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Case series

Integrated Surgical and Anesthetic Management of Pediatric Small Bowel Obstruction Due to Foreign Body Ingestion: A Comparative Case Series on Anatomical and Perioperative Implications

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Abstract
We conducted a retrospective review of three young female pediatric patients (aged 2, 3, and 4 years) who presented to our institution between May 2020 and March 2022 with SBO secondary to FB ingestion, all of whom were managed via laparotomy and enterotomy. This case series provides a comparative analysis of the clinical presentation, diagnostic trajectory, surgical findings, and, most importantly, perioperative anesthetic management in one patient with a history of neonatal jejunal atresia repair and two patients with anatomically normal GI tracts. All three patients successfully underwent surgical removal of the FB and experienced uncomplicated postoperative courses (Length of Stay: 4–7 days). In the two anatomically normal patients (aged 3 and 4), impaction occurred predictably at the ileocecal valve (ICV)-(Photograph 4). Conversely, the post-surgical patient (aged 2) demonstrated a more proximal obstruction in the dilated jejunum, immediately adjacent to the previous anastomosis. Significantly, the anesthetic management across all cases was characterized by aggressive fluid resuscitation, meticulous correction of electrolyte imbalances, and stringent aspiration prophylaxis via Rapid Sequence Induction (RSI). This protocol directly addressed the inherent high-risk profile of this patient cohort and was instrumental in achieving the favorable clinical outcomes. The location of foreign body-induced SBO in children is fundamentally dictated by the underlying GI anatomy, which mandates a precisely tailored surgical strategy. However, optimal patient outcomes are inextricably linked to an integrated, multidisciplinary approach. Specialized pediatric anesthetic protocols, which prioritize aspiration prevention, meticulous fluid and electrolyte homeostasis, and effective pain management, are foundational elements for minimizing morbidity and accelerating patient recovery.
Keywords: *Small Bowel Obstruction, Foreign Bodies, Pediatrics, Ileocecal Valve, Intestinal Atresia.*

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Introduction

Foreign body ingestion remains a major public health concern and a frequent cause of emergency presentation within the pediatric population, particularly among toddlers [1]. While the vast majority of ingested objects traverse the gastrointestinal (GI) tract spontaneously, approximately 1% to 3% lead to complications such as obstruction, perforation, or hemorrhage, necessitating clinical intervention [2]. Small bowel obstruction (SBO) represents a severe complication that invariably requires surgical exploration. The anatomical site where an FB becomes lodged is typically determined by physiological constrictions, with the ileocecal valve (ICV)- recognized as the most common choke point in a native GI tract [3]. A distinct clinical and anesthetic challenge emerges in children with a history of prior abdominal surgery, such as the repair of intestinal atresia. In this specific patient group, the presence of adhesions, anastomotic strictures, or segments exhibiting altered motility and persistent dilatation can create novel, atypical sites of vulnerability for FB impaction [4]. Furthermore, the protracted emesis and substantial third-space fluid losses characteristic of SBO induce significant volume depletion and profound electrolyte derangements. These physiological disturbances dramatically escalate the anesthetic risk profile and necessitate meticulous preoperative stabilization [5].

This case series is designed to elucidate the differential presentation and surgical management of SBO caused by foreign bodies in children, both with and without a history of prior GI surgery. Moreover, and of paramount importance for the academic community, we present an in-depth analysis of the specialized clinical anesthesia

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considerations and protocols that proved integral to the successful perioperative management of these high-risk pediatric patients. This integrated surgical and anesthetic perspective is essential for establishing evidence-based best practice guidelines in this specific surgical emergency, underscoring that the anesthetic plan is of equal criticality to the surgical technique.

Methods

Study Design and Participants

This investigation constitutes a retrospective case series conducted at Misurata Medical Center. We systematically reviewed the medical records of three female pediatric patients who underwent surgical management for SBO secondary to an ingested foreign body between May 2020 and March 2022. The inclusion criteria were strictly limited to young children who required definitive surgical management via laparotomy and enterotomy for FB removal.

Data Collection

Data collected encompassed patient demographics (age, sex), relevant medical and surgical history, clinical presentation (symptoms, duration, physical findings), diagnostic investigations (imaging modalities and findings), intra-operative findings (FB type, location of impaction, bowel condition, surgical procedure), and post-operative outcomes (complications, length of hospital stay). Crucially, detailed records pertaining to the anesthetic course, including fluid balance, electrolyte correction, induction technique, and postoperative analgesia regimen, were subjected to meticulous analysis.

