

Chapter 5

The Diagnosis and Management of Ileo-Sigmoid Knotting

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Abstract

Ileo-sigmoid knotting represents a rare form of colonic volvulus, characterized by acute intestinal obstruction and a significant risk of gangrene and perforation. Clinically, it manifests as acute intestinal obstruction, and diagnostic imaging techniques such as abdominal radiographs and computed tomography can facilitate its identification. However, diagnosis is frequently confirmed intra-operatively. The management of ileo-sigmoid knotting necessitates surgical intervention, involving the release of the volvulus segment and resection of the non-viable ileal segment, followed by anastomosis. Additionally, a sigmoid colectomy is performed, and depending on the colon's viability, either an anastomosis or stoma formation is executed. This chapter will explore the diagnosis, classification, and management of ileo-sigmoid knotting.

Keywords: Ileo-sigmoid volvulus, Sigmoid volvulus, Compound volvulus, Double volvulus, Sigmoid resection, Laparotomy, and stoma formation.

1. Introduction

Ileo-sigmoid knotting represents a specific form of mid-gut volvulus, characterized by a loop of the small intestine that migrates to the left side of the abdomen, encircling the sigmoid colon in either a clockwise or counterclockwise direction, thereby inducing acute intestinal obstruction. This condition, also referred to as compound volvulus or double volvulus, is a prevalent cause of acute intestinal obstruction in regions such as Africa, parts of Central Asia, and the Middle East (Mallick & Winslet, 2004; Rakinic, 2011). The development of ileo-sigmoid knotting necessitates the presence of a long, small bowel mesentery with a mobile small bowel, a long sigmoid colon on a narrow mesentery, and the consumption of a large meal with an empty bowel. Ileo-sigmoid knotting is categorized into three types: Type 1, where the ileum encircles the sigmoid colon in a clockwise or counterclockwise manner; Type 2, where the sigmoid colon encircles the small intestine in a clockwise or counterclockwise manner; and Type 3, where the ileocecal segment encircles the sigmoid colon (Akgun et al, 1997; Mandal et al., 2012).

The clinical manifestation of ileo-sigmoid knotting typically includes abdominal pain, vomiting, abdominal distension, and constipation. Diagnosis is primarily achieved through imaging techniques such as abdominal X-ray, which may reveal a significantly dilated sigmoid colon and corresponding dilated loops of the small bowel. However, computed tomography (CT) is more effective in diagnosing this condition, as it can identify a twisted or dilated sigmoid colon along with a corresponding segment of the small bowel. Given the association of ileo-sigmoid knotting with an elevated risk of bowel ischemia and gangrene, immediate intervention with fluid resuscitation, intravenous antibiotics, analgesics, and emergency laparotomy is warranted. Surgical treatment involves releasing the intestinal segment causing volvulus, and depending on the viability of the intestine, either resection and anastomosis or stoma formation is performed. The objective of surgical management is also to prevent recurrence of the ileo-sigmoid knotting (Atamanalp, 2009.; Ephraim Kazuma et al., 2021; Kapadia, 2017; Puthu et al., 1991).

Ileo-sigmoid knotting represents a rare yet perilous form of volvulus, characterized by significant morbidity and mortality rates. This chapter aims to explore the diagnostic and therapeutic approaches to ileo-sigmoid knotting, with a particular focus on its surgical management and classification. A comprehensive literature review was conducted utilizing PUBMED, the Cochrane Database of Clinical Reviews, and Google Scholar, concentrating on clinical trials, observational studies, cohort studies, systematic reviews, case reports, and meta-analyses spanning from 1980 to 2026. The search strategy incorporated keywords such as "Sigmoid volvulus," "ileo-sigmoid knotting," "Compound volvulus," "double volvulus," "sigmoid resection," "laparotomy," and "stoma formation." Only English-language publications were included.

Additional pertinent articles were identified through manual cross-referencing of the literature. The study population comprised adult male and female patients, with the exclusion of pregnant and pediatric patients.

2. Discussion

2.1. Epidemiology and Risk Factors for Ileo-Sigmoid Knotting

The precise incidence of ileo-sigmoid knotting remains undetermined; however, it is documented to constitute 18% to 27% of all sigmoid volvulus cases in regions with high incidence and 5% to 8% in areas with low incidence. Regions with high incidence include the Middle East, Africa, and Central Asia. Ileo-sigmoid knotting is predominantly observed in patients aged between the third and fifth decades of life and is more frequently encountered in male patients (Gupta et al., 2020).

