Colonoscopy aided by magnetic 3D imaging
Are there important differences between male and female patients?

[1]Bell GD, [2]Rowland RS, [3]Dogramadzi S, [3]Allen C

[1]Faculty of Medical Sciences, Sunderland University, [2]RMR Systems Limited, Kirton, Suffolk, [3]Dept of Electrical and Electronic Engineering, Newcastle University

Introduction

Endoscopic examination of the colon tends to be more difficult in women than men (Marshall 1996, Saunders et al., 1996) and, in the case of flexible sigmoidoscopy, the mean insertion depth is less and the pain rating significantly greater in women (Maule 1994).

Our group have been using a non-radiological method for real time 3D imaging of the endoscope around the colon for the last 6 years (Bladen et al., 1993). Recent improvements to the system include the facility to measure the length of any segment of the colonoscope as it is passed around the bowel (Rowland and Bell 1998, Rowland et al., 1999).

We were interested to see if we could confirm the barium enema studies of Sadahiro et al., 1992 and Saunders et al., 1996 showing that women tend to have longer colons than men and that most of this difference could be explained by the fact that the female transverse colon was on average about 8 cm longer.

Methods and patient groups studied

All 232 total colonoscopies were carried out by one experienced endoscopist (GDB) with the aid of the Bladen magnetic imaging system. There were 156 patients in Group I (76 male and 80 female), endoscoped *without* the aid of a stiffening overtube and 77 patients in Group II (40 male and 37 female) in whom an overtube *was* used to splint the sigmoid colon.

The formation of any loops in the sigmoid colon was noted once 50 cm of endoscope had been inserted and the position of the colonoscope tip was given an arbitrary score of 1 point - sigmoid colon, 2 points - sigmoid/descending colon junction, 3 points - mid descending colon, 4 points - splenic flexure and 5 points if in the transverse colon.

Once the tip of the instrument was at the splenic flexure, the instrument was shortened before passing the endoscope across the transverse colon. The time taken to pass the colonoscope from splenic flexure to just beyond hepatic flexure was recorded.

Results

There was no statistically significant difference between male and female patients in the length of colonoscope inserted into the rectum, sigmoid colon or descending colon to reach the splenic flexure (see

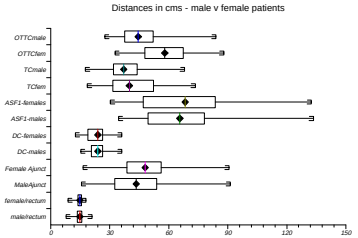


Figure 1 - Male / female differences - Box and Whisker plot of Median lengths/distances (cm) measured along the colonoscope of 1) rectum, 2) anus to sigmoid/descending colon junction (Ajunct), 3) descending colon (DC), 4) anus to splenic flexure when colonoscope first reaches splenic flexure (ASF-1), 5) splenic flexure to hepatic flexure as indicator of length of transverse colon (TC) in Group I patients and 6) the same measurements made in Group II patients with an overtube inserted to splint the left side of colon (OTTC).

Figure 1). Female patients tended to have longer transverse colons than male patients (Figure 2 and Table 1). In Group II patients, the difference between the sexes was more dramatic with a mean of 57.5(14.1) cm for women compared with 47.1(13.9) cm for men (Mann-Whitney U test, p = 0.0009).

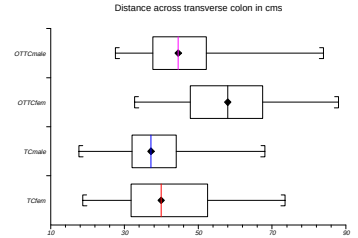


Figure 2 - Male / female differences in length of transverse colon (cm) - effect of using an overtube -

Group I = no overtube employed to splint left side of colon -TCmale for male patients and TCfem for females

GroupII = overtube employed to splint left side of colon - OTTCmale for male patients and OTTCfem for females

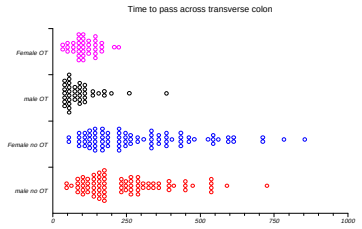
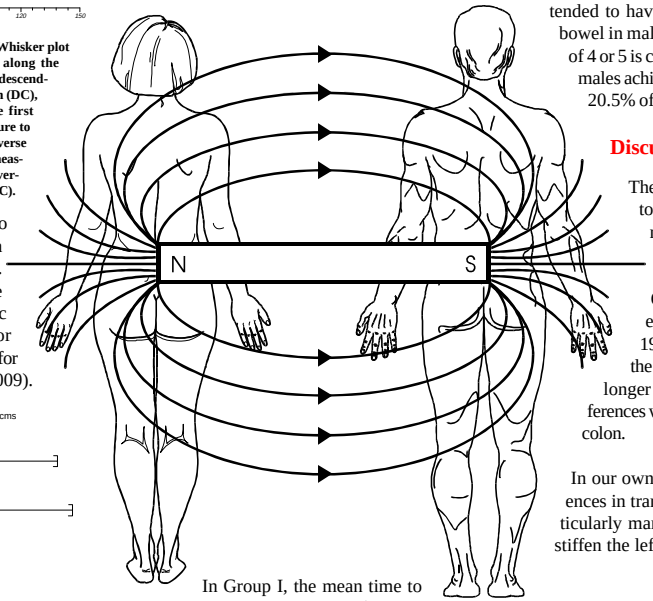


