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Case Series

Recognizing Postoperative Intussusception: Lessons from Four Pediatric Cases

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ABSTRACT

Postoperative intussusception (PI) is a rare but serious complication following abdominal surgery in children. Its diagnosis is challenging due to overlapping features with postoperative ileus, electrolyte disturbances, and other factors affecting the return of normal peristalsis. Delayed recognition can lead to bowel ischemia and increased morbidity. In this case series, four cases of PI were identified among 13,742 abdominal surgical procedures performed during the last 5 years (incidence: 0.029%). All patients were male, aged 7 months to 3 years. Three cases occurred following left nephroureterectomy with lymph node sampling for Wilms' tumor, and one followed repair of a left-sided congenital diaphragmatic hernia. All children became symptomatic between postoperative days 6 and 7, presenting with bilious vomiting, abdominal pain/distension, and inconsolable crying—symptoms that emerged after oral feeding had commenced. Ultrasound confirmed the diagnosis in all cases, demonstrating the characteristic bowel-within-bowel appearance. Two cases with ileo-ileal intussusception underwent immediate operative manual reduction. Two cases with ileo-colic intussusception had unsuccessful ultrasound-guided hydrostatic reduction followed by successful operative reduction. All reduced bowel segments appeared viable without identifiable lead points. All patients recovered uneventfully, though the first postoperative chemotherapy dose was delayed in the three Wilms' tumor patients. therefore, PI should be considered in any child presenting with bilious vomiting and abdominal symptoms toward the end of the first postoperative week, particularly following retroperitoneal surgery. Early ultrasound examination and prompt surgical intervention, when indicated, are essential to minimize morbidity. A high index of suspicion remains the cornerstone of timely diagnosis.

Keywords: Intussusception, postoperative complications, Wilms' tumor, congenital diaphragmatic hernia, child

INTRODUCTION

Intussusception represents one of the most common gastrointestinal emergencies in children, with peak incidence between 6 and 36 months of age. While the vast majority of cases are idiopathic and present with the classic triad of colicky abdominal pain, vomiting, and "currant jelly" stools, postoperative intussusception (PI) constitutes a distinct and diagnostically challenging subset. [1]

PI is an uncommon complication following abdominal surgery in children, with reported incidences ranging from 0.01% to 0.25% after laparotomies. [2] In a review of seven cases, Jiang et al. emphasized that PI often presents with subtle symptoms that may be attributed to prolonged postoperative ileus, delaying diagnosis and increasing the risk of bowel ischemia. [3] The condition has been described following various procedures, including appendectomy, retroperitoneal surgery, intestinal malrotation correction, Meckel diverticulectomy, tumor resections, and Hirschsprung's disease surgery. [4–6] The pathogenesis of PI remains incompletely understood. Proposed mechanisms include surgical trauma, bowel manipulation, tissue edema, electrolyte disturbances, hypoxia, abnormal peristalsis, and altered bowel motility. [7,8] However, the variable incidence across different surgical procedures suggests that additional, procedure-specific factors may be at play.

Certain surgeries appear to carry a higher risk. Van Houwelingen et al. reported 10 cases of PI among 852 laparotomies for pediatric abdominal tumors over 20 years, with equal distribution between neuroblastoma and Wilms' tumor resections. [9] Similarly, urological and retroperitoneal procedures have been repeatedly associated with PI. [1,10]

Diagnostic delay in PI can have serious consequences. Unlike classic intussusception, which often presents with overt signs of obstruction, PI symptoms may be masked by the ongoing postoperative course. Prolonged ileus, narcotic use, electrolyte imbalances, and the underlying surgical condition can all confound the clinical picture. [11] When diagnosis is missed or delayed, bowel ischemia, perforation, and increased morbidity may ensue. [12]

In this case series, we describe four children with PI at our institution, highlighting the clinical presentation, diagnostic approach, and management principles. We aim to increase awareness of this rare but potentially serious complication and emphasize the importance of early clinical suspicion, prompt sonographic confirmation, and timely surgical intervention.

