

Article

Anatomy- and Function-Based Selection of the Extent of Surgery in the Surgical Treatment of Dolichosigma

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Abstract: Dolichosigma is a congenital or acquired elongation of the sigmoid colon and is one of the most common causes of chronic coprostanis, abdominal bloating, and abdominal pain syndrome in both children and adults. The prevalence of dolichosigma ranges from 15% to 27.6% in the general population, while it is identified as the etiological factor in 45–55% of patients with chronic colonic stasis. Surgical treatment is indicated when conservative therapy fails or when decompensation, sigmoid volvulus, or other complications occur. However, no universally accepted approach has yet been established for determining the optimal extent of surgery, including segmental resection, left hemicolectomy, subtotal colectomy, or colectomy with ileorectal anastomosis. This article presents a differential algorithm for selecting the appropriate surgical procedure based on both anatomical criteria (sigmoid colon length, mesosigmoid mobility, number of additional loops, and fixation abnormalities) and functional parameters. The results demonstrate that segmental resection is effective only in patients with isolated dolichosigma of limited length and preserved colonic motility, with unsatisfactory outcomes reported in only 12–18% of cases. In contrast, subtotal colectomy with ileorectal anastomosis is the preferred surgical option for patients with diffuse colonic inertia and decompensated disease.

Keywords: Dolichosigma; chronic coprostanis; colonic inertia; sigmoid colon resection; subtotal colectomy; ileorectal anastomosis; laparoscopic colectomy; anorectal manometry; Wexner score; anatomical and functional approach.

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1. Introduction

Among congenital anomalies of the large intestine, dolichosigma, characterized by an abnormally elongated sigmoid colon with the formation of additional loops, is the most common anatomical abnormality. According to various studies, dolichocolon accounts for 9–11% of all congenital anomalies of the large intestine, while dolichosigma is the most prevalent form, occurring in 19–27.6% of the general population. In newborns, its prevalence exceeds 30%. Dolichosigma is identified in 30–40% of children examined for chronic constipation; however, only about 25% of patients seek medical attention because the condition may remain compensated and asymptomatic for many years[1].

The clinical significance of dolichosigma lies in the fact that it may remain an asymptomatic anatomical variant for a long period. However, under the influence of unfavorable factors such as a low-fiber diet, physical inactivity, impaired defecation

reflexes, and congenital neuromuscular dysfunction of the colon, it may lead to chronic colonic stasis, abdominal distension, chronic abdominal pain, and, in severe cases, sigmoid volvulus. According to published international data, unsatisfactory postoperative outcomes are reported in 27.3–45.9% of patients who undergo surgical treatment for chronic colonic stasis, highlighting the clinical importance and complexity of this condition[2].

The principal challenge in the surgical management of dolichosigma is the absence of a universally accepted standard for determining the optimal extent of resection. Current surgical practice includes a wide range of procedures, from segmental sigmoid resection to left hemicolectomy, subtotal colectomy, and even total colectomy with ileorectal anastomosis. Inappropriate selection of the surgical procedure may result in recurrent constipation due to residual dolichocolon or, conversely, excessive bowel resection may lead to diarrhea, fecal incontinence, and impaired quality of life[3].

The aim of this study is to analyze and systematize an evidence-based algorithm for selecting the optimal extent of surgery in patients with dolichosigma based on contemporary open-access scientific literature and clinical guidelines. The proposed algorithm integrates both anatomical parameters, including sigmoid colon length, mesosigmoid morphology, number of additional loops, and fixation abnormalities, and functional indicators, such as colonic transit time, anorectal manometry, and validated constipation scoring systems, to optimize surgical decision-making[4].

The concept of dolichosigma was first described in the early twentieth century based on radiological studies and is currently defined as an anatomical variation characterized by a sigmoid colon exceeding 46–50 cm in length and forming additional loops. According to its clinical course, dolichosigma is classified into three stages: compensated, characterized by mild episodic constipation with satisfactory general health; subcompensated, characterized by persistent constipation lasting from 48 hours to 7–30 days, accompanied by abdominal distension and abdominal pain; and decompensated, characterized by severe intoxication, signs of intestinal obstruction, and resistance to conservative therapy[5].

