

# Adult intussusception: an 11-year study of diagnosis, clinic manifestations, and the optimal operation

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## Research Article

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# Abstract

## Background

Intussusception can occur at any age and is common in children but less common in adults. In addition, adult intussusception differs from intussusception in children with respect to etiology and clinical presentation, which makes the diagnosis difficult.

## Methods

This retrospective analysis assessed the clinical manifestations, etiology, diagnosis, and treatment of adult intussusception in 51 adult patients at the Department of Gastrointestinal Surgery of China-Japan Union Hospital of Jilin University from January 2010 to December 2020.

## Results

The mean age of the cohort was  $54.43 \pm 18.21$  years, and 42 patients were diagnosed by abdominal ultrasonography and abdominal computed tomography (CT). Among them, 76.5% (39/51) had abdominal pain, 11.8% (6/51) had blood in stool, and 5.9% (3/51) had a palpable abdominal mass. Of these, 62.7% had tumors: malignant accounted for 39.2% (20/51) and benign accounted for 23.5% (12/51). CT is the preferred imaging method with a sensitivity of 92.2%, while colonoscopy provides a complementary diagnosis in patients involving the colon. All patients underwent surgical treatment, including 21.6% (11/51) laparoscopic surgery, 74.5% (38/51) open surgery, and 5.9% (3/51) intussusception reduction during the operation. The average operation time of the open group was  $133.27 \pm 43.75$  min and the average hospital stay was  $16.24 \pm 12.55$  days, while the average operation time of the laparoscopic group was  $140.50 \pm 46.15$  mins, and the average hospital stay was  $16.60 \pm 16.98$  days ( $P > 0.05$ ).

## Conclusion

The most common cause of adult intussusception is underlying pathological change. CT is the preferred method for adult intussusception diagnosis, and laparoscopic surgery is the preferred treatment for adult intussusception.

## Background

Intussusception is a condition in which a section of the intestine is inserted into a distal neighbor and causes obstruction of the passage of intestinal contents. It is common in children but uncommon in adults <sup>[1]</sup>. Adult intussusception accounts for only 5% of total cases <sup>[2]</sup> and causes 1–5% of intestinal obstructions <sup>[3]</sup>. Adult intussusception is a rare surgical emergency that often leads to misdiagnosis or missed diagnosis.

The clinical manifestations of adult intussusception are often nonspecific, it can be acute paroxysmal colic or chronic, dull pain that lasts for months or longer<sup>[4, 5]</sup>. As the disease progresses, symptoms of intestinal obstruction such as abdominal distention and vomiting may occur, and in severe cases, intestinal necrosis may occur, which can cause fever, loss of consciousness, and even death. Due to the atypical clinical manifestations of adult intussusception, it is difficult to diagnose before surgery, therefore, we need to use adjuvant testing. This article will discuss which of the various auxiliary tests works best.

Adult intussusception usually requires surgical treatment<sup>[6, 7]</sup>. Although laparoscopic equipment and surgical techniques have recently been improved and applied to adult intussusception, there is no consensus on safety and efficacy. The optimal management for adult intussusception is still controversial. Here, we mainly discuss the etiology, clinical manifestations, diagnosis, and treatment of adult intussusception from 51 patients collected in the 11-year study, so as to make some contributions to the diagnosis and treatment of adult intussusception.

