# World Journal of Gastrointestinal Surgery

World J Gastrointest Surg 2024 November 27; 16(11): 3381-3642





Published by Baishideng Publishing Group Inc

WJGS

# World Journal of Gastrointestinal Surgery

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WJGS mainly publishes articles reporting research results and findings obtained in the field of gastrointestinal surgery and covering a wide range of topics including biliary tract surgical procedures, biliopancreatic diversion, colectomy, esophagectomy, esophagostomy, pancreas transplantation, and pancreatectomy, etc.

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# **RESPONSIBLE EDITORS FOR THIS ISSUE**

Production Editor: Zi-Hang Xu; Production Department Director: Xiang Li; Cover Editor: Jia-Ru Fan.

NAME OF JOURNAL	INSTRUCTIONS TO AUTHORS		
World Journal of Gastrointestinal Surgery	https://www.wignet.com/bpg/gcrinfo/204		
<b>ISSN</b>	GUIDELINES FOR ETHICS DOCUMENTS		
ISSN 1948-9366 (online)	https://www.wjgnet.com/bpg/GerInfo/287		
LAUNCH DATE	GUIDELINES FOR NON-NATIVE SPEAKERS OF ENGLISH		
November 30, 2009	https://www.wjgnet.com/bpg/gerinfo/240		
FREQUENCY	PUBLICATION ETHICS		
Monthly	https://www.wjgnet.com/bpg/GerInfo/288		
EDITORS-IN-CHIEF	PUBLICATION MISCONDUCT		
Peter Schemmer	https://www.wjgnet.com/bpg/gerinfo/208		
EDITORIAL BOARD MEMBERS	ARTICLE PROCESSING CHARGE		
https://www.wjgnet.com/1948-9366/editorialboard.htm	https://www.wjgnet.com/bpg/gerinfo/242		
PUBLICATION DATE	STEPS FOR SUBMITTING MANUSCRIPTS		
November 27, 2024	https://www.wjgnet.com/bpg/GerInfo/239		
COPYRIGHT	ONLINE SUBMISSION		
© 2024 Baishideng Publishing Group Inc	https://www.f6publishing.com		

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# World Journal of Gastrointestinal Surgery

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World J Gastrointest Surg 2024 November 27; 16(11): 3606-3613

DOI: 10.4240/wjgs.v16.i11.3606

ISSN 1948-9366 (online)

CASE REPORT

# Unexpected right-sided sigmoid colon in laparoscopy: A case report and review of literature

Shi-Fu Hu, Xiang-Yu Liu, Han-Bo Liu, Yuan-Yuan Hao

Specialty type: Gastroenterology and hepatology

Provenance and peer review: Unsolicited article; Externally peer reviewed.

Peer-review model: Single blind

Peer-review report's classification Scientific Quality: Grade A, Grade В

Novelty: Grade A, Grade B Creativity or Innovation: Grade A, Grade B Scientific Significance: Grade A,

Grade B

P-Reviewer: Sun PT

Received: August 1, 2024 Revised: August 29, 2024 Accepted: September 11, 2024 Published online: November 27. 2024 Processing time: 90 Days and 2.2



Hours

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# Abstract

# BACKGROUND

The presence of a right-sided sigmoid colon is a rare anatomical variation usually discovered incidentally during surgical interventions. This case report details an unexpected right-sided sigmoid colon identified during a laparoscopic appendectomy and examines the pertinent literature to explore its clinical importance.

#### CASE SUMMARY

A 71-year-old woman presented with acute appendicitis. A preoperative computed tomography (CT) scan showed peri-appendiceal inflammation but no significant anatomical abnormalities. During laparoscopic surgery, an unexpected finding was encountered: The sigmoid colon was situated on the right side and exhibited an abnormal relationship with the cecum and ascending colon. Postoperative pathological examination confirmed appendicitis with no additional pathological findings. The right-sided sigmoid colon anomaly was verified through intraoperative assessment and later re-evaluation with CT and colonographic imaging. The patient underwent a laparoscopic appendectomy and experienced a smooth postoperative recovery.