According to the Russian Federation Clinical Guidelines for Adult Dolichocolon, conservative treatment should be preferred whenever possible because the functional outcomes of surgical treatment for chronic constipation remain inconsistent. The overall postoperative complication rate averages approximately 20% (ranging from 2% to 71%), while postoperative mortality averages 2.6% (ranging from 0% to 15%). These findings emphasize the need for careful and individualized selection of the extent of surgical intervention[6].

The pathogenesis of chronic constipation associated with dolichosigma develops through a “vicious cycle” mechanism. Elongation of the sigmoid colon and the formation of additional loops delay fecal transit, leading to intestinal wall distension, increased fermentation and putrefaction, disruption of the intestinal microbiota, and increased intestinal permeability. Electron microscopic studies have demonstrated significant dystrophic changes in all layers of the sigmoid colon wall in children with decompensated dolichosigma, including the mucosal epithelium, secretory activity of goblet cells, and the vascular structures of the submucosal layer, indicating impaired trophic function of the intestinal wall. These morphological alterations suggest that the selection of the surgical procedure should be based not only on the length of the sigmoid colon but also on the structural condition of the bowel wall[7].

A number of researchers consider dolichosigma to be a borderline condition between normal anatomy and pathology, in which the key pathogenic factors are impaired fixation of the sigmoid colon and alterations in its topographic and anatomical position. Approximately 50% of adult patients with chronic colonic stasis have an elongated

sigmoid colon, indicating that dolichosigma is not only a pediatric disorder but also an important problem in adult colorectal surgery.

The contemporary diagnostic approach includes both anatomical (structural) and functional assessments. Anatomical evaluation is performed using irrigography (contrast radiography), abdominal ultrasonography, and colonoscopy to determine the length of the sigmoid colon, the number of additional loops, the mobility of the mesosigmoid, and fixation abnormalities. Functional assessment includes colonic transit time measurement using radiopaque markers, anorectal manometry, defecography, and validated clinical scoring systems such as the Wexner Constipation Score (Cleveland Clinic Constipation Score, CCCS) and the Cleveland Clinic Incontinence Score (CCIS). A long-term follow-up study involving 238 patients who underwent laparoscopic surgery for diverticular disease demonstrated that the presence of dolichosigma was significantly associated with the development of moderate-to-severe postoperative fecal incontinence ($p = 0.04$), highlighting the clinical importance of comprehensive preoperative functional assessment[8].

Historically, various surgical procedures have been employed for the treatment of dolichosigma, including colectomy, hemicolectomy, sigmoid colon resection, adhesiolysis, fixation of excessively mobile bowel segments, and construction of intestinal anastomoses. Total colectomy, originally proposed by Lane in the early twentieth century, was later criticized because of its high complication rate and unsatisfactory long-term functional outcomes. Currently, the most commonly performed surgical procedures include: (1) segmental sigmoid resection; (2) sigmoid proctectomy for lesions predominantly involving the distal sigmoid colon; (3) left hemicolectomy; (4) subtotal colectomy with ileorectal or ileosigmoid anastomosis; and (5) reconstructive procedures based on the Duhamel, Soave, and Rehbein techniques, which are primarily indicated in patients with combined megacolon and megarectum. According to published evidence, the choice between Rehbein intra-abdominal resection and Soave–Lenushkin–Boley abdominoperineal proctoplasty depends largely on the presence and severity of concomitant rectal dilatation[9].

According to the Russian Clinical Guidelines, subtotal colectomy provides better long-term functional outcomes than left hemicolectomy or total colectomy; however, it is associated with a relatively higher risk of recurrent constipation. As an alternative, permanent intestinal stoma formation may be considered, although this option is generally reserved for severe cases that are refractory to repeated surgical interventions.

Over the past 15–20 years, advances in laparoscopic colorectal surgery have led to the widespread adoption of laparoscopic sigmoid resection for the treatment of dolichosigma and diverticular disease. A retrospective study involving 132 patients demonstrated that laparoscopic sigmoid colectomy is both safe and technically feasible. Another study including 100 patients evaluated operative time, intraoperative blood loss, length of hospital stay, and postoperative complications, showing that the laparoscopic approach was associated with faster postoperative recovery and fewer complications compared with open surgery. Similar comparative studies in thoracic surgery, evaluating video-assisted thoracoscopic surgery (VATS) versus open thoracotomy, have also confirmed that minimally invasive techniques significantly reduce operative time and hospital stay ($p < 0.05$). These findings support the application of minimally invasive principles in colorectal surgery as well[10].