CASE SERIES

During the last 5 years study 13,742 abdominal surgical procedures were performed on pediatric patients at our institution. Four cases of PI were identified, yielding an overall incidence of 0.029% (95% CI: 0.008–0.074%). All four cases were male, with ages ranging from 7 months to 3 years (median: 2.25 years). The details of these patients have been summarized in **Table 1**.

Case 1

A 3-year-old male with left-sided Wilms' tumor was managed according to the SIOP (Société Internationale d'Oncologie Pédiatrique) protocol, receiving 4 weeks of preoperative chemotherapy with vincristine and actinomycin D. He underwent left nephroureterectomy with lymph node sampling. On postoperative day 7, after the nasogastric tube had been removed and oral feeding had commenced with normal bowel movements, he developed bilious vomiting, abdominal pain, and abdominal fullness. Complete blood count and serum electrolytes were within normal limits. Abdominal ultrasound demonstrated the classic "target" or "doughnut" sign, consistent with ileo-ileal intussusception. Repeat ultrasound 8 hours later showed persistent findings. Operative manual reduction was performed through a limited laparotomy. The involved bowel segments appeared viable and edematous, with no identifiable lead point. The patient recovered uneventfully. His first postoperative chemotherapy dose was delayed by 10 days due to the reoperation. At 24 months of follow-up, he remains disease-free with no gastrointestinal sequelae.

Case 2

A 2.5-year-old male with left-sided Wilms' tumor, also managed per SIOP protocol with preoperative chemotherapy, underwent left nephroureterectomy with lymph node sampling. On postoperative day 6, he developed bilious

Table 1: Clinical characteristics and outcomes of all four cases.

Case	Age	Sex	Primary surgery	PI type	Day of onset	Primary symptoms	Management	Chemotherapy delay	Follow-up
1	3 years	Male	Left nephroureterectomy (Wilms', SIOP)	Ileo-ileal	POD 7	Bilious vomiting, pain, fullness	Operative manual reduction	10 days	24 months, disease-free
2	2.5 years	Male	Left nephroureterectomy (Wilms', SIOP)	Ileo-ileal	POD 6	Bilious vomiting, pain, fullness	Operative manual reduction	12 days	20 months, disease-free
3	2 years	Male	Left nephroureterectomy (Wilms', COG)	Ileocolic	POD 7	Bilious vomiting, pain, fullness	Failed hydrostatic → operative manual reduction	9 days	18 months, disease-free
4	7 months	Male	Left CDH repair	Ileocolic	POD 7	Bilious vomiting, distension, inconsolable crying	Failed hydrostatic → operative manual reduction	N/A	12 months, well

PI, postoperative intussusception; POD, postoperative day; SIOP, Société Internationale d'Oncologie Pédiatrique; COG, Children's Oncology Group; CDH, congenital.

vomiting, abdominal pain, and distension. Laboratory parameters were unremarkable. Ultrasound revealed ileo-ileal intussusception, which was persistent on repeat imaging. Immediate operative manual reduction was performed. The bowel appeared healthy with no lead point. Recovery was uneventful. The first postoperative chemotherapy dose was delayed by 12 days. At 20 months of follow-up, he is disease-free with no complications.

Case 3

A 2-year-old male with left-sided Wilms' tumor, managed per the COG (Children's Oncology Group) protocol with upfront surgery, underwent left nephroureterectomy with lymph node sampling. On postoperative day 7, he developed bilious vomiting, abdominal pain, and fullness. Ultrasound revealed ileocolic intussusception. An initial attempt at ultrasound-guided hydrostatic reduction was unsuccessful. The patient underwent operative manual reduction, which was successful. The reduced bowel appeared viable and edematous, without a lead point (**Figure 1**). Recovery was uneventful. The first postoperative chemotherapy dose was delayed by 9 days. At 18 months of follow-up, he remains disease-free.

