Comparative outcome analysis of the management of pediatric intussusception with or without surgical admission

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A B S T R A C T

Background: Controversy persists about the need to admit patients after successful reduction of intussusception. Our hypothesis is that pediatric intussusception can be managed with discharge from the emergency department (ED) after reduction without increasing morbidity, yielding significant cost savings.

Methods: A chart review over 10 years was performed at two Canadian institutions. Data abstracted included: demographics, length of stay (LOS), initial and recurrence management. Primary outcome was early recurrence and resultant management, including LOS and need for operative intervention. Costs were calculated using hospital-specific data.

Results: 584 patient records were assessed: 329 patients were managed with admission after reduction, 239 as outpatients. In the admission group, 28 patients had at least one recurrence (8.5%), with 8 after discharge. In the outpatient group, 21 patients had at least one recurrence (8.8%), with 19 after discharge. The difference post-discharge was significant (p = 0.004). Outcomes of recurrence did not differ, with 2 patients in each group requiring operative intervention. Average LOS in the admission group was 90 h, with additional average cost of $1771 per non-operated patient.

Conclusions: Pediatric intussusception can be safely managed as an outpatient with reliable follow up. Discharge from the ED reduces hospital charges without increasing morbidity. This approach should be considered in managing patients with intussusception.

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Intussusception is one of the most common causes of bowel obstruction in infants and toddlers. The majority of cases occur in patients less than 12 months of age and are considered idiopathic in nature [1]. The management of pediatric intussusception has evolved from operative intervention to non-operative, radiologic-guided reduction via enema [2]. With the increasing success of non-operative reduction there has been an evolving interest in post-reduction early discharge, or “outpatient” management of these patients [3]. However, there remains great practice variability and the traditional pathway of inpatient observation remains widely used [4].

Traditionally, early surgical consultation has been initiated to coordinate management and for subsequent admission and observation. At the Montreal Children’s Hospital (MCH), surgical consultation is instituted at the time of diagnosis, and a surgical presence is required at the time of enema reduction attempt. The child is then admitted to the surgical service for further observation and care. At The Hospital for Sick Children (HSC), the current practice entails management and observation under the direction of the team in the emergency room, and surgical involvement is only initiated in cases where non-operative management has failed, or is not indicated secondary to presenting signs and symptoms.

The reasons why early discharge from the emergency department (ED) has not become standard of care likely relates to the known recurrence rate of 8%–15% [5,6], and the potential complications related to intussusception, including bowel necrosis, sepsis and even death [7]. The goal of this study was to compare outcome differences after management of patients with intussusception who either followed the traditional hospital admission pathway or were discharged after a period of observation in the ED. We also evaluated the potential cost savings related to early discharge. Our hypothesis was that pediatric intussusception could be managed with discharge from the emergency department after successful reduction without increasing morbidity, potentially yielding significant health care cost savings.

1. Methods

A retrospective review was performed of all cases of intussusception presenting to two tertiary care pediatric hospitals between July 2000 and July 2010. Ethics review board approval was obtained at both institutions (REB # 100002522 at The Hospital for Sick Children, IRB 11-605-PED at The Montreal Children’s Hospital). Data
collected included demographics (age, gender), length of symptoms prior to presentation, method of diagnosis, enema attempts, surgical consultation and admissions, operative intervention, length of stay (LOS; ED or inpatient), timing and management of recurrence and complications (such as bowel necrosis, shock requiring intensive care admission, and death). Data from both institutions were combined and patients were defined as ‘inpatient’ if they were admitted to the surgical service, or ‘outpatient’ if they were treated and discharged directly from the ED without admission. All patients from the MCH were in the ‘inpatient’ group while patients from HSC fell into both ‘inpatient’ and ‘outpatient’ groups as the institutional practice changed to ‘outpatient’ management in 2008. All patients at HSC were managed as ‘outpatient’ after implementation of practice change, unless they had been transferred from a long distance away.

