Prophylactic Postoperative Nasogastric Decompression

A Prospective Study of Its Requirement and the Influence of Cimetidine in 200 Patients

WILLIAM G. CHEADLE, M.D.,* GARY C. VITALE, M.D.,* COLIN R. MACKIE, F.R.C.S.,†
ALFRED CUSCHIERI, M.D., F.R.C.S.†

To determine the need for prophylactic nasogastric decompression following laparotomy and the influence of cimetidine, 200 consecutive patients who underwent major abdominal procedures were prospectively randomized into one of four limbs: (1) no tube-placebo; (2) no tube-cimetidine; (3) tube-placebo; and (4) tube-cimetidine. Patients were evenly distributed among these groups with respect to age, sex, alcohol and tobacco use, previous operations, and types of operations. There was significantly longer time until passage of flatus, bowel movement, and cessation of intravenous fluids in the tube group ($p < 0.05$). Duration of postoperative stay increased from 11.4 to 14.1 days in the intubated patients ($p < 0.05$). There was also significantly more pain with and frequency of swallowing, and nose/throat discomfort in the tube group. Nasogastric tubes reduced the incidence of vomiting from 28 in the no-tube group to 10 in the tube group ($p < 0.05$), but most had only one or two episodes. Cimetidine did not affect either the incidence of vomiting or the duration of intubation, but was associated with a significant increase in pneumonias ($p < 0.05$). Five patients without tubes initially, and seven patients with tubes had to have them inserted or replaced for vomiting or abdominal distention, which occurred equally in the placebo and cimetidine limbs. There were no cases of aspiration pneumonia, gastric dilatation, or wound dehiscence in the trial, and the four anastomotic leaks were divided equally between the tube and no-tube groups. The results indicated that prophylactic decompression was unnecessary in most patients and associated with increased morbidity and delayed return of gastrointestinal function. Cimetidine lowered nasogastric output on the first postoperative day ($p < 0.05$), but did not prevent vomiting.

From the Department of Surgery, University of Louisville, Louisville, Kentucky, and the Department of Surgery, University of Dundee, Dundee, Scotland†*

NASOGASTRIC DECOMPRESSION FOLLOWING LAPAROTOMY, as a prophylactic measure for the prevention of nausea, vomiting, and abdominal distention, has been standard in most centers since its description and popularization by Wangensteen.[1] Several retrospective series, however, have demonstrated satisfactory results without its use,[2-5] and a variety of complications, particularly pulmonary complications, have been attributed to nasogastric tubes.[3,7,8] Two recent prospective studies that compared intubated and nonintubated patients following laparotomy demonstrated little difference in morbidity and mortality rates apart from increased patient discomfort associated with the nasogastric tubes themselves.[9,10] These studies, however, included no patients who underwent major vascular operations and had relatively few who had major gastric and esophageal procedures. In a previous pilot study from our unit of 30 patients with nasogastric tubes in place following aortic graft placement and colon resection, cimetidine was found to significantly reduce the amount of nasogastric aspirate and permit earlier removal of the tubes.[11] The present study was undertaken prospectively to determine the necessity of prophylactic nasogastric decompression and the effect of cimetidine on that need in a larger group of patients who underwent all types of elective, major abdominal procedures.

Materials and Methods

Over a 15-month period in one university surgical unit, 200 consecutive patients scheduled to undergo laparotomy and a major abdominal procedure were prospectively randomized into one of four limbs of the trial. Group 1 had nasogastric tubes and received placebo; group 2 had nasogastric tubes and received cimetidine; group 3 had no nasogastric tubes and placebo; and group 4 had no tubes and received cimetidine. The study was double blind

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Reprint requests: Professor A. Cuschieri, Department of Surgery, Ninewells Hospital and Medical School, Dundee, Scotland, DD1 9SY.