Case 4

A 7-month-old male underwent surgical repair of a left-sided congenital diaphragmatic hernia (Bochdalek defect). Reduction of herniated contents and primary diaphragmatic repair were performed. Malrotation and other bowel pathologies were ruled out intraoperatively. Oral feeding was initiated on postoperative day 5, following return of normal bowel function. On postoperative day 7, he developed multiple episodes of bilious vomiting, abdominal distension, and inconsolable crying. Laboratory investigations were normal. Ultrasound demonstrated ileocolic intussusception, which persisted despite an attempted hydrostatic reduction. Operative manual reduction was performed, revealing healthy but edematous bowel with no lead point (**Figure 2**). The patient recovered uneventfully and was discharged on postoperative day 14. At 12 months of follow-up, he is growing well with no gastrointestinal issues.

DISCUSSION

Key Findings

This case series highlights several important observations regarding PI in children. First, all four cases occurred toward

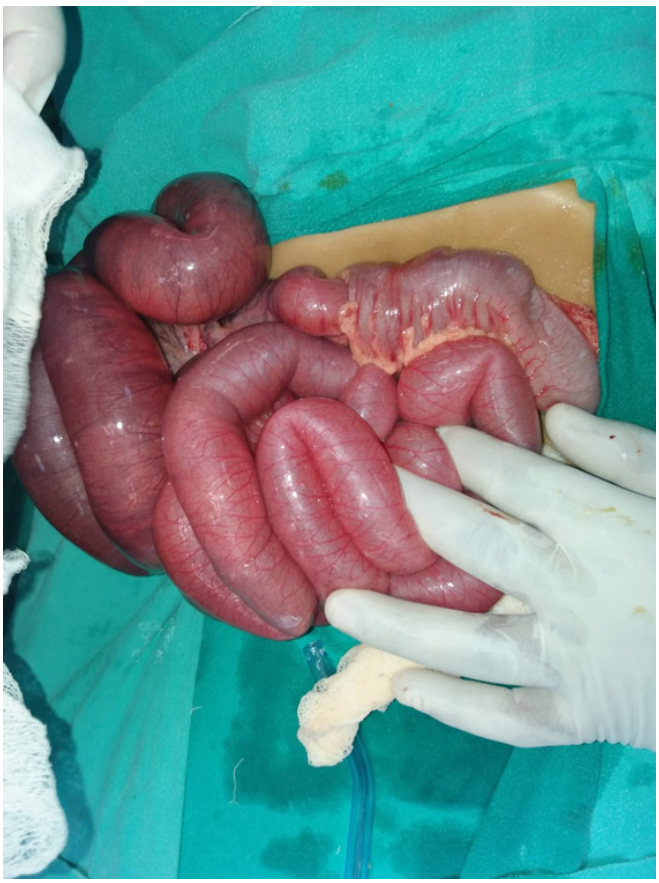

Figure 1: Intraoperative photograph of ileocolic intussusception in Patient 3 following left nephroureterectomy for Wilms' tumor. The invaginated ileum (arrow) is visible within the colon, with surrounding edematous bowel. Manual reduction was successfully performed without bowel resection.

