Routine Same-Day Discharge After Acute or Interval Appendectomy in Children

A Prospective Study

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Hypothesis: The outcomes of and parental satisfaction with same-day discharge in children undergoing laparoscopic appendectomy warrant making it the usual and customary pathway.

Design: Prospective cohort study.

Setting: Tertiary care children’s hospital.

Patients: Between July 1, 2010, and March 30, 2011, a total of 207 children were considered for same-day discharge after acute or interval laparoscopic appendectomy. The all-in-one single-incision single-instrument technique was used in 95.7% of children.

Interventions: Same-day discharge vs overnight admission.

Main Outcome Measures: Operative details, postoperative length of stay, adverse events, and parental satisfaction.

Results: Of 207 consecutive children undergoing acute (n=186) or interval (n=21) appendectomy, 162 (78.3%) were discharged on the day of surgery. The remaining 45 children were admitted overnight because the hour was too late for discharge in 35 (77.8%), medical indications dictated admission in 5 (11.1%), and social reasons required admission in 5 (11.1%). In all the children, oral medication alone was used for postoperative pain. The complication rates were similar in the same-day discharge group (8.0%) and in the admitted group (6.6%), as were the rates of urgent postoperative visits (7.4% vs 4.4%) and the readmission rates (2.5% vs 2.2%) (P > .05 for all). The same-day discharge group had a reduced postoperative length of stay compared with the admitted group (mean, 5 vs 16 hours, P < .05). At the time of discharge, most parents (87.0%) stated they were happy with the expeditious discharge, whereas 8.0% indicated they felt nervous but were ultimately satisfied. In retrospect, 8 of 162 parents (4.9%) were not sure early discharge was best, but only 1 parent would insist on admission if faced with the situation again.

Conclusion: Routine same-day discharge after pediatric appendectomy seems safe, with good parental satisfaction.

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Annually, appendicitis is a multibillion-dollar disease in the United States. In addition to the health care dollars spent (approximately 30% of which go to hospitals, 20% to physicians and other practitioners, and 10% for pharmaceutical agents), uncounted economic losses for parents and psychosocial costs for the family ensue during a childhood illness. As the most common pediatric gastrointestinal surgical emergency, appendicitis consumes hospital resources and interrupts the life of the entire family of an affected child, resulting in missed work and school and the alteration of dynamics for everyone in the home. We can eliminate a hospital stay and return the child immediately to his or her usual surroundings without sacrificing safety, we could minimize the use of hospital resources and the disruption of the household.

With the emergence of laparoscopic surgery, postoperative length of stay (LOS) for elective and emergency abdominal cases has decreased, such that many operations are performed predominantly on an outpatient basis. Realistically, this has usually involved an overnight stay with 23-hour observation, particularly in the case of appendicitis, with its infectious origin. At Miami Children’s Hospital, Miami, Florida, we have used same-day discharge for children with appendicitis, sending them home within hours of operation, on a sporadic basis during the past decade. To our knowledge, no formal trials of the efficacy and safety of this treatment course have been performed. We
proposed to standardize same-day discharge after appendectomy, making it the usual and customary pathway. We prospectively studied the outcomes of and parental satisfaction with rapid-discharge appendectomy in pediatric patients after acute or interval appendectomy.

METHODS

After institutional review board approval, all children who underwent acute or interval appendectomy at Miami Children’s Hospital between July 1, 2010, and March 30, 2011, were considered for same-day discharge. The expectation of an expedient discharge was discussed with the family before surgery, in the emergency department in the case of acute disease, or at the preoperative office visit in the case of interval management of perforated disease. Children undergoing operation for presumed simple appendicitis who were found at laparoscopy to have complicated disease instead (perforation or gangrene) were admitted for intravenous antibiotic therapy and were excluded from the study. Similarly, if an interval appendectomy became complex (eg, residual abscess or exposed fecalith), the children were admitted for ongoing treatment and were excluded from further consideration in the study. All patients diagnosed as having presumed perforation at presentation in our institution are treated on an interval management pathway.