Inclusion criteria of patients for the study were as follows: 1) documented diagnosis of ileocolic intussusception (either on ultrasound, enema or computed tomography (CT) imaging), and 2) attempt at reduction via enema (air or contrast) in radiology. Patients with ileo-ileal intussusception or those who required immediate surgery without attempted reduction were excluded. Successful reduction was determined by radiologic evidence of air or contrast reflux into the terminal ileum, and confirmation by ultrasound as needed.

Outcomes of primary recurrence and management of the recurrence were compared using Fisher’s exact or Student’s t-test where appropriate with a p value of <0.05 considered significant. Primary recurrence was defined as a second intussusception occurring within the first 14 days after successful complete radiologic reduction [8]. Any additional episodes of intussusception after two weeks were considered as separate, unrelated episodes. Length of stay in either the ED or inpatient unit was compared. Cost data were obtained from each hospital’s finance department based on the cost of a 24-h inpatient admission to a regular surgical ward bed. Since all study patients underwent ED evaluation followed by imaging and attempted reduction, these costs were assumed to be similar in both groups and were not specifically calculated.

2. Results

A total of 584 patient records were assessed at both institutions. Sixteen patients required immediate surgery without attempted enema reduction and were excluded from further analysis. Of the remaining 568 patients, 329 patients were managed with admission after reduction, and 239 as outpatients with early discharge from the ED. One hundred and eleven patients required operative intervention after attempted reduction, either for failed attempt or discovery of a lead point. Demographics were similar in both groups for age, gender and length of symptoms prior to presentation (Table 1).

In the admission group 28 patients had at least one recurrence (8.5%), 8 after discharge from hospital. In the early discharge group, 21 patients had at least one recurrence (8.8%), 19 after discharge from the ED; the difference in recurrence after hospital discharge was highly significant (p = 0.004). However, outcomes of recurrence post discharge did not differ. Two patients in each group (Recurrence post ED discharge and recurrence after inpatient discharge) required operative intervention (Fig. 1). Three out of four patients who required operation for recurrence had a documented underlying pathology as a lead point: Meckel’s diverticulum, duplication cyst and a newly diagnosed Burkitt’s lymphoma. Of the 20 recurrences during inpatient observation, all had attempted repeat reduction(s). Five of the 20 patients required operative intervention for failure of reduction, with 3/5 having a documented lead point (lymphatic malformation, Meckel’s diverticulum, and an adhesive band). For the 2 patients without lead points, 1 patient required a cecal resection, and the other underwent operative reduction without resection. In total, 21% of the admission group that recurred required operative intervention (Fig. 1), while only 9.5% of the recurring early discharge group did (p = 0.43). There were no additional morbidities documented in either of the groups that required operative intervention after recurrence of the intussusception.

The average LOS for patients managed with discharge from the ED was 7.2 h (±4.8) after enema reduction, and a 12 h (±5.9) overall stay in the ED. The average LOS in the admission group was 90 h (±292), resulting in an additional average cost of $3742 (Canadian dollars) per patient. Removing the 111 patients who underwent surgical intervention, the 218 patients admitted after non-operative reduction had an average LOS of 42.6 (±55.6) h, or an additional cost

### Table 1

<table>
<thead>
<tr>
<th>Demographic data.</th>
<th>Early discharge</th>
<th>Admitted</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>n = 239</td>
<td>n = 329</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age, months (mean ± SD)</td>
<td>25.9 ± 21.9 months</td>
<td>25.5 ± 30.2 months</td>
<td>0.86</td>
</tr>
<tr>
<td>Gender (% male)</td>
<td>69%</td>
<td>61%</td>
<td>0.09</td>
</tr>
<tr>
<td>Length of symptoms prior to presentation, h (mean ± SD)</td>
<td>49.4 ± 59.4 h</td>
<td>41.5 ± 70.8 h</td>
<td>0.16</td>
</tr>
</tbody>
</table>

Fig. 1. Management and outcomes of intussusception recurrences. ED = emergency department.
of $1771 per patient. This is more representative of the actual cost savings, given that the length of stay increase can be attributed to post-operative care.