## Methods

This retrospective study was conducted in the Department of Gastrointestinal Surgery of China-Japan Union Hospital of Jilin University (Changchun, China). The medical records of adult intussusception patients treated from January 2010 to December 2020 were reviewed. The study was performed in accordance with Declaration of Helsinki, and approved. by the Ethics Committee of China-Japan Union Hospital of Jilin University. Since this is a retrospective study, the Ethics China-Japan Union Hospital of Jilin University provides a waiver for informed consent. All patients underwent abdominal ultrasound, plain abdominal radiography, CT scan, and colonoscopy before surgery to confirm the diagnosis. Data on patients' age, sex, clinical manifestations, diagnosis-assisting tests, clinicopathological types, and surgical treatment were collected and analyzed. Patients with intussusception were diagnosed by abdominal ultrasound, plain abdominal film, CT, colonoscopy, or surgical exploration. Patients receiving laparoscopic-assisted surgery were compared to those receiving open surgery, and the operative time, hospital stay, and postoperative complications were compared. Parameters, such as age, sex, clinical manifestations, assistive examination, clinicopathological type, and surgical treatment, were analyzed. All open surgeries were performed by surgeons skilled in gastrointestinal surgery, while laparoscopic surgery was performed by surgeons with expertise in laparoscopy.

**1.1 Inclusion criteria:** 1) Intussusception was definitely diagnosed; 2) Preoperative assessment of patients who could tolerate laparoscopic or open surgery;

**1.2 Exclusion criteria:** 1) Heart, lung, brain, kidney, and other organ functions cannot tolerate general anesthesia operation; 2) Intraoperative exploration was combined with other operations; 3) Severe coagulation is abnormal; 4) Follow-up and communication disorders in patients.

**1.3 Adult intussusception** was classified into acute (duration  $\leq$  3 days), subacute (4–14 days), and chronic ( $>$  14 days) according to the duration of symptoms [4].

**1.4 Adult intussusception** was classified according to its location in the gastrointestinal tract: 1) small intestine type: intussusception (limited to the small intestine); 2) ileocolonic type: ileocecal intussusception or ileocecal intussusception, including invagination of the ileum through the ileocecal valve; 3) colonic type: intussusception involving the colon; 4) sigmoid-rectal type: intussusception involving the sigmoid colon and rectum [8].

### **Statistical methods:**

IBM® SPSS® statistics software version 26.0 (IBM Corp., Armonk, NY) was used for data analysis.

Quantitative variables were expressed as mean ( $\bar{x}$ )  $\pm$  standard deviation (SD). Continuous variables were tested for normality, and continuous variables conforming to normal distribution should be represented by mean  $\pm$  SD. Continuous variables that do not conform to a normal distribution are represented by the median (range). The classification variables were expressed by frequency and percentage. The Chi-square test was used for comparison between the two groups.  $P < 0.05$  indicated a statistically significant difference between the two groups.

## **Results**

In the current study, 51 patients aged 17–92 years were diagnosed with adult intussusception. The cohort comprised 21 males with an average age of  $57.50 \pm 15.88$  (range: 28–86) years and 30 females with an average age of  $52.30 \pm 19.55$  (17–92) years. There were 12 patients of small intestine type, 27 patients of ileocolonic type, 6 patients of colonic type, and 6 patients of sigmoid-rectal type (Table 1).

Table 1

Demographics and Clinical characteristics in patients

	N	Percentage%
Male	21	41.2
Female	30	58.8
Clinical manifestations		
Abdominal pain	39	95.1
Bloody stools	6	11.8
Abdominal mass	3	5.9
Nausea and vomiting	30	55.8
Weight loss	8	15.7
Ileus	30	58.8
Course of disease		
Acute	20	39.2
Subacute	19	37.3
Chronic	12	23.5
Pathological types		
Tumor	32	67.2
Malignant	20	39.2
Benign	12	23.5
Intestinal inflammatory disease	13	25.5
Idiopathic	3	5.9
Small bowel stromal tumors	1	2.0
Adhesion of small intestine	1	2.0
Peutz-Jeghers syndrome	2	3.9
Types		
Small intestine type	12	23.5
Ileocolonic type	27	52.5
Colonic type	6	11.8
Sigmoid-rectal type	6	11.8

The pathological examinations of 51 patients of intussusception showed that tumors accounted for 62.7% (32/51): malignant tumors accounted for 39.2% (20/51), and benign tumors accounted for 23.5% (12/51) of patients, while one case was a small intestinal stromal tumor. 25.5% (13/51) of tumors could be attributed to inflammatory and inflammatory diseases of the intestine. Two patients had small intestinal Peutz-Jeghers syndrome. Three patients were primary tumors, one of which was caused by intestinal adhesions (Table 1).