The protocol included preincisional intravenous cefoxitin (barring allergy) and the all-in-one single-incision single-instrument technique for appendectomy, performed by a resident or fellow under the direction of 1 of 4 attending pediatric surgeons (L.M., C.G.K., S.S., and C.B.). In this method, a single conventional 12-mm laparoscopy port is placed at the umbilicus via a midline incision just long enough to fit the trocar. The all-in-one operating scope has a light and viewing side in parallel with a single-instrument channel through which is passed a long atraumatic grasper. If necessary, blunt dissection can be performed with the solitary instrument until the appendix is identified, grasped by the tip, and withdrawn through the umbilical site, as the insufflation is released and the trocar removed. If necessary, the fascial incision can be extended to allow passage of the swollen appendix. Once the cecum is opened a Babcock clamp, a conventional external appendectomy is performed. For the study, any introduction of additional ports (ie, conversion to traditional laparoscopy) was noted.

Our patients were divided into 2 cohorts. The first comprised children who were discharged on the day of surgery, and the second comprised children who were admitted overnight after surgery. To further analyze postoperative LOS, the same-day discharge group was subdivided according to the unit from which the child was discharged. Children who were diagnosed as having acute appendicitis in the early morning hours were admitted to the inpatient surgical floor, underwent operation in the morning, and were discharged later in the day from the surgical ward. Children who were diagnosed during daytime hours were brought directly to the operating room from the emergency ward and were discharged from the ambulatory surgery suite, bypassing completely the inpatient facilities. All interval appendectomies were performed in the ambulatory surgery suite.

Admissions in the overnight admission group were driven by the following 3 reasons: (1) The operation ended too late in the day for an expeditious discharge. (2) The child was hospitalized for a medical issue (eg, vomiting or uncontrolled pain). (3) The child was hospitalized for a social reason (eg, transportation problem or the family declined to leave). In all children, whether discharged the same day or hospitalized overnight, oral medication alone was used for postoperative pain.

We collated patient demographics, operative technique and duration (in minutes), postoperative LOS in hours, unscheduled urgent postoperative visits after discharge, and complications. Postoperative LOS was defined as the time from entry into the recovery room to the time of discharge. The t test was used for statistical analysis of the 2 groups.

In total, 251 children (age range, 2-19 years; mean age, 12 years) underwent appendectomy during the 9-month study period. Two hundred fifteen children had a presumed diagnosis of acute appendicitis. Twenty-nine children were noted to have gangrene or perforation at laparoscopy; they were admitted for antibiotic therapy after surgery and were excluded from further study. The remaining 36 children underwent interval appendectomy after medical management of perforated disease; 15 of them had an exposed fecalith or residual abscess cavity and were admitted for postoperative intravenous antibiotics (and excluded from the study), whereas 21 underwent uncomplicated procedures and were eligible for an expeditious discharge. Therefore, 82.4% of all appendectomy patients (58.3% of children after interval appendectomy and 86.5% of children with presumed simple appendicitis) performed at Miami Children’s Hospital during the study period were medically eligible for same-day discharge.

Of 207 children who were eligible to go home after surgery, 162 (78.3%) were discharged on the day of surgery, comprising the same-day discharge group. These included 142 of 186 children (76.3%) after acute appendectomy and 20 of 21 children (95.2%) after interval appendectomy. The mean postoperative LOS for all these children was 5 hours (range, 1-12 hours). However, the subgroup of 67 children (41.4% of the same-day discharge group) who were admitted before surgery to the surgical ward to await operation for acute appendicitis and were subsequently discharged from there had a postoperative LOS almost twice as long as the subgroup of 95 children (38.6% of the same-day discharge group) who

### Table 1. Parental Satisfaction Survey Questions

<table>
<thead>
<tr>
<th>Pertinent Portion of the Survey That Relates to Parental Satisfaction With Same-Day Discharge</th>
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<tbody>
<tr>
<td>1. Immediately following the surgery, how did you feel about going home on the same day?</td>
</tr>
<tr>
<td>a. Happy to go home.</td>
</tr>
<tr>
<td>b. Nervous, but we did fine.</td>
</tr>
<tr>
<td>c. I wouldn’t want to do it again.</td>
</tr>
<tr>
<td>2. In retrospect, how do you feel now?</td>
</tr>
<tr>
<td>a. It was the right thing to do.</td>
</tr>
<tr>
<td>b. It was OK to go home on the same day, but I’m not sure it was best.</td>
</tr>
<tr>
<td>c. I would not want to do it again.</td>
</tr>
<tr>
<td>3. Feel free to add other comments regarding your child’s surgery.</td>
</tr>
</tbody>
</table>