3. Discussion

The first-line management of pediatric intussusception in stable patients remains an attempt at enema reduction [6]. While success rates for initial reduction are reported to be 75%–90% [9–11], close to 30% of patients will require surgical intervention eventually — either due to failure to reduce the intussusception at the time of initial presentation, the presence of a pathologic lead point, or a presentation with clinical unsuitability for a reduction attempt in radiology [12]. Despite high rates of non-operative reduction, the recurrence rates for intussusception have changed little over time, and are consistently reported in the range of 8%–15% [6,8,13].

In this study, the recurrence rate in the first 14 days post successful reduction was 8.5% for the patients who followed the traditional hospital admission pathway, and 8.8% for those who were discharged directly from the ED after a period of observation. These recurrence rates agree with prior publications and tended to occur within the first 2–3 days after reduction, as is typical of pediatric intussusception [8,14,15]. Since the average admission time for patients after successful reduction was 42 h, it is not surprising that the admission group had more “in house” recurrences. Importantly, none of the patients that developed a recurrence of intussusception had a poor outcome, irrespective of where they recurred. Overall recurrence rates and the need for operative intervention were similar in both groups without any additional morbidity or mortality reported. This has been similarly reported by Bajaj and Roback [3] and many centres are now changing their practice [16].

Reduction of health care costs, both to the patient and to the health care system as a whole, remains at the forefront of many clinical decisions. Cost reduction is an increasingly common beneficiary of clinical pathways and protocelized care in a variety of settings and patient groups [17,18]. Given its frequency and variability in treatment strategies, the management of children with intussusception is an excellent target for cost reduction. Admission times have already improved with the wide adoption of enema reduction, thereby greatly decreasing operative reductions and prolonged post-operative admissions. In addition, many pediatric centres are now managing uncomplicated intussusception with early-discharge from the ED after radiologic reduction. A study from France published in 1999 demonstrated a cost reduction of $1000 per case in a small group of children managed with ED observation after reduction [19]. Actual costs and patient charges will vary from centre to centre. Our analysis of cost assumed equivalence in the cost of the ED physician assessment and the workup for intussusception, as well as costs related to radiologic reduction. The savings to the health care system for a patient with uncomplicated intussusception with ED discharge after observation post-reduction would be an average of $1771 CAD. The charges to the patient, if they did not have medical coverage by a provincial or private insurance plan would be approximately 3 times this amount. We acknowledge that our cost analysis has been simplified and the actual cost calculations are complex. However, it is clear that costs associated with an in-patient admission will greatly exceed those for early ED discharge. There are also the hidden costs associated with the loss of work days for the family, and the general disruption of routine that occurs with pediatric hospitalization.

While the results of this dataset support early discharge from the ED as safe and cost-effective, this management should not be applied to all patients. Patients who present with significant dehydration, electrolyte disturbance or acid–base imbalance should be admitted for in-patient observation and resuscitation. Furthermore, patients with parents or guardians who may not reliably follow up should a child’s condition worsen, or who live at a long distance from the hospital, should be admitted. All families should be counseled about the risks of recurrence and explained the typical signs and symptoms.

We acknowledge that the data in this study are retrospective in nature, and are subject to possible bias as a result. In addition, patients that were discharged directly from the ED after successful reduction could conceivably have re-presented to different institutions with recurrences or other complications and would have been incorrectly assumed to have had a favorable outcome in our dataset. This is unlikely, however, given the large catchment area of each institution. Another limitation of the study was the low frequency of adverse events. Even though our study numbers are large, it is possible that we were not sufficiently powered to detect an actual difference. Our study included a large number of patients successfully managed with early discharge from the ED, demonstrating that this protocol is feasible and safe, despite the known recurrence risk. The authors therefore would strongly advocate for the outpatient management of pediatric patients with intussusception after successful radiologic reduction, provided no pathologic lead point is identified and appropriate follow-up is assured.

References