

## Ambulatory laparoscopic fundoplication

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### Abstract

**Background:** Increasingly larger series of laparoscopic funduplications (LF) are being reported. A well-documented advantage of the laparoscopic approach is shortened hospital stay. Most centers report typical lengths of stay (LOS) for LF of 2–3 days. Our success with LF with a LOS of 1 day led to an attempt at performing LF on an ambulatory basis.

**Methods:** Sixty-one consecutive patients with appropriate criteria for LF underwent surgery at our institution. Patients were counseled by the authors as to the usual postop course and progression of diet. All patients received preemptive analgesia (PEA) consisting of perioperative ketorolac and preincisional local infiltration with bupivacaine. Anesthetic management included induction with propofol, high-dose inhalational anesthetics, minimizing administration of parenteral narcotics, and avoidance of reversal of neuromuscular blockade. Immediate postop pain management included parenteral ketorolac and oral hydro- or oxycodone. All patients were given oral fluids and soft solids after transfer from the recovery room to the postoperative observation unit. Two patients were excluded from ambulatory consideration due to excessive driving distance from our hospital. Another two were hospitalized for observation after experiencing intraoperative technical problems.

**Results:** Of 57 patients in whom same-day discharge was attempted, there were three failures requiring overnight hospitalization: All were due to pain and nausea; one patient also suffered transient urinary retention. There were no adverse outcomes related to early discharge, and there were no readmissions. One patient returned to the emergency room after delayed development of urinary retention. Median time from conclusion of operation to discharge was less than 5 h. No patients expressed dissatisfaction with early discharge on follow-up interview.

**Conclusions:** LF can be safely performed as an ambulatory procedure. Analgesic and anesthetic management should be tailored to minimize nausea and provide adequate pain control.

**Key words:** Laparoscopic fundoplication — Ambulatory surgery — Preemptive analgesia — Propofol — Ketorolac — Bupivacaine

Minimally invasive surgical techniques have created a revolution in the management of gastroesophageal reflux disease (GERD). The ability to combine the time-tested efficacy and durability of total and partial funduplications with the more rapid recovery afforded by laparoscopic techniques is at the cornerstone of this change. As increasingly larger series of laparoscopic funduplications (LF) are reported, a clear and favorable picture of both outcomes and costs is emerging. Although the cost of surgical therapy hinges on many variables, length of hospital stay (LOS) is a prime contributor. Published American series of LF, ranging upward to nearly 300 patients, have reported average LOS of 2–4 days [3, 4]. Against concurrent controls, this would appear to afford a greater than 5-day improvement in LOS compared with fundoplication via laparotomy [6].

In our own series of LF, a gradual evolution in analgesic and anesthetic techniques combined with improving patient care strategies resulted in a more predictable recovery and progressively shorter LOS. This was accomplished without compromise in safety, efficacy, or patient satisfaction. After first establishing a consistent and reproducible experience with overnight hospitalization for LF, we embarked on a trial of same-date discharge, i.e., true ambulatory surgery.

### Patients and methods

From May 1995 to January 1997, a consecutive series of 61 patients with documented GERD were referred from our Gastroenterology Unit for LF by the authors. The patients, 26 women and 35 men, ranged in age from 30 to 77 years, with a median of 47 years. Only one patient was over 65 years of age. Age distribution is shown in Fig. 1. The women ranged in weight from 56 to 109 kg (123–240 pounds), with Body Mass Indices (BMI) (calculated as weight in kilograms, divided by height in meters, squared) ranging from 23.9 to 38.1. The men ranged from 68 to 130 kg (150–286 pounds), with BMI ranging from 23.4 to 37.7. BMI distribution for all patients is shown in Fig. 2. All had met criteria for operability on the basis of endoscopically documented esophagitis, and dependence upon omepra-

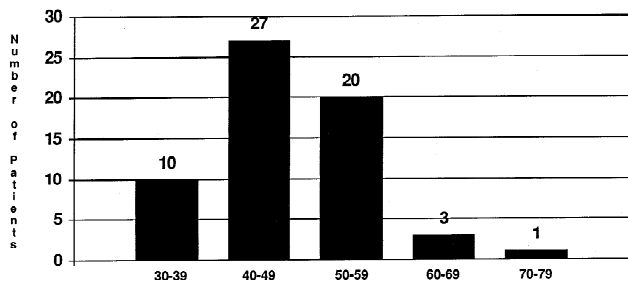


Fig. 1. Age distribution of 61 consecutive patients undergoing laparoscopic fundoplication.