Ethical Considerations

Ethical approval for this retrospective review was secured from the Institutional Review Board of Misurata Medical Center. Written informed consent was obtained from the parents or legal guardians of each patient for the publication of case details and accompanying images.

Anesthetic Management Protocol

The anesthetic management for all three patients adhered to a standardized protocol for pediatric SBO, specifically focusing on the mitigation of the two primary anesthetic implications: the elevated risk of pulmonary aspiration and the imperative for correction of severe fluid/electrolyte derangements. This protocol included: Preoperative Anesthetic Stabilization: Nasogastric tube (NGT) decompression was performed to minimize gastric volume. This was followed by aggressive fluid resuscitation utilizing isotonic crystalloids (20 mL/kg boluses) to correct hypovolemia, and the correction of electrolyte imbalances (e.g., hypokalemia) prior to the induction of anesthesia. This stabilization phase is paramount for ensuring hemodynamic stability. Induction and Airway Management: Rapid Sequence Induction (RSI) with cricoid pressure and immediate endotracheal intubation was strictly employed to minimize the risk of aspiration, which is a major contributor to morbidity in SBO patients. Maintenance and Intraoperative Monitoring: Anesthesia was maintained using a balanced technique involving volatile agents and opioid analgesia. This was coupled with meticulous temperature control (normothermia) to prevent coagulopathy and metabolic acidosis, and goal-directed fluid therapy (targeting a urine output of 1–2 mL/kg/hr). The fluid management strategy was specifically calibrated to account for third-space losses into the distended bowel, a critical anesthetic consideration in SBO. Postoperative Anesthetic Care: A multimodal, opioid-sparing analgesia regimen (scheduled acetaminophen and ibuprofen) was instituted, alongside continued fluid/electrolyte monitoring until the resumption of normal bowel function. This regimen was intentionally designed to facilitate early patient mobilization and minimize opioid-related adverse effects, such as respiratory depression and prolonged ileus.

Cases description

Patient 1. A 5-year-old girl with a history of neonatal repair for proximal jejunal atresia presented with upper abdominal fullness and obstructive symptoms (bilious vomiting). An upper GI contrast study revealed a large, intraluminal filling defect within a significantly dilated segment of proximal jejunum (Figure 1). At laparotomy, marked jejunal dilatation proximal to the previous anastomosis site was noted. An enterotomy was performed, and an ingested balloon was extracted. The patient had an uneventful post-operative recovery.

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Figure 1. Upper GI contrast study with a filling defect.

A B C

Figure 2. A: Dilated jejunum; B: Extraction of the balloon via enterotomy; C: The extracted balloon

Patient 2. A previously healthy 3-year-old girl presented with one day of abdominal pain and vomiting. Plain abdominal X-ray showed SBO and a radioopaque shadow at the right iliac fossa (Figure 3). A subsequent abdominal CT scan identified a radiopaque, ring-shaped foreign body lodged in the ICV with proximal small bowel dilatation (Figure 4). Laparotomy confirmed these findings, and the object was removed via enterotomy through the terminal ileum. Her recovery was unremarkable.

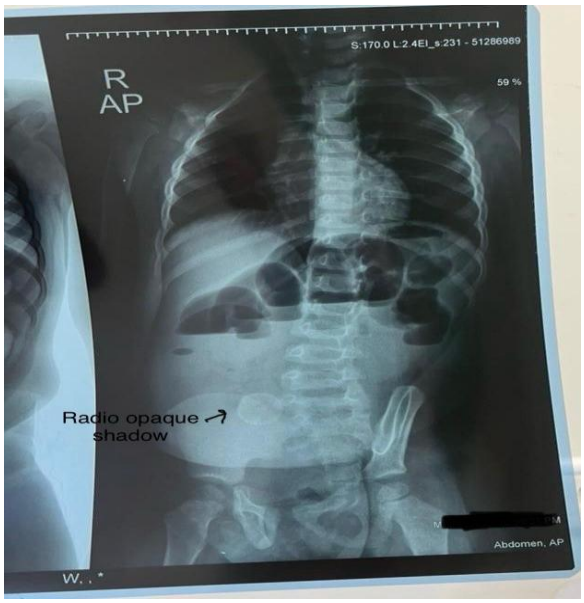

Figure 3. Dilated bowel with multiple air fluid levels and a radio-opaque shadow at the right iliac fossa