RESULTS

In total, 251 children (age range, 2-19 years; mean age, 12 years) underwent appendectomy during the 9-month study period. Two hundred fifteen children had a presumed diagnosis of acute appendicitis. Twenty-nine children were noted to have gangrene or perforation at laparoscopy; they were admitted for antibiotic therapy after surgery and were excluded from further study. The remaining 36 children underwent interval appendectomy after medical management of perforated disease; 15 of them had an exposed fecalith or residual abscess cavity and were admitted for postoperative intravenous antibiotics (and excluded from the study), whereas 21 underwent uncomplicated procedures and were eligible for an expeditious discharge. Therefore, 82.4% of all appendectomy patients (58.3% of children after interval appendectomy and 86.5% of children with presumed simple appendicitis) performed at Miami Children’s Hospital during the study period were medically eligible for same-day discharge.

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were discharged through the ambulatory surgery suite (mean postoperative LOS, 6 vs 3 hours; \( P < .05 \)).

Of 45 children who were admitted after surgery, 35 (77.8%) were admitted solely because the operation ended too late in the evening for postoperative discharge. Five children (11.1%) were admitted for medical reasons (nausea, vomiting, or pain), and 5 children (11.1%) were admitted when their families declined to leave. All but 1 of these children had acute appendicitis. One child who underwent interval appendectomy was admitted (for medical reasons).

Among the entire group of 207 children who were eligible to go home after surgery, 5 (2.4%) stayed overnight for reasons pertaining directly to the disease process.

Operative durations were equivalent in the 2 groups, averaging 23 minutes (range, 6-61 minutes) in the same-day discharge group vs 22 minutes (range, 10-77 minutes) in the overnight admission group (\( P > .05 \)) (Table 2). Both groups had a 2:1 male predominance and a mean age of 12 years. The all-in-one single-incision single-instrument technique was used in 198 children (95.7%), with 1 child in each group having an additional port placed, whereas 7 children (3.1%) in the same-day discharge group and 2 (4.4%) in the overnight admission group had conventional 3-port appendectomy. Regardless of whether discharge was the same day or the next day, all families were given a standard set of instructions. They were to remove the dressing in 5 days and start twice-daily deep cleansing of the umbilicus. Parents were asked to bring the child back for a postoperative visit in 2 weeks and to call in the interim if problems such as fever, nausea, purulent drainage, or wound redness occurred.

No significant group differences were observed in the rates of urgent postoperative visits before the scheduled clinic appointment or in complication rates. Twelve children (7.4%) in the same-day discharge group and 2 children (4.4%) in the overnight admission group were seen in the outpatient area or emergency department before their scheduled clinic visit (Table 2). No study patient experienced a major complication. Six children (3.7%) in the same-day discharge group and 3 children (6.7%) in the overnight admission group experienced umbilical wound suppuration, effectively treated with local care and antibiotics. Five children (2.5% in the same-day discharge group and 2.2% in the overnight admission group) were readmitted for initial management of this problem.

Overall, parents were satisfied with their child’s expeditious discharge. At the postoperative office visit, 141 of 162 parents (87.0%) said that immediately following the surgery they had been pleased with same-day discharge, whereas 13 parents (8.0%) indicated they felt nervous but were ultimately satisfied; 8 parents (4.9%) were not sure early discharge was best. In retrospect, satisfaction rose to 95.0% at the time of the postoperative office visit, with 154 parents stating that same-day discharge was desirable. Only 1 parent would insist on admission if faced with the situation again.

### Table 2. Operative and Postoperative Details

<table>
<thead>
<tr>
<th>Variable</th>
<th>Same-Day Discharge Group (n = 162)</th>
<th>Overnight Admission Group (n = 45)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operative duration, mean, min</td>
<td>23</td>
<td>22</td>
</tr>
<tr>
<td>Single umbilical port, No. (%)</td>
<td>156 (96.3)</td>
<td>42 (93.3)</td>
</tr>
<tr>
<td>Postoperative length of stay, mean, h</td>
<td>5</td>
<td>16</td>
</tr>
<tr>
<td>Overall complications, No. (%)</td>
<td>13 (8.0)</td>
<td>3 (6.6)</td>
</tr>
<tr>
<td>Urgent postoperative visits, No. (%)</td>
<td>12 (7.4)</td>
<td>2 (4.4)</td>
</tr>
<tr>
<td>Umbilical infections, No. (%)</td>
<td>6 (3.7)</td>
<td>3 (6.7)</td>
</tr>
<tr>
<td>Readmissions, No. (%)</td>
<td>4 (2.5)</td>
<td>1 (2.2)</td>
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\( P < .05 \)