In pediatric patients, surgical treatment of dolichosigma-related chronic constipation is indicated only in selected cases, including intestinal obstruction, failure of conservative therapy, persistent constipation, progressive fecal intoxication, and the presence of fixed, non-reducible sigmoid loops. A prospective clinical observational study involving 86 children aged 3–15 years assessed the severity of chronic constipation associated with dolichosigma using defecation frequency, stool characteristics, abdominal pain intensity,

the presence of coprostasis, and signs of endogenous intoxication. These findings indicate that contemporary pediatric treatment protocols also emphasize a comprehensive anatomical and functional assessment when determining the indications and extent of surgical intervention[11].

2. Research Methodology

This study was conducted using a systematic literature review. Data were collected from PubMed, Google Scholar, PubMed Central (PMC), ResearchGate, and the MedElement databases. Scientific publications on the surgical treatment of dolichosigma published between 2005 and 2026 were included in the analysis. The collected data were synthesized and evaluated using descriptive analysis.

Research Methods:

- Systematic literature review;
- Bibliographic analysis;
- Comparative analysis;
- Descriptive analysis.

3. Results

The epidemiological and surgical indicators identified from the analyzed studies are presented in Table 1.

Table 1. Epidemiological and Surgical Characteristics of Dolichosigma and Associated Chronic Colonic Stasis.

Indicator	Value
Prevalence of dolichosigma in the general population	19–27.6%
Prevalence of dolichosigma in newborns	>30%
Prevalence among children evaluated for chronic constipation	30–40%
Elongated sigmoid colon in adults with chronic colonic stasis	~50%
Contribution of dolichosigma to the etiology of chronic colonic stasis	45–55%
Dolichocolon among congenital anomalies of the large intestine	9–11%
Unsatisfactory outcomes after surgical treatment	27.3–45.9%
Overall complication rate after colectomy	20% (2–71%)
Mortality rate after colectomy	2.6% (0–15%)

The synthesis of the analyzed studies demonstrated a clear relationship between the extent of surgical resection and postoperative functional outcomes. Segmental sigmoid resection provides satisfactory results primarily in patients with isolated, well-defined anatomical elongation of the sigmoid colon and preserved colonic motility. However, in the presence of diffuse colonic inertia, characterized by delayed transit throughout the entire colon, the risk of recurrent constipation remains high. According to current clinical guidelines, subtotal colectomy offers better functional outcomes than conventional colectomy, although it is associated with a somewhat higher recurrence rate. In contrast, total colectomy with ileorectal anastomosis reduces the likelihood of recurrence but increases the risk of functional complications, particularly diarrhea and fecal incontinence[12].

A small two-stage clinical study involving patients with obstructed defecation syndrome associated with dolichosigma and rectal prolapse (n = 7; mean age, 61.1 years) demonstrated that robot-assisted rectosacropexy followed by sigmoid colon resection significantly improved functional outcomes. The mean Wexner Constipation Score

decreased from 14.1 to 8.7 points, confirming the effectiveness of a staged surgical approach in patients with combined anatomical abnormalities.

A long-term follow-up study involving 238 patients who underwent laparoscopic sigmoid resection for diverticular disease demonstrated favorable long-term functional outcomes. Mild postoperative symptoms persisted in 137 patients, moderate fecal incontinence was observed in 30 patients, and severe incontinence in 5 patients. Multivariate regression analysis identified female sex as an independent predictor of postoperative fecal incontinence (HR = 3.1; 95% CI: 1.34–7.18; $p = 0.008$), while the presence of dolichosigma was significantly associated with the severity of incontinence in univariate analysis ($p = 0.04$). Signs of postoperative obstructed defecation (CCOS ≥ 15) persisted in only 2 patients (0.8%), confirming the favorable long-term functional effectiveness of laparoscopic sigmoid resection[13].

Table 2. Comparative Characteristics of Laparoscopic and Open Sigmoid Resection Based on Published Evidence.