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TABLE 1. *Patient Stratification and Distribution of Procedures*

	Distribution of Patient Characteristics			
	No Tube		Tube	
	Placebo	Cimetidine	Placebo	Cimetidine
Age (years)	60	56	59	61
Sex (% male)	60	60	57	50
ETOH (%)	58	57	64	67
Tobacco (%)	47	40	43	52
Per cent previous laparotomy	26	29	22	21
	Distribution of procedures			
	No tube		Tube	
	Placebo	Cimetidine	Placebo	Cimetidine
Gastroesophageal	38	38	45	46
Colon	28	13	27	27
Vascular	11	17	16	15
Hepatopancreatic	13	10	4	2
Small bowel	6	13	6	4
Miscellaneous	4	9	2	6
Total	100%	100%	100%	100%

with respect to placebo/cimetidine administration, and patients did not know whether or not they would receive a nasogastric tube.

Randomization was accomplished by means of a random number generator and subsequent randomization list furnished by Smith, Kline, and French Laboratories, Ltd., Welwyn Garden, England. A sealed envelope attached to the patient chart was opened by the anesthetist toward the end of each case to determine if a nasogastric tube was to be placed. If it was, it was placed at that time and its position in the stomach was verified by the surgeon. Patients who underwent emergency laparotomy and those with evidence of active intraabdominal inflammation manifest by tenderness, fever, and leukocytosis were not randomized. Patients scheduled for cholecystectomy were not randomized, but those with known common duct stones scheduled to have duct exploration and possible biliary bypass were randomized. Those patients who were found at laparotomy to have active intraabdominal inflammation or abdominal carcinomatosis were excluded from the trial.

TABLE 2. *Distribution of Anastomoses and Other Operations*

	No tube	Tube
Anastomoses (94)		
Esophageal	6	12
Gastric	14	19
Small bowel	6	4
Colonic	13	15
Biliary	3	2
Ostomy (20)	10	10
Nissen fundoplication (19)	11	8
Aortic graft (26)	15	11

The nasogastric tubes used had a 14-gauge single lumen and were placed to gravity drainage with aspiration every 4 hours on the wards to evacuate gastric contents. Samples in several patients were saved twice daily to determine pH of the contents. Cimetidine 200 mg or placebo was administered intravenously every 6 hours beginning at midnight the night of operation and continued until intravenous maintenance fluid therapy was stopped. A number of postoperative parameters were recorded and each patient underwent a daily assessment of nine gastrointestinal symptoms by the author using a visual linear analog scale. The symptoms included heartburn, pain with swallowing, dry mouth, nose/throat discomfort, abdominal distention, crampy abdominal pain, nausea, and frequency of belching and swallowing. All patient care, including management of the nasogastric tubes, was carried out by the surgeon in charge of the particular patient, and narcotics and antinauseants were offered on an as-needed basis to all patients. Oral intake was usually started the first or second postoperative day and began with 15 ml of water per hour and increased to 30, 45, 60, and 90 ml per hour each day until a light diet was begun. Statistical analyses were performed by chi square, Mann-Whitney U, and Student's t-tests as appropriate.

Results

Two patients who underwent antireflux procedures *via* thoracotomy were inadvertently entered into the trial, and three patients were found to have been wrongly randomized after the code was broken, so 195 patients were available for analysis. The results of patient randomization demonstrated relatively equal distribution between the four groups with respect to patient characteristics and type of operations performed (Table 1). The average age ranged from 56 to 61 years and there was a slight male preponderance (57%) overall. About one-fourth of the patients had one or more previous laparotomies.

The procedures were grouped into six categories and results given as a per cent within each group (Table 1). There were relatively more patients with tubes in the gastroesophageal groups and without tubes in the hepatopancreatic groups. Ninety-four of the 195 patients had a gastrointestinal anastomosis performed and they, along with other major procedures, are listed in Table 2. There was equal distribution between the tube and no-tube groups among those who underwent construction of an ostomy, Nissen fundoplication, and placement of an aortic graft. Those with anastomoses were also evenly distributed with the exception of patients with esophageal anastomoses who were greater in the tube group.