Among 51 patients with adult intussusception, 95.1% (39/51) had abdominal pain, 11.8% (6/51) had bloody stools, and 5.9% (3/51) had palpable abdominal mass, 55.8% (30/51) had nausea and vomiting, and 15.7% (8/51) had weight loss. Moreover, 58.8% (30/51) of patients had different degrees of ileus, with 20 (39.2%) presenting acute symptoms, 19 (37.3%) had subacute symptoms, and 12 (23.5%) exhibiting chronic symptoms (Table 1).

Of the 51 patients, 15 patients failed to show intussusception on the plain abdominal film. Abdominal ultrasound was performed on 15 patients; among them, 8 were diagnosed with intussusception (accuracy 53.3%). A total of 27 patients underwent abdominal CT scans, of which 25 were diagnosed with intussusception (accuracy 92.2%); 7 patients with adult intussusception underwent colonoscopy, and the cause was identified (Table 2).

Table 2

Diagnostic radiological evaluation

Variable	n	Diagnosis (n)	Diagnosis (%)
Abdominal plain film	15	0	0.00%
Abdominal CT	27	25	92.2%
Abdominal ultrasound	15	8	53.3%
Colonoscopy	7	7	100%

CT: computed tomography.

All patients underwent surgery, including 1 case of small bowel reduction due to intussusception caused by intraoperative adhesions, 2 patients of reduction due to rectal intussusception, and 1 case of Hartmann surgery due to malignant rectal lesions, and the remaining patients underwent intussusception and intestinal anastomosis. Among them, there were 40 patients of open surgery: 3 of bowel reduction, 9 of partial small bowel resection, 8 of ileocecal resection, 14 of right hemicolectomy, 2 of left hemicolectomy, 1 of partial resection of transverse colon, 1 case of Hartmann surgery, 1 of rectetomy, and 11 of laparoscopic surgery (2 patients of laparoscopic partial resection of the small intestine, 5 patients of laparoscopic ileocecal resection, 3 patients of Laparoscopic right hemicolectomy, and 1 case of laparoscopic rectal resection). The average duration of surgery in the open group was 133.27±43.75 min, the average length of hospital stay was 16.24 ± 12.55 days, the average operation time of the

laparoscopic group was 140.50±46.15 min, and the average length of hospital stay was 16.60 ± 16.98 days. The average operation time of the open group was less than that of the laparoscopic group, albeit not significantly ( $P>0.05$ ). In the open group, there were 3 patients of postoperative incision infection, 1 of pulmonary infection, 2 of lower limb venous embolism, and 1 of abdominal effusion, while no postoperative complications were detected in the laparoscopic group (Table 3).

Table 3

Statistics of adult intussusception surgical treatment

	OS (n=40)	LS (n=11)	<i>P</i>
Operation methods			
Bowel reduction	3	0	
Small bowel resection	9	2	
Ileocecal resection	8	5	
Right hemicolectomy	14	3	
Transverse colectomy	1	0	
Rectectomy	1	1	
Hartmann surgery	1	0	
Left hemicolectomy	1	0	
Sigmoidectomy	2	0	
Length of hospital stay (mean ± SD)	16.24±12.55	16.60±16.98	0.937
Duration of surgery (mean ± SD)	133.27±43.75	140.50±46.15	0.649
Postoperative complications			
Incision infection	3	0	1.000
pulmonary infection	1	0	1.000
Lower limb venous embolism	2	0	1.000
abdominal effusion	1	0	1.000

OS☐open surgery; LS☐laparoscopic surgery; SD☐standard deviation

## Discussion

Abdominal pain is the most common symptom of adult intussusception, and the variability of the clinical manifestations makes diagnosis difficult. The most common cause of adult intussusception is a potential secondary lesion, which are tumors, followed by inflammatory lesions. adult intussusception can occur anywhere in the digestive tract, most commonly in the ileocolon, followed by the small intestine. CT provides a comprehensive observation and assessment of the intestinal obstruction in adult intussusception. Surgical resection of intestinal lesions is the main treatment for adult intussusception, and laparoscopic surgery for adult intussusception is a safe and feasible treatment for experienced physicians.

