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Redundant Loop of Sigmoid Colon with its Unusual Position and Fixation- A Case Report

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Abstract

A right-sided sigmoid colon with excessively lengthy redundant loops and peculiar peritoneal relationship is an anatomical variation that mainly manifests as a developmental anomaly. It can result in a variety of acute and chronic clinical disorders. This study is a case report of variation in the position, orientation and length of sigmoid colon along with its redundant loop and peculiar fixation. A sigmoid colon with an abnormal length and position was discovered in a 45-year-old male cadaver at the Central Ayurveda Campus in Dang, Nepal, during an undergraduate student dissection session. In contrary to conventional length and course, the sigmoid colon was exceptionally long and traversed from the left iliac fossa, upwards,

backwards and to the right to reach to the right upper lumbar region at the level of L3. The loop then descended downward to the right iliac fossa, from where it moved downward and medially into the pelvic cavity to join the rectum. Knowledge of such a rare variation is critical for interventional radiologists and colorectal surgeons. The findings of this study may be useful in informing surgeons and radiologists about different types of presentations of colon while performing an investigative or surgical procedure such as sigmoidoscopy, percutaneous cecostomy etc.

Key words: Redundant loop, Sigmoid colon, Sigmoid mesocolon, Sigmoidoscopy

INTRODUCTION

The sig-moid colon is the part of the large intestine derived from hindgut. It is about 40cm long and extends from the left pelvic brim as a continuation of descending colon and ends at the recto-sigmoid junction in front of the S3 vertebra. It forms a sinuous loop and is suspended from posterior pelvic wall by sigmoid mesocolon. The first part of loop passes vertically downwards along the left pelvic wall, second part passes horizontally from left to right between the urinary bladder and rectum in male or between the uterus and rectum in female; the third part passes obliquely from the right pelvic wall in the recto-sigmoid junction.¹ It remains suspended by a V shaped peritoneal fold called sigmoid mesocolon. The apex of this fold lies over the left ureter at the termination of the common iliac artery. Its left limb is attached along the upper half of the left external iliac artery, while the right one to the posterior pelvic wall extending downwards and medially to the median plane at the level of S3. It is supplied by 3-4 sigmoid arteries and a recurrent branch of superior rectal artery.²

Sigmoid colon is one of a most variable part of large intestine. There is considerable variation in the length, position, orientation and fixation of sigmoid colon. Right sided

sigmoid colon with its redundant loops and atypical fixation are common anatomical variations.³ A redundant loop is one which is too long to fit into the body of the person without undergoing reduplication. A portion of hindgut loop may be elongated abnormally giving rise to a redundant loop. Numerous acute and chronic pathological conditions may be associated with these variations. In addition, they can pose significant misunderstandings in radiological diagnosis, and challenges with sigmoidoscopic interventions. Such anatomical variants must be identified early and precisely defined anatomically in order to optimize their surgical approach.^{4,5} Therefore, it is imperative to investigate the prevalence and clinical relevance of such anatomical variations.

Case Report

During the routine anatomy dissection for undergraduates at the Department of Rachana Sharir, Central Ayurveda Campus in Dang, Nepal, an anatomical variation regarding length and position of sigmoid colon was observed in a male cadaver aged about 45 years. The sigmoid colon was abnormally long, having 3 loops. The transverse loop began in the left iliac fossa as a sharp bend from the descending colon and continued upward, backward, and to the right.

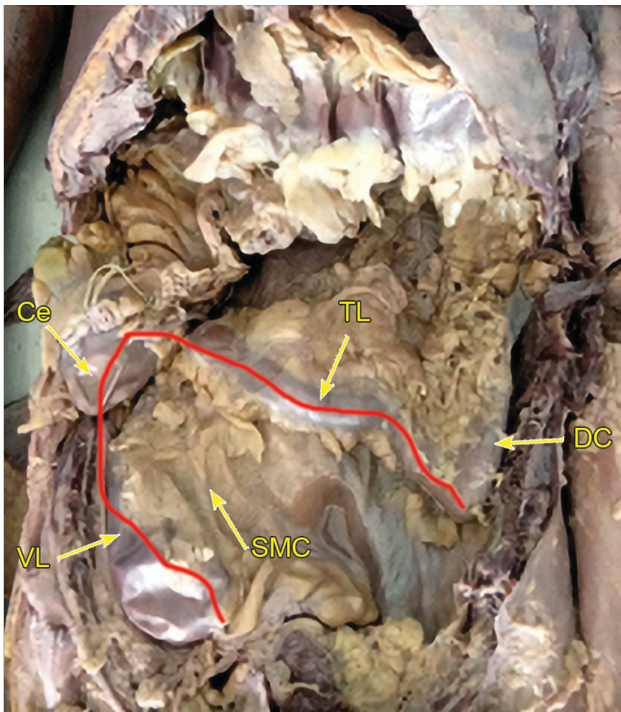


Fig.1: Sigmoid colon in situ (line marked)'
Ce-Cecum, DC-Descending Colon, TL-Tranverse Loop,VL-Vertical Loop, SMC- Sigmoid Mesocolon