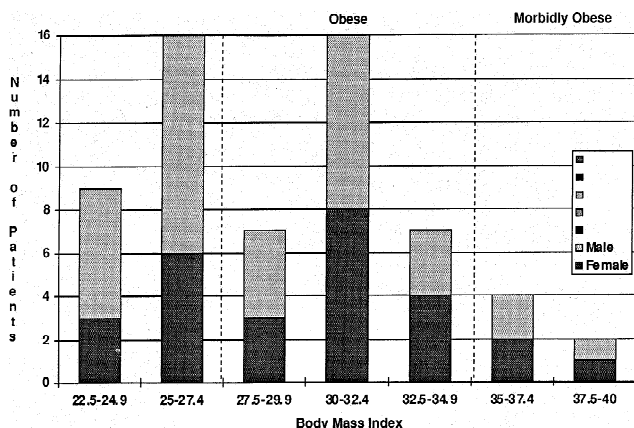


Fig. 2. Body Mass Index distribution of the same 61 patients.

zole (Prilosec) for symptom control. Esophageal motility was routinely assessed by preoperative esophageal manometry. In 51 patients, esophageal body motility was normal, and laparoscopic Nissen fundoplication was performed. In 10 patients, esophageal motility was diminished, and partial (modified Toupet) fundoplication was performed. Patients were not excluded from operative candidacy due to age, weight, or prior upper abdominal operative history. Comorbidities were relatively rare, although seven patients (11%) were under treatment for asthma/reactive airway disease. Patients were counseled regarding the common postoperative experience, anticipated hospitalization period, and criteria and conditions for discharge. All patients were agreeable to this approach.

Patients were electively admitted for same-day surgery approximately 2 h prior to anticipated anesthetic induction. Preoperative parenteral metoclopramide (Reglan) was administered as prophylaxis against aspiration. In the operating room, all patients received a standard combination of agents as preemptive analgesia (PEA), after anesthetic induction. All were administered a total of 50 ml of bupivacaine (Marcaine) with epinephrine, a long-acting local anesthetic, at the five pre-marked port sites, by the operating surgeon. Patients also received a preincisional dose of 30 mg of parenteral ketorolac (Toradol), a nonsteroidal antiinflammatory drug (NSAID) that has shown analgesic effects comparable to that of commonly used doses of narcotics. This was followed in most cases by another identical dose at the time of fascial closure. Adults greater than 65 years of age received half of this dose.

Anesthetic technique was tailored to minimize immediate postoperative anesthetic side effects Propofol (Diprivan) was used as the induction agent, in contrast to barbiturates, which have some nausea-inducing properties. Isoflurane (Forane) was used, without nitrous oxide, for maintenance of anesthetic depth. Fentanyl (Sublimaze), a short-acting parenteral narcotic, was selectively used to complement the inhalation agent, but in minimal doses. Intermediate-acting neuromuscular relaxants such as vecuronium (Norcuron) were utilized in order to avoid the use of neuromuscular reversal regimens and their autonomic side effects. An orogastric tube was utilized in the first half of the procedure only, and it was not replaced after construction of the fundoplication. Urinary catheters were not utilized.

The procedure was performed with the patient in modified lithotomy, reverse Trendelenburg position. A standard five-puncture technique was used, typically with 10–12-mm ports. In 51 patients, a (360°) sutured

Table 1. Standard ambulatory surgery discharge criteria at Kaiser Foundation Medical Center, San Diego

*Medical:*

Alert and oriented  
Vital signs stable  
No evidence of active bleeding  
Ambulation without nausea or dizziness  
Tolerating oral fluids well  
Free of excessive pain  
Able to void

*Social:*

Escort available to transport patient to home  
Home care instructions explained, copy given  
Patient/family verbalized understanding of home care instructions

Nissen-style fundoplication was created, 2.0 cm long. In 10 patients, a partial (270°) modified Toupet-style fundoplication was created using interrupted sutures and Teflon felt pledgets. The fundoplications were constructed over a 60-French (Maloney) dilator. In all instances, the dilators were placed by the assisting surgeon under strict video observation. The short gastric vessels were divided by either laparoscopic intestinal stapling devices or by use of an ultrasonic scalpel. Crural closure was routinely performed. Fascia was routinely closed at 10- and 12-mm sites. An attempt was made to evacuate all CO<sub>2</sub> at the conclusion of the procedure.

Additional planned procedures were performed as medically or technically indicated. Seven patients, with histories of prior upper laparotomies, underwent adhesiolysis/enterolysis to allow exposure of the left upper quadrant. One of these patients had previously undergone an (open) Nissen fundoplication, which had failed. Two patients underwent synchronous cholecystectomy. One patient each underwent paraesophageal hernia repair with prosthetic mesh and incisional hernia repair.

In the recovery room, standard monitoring and techniques were utilized. Parenteral narcotics and antiemetics were used as needed under the direction of the supervising anesthesiologist. Once directed to the postoperative observation unit, patients were offered liquids and soft solids by mouth. Analgesics were provided, when needed, in the form of parenteral ketorolac and/or oral hydrocodone or oxycodone. Once diet and oral analgesic tolerance were demonstrated, patients were required to meet standard criteria prior to consideration for discharge. Discharge criteria are itemized in Table 1. Patients were routinely contacted by telephone on the day after operation by a registered nurse experienced in perioperative care. Patients were routinely seen back in the office within 10 days.

