Use of Tubes and Radiographs in the Management of Small Bowel Obstruction

ROBERT E. BROLIN, M.D., F.A.C.S., MARK J. KRASNA, M.D., and BRUCE A. MAST, B.A.

From the UMDNJ–Robert Wood Johnson Medical School, New Brunswick, New Jersey

During the past 10 years 311 consecutive patients were admitted with 342 episodes of small bowel obstruction (SBO). There were 193 cases of partial small bowel obstruction (PSBO) and 149 cases of complete small bowel obstruction (CSBO) as determined by interpretation of the abdominal radiographs done on admission. The purpose of this review was to determine the reliability of the admission plain abdominal radiographs and subsequent upper gastrointestinal (UGI) contrast studies in predicting the need for operative intervention. The use of nasogastric tubes (NGT) *versus* nasointestinal (long) tubes (NIT) was correlated with the following outcome variables; length of hospital stay (LOS), timing of operative intervention, incidence of postoperative complications, and duration of postoperative ileus. Long tubes (NIT) were used in 64 episodes of PSBO and 81 episodes of CSBO, whereas nasogastric tubes (NGT) were used in 116 cases of PSBO and 68 cases of CSBO. Thirty-eight of 193 (19%) patients with PSBO required operation (20 of 116 with NGT and 18 of 64 with NIT), whereas 125 of 149 (84%) patients with CSBO required operation (60 of 68 with NGT and 65 of 81 with NIT). Need for operation was not correlated with whether or not long tubes passed beyond the pylorus; 50 passed *versus* 33 not passed in operative groups ($p = 0.15$). Twelve of 83 patients with NIT had operation within 24 hours *versus* 52 of 80 patients with NGT ($p < 0.001$). In six of 64 patients who had surgery within 24 hours, complications developed *versus* in 39 of 99 patients operated on more than 24 hours after admission ($p \leq 0.001$). In 29 of 83 patients treated with NIT, postoperative complications developed *versus* in 16 of 80 patients with NGT ($p \leq 0.04$). The mean duration of postoperative ileus in patients with NIT was 7 days *versus* 4.1 days for NGT patients ($p < 0.001$). The mean LOS was 12.2 days for NGT patients *versus* 21 days for patients with NIT ($p < 0.001$). Barium UGI contrast studies were performed in 57 patients to establish the presence of obstruction. In 34 of 57 patients the UGI disclosed mechanical obstruction that required operative intervention. In the remaining 23 patients no obstruction was demonstrated, and all 23 patients recovered without operation. In conclusion, there is no inherent superiority of NIT *versus* NGT in the treatment of SBO. Long tubes (NIT) were associated with a significantly greater LOS, duration of postoperative ileus, and incidence of postoperative complications, probably because of the significantly greater delay in operation in patients treated with NIT *versus* NGT. The radiographic distinction between PSBO and CSBO is clinically important in that 84% of patients with features of CSBO required operation *versus* only 19% of patients with PSBO.

THERE IS CONSIDERABLE controversy regarding both the effectiveness of tube decompression and what constitutes "reasonable delay" before operation in mechanical small bowel obstruction. Strangulation of obstructed bowel has been attributed to delayed decisions for operative treatment.[1,2] The incidence of postoperative complications is 5–10 times greater with strangulation than with cases of nonstrangulated obstruction.[1,3,4] It is well known that strangulation of the bowel occurs without specific signs and symptoms. Thus, many surgeons believe that all patients with mechanical intestinal obstruction should have laparotomy as soon as fluid losses have been replenished.[4–6] On the other hand, the diagnosis of "partial" bowel obstruction is based on clinical and radiographic signs that, in the opinion of most surgeons, warrants a trial of tube decompression rather than immediate operative intervention.[7,8] There are still others who believe that a trial of nonoperative tube decompression should be rendered to any patient with obstruction who does not have obvious signs of strangulation.[9–11] These diverse opinions can be attributed to the paucity of objective criteria that can reliably distinguish cases of obstruction that are likely to respond to tube

Presented at The Papers Session of the 72nd Clinical Congress of the American College of Surgeons, New Orleans, Louisiana, October 20–24, 1986.

Reprint requests: Robert E. Brolin, M.D., UMDNJ–Robert Wood Johnson Medical School, One Robert Wood Johnson Place, CN 19, New Brunswick, NJ 08903-0019.

Submitted for publication: February 11, 1987.

decompression from those that require early operation. It was the purpose of this review to determine the reliability of the admission clinical signs and plain abdominal radiographs in predicting the need for operative intervention in mechanical small bowel obstruction. We also compared the effectiveness of nasogastric (NGT) with nasointestinal or long tubes (NIT) in terms of successful avoidance of operative treatment.