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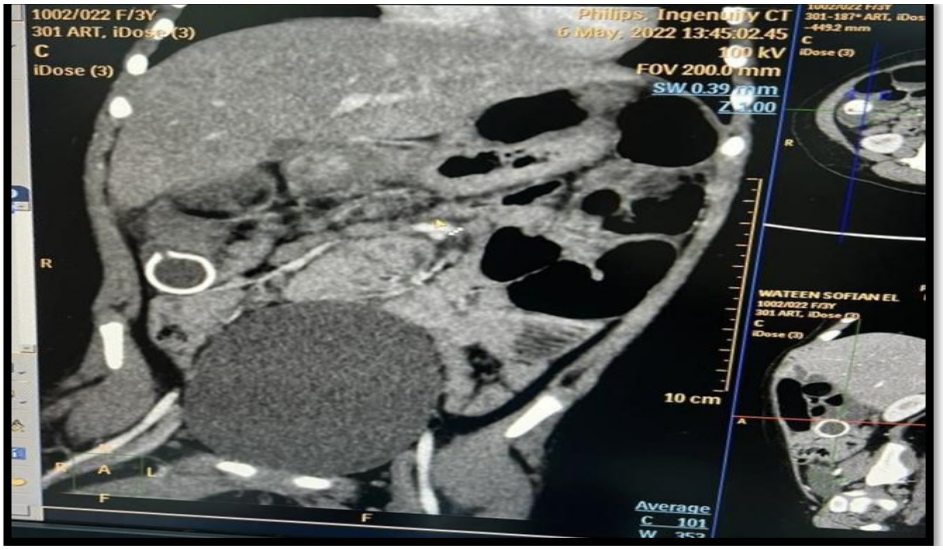

Figure 4. Ring Shape forgien body lodged at ICV in the CT scan of the abdomen

Patient 3. A previously healthy 2-year-old girl presented with an acute onset of intestinal obstruction symptoms over one day duration. Plain abdominal X-ray demonstrated significant small bowel dilatation without a visible opaque foreign body (Figure 5). Given the high-grade obstruction, she underwent laparotomy. Markedly dilated small bowel was encountered proximal to the ICV (Figure 6A -C). A hard, impacted dried fig was found obstructing the ICV and was removed via enterotomy. She recovered well postoperatively.

Figure 5. Dilated small bowel without a visible foreign body

Figure 6. A: Dilated Small Bowel Loop; B : Foreign Body (Dried Fig) Removed Via Enterotomy; C: *Dried Fig*

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Results

Three female patients, aged 2, 3, and 4 years, were included in the series. All presented with the characteristic clinical trial of abdominal pain, distention, and vomiting. Key findings, including the critical anesthetic implications, are comprehensively summarized in Table 1.

Table 1: Comparative Clinical and Anaesthetic Data of Pediatric Patients with Foreign Body SBO

Feature	Patient 1	Patient 2	Patient 3
Age	2 years	3 years	4 years
Prior GI Surgery	Yes (Neonatal Jejunal Atresia Repair)	No	No
Presenting Symptoms	Upper abdominal fullness, epigastric pain, distention, bilious vomiting, constipation	Abdominal pain, distention, vomiting, constipation	Abdominal pain, distention, vomiting, constipation
Foreign Body Type	Balloon (metallic toy part covered with plastic (Photograph 2)	Ring-shaped object	Dried Fig (Photograph 7)
Impaction Location	Proximal Jejunum (near anastomosis)	Ileocecal Valve (ICV) (Photograph 4)	Ileocecal Valve (ICV)
Surgical Procedure	Laparotomy, Enterotomy	Laparotomy, Enterotomy	Laparotomy, Enterotomy
Intra-op Findings	Marked jejunal dilatation proximal to anastomosis	Dilated small bowel proximal to ICV	Dilated small bowel proximal to ICV
Anesthetic Induction	Rapid Sequence Induction (RSI)	Rapid Sequence Induction (RSI)	Rapid Sequence Induction (RSI)
Key Anesthetic Implications	High risk due to prior surgery and proximal obstruction (higher aspiration risk)	High aspiration risk due to SBO	High aspiration risk due to SBO
Outcome	Uneventful recovery	Uneventful recovery	Uneventful recovery
Length of Stay (days)	7 days	4 days	6 days

Surgical and Diagnostic Findings

The two patients with anatomically normal GI tracts (Patients 2 and 3) exhibited impaction at the ICV, which aligns with the expected site of physiological narrowing. In sharp contrast, Patient 1, with a documented history of jejunal atresia repair, presented with a proximal jejunal obstruction. The ingested balloon was found lodged within a significantly dilated segment of the jejunum, immediately proximal to the site of the previous anastomosis (Photograph 2). This observation underscores the altered anatomical risk profile in post-surgical patients, which carries a direct anesthetic implication as a more proximal obstruction is typically associated with a greater volume of gastric contents and, consequently, an elevated aspiration risk.