Figure 3 - Time in seconds to pass the colonoscope from splenic flexure to just beyond hepatic flexure. Individual data points in male and female patients with and without a stiffening overtube to splint the left side of the colon



In Group I, the mean time to traverse the transverse colon from the splenic flexure to the hepatic flexure was 254.1 seconds for males and 307.4 seconds for females (Mann-Whitney U test, P = 0.0999). In Group II patients, the mean time for males was 102.7 seconds and for females 116.5 seconds (Mann-Whitney U test, p = 0.0302) (see Figure 3).
As can be seen from Table 2a, there was a tendency

	Group I – Transverse colon		Group II (OT) – Transverse colon	
	Females	*Males*	*Females*	*Males*
Mean	41.0	38.5	57.5	47.1
SD	13.6	11.1	14.1	13.9
Lower 95% CL	37.7	35.9	52.8	42.5
Upper 95% CL	44.3	41.1	62.2	51.6
Maximum	73.5	67.9	88.0	83.9
Minimum	39.9	37.2	57.9	44.5
Median	39.9	37.2	57.9	44.5

Table 1 - Length of transverse colon - differences between males and females and effect of using an overtube to splint the left side of colon

for male patients to be less prone to pelvic loop formation than females. In addition, the endoscopist tended to have progressed further around the bowel in male than female patients. If a score of 4 or 5 is compared then 40/116 or 34.5% of males achieved this point but only 24/117 or 20.5% of females (p = 0.0137).

Discussion

These observations may, in part, help to explain why endoscopic examinations of the large intestine are more difficult in women.

Our results confirmed the barium enema findings of Sadahiro et al., 1992 and Saunders et al., 1996 that the female colon tended to be slightly longer than the male and that these differences were most marked in the transverse colon.

In our own study, the male / female differences in transverse colonic length were particularly marked if an overtube was used to stiffen the left side of the colon. Furthermore

	Females	*Males*
no loop	18	30
N-loop	34	36
Sigmoid loop	47	33
Alpha loop	18	16

Table 2a - Formation of loops when 50cm of colonoscope inserted *(One patient with a persistent descending mesocolon excluded)*

the time taken to pass the colonoscope across the transverse colon tended to be slightly longer in women than men.

In the present study (Table 2a) pelvic loops tended to occur significantly more frequently in female patients (p<0.05). As can be seen from Table 2b, when 50 cm of endoscope had been inserted, the mean score

Score		*Females*	*Males*
1	*In sigmoid colon*	21	20
2	*At sigmoid / descending colon junction*	42	27
3	*Mid descending colon*	30	29
4	*At splenic flexure*	5	13
5	*In transverse colon*	19	27

Table 2b - Position of the endoscope tip when 50cm of colonoscope inserted

in terms of position tip was significantly better in men than women with 34.5% of males but only 20.5 % of women getting a score of 4 or 5 (p = 0.0137).

Acknowledgements

The authors wish to thank the endoscopy nursing staff of the Royal Sunderland Hospital for their help in conducting this study.

References

Bladen JS, Anderson AP, Bell GD, Rameh B and Evans B. (1993): 'Non-radiological technique for three dimensional imaging of intestinal endoscopes,' Lancet, 341:719-22.

Marshall JB. (1996): 'Use of a pediatric colonoscope improves the success of total colonoscopy in selected adult patients' Gastrointest Endosc, 44:675-8.

Maule WF. (1994): 'Screening for colorectal cancer by nurse endoscopists.' N Engl J Med, 330:183-7.

Rowland RS, Bell GD. (1998): 'Non-radiological technique for 3D imaging of intestinal endoscopes : computerised graphical 3D representation of endoscope and skeleton' Med. Biol. Eng. Comput.,36:285-290.

Rowland RS, Bell GD, Dogramadzi S, Allen C. (1999): 'Validation of a 3D computerised method for accurately measuring insertion depth of different sections of the colon during flexible endoscopy' Gut Abstract T85. In press.

Sadahiro S, Ohmura T, Yamada Y. (1992) : 'Analysis of length and surface area of each segment of the large intestine according to age, sex, and physique' Surg Radiol Anat, 14:251-7.

Saunders BP, Fukumoto M et al (1996) : 'Why is colonoscopy more difficult in women ?', Gastrointest Endosc, 43:124-126.

Abstract TH568 presented at the British Society of Gastroenterology Annual Meeting 1999, 23-25th March, Glasgow