Clinical Material

For the 10-year period beginning January 1, 1976 through December 31, 1985, 311 consecutive patients with 342 episodes of mechanical small bowel obstruction were admitted to Robert Wood Johnson University Hospital. This review excluded patients with adynamic ileus, fecal impaction (including meconium ileus), and mesenteric vascular occlusion. Plain abdominal radiographs were taken at the time of admission in all but six patients with incarcerated hernia in whom the clinical diagnosis of complete mechanical intestinal obstruction was confirmed at operation. There were 193 cases of partial bowel obstruction and 149 cases of complete obstruction. The distinction between partial and complete mechanical obstruction was based on the radiologist's interpretation of the admission abdominal radiographs. The primary distinguishing radiographic feature between partial and complete obstruction is the presence of gas in the colon above the peritoneal reflection. Cases of complete obstruction were characterized by dilated loops of small bowel with fluid levels and no visible gas in the colon, whereas cases of partial obstruction showed clear-cut evidence of colonic gas in addition to dilated loops of small bowel (Fig. 1).

The frequency of the presenting clinical symptoms is shown in Table 1. Nausea, vomiting, and abdominal pain were reported in 99% of the 342 episodes of obstruction. Abdominal pain was typically colicky in nature. Patients who denied either pain or vomiting had plain abdominal radiographs that showed dilated small bowel loops with fluid levels. Sixty-one per cent of patients in whom the duration of obstipation was documented denied passage of stool or flatus for more than 24 hours. Seven patients had obvious peritonitis, six of whom had hypotension and a temperature ≥ 100 F at the time of admission. Other admission criteria that were assessed included the presence of abdominal tenderness and leukocyte count. Neither of these correlated with the need for operation. Table 2 shows the etiology of obstruction. Adhesions from previous abdominal operations was the most common cause of obstruction, accounting for 59% of cases of complete obstruction and 73% of cases of partial obstruction. Intra-abdominal malignancy was the second most common case of obstruction, accounting for 17% of cases of complete obstruction and 10% of cases of partial obstruction. Hernia and Crohn's disease were the third and fourth most frequent causes, respectively. The correct admission diagnosis of small bowel obstruction, partial or complete, was made in 322 cases (94%). The admission diagnoses for the remaining 20 cases are shown in Table 3.

NIT were used in 64 cases of partial obstruction and 81 cases of complete obstruction, whereas NGT were used in 116 cases of partial obstruction and 68 cases of complete obstruction. Generally, the attending surgeon decided whether a long or short tube would be used, although occasionally the surgical house staff made this decision. The suspected etiology of obstruction did not

TABLE 1. *Presenting Clinical Features*

Features	No. of Cases (%)
Nausea/vomiting	340 (99)
Abdominal pain	339 (99)
Obstipation ≥24 hours	102* (61)*
Peritonitis	7 (2)
Fever ≥100 F	7 (2)
Hypotension ≤90 mmHg systolic	6 (2)

* The duration of obstipation was clearly documented in 102 cases of which 61% had obstipation ≥ 24 hours.

TABLE 2. *Etiology of Obstruction*

	PSBO	CSBO
Adhesions	140	88
Malignancy	18	25
Hernia	—	22
Crohn's	12	2
Other*	23	12

* Other causes of obstruction included gallstone ileus (4), volvulus (4), intussusception (4), abdominal abscess (4), bezoar (2), diverticulitis (2), and cause undetermined (10). Twelve cases of early postoperative obstruction were included in the adhesion group.

TABLE 3. *Incorrect Admission Diagnoses and Outcome**

Admission diagnosis	Radiographic Diagnosis	
	PSBO	CSBO
Abdominal pain	10 (7)	—
Pancreatitis	3 (2)	1 (1)
Pelvic inflammatory disease	3 (1)	—
Acute cholecystitis	2 (0)	—
Pneumonia	1 (0)	—

* Abdominal pain of uncertain etiology was the most frequent "incorrect" diagnosis. Numbers in parentheses are the number of patients who required operation, 11 of 20 (55%) in all. The admission radiographs were consistent with partial obstruction in 19 of these 20 patients.

TABLE 4. *NGT* Versus *NIT and Outcome**

	NGT	NIT	
Need for operation	80/184	83/145	
Operation ≤24 hours	52/80	12/83	(p < 0.001)†
Postoperative complications	16/80	29/83	(p ≤ 0.04)†
Duration of postoperative ileus (days)	4.1	7.0	(p < 0.001)†
Length of hospitalization (days)	12.2	21.0	(p < 0.001)†

* The type of tube used for decompression did not impact on need for operative intervention. However, a significantly greater number of patients managed with NGT compared with NIT had operation within the first 24 hours of hospitalization. The incidence of postoperative ileus and length of hospitalization were significantly greater in patients managed with long tubes.