# CONCLUSION

This case highlights the necessity of being attentive to anatomical variations during laparoscopic surgery, particularly when managing appendicitis. A review of the literature indicated that the occurrence of a right-sided sigmoid colon is infrequent and may be associated with anomalies in midgut rotation during embryonic development. Awareness of this variation can help prevent surgical complications and inform future clinical practice.



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Key Words: Right-sided sigmoid colon; Laparoscopy; Anatomical variation; Literature review; Surgical implications; Case report

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**Core Tip:** This case report spotlights an unexpected right-sided sigmoid colon detected during laparoscopic appendectomy, emphasizing its clinical impact. Surgeons must be vigilant for such anatomical variations in minimally invasive surgery. A literature review reveals the rarity and embryological roots of this condition, crucial for preventing surgical errors. The case highlights the necessity of preoperative imaging and intraoperative assessment for detecting and managing this anatomical peculiarity.

Citation: Hu SF, Liu XY, Liu HB, Hao YY. Unexpected right-sided sigmoid colon in laparoscopy: A case report and review of literature. World J Gastrointest Surg 2024; 16(11): 3606-3613 URL: https://www.wjgnet.com/1948-9366/full/v16/i11/3606.htm DOI: https://dx.doi.org/10.4240/wjgs.v16.i11.3606

# INTRODUCTION

The sigmoid colon is typically situated in the left abdominal cavity. However, in rare instances, it may be found in the right abdominal cavity in adults, representing an unusual anatomical variation. This condition may be linked to factors such as fixation anomalies, colon redundancy, or secondary rotation during embryonic development[1,2]. The clinical significance of this variation is notable. Insufficient preoperative identification of such anatomical deviations through imaging can lead to unexpected challenges during surgery. For instance, cases involving primary malignant tumors, complicated appendicitis, rectal cancer, and pelvic organ prolapse may require intraoperative adjustments due to the unexpected presence of this condition[3-6]. This highlights the clinical importance of the ectopic right sigmoid colon, particularly for surgeons and radiologists. This report details a case of a right-sided sigmoid colon discovered unexpectedly during a laparoscopic appendectomy and includes a review of the pertinent literature.

# **CASE PRESENTATION**

#### Chief complaints

A 71-year-old Chinese woman presenting with abdominal pain in the right lower quadrant for 24 hours was admitted to our hospital.

#### History of present illness

A 71-year-old female patient presented with acute pain in the right lower abdomen, intermittent nausea without vomiting, absence of fever, and decreased passage of flatus and stool over the past 24 hours.

#### History of past illness

She had no significant past medical history or known allergies and denied a history of smoking or excessive alcohol consumption. There was no family history of gastrointestinal disorders or hereditary conditions.

#### Physical examination

On physical examination, the patient exhibited tenderness in the right lower quadrant, without rebound tenderness or guarding.

#### Laboratory examinations

The white blood cell count (13.6  $\times$  10<sup>9</sup>/L) and neutrophil count (11.20  $\times$  10<sup>9</sup>/L) were elevated. All other laboratory parameters were within normal limits.

#### Imaging examinations

A computed tomography (CT) scan was conducted, showing signs of appendicitis with peri-appendiceal inflammation. Unexpectedly, the CT also identified an anatomical variant: The sigmoid colon was positioned on the right side of the abdomen, contrary to the usual anatomical location (Figure 1).

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Hu SF et al. Right-sided sigmoid colon in laparoscopy



Figure 1 Computed tomography. The right sigmoid colon in the white circle and box areas, with the white arrowhead indicating the cecum located in front.

# **FINAL DIAGNOSIS**

Based on the symptoms, physical examination, and imaging studies, the diagnosis of acute appendicitis was established. During the operation, the sigmoid colon was unexpectedly found to be positioned laterally to the right cecum. Postoperative assessment through CT and colonography confirmed the misplacement of the right-sided sigmoid colon.

### Surgical findings

During surgery, the left descending colon was observed extending above the level of the left iliac crest, with the sigmoid colon passing through the mid-abdomen and positioned anterior to the posterior parietal peritoneum, behind the small intestine and right cecum. It then ascended behind the ascending colon, was anchored at the level of the right renal region, and folded back to merge with the lateral parietal peritoneum, extending downward along the right iliac fossa to the rectum. The cecum was situated anteriorly and medially to the sigmoid colon, with adhesions forming between the cecum and the lateral side of the descending sigmoid colon. The appendix was found internally within the cecum, exhibiting signs of congestion, edema, and suppuration (Figure 2).

