the mean score of severity of flatulence of the two groups from the first day until the sixth day after surgery, there was a statistically significant difference (P<0.05); but on the seventh day after surgery, the difference was not statistically significant. On the other hand, the mean score of severity of flatulence in the intervention group from the first day until the seventh was significantly improved (p<0.01). According to the result of paired t-test, the flatulence severity of patients in this group on the second day compared to the first day (p <0.001), on the third day compared to the first day (p <0.001), on the fourth day compared to the first day (p <0.001), on the fifth day compared to the first day (p<0.001), on the sixth day compared to the first day (p <0.001), on the seventh day compared to the first day (p<0.001), has significantly increased; but this difference was not significant in the control group.

In regard to liquid tolerance on the fourth day after the operation, 24 patients (75%) in the intervention group and 29 patients (85.3%) in the control group tolerated the diet. According to chi-square test, the difference between the two groups was not significant (P=0.29). Moreover, on the fifth day after the surgery, 30 patients (93.8 %) in the intervention group tolerated the liquid diet; while in the control group, all of the patients tolerated the diet. According to Fisher's exact test this difference between the two groups was not significant (P=0.23). On the sixth day after surgery, all patients in both groups were able to tolerate a liquid diet.

Table 1. Demographic characteristics of participants

Variable	Group	Intervention	Control	P -value
		N(%)	N(%)	
Gender	Male	20(58.8)	19(59.4)	*0.964
	Female	14(41.2)	13(40.6)	
Marital status	Single	3(8.8)	0(0.0)	**0.153
	Married	24(70.6)	21(65.6)	
	Divorced	3(8.8)	2(6.2)	
	Widowed	4(11.8)	9(28.2)	
Type of diet	Normal	23(67.6)	19(59.4)	**0.800
	Low salt	6(17.6)	8(25.0)	
	Low fat	2(5.9)	3(9.4)	
	Other	3(8.9)	2(6.2)	
Type of surgical procedure	Subtotal	21(61.8)	20(62.5)	*0.951
	Total	13(38.2)	12(37.5)	
Age	M± SD	12.5±60.9	11.3±61.5	***0.842

*Chi-square test, **Fisher's exact test, ***Independent t-test

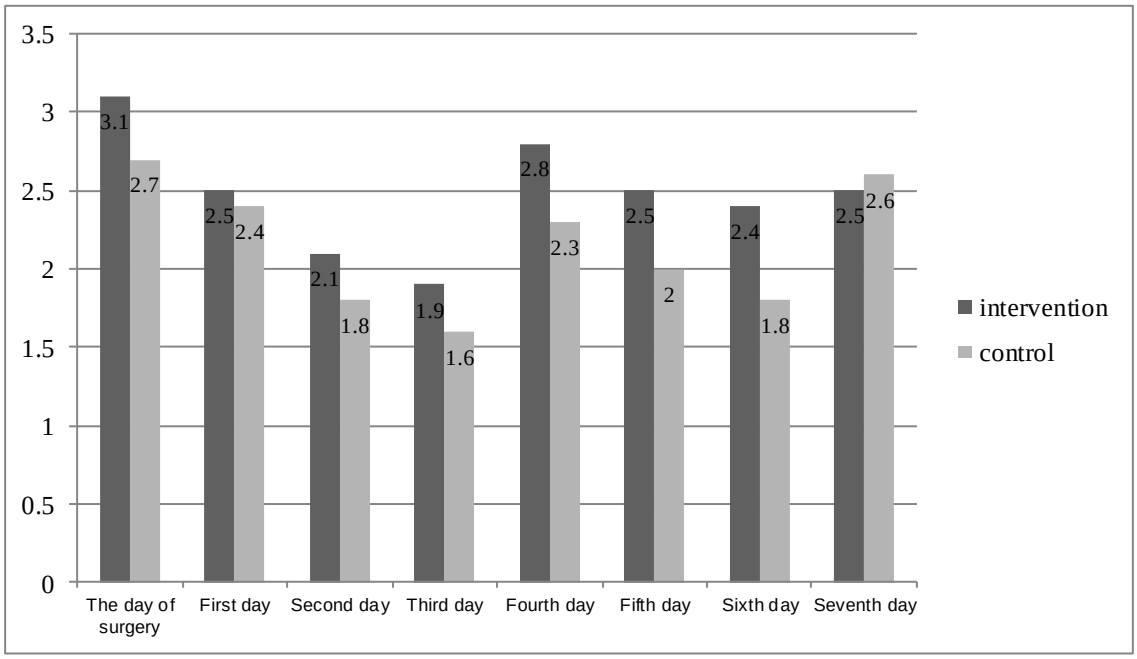

Figure 1. Changes in mean score of patient satisfaction with patient education during a 12 months course after the initiation of clinical supervision Comparison of nausea severity between control and intervention groups