## Results

Of the 59 patients who were considered ambulatory candidates at the outset of the procedure, two were admitted to hospital after operation for technical reasons. One suffered a splenic capsular tear, which required additional hemostatic maneuvers. The other suffered an esophageal tear from passage of the Maloney dilator. This patient had a history of prior stricture and dilatation, which may have contributed to this problem. Both problems were corrected laparoscopically, and both patients were discharged uneventfully on the following day. No other complications occurred. No patients were converted to laparotomy. No difficulties with hemostasis were ascribed to the use of ketorolac. Mean operating time for all 61 patients was 87 min (1 h, 27 min), ranging from 53 to 160 min.

Of the 57 patients who were directed to the postoperative observation unit, 54 (95%) successfully met discharge criteria that date and left hospital at a median interval of 290 min (4 h, 50 min) after completion of operation (range 140–607 min). In this group, 21 patients (39%) required no additional parenteral narcotic after leaving the operating room. An additional 24 patients (44%) required 1.0 mg or

less of parenteral hydromorphone (Dilaudid), which was administered in the recovery room. Only 12 patients (22%) requested antiemetic agents while in the recovery room. Their complaints of nausea did not recur in the observation area, prior to discharge. Three patients failed to meet discharge criteria, all due to complaints of unresolved nausea and inadequate pain control. One of these patients, a 50-year-old man, also had initial urinary retention, which resolved after a single catheterization. All three patients required additional doses of both ketorolac and Dilaudid for adequate analgesic effect. All three were improved and able to be discharged on the following day. Patients who failed to meet discharge criteria did not differ from those who did in regard to length of operation, age, obesity, or extent of procedure (fundoplication alone vs fundoplication with additional procedures). No patients required readmission after successfully meeting discharge criteria. Only one patient, a 56-year-old man, returned to office or emergency room for unanticipated postoperative problems during the follow-up period, this being due to delayed presentation of urinary retention. At scheduled clinic follow-up, no patients expressed any dissatisfaction with the conduct of their postoperative care or their readiness for discharge.

## Discussion

Many series of LF have recently been published, attesting to the popularity of this approach. Excellent records of safety and efficacy have been established, paralleling that of the open procedure. Typically, however, little detail is provided regarding analgesic or anesthetic methods or dietary progression. As a result, it is unclear why LF patients have significantly longer hospital stays than other laparoscopic procedures currently performed on an ambulatory basis, such as cholecystectomy.

In our own series of LF, dating to 1993, early cases were managed with emphasis on those mechanical aspects of postoperative care that might minimize the potential for nausea, retching, and/or gastric distension. As a consequence, patients were subjected to a mandatory period of nasogastric tube decompression and bowel rest. These measures were largely ineffective, however, in prevention or treatment of complaints of nausea. As a result, neuroleptic-class antiemetics were commonly prescribed, which then contributed to sedation and lethargy. In contrast, during this same period, it was observed that nausea and failure of dietary tolerance were rare in those patients who had postoperative analgesia with parenteral ketorolac rather than traditional parenteral narcotics. This suggested that medication side effects, rather than ileus or gastroparesis, contributed to these complaints, which is consistent with the known side-effect profiles of the two respective classes of analgesic (NSAID vs opiate). Additionally, patients who had received preincisional ketorolac required less total analgesic than those who received it after operation was complete, suggesting what has been termed a preemptive effect [7].

Preemptive analgesia is a concept that has not yet gained widespread clinical acceptance. There is ample laboratory evidence to show that noxious stimuli, even when experienced under general anesthetic, create alterations in peripheral and spinal cord pathways that heighten the sensitivity of these channels to pain [8]. If these stimuli are blocked, the subsequent pain experienced when conscious may be lessened. Ketorolac and bupivacaine appear to be ideal agents for PEA in an ambulatory setting, since the former has systemic efficacy comparable to potent narcotics, but with lessened propensity for nausea, and both have durations of action sufficient to cover the time from incision to postoperative observation unit. Ketorolac has been shown to have clinically measurable preemptive analgesic effect in prospective studies on both total hip replacement [2] and hysterectomy patients [5]. Similarly, the use of preincisional vs postincisional bupivacaine has been shown to lessen early postoperative analgesic requirements in pediatric hernia patients [1].

Once ketorolac/bupivacaine PEA was adopted as our standardized technique for pain management, the rarity of nausea led to the abandonment of postoperative nasogastric tubes and progressively earlier feeding. The final step in the transition from overnight hospitalization to true ambulatory status was minimizing both length of recovery and side effects from anesthesia, particularly within the first 6 h after the operation concluded. We empirically selected a scheme that minimizes or excludes those agents with prolonged, emetogenic and/or adverse autonomic activities. The resulting series of patients shows consistently shorter LOS than previously reported series.

We believe that this combination of preoperative counseling, ketorolac-bupivacaine PEA, and a tailored anesthetic method is a simple, effective, and reproducible technique. The resulting improvement in patient comfort and functional status has led to a significant reduction in hospital stay for laparoscopic fundoplication.

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