

Morphometry of the adult sigmoid colon and relation to volvulus

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Abstract

BACKGROUND: The sigmoid colon in Africans is commonly affected by volvulus formation. Anatomical characteristics of this part of the colon could provide some of the contributory explanations for male gender predisposition.

METHOD: Ninety five sigmoid colons (fifty male subjects) were harvested at autopsy. The following measurements were made: length of the sigmoid colon, length of the mesocolon root, height of the mesocolon. The sigmoid length: mesocolic root length ratio and sigmoid length: mesocolic height ratios were also calculated. All means and ratios were compared for gender using the Student t-test. $P < 0.05$ was considered statistically significant.

RESULTS: The mean sigmoid colon length was higher in males (36.9cm) than in females (32.6cm) ($p=0.007$). Most (41.7%) of the sigmoid colons measured 30-34.9cm long. Males had shorter mesocolon roots and longer mesocolon heights.

CONCLUSION: The greater colon length and smaller mesocolic root lengths in males may be the anatomical basis for the higher incidence of sigmoid volvulus in males.

Introduction

The sigmoid colon is the commonest site for volvulus formation. The incidence of sigmoid

volvulus shows both gender and population disparities being more common in males and in several developing countries (1-4). In Africa, epidemiological studies indicate a higher incidence of sigmoid volvulus in males than females with a male to female ratio ranging from 9:1 in South Africa (5,6) to 13.5:1 in Ethiopia (7). Elsewhere, similar gender pattern is documented and is thought to be due to anatomical factors (1,2). Sigmoid loops with tall mesocolons (dolichomesocolic) show a male predominance while loops with short mesocolons (brachymesocolic) depict a female predominance among Indians (1) and Caucasians (3). The literature on the morphometry of the sigmoid colon among Africans is limited (8).

This study describes the morphometric features of the sigmoid colon in adult Kenyans autopsied at a University and a city council mortuary in Nairobi.

Materials and Methods

Ninety five sigmoid colon specimens were obtained during autopsy examinations performed at the Chiromo and Nairobi city mortuaries. Ethical approval was obtained from the Kenyatta National Hospital Ethical Review Committee (KNH-ERC) before specimen retrieval from fifty adult males and forty five adult females. The ages of the subjects used

ranged from twenty one to fifty six years. The effects of post mortem shrinkages were limited by taking measurements from subjects that had died within forty eight hours.

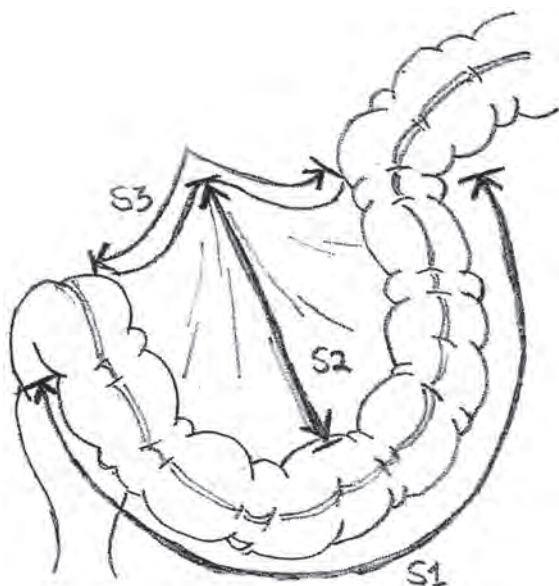
The colons were accessed through midline abdominal incisions used at autopsy. After reflection of the small intestines and the bladder (uterus in females), the sigmoid colons were identified and both the root and vertical lengths of sigmoid mesocolon were measured *in situ* (Figure 1). The length of the sigmoid colon at the antimesenteric border was also estimated (in centimeters) using a tape measure.

Two indices relating the total length of the sigmoid colon and the vertical height of the mesocolon to the length of the mesocolon root were calculated as shown;

- Index 1 = sigmoid colon length/ mesocolon root length (S1/S3)
- Index 2 = mesocolon vertical height mesocolon root length (S2/S3)

The results of the measurements were tabulated and analyzed using computer software and statistical package of social sciences (SPSS) for windows version 11.50, Chicago Illinois, 2002. The means and the calculated ratios were compared for males and females using the Student t-test. The level of significance was set at $P < 0.05$.