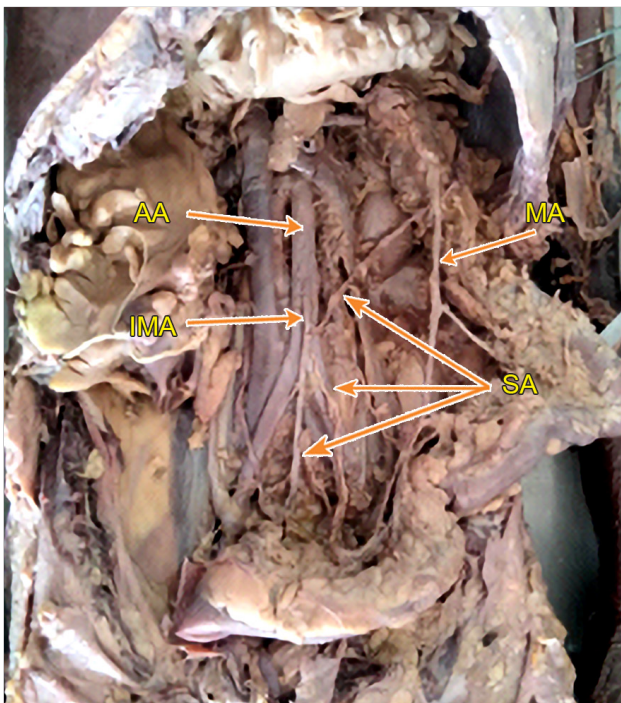


Fig.2: Blood supply of Sigmoid Colon; AA-Abdominal Aorta, IMA- Inferior Mesenteric Artery, MAD-Marginal Artery, SA- Sigmoid Arteries, SC- Sigmoid Colon loop

The loop crossed the midline at the upper border of the L4 vertebra and extended to the right lumbar region beneath the caecum at the level of upper border of L3. It was

30cm long. The vertical loop was 17cm long and had reached down to the right iliac fossa. The lowermost sigmoid loop traversed downward backward, and to the left, crossing the right brim of the pelvis, and reaching the left side of the 3rd piece of sacrum before ending in the rectum. It was 27cm long. The mesosigmoid was attached towards the right side. The caecum was situated in the lumbar region 3cm above the right iliac crest, anterior to the right kidney. The ascending colon was only 6cm in length. The transverse colon was normally placed. The blood supply was traced out carefully and it was observed that Sigmoid branches of Inferior mesenteric artery and Recurrent branch of Superior rectal artery were supplying the sigmoid colon. Sigmoid arteries were appeared to anastomose with each other and with the descending branch of left colic artery completing the Marginal artery of Drummond.

DISCUSSION

The principal ontogenic factors responsible for colon positional variations include differential development of abdominal organs with their peritoneal coverings, as well as some mechanical causes. The anti-clockwise rotation of the mid gut in the extraembryonic coelom (umbilical sac) causes the pre-arterial segment to pass to the right of the post-arterial segment. The herniated pre-arterial segment is rotated and then reduced, pushing the post-arterial segment (coils of jejunum and ileum) to the posterior and left parts of the mesentery. The existence of jejunal loops in the left upper quadrant helps to develop the normal splenic flexure.⁶

During the tenth week of gestation, the post-arterial portion of the midgut returns to

the peritoneal cavity, and the colon resumes its usual form with its rotation. On the right side, the development process includes the establishment of the hepatic flexure and the descent of the caecum into the right lower quadrant. The jejunal loops on the left side cause the hindgut to be shifted laterally from its midline position, resulting in a formation of the future splenic flexure and descending colon. The dorsal mesentery follows the colon in this process of reorganization and completes its fusion with the posterior abdominal wall between the 4th and end of the 5th month of gestation.⁷ The unusual extension of the hindgut, coupled with the persistent excessive elongation of the sigmoid colon, could be the embryological basis for a redundant loop of the sigmoid colon, as in this case.⁵ Failure of jejunal loops to migrate ventrally and inferiorly might serve as a mechanical barrier to the union of primitive parietal peritoneum and the left wall of the mesocolon. A sigmoid loop in the right iliac fossa may prevent the cecum from descending, resulting in an undescended lumbar cecum.⁶

The sigmoid colon constitutes one of the variable parts of the large intestine in terms of volume and position.⁸ Redundancy seems to occur at any age, in either sex, and without special preference to any habitus.⁹ However, some studies show agewise, sexwise and racial variations in relation to redundancy and position of sigmoid colon. A study conducted by Kantor in 1614 patients by means of opaque roentgenography showed 258 cases of reductant loop, accounting an incidence of 16.0%. In terms of sex, 54% of the patients were male and 46% were female, with 28% and 24% being sthenic and asthenic, respectively.¹⁰ A

study in 68 patients with a redundant sigmoid colon confirmed by barium enema in Uganda showed a male to female sex ratio of 5:1.¹¹