Anesthetic Outcomes and Postoperative Course

All patients tolerated the surgical procedure successfully under general anesthesia. Strict adherence to the Rapid Sequence Induction (RSI) protocol, including the use of cricoid pressure, was a critical anesthetic intervention that prevented aspiration events. Preoperative fluid resuscitation proved effective in correcting initial volume deficits and metabolic derangements, thereby ensuring hemodynamic stability throughout the surgical procedure. This anesthetic stabilization was an absolute prerequisite for the safe commencement of surgery.

Postoperative pain was managed effectively through a multimodal, opioid-sparing regimen consisting of scheduled acetaminophen (15 mg/kg every 6 hours) and ibuprofen (10 mg/kg every 8 hours), with intravenous morphine (0.05-0.1 mg/kg) reserved for breakthrough pain. This approach, a cornerstone of modern pediatric anesthetic practice,

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facilitated early patient mobilization, minimized opioid-related side effects (e.g., respiratory depression, ileus), and contributed to the prompt return of bowel function."

Discussion

This comparative case series substantiates the established understanding that the ICV constitutes the most common site of FB impaction in children with native anatomy [3]. However, the clinical course of patient 1 provides a pivotal clinical lesson: prior GI surgery fundamentally alters the risk profile, creating new, more proximal sites of vulnerability attributable to factors such as persistent dysmotility or chronic dilatation proximal to an anastomosis [4]. The successful clinical outcomes documented in this series are inextricably linked to the rigorous implementation of specialized pediatric anesthetic protocols, a critical component that is often insufficiently emphasized in purely surgical literature. Pediatric SBO patients present a formidable anesthetic challenge, primarily due to the "full stomach" status and the pronounced risk of pulmonary aspiration. The non-negotiable use of Rapid Sequence Induction (RSI), guided by contemporary guidelines [5], was paramount in mitigating this high-risk profile.

A robust correlation was observed between the meticulous preoperative correction of fluid and electrolyte derangements and the subsequent intraoperative hemodynamic stability. This anesthetic implication of SBO pathology—severe hypovolemia and electrolyte imbalance—must be addressed aggressively prior to the induction of anesthesia to avert potential cardiovascular collapse [5]. Intraoperatively, the maintenance of normothermia, achieved through active warming, and the goal-directed titration of fluid replacement—carefully accounting for third-space losses into the distended bowel—were pivotal anesthetic considerations that directly influenced the patients' physiological resilience and optimized surgical field conditions. The rapid and uneventful postoperative recovery, evidenced by a mean length of stay of 5.7 ± 1.2 days, compares favorably with reported outcomes in the literature, where similar pediatric SBO studies have documented hospital stays ranging from 4 to 8 days [6,7,8]. This favorable outcome strongly suggests that specialized pediatric anesthesia care is a foundational element in minimizing morbidity and accelerating recovery in this vulnerable population [9,10]. The strategic choice of an opioid-sparing multimodal analgesia regimen is a key anesthetic consideration that directly influences the duration of postoperative ileus and the overall recovery trajectory [11].

The primary limitation of this study is its retrospective design and the inherent constraint of a small sample size (n = 3). While this restricts the statistical generalizability of the findings, the comparative nature of the cases effectively illustrates the differential mechanisms of obstruction and, more importantly, the consistent and indispensable role of the anesthetic management protocol in achieving successful outcomes across varying surgical presentations. Future prospective studies involving larger cohorts are warranted to statistically validate the impact of prior surgery on the impaction site and to further refine anesthetic protocols for this high-risk group.

Conclusion

Ingested foreign bodies frequently precipitate SBO requiring surgical intervention in young children. The impaction site is critically dependent on the underlying GI anatomy, occurring predictably at the ICV in native bowels but at altered, more proximal sites in post-surgical patients. Optimal management of foreign body-induced SBO necessitates a truly integrated, multidisciplinary approach where the anesthetic plan is central to ensuring patient safety and promoting rapid recovery. Specialized pediatric anesthetic protocols—which must encompass stringent aspiration prophylaxis (RSI), meticulous fluid and electrolyte management, and a robust multimodal analgesia regimen—are fundamental to achieving successful outcomes, accelerating recovery, and significantly minimizing morbidity. The compelling correlation between high-quality anesthetic care and the observed rapid return to normal function in these cases establishes a clear benchmark for perioperative excellence in this challenging surgical pathology. The findings emphatically underscore that the anesthesiologist's role extends beyond the confines of the operating room, profoundly influencing both preoperative stabilization and the entire postoperative recovery phase.

Conflict of interest. Nil

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