Several anatomical and dietary factors predispose individuals to ileo-sigmoid knotting. These factors include a long, mobile small intestine and the consumption of a single bulky, high-fiber meal following prolonged fasting, a practice commonly observed during religious fasting periods. Such dietary habits may precipitate sudden bowel hypermotility and twisting. Additionally, chronic constipation, pregnancy, adhesions, and prior abdominal surgery have been implicated as contributing factors (Atamanalp, Peksöz, et al., 2022; Korkut & Atamanalp, 2022).

2.2. Classification of Ileo-sigmoid knotting

Various classification systems have been established to categorize ileo-sigmoid knotting based on its severity. The most widely recognized is the anatomical classification proposed by Alver et al. This system delineates ileo-sigmoid knotting into four types: Type 1, where the ileum, serving as the active component, encircles the sigmoid colon, the passive component, representing the most prevalent form; Type 2, where the sigmoid colon acts as the active component, wrapping around the ileum, which is the passive component; Type 3, where the ileo-sigmoid segment, as the active component, encircles the sigmoid colon, the passive component; and Type 4, where it is indeterminate which component is active (Alver et al., 1993.).

Table 1: Anatomical Classification of Ileo Sigmoid Knotting

Type	Active Segment	Anatomical Description	Subtypes / Direction
Type I	Ileum	The ileum wraps around the base of the sigmoid colon, resulting in knot formation.	Ia: Clockwise Ib: Counter-clockwise
Type II	Sigmoid colon	The sigmoid colon twists around the ileum, causing entrapment and obstruction.	IIa: Clockwise IIb: Counter-clockwise
Type III	Ileo-cecal segment	The ileo-cecal segment twists around the sigmoid colon.	No consistent subtypes
Type IV	Indeterminate	Unable to identify the initiating or active segment intra-operatively.	Not applicable

This is the anatomical classification of ileo-sigmoid knotting by Alver et al.

Table 2: Classification of ileo-sigmoid knotting by Atamanalp

Group	Definition	Surgical Treatment	Mortality (%)	Morbidity (%)
1A	G0, A0, ASA1-3	Decompression Or Colopexy, mesoplexy,mesoplasty	1-5%	5-15%
1B	G0, A1, ASA 4-5	Or sigmoid resection and anastomosis	1-10%	15-25%
2A	G0, A1, ASA 4-5	Decompression	10-30%	20-40%
2B	G1, A0, ASA1-3, B0	Ileal or sigmoid resection and anastomosis	5-20%	10-30%
2B	G1, A1, ASA 4-5, B1	Ileal or sigmoid resection and stoma	20-50%	30-60%
3A	G2, A0, ASA 1-3, B0	Ileal and sigmoid resection and anastomosis	10-30%	20-40%
3B	G2, A1, ASA 4-5, B1	Ileal and sigmoid resection, one anastomosis and one stoma	30-60%	40-80%

A0-age less than 75, A1-age more than 75, ASA1-no disease, ASA2-mild systemic disease, ASA3-severe systemic disease, ASA4-life threatening disease, ASA5-moribund patient. B0-normal anastomotic risk, B1-increased anastomotic risk, G0-viable bowel, G1-gangrenous ileum or sigmoid colon, G2-gangrenous ileum and sigmoid colon.

Atamanalp et al. proposed a classification system for ileo-sigmoid knotting, categorizing patients into several groups: C1, comprising patients without risk factors; C2, including patients with medical conditions and those over the age of 60; C3, consisting of patients experiencing shock; C4, involving patients with single-segment bowel gangrene; C5, encompassing patients with both shock and single-segment bowel gangrene; and C6, representing patients with gangrene affecting both segments. This classification was subsequently refined

to incorporate the American Society of Anesthesiologists (ASA) score, surgical treatment options, and the associated morbidity and mortality for each respective grade (Atamanalp et al., 2009).

2.3. Diagnosis of Ileo-sigmoid knotting

Imaging modalities are frequently employed to assist in the diagnosis of ileo-sigmoid knotting. Abdominal radiographs often reveal dilated small bowel loops alongside a dilated sigmoid colon. While abdominal radiographs typically display mixed features of the small bowel, they are insufficient for diagnosing ileo-sigmoid knotting independently. Currently, computerized tomography is the preferred imaging modality for diagnosing ileo-sigmoid knotting. The characteristic appearance of ileo-sigmoid knotting includes the whirl sign, which indicates twisted mesentery and vessels. Additionally, there is simultaneous volvulus of the ileal and sigmoid loops, as well as beak-medial deviation of the cecum and descending colon (Atamanalp, 2013; Baheti et al., 2011; Hegde et al., 2019; Lee et al., 2000.).

