

Surgical Management of Intussusception in the Adult

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Controversy concerning the appropriate surgical management of intussusception in the adult prompted review of the Mayo Clinic's experience with this uncommon entity. During the last 23 years, 48 patients had documented intussusception: 24 instances of intussusception originating in the small intestine and 24 instances of intussusception originating in the colon. Two-thirds of the colonic intussusceptions were associated with primary carcinoma of the colon. Only one-third of the intussusceptions of the small intestine were harbingers of malignancy, and 70% of these lesions were metastatic. Because of these findings, we advocate resection of intussusceptions of the colon without initial surgical reduction, in order to minimize the operative manipulation of a potential malignancy. In the patient with intussusception of the small intestine, an associated primary malignancy is uncommon. Initial reduction, followed by limited surgical resection, is the preferred treatment. Surgical resection without reduction is favored only when an underlying primary malignancy is clinically suspected.

CONTROVERSY CONCERNING THE OPTIMAL surgical approach in the management of adult intussusception persists. Before the mid-1950s, manual reduction of the intussusception, followed by definitive surgical resection, was advocated. Later, Brayton and Norris¹ and Sanders and co-workers² recommended that primary resection without attempting reduction be performed in all colonic intussusceptions, because of the incidence of associated malignancy, which approached 65%. More recently, Weilbaeher et al.³ claimed that malignancy also was associated with enteric intussusception more frequently than had previously been appreciated. These authors advocated primary surgical resection without reduction in all adult patients with intussusception, regardless of its anatomic site. Thus, controversy continues to focus on whether intussusception in the adult should be surgically resected without a prior attempt at reduction, for fear that undue operative manipulation of a malignant lesion may hinder the patient's chances of survival.

In 1956, Dean et al.⁴ reported on 96 adult patients with intussusceptions who were treated at the Mayo

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Clinic between 1910 and 1955. Since then, several reports of adult intussusception^{2,3,5-11} have reviewed the cause, clinical features, and management of this uncommon entity. The purposes of the present study are 1) to review and update our experience with adult intussusception during the intervening 23 years, including the addition of follow-up data, 2) to discuss the various considerations involved in the management of adult intussusception, and 3) to detail an appropriate surgical approach, based on the anatomic site of the intussusception.

Materials

The records of all patients who were 15 years old or older, who presented with intussusception at the Mayo Clinic between 1955 and 1978, were reviewed retrospectively. Only patients with intussusception documented at laparotomy were included; in two patients, intussusception was confirmed at autopsy. Patients with agonal intussusceptions, "incidental" intussusceptions noticed at laparotomy, rectal or stomal prolapses, and jejuno gastric intussusceptions after gastroenterostomies were excluded from this study. During the same period, 24 patients with postoperative or intestinal intubation-related intussusception also were excluded from the study, because this type of intussusception is considered to be a different entity.

Forty-eight patients were classified into four categories on the basis of the location of the lead point of the intussusception: 1) enteric, where the intussusception is confined to the small bowel; 2) ileocolic, where the ileum invaginates through the stationary ileocecal valve; 3) ileocecal, where the ileocecal valve itself leads the intussusception; and 4) colocolic, where the intussusception is confined to the large bowel. For each category, data on cause, age, sex, clinical features, and results of diagnostic roentgenographic and laboratory studies were gathered. Operative and pathologic records were carefully reviewed

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to determine the location, viability of the involved intestinal segment, and the methods of surgical management. Data on the morbidity and mortality rates of the patients while in the hospital were recorded. Follow-up data until death or until December 1978 were gathered on all patients who had idiopathic or malignant intussusceptions.

Results

Site

Of the 48 intussusceptions, 24 originated in the small intestine and 24 originated in the colon (Table 1). The incidence of enteric intussusception (38%) had not changed significantly from the previous Mayo Clinic experience (30%).⁴ Ten intussusceptions originated in the jejunum and eight originated in the ileum; all were antegrade. At presentation, two patients had two separate areas of jejunojejunal intussusception: one patient had Peutz-Jeghers syndrome and the other patient had multiple adhesions. No patient had an esophageal, gastric, or duodenal intussusception.