Table 2. Frequency distribution of patients according to number of vomiting after surgery in both groups

Vomiting frequency	group	intervention N (%)	control N (%)	p-value
The day of surgery	Without vomiting	19(59.4)	18(52.9)	0.550*
	Less than 3 times	10(31.2)	10(29.4)	
	3-5 times	3(9.4)	4(11.8)	
	More than 5 times	0(0.0)	2(5.9)	
	M ± SD	0.5±0.7	0.7±0.9	0.301**
First day	Without vomiting.	24(75.0)	28(82.4)	0.720*
	Less than 3 times	6(18.8)	5(14.7)	
	3-5 times	1(3.1)	0(0.0)	
	More than 5 times	1(3.1)	1(2.9)	
	M ± SD	0.3±0.7	0.2±0.6	0.503**
Second day	Without vomiting.	33(97.1)	29(90.6)	0.465*
	Less than 3 times	1(2.9)	2(6.2)	
	3-5 times	0(0.0)	1(3.2)	
	M ± SD	0.4 ±0.1	0.20.±0.03	0.239**
Third day	Without vomiting	30(93.8)	33(97.1)	0.519***
	Less than 3 times	2(6.2)	1(2.9)	
	M ± SD	0.2±0.06	0.2±0.03	0.526**
Fourth day	Without vomiting.	26(81.2)	29(85.3)	0.626 *
	Less than 3 times	5(15.6)	3(8.8)	
	3-5times	1(3.2)	2(5.9)	
	M ± SD	0.5±0.2	0.5±0.2	0.920**
Fifth day	Without vomiting	29(90.6)	31(92.2)	0.938***
	Less than 3 times	3(9.4)	3(8.8)	
	M ± SD	0.3 ±0.1	0.3±0.1	0.939**
Sixth day	Without vomiting.	26(81.2)	33(97.1)	0.927***
	Less than 3 times	5(18.8)	1(2.9)	
	M± SD	0.3 ±0.1	0.2±0.03	0.212**
Seventh day	Without vomiting.	9(90.0)	15(83.3)	0.181*
	Less than 3 times	0(0.0)	2(11.1)	
	5-3 times	1(10.0)	1(5.6)	
	M ± SD	0.6±0.2	0.2±0.4	0.584**

*Chi-square,** Mann–Whitney test, ***Fisher's exact test

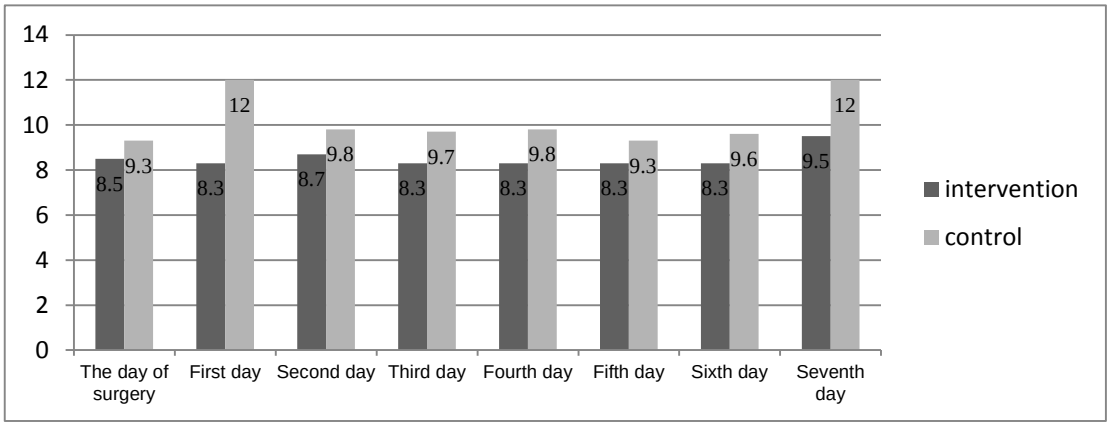

Figure 2. Comparison of the mean and standard deviation severity of emphysema in patients of both the two groups

4. Discussion

According to the findings of the current study it could be concluded that during the study the severity of nausea and vomiting, the first passage of gas, and the flatulence severity of the patients in the control group was less than the intervention group, and this group compared to the intervention group had better toleration of the diet after the surgery.