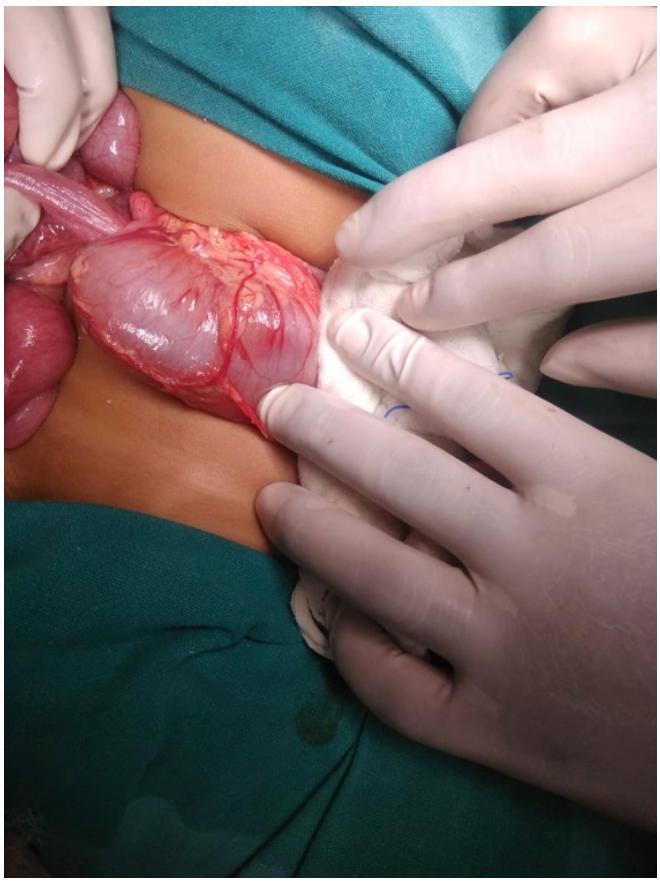

Figure 2: Intraoperative photograph of ileocolic intussusception in Patient 4 following left congenital diaphragmatic hernia repair. The intussusceptum (arrow) demonstrates edema but remains viable. No lead point was identified after reduction.

the end of the first postoperative week (days 6–7), a period when patients had resumed oral feeding after initial recovery. This timing is consistent with previous reports and likely reflects the return of coordinated peristalsis, which may precipitate intussusception in a susceptible bowel. [2,3] Second, the presentation was remarkably uniform—bilious vomiting associated with abdominal pain, distension, or inconsolable crying—despite varying primary surgeries. Third, three of four cases occurred after left-sided retroperitoneal surgery (nephroureterectomy), suggesting a potential association between retroperitoneal dissection and PI risk.

Clinical Presentation and Diagnostic Challenges

The diagnosis of PI is often delayed because early symptoms mimic prolonged postoperative ileus. [13] In our series, all patients had resumed oral feeding and had normal bowel movements before symptoms developed, distinguishing PI from simple ileus. The presence of bilious vomiting in the setting of a previously functional gastrointestinal tract should raise suspicion for mechanical obstruction, including intussusception.

Unlike classic idiopathic intussusception, which frequently presents with bloody stools (currant jelly stools), our patients did not manifest this sign. This observation aligns with previous literature suggesting that PI may present with less specific symptoms, making clinical recognition more challenging. [14] The absence of blood-mixed stools should not exclude the diagnosis.

In the postoperative setting, several factors can confound the clinical picture: ongoing narcotic use, electrolyte imbalances, the stress response to surgery, and the underlying disease process (particularly in oncology patients). [15] This diagnostic "noise" requires clinicians to maintain a low threshold for abdominal ultrasound when symptoms deviate from the expected postoperative course. In all four cases, normal laboratory parameters (including electrolytes) did not rule out a surgical abdomen.

Role of Ultrasound in Diagnosis

Ultrasound is the imaging modality of choice for suspected intussusception in children, offering high sensitivity (98%–100%) and specificity (88%–100%) without radiation exposure. [16] In the postoperative setting, ultrasound has the added advantage of being portable and repeatable. In our series, all cases were diagnosed on the initial ultrasound, demonstrating the classic bowel-within-bowel appearance.

In two cases of ileocolic intussusception, attempted ultrasound-guided hydrostatic reduction was unsuccessful. This may reflect the more adhesive nature of PI, where bowel edema or early adhesions may prevent successful non-operative reduction. When hydrostatic reduction fails or when ileo-ileal intussusception is diagnosed (as in cases 1 and 2), operative management is the standard approach. [17]

Association With Specific Surgeries

The predominance of Wilms' tumor nephroureterectomy in our series (3 of 4 cases) warrants discussion. This observation is not unique; previous studies have similarly reported PI following Wilms' tumor resection and other retroperitoneal surgeries. [1,9,18]

Bottom of Form

Several hypotheses may explain this association:

1. **Extensive retroperitoneal dissection**: Mobilization of the colon and small bowel during exposure of the renal hilum may disrupt normal mesenteric attachments and create areas of bowel instability.
2. **Lymph node sampling**: Dissection along the great vessels may affect autonomic innervation to the bowel, altering peristaltic coordination.
3. **Postoperative edema**: Local tissue edema from dissection may create a functional lead point.
4. **Chemotherapy effects**: Preoperative chemotherapy (as in cases 1 and 2) may affect bowel wall integrity, though upfront surgery without chemotherapy (case 3) was also associated with PI.