Only three patients with ileocolic (6%) and three patients with ileocecal (6%) intussusceptions have been treated since 1955. While the prevalence of the ileocolic type has not changed, an apparent decrease in the ileocecal type, from 30% in our early series⁴ to 6% in our current series, has occurred. This decrease in incidence of ileocecal intussusceptions probably reflects our classification, which is more exact than that used by Dean et al.⁴ Intussuscepting cecal neoplasms, although resembling true ileocecal intussusceptions at gross examination, have been more correctly classified as colocolic, because the inciting factor is an abnormality in the wall of the cecum and not the ileocecal valve.

Of the 24 colocolic intussusceptions, 17 (70%) involved the right colon, while the remainder involved the left colon. Although this predilection of right-sided colonic intussusception is consistent with other recent reports,^{11,12} this finding denotes a significant increase in the incidence of right-sided colonic intussusceptions, compared with our experience prior to 1955. While the reasons for this increase remain unclear, we believe that the increasing incidence of carcinoma in the right colon¹³ may be a contributing factor. Of interest were two intussusceptions of the appendix and one retrograde intussusception led by a sigmoid polyp.

Etiologic Factors

In our current series, a discrete pathologic process was associated with 83% of the intussusceptions

TABLE 1. Sites of Adult Intussusception

Site	Patients	
	Number	Per Cent
Enteric	18	38
jejunojejunal*	10	
ileoileal	8	
Ileocecal	3	6
Ileocolic	3	6
Colocolic	24	50
ascending colon†	17	
descending colon	1	
sigmoid colon	6	
Total	48	100

* Includes two patients with two separate areas of intussusception.

† Includes two patients with intussusception of appendix.

(Table 2). Overall, malignant neoplasms accounted for 46% of the intussusceptions, and benign neoplasms accounted for 29%. Congenital malformations, which included three Meckel's diverticuli and one ileal duplication, were associated with 8% of the intussusceptions, while only 17% of the intussusceptions were considered to be idiopathic in nature. The incidence of malignancy was 65% for colocolic intussusceptions, but only 29% for enteric intussusceptions. These data are remarkably similar to those in our earlier series and other recent series.^{3,11}

Although enteric intussusception was recognized in one patient who had acute abdominal trauma, other reputed associations with intussusception, including pregnancy, inflammatory disorders, chemotherapy, and hematologic disorders of coagulation, were not found.

Age and Sex

There was a slight male predominance in our study (1.3:1). At the time of diagnosis, the patients ranged in age from 17 to 91 years (mean: 57 years). Sixty per cent of the patients were older than 50 years, while only 8% were less than 30 years of age. This age distribution demonstrated a significant change from past experience, in which less than 36% of the 655 adults with intussusception, treated between 1900 and 1947,¹⁴ were more than 50 years of age. This difference is most likely due to the present longer life expectancy and is consistent with more recent series.^{3,5}

Clinical Features

The symptoms of adult intussusception were characteristic of partial intestinal obstruction (Table 3). Intermittent cramping abdominal pain was noticed in 71% of the patients. Vomiting occurred more often in patients with small-bowel intussusceptions, while

TABLE 2. Lesions Associated with Adult Intussusception

Large Intestine	Number of Patients	Small Intestine	Number of Patients	Total
Malignant neoplasm		Malignant neoplasm		
carcinoma		leiomyosarcoma	2	
cecum	12	metastatic		
descending colon	1	melanoma	2	
sigmoid colon	1	myeloma	1	
metastatic leiomyosarcoma	1	renal cell	1	
		squamous cell (lung)	1	
Total	15		7	22 (46%)
Benign neoplasm		Benign neoplasm		
adenomatous polyp	4	lipoma	2	
villous adenoma	2	fibroma	1	
appendix		lipomatous ileocecal		
mucocele	1	valve	1	
villous adenoma	1	Peutz-Jeghers	2	
Total	8		6	14 (29%)
Idiopathic	1	Idiopathic	7	
		Congenital		
		Meckel's diverticulum	3	
		ileal duplication	1	
Total	1		11	12 (25%)
Totals	24		24	48 (100%)

diarrhea occurred more frequently in patients with colonic intussusceptions. Hematochezia, either reported by the patient or proven by a guaiac-positive stool, was found in only 27% of the patients. Three patients were asymptomatic: two with intussuscepting cecal carcinomas discovered during evaluation of unrelated problems and one with an intussuscepting ileal duplication found during elective splenectomy for hairy cell leukemia.