Briggs et al. reported that adult intussusception patients are more common in males (male: female ratio 2.9:1) with an average onset age of 40 years<sup>[9]</sup>. The current data showed that there were more females than males, the ratio of males to females was 0.7(1:1.4), and  $P > 0.05$  indicated no statistical significance. However, the average age of adult intussusception in the current study was  $57.50 \pm 15.88$  years, indicating that adult intussusception might not be related to the gender of patients. Presently, the pathogenesis of intussusception is not clear, and the pathological changes and inflammatory stimulation in the intestinal lumen could alter intestinal luminal peristalsis. The abnormal changes in the intestinal wall are usually the starting point of intussusception, moving to the adjacent segment of the intestinal wall peristalsis, resulting in intussusception<sup>[10]</sup>. Although gastrointestinal, ileocolonic, and colonic intussusception also occurs, the small intestine type intussusception accounts for the majority of the adult patients<sup>[11]</sup>. In the current study, the ileocolonic type is the most common, followed by the small intestine type, which was similar to the report by Goh et al.<sup>[12]</sup>. In addition to the classification based on location in the intestine, intussusception can also be classified by etiology or root cause: idiopathic, benign, or malignant<sup>[13]</sup>. In the current study, tumors accounted for 62.7% (32/51), malignant for 39.2% (20/51), and benign for 23.5% (12/51). About 25.5% (13/51) of lesions were due to inflammatory diseases of the intestine. It can be seen that the most common intussusception of adult intussusception is the ileocolonic type, and benign or malignant tumors are the most common causes of adult intussusception. The clinical manifestations of adult intussusception vary and are usually occult and intermittent rather than acute<sup>[4]</sup>. Symptoms include abdominal pain, bloating, nausea and vomiting, changes in bowel habits, and bleeding in the lower gastrointestinal tract. Abdominal pain is considered the most common symptom, occurring in 70–100% of patients<sup>[10]</sup>. When tumors cause intussusception, symptoms include weight loss, black stools, or a palpable abdominal mass<sup>[10]</sup>. In this study, abdominal pain was the most common symptom. The symptoms of intussusception are largely nonspecific and periodic, which makes the diagnosis difficult. Typically, adult intussusception is only detected during exploratory surgery. Some studies reported that the preoperative diagnosis rate was  $< 50\%$ <sup>[15]</sup>.

The abdominal plain film shows dilated bowel loops and fluid-gas planes, similar to the features of intestinal obstruction, but often fails to identify the cause of the obstruction. Plain abdominal films are useful when an obstruction is suspected<sup>[10]</sup>. In the current study, plain abdominal films were used in 15 patients, which could not be identified as adult intussusception and had specific limitations. On abdominal ultrasonography, intussusception showed a concentric circle sign and target ring syndrome,