The congenital diaphragmatic hernia case is particularly instructive. PI following CDH repair is rare, with only two previous case reports identified in the literature. [19] Proposed mechanisms include relative atony of previously herniated bowel loops (creating a functional lead point) and abnormal peristalsis during recovery from chronic bowel compression. [20] In our case, the return of normal bowel function with subsequent food intake on postoperative day 5, followed by symptoms on day 7, supports the theory that resumption of vigorous peristalsis in a vulnerable bowel segment may trigger intussusception.

Timing and Clinical Course

The consistent timing of symptom onset (postoperative days 6–7) in our series is a critical clinical pearl. This period typically coincides with:

- Return of normal bowel function and resumption of oral intake
- Discontinuation of nasogastric decompression
- Transition from parenteral to enteral nutrition
- Mobilization and increased physical activity

We hypothesize that the resumption of normal peristalsis after a period of relative ileus may create conditions conducive to intussusception, particularly when bowel segments are edematous, have altered motility, or have been manipulated during surgery. The presence of an intraluminal "lead point" was absent in all our cases, suggesting a functional (rather than anatomic) lead point in PI.

Management Considerations

All four of our patients underwent successful operative reduction with preservation of bowel viability. Two important management principles emerge:

5. **Failed hydrostatic reduction should not lead to repeated attempts**: In cases 3 and 4, a single attempt at hydrostatic reduction was performed. When this failed, prompt operative intervention was undertaken. Prolonged attempts at non-operative reduction in the postoperative setting may increase the risk of perforation, particularly in edematous bowel.

6. **Bowel viability should be carefully assessed**: In all cases, the reduced bowel appeared viable despite being edematous. However, careful evaluation for ischemia is essential, as delayed diagnosis can lead to necrosis and resection.

Impact on Adjunctive Therapy

In the three Wilms' tumor patients, the first postoperative chemotherapy dose was delayed by 9 to 12 days due to the reoperation. While all patients eventually completed their planned chemotherapy regimens, this delay could theoretically impact oncologic outcomes. This underscores the importance of minimizing diagnostic delay and, when PI is identified, proceeding promptly with appropriate management to allow timely resumption of cancer therapy.

A comparison between our findings and those of major published studies is presented in **Table 2**.

Table 2: Comparison of the present case series with major published studies on pediatric PI.

Study	Study design	Number of PI cases	Predominant primary surgery	Median/ typical time to PI	Diagnostic modality	Management	Main findings
Present study	Single-center retrospective case series	**4**	Wilms' tumor nephroureterectomy (3), congenital diaphragmatic hernia repair (1)	POD 6–7	Ultrasound in all cases	Manual surgical reduction in all; hydrostatic reduction attempted in 2 ileocolic cases	Bilious vomiting after recovery of bowel function was the earliest warning sign. Early ultrasound enabled prompt diagnosis with bowel preservation in all patients.
West et al. (1988)	Retrospective case series	**36**	Various abdominal procedures	Mostly within first 2 postoperative weeks	Clinical assessment and imaging	Primarily operative reduction; bowel resection when ischemic	Largest early pediatric series demonstrating that PI frequently mimics postoperative ileus and requires early surgical intervention to prevent bowel necrosis.
Klein et al. (2013)	Single-center retrospective review (13 years)	**19**	Predominantly minimally invasive abdominal procedures	Median approximately POD 7	Ultrasound	Mostly operative reduction	Demonstrated that PI continues to occur in the minimally invasive era and emphasized early ultrasonography in children with persistent postoperative bowel obstruction.
Jiang et al. (2012)	Retrospective case series	**7**	Various abdominal surgeries	Mean approximately POD 6	Ultrasound	Operative reduction	Reported that delayed diagnosis commonly resulted from misinterpretation as prolonged postoperative ileus and highlighted the importance of early imaging.
Yang (2013)	Systematic review	**>300 reported pediatric cases***	Wide range of abdominal and retroperitoneal procedures	Usually within 1–2 postoperative weeks	Ultrasound most frequently used	Predominantly operative management	Concluded that PI is rare but should be suspected in children with persistent bilious vomiting or obstruction after abdominal surgery. Early diagnosis substantially improves bowel preservation and outcomes.