Most patients' symptoms were chronic. Sixty-five per cent of the patients had symptoms for more than one month before presentation at the hospital; many patients complained of symptoms for more than one year. In contrast, only 14% of the patients presented

acutely. The duration of symptoms was not related to age, sex, cause, or type of intussusception.

An abdominal mass was the most frequent physical finding. Of the 48 patients, 20 (42%) had palpable masses, frequently described before operation as being "tubular" or "sausage-shaped." Palpable masses were noted twice as frequently in patients with colocolic intussusceptions as in patients with enterocolic intussusceptions. Abdominal tenderness was found in 33% of the patients, but only four patients presented with an acutely tender abdomen. Fever and abdominal distention were uncommon, and each was noted in less than 10% of the patients.

Diagnostic and Laboratory Investigations

Intussusception was diagnosed by preoperative roentgenographic examinations in 35% of patients. While only 4 of the 21 enteric and enterocolic intussusceptions were recognized preoperatively, 57% of the colocolic intussusceptions were correctly diagnosed. Other preoperative diagnoses included intestinal obstructions in 18% of the patients and intestinal masses in 20% of the patients.

The most beneficial diagnostic procedures were barium contrast studies of the colon and upper gastrointestinal tract (Table 4). Barium enema studies demonstrated intussusception, mass, or obstruction in 95% of the patients with colonic involvement. Similarly, barium contrast studies of the upper

TABLE 3. Symptoms and Signs of Intussusception in 48 Adults

Symptom/Sign	Large Bowel (24 pt)	Small Bowel (24 pt)*	Total	
			Number of Patients	Per Cent
Abdominal pain	15	19	34	71
Vomiting	5	12	17	36
Hematochezia	7	6	13	27
Diarrhea	9	2	11	23
Tenesmus	2	0	2	4
Constipation	1	1	2	4
Asymptomatic	2†	1‡	3	6

* Includes ileocolic and ileocecal intussusceptions.

† Cecal masses found on barium enema study for unrelated problems.

‡ Chronic enteric intussusception secondary to ileal duplication noted at elective splenectomy.

TABLE 4. Efficacy of Diagnostic Procedures for Intestinal Intussusception

Procedure	Findings			
	Intus-susception	Mass	Obstruc-tion	Neg
Upper gastro-intestinal*	4	2	4	3
Barium enema†	11	7	0	1
Abdominal film	0	0	4	6
Sigmoidoscopy	2	0	0	0
Total	17 (39%)	9 (20%)	8 (18%)	10 (23%)

* Enteric and ileocolic types.

† Colocolic and enterocolic types.

gastrointestinal tract demonstrated intussusception, mass, or obstruction in 77% of the patients with enteric and ileocolic intussusceptions. Barium was the contrast medium of choice because the patterns of obstructions, in our patients, were both chronic and partial. However, in patients with acute complete obstruction, water-soluble contrast material was preferred. Although plain abdominal radiographs are occasionally helpful in diagnosing intussusception,¹⁵ this diagnostic method, in our experience, was useful only in demonstrating intestinal obstruction. Recently, ultrasonography,¹⁶ angiography,¹⁷ and abdominal scan using technetium-99m pertechnetate¹⁸ have demonstrated diagnostic efficacy, but these diagnostic methods were not used in any of our patients.

Laboratory findings were nonspecific. Anemia (hemoglobin less than 12 g/dl) was noted in 46% of our

patients; yet, this finding provided no differentiation of site or cause of intussusception. Leukocytosis (leukocyte count greater than 10,000/cm³) was found in only eight patients; however, at presentation, two of the three patients with strangulated intussusception had the triad of leukocytosis, fever, and localized abdominal tenderness. None of the 45 patients without gangrenous bowels demonstrated this complex of findings.