# TREATMENT

A laparoscopic appendectomy was performed on the patient. During the procedure, the right-sided sigmoid colon was confirmed, and its relation to the appendix and other abdominal structures was thoroughly assessed. The appendectomy was conducted carefully to prevent damage to nearby anatomical structures. The surgical team adjusted the procedure to account for the anatomical variation, ensuring the safe and complete removal of the appendix. On the third postoperative day, a double-contrast barium enema examination identified the presence of an ectopic right sigmoid colon (Figure 3).

# **OUTCOME AND FOLLOW-UP**

Postoperatively, the patient experienced a smooth recovery and was discharged on the third day after the surgery. The pathological analysis of the appendectomy specimen confirmed the diagnosis of appendicitis without complications.

# DISCUSSION

The literature on right-sided sigmoid colon is limited, with a scarcity of reported cases in the medical community. This rare anatomical variation is characterized by a low incidence, with most cases discovered incidentally during autopsies, surgeries, or imaging studies. Embryological theories propose that this anomaly may result from abnormal rotation and fixation of the midgut during embryonic development [7,8]. Anatomical features include an unusually displaced position of the sigmoid colon, altered blood supply vessels, and closer proximity to adjacent organs such as the ascending colon, liver, and small intestine. Diagnosis is generally achieved through CT or magnetic resonance imaging (MRI), which are crucial for revealing the atypical positioning of the sigmoid colon[9]. CT scans are particularly effective in identifying the right-sided sigmoid colon, as they can detail the anatomical position and its relation to adjacent structures [7,8]. CT images frequently show the sigmoid colon positioned on the right side of the abdomen, often accompanied by descriptions of abnormal mesenteric vascular anatomy. MRI provides an alternative imaging method with similar diagnostic capabilities, offering detailed soft tissue contrast that can further clarify the colon's position and potential complications, such as



Figure 2 Surgical findings. A: The left descending colon continued to cross the mid-abdomen at the level of the left iliac crest, where the sigmoid colon appeared; B and C: The sigmoid colon traversed behind the cecum, making a flip behind the ascending colon and continued downwards along the right colonic lateral sulcus; D: The mesentery of the sigmoid colon fused with the lateral parietal peritoneum.



Figure 3 A double-contrast barium enema examination. The Right-sided Sigmoid Colon.

torsion[2]. Although barium enemas are less commonly used today due to the prevalence of cross-sectional imaging, they still offer valuable information on mucosal patterns and the overall configuration of the colon, particularly in patients suspected of malrotation[9]. Ultrasound examination may also be helpful in diagnosis, especially for assessing intestinal wall thickness and detecting complications like obstruction or torsion[6]. Identifying imaging features preoperatively can assist surgeons in planning more effective surgical approaches and help prevent complications arising from unexpected findings during surgery[10,11].

Through a systematic review of the literature, this study identified 34 instances of right-sided sigmoid colon across 20 articles[3-5,12-39]. Of these patients, 31 were male and 3 were female. The cases were identified as follows: 23 during autopsy, 6 unexpectedly during surgeries for abdominal pain, and the rest through physical examination, rectal bleeding, or constipation. Variations in the sigmoid colon were confirmed intraoperatively in four cases of appendicitis, two cases of rectal cancer, one case of sigmoid colon cancer, and one case of pelvic organ prolapse. The remaining 26 patients had no primary disease, with 23 diagnosed postmortem (Table 1). The anatomical features of the sigmoid colon were analyzed, and based on its positioning relative to the cecum and the presence of an abnormal descending colon, the rightsided sigmoid colon was categorized into several types: (1) The right-sided sigmoid colon is attached to the right iliac fossa and is located inferior to the cecum, with the descending-sigmoid junction in the left iliac fossa; (2) The right-sided



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#### Table 1 Comprehensive literature review focused on the right-sided sigmoid colon<sup>1</sup>

