ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Anatomical Variations of the Large Intestine: A Cadaveric Observational Study.

Sowbarnika Chinnathambi[1], LK Mukesh Kanna[2], Sakkarai Jayagandhi[3]*, and Rema Devi[4].

[1]Final Year MBBS Student, Pondicherry Institute of Medical Sciences, Pondicherry-605014, India.
[2]Junior Resident
[3]Professor, Department of Anatomy, PK Das Institute of Medical Sciences, Palakkad-679522,India.
[4]Professor & Head of the Department, Department of Anatomy, Pondicherry Institute of Medical Sciences, Puducherry-605014, India.

ABSTRACT

Anatomical variations of the large intestine, although uncommon, may complicate clinical diagnosis and surgical procedures. These variations are often identified incidentally during radiological imaging, surgical interventions, autopsies, or routine cadaveric dissections. Awareness of such anomalies is important for surgeons, radiologists, and anatomists to minimize diagnostic errors and operative complications. A descriptive cadaveric study was conducted on 40 cadavers, including 30 adults (25 males and 5 females) and 10 foetuses. The large intestine was carefully dissected and examined for anatomical variations, with particular attention to the caecum, appendix, sigmoid colon, and associated vascular anatomy. Anatomical variations were identified in four specimens, comprising three adult male cadavers and one male foetus. The observed anomalies included a right-sided sigmoid colon associated with an altered inferior mesenteric artery, sigmoid volvulus, and a subhepatic caecum with appendix. Knowledge of anatomical variations of the large intestine is essential for accurate diagnosis and effective surgical planning. Early recognition of these anomalies can help prevent intraoperative difficulties, reduce operative time, and avoid delays in diagnosis and management.

Keywords: Large intestine, anatomical variation, right-sided sigmoid colon, sigmoid volvulus, subhepatic caecum.

https://doi.org/10.33887/rjpbcs/2026.17.4.3

*Corresponding author

ISSN: 0975-8585

INTRODUCTION

The large intestine absorbs fluid, forms stool, and maintains digestive health. Its structure is usually consistent, but developmental changes, such as variations in rotation, length, or attachment, can cause anatomical differences. Most variants are asymptomatic; some affect diagnosis and surgical planning. Rare findings such as right-sided sigmoid colon, sigmoid volvulus, and subhepatic caecum are clinically significant. Studies report a prevalence of less than 5% for right-sided sigmoid colon and subhepatic caecum [1,2]. The incidence of sigmoid volvulus varies, but it accounts for 4–5% of large-bowel obstructions in some populations [3]. Comprehensive data on prevalence in cadavers are limited, creating gaps in anatomical education and practice. Variations may mimic other conditions, cause unusual symptoms, or complicate surgery. Clinicians' lack of awareness may lead to misreading of imaging or delayed diagnosis.

Cadaveric studies provide direct evidence of anatomical variations and their developmental origins. The present study aims to document anatomical differences in the large intestine, relate them to embryological causes, and elucidate their clinical significance for surgical and diagnostic practice.

METHODS

This observational study examined anatomical variations of the large intestine during routine cadaveric dissection for undergraduate teaching. Forty cadavers (30 adults: 25 males, 5 females; 10 foetuses) were studied. Each abdominal cavity was dissected to observe the position, course, attachments, vascular supply, and mesenteric features of abdominal structures. While observing we have identified right-sided sigmoid colon with an altered artery, sigmoid volvulus, and a subhepatic caecum. The variations were evaluated with its embryological and clinical significance.

OBSERVATIONS

Right-Sided Sigmoid Colon with Altered Course of Inferior Mesenteric Artery

In 22 of 25 male cadavers (88%), the sigmoid colon was normal in the lower left abdomen and pelvis. The inferior mesenteric artery starts from the abdominal aorta, runs down and to the left behind the peritoneum, and ends at the left common iliac artery, supplying the hindgut.

Three male cadavers showed an unusual sigmoid colon course, extending from the left abdomen to the right iliac fossa. The descending colon was shorter. The inferior mesenteric artery ran vertically instead of its usual angle (Figure 2).

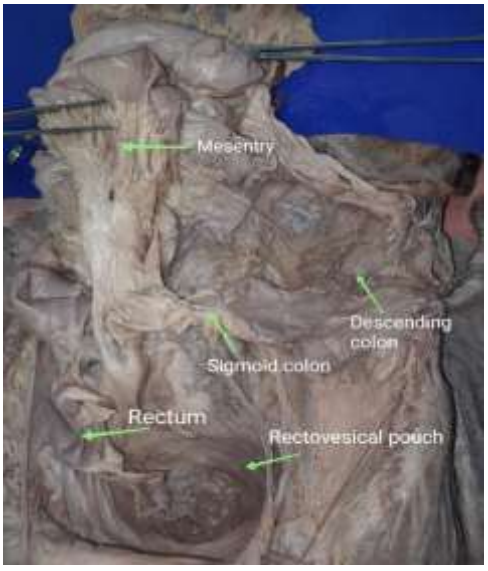

Figure 1: A Right-Sided Sigmoid Colon **Figure 2: Altered Course of the Inferior Mesenteric Artery**

ISSN: 0975-8585

Sigmoid Volvulus

In a 75-year-old male cadaver, the sigmoid colon was enlarged and twisted around its mesentery above the sacral promontory (Figures 3, 4). The sigmoid loop and mesentery were long, and the mesenteric attachment was narrow. These features match those of sigmoid volvulus.