TABLE 3. *Distribution of Oral Intake over the First Four Days*

	No tube		Tube	
Day	Placebo	Cimetidine	Placebo	Cimetidine
1	171	164	80	61
2	359	403	235	281
3	568	702	420	487
4	795	792	543	530

TABLE 5. *pH of Nasogastric Aspirate during the First Two Postoperative Days*

	Placebo	Cimetidine
Day 1		
0800 (N = 38)	4.35 ± 0.48	5.79 ± 0.46
2000 (N = 29)	3.75 ± 0.49	4.25 ± 0.63
Day 2		
0800 (N = 26)	3.29 ± 0.58	3.36 ± 0.43
2000 (N = 21)	2.93 ± 0.63	3.03 ± 0.39

Urine output was used as a measure of hydration and ranged from 1553 to 2272 ml/day. There was no significant difference between the four limbs over the first 4 days. Oral intake over the first four days is listed in Table 3 and, although greater in the nonintubated group each day, the difference was not statistically significant. There was little difference between the placebo and cimetidine limbs.

There was also little difference in the duration of intubation between the placebo and cimetidine limbs, and no significant difference in the amount of time from 0800 on the first postoperative day until zero net aspirate was obtained for 8 hours (Table 4). There was, however, a significant decrease in the amount of nasogastric aspirate during the first postoperative 24-hour period starting from 0800 the first postoperative day. There was no significant difference over the second postoperative day, and the mean net aspirates were actually negative for both limbs because of the greater oral intake. The pH of the aspirates over the first 2 days are listed in Table 5. These were 1.4 units higher and 0.5 units higher in the cimetidine groups at the first two sampling periods, but were not statistically significant because of wide variations in both groups. There was little difference between the two limbs during the second day and an acidic trend in general with time in both groups.

The five parameters of postoperative recovery are listed in Table 6. There was a significant increase in the number of days until first passage of flatus per rectum and first bowel movement, duration of maintenance intravenous fluid therapy, and the number of postoperative days until discharge in the intubated group. There was no difference between the placebo and cimetidine limbs in these parameters with the exception of the number of days until resumption of a regular diet. This occurred significantly sooner in the nonintubated group compared to the tube group in only those patients who received cimetidine. There was no difference between these groups in those who received placebo.

The number of patients in the nonintubated groups who vomited was significantly greater than those in the intubated group while the tube was in place ($p < 0.001$). Eighteen of the 28 patients who vomited in the no-tube group had one episode of vomiting, and seven had two episodes. All ten patients who vomited with the tube in place had only one episode, but an additional 13 patients vomited after the tube was removed in this group. Twelve of the 28 patients in the no-tube group and six of the ten in the tube group received cimetidine. There was no significant difference, therefore, between the number of patients in the placebo and cimetidine limbs of either of the groups (including the additional 13 patients) who vomited. Thus, cimetidine did not prevent vomiting.

The results of the visual linear analogue scale of symptoms demonstrated a significant increase in pain with swallowing, frequency of swallowing, and nose and throat discomfort during the first 3 postoperative days in the tube group compared to the no-tube group. There was no difference between the placebo and cimetidine limbs within the groups. There was, however, a significant decrease in subjective abdominal distention on the first 2 postoperative days and dry mouth on the second postoperative in all patients who received cimetidine compared to those who did not. There were no differences in the other symptoms of heartburn, crampy abdominal pain, nausea, or frequency of belching between any of the four limbs.

The deaths and complications are listed in Table 7. Although there were more deaths in the tube group as a

TABLE 4. *Effect of Cimetidine on Duration of Intubation and Nasogastric Aspirate*

	Placebo	Cimetidine
Duration of intubation (days)	2.34 ± 0.19	2.20 ± 0.18
Hours until zero net aspirate X8 hours (median)	20.00	16.00
Net aspirate first day	228.5 ± 54	57.6 ± 31

TABLE 6. *Comparison of Postoperative Parameters of Recovery*

	No Tube (days)	Tube (days)	p Value
First flatus	2.5 ± 0.13	3.1 ± 0.16	<0.002
First bowel movement	3.2 ± 0.16	3.6 ± 0.19	<0.05
IV fluids	4.3 ± 0.22	5.0 ± 0.26	<0.02
Regular diet	6.0 ± 0.37	6.6 ± 0.41	>0.05
Discharge	11.4 ± 0.95	14.1 ± 1.0	<0.05