Surgical Treatment

Forty-five patients underwent operations for intussusception (Table 5). One additional patient underwent sigmoidoscopic reduction of a sigmoidorectal intussusception with concomitant polypectomy. The two remaining patients with terminal malignancies did not undergo operations.

The choice of procedure was influenced by the site, size, cause, and viability of the intussusception. Overall, 23 (50%) of the 46 patients underwent primary resections of the intussusceptions without initial reductions, 16 patients (35%) underwent resections after initial reductions, and six patients (13%) had reductions only. In the colocolic group, 17 of the 23 patients underwent primary resections without reductions, while the remainder of the patients had resections after initial reductions. Of the 23 patients with intussusceptions involving the small intestine, six patients underwent primary resections, 11 patients underwent resections after initial reductions, and six patients underwent reductions only

TABLE 5. Operative Procedures for Treatment of 46 Adults with Intussusception*

Lesion	Procedure			
	Primary Resection	Reduction Then Resection	Reduction Alone	Sigmoidoscopic Reduction and Polypectomy
Large intestine origin (23 patients)				
neoplasm	16	5		1
benign	5	2		1
malignant	11	3		
idiopathic	1	0		
Total	17	5	0	1
Small intestine origin (23 patients)†				
neoplasm	3	9		
benign	2	4		
malignant	1	5		
congenital	2	2		
Meckel's diverticulum	1	2		
ileal duplication	1			
idiopathic	1		6	
Total	6	11	6	0
Totals	23 (50%)	16 (35%)	6 (13%)	1 (2%)

* Two patients had diagnosis at autopsy.

† Enteric, ileocolic, and ileocecal types.

TABLE 6. *Mortality and Morbidity After Surgical Treatment of 46 Adults with Intussusception*

	Large Intestine	Small In-testine*	Total	
			Number of Patients	Per Cent
Operative mortality rate†	1	2	3	7
Wound infection	1	2	3	7
Intra-abdominal abscess	1	1	2	4
Gastrointestinal bleeding	0	2	2	4
Acute renal failure	1	0	1	2
Dehiscence	0	1	1	2
Total	4	8	12	26

* Includes ileocecal and ileocolic types.

† Thirty-day postoperative period.

(two of whom had concomitant intestinopexies performed on the distal ileum and cecum).

Morbidity and Mortality Rates

Overall, only six patients (12%) suffered postoperative complications (Table 6). Three of the 45 patients who underwent abdominal operations died (operative mortality rate: 6%). One death was related to multi-system trauma, while another death (a 91-year-old patient) was secondary to cardiac arrhythmia. The remaining death was in a patient with widely metastatic melanoma, in whom wound-related abdominal sepsis developed after wound dehiscence.

Follow-up Data

Follow-up data were complete on all patients with idiopathic or malignancy-related intussusceptions. There have been no documented recurrences to date; the follow-up periods ranged from one to 23 years, with a mean of 12 years. However, at the present time, two patients, each with a history of idiopathic intussusception treated by reduction alone, have symptoms suggestive of their original complaints.

Of particular interest was the follow-up data on the patients in whom the intussusceptions were related to malignant lesions. All such patients with enteric intussusceptions (two with primary leiomyosarcomas and four with metastatic lesions) died of tumor-related causes. Although the median survival period was only five months, palliation was significant. In contrast, the survival of the 15 patients with primary colonic malignancy proved to be more favorable. Of the 13 patients with primary adenocarcinomas, ten patients had either modified Dukes' A (one patient) or Dukes' B (nine patients) lesions. None of these patients developed recurrences of intussusceptions or carcinomas during follow-up periods that lasted

from six to 22 years. Two of three patients with Dukes' C lesions died of tumor-related causes two and nine years after operations; the remaining patient was tumor-free when he died 14 years after operation.

