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Diagnosis and treatment of childhood intussusception from 1997 to 2016: A population-based study☆,☆☆,★

Mila Kolar [a], Mercedes Pilkington [a,*,1], Andrea Winthrop [a], Arany Theivendram [b,2], Katherine Lajkosz [c], Susan B. Brogly [a,c]

[a] Department of Surgery, Queen's University, Kingston Health Sciences Centre, 76 Stuart St., Kingston, ON, Canada K7L 2V7
[b] Department of Public Health Sciences, Queen's University, 99 University Avenue, Kingston, ON, Canada K7L 3N6
[c] ICES Queen's, Queen's University, Arch Street, Kingston, ON, Canada K7L 3L4

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ABSTRACT

Objectives: Describe changes in the diagnostic approach and treatment for pediatric intussusception over two decades.
Study design: Administrative universal healthcare data were used to conduct a population-based cohort study of intussusception between January 1997 and December 2016 in Ontario, Canada.
A validated case definition was used to identify all patients (<18 years) treated for intussusception in the province at community or tertiary care centers. Treatment modality was determined using physician billing data and databases linked at ICES; it was categorized as nonoperative alone, surgical alone, or failed nonoperative. Descriptive statistics, Cochrane–Armitage for trend analyses, and graphical and multinomial logistic regression were performed.
Results: Over 20 years, 1895 pediatric patients were treated for intussusception. Pretreatment imaging use rose from 57.5% to 99.3%. Nonoperative management increased from 23.4% to 75.2%. However, 43% of children who presented to a community hospital underwent immediate surgical management, compared with just 11% of children at tertiary centers (RR 0.39, 95% CI: 0.25–0.62). Among children who underwent surgery, there was an increase in bowel resection over time (41.7% to 57.6%).
Conclusions: Over the 20 year period of study, pretreatment imaging became universal, and management shifted from predominantly surgical to nonoperative reduction in Ontario. The rate of surgical intervention remains higher in community versus tertiary centers.
Level of evidence: Treatment study, III.

Intussusception is a common cause of pediatric bowel obstruction. It occurs when a segment of bowel invaginates into an adjacent segment causing upstream obstruction. Abdominal ultrasound has replaced x-ray for diagnosis due to its improved sensitivity and specificity identifying intussusception [1]. Management decisions are predicated on clinical presentation and available expertise.

A century ago surgeons advocated for surgical management as the standard of care. Nonoperative reduction is now considered first-line treatment for most children meeting appropriate clinical criteria [2,3]. Successful nonoperative management is achieved by either hydrostatic or pneumatic reduction. This involves instillation of rectal contrast, saline, or air. Resolution is confirmed radiographically with fluoroscopy or ultrasound. Surgical management of intussusception is reserved for patients who have failed attempts at nonoperative reduction, in patients with a known pathologic lead point, or in patients who present with peritonitis or clinical instability [4]. When surgery is required, this can be by either an open or laparoscopic approach. Etiology of the

Abbreviations: ICD, International Classification of Disease; OHIP, Ontario Health Insurance Program; CIHI DAD, Canadian Institute for Health Information Discharge Abstract Database; SDS, Same Day Surgery Database; NACRS, National Ambulatory Care Reporting System; LHIN, Local Health Integration Network; INST, Institution Database; CCP, The Canadian Classification of Diagnostic, Therapeutic and Surgical Procedures; CCI, Canadian Classification of Health Interventions; CI, Confidence Intervals.

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* Corresponding author at: Alberta Children's Hospital, 28 Oki Drive, Calgary, AB T3B 6A8. Tel.: +1 403 888 7218.
E-mail address: 8mmap@queensu.ca (M. Pilkington).
[1] Present address: Department of Pediatric Surgery, Alberta Children's Hospital, 28 Oki Drive, Calgary, AB Canada T3B 6A8.
[2] Present address: Canadian Institute for Health Information.

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intussusception and bowel viability determine the need for bowel resection.

The techniques used for radiographic-guided reduction of intussusception have evolved over many decades [5,6]. There have been changes from hydrostatic to pneumatic reduction, with air enema demonstrating an improved success rate and safer risk profile than barium sulfate [7,8]. In addition, there is increased use of ultrasound for the diagnosis and nonoperative treatment of intussusception, with a goal of reducing nonionizing radiation exposure. Finally, the clinical criteria used for consideration of attempted nonoperative reduction have been modified [9].

The purpose of this study was to describe the trends in intussusception diagnosis and management over a 20-year period in Ontario, Canada. Ontario is the most populous province in Canada with almost 14 million inhabitants. Its single-payer universal health coverage and diverse population make it an excellent setting to evaluate this pediatric disease.