TABLE 7. *Deaths and Complications*

	No tube		Tube	
	Placebo	Cimetidine	Placebo	Cimetidine
Deaths	1	2	4	5
Anastomotic leaks	2	0	0	2
Intubated (no tube)	2	3	—	—
Reintubated (tube)	—	—	4	3
Pneumonia	0	5	3	8
Wound infection	7	4	4	6
Hematemesis	1	0	2	2
DVT	1	1	3	2

whole, the difference was not significant. Six deaths were due primarily to cardiopulmonary disease, including two from pneumonia and congestive heart failure in the tube group. Two patients with myocardial infarction and two with pulmonary embolism were equally divided between the tube and no-tube groups. Three patients died of metastatic malignancy (two with tubes) and another, who had a tube, died of cardiac arrest following abdominoperineal resection for carcinoma of the rectum. Two patients, both with tubes, died following anastomotic leakage. One patient leaked from an esophagojejunostomy following esophagogastrectomy for carcinoma and another developed a colocutaneous fistula following sigmoid resection for diverticular disease.

The four patients who had anastomotic leaks were equally divided between the tube and no-tube groups. The two leaks in the no-tube group were both from choledochojejunostomies. The first followed excision of a choledochal cyst and development of postoperative pancreatitis, and the second following bypass for carcinoma of the head of the pancreas.

A total of five patients without tubes initially had to have insertion of a nasogastric tube for continued vomiting or abdominal distention. This resolved in four of the five, but one patient underwent reexploration for small bowel obstruction due to a metastasis in the terminal ileum before she died. Seven patients who initially had nasogastric tubes had to have them reinserted after their removal for the same reason. Five of the seven resolved, but one patient developed malignant ascites and prolonged adynamic ileus before he died. Another underwent reexploration with lysis of adhesions for small bowel obstruction.

There were more pneumonias in the tube group, but this did not reach statistical significance. However, there were significantly more pneumonias in those patients treated with cimetidine as a whole compared to all patients given placebo. Wound infections were equally divided between the four limbs, but there were more patients in the tube group with hematemesis and deep venous thrombosis. There were no cases of aspiration pneumonia, wound dehiscence, or gastric dilatation, although patients were not routinely screened with abdominal films.

Discussion

Levin described the single lumen nasogastric tube[12] at a time when little was understood about perioperative fluid and electrolyte management, and nausea and vomiting were a prominent side effect of general anesthesia.[13] The concept of prophylactic decompression following laparotomy, therefore, was popularized by Wangensteen with his description of continuous aspiration with a nasogastroduodenal tube.[1] Gerber was the first to describe a large series of patients without routine nasogastric decompression in 1958, but the only two prospective studies which compared decompressed and nondecompressed patients have just recently emerged.[9,10] These trials both showed that prophylactic decompression could have been avoided in most patients without an increase in mortality rate or major morbidity such as anastomotic leak or wound dehiscence. Nine per cent of the total number of patients in these two studies had tube placement or replacement for vomiting or abdominal distention. Our results in patients who underwent virtually all types of major intraabdominal procedures further confirm the results of these studies. The vast majority of patients in this trial did not require routine prophylactic decompression, but six per cent did require therapeutic nasogastric decompression after surgery.

The incidence of vomiting was significantly lowered in those patients who were routinely intubated but at the expense of delayed postoperative recovery and increased patient discomfort. In addition, 13 patients in the tube group vomited after their tubes were removed, which may have been caused in part by gastroesophageal irritation and habit aerophagia which persisted after their removal. Twenty-five of the 28 patients who vomited in the nonintubated group did so only once or twice and those episodes were spread out over the first 6 postoperative days. Wound dehiscence was not seen, and the anastomotic leakage rate of four per cent was not affected by the presence of a tube.