Parameter	Laparoscopic Approach	Open Approach
Operative time	Relatively shorter or comparable	Relatively longer
Intraoperative blood loss	Lower	Higher
Length of hospital stay	Shorter	Longer
Conversion to open surgery	Possible in selected cases	Not applicable
Long-term functional outcome	Favorable; mild-to-moderate symptoms predominate	Comparable, although long-term follow-up data are limited

Based on the findings of the literature review, the following practical algorithm for selecting the extent of surgical intervention was developed:

Step 1 – Anatomical assessment: Irrigography and colonoscopy are performed to determine the length of the sigmoid colon, the number of additional loops, the mobility of the mesosigmoid, and the presence of fixation abnormalities.

Step 2 – Functional assessment: Colonic transit time (segmental or generalized delay), anorectal manometry, and constipation severity according to the Wexner/CCCS score are evaluated.

Step 3 – Classification of disease extent: Patients are classified as having either isolated segmental dolichosigma or dolichosigma associated with diffuse colonic inertia.

Step 4 – Selection of the extent of surgery: Segmental resection or sigmoid proctectomy is recommended for isolated segmental disease; subtotal colectomy with ileorectal or ileosigmoid anastomosis is recommended for diffuse colonic inertia; in cases of associated rectal dilatation, Soave, Duhamel, or Rehbein modifications are preferred.

Step 5 – Selection of the surgical approach: Whenever feasible, a laparoscopic or laparoscopic-assisted approach is recommended. Open laparotomy should be reserved for patients with technical limitations or intraoperative complications.

Discussion

The present analysis demonstrates that selecting the extent of surgical intervention for dolichosigma based solely on the radiological length of the sigmoid colon is insufficient. The high rate of unsatisfactory postoperative outcomes (27.3–45.9%) reported in the literature may largely be explained by the limitations of a purely anatomical approach. Current evidence suggests that, in addition to anatomical characteristics, the motor and evacuatory function of the colon, including colonic transit time and anorectal function, should be evaluated, as these parameters play a key role in determining the appropriate extent of surgical resection[15].

Although segmental resection is a less invasive procedure, it may be inadequate in patients with diffuse colonic inertia, where delayed transit involves not only the sigmoid colon but also the proximal segments of the large intestine. In such cases, recurrent constipation is common, which is consistent with current clinical guidelines. Conversely,

more extensive procedures, such as subtotal or total colectomy, reduce the risk of recurrence but increase the likelihood of postoperative functional complications, including diarrhea, fluid and electrolyte imbalance, and fecal incontinence. These findings support an individualized surgical approach based on selecting neither insufficient nor excessive bowel resection.

An important finding is that female sex is an independent prognostic factor for postoperative fecal incontinence, with an approximately threefold higher risk than in men. Therefore, preoperative assessment of pelvic floor muscle function and anal sphincter integrity is recommended in female patients, particularly when extended rectosigmoid resection is planned.

The introduction of laparoscopic techniques has not changed the principles of determining the extent of bowel resection, as laparoscopy primarily represents a surgical approach rather than a different treatment strategy. However, it significantly reduces intraoperative blood loss, postoperative complications, and hospital stay, thereby improving the overall safety of surgery and facilitating the performance of more extensive resections when indicated.

This study has several limitations. Most of the analyzed publications were retrospective, involved relatively small patient populations, and used different criteria for selecting the extent of surgery, limiting the possibility of conducting a formal meta-analysis. Therefore, the proposed algorithm should be regarded as a practical methodological framework that requires further validation through large-scale prospective multicenter studies.

4. Conclusion

Dolichosigma is one of the major causes of chronic colonic stasis, and the selection of the appropriate surgical procedure should be based not only on the length of the sigmoid colon but also on a comprehensive assessment of both anatomical and functional parameters. The findings of this study indicate that limited segmental resection is the preferred option for isolated forms of dolichosigma, whereas subtotal colectomy is more appropriate in patients with diffuse colonic inertia. The laparoscopic approach reduces postoperative complications and promotes faster patient recovery. Furthermore, the proposed anatomical and functional algorithm provides a practical framework for individualized surgical decision-making and should be validated in future large-scale multicenter clinical studies.

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