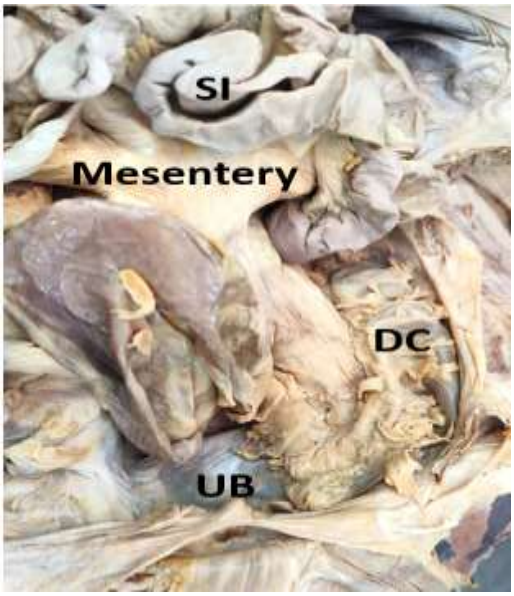

Figure 3: Sigmoid Volvulus Shows Twisted Sigmoid Loop Figure 4: Structures Around Sigmoid Volvulus

Subhepatic Caecum

In a 65-year-old male cadaver, the caecum and appendix lay under the liver in a subhepatic position (Figures 5, 6). The ascending colon was short, and the small intestine's end was attached to the abdominal wall (Figure 7). The appendix started at the caecum and pointed up toward the hepatic flexure.

Figure 5: Subhepatic Caecum (Red Circle) and Appendix in an Adult Cadaver
Figure.6: Subhepatic Caecum and Appendix in Adult Cadaver
Figure.7: The Ileum is Retroperitoneally Fixed to the Posterior Abdominal Wall.

Subhepatic Caecum in Foetus

In a 27-week-old male foetus, the caecum and appendix were also subhepatic (Figures 8, 9). The ascending colon was short, and its attachment was incomplete, suggesting that descent did not occur during development.

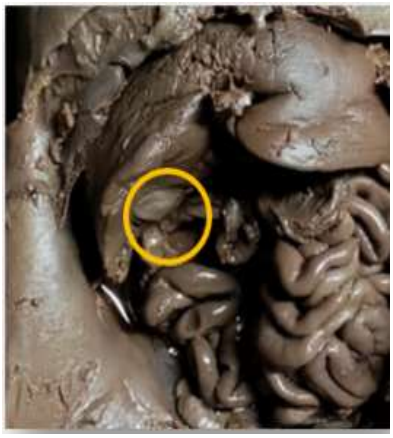

Figure 8: Indicates the Subhepatic Caecum (Yellow Circle) and Appendix in the Foetus
Figure 9: Subhepatic Caecum and Appendix in a Foetus

Embryological Explanation

Normally, the hindgut lengthens and attaches after midgut rotation, completed by week 10. If abnormal, the sigmoid colon may end up on the right. Blood vessels develop with gut rotation. A change in the artery's course shows disrupted development.

If the sigmoid colon grows longer than its mesentery, it forms an extra loop. If the attachment remains narrow and is not fully fixed, it increases the risk of later twisting, which can lead to sigmoid volvulus.

caecum first develops under the liver before descending to the right iliac fossa. If the ascending colon does not grow enough or attach properly, the caecum and appendix stay in the subhepatic position.[4]

DISCUSSION

Routine dissection of a 65-year-old male cadaver revealed that the sigmoid colon followed an unusual path, extending from the left side of the abdomen to the right iliac fossa (Figs. 1 and 2).

Ashwini Nuchhi et al. reported a 70-year-old male cadaver with a caecum and appendix in the right lumbar region. The ascending colon was short, and the descending colon crossed the great vessels obliquely [1].

Bertelli et al. (2022) described a 65-year-old male with acute intestinal obstruction due to right-sided sigmoid colon and internal herniation. Early anatomical recognition was crucial [2].

Shi-Fu Hu et al. (2024) reported a 71-year-old woman with a right-sided sigmoid colon found during a laparoscopic appendectomy. The anomaly was due to a rare midgut rotational abnormality. Preoperative imaging helped prevent complications [5].

Sigmoid volvulus is an emergency caused by the twisting of the sigmoid colon, which can obstruct the intestine and block blood flow. Dissection revealed a variation that could increase the risk of volvulus (Figures 3 and 4).

Zenda T et al. (2019) reported cases with acute abdominal distress due to sigmoid volvulus [6]. Bruusgaard et al. found that an elongated colon, narrow mesenteric base, and increased mobility are risk factors. These were more common in males [7]. Atamanalp SS et al. (2010) emphasised that sigmoid volvulus is a major cause of large-bowel obstruction and requires prompt diagnosis and intervention [3].