1. Methods

1.1. Study population and case definition

The study cohort was defined as Ontario residents less than 18 years of age who had an emergency room visit and/or hospital admission for treatment of intussusception between January 1, 1997, and December 31, 2016. Universal coverage for physician care and hospital services is provided to all Ontario residents through the Ontario Health Insurance Program (OHIP). The ICES data comprise the linked databases of coded universal coverage health service records for Ontario residents. A validated case definition utilizing ICD-9 and ICD-10 codes and a relevant OHIP physician billing code that indicated treatment was utilized [10]. Patients were identified with ICD9 (560.0) and ICD10 (K56.1) codes for intussusception in the Canadian Institute for Health Information Discharge Abstract Database (CIHI DAD), Same Day Surgery Database (SDS), and National Ambulatory Care Reporting System (NACRS) databases. Treatment was determined using OHIP physician billing data (see Appendix A for codes). The yearly health services contact database, registered persons database, local health integration network (LHIN) database, and healthcare institution databases were used to further characterize the patient population and the institutions to which they presented and at which care was provided. Patients with a diagnostic code for intussusception but without a treatment code were excluded from the cohort. It was assumed that these patients had either incidental intussusception or a clinically suspected but unconfirmed intussusception that did not require reduction. The study was approved by Queen's University Health Sciences Research Ethics Board.

Treatment for intussusception was classified in three groups: nonsurgical enema reduction (nonoperative alone), surgical management (surgery alone), and failed nonoperative reduction necessitating surgical management (failed nonoperative). See Appendix A for OHIP, CCP, and CCI codes used to define each group. The surgical procedures were analyzed in three groups: patients who required manual reduction alone, patients who underwent a bowel resection, and patients who had an ostomy creation. Surgical procedures include those performed as an open laparotomy and as a laparoscopic procedure. Laparoscopic procedures were identified using E793 billing code and, as such, procedures which were converted from laparoscopy to open could not be reliably identified. Pretreatment imaging was determined from CCI and/or CCP codes billed in the emergency department. Institutional type (community versus academic center) where patients presented and received nonoperative and or surgical treatment was also captured (see Appendix B for list of community and academic center hospitals in Ontario with the Ministry of Health list of teaching hospitals). In Ontario only tertiary centers are staffed by pediatric surgeons and radiologists. Data sets were linked with unique encoded identifiers and analyzed at ICES Queen's.

1.2. Statistical analysis

Descriptive statistics were used to describe the frequency of imaging modalities Cochran–Armitage test for trend by year of diagnosis was performed. Trends in treatment modality were analyzed graphically. Multinomial logistic regression was used to estimate associations between treatment procedure, year and type of treating facility. Risk ratios were reported with 95% confidence intervals (CI). A plot of model-predicted probabilities against year was used to assess for patterns.

Descriptive statistics were used to present the proportion of patients who had a bowel perforation from attempted nonoperative reduction that were identified by CCI and CCP codes. A log-binomial regression model was used to compare the probability of 30-day readmission and 1-year mortality by treatment. Comparisons were made between patients treated with nonoperative alone and surgical alone, and failed nonoperative and surgical alone management.

2. Results

2.1. Study population

A total of 1895 patients less than 18 years of age underwent treatment for intussusception in Ontario during the 20-year study period from 1997 to 2016. Overall 35.5% of patients were female, and 57.5% were younger than 24 months. Patients were equally distributed across income quartiles. Patient characteristics by year of presentation are shown in Table 1. An additional 1779 patients had the diagnostic code for intussusception but no associated treatment codes and were excluded from further analysis as per our case definition (section 2.1).

2.2. Diagnostic trends

The use of any pretreatment imaging rose from 57.5% to 99.3% over the two decades (Fig. 1; $p < 0.0001$). In 1997, 38.3% of patients underwent surgical exploration directly without preoperative imaging. In the final four years of the study period, no patient underwent treatment without initial diagnostic imaging. Among patients who were treated with an enema, the rate of pretherapeutic enema imaging more than doubled (from 40.4% to 94.0%).

Coding for emergency room interventions including imaging changed in 2002. Of the 393 patients seen from 1997 to 2002 there were 50 abdominal ultrasounds (12.7% of early cohort), 31 abdominal x-rays (7.9%) and 9 other x-rays (2.3%) completed in the emergency department. In the more recent cohort from 2002 to 2016 there were 1502 patients seen with 1433 ultrasounds (95.4% of late cohort), 383 abdominal x-rays (25.5%), and 18 CT scans (1.2%).

2.3. Intussusception treatment modality

Fig. 2 shows the treatment modality by year of diagnosis. The proportion of intussusception patients managed with surgery alone decreased 10-fold while the proportion of patients treated with nonoperative enema reduction more than doubled ($p < 0.0001$; Fig. 2). The proportion of patients who failed nonoperative enema reduction and required a subsequent surgical intervention rose sharply from 2002 to 2004, but subsequently declined.

Less than 4% of patients had a pathologic lead point for intussusception including Meckel's diverticulum, intestinal duplication, or benign or malignant neoplasms. Though small numbers limit comparisons, more patients in the operative group had Meckel's diverticulum and intestinal duplication (Table 2).