Cimetidine appeared to be an attractive depressant of nasogastric output as shown previously by Mackie,[11] and although it did reduce output during the first postoperative day, there was no reduction in the incidence of vomiting. Cimetidine appeared to have most of its effect early on as shown by reduced nasogastric output and increased pH on the first postoperative day only, as well as mild symptomatic benefit over the first 2 postoperative days. The increase in pneumonias in the cimetidine-treated patients is interesting and may have been a result of altered gastric flora, as bacterial overgrowth has been shown to occur at pH > 4.[14] Cimetidine has been shown to increase

bacterial counts when taken on a long-term basis, but postoperative gastric aspirates have not been studied.[14] The incidence of wound infection, however, was not greater in those who received cimetidine. The routine or even therapeutic use of cimetidine following laparotomy does not appear justified based on these results particularly because of the lack of prevention of vomiting.

In conclusion, prophylactic nasogastric decompression was unnecessary in most of the patients in the trial and was associated overall with increased patient discomfort, delayed recovery of gastrointestinal function, and longer convalescence. Vomiting occurred more frequently in those patients without tubes, but the number of episodes per patient was low and it did not produce aspiration pneumonia. Therapeutic decompression was safe and effective in those used, including the two patients who went on to reexploration for small bowel obstruction. Cimetidine had little effect on this need and especially did not prevent vomiting. This trial has shown that there is no indication for routine prophylactic nasogastric decompression in patients undergoing elective abdominal surgery. Nasogastric suction should be used therapeutically in those patients who develop persistent vomiting or abdominal distention after surgery.

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Discussion

DR. ROBERT ZEPPA (Miami, Florida): I would like to commend the authors on a very scholarly approach to a task with which we are involved day after day.

I would like, however, to remind the audience that perhaps 35 years ago the late Sam Harbison reported on 100 consecutive patients operated on for peptic ulcer disease in whom no nasogastric decompression was used and with excellent results.

Unfortunately, that paper has never really achieved the respect that I think it deserves, but at any rate, this study utilizing the prospective randomized technique supports the original uncontrolled observations of the late Sam Harbison.

DR. JOHN M. HOWARD (Toledo, Ohio): Somewhat tangential to the presentation, several years ago it dawned on me that I could not recall having seen gastric peristalsis during laparotomy, and so in a casual way I started looking for gastric peristalsis. In contradistinction to small bowel peristalsis, I can recall having seen it only one time during laparotomy.

DR. CLARENCE DENNIS (Stony Brook, New York): I would like to commend the authors on the paper, which I think is a very fascinating one, but I wonder if they would consider continuing the study until they have statistical significance.

In the second place, I wonder whether it might have made a difference if the suction had been applied as my preceptor, Owen Wangensteen, recommended after a great deal of experimental work. In other words, why did they use just 4-hourly evacuation instead of continuous suction?

DR. GEORGE L. JORDAN, JR. (Houston, Texas): I am hesitant to report anecdotal data to this organization, but I cannot refrain.

Some years ago when I was a resident I worked with Dr. O. T. Claggett. I will not tell you why Dr. Claggett did not use nasogastric tubes, but he had his reasons, and with a series certainly as large as this, we only had to put down one tube after surgery during the entire time I worked with him, with no patients having tubes used prophylactically. Therefore, there is no question that this can be done.

When I went to Houston, I had been impressed with this and, therefore, decided that we would try it at the VA hospital in Houston where I was working at that time. Therefore, in patients having gastrectomy, we did not use prophylactic tubes.

However, 50% of these patients subsequently required tubes. Some of them got into severe difficulty because of ileus, nausea, and vomiting, although the death rate was not influenced with the prophylactic tube. Looking into the reasons why we could not repeat Dr. Claggett's experience in the VA hospital in Houston, a number of factors were immediately apparent.

One was anesthesia itself, both the type of agent and the skill with which the anesthesia was given, whether or not abdominal wound closure was easy, and whether or not one had to work to close the abdominal wall, and thus give some irritation to the small bowel. The length of the procedure was important. The amount of manipulation of the bowel