† Statistics computed by Fisher's exact test.

influence the selection of one type of tube over the other. The type of tube used also did not influence requirement for operative intervention. Thirty-eight of 193 (19%) cases of partial obstruction required operation, including 20 of 116 (10%) treated with nasogastric tubes and 18 of 64 (28%) treated with long tubes. One hundred twenty-five of 149 cases (84%) of complete obstruction required operation, including 60 of 68 (89%) treated with nasogastric tubes and 65 of 81 (80%) treated with long tubes. Tube decompression was not used in the 13 remaining cases. Long tubes passed through the pylorus in 50 of the 83 cases (60%) that required operation compared with 49 of the 64 cases (76%) treated with long tubes that did not require operative intervention ($p = 0.15$ by chi-square test). The use of nasogastric tubes *versus* long tubes was correlated with the following outcome variables: need for operation, timing of operative intervention, number of postoperative complications, duration of postoperative ileus, and length of hospitalization. These data are shown in Table 4.

One hundred eighteen of 191 patients (62%) who were managed for at least 24 hours by tube decompression showed signs of clinical or radiographic improvement within the first 24 hours of treatment. Only eight patients (5%) whose obstructions ultimately resolved without operation did not show signs of improvement during the first 48 hours of tube decompression. Improvement was recognized radiographically as decreased gaseous distention of the small bowel and clinically by spontaneous passage of stool and/or flatus. Thirty-eight of these 191 patients (20%) did not respond to tube decompression and eventually had operation.

TABLE 5. *Timing of Operation* Versus *Postoperative Complications**

Complication	<24 Hours (N = 64)	>24 Hours (N = 99)
Wound infection	1	13
Pneumonia	1	6
Fistula/abscess	—	6
Myocardial infarction	—	1
Pulmonary embolus	—	1
Death	4	12
Total	6	39

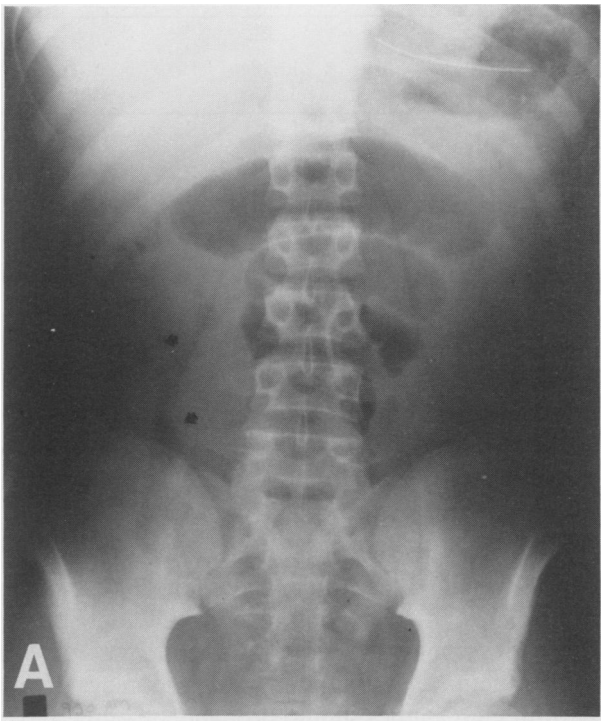
* Infectious complications were significantly more common in patients operated on more than 24 hours after admission. Fistulae and abscesses occurred in patients with either strangulation or iatrogenic perforation of the bowel.

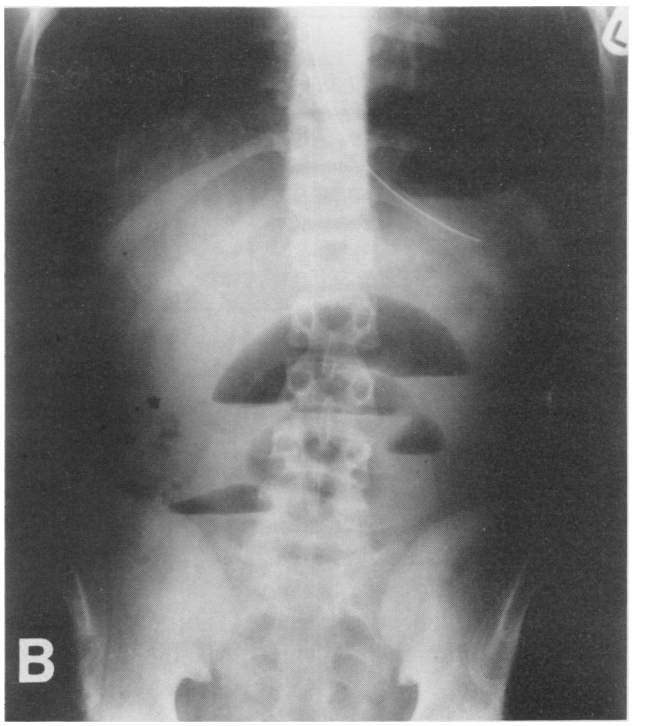
Table 5 shows the correlation between timing of operative intervention and the frequency of postoperative complications. Of the 64 patients who had operation within 24 hours of admission, postoperative complications developed in six patients (9%) compared with in 39 of 99 patients (39%) who had operation more than 24 hours after admission ($p \leq 0.001$ by chi-square test). Twenty-four of the 311 patients died (7.7%). Twenty-six patients had strangulation obstruction at operation. Nine of these 26 patients had operation within 24 hours of admission with three subsequent deaths compared with six deaths among the 17 patients who had operation more than 24 hours after admission. Eight patients other than those with strangulation died after operation. Seven of these patients had advanced carcinomatosis and one died of a massive stroke. The remaining seven patients who died did not have operation. Three of these patients were moribund with septic shock at the time of admission and four had inoperable abdominal malignancies.