2.4. Treatment modality by treating center

There were 631 patients diagnosed in the community with intussusception (33% of the overall cohort); of these, 149 (24%) were managed

Table 1
Pediatric intussusception patient characteristics by year of index hospitalization in Ontario, Canada.

		1997–1998	1999–2000	2001–2002	2003–2004	2005–2006	2007–2008	2009–2010	2011–2012	2013–2014	2015–2016
		N = 99	*N* = 125	*N* = 169	*N* = 128	*N* = 153	*N* = 205	*N* = 256	*N* = 275	*N* = 224	*N* = 261
Female		28 (28.3%)	39 (31.2%)	67 (39.6%)	41 (32.0%)	59 (38.6%)	57 (27.8%)	101 (39.5%)	109 (39.6%)	72 (32.1%)	100 (38.3%)
Age Group	0–6 Months	16 (16.2%)	26 (20.8%)	19 (11.2%)	20 (15.6%)	23 (15.0%)	35 (17.1%)	28 (10.9%)	33 (12.0%)	30 (13.4%)	26 (10.0%)
	>6–12 Months	34 (34.3%)	29 (23.2%)	42 (24.9%)	27 (21.1%)	36 (23.5%)	38 (18.5%)	67 (26.2%)	50 (18.2%)	32 (14.3%)	51 (19.5%)
	>12–24 Months	15 (15.2%)	22 (17.6%)	49 (29.0%)	27 (21.1%)	36 (23.5%)	45 (22.0%)	53 (20.7%)	71 (25.8%)	47 (21.0%)	63 (24.1%)
	>24–36 Months	5 (5.1%)	16 (12.8%)	28 (16.6%)	20 (15.6%)	22 (14.4%)	23 (11.2%)	38 (14.8%)	40 (14.5%)	45 (20.1%)	47 (18.0%)
	3–5 Years	16 (16.2%)	17 (13.6%)	21 (12.4%)	24 (18.8%)	16 (10.5%)	42 (20.5%)	42 (16.4%)	51 (18.5%)	46 (20.5%)	44 (16.9%)
	6–12 Years	10 (10.1%)	14 (11.2%)	6 (3.6%)	8 (6.3%)	12 (7.8%)	16 (7.8%)	21 (8.2%)	21 (7.6%)	22 (9.8%)	21 (8.0%)
	13–18 Years	3 (3.0%)	1 (0.8%)	4 (2.4%)	2 (1.6%)	8 (5.2%)	6 (2.9%)	7 (2.7%)	9 (3.3%)	2 (0.9%)	9 (3.4%)
Income Quintile	1 (lowest)	20 (20.2%)	33 (26.4%)	41 (24.3%)	23 (18.0%)	31 (20.3%)	48 (23.4%)	54 (21.1%)	56 (20.4%)	54 (24.1%)	57 (21.8%)
	2	21 (21.2%)	25 (20.0%)	27 (16.0%)	26 (20.3%)	30 (19.6%)	39 (19.0%)	57 (22.3%)	54 (19.6%)	39 (17.4%)	41 (15.7%)
	3	23 (23.2%)	26 (20.8%)	25 (14.8%)	26 (20.3%)	27 (17.6%)	42 (20.5%)	46 (18.0%)	55 (20.0%)	39 (17.4%)	57 (21.8%)
	4	16 (16.2%)	17 (13.6%)	36 (21.3%)	29 (22.7%)	36 (23.5%)	42 (20.5%)	56 (21.9%)	59 (21.5%)	44 (19.6%)	70 (26.8%)
	5 (highest)	19 (19.2%)	24 (19.2%)	39 (23.1%)	24 (18.8%)	28 (18.3%)	34 (16.6%)	43 (16.8%)	51 (18.5%)	46 (20.5%)	36 (13.8%)
	Unknown	0 (0.0%)	0 (0.0%)	1 (0.6%)	0 (0.0%)	1 (0.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (0.9%)	0 (0.0%)

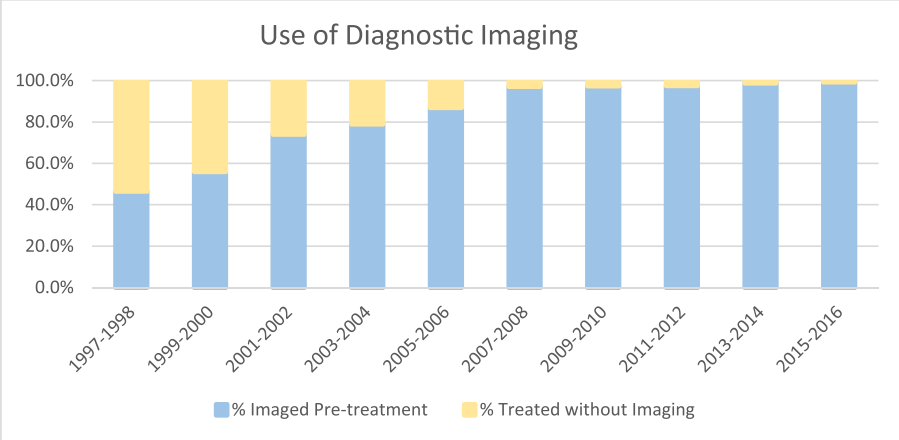

Fig. 1. Trends in the use of pretreatment imaging for pediatric intussusception in Ontario, 1997–2016.