In this study the intensity of nausea on the day of surgery and on the first day after surgery in both groups was approximately the same, which is probably due to the impact of anesthetic medicines; but from the second day until the seventh day, the intensity of nausea in the intervention group was more than the control group, which this difference was not significant. Moreover, there were no statistically significant differences between the mean score of vomiting in the intervention and control groups.

Pang et al. (2015) in their study stated that the intensity of nausea and vomiting between the group with nasogastric intubation and the group without it, no significant differences exist.[21] But the results of Fazel et al. (2009) study in this regard indicated that, the mean frequency and intensity of nausea in the second and third postoperative days in the group with nasogastric intubation was significantly more than the intervention group.[18] In addition, the results of study conducted by Lee et al. (2002) showed that the incidence of nausea in group without nasogastric tube is significantly lower than patients with it.[22] the results of Carrère et al. (2007) showed that the incidence of nausea and vomiting in patients without nasogastric tube is significantly more than in patients with it.[23] The results of these study is not consistent with the result of the present study, which is probably due to the use of nausea medications, type of decompression and the difference in the visceral manipulation during the surgery.

The results showed that the first passage of gas after the surgery in most patients in both the intervention and control groups has been on the third day after gastrectomy, and the control group earlier than the intervention group experienced gas passage, and there was no statistically significant differences between the two groups. In this regard, results of study conducted by Lee et al. (2002) showed that the first passage of gas after surgery in patients with nasogastric tube is longer than in patients without them, and there was no statistically significant difference between the two groups.[22] Pang et al. (2015) demonstrated there is no significant difference between the first passage of gas in the group with nasogastric intubation and the group without it.[21] The results of these studies are consistent with the present study. Due to the higher frequency of patients in the control group, considering the first passage of gas, in the second and third days after surgery, it could be concluded that in the present study and above mentioned studies, patients have developed transient post-operative ileus, and using nasogastric tubes had no effect on the returning of bowel function. Yu et al. (2012) reported that, the first passage of gas in the patients without nasogastric intubation was significantly shorter than patients with it.[24] The results of Carrère et al. (2007) demonstrated that the first passage of gas in patients with nasogastric intubation in the days after the surgery was significantly delayed compared with those without them.[23] this study is consistent with the outcomes of the present study examined the issue that the nasogastric intubation not only doesn't precipitate the first passage of gas, but also might postpone the return of normal function of the gastrointestinal system. It's probably due to disruption in the natural oral-gastric reflexes is caused by digestive secretions.[9]

The findings of study by Pacelli et al. (2014) and Zhou et al. (2006) showed that the first passage of gas after gastric surgery in patients with nasogastric tubes is significantly earlier.[17,25] The results of these studies are not consistent with the present study. Given the duration of postoperative ileus in different sections of digestive system and the impact of multiple factors affecting it including the type of surgery, duration of surgery, the degree of manipulation and pre- and post-operation patient care, it could be expected that improvement of gastrointestinal function after operation be different. However, results of studies such as the study carried out by Carrère et al. (2007) illustrated that the common belief that post-operative discharging of gastric secretions would accelerate the recovery of gastrointestinal function has not been approved; and not only it causes a significant improvement in gastrointestinal function, but also it seems this procedure delays recovery of gastrointestinal function.[23]

In this study, the severity of the abdominal flatulence in the control group, after the surgery was significantly less than the intervention group. In this study, Fazel et al. (2009) indicated that, the severity of flatulence (abdominal circumference) in patients without nasogastric intubation, was insignificantly less than patients with these tubes .[18] The results of this study are to some extent consistent with the results of the present study. The increment in the abdomen circumference of the patients from the day of surgery until the sixth day, could indicate a post-operative transient ileus. Given that there has been significantly more cases of severe abdominal flatulence in the group of patients with nasogastric

tubes, so it could be assumed that using nasogastric tube, may delay resolution of postoperative ileus and exacerbate flatulence. Although based on self-report scale of the flatulence severity, only on the sixth day after surgery flatulence severity of the patients with nasogastric tubes has been more than patients without them; but the severity of flatulence in patients with nasogastric tubes, has increased especially on the fourth, fifth and sixth days after the surgery. This issue also could be a reason to discontinue use of nasogastric tubes in these cases.