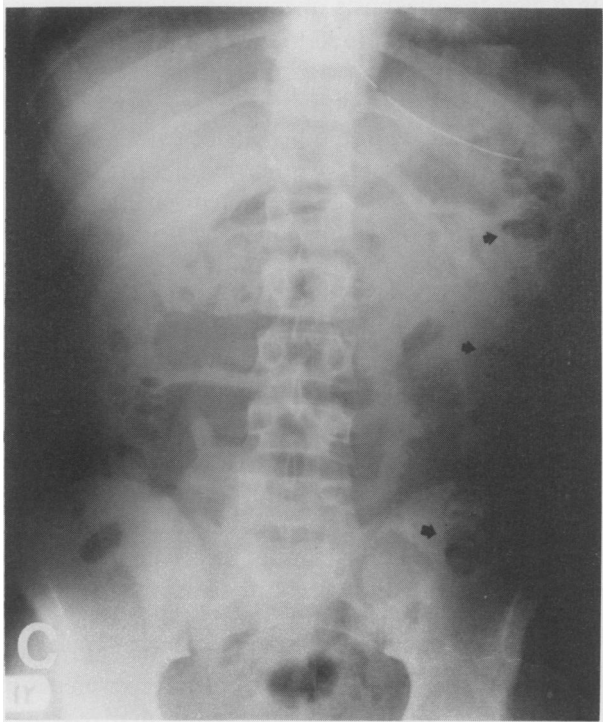
Barium upper gastrointestinal (UGI) contrast studies were performed in 57 patients to establish the presence of mechanical obstruction. In 34 of the 57 patients the contrast study disclosed mechanical obstruction, and each of these patients required operative intervention. In the remaining 23 patients no obstruction was demonstrated and all of these patients recovered without having operation. Those patients who required operation demonstrated either a discrete point of blockage (Fig. 2B) or failure of the barium to reach the cecum after 18–24 hours (Fig. 3). In the 23 patients who did not require operation all or nearly all of the barium had entered the cecum within the 24-hour observation period.

Discussion

There is surprisingly little information in the surgical literature regarding the reliability of either clinical or radiographic criteria in predicting the need for operative intervention in patients with intestinal obstruction. Table 6 shows data from six reports on small bowel obstruction published during the past 30 years. The reports of Wolfson et al. and Hofstetter were restricted to patients with adhesive obstruction, whereas the remainder included all well-documented cases of me-







FIGS. 1A–C. *A* and *B*. Flat and erect views of abdominal radiographs of a 16-year-old boy admitted with symptoms of intestinal obstruction 1 year after appendectomy for perforated appendicitis. Arrows demonstrate gas in the cecum consistent with partial obstruction. *C*. Radiograph of the same patient taken 24 hours later, which shows decreased gaseous distention of the small bowel and gas in the sigmoid colon (arrows). This patient was discharged on the fifth hospital day tolerating a solid diet.

chanical small bowel obstruction.[2,4,8,10–12] Becker, Hofstetter, Wolfson et al., and Stewardson et al. distinguished partial from complete obstruction, although Stewardson et al. excluded cases of partial obstruction from their review. Of note are the variable percentages of patients who required operation *versus* those who responded to tube decompression and avoided operative treatment. Becker and Silen et al. strongly advocated early operation for all cases of small bowel obstruction citing the abuse of tube decompression as a primary cause of death. On the other hand, Stewardson et al., Bizer et al., and Wolfson et al. recommend trials of