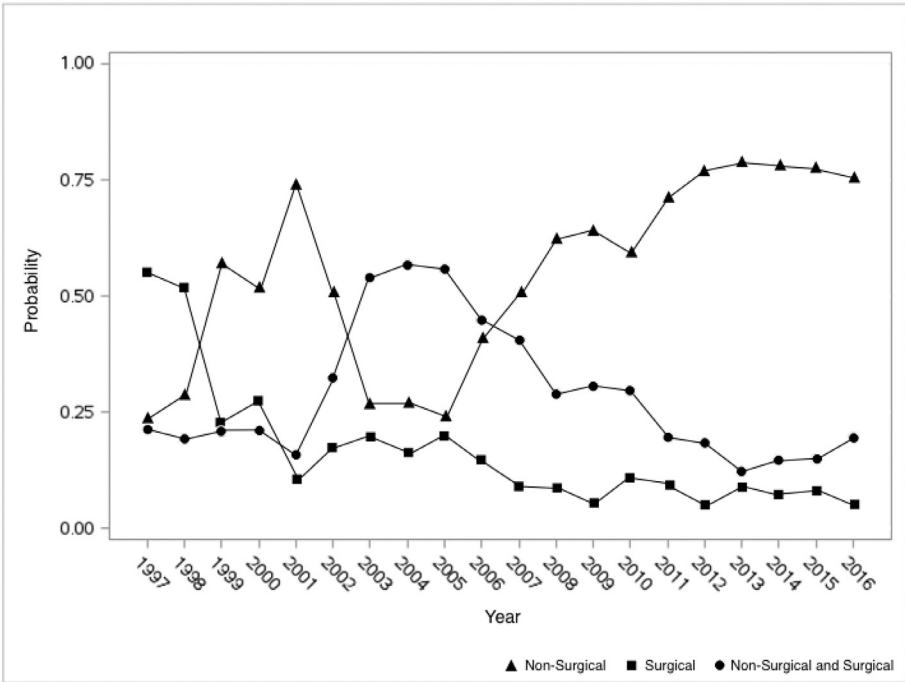

Fig. 2. Predicted probability of each treatment modality by year of emergency department visit or hospital admission in Ontario, 1997–2016.

Table 2
Pediatric patients with identified pathologic lead points.

	Nonoperative reduction	Surgery	p-value
Meckel's diverticulum	3 (0.2%)	57 (3.0%)	<.001
Intestinal duplication	0 (0%)	6 (0.3%)	0.018
Benign intestinal neoplasms	5 (0.3%)	7 (0.4%)	0.639
Malignant neoplasms of small/large bowel + lymphoma	0 (0%)	3 (0.2%)	0.093

definitely in the community with 67 (47%) managed nonoperatively and 82 (58%) managed surgically in the community center (Fig. 3). Among those who presented to community hospital, 482 patients (76%) were ultimately transferred to a tertiary center for definitive care; there were 306 patients (64%) who underwent successful nonoperative treatment and 173 (36%) who underwent successful surgical management at the receiving tertiary center. Fewer than 6 patients underwent nonoperative management in the community followed by nonoperative or surgical management at the tertiary center.

There were 1264 patients who presented initially to a tertiary center for care (Fig. 4). Among these patients 759 (60%) underwent successful nonoperative management, 435 (34%) underwent surgical management alone, and 62 (5%) underwent failed nonoperative management followed by surgical treatment. Eight patients (0.7%) who presented to a tertiary center underwent treatment at a community center.

Among all intussusception patients, 43% of children who presented to community institutions were treated surgically while only 11% were treated with surgery alone at tertiary hospitals (Fig. 3). Patients treated at a community institution were less likely than those treated at a tertiary hospital to be treated nonoperatively (0.39, 95% CI: 0.25–0.62). The proportion of patients transferred from a community center to a tertiary center increased from 25% to 83% between 1997 and 2016 ($p < 0.0001$).

2.4.1. Patients treated nonoperatively

Success with enema reduction varied over the study period. From 2003 to 2006 there was a decrease in the enema success rate, with only one third successful in 2002–2003. However, nonoperative reduction has become consistently more successful since that time (Fig. 5). Successful nonoperative management may have necessitated more than one enema attempt.