which is useful in evaluating the intussusception in adults presenting a palpable abdominal mass, with a > 90% accuracy rate [16]. However, the main disadvantages of ultrasound are that it relies on the operator and is difficult to interpret in the presence of air, which often occurs in the case of intestinal obstruction and has some limitations. Furthermore, 15 patients were examined by abdominal ultrasound, with a diagnostic rate of 53.5%. On the other hand, a colonoscopy may be a useful diagnostic tool for patients with subacute or chronic intermittent ileus [17]. It is the most useful method for adult intussusception involving the colon, terminal ileum, and cecum that confirms intussusception, location, and biopsy with respect to the diagnosis and the planning of surgery [18, 19]. In this study, 7 patients with adult intussusception (confirmed mass) underwent colonoscopy, while the procedure should be avoided in patients with acute obstruction as it may increase the risk of perforation [20]. The CT findings of intussusception were target sign, concentric circle sign, and pseudorenal sign (Fig. 1). CT displays the length and diameter of intussusception, the three-dimensional view of the intestine and surrounding organs, the starting point, type, and position of intussusception, mesenteric vascular system, the possibility of strangulation, and the possibility of partial or complete intestinal obstruction [21]. Currently, CT is the most sensitive scan for diagnosing intussusception in adults, with a diagnostic accuracy of 58–100% [22]. In addition, CT can determine the most appropriate treatment method and avoid unnecessary surgery [23]. In the current study, 27 patients underwent abdominal ultrasound, with a diagnostic rate of 92.2%. CT scan can determine the severity of adult intussusception and the best treatment, thereby providing strong evidence for the diagnosis of intussusception. Also, colonoscopy is recommended to supplement the treatment of colic intussusception.

Currently, surgical treatment is the primary treatment for most adult intussusception patients [24]. However, the optimal surgical approach remains controversial because the main reason for the original recommendation of whole intussusception resection was the theoretical risk of venous embolization of tumor cells during intestinal canal operation and the risk of penetrating the ischemic, fragile, and edematous intestinal canal, which might lead to the implantation of tumor cells and microorganisms into the peritoneal cavity [18, 25]. In recent years, due to the progress of laparoscopic equipment and surgical technology, as well as its advantages of rapid recovery, less pain, and minimal scarring [26], laparoscopic surgery for adult intussusception is being increasingly performed and has been reported to be feasible for adult intussusception [27]. Laparoscopic exploration is effective for the diagnosis of adult intussusception, avoiding unnecessary incisions. However, there is no consensus on the safety and effectiveness of laparoscopic surgery for adult intussusception. Tartaglia et al. [28] reported that laparoscopic surgery for adult intussusception is a safe and feasible treatment, especially when the preoperative diagnosis is unclear [29]. In the current study, we did not find any significant differences in the duration of surgery and the incidence of postoperative complications between the laparoscopic and open groups ( $P > 0.05$ ). Postoperative incision infection was the most common postoperative complication in the open group. The laparoscopic group had fewer complications than the open group. Siow et al. [30] showed that segmentectomy for intussusception in adults cannot be removed because most of the lesions may have pathological causes, and conservative treatment may be ineffective. Our

experience indicated that surgery is the predominant treatment for intussusception in adults. In some cases, laparoscopy is a useful adjunct to open surgical techniques<sup>[31]</sup>. Although laparotomy or laparoscopic enterectomy is the ideal method, patients using laparoscopic techniques have no postoperative complications, leading us to put forth that laparoscopy-assisted surgery is safer and more effective than open surgery. Finally, our study showed that surgery, including the whole resection of the intussusception segment, remains the primary treatment for adult intussusception. For experienced physicians, laparoscopic techniques are the preferred treatment for adult intussusception. However, we recommend caution to patients with acute obstruction of flatulence, as the visibility of flatulence may be poor and intestinal manipulation may further increase the risk of perforation and the incidence of surgery<sup>[32]</sup>. The current study was a retrospective design with a small sample size, and hence there was the possibility of selection and recommendation bias.

## Conclusion

In conclusion, Intermittent periodic abdominal pain is the most common symptom of adult intussusception. adult intussusception can occur anywhere in the gastrointestinal tract, of which ileum intussusception cecum. Benign or malignant tumors are the most common causes of adult intussusception. The abdominal plain film and ultrasound examination are routine examination methods. At present, CT is the most reliable method for preoperative diagnosis of intussusception. Surgery remains the primary treatment for adult intussusception. laparoscopic techniques are the preferred treatment for adult intussusception.