Discussion

Unlike the more common idiopathic intussusception found in children,¹⁹ intussusception in the adult remains a surgical disease. The Mayo Clinic experience with 144 cases of adult intussusception, treated since 1910, has demonstrated that at least 86% of the cases were associated with a discrete, pathologic process leading the intussusception. In contrast, only 20 cases (14%) were considered to be "idiopathic." Although recent smaller series^{10,15,20,21} have claimed a higher incidence of the idiopathic variety, ranging as high as 47% of the cases, our findings support the results of two large review series,^{3,14} each of which found that intussusception in the adult was caused by a specific lesion in more than 75% of cases. Moreover, at our institution and others,^{8,11} neoplasms have accounted for most adult intussusceptions, two-thirds of which have proved to be malignant. Whereas earlier reports claimed only a 20% incidence of malignancy,^{1,8,14,22} more recent studies have reported a larger incidence ranging from 27–37%.^{3,20,21,23} Indeed, in our recent experience, we found an even greater incidence of malignancy, accounting for 46% of all intussusceptions. These data substantiate the claim made two decades ago by both Roper²³ and Sanders et al.,² and more recently by Weilbaecher and co-workers,³ that malignant lesions are being recognized with increasing frequency in adults with intussusception. Thus, surgical exploration remains mandatory in all but the most unusual circumstances. Attempts at hydrostatic reduction alone should never be recommended as definitive treatment in the adult patient.

Nevertheless, controversy concerning the optimal surgical management of intussusception in the adult persists. The surgical approach is influenced by four major considerations: 1) the frequency of an underlying etiologic factor, itself requiring operative therapy, 2) the prevalence of associated malignancy and the implications of any undue operative manipulation, 3) the anatomic site and extent of the intussusception, and 4) various local, intraoperative factors, such as the degree of associated inflammation, edema, and relative ischemia of the involved bowel. Whether reduction of the intussuscepted bowel before definitive treatment of the inciting lesion influences operative management, postoperative morbidity, or long-term

survival remains speculative. Theoretically, initial reduction might permit a more limited resection or, in enterocolic intussusception, avoid colectomy. However, concepts of intraluminal seeding or venous embolization of malignant cells during operative manipulation weigh against primary reduction of the intussusception in situations in which a significant risk of underlying malignancy exists. Furthermore, pathologic review of three nongangrenous intussusceptions resected without prior reduction revealed focal areas of mucosal necrosis, which might have extended beyond the margins of an adequate resection had reduction been performed before resection. Whether areas of isolated mucosal necrosis would have been subject to perforation or tumor implantation remains speculative.

Careful consideration of each of these factors, based on our experience and selected review of the literature, has allowed us to develop general guidelines for the optimal management of intussusception in the adult. In colocolic intussusceptions, we agree with others^{1,2,21} that primary surgical resection without prior attempt at reduction represents the treatment of choice, except in unusual circumstances. Wide resection of the intussuscepted colon and its mesentery dictates the most important technical consideration, because two-thirds of these intussusceptions are associated with a malignant lesion. Treatment of intussusception involving the right colon should encompass a right or extended right hemicolectomy. When the intussusception involves only the descending or sigmoid colon, left hemicolectomy without reduction is advocated. In patients with sigmoidorectal intussusception, careful endoscopic assessment of the rectum for tumor involvement is mandatory. If the lower rectum is involved, an abdominoperineal resection is indicated. However, without evidence of distal disease, initial reduction of the intussusception may allow anterior resection, and, thus, avoid abdominoperineal resection. Because most colonic intussusceptions lead to only partial luminal obstruction, adequate preoperative bowel preparation is generally possible, thus allowing primary anastomosis. However, intussusceptions causing complete colonic obstruction warrant treatment governed by the usual dictums that apply to obstructing colonic lesions.

In unusual circumstances, wide resection of colocolic intussusceptions may be avoided. An intussuscepted appendix may be treated by simple wedge resection or cecectomy; however, most intussuscepted appendices present as cecal masses presumed to be malignant, and should be treated as such. Similarly, preoperative studies occasionally demonstrate a truly pedunculated polyp leading the colonic intussusception. In selected

patients, surgical reduction and polypectomy through a limited colotomy or, as in one of our patients, endoscopic reduction and polypectomy through the sigmoidoscope, are occasionally feasible. However, attempts at local removal of large sessile polyps through a limited colotomy, or by wedge resection through edematous bowel, may be dangerous, and primary resection with margins of healthy bowel might be fraught with less risk.