2.4.2. Patients treated surgically

There were 764 patients in the study cohort treated surgically. Of those, 493 patients underwent manual reduction alone, 118 patients had a bowel resection, and 13 patients had an ostomy creation. Of the 764 patients treated surgically, only 11 (1.4%) underwent laparoscopy. The frequency of manual reduction versus bowel resection varied over the study period. There was a decrease in frequency of manual reduction alone with a concomitant increase in bowel resection (Fig. 6). Only 1.7% of the study cohort underwent ostomy creation and the frequency remained low throughout the period of study. The likelihood of undergoing surgery increased with patient age ($p < 0.001$).

2.5. Risk of complications, readmission, and mortality by treatment modality

Intestinal perforation, a rare but potentially fatal complication of nonoperative management with enema reduction, occurred in 1.04% of patients who had attempted nonoperative reduction.

Although infrequent, 30-day readmission was most common in patients treated nonoperatively (4.77%), followed by 3.16% in patients treated surgically, and 3.13% in patients who had failed nonoperative reduction and required subsequent surgical intervention. After adjusting for age and sex, patients treated nonoperatively had 1.76 (95% CI: 0.81, 3.83) times the risk of readmission compared with patients treated surgically. There was no difference in readmission in patients who underwent surgery after failed nonoperative reduction and those who underwent surgery alone (RR 1.15, 95% CI: 0.48, 2.73). Seven patients died (0.37%) within one year of diagnosis. Temporal trends could not be assessed for perforation, readmission, or mortality due to small number of occurrences.

3. Discussion

This is the first population-based study to describe the management of pediatric intussusception in the context of changing diagnostic and treatment options. The treatment of intussusception has changed quite dramatically over the past two decades in Ontario. Pretreatment imaging has become standard. Whereas in 1997 surgery was the most

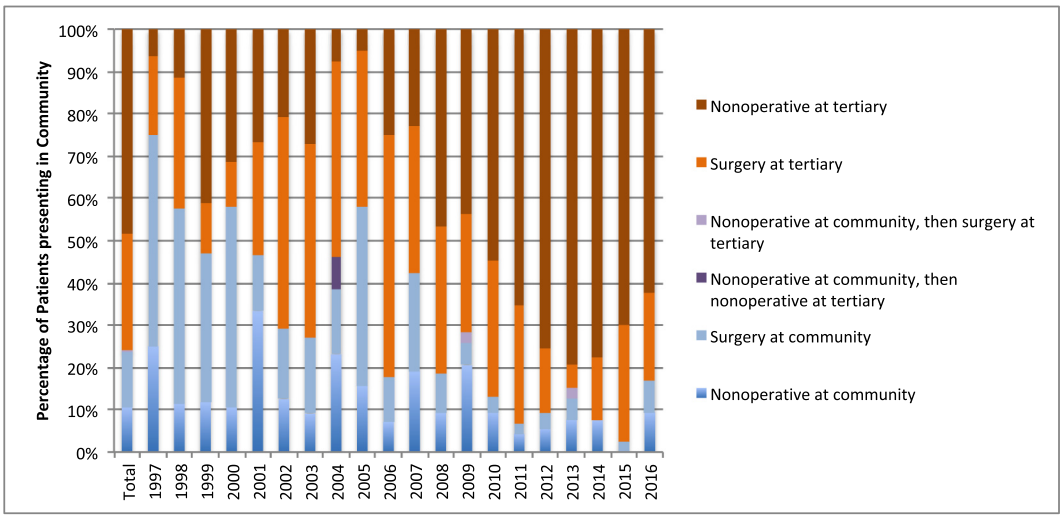

Fig. 3. Treatment patterns of patients presenting to community hospitals in Ontario, 1997–2016.