Figure 1: Morphometric parameters of the sigmoid loop and mesocolon. S1 — sigmoid colon length, S2- mesocolon vertical height, S3- mesocolon root length



Results

The length of the sigmoid colon in the studied sample ranged from 27.6cm to 46.7cm in males and 27.1cm to 40.2cm in females. Most sigmoid colons measured 30-34.9cm in length (41.7%). The frequency of loops measuring 20-29.9cm, 35.39.9cm and 40-49.9cm length was 15.3%, 27.8% and 15.3% respectively.

The mean length for males ($36.9 \pm 5\text{cm}$) was significantly longer than for females ($32.6 \pm 3.8\text{cm}$) ($p = 0.007$) (Table 1). The range of the mesocolic root length was 9.6 cm to 20.7cm in males (mean $14.2 \pm 3.4\text{cm}$) and 10.2cm to 25.1cm in females ($17.6 \pm 3.4\text{cm}$).

The range of the mesocolic vertical height was 3.1cm to 26.4cm in males and 9.5cm to 18.1cm in females. The mean vertical height was $15.1 \pm 4.3\text{ cm}$ and $13.4 \pm 2.6\text{cm}$ in males and females respectively (Table 1, Figure 3).

The average value of index 1 (sigmoid colon length/mesocolon root length) was 2.68 in males and 1.76 in females ($p = 0.004$). The average value of index 2 (mesocolon vertical height/mesocolon root length) was 1.22 in males and 0.74 in females ($p = 0.024$).

Male subjects generally had longer sigmoid loop length, shorter mesocolic root lengths and longer mesocolic heights. Female subjects possessed shorter sigmoid loops, longer mesocolic root lengths and shorter mesocolic heights (Figures 2, 3 and 4).

Figure 2: Morphometry of sigmoid colon/mesocolon by gender

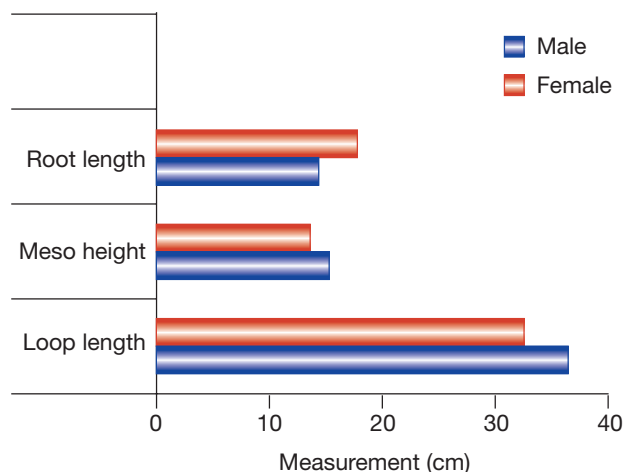
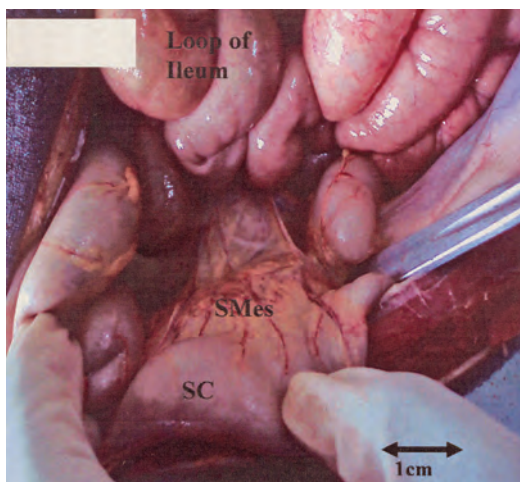


Table 1 Morphometry of the sigmoid colon and mesocolon in adult males and females

Gender	Males			Females			P-value
	Mean (cm)	Standard deviation	Range (cm)	Mean (cm)	Standard deviation	Range (cm)	
Sigmoid colon length	36.9	5.0	27.6–46.7	32.6	3.8	27.1–40.2	0.007
Mes vertical height	15.1	4.3	3.1–26.4	13.4	2.6	9.5–18.1	0.067
Mes root length	14.2	3.4	9.6–20.7	17.6	3.4	10.2–25.1	0.012
Index 1	2.68			1.76			0.004
Index 2	1.22			0.74			0.024