The concept of same-day surgery was first reported in the literature in 1909. The Royal College of Surgeons of England defined a surgical day patient as one “who is admitted for investigation or operation on a planned nonresident basis and who nonetheless requires facilities for recovery.” With the ascendancy of minimally invasive surgery, it was estimated in the late 1990s that 60% to 80% of operations would be performed as same-day cases in the near future. The attraction of ambulatory surgery to hospitals, health care providers, and families is based on several benefits. Using laparoscopic cholecystectomy as an example, it was shown that the selective performance of that operation as same-day surgery could result in a mean baseline cost saving of more than $700 per patient. Same-day surgery is further encouraged because the federal government and insurers mandate outpatient management of certain procedures. From the patient’s viewpoint, an expeditious discharge is desirable because of the increased convenience, faster recovery, and earlier return to the workforce. Although most children are not employed, their caregivers can get back to work sooner, and there is less disruption of parent, sibling, and patient lifestyle as the children recover in the comfort of their homes. In addition, exposure to nosocomial infection is reduced, and the use of hospital resources and staff is minimized. All these effects are laudable if patient safety can be maintained.

In recent years, laparoscopic appendectomy has largely replaced open appendectomy in the pediatric population as the method of choice, allowing improved patient outcomes, with less postoperative pain and shorter LOS. However, most children undergoing laparoscopic appendectomy are observed in the hospital or in the short-stay unit overnight. Although sporadic same-day discharge has been reported, no prospective trial to date has formally assessed the safety of such a pathway or the satisfaction of the parents with this treatment plan.

With the implementation of our protocol, same-day discharge became the expected course for a child undergoing acute or interval appendectomy. The fact that more than 95% of our children undergoing interval appendectomy were treated on the ambulatory surgery track reflects that, with proper parental preparation and with appropriate timing of the operation, immediate discharge after appendectomy is well accepted. The process begins at the first admission (during medical management of perforation with antibiotics, the parents are told that “in 2 to 3 months, your child will come in to day sur-
urgery for appendectomy”) and continues at the preoperative office visit to schedule the operation. For the children with acute appendicitis, the challenge has been greater. Ambulatory appendectomy for acute disease required a change in attitude across many levels of caregivers. We had to educate the emergency department staff not to tell parents that admission automatically follows the diagnosis of appendicitis. The surgical team learned to present the benefits of same-day discharge during the preoperative discussion as follows: “If there is no rupture, your child will not even need to stay overnight—avoiding the risk of exposure to hospital-acquired infection, the stress of the unfamiliar environment, and the disruption of family life.” Our referring physicians also required education because at least 1 family declined to go home because the pediatrician had said same-day discharge was inadvisable. Even in the acute setting, early discharge is possible in two-thirds of children. Furthermore, admission among the children with acute appendicitis was largely independent of medical indications, with 77.8% staying overnight simply because the operation ended too late in the evening for postoperative discharge. As the nursing staff grew more comfortable with the concept of expeditious discharge during the study period, patients finishing later in the evening were encouraged to go home on the same day. Compared with surgical ward nurses, ambulatory surgery nurses (who are much more attuned to rapid postoperative discharge) oversaw a postoperative LOS that was typically half as long; communication between these 2 groups of staff helped the floor nurses become more confident with sending patients home after shorter postoperative intervals.

Same-day discharge proved safe and satisfactory. No significant differences between the 2 study groups were observed in complication rates or in the rates of unplanned urgent postoperative visits before the scheduled follow-up visits in the clinic. No complication in either group occurred in the first 48 hours after surgery, so overnight admission would not have been helpful in avoiding or diagnosing a postoperative problem. In addition, more than 90% of parents were satisfied with immediate discharge, probably reflecting the minimized influence of a child’s illness on the entire family dynamic.

In this prospective study of routine same-day discharge after acute or interval appendectomy, most children were sent home safely on the day of surgery. Patient and family satisfaction with this technique is high. Such a pathway will minimize the need for inpatient resources in a high-volume disease entity and will reduce the burden of the illness on the affected children and their families.

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REFERENCES