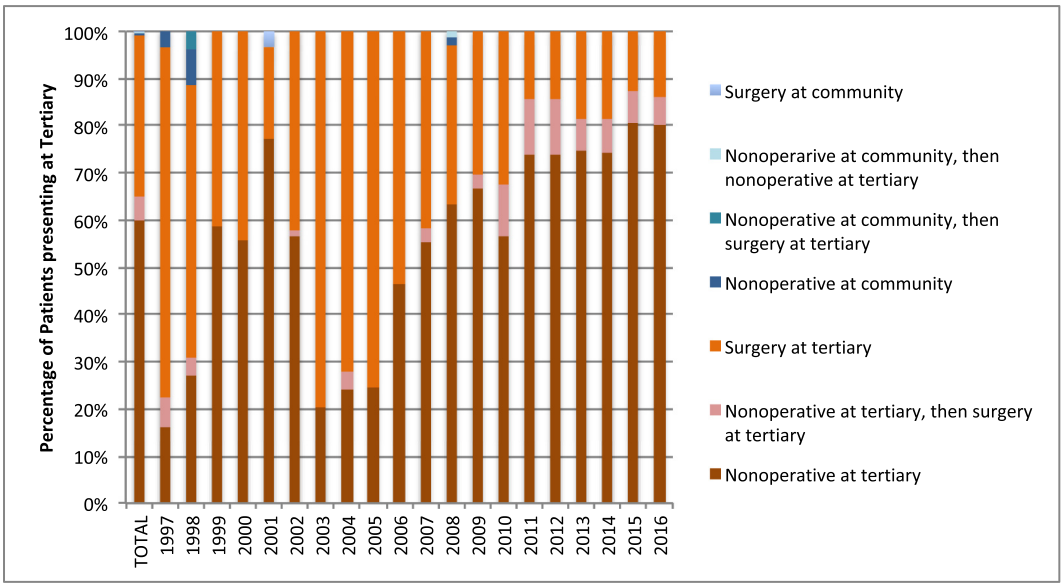

Fig. 4. Treatment patterns of patients presenting to tertiary hospitals in Ontario, 1997–2016.

common first-line treatment approach (55.3%), nonoperative reduction was attempted in 94.8% of patients and was the only modality used in 75.2% of patients by the final year of the study. Treatment modality offered to children differed based on the type of clinical center to which they presented and at which they were treated.

Patients with intussusception in the later years of the study had a much higher probability of being managed nonoperatively. There are several potential explanations for this trend. It may in part relate to improved clinical and radiographic diagnostic accuracy [11]. Pretreatment imaging rose from 57.5% to 99.2% of patients over the two decades of the study. Another factor contributing to the increase in successful nonoperative reduction is that physicians may be increasingly willing to attempt nonoperative reduction, including accepting that multiple attempts may be required, and that this approach has proven safe [12,13]. This may be particularly true in tertiary centers where there is ready access to surgical intervention should aggressive nonoperative reduction fail to resolve the intussusception.

Nonoperative reduction was most often the first line of therapy at tertiary care centers whereas children were far more likely to undergo surgical management without a trial of nonoperative reduction when presenting for care at community hospitals. Patients who presented to a community hospital but underwent first trial of reduction at a receiving tertiary hospital were also more likely to undergo successful nonoperative reduction than the cohort that was not transferred. This is consistent with previous studies that have demonstrated that rates of successful nonoperative reduction are lower in community hospitals [14] and that there is a lower risk of operative intervention when children present for care at specialized pediatric hospitals [15]. Nonoperative management with enema reduction has been recommended when surgical services exist that can provide immediate intervention in an ill child should perforation occur or nonoperative reductions fail [16]. The relative scarcity of pediatric tertiary care centers in the province, and the province's vast geography may lead to delayed presentation and/or transfers from remote areas of the province. Children who have delayed presentation to any hospital, or who are transferred in a delayed fashion are more likely to require surgical management up front [17]. Once a patient was transferred for management to a tertiary center their likelihood of successful management was similar to those who presented initially to a tertiary center. It remains unclear from this study whether this is due to clinical factors in patients treated at the community versus transferred patients, or whether it is due to

Fig. 5. Proportion of successful nonoperative reductions in Ontario, 1997–2016.

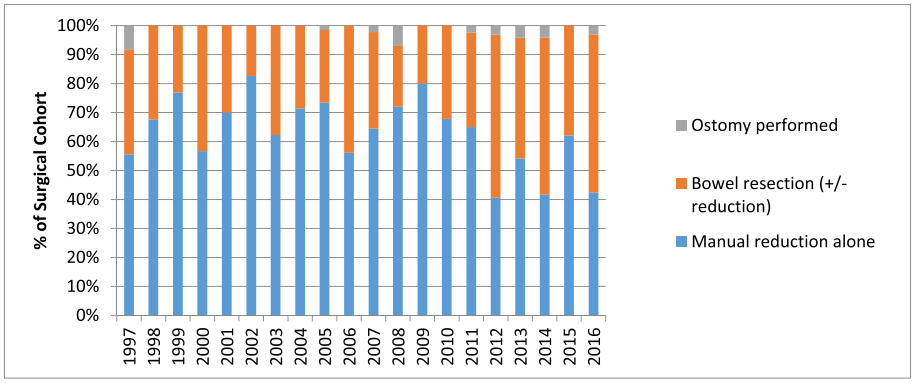

Fig. 6. Relative frequency of type of surgical intervention by year in Ontario 1997–2016.

improved nonoperative treatment success at the tertiary centers. Patient transfer to tertiary centers for initial treatment was more common in the latter years of the cohort.

In this population-based study, the success rate of nonoperative reduction varied year-to-year from 32.4% in 2003–2004 to 85.4% in 2013–2014. A previous published systematic review including studies from multiple centers between 1986 and 2002 showed variable success rates from 12.5% to 100% and recommended achieving at least 80% successful reduction [16]. It is difficult to compare the current study's results with those in the literature because with utilization of administrative data, it is not possible to ascertain the specific method of nonoperative reduction or number of attempts per patient. In the later years of our study, patients who did undergo surgical intervention were more likely to require bowel resection. This suggests that nonoperative reductions were more successful in reducing difficult intussusceptions that involved viable bowel whereas the children who required surgery were more likely to have necrotic bowel prompting resection.