TABLE 6. *Small Bowel Obstruction: Previous Clinical Reports**

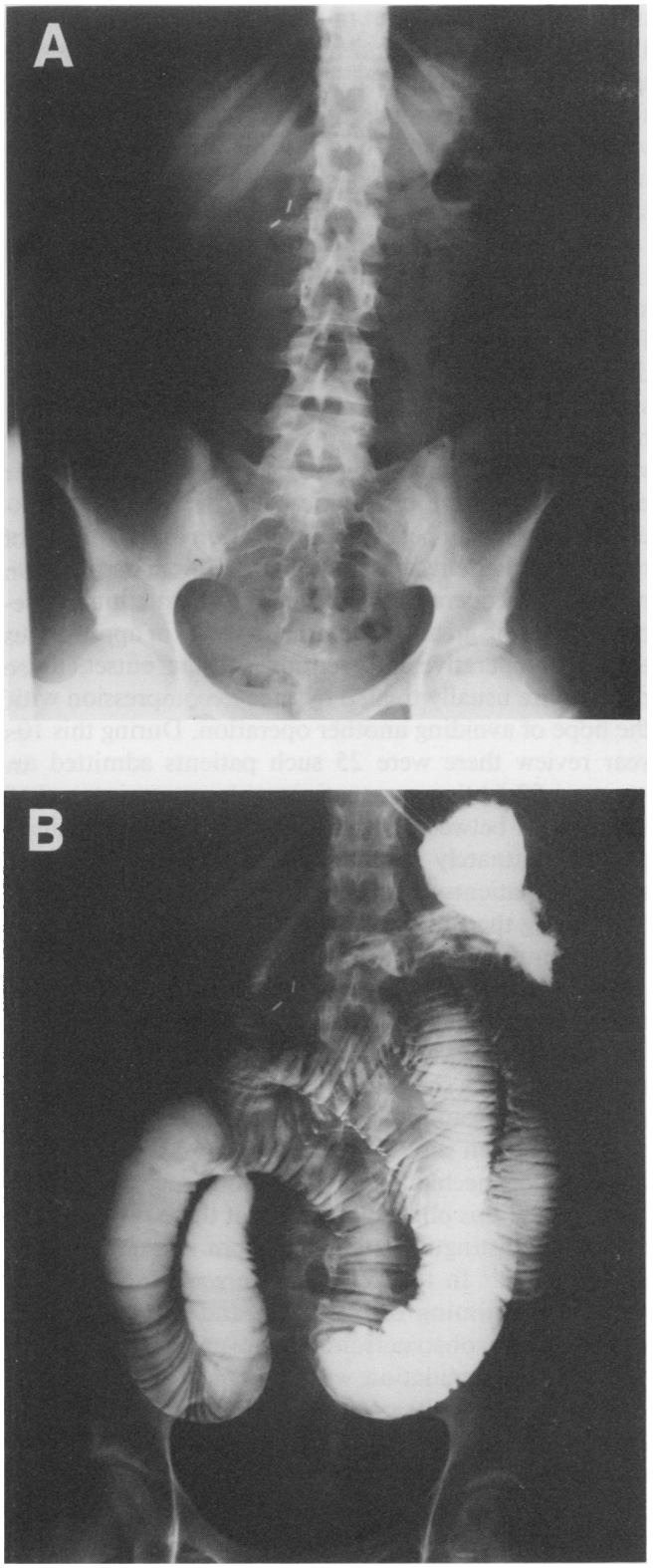
	Total Patients	No. of Patients Operated On (%)	% with Strangulation	% Total Mortality
Becker[2]	412	297 (72)	22%	12%
Silen et al.[4]	480	316 (66)	23%	11%
Stewardson et al.[10]	238	112 (47)	11%	5.5%
Hofstetter[11]	52	31 (60)	8%	1.9%
Bizer et al.[8]	405	267 (66)	10%	6.7%
Wolfson et al.[12]	127	48 (38)	12%	1.5%
Brolin (current series)	311	163 (53)	9%	7.7%

* The percentage of patients with mechanical small bowel obstruction who had operation ranged from a low of 38% (Wolfson et al.) to a high of 72% (Becker). The two series with the lowest mortality (Hofstetter, Wolfson et al.) included only patients with adhesive obstruction.

nonoperative tube decompression for all patients who lack the typical signs of intestinal strangulation. Hofstetter stated that the duration of nonoperative tube decompression should not exceed 24 hours. The overall incidence of operative intervention appears to have decreased during the past 2 decades. Table 6 also shows the incidence of strangulation and overall mortality in these clinical reports. The chronology of these reports shows a decreased incidence of both strangulation and mortality despite more conservative recommendations in treatment. In the current series the incidence of strangulation and mortality was 9% and 7.7%, respectively. These data suggest that factors other than early operative intervention are responsible for the decreased incidence of strangulation and mortality during the past 30 years.