PI, postoperative intussusception; POD, postoperative day.

As shown in **Table 2**, our findings closely parallel those of previous studies regarding the timing of symptom onset, diagnostic utility of ultrasonography, and the excellent outcomes achieved with early operative intervention. However, our series differs in that three of the four cases occurred following nephroureterectomy for Wilms' tumor, reinforcing previous observations that retroperitoneal surgery may confer an increased risk of PI. Although the small sample size precludes definitive conclusions, this consistent pattern suggests that heightened postoperative surveillance may be warranted in children undergoing extensive retroperitoneal dissection.

Limitations

Several limitations of this study should be acknowledged:

7. **Small sample size**: With only four cases, we cannot draw definitive conclusions about risk factors, optimal management, or outcomes. The incidence estimates should be interpreted with caution given the small numerator.
8. **Retrospective design**: Data collection relied on medical records, which may be incomplete. Some PI cases could have been missed if not captured by our search strategy.
9. **Single-center experience**: Findings may not be generalizable to other institutions with different patient populations or surgical techniques.
10. **Selection bias**: We cannot exclude the possibility that some patients with PI were managed conservatively or at other institutions.
11. **Follow-up variability**: Follow-up duration ranged from 12 to 24 months, and long-term gastrointestinal outcomes are unknown.
12. **Lack of comparison group**: Without a control group of patients who underwent similar surgeries but did not develop PI, we cannot identify independent risk factors.

Recommendations for Clinical Practice

Based on our experience and review of the literature, we recommend:

13. **Maintain a high index of suspicion**: In any child who has undergone abdominal surgery, particularly retroperitoneal procedures, develop symptoms of bilious vomiting with abdominal pain/distension around postoperative days 5 to 7, consider PI.
14. **Low threshold for ultrasound**: Abdominal ultrasound is the diagnostic test of choice and should be performed promptly when PI is suspected.
15. **Prompt surgical consultation**: If ultrasound confirms intussusception, surgical consultation should be obtained immediately. For ileocolic intussusception, one attempt at hydrostatic reduction may be considered, but persistent cases should proceed to operation.
16. **Expect absence of typical findings**: Bloody stools and signs of complete obstruction may be absent in PI. Do not wait for classic signs to develop.

Future Directions

Larger multicenter studies are needed to:

- Establish the true incidence of PI across different surgical procedures
- Identify risk factors for PI to allow risk stratification
- Compare outcomes of operative versus non-operative management
- Determine optimal timing of postoperative chemotherapy resumption following PI

CONCLUSIONS

PI is a rare but clinically significant complication following pediatric abdominal surgery. Our series demonstrates a consistent clinical pattern: onset of bilious vomiting and abdominal symptoms at postoperative days 6 to 7, after resumption of oral feeding, particularly following left-sided retroperitoneal procedures. A high index of suspicion, prompt ultrasound confirmation, and timely operative intervention when indicated are essential to reduce morbidity and avoid bowel compromise. Clinicians caring for children after abdominal surgery, particularly those with Wilms' tumor or congenital diaphragmatic hernia, should be aware of this potential complication and maintain a low threshold for diagnostic imaging.

CONSENTS

Written informed consent was obtained from the patients' parents for publication of this case report.

AUTHORS' CONTRIBUTION

All authors have significantly contributed to the work, whether by following the case at the bedside, conducting literature searches, drafting, revising, or critically reviewing the article. They have given their final approval of the version to be published, have agreed with the journal to which the article has been submitted, and agree to be accountable for all aspects of the work.

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CONFLICT OF INTEREST

None.

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