The results of Chung et al. (2003) showed that only one of the patients with nasogastric intubation suffered from flatulence, but several patients without nasogastric intubation experienced flatulence, but there was no significant statistical differences between the two groups.[26] The results of this study is inconsistent with the result of the present study. Considering the duration of postoperative ileus in different parts of the gastrointestinal tract and the start of oral nutrition, it could be expected that the severity of flatulence after surgery in the two studies be different; since in the present study oral intake was started simultaneously in two groups and without taking into account the first passage of gas.

In regard to the diet tolerance timing after the gastrectomy, the results indicated that diet tolerance in the control group has been better. The findings of Fazel et al. (2009) study demonstrated that no cases of diet intolerance in groups with or without nasogastric tubes has been observed.[18] Additionally, Chung et al. (2003) reported that during the return to a normal diet after surgery, there was no statistically significant difference between the two groups of patients.[26] The results of this study is consistent with the results of the present study. Subsequently, the nasogastric intubation after surgery has less/no impact on improvement or accelerating the return of gastrointestinal function, and sometimes may even worsen the condition of the patient.

Pacelli et al. (2014) reported that, the time of beginning liquid diet after the surgery in patients with nasogastric tubes, is significantly longer than patients without them.[17] This study is not consistent with the present study. Possible cause of this in consistency might be due to the simultaneous beginning of the diet in two groups of patients on the fourth day after surgery without waiting for the first passage of gas.

This issue is one of the limitations of the present study. Generally the start of oral intake is assumed on the basis of the first passage of gas; because despite the paralysis of the stomach until 24 hours and colon 72 hours post-operation, if the patient be placed in a semi-upright position, a fluid bolus can reach the duodenum by gravity force and stimulate Gastro-colic reflex.[23, 26,27] However, due to the type of surgery and the restrictions in the surgery department of Imam Reza (AS) Hospital in Mashhad, there was no possibility of oral intake after the first passage of gas. In addition the duration of postoperative ileus is influenced by several factors, many of which are unknown and controlling them were out of scope of this study.

5. Conclusion

Based on the results of the present study, the use of nasogastric intubation aggravates flatulence intensity and has no positive impact on the severity of nausea and vomiting, the first passage of gas and diet tolerance. Therefore it can be stated that using nasogastric intubation not only doesn't positively affect the gastrointestinal function, but also it might postpone its return to normal function. So the routine use of nasogastric intubation after gastric operation is not appropriate and it is recommended that its use be limited to essential situations and for certain patients.

Conflicts of interest

The authors declare no conflicts of interest.

Authors' contributions

Hamid Chamanzari: supervisor teacher, overseeing the implementation of the plan, participation in the drafting of the article. Mahdi Kari: study design, data collection, data analysis, drafting the article. Seyed Reza Mazloum: advising on how to analyze data, monitoring the implementation of the plan, participation in the drafting of the article. Ali Jangjoo: advising on designing the study, participation in the implementation of the research and drafting the article.

Acknowledgments

This study was the result of a master's thesis and an approved project by Mashhad University of Medical Sciences (code: 940190), which has been registered in the Iranian Registry of Clinical Trials (Code: IRCT2016073124845N2). Hereby, we express our gratitude to Research deputy of university for his financial support. Moreover, we extend our appreciation to all the Faculty of Nursing and Midwifery and the School of Medicine in Mashhad, Imam Reza (AS) hospital officials and the patients and their loved ones who helped us in conducting this study.

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How to cite: Chamanzari H, Kari M, Mazloum SR, Jangjoo A. Evaluation of the effect of nasogastric intubation on gastrointestinal function after gastrectomy in gastric cancer patients. Medical - Surgical Nursing Journal 2016; 5(2): 42-50.