Discovery method	Sex	Age	Original disease	Surgical procedure	Anatomical relationship	Ref.
Autopsy	Male	Elderly	None	None	2	[13]
Autopsy	Male	60	None	None	1	[14]
Autopsy	Male	Elderly	None	None	3	[15]
Autopsy	Male	55	None	None	7	[16]
Autopsy	Male	Elderly	None	None	4	[17]
Autopsy	Male		None	None	3	[18]
Autopsy	Male	Adult	None	None	5	[19]
Autopsy	Male	Adult	None	None	4	[20]
Autopsy	Male	40	None	None	4	[21]
Autopsy	Male	Adult	None	None	4	[22]
Autopsy	Male		None	None	1	[23]
Autopsy	Female	60	None	None	5	[24]
Autopsy	Male		None	None	3	[25]
Autopsy	Male	50	None	None	7	[26]
Autopsy	Male	70	None	None	3	[27]
Autopsy	Male		None	None	5	[28]
Autopsy	Male	45	None	None	7	[29]
Autopsy	Male	53	None	None	2	[30]
Autopsy	Male		None	None	1	[31]
Autopsy	Male		None	None	1	[31]
Autopsy	Male	45	None	None	7	[32]
Autopsy	Male	Elderly	None	None	7	[33]
Autopsy	Male	Elderly	None	None	7	[33]
Abdominal pain	Male	34	Appendicitis	Appendectomy	6	[34]
Abdominal pain	Male	44	Appendicitis	Appendectomy	6	[35]
Abdominal pain	Male	19	Appendicitis	Appendectomy	5	[36]
Abdominal pain	Male	20	Appendicitis	Appendectomy	4	[37]
Abdominal pain	Male	56	Sigmoid colon cancer	Radical surgery for sigmoid colon cancer	3	[3]
Abdominal pain	Male	62	None	None	6	[38]
Physical exam	Female	30	None	None	7	[ <mark>39</mark> ]
Physical exam	Male	53	None	None	4	[40]
Rectal bleeding	Male	74	Rectal cancer	Laparoscopic radical rectal cancer surgery	3	[41]
Rectal bleeding	Male	Elderly	Rectal cancer	Abdomino-perineal resection for rectal cancer + sigmoidostomy	3	[5]
Constipation	Female	83	Pelvic organ prolapse	Laparoscopic sacral colpopexy	4	[6]

<sup>1</sup>The right-sided sigmoid colon is attached to the right iliac fossa and is positioned inferior to the cecum. The descending-sigmoid junction is located within the left iliac fossa. The right-sided sigmoid colon is anchored superior to the right iliac fossa, positioned beneath the elevated cecum. The descending-sigmoid junction is also situated within the left iliac fossa. The right-sided sigmoid colon, located superior to the right iliac fossa, is positioned posterior-lateral to the cecum. The descending-sigmoid junction is unattached and mobile. The right-sided sigmoid colon is attached to the medial aspect of the

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cecum and is positioned anterior-medial to it. The descending-sigmoid junction is unattached and mobile. The right-sided sigmoid colon is attached superior to the right iliac fossa and is positioned beneath the elevated cecum. The descending-sigmoid junction is unattached and mobile. The right-sided sigmoid colon is attached to the medial aspect of the cecum and is positioned anterior-medial to it. The descending-sigmoid junction is located within the left iliac fossa. The right-sided sigmoid colon is attached superior to the right iliac fossa and is located posterior-lateral to the cecum. The descendingsigmoid junction is also situated within the left iliac fossa.

sigmoid colon is anchored above the right iliac fossa and positioned under the elevated cecum, with the descendingsigmoid junction also in the left iliac fossa; (3) The right-sided sigmoid colon, located above the right iliac fossa, is positioned posterior-lateral to the cecum, with an unattached and mobile descending-sigmoid junction; (4) The rightsided sigmoid colon is attached to the medial aspect of the cecum and positioned anteriorly medial to it, with an unattached and mobile descending-sigmoid junction; (5) The right-sided sigmoid colon is attached above the right iliac fossa and is situated beneath the elevated cecum, with an unattached and mobile descending-sigmoid junction; (6) The right-sided sigmoid colon is attached to the medial aspect of the cecum and positioned anteriorly medial to it, with the descending-sigmoid junction in the left iliac fossa; and (7) The right-sided sigmoid colon is attached above the right iliac fossa and located posterior-lateral to the cecum, with the descending-sigmoid junction also in the left iliac fossa. According to the data presented in Table 1, Types 3, 4, and 7 had relatively high incidence rates, comprising 61% of the cases. These types should be particularly considered in clinical practice (Figure 4).