The primary radiographic criterion for diagnosis of partial small bowel obstruction is gas in the colon above the peritoneal reflection.[6,13] The presence of colonic gas above the peritoneal reflection suggests that some air has passed beyond the obstruction, hence the blockage is incomplete. Because gas can be introduced into the rectum by digital examination, air in the rectum alone is not sufficient for making the diagnosis of partial obstruction. The radiographic diagnosis of "partial" bowel obstruction probably encompasses a number of cases of early complete obstruction, which may also show gas in the colon on the admission abdominal radiographs. In these early cases, the colonic gas antedates the time of obstruction and has not yet been evacuated. The typical radiographic features of mechanical intestinal obstruction may be absent in cases of high jejunal obstruction. Figure 2 shows the plain abdominal radiograph and subsequent barium UGI contrast study of a patient with complete obstruction 60 cm below the ligament of Treitz. The plain x-rays showed a paucity of gas in the small and large bowel without air fluid levels on the erect view. Plain radiographs performed 18 hours later showed one visible loop of small bowel. The barium UGI was performed to rule out obstruction of the proximal small bowel. In this series, barium UGI contrast studies were extremely reliable in determining need for operation. All patients whose barium studies demonstrated either a discrete site of blockage or failure of barium to reach the cecum within a 24-hour observation period ultimately required operation. Patients who recovered with tube decompression had contrast studies that showed complete transit of barium and no evidence of obstruction. Despite their great accuracy, the use of barium UGI studies should probably be limited to cases in which the diagnosis of mechanical obstruction is in doubt. Patients admitted to the hospital with partial obstruction who have not responded to tube decompression after 48 hours should be operated on without a UGI contrast study. On the other hand, patients responding to tube decompression who have no past history of abdominal surgery should have a predischarge UGI examination to rule out malignancy as a possible cause of obstruction. Barium UGI studies are probably most useful in distinguishing cases of early postoperative obstruction from prolonged adynamic ileus.

In this report, the selection of a nasogastric or long tube was made arbitrarily at the time of admission. Although some surgeons have strong sentiments for use of one type of tube over the other, there are no data demonstrating superiority of long *versus* short tubes in the treatment of mechanical intestinal obstruction. Wolfson and associates recently touted the efficacy of long tube decompression in the treatment of adhesive obstruction.[12] They made these claims despite the fact that approximately two thirds of their patients with complete obstruction did not respond to tube decompression and required operation. They also stated that passage of a long tube beyond the pylorus was of "significant predictive value" with respect to avoiding operative treatment, although no statistical support for those claims was provided. In the current review there was no correlation between need for operative intervention and whether or not long tubes passed beyond the pylorus. Fifty of the 83 patients (60%) managed with long tubes who required operation had passage of their tube into the upper small



FIGS. 2A and B. *A*. The erect admission radiograph of a 26-year-old woman who had symptoms of small bowel obstruction 2 years after laparotomy for blunt trauma. There is little gas in either the small or large bowel. *B*. A barium contrast study performed 24 hours later, which showed a discrete point of obstruction in the right midabdomen. Several hours later this patient had laparotomy and lysis of a single adhesive band.

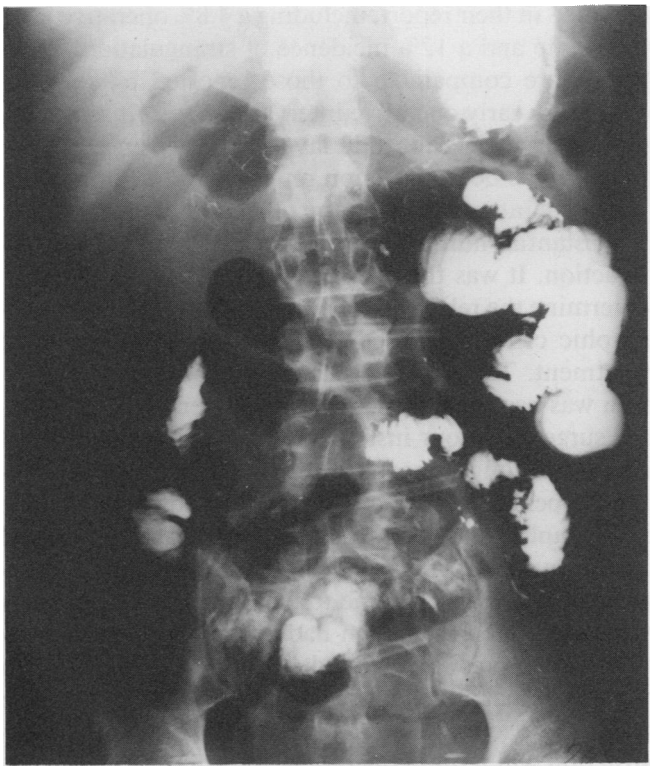


FIG. 3. Twenty-four hour delayed film of barium UGI performed on a 42-year-old man in whom signs of obstruction developed 6 days after right hemicolectomy and ileostomy for perforated cecal volvulus. The contrast study was performed after 4 days of nasointestinal tube (NIT) decompression. (Tube was removed during study). Although some barium emptied through the ileostomy, much remained in the upper small bowel. This patient had lysis of multiple adhesions on the eleventh postoperative day and had a subsequently uneventful recovery.

bowel. There was also no difference between nasogastric and nasointestinal tubes with respect to avoiding operative intervention. In this review there were several negative features associated with the use of long tubes compared with nasogastric tubes. Long tubes were associated with a significantly greater number of postoperative complications and significantly longer duration of both postoperative ileus and hospitalization (Table 3). These negative findings were most likely due to the significantly greater delay in operative intervention in patients managed with long tubes compared with nasogastric tubes. All of these data clearly show that the mere passage of a long tube into the upper small bowel does not justify delay in operative intervention.