2.4. The Management of Ileo-Sigmoid Knotting

The initial management of ileo-sigmoid knotting involves the administration of intravenous fluids to correct any fluid or electrolyte imbalances, followed by the administration of intravenous antibiotics. Definitive management requires a laparotomy to identify and release the site of volvulus. Based on the viability of the bowel, a decision is made regarding the necessity of bowel resection. The indication for performing bowel resection and anastomosis or stoma formation depends on patient-specific factors and the degree of intestinal and surrounding tissue contamination. The most common surgical procedure typically involves small bowel resection and anastomosis for the ileal segment, and either sigmoid resection and anastomosis or a Hartmann's procedure (Atamanalp, Disci, et al., 2022; Atamanalp et al., 2024). Atamanalp conducted a retrospective study involving 74 patients diagnosed with ileo-sigmoid knotting, where treatment included surgical resection and anastomosis for patients with viable bowel. The mortality rate was 0% for patients without gangrene, while the mortality rates for those with gangrenous ileum, sigmoid colon, and both ileum and sigmoid colon were 12.5%, 14.3%, and 28.9%, respectively (Selçuk Atamanalp, 2014).

Atamanalp et al. conducted a retrospective analysis of 78 patients with ileo-sigmoid knotting over the past 50 years, focusing on management strategies. Their findings indicate no significant changes in the diagnosis and treatment of ileo-sigmoid knotting; however, there is a discernible shift towards a higher incidence of resection and anastomosis as opposed to stoma formation. The morbidity and mortality rates for patients with ileo-sigmoid knotting remained unchanged (Atamanalp et al., 2018). Abebe et al. also analyzed patient outcomes, including 28 individuals, with small bowel resection and anastomosis, and Hartmann's procedure being the most frequently performed surgical interventions. The study reported a mortality rate of 21.4% and a morbidity rate of 39.3% (Abebe et al., 2020). Similarly, Ooko et al. conducted a retrospective study involving 61 patients, where resection and anastomosis were performed in 85% of cases, while stoma formation was utilized in the remaining 15%. The morbidity and mortality rates were 24.6% and 11.5%, respectively (Ooko et al., 2016). Molla et al. conducted a comparable retrospective study on 25 patients, concluding that prompt diagnosis and treatment are crucial for reducing mortality (Molla et al., 2023).

Bayleyegn et al. conducted an evaluation of the clinical profile and outcomes of patients with ileo-sigmoid knotting. The study followed 40 patients who underwent surgical intervention for this condition over a period of one year, reporting a mortality rate of 3.2%. The presence of shock, co-morbidities, and tachycardia were identified as predictors of mortality (Bayleyegn et al.). In a separate study, Chalya et al. investigated the management of ileo-sigmoid knotting over a five-year period. This study included 26 patients, with surgical resection and anastomosis performed in 63% of cases, while colostomy was conducted in 30.1%. The mortality rate was reported at 17.1%, underscoring the significance of early diagnosis and treatment of ileo-sigmoid knotting (Chalya & Mabula, 2015). Mbanje et al. retrospectively assessed 21 patients, all of whom underwent ileal resection and anastomosis with a Hartmann's procedure, resulting in a mortality rate of 4.8% (Mbanje et al., 2020). Another retrospective study by Cakir et al. focused on the diagnosis and management of ileo-sigmoid knotting, reaching similar conclusions (Cakir et al., 2015). Several case series on the diagnosis and management of this condition have also emphasized the critical importance of early diagnosis and treatment (Ahbala et al., 2024; Sseruwagi & Lewis, 2022).

3. Conclusion

Ileo-sigmoid knotting represents an uncommon manifestation of colonic volvulus, necessitating prompt diagnosis and intervention due to the elevated risk of bowel ischemia and perforation. Imaging techniques, such as computerized tomography, play a crucial role in the perioperative diagnosis; however, the majority of cases are typically identified intraoperatively. In instances where the bowel segments remain viable, bowel resection and anastomosis are recommended, while stoma formation should be considered for patients exhibiting hemodynamic instability or significant contamination of the peritoneal cavity. Effective postoperative management of ileo-sigmoid knotting is essential to mitigate the morbidity and mortality associated with this condition.

Conflict of interest

There is no conflict of interest

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