#### Anatomical relationship



#### Figure 4 Variation categories in the right-sided sigmoid colon.

A notable aspect of this case is the detection of the ectopic sigmoid colon during laparoscopic surgery, which was validated by preoperative and postoperative imaging, contributing to a deeper understanding of this anatomical variation. Additionally, this study emphasizes the importance of preoperative imaging. CT scans can disclose anatomical relationships that might not be evident through physical examination alone, which is crucial for preoperative planning and reducing the risk of surgical complications. This anatomical variation greatly complicates the identification of organs during surgery. A cautious approach is required when dealing with unconventional vessels, and a more precise dissection technique is necessary when separating adjacent organs to prevent disrupting the surgical procedure. For example, Watanabe et al[6] reported extended surgery time and increased anesthetic risks in elderly patients undergoing laparoscopic sacrocolpopexy for pelvic organ prolapse due to inadequate preoperative awareness of right-sided sigmoid colon variation. In another case, a 56-year-old Chinese male who had laparoscopic exploration for right-sided colon cancer was found to have the tumor in an atypical location within the right-sided sigmoid colon, leading to a conversion to open surgery for safety reasons[3]. Thus, it is argued that preoperative imaging is critical for detecting such anatomical variations. Failure to properly identify these anomalies may necessitate immediate changes in the surgical approach during the procedure. This situation highlights the essential role of accurate preoperative assessment in surgical planning and the need for surgeons to adjust their strategies based on intraoperative findings to prevent surgical errors and ensure patient safety.

Gao et al[5] suggested that physiological visceral heterotopia might increase the risk of conditions such as internal hernias, intestinal obstruction, and volvulus. However, our literature review identified only one case of acute obstruction linked to a small bowel hernia, where intraoperative findings confirmed a direct association between the obstruction and the anomaly of the right-sided sigmoid colon[40]. In other cases, clinical symptoms were primarily related to the primary disease and not directly connected to the right-sided sigmoid colon variation [10,11,41]. Therefore, it is posited that the anatomical anomaly of the right-sided sigmoid colon is mostly benign, with pathological changes affecting bowel patency

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occurring only in rare instances. This variation is more likely to influence surgical strategies in the affected area rather than causing clinical symptoms directly. Consequently, the management approach for the right-sided sigmoid colon should be based on the clinical context in which the abnormality is detected. In cases of asymptomatic anomalies, a conservative approach may be appropriate. Conversely, when symptoms or complications are present, surgical intervention is generally warranted<sup>[6]</sup>.

# CONCLUSION

This case report highlights the significance of the unexpected identification of a right-sided sigmoid colon during laparoscopic appendectomy. This rare anatomical variation may result from abnormal midgut rotation during embryonic development. Although its incidence is low, it significantly affects surgical planning. Preoperative imaging plays a crucial role in detecting such variations, helping to prevent intraoperative complications and guide clinical decision-making. Although the right-sided sigmoid colon may be associated with certain conditions, it often presents no direct symptoms, and treatment approaches should be tailored to the clinical context. This report emphasizes the need to recognize anatomical variations in minimally invasive surgery and underscores the importance of thorough preoperative planning and intraoperative flexibility.

# FOOTNOTES

Author contributions: Hu SF contributed to manuscript drafting; Liu XY and Liu HB reviewed the literature; Hao YY was responsible for the revision of the manuscript for important intellectual content; all authors issued final approval for the version to be submitted.

Informed consent statement: A written informed consent was obtained from patients enrolled.

**Conflict-of-interest statement:** The authors declare that they have no conflict of interest.

CARE Checklist (2016) statement: The authors have read the CARE Checklist (2016), and the manuscript was prepared and revised according to the CARE Checklist (2016).

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S-Editor: Liu H L-Editor: A P-Editor: Zhang XD

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