Usually the sigmoid colon is considered to occupy the left iliac fossa. A recent investigation reveals that the sigmoid colon in young children (age <5 years) differs from the adult sigmoid colon in that it has greater redundancy and can shift entirely to the right side. A study by Fiorella D.J and Donnelly L.F on 169 young children (ages ranged from one day to five years (mean age, 13 months) revealed that the sigmoid colon is generally positioned in the right lower quadrant in young children. They found that the sigmoid colon was located in the right lower quadrant in 74 (44%), the left lower quadrant in 73 (43%), and the midline in 18 (11%).¹²

In a retrospective study of contrast enema examinations in 91 children (2 months to 13 years) the position of sigmoid colon was found to be present in the right lower quadrant in 35 (16%) of cases, left lower quadrant in 36 (26%) of cases, midline in 13 (19%) of cases, and indeterminate in 15 (38%) of cases.⁴

Racial variation has been observed in some groups, particularly Ethiopians, where the prevalence of a suprapelvic loop is especially high. In a study of 590 cadavers, Madiba T.E and Haffajee M.R observed that Africans had longer sigmoid colons and mesocolons than Indians and whites.¹³ However, there were no statistical significances in variation in length and position associated with age, sex and race in all studies.

A study on 204 patients in Uganda showed that there was an association between redundant sigmoid colon and consumption of cereals, fruits and fats. People with irregular bowel

habits were about five times more likely to have redundant sigmoid colon than those who had regular bowel habits. Majority of patients with redundant sigmoid colon were of low socioeconomic status. Statistically significant association was observed between redundant sigmoid colon and consumption of cereals, fruits and fats and irregular bowel habits. The majority (57.4%) of cases were peasants.¹¹

A redundant loop is one which is too long to fit into the body of the person without undergoing reduplication. A portion of hindgut loop may be elongated abnormally giving rise to a redundant loop. Redundant colon is classified into four types: I: presence of ascending and descending mesocolon, II: presence of double hepatic flexure, III: expansion of the sigmoid colon into the belly, IV: sigmoid colon displaced to the right. Observations in this case resemble categories I and IV as there were both ascending and descending limbs of the sigmoid colon and its associated mesocolon and it was entering into the pelvic cavity along the right iliac fossa.¹⁴

Madiba and Haffajee has classified the sigmoid colon into three main types: classical, long- narrow and long- broad type. The classical type of sigmoid colon is the one that lies close to the pelvic brim with the normal anatomical textbook description. In the long-narrow type, sigmoid colon is long with the root of mesocolon being narrow; in the long-broad type, though the sigmoid colon is long, the mesocolon is broad.¹³ The present case matches with long broad type as the sigmoid was very long extending from left iliac fossa to right lumbar region at the level of L3, then descending down to right iliac fossa and finally entering the pelvic cavity. In addition, it had

a wide lumen, and no visible taeniae coli and haustra. Madiba and Haffajee also categorized the sigmoid colon into four categories based on its position relative to the pelvic brim: the brim, pelvic, suprapelvic, and axial types. Our case comes under the suprapelvic type.¹³

Several researchers have reported abnormal length and position of sigmoid colon. Rymbai D. et al reported a case of abnormal length of sigmoid colon with unusual fixation. It was 58cm long.¹⁵ Nayak SB et al reported a 60cm long sigmoid colon with no pelvic sigmoid mesocolon.¹⁶ Woldeyes DH et al. reported abnormally positioned and morphologically variant sigmoid colon. It was 66cm long, covering the left half of the transverse colon, hiding the spleen and in contact with the left lobe of the liver. In addition, it had no visible taeniae coli and sacculations.¹⁷ In present study, the sigmoid colon was 74cm long.

Variability in the anatomical configuration of the sigmoid colon and its mesocolon influences colonic physiology, predisposes to both acute and chronic disorders, and complicates diagnostic and procedural interventions including radiological assessment and sigmoidoscopy. The condition may also be critical in interpreting plain radiographs of the abdomen, evaluating the end result of percutaneous reduction of intussusceptions, and conducting percutaneous cecostomies. An elongated colon is frequently associated with a failure of agglutination of mesentery with the parietal peritoneal. As a result, the elongated colon is not anchored to the dorsal wall and can swing freely on a long mesentery, and loose redundant loops pose a risk of volvulus.^{4,5} In present report, it was observed that the sigmoid colon was fixed throughout

its entire length on the dorsal abdominal and pelvic wall by sigmoid mesocolon.

A redundant sigmoid colon loop may be asymptomatic or have a compressive impact on the small intestine, resulting in a variety of symptoms such as right iliac fossa pain and tenderness, indigestion, bloating, weight loss, constipation, and colon discomfort. In addition to appendicitis, redundancy loop symptoms can resemble those of heart disease, chronic intestinal obstruction, and stomach ulcers. Chances of developing a varicocele is greater because it may directly compress the left testicular artery.^{16,17,18}

CONCLUSION

Sigmoid colon is one of a most variable part of large intestine. The length, position, orientation, and fixation of the sigmoid colon vary greatly. Common anatomical variations include the right-sided have implications for surgical approaches, diagnostic procedures, and the management of colorectal diseases. Therefore, developing a greater understanding of individual anatomical differences in colorectal health and being aware of such variations is essential for radiologists, physicians, and surgeons. Additional research is needed to determine the functional implications of these variants and their significance across diverse clinical scenarios.

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