Over the 20 years of the study, perforation rates with attempted enema reduction were low (1.04%) and readmission within 30 days of discharge was uncommon (4.77%). Overall mortality was also very low with seven patients dying within one year of intussusception diagnosis in 20 years in the province. Although there have been changing trends in treatment modality over the past two decades there has remained a low rate of associated morbidity and one-year mortality.

A limitation of the study is the inability to identify patients' delayed presentation, clinical status at presentation, or the indications for surgical management. Patients with pathologic lead points were not reliably identified in the extant administrative data. Thus this study cohort includes both idiopathic intussusception and intussusception with an anatomic lead point without distinction. The single-payer universal health coverage that exists in Ontario contributes to more equitable access to health care resources, with reasonable generalizability to other provinces and/or countries with similar health care systems. However, there may be limitations to extrapolate these results to settings with variable access to health care resources, such as the United States. Despite these limitations, this remains the largest population-based study to describe the changing diagnosis and treatment of pediatric intussusception.

4. Conclusions

The management of intussusception has changed dramatically in the past two decades in Ontario. Nonoperative reduction has become much more common as first line management although its success-rate remains variable. Overall complications of perforation, readmission, and mortality remained low across all modalities of treatment. Patients presenting to community centers are far more likely to undergo surgery alone. Further study is needed to determine the factors that contributed to this disparity in order to provide increased access to nonoperative management when appropriate.

Appendix A. OHIP codes for Nonoperative and Operative Treatment

Nonsurgical Management

OHIP (any fee suffix)

J068 Hydrostatic/pneumatic reduction of intussusception

X112 Diagnostic Radiology Colon-Barium Enema Including Survey Film

X113 Diagnostic Radiology Colon – Air Contrast

CCP

10.20 other non-operative dilation and manipulation procedures

CCI

1NP73BAPK Reduction, small and large intestine endoscopic per orifice approach and pneumatic [air pressure] device

1NP73CC Reduction, small and large intestine using per orifice [rectal] approach and [water] pressure

1NP73BA Reduction, small and large intestine using endoscopic per orifice approach

Surgical Management

OHIP (fee suffix = A only)

S149 Ileostomy

S157 Colostomy

S165 Resection of small bowel with anastomosis, other

S167 Resectiona and anastomosis of large intestine, any portion

S156 Exteriorization of intestine (Mickulicz)

S166 Small and large intestine terminal ileum, cecum and ascending colon (right hemicolectomy) - Resection with anastomosis

S175 Intestinal obstruction without resection (one stage)

S175 + E793 Intestinal obstruction without resection (one stage), performed laparoscopically

S177 Intestinal obstruction with resection (one stage)

CCP

58.80 INTRA-ABDOMINAL MANIPULATION OF INTESTINE

58.81 INTRA-ABDOMINAL MANIPULATION OF INTESTINE, UNQUALIFIED

58.82 INTRA-ABDOMINAL MANIPULATION OF SMALL INTESTINE
58.83 INTRA-ABDOMINAL MANIPULATION OF LARGE INTESTINE
58.90 OTHER OPERATIONS ON INTESTINES
57.00 INCISION, EXCISION AND ANASTOMOSIS OF INTESTINE
57.41 MULTIPLE SEGMENTAL RESECTION OF SMALL INTESTINE
57.42 OTHER PARTIAL RESECTION OF SMALL INTESTINE
57.50 PARTIAL EXCISION OF LARGE INTESTINE
57.51 MULTIPLE SEGMENTAL RESECTION OF LARGE INTESTINE
57.52 CECECTOMY
57.53 RIGHT HEMICOLECTOMY
57.54 RESECTION OF TRANSVERSE COLON
57.55 LEFT HEMICOLECTOMY
57.59 OTHER PARTIAL EXCISION OF LARGE INTESTINE
57.70 SMALL-TO-SMALL INTESTINAL ANASTOMOSIS
57.80 OTHER ANASTOMOSIS OF INTESTINE
57.81 INTESTINAL ANASTOMOSIS, UNQUALIFIED
57.83 OTHER SMALL-TO-LARGE INTESTINAL ANASTOMOSIS
57.84 LARGE-TO-LARGE INTESTINAL ANASTOMOSIS
57.90 INVASIVE DIAGNOSTIC PROCEDURES ON INTESTINE
57.98 OTHER INVASIVE DIAGNOSTIC PROCEDURES OF SMALL INTESTINE
57.99 OTHER INVASIVE DIAGNOSTIC PROCEDURES OF (LARGE) INTESTINE
58.00 OTHER OPERATIONS ON INTESTINE
58.00 EXTERIORIZATION OF INTESTINE
58.01 EXTERIORIZATION OF SMALL INTESTINE
58.02 RESECTION OF EXTERIORIZED SEGMENT OF SMALL INTESTINE
58.03 EXTERIORIZATION OF LARGE INTESTINE
58.04 RESECTION OF EXTERIORIZED SEGMENT OF LARGE INTESTINE
58.10 COLOSTOMY
58.20 ILEOSTOMY
58.21 ILEOSTOMY, UNQUALIFIED
58.22 TEMPORARY ILEOSTOMY
58.70 OTHER REPAIR OF INTESTINE
58.82 INTRA-ABDOMINAL MANIPULATION OF SMALL INTESTINE
58.83 INTRA-ABDOMINAL MANIPULATION OF LARGE INTESTINE
58.90 OTHER OPERATIONS ON INTESTINES
59.20 INCIDENTAL APPENDECTOMY