## Abbreviations

OS☐open surgery

LS☐laparoscopic surgery;

SD☐standard deviation

CT: computed tomography

## Declarations

### Ethics approval and consent to participate

The study was approved.by the Ethics Committee of China-Japan Union Hospital of Jilin University. Since this is a retrospective study, the Ethics China-Japan Union Hospital of Jilin University provides a waiver for informed consent.

### Consent for publication

No applicable.

## Availability of data and materials

The datasets used or analysed during the current study are available from the corresponding author on reasonable request.

## Competing interests

We declare that have no competing interests.

## Funding:

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## Author contributions:

Liu X and Sun MZ contributed equally to this work; Liu X and Sun MZ designed the research; Li ZM, Shu ZB collected the data; Liu X, Sun MZ, Li ZM, Shu ZB, and Wu Q analyzed the data; Sun MZ wrote the manuscript.

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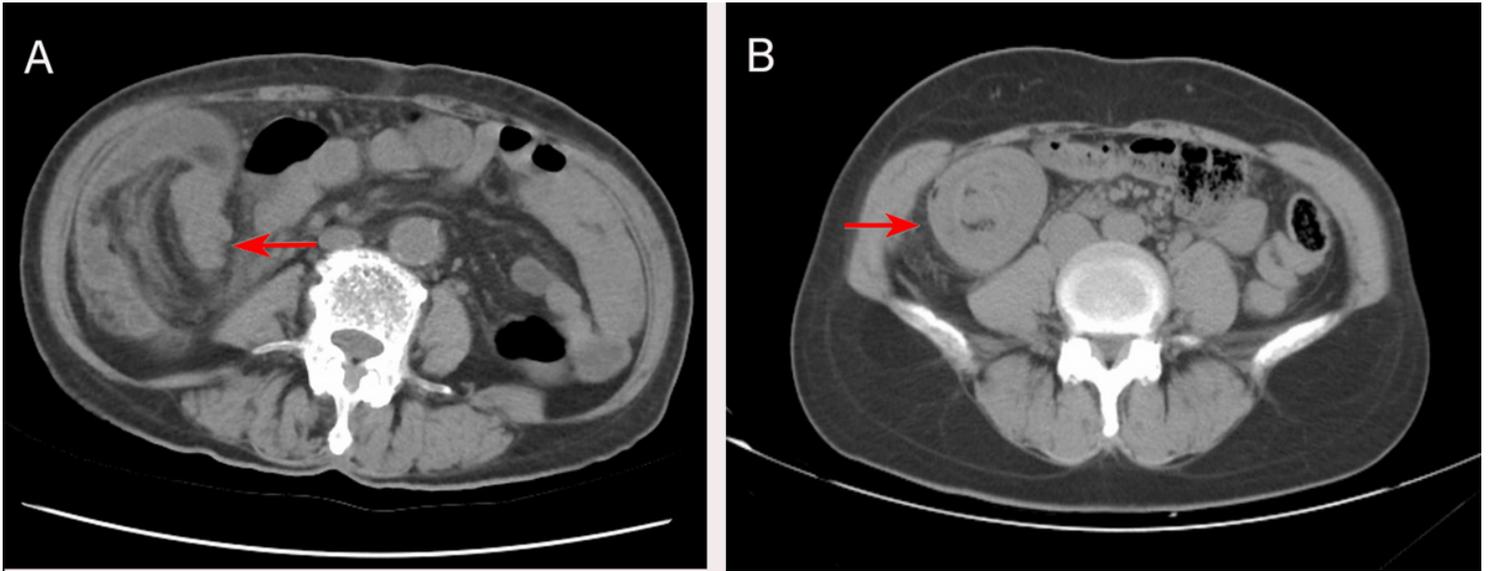
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## Figures



**Figure 1**

A: CT at the level of the abdomen shows ileocecal intussusception (arrow). B: CT at the level of the abdomen shows a round, target-shaped mass in the right abdomen (arrow).