Figure 3: Short mesocolon height of a thirty two year old female. The height was 3cm, the lowest recorded mesocolic parameter



SC = Sigmoid colon; SMes = Sigmoid mesocolon

Figure 4a: Volvulus of the sigmoid colon in a fifty two year old male

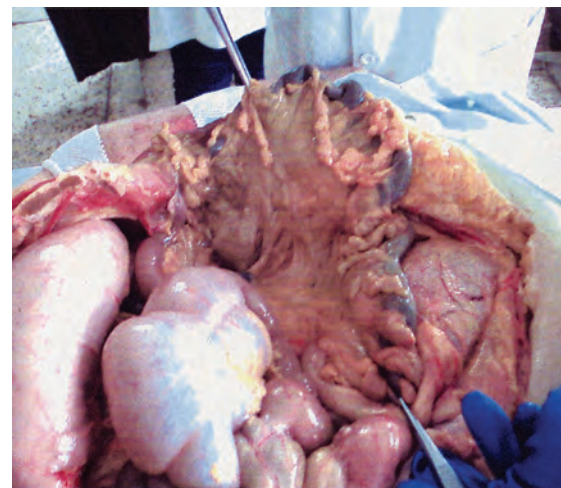
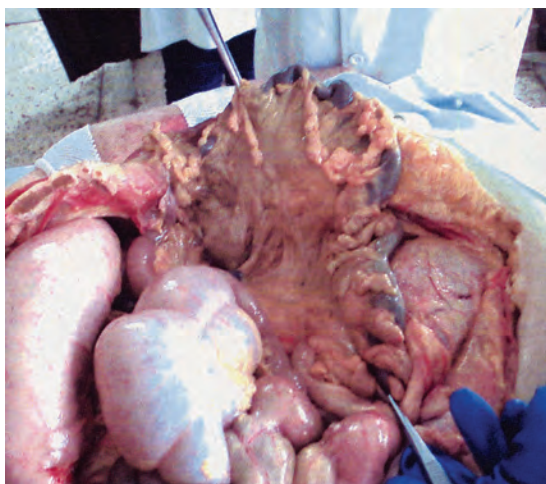


Figure 4b: The uncoiled sigmoid loop measured 46cm



Discussion

Observations of the present study indicate significantly longer sigmoid loops for males than females. These findings support and extend those of previous reports in other populations. Ertem (1995) reported a mean sigmoid colon length of 38.9cm for adult males and 34.2cm for adult females in Turkey (3). Bhatnagar *et al* (1) described a gender difference in mean length of the human sigmoid colon in adult Indians. The study by Bhatnagar *et al* used fifty one live subjects and reported a much longer loop for the population (46.5cm males, 36.8cm females) than we have reported in this study. Presumably, the discrepancy was occasioned by post-fixation shrinkage of the sigmoid in our subjects. Unsurprisingly, in their subgroup of

16 fixed cadavers in the same article, Bhatnagar *et al* report average loop lengths of 26.5cm for males and 36.5 cm for females.

Population studies have shown that sigmoid volvulus is more common in males than in females (1,3) implicating a morphometric basis in the susceptibility to this pathology. The longer sigmoid loop in males may be the anatomic factor. Morphometric dimensions of the sigmoid mesocolon studied here also showed significant gender difference. The root length was 14.3cm for males and 18.4cm for females (average, 16.0cm) (P = 0.012). Previous studies suggest that individuals with a long sigmoid colon length and short mesocolon root length are more susceptible to volvulus (1). From indices calculated in this study, taking account of these colon and mesocolon dimensions, index 1 was 2.68 for males and 1.76 for females while index 2 was 1.22 for males and 0.74 for females.

Both indices indicated that males in the studied population are more prone to volvulus formation than females. The current results therefore extend the observation that the sigmoid mesocolon in the male is dolichomesocolic (longer than wide), whereas the female mesocolon is brachymesocolic (wider than long) (1). Accordingly, the narrower mesocolic root and a longer vertical length of the mesocolon make the male sigmoid colon more prone to volvulus (3).

In conclusion the adult male sigmoid colon is longer in males than in females with a shorter

root length. This pattern, added to a longer mesocolic height forms the anatomical basis for higher prevalence of sigmoid volvulus in males in Africa.

References

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