CCI

1NK80DA Repair, small intestine endoscopic [laparoscopic] approach using apposition technique [e.g. suturing, stapling]

1NK80LA Repair, small intestine open approach using apposition technique [e.g. suturing, stapling]

1NK87DA Excision partial, small intestine endoscopic [laparoscopic] approach Simple excisional technique

1NK87DN Excision partial, small intestine endoscopic [laparoscopic] approach Enterocolostomy anastomosis technique

1NK87DP Excision partial, small intestine endoscopic [laparoscopic] approach Enteroenterostomy anastomosis technique

1NK87DX Excision partial, small intestine endoscopic [laparoscopic] approach Stoma formation with distal closure

1NK87DY Excision partial, small intestine endoscopic [laparoscopic] approach Stoma formation with mucous fistula

1NK87LA Excision partial, small intestine open approach Simple excisional technique

1NK87RE Excision partial, small intestine open approach Enterocolostomy anastomosis technique

1NK87RF Excision partial, small intestine open approach Enteroenterostomy anastomosis technique

1NK87TF Excision partial, small intestine open approach Stoma formation with distal closure

1NK87TG Excision partial, small intestine open approach Stoma formation with mucous fistula

1NM80DA Repair, large intestine endoscopic [laparoscopic] approach using apposition technique [e.g. suturing, stapling]

1NM87RE Excision partial, large intestine open approach Enterocolostomy anastomosis technique

1NM87RN Excision partial, large intestine open approach Colocolostomy anastomosis technique

1NP72LA Release, small with large intestine using open approach

1NP73DA Reduction, small and large intestine using endoscopic [laparoscopic] approach

1NP73JH Reduction, small with large intestine using manual technique (for hernia reduction alone)

1NP73LA Reduction, small with large intestine using open approach

2OT70DA Inspection, abdominal cavity using endoscopic [laparoscopic] approach

2OT70LA Inspection, abdominal cavity using open approach

Appendix B. Community and academic treating institutions in Ontario

B.1 Academic Institutions

- Children's Hospital of Eastern Ontario
- Children's Hospital of Western Ontario
- Hamilton Health Sciences Corporation
- Hospital for Sick Children, The
- Kingston Health Sciences Centre (Hotel Dieu Hospital and Kingston General Hospital)
- London Health Sciences Centre
- Health Sciences North-Laurentian
- Sunnybrook Health Sciences Centre
- University Health Network

B.2 Community Hospitals

- Bluewater Health-Sarnia
- Brantford General Hospital
- Cambridge Memorial Hospital
- Centenary Health Centre
- Credit Valley Hospital, The
- Georgetown and District Memorial Hospital
- Grey Bruce Health Services
- Guelph General Hospital
- Headwaters Health Care Centre
- Hotel-Dieu Grace Hospital
- Huntsville District Memorial Hospital
- Joseph Brant Hospital
- Lake-of-the-Woods District Hospital
- Lakeridge Health
- Mackenzie Health
- Markham Stouffville Hospital
- Niagara Health System
- North Bay General Hospital
- Oakville-Trafalgar Memorial Hospital
- Orillia Soldiers' Memorial Hospital
- Oshawa General Hospital
- Peterborough Regional Health Centre

- Quinte Healthcare Corporation
- Renfrew Victoria Hospital
- Rouge Valley Health System
- Royal Victoria Regional Health Centre
- Sarnia General Hospital
- Sault Area Hospital
- Scarborough Hospital
- Southlake Regional Health Centre
- St Joseph's Health Care System
- St Mary's General Hospital
- St Thomas-Elgin General Hospital
- St. Joseph's Health Care
- St. Joseph's Health Service Association of Chatham
- Stratford General Hospital
- The Grey Bruce Regional Health Centre
- Thunder Bay Regional Health Sciences Centre
- Timmins & District General Hospital
- Toronto East Health Network
- Trillium Health Centre
- William Osler Health System
- Windsor Regional Hospital
- Woodstock General Hospital Trust

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