Unfortunately, most ileocecal intussusceptions are indistinguishable from cecally based colocolic intussusceptions during operation and should be treated by right hemicolectomy, as recommended by Brayton and Norris.¹ However, true ileocecal intussusceptions are often idiopathic, especially in the younger adult, and resemble the childhood variety. In these patients, careful transmural palpation of the terminal ileum, ileocecal valve, and cecum is indicated. If intraluminal disease is excluded, these ileocecal intussusceptions can be treated, as in two of our patients, by simple reduction and concomitant intestinopexy of both cecum and terminal ileum. Recurrence is extremely rare.²⁴

Ileocolic intussusception is best treated by right hemicolectomy without reduction. Because of the constricting effect of the ileocecal valve,²⁵ the incidence of strangulation is highest with this type of intussusception. An overambitious attempt at surgical reduction can lead to peritoneal soiling. However, initial reduction may be considered in selected patients (those with a history of previous malignancy or those in whom the lesion is easily reduced) since a localized enteric resection may suffice and the risks of colectomy may thereby be avoided.

In contrast, when the intussusception involves only the small intestine, the procedure of choice becomes less clear. In our experience, although one-third of these intussusceptions were related to underlying malignancies, the incidence of primary malignant lesions of the small intestine was low compared with the more frequent metastatic implants. We seriously doubt that reduction of an intussusception caused by a metastatic lesion influences the long-term prognosis. Similarly, two-thirds of the enteric intussusceptions had causes other than malignancy, and primary reduction of the intussusception would not have been contraindicated. Indeed, these might have required only a localized segmental resection after reduction. Therefore, treatment should be individualized according to the clinical situation; these patients do not require primary resection, as advocated by Weilbaecher and co-workers.³

In patients with enteric intussusceptions presenting as isolated clinical entities, the risk of under-

lying primary malignancies remains significant and, thus, justifies resections without initial reductions. However, a history of previous malignancy, especially melanoma or breast cancer, warrants an attempt at reduction, followed by a more localized resection. Similarly, in patients with Peutz-Jeghers syndrome, initial reduction followed by enterotomy and polypectomy is preferred, because of the recurrent nature of intussusception in this disease. Occasionally, enteric intussusceptions are associated with old serosal adhesions without demonstrable intraluminal disease. These, in addition to intussusceptions associated with acute trauma, chemotherapy, or sprue, can be treated by simple reduction and lysis of all surrounding adhesions. However, repeated attempts at reducing a chronic intussusception associated with multiple adhesions or an inflammatory mass are to be avoided, and primary resection may be the conservative approach.

Despite the lack of adequate preoperative bowel preparation and often emergent indications for operation, mortality and morbidity rates are minimal. Of the three patients who died after their operations, only two deaths were related to the surgical procedure, both in poor-risk patients. Similarly, only three wound infections and two intra-abdominal abscesses developed. One likely explanation for so few complications in such a high-risk population must lie in the fact that intussusception, while causing significant symptoms, only rarely produced complete obstruction—less than 20% of the patients in our series. Also, convalescence was speeded by the ability to achieve primary anastomosis under such conditions. Only one patient required a two-stage approach, because of severe inflammation surrounding an ileoileal intussusception.

Long-term follow-up data have generally been uncomplicated. Although all other series have failed to report detailed follow-up information, we had no patients with recurrent intussusceptions. The complete survey ranges from one to 23 years, with a mean follow-up period of 12 years. Of interest was the excellent prognosis for the ten patients who, at presentation, had intussusception associated with primary colonic carcinoma limited to the bowel wall (Dukes' B). No patient from this group had recurrent carcinoma after a mean follow-up period of 12.3 years. These early-stage lesions were detected because they caused symptoms related to the intussusception itself. In fact, the permissive mobility of the bowel wall and mesentery that allows invagination implies a lack of surrounding induration and reaction characteristic of locally advanced tumor.

Whether operative reduction of an intussusception

prior to resection influences ultimate survival remains unanswered. Unfortunately, the number of patients with malignancies was too small to determine any statistically significant conclusions regarding reduction and survival. Further data regarding the type, stage, and site of the malignancy and its detailed surgical management are required to fully answer this question.

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