Surgeons who favor a nonoperative trial of tube decompression for all cases of obstruction except those with signs of strangulation base support for their position on the substantial percentage of cases that resolve with tube decompression alone. Wolfson and associates operated on only 38% of 127 patients with adhesive obstruction after an empirical trial of tube decompression.[12] The incidence of postoperative complications

was 30% in their report, including a 4.8% operative mortality rate and a 12% incidence of strangulation. These results are comparable to those reported by surgeons who favor early operative intervention.[4,9,10] It seems obvious that a rigid attitude favoring either an empirical trial of tube decompression on one hand or immediate operative intervention on the other will do disservice to a substantial number of patients with small bowel obstruction. It was the primary purpose of this review to determine the reliability of admission clinical and radiographic criteria in predicting the need for operative treatment. The actual decision for operative intervention was based on the clinical judgement of the attending surgeon. At our institution there is no consensus of opinion among surgeons regarding the appropriate timing of operation for small bowel obstruction. Hence, the radiographic diagnosis of partial bowel obstruction did not always result in a nonoperative trial of tube decompression and, by the same token, a number of patients with complete obstruction had prolonged treatment by tube decompression. Nonetheless, in accordance with the axiom that all cases of partial obstruction will resolve with tube decompression and all cases of complete obstruction will require operation, the admission abdominal radiographs predicted the clinical course in 82% of cases in this series. Duration of obstipation was less reliable in predicting need for operation as 31% of patients with obstipation $\leq$ 24 hours required operation, whereas 38% with obstipation for more than 24 hours were successfully treated by tube decompression. On the basis of these data we recommend that all patients with radiographic features of complete obstruction have operation as soon as fluid losses have been replaced, whereas patients with features of partial obstruction and no clinical signs of strangulation be given a trial of tube decompression with the reasonable likelihood of avoiding operation. Although 16% of patients with complete obstruction successfully avoided operation, we could not identify specific features that distinguished those patients from the 84% who required operation.

There are several causes of obstruction that generally warrant an empirical trial of tube decompression. These include Crohn's enteritis, advanced abdominal carcinomatosis, and early postoperative obstruction. Obstruction due to Crohn's disease usually resolves after 24–48 hours of treatment with parenteral steroids and antibiotics. This treatment regimen was successful in avoiding operation in 11 of the 14 cases of obstruction caused by Crohn's enteritis in this report. Patients with obstruction secondary to abdominal tumor metastasis represent a treatment dilemma because of their generally debilitated condition on one hand and the low probability of response to tube decompression on the other. Furthermore, operative treatment is frequently difficult because of blockage by tumors at multiple sites along the bowel. In this series the hospital mortality rate of obstruction due to metastatic disease was 64%. Intestinal obstruction in the early postoperative period frequently resolves with tube decompression.[14–16] With early postoperative obstruction, many surgeons prefer a long tube to a nasogastric tube because of the theoretical advantage of internal enterolysis as it passes distally through the bowel. In the early postoperative period mechanical obstruction must be distinguished from prolonged ileus. Patients who do not improve after 48 hours of tube decompression should have a barium UGI contrast study. In this review, barium contrast studies were highly reliable in determining need for operative intervention. The relatively high mortality associated with early postoperative obstruction has been attributed to unnecessary delay before re-exploration in two previous reports.[14,15] Patients who have had multiple hospital admissions and operations for adhesive obstruction probably present the greatest dilemma in terms of appropriate timing of operative intervention. At the outset, these patients are usually treated by tube decompression with the hope of avoiding another operation. During this 10-year review there were 25 such patients admitted an average of 2.64 times per patient with a mean interval of 1.8 months between admissions. All but four of these patients ultimately required operation, and none of the surviving patients have been readmitted with obstruction during the subsequent follow-up period. We therefore recommend that patients who have had more than two hospital admissions for obstruction during a 6-month interval have laparotomy.