Previous reports documented variations mainly in symptomatic cases. This study found routine dissection in asymptomatic individuals. These differences may go undetected during a person's lifetime. Cadaveric studies reveal latent prevalence and are vital for anatomical knowledge and identifying risks like volvulus that may be missed.

A subhepatic caecum and appendix are positional variations. In this study, this variation appeared in an adult cadaver during routine dissection, indicating a developmental anomaly. Recognising these variations matters, even in the absence of symptoms, since they may have clinical implications.

Guru Prasad Painuly et al. (2020) reported that the subhepatic caecum and appendix are often missed in clinical settings and may escape detection on USG or CT. This can delay diagnosis and lead to complications, such as rupture or abscess formation [8].[Anasuya Ghosh et al. (2022) noted that diagnosis and treatment are hard due to altered positions [9]. Biniam Addis Anelay et al. (2024) described rare clinical cases that were often misdiagnosed as non-surgical conditions. Awareness and early imaging are important [10].

The observation in the foetus confirms that a subhepatic caecum is a developmental anomaly present at birth rather than an acquired condition (Figures 8 and 9).

This study documents anatomical variations of the large intestine with significant developmental and clinical implications. A right-sided sigmoid colon with altered vascular supply reflects abnormal rotation and attachment of the hindgut, while sigmoid volvulus results from excessive length and a narrow mesenteric base. Identification of a subhepatic caecum and appendix in both adults and foetuses indicates failed caecal descent during development. Limitations include a small sample size from a single institution, possible selection bias, and a lack of clinical correlation with symptoms. These findings highlight the necessity for greater awareness, as such deviations represent key embryological stages and may mimic other pathologies or complicate surgery. Early recognition and comprehensive knowledge of these abnormalities are essential for optimal patient management and surgical planning.

Although these anatomical variations are rare, they are of considerable importance in clinical practice. Such variations may present atypical symptoms, complicate imaging interpretation, delay diagnosis, and create intraoperative challenges. Recognition of these differences can improve patient care.

CONCLUSION

Recognition of these anatomical variations is crucial: it strengthens anatomical education, informs surgeons to prevent intraoperative complications, assists radiologists in imaging interpretation, and enables emergency physicians to identify atypical presentations promptly.

Awareness of these anatomical differences across specialities can reduce surgical difficulties and improve outcomes when managing unusual large-intestine anatomy.

Abbreviations

SI – Small Intestine
UB – Urinary Bladder
DC – Descending Colon
TC – Transverse Colon

Authors' contributions

All authors contributed to the conception and design of the study. The primary authors performed data collection and cadaveric dissection, while analysis and interpretation of findings were conducted collaboratively. All contributors undertook manuscript drafting and critical revisions, and each author approved the final version for publication.

ACKNOWLEDGEMENTS

We thank the institution and the sacrificed Soul.

REFERENCES

[1] Nuchhi A, Yatagiri S, Bulagouda RS. Right-sided sigmoid colon and oblique descending colon with its embryological basis and clinical significance. BLDE Univ J Health Sci. 2020;5(Suppl 1): S52.

[2] Bertelli G, Patauner S, Gorgatti T, et al. Right-side fixation of the sigmoid colon causing internal herniation with closed-loop obstruction of both small and large bowel: a case report and review of the literature. J Med Case Rep. 2022; 16:323.

[3] Atamanalp SS. Sigmoid volvulus. Eurasian J Med. 2010; 42:142-7.

[4] Moore KL, Persaud TVN, Torchia MG. *The Developing Human: Clinically Oriented Embryology*. 12th ed. Philadelphia: Elsevier; 2023.

[5] Hu SF, Liu XY, Liu HB, Hao YY. Unexpected right-sided sigmoid colon in laparoscopy: A case report and review of the literature. World J Gastrointest Surg. 2024;16(11):3606-13.

[6] Zenda T, Araki I, Hamano N, Sawada E, Nakamiya O, Endo T, et al. Progressive atrophy in a deformed liver as a contributor to sigmoid volvulus. Clin J Gastroenterol. 2019;12(5):453-9.

[7] Bruusgaard C. Volvulus of the sigmoid colon and its treatment. Surgery. 1947; 22:466-78.

[8] Painuly GP, Singhal GPM. Difficult diagnosis of acute abdomen caused by subhepatic caecum with acute appendicitis: A rare case report. Int J Surg Case Rep. 2020; 2:608-9.

[9] Ghosh A, Sarkar A. A rare presentation of subhepatic caecum and appendix with atrophic gall bladder in a cadaver. J Clin Diagn Res. 2023;17(2):AD01-2.

[10] Anelay BAA, Chekol LM, Tigabie W, Sintayew M, Tadesse E. Malrotated subhepatic caecum with subhepatic appendicitis: Diagnostic dilemma: A case report. Int J Surg Case Rep. 2024; 123:110320.