That delayed operative intervention in this review was associated with a significantly greater number of postoperative complications supports the frequently quoted adage, "The sun should never be allowed to set (or rise) on a case of mechanical intestinal obstruction." Those who espouse this philosophy cite that there is no reliable method of distinguishing simple from strangulated obstruction.[4,6,9,17] In this review there was no correlation between the timing of operation and mortality from strangulation obstruction. However, complications other than strangulation were significantly more common among patients operated on more than 24 hours after admission (Table 4). These complications occurred almost exclusively in patients whose admission radiographs showed complete as opposed to partial obstruction. The only postoperative complications that occurred in patients admitted with partial obstruction were three wound infections and one anastomotic leak after bowel resection for strangulation. The wound infections occurred in elderly patients who were operated on at a mean 7.3 days after admission. These data suggest that increased complications other than strangula-

tion represent the most cogent mitigating factor favoring early operation for complete small bowel obstruction.

An incorrect admitting diagnosis was made in only 20 of the 342 cases (6%) in this series (Table 3). Inaccurate diagnosis delayed operation more than 24 hours in all of the misdiagnosed patients who required operative intervention. One patient with radiographic features of complete obstruction had strangulation after a misdiagnosis of acute pancreatitis. There were also two cases of strangulated volvulus that were misdiagnosed as partial obstruction. Progression of radiographic signs led to operation within 24–36 hours in both cases, and both patients survived. These misdiagnosed volvulus cases were the only cases of strangulation in the 193 episodes of "partial" small bowel obstruction.

In summary, the requirement for operative intervention is the most critical decision to be made during the initial evaluation of patients with intestinal obstruction. In this review the radiographic distinction between partial and complete obstruction was the most reliable determinant of need for operative treatment in that 84% of patients with complete obstruction required operation compared with only 19% of patients with partial obstruction. Operations delayed more than 24 hours after admission were associated with a significantly greater number of complications. Ninety-one per cent of the postoperative complications occurred in patients with complete obstruction. On the basis of these data, we recommend that all patients with features of complete obstruction have operation shortly after admission, whereas patients with partial obstruction be given a trial of tube decompression with the likelihood of avoiding operative treatment. Nearly 75% of patients initially managed by tube decompression who ultimately avoided operation showed clinical or radiographic signs of improvement during the first 24 hours, whereas only 5% of patients whose obstructions resolved without operation did not show improvement within the first 48 hours of treatment. We therefore recommend that trials of nonoperative tube decompression for partial obstruction not exceed 48 hours. Clinical deterioration or increased small bowel distention on abdominal radiographs during the course of tube decompression warrants prompt operative intervention.

References

1. Barnett WO, Petro AB, Williamson JW. A current appraisal of problems with gangrenous bowel. Ann Surg 1976; 183:653–659.
2. Becker WF. Acute adhesive ileus. Surg Gynecol Obstet 1952; 95:472–476.
3. Leffall LD, Syphax B. Clinical aids in strangulation intestinal obstruction. Am J Surg 1969; 120:756–759.
4. Silen W, Hein MF, Goldman L. Strangulation obstruction of the small intestine. Arch Surg 1962; 85:138–144.
5. Zadeh BJ, Davis JM, Canizaro PC. Small bowel obstruction in the elderly. Am Surg 1985; 51:470–473.
6. Shatila AH, Chamberlain BE, Webb WR. Current status of diagnosis and management of strangulation obstruction of the small bowel. Am J Surg 1976; 132:299–303.
7. Brolin RE. Partial small bowel obstruction. Surgery 1984; 95:145–149.
8. Bizer LS, Liebling RW, Delany NM, Gliedman MD. Small bowel obstruction: the role of non-operative treatment in simple intestinal obstruction and predictive criteria for strangulation obstruction. Surgery 1981; 89:407–413.
9. Playforth RN, Holloway JB, Griffen WO Jr. Mechanical small bowel obstruction: a plea for earlier surgical intervention. Ann Surg 1970; 171:783–788.
10. Stewardson RH, Bombeck CT, Nyhus LM. Critical operative management of small bowel obstruction. Ann Surg 1978; 187:189–193.
11. Hofstetter SR. Acute adhesive obstruction of the small intestine. Surg Gynecol Obstet 1981; 152:141–144.
12. Wolfson PJ, Bauer JJ, Gelernt IM, et al. Use of the long tube in the management of patients with small intestinal obstruction due to adhesions. Arch Surg 1985; 120:1001–1006.
13. Goldberg HI, Dodds WJ. Roentgen evaluation of small bowel obstruction. Dig Dis Sci 1979; 24:245–248.
14. Sykes PA, Schofield PF. Early postoperative bowel obstruction. Br J Surg 1974; 61:594–600.
15. Coletti L, Bossart PA. Intestinal obstruction during the early postoperative period. Arch Surg 1964; 88:775–777.
16. Quatramoni JC, Rosoff L, Halls JM, Yellin AE. Early postoperative small bowel obstruction. Ann Surg 1980; 191:72–74.
17. Lo AM, Evans WE, Carey LC. Review of small bowel obstruction at Milwaukee County General Hospital. Am J Surg 1966; 111:884–886.