ANATOMICAL DISTRIBUTION OF DIVERTICULA OF THE LARGE INTESTINE

MARIE T. PODESTA

and

J.L. PACE

Department of Anatomy,
Royal University of Malta

Introduction

The anatomical distribution of diverticula of the large intestine as reported by different authors varies widely. This may be due to several factors, including the geographical since the right colon is much more often involved in Orientals than in Europeans (Peck *et al.*, 1968). The methods of investigations used by different authors (viz. surgery, radiology, necropsy) involve population selection and so influence rresults. Thus surgery is undertaken for symptomatic or complicated cases only and small diverticula scattered throughout the colon are liable to be missed at operation. Barium investigations are usually undertaken because of alimentary symptoms and may not give a true picture of the distribution of diverticula due to inadequate filling by barium. Necropsy studies include older subjects but allow direct examination both of mucosal and serosal colonic surfaces and are probably the most reliable method of study of the anatomical distribution of diverticula. Furthermore, the number and age of the patients studied varies with the different investigations; the greater the number of patients surveyed the more reliable is the investigation, while the average age of the patients investigated is also important since diverticula of the right colon occur in a younger age group.

Materials and Methods

The literature on the anatomical distribution of diverticula of the large intestine was reviewed and compared with the findings obtained from a survey of 5094 barium investigations carried out in the period 1967-1972. Of 310 patients with colonic diverticula the anatomical distribution of the diverticula was studied in 259.

Observations

In the present survey, diverticula were found to involve predominantly the left colon (98.4%). Involvement of the right colon was uncommon (18.9%) and generally occurred as part of more extensive involvement (18.1). The commonest regions affected were the sigmoid only (48%), the sigmoid with the descending colon (24.4%) and the descending colon (13%). The sigmoid was involved alone or in combination with other regions in 84% of cases. The average age of patients with extensive involvement was 62.6 years, while that of patients with diverticula limited to the sigmoid or sigmoid and descending colon was 61.1 years. Patients with few diverticula were on an average significantly younger (60.5 years) than patients with many diverticula (64.6 years).

Discussion

There is general agreement that diverticula occur most frequently in the sigmoid colon whilst involvement of the adjacent rectum is extremely rare (Table 1). The sigmoid may be involved alone or in combination with other regions, usually the descending colon (Table 2). Some investigators state that diverticular disease involving initially the sigmoid region may spread proximally until sometimes the entire large intestine and even the rectum may be affected (Horner, 1958; Painter, 1968). Others maintain that the progress of the disease is usually limited to the segments affected initially because patients with extensive involvement are younger than patients with disease localised to the lower colon (Parks, 1969). In our survey the average age of patients with extensive involvement was not significantly different from that of patients with diverticula limited to the lower colon.

It has been previously observed and this has been confirmed in our series that there is much variation in the distribution of diverticula along the colon. Thus diverticula may be limited to the transverse colon or to peculiar combination of sites (eg. sigmoid with ascending colon) with the intervening area free from disease.

The right colon is infrequently affected by diverticular disease: its involvement may be manifested as part of more extensive diverticular disease, as localised diverticular disease or as a solitary diverticulum. In our survey the former type of involvement was by far the commonest.

The number of diverticula appears to increase with the passage of time, since patients with many diverticula are, on average, older than those with few diverticula (Parks, 1969). This was confirmed in our own study since patients with few diverticula were appreciably younger than those with many. Right-sided diverticula occur at an earlier age than the more common left-sided form and are equally distributed between the sexes (Anderson, 1947). We found that the distribution of right-sided diverticula was equal in both sexes.

Table I

Anatomical site of Diverticula (in percentages)

Author		No. in Series	Rectum	Sigmoid Colon	Descending Colon	Transverse Colon	Ascending Colon	Caecum
Goodwin & Collins	(1948)	726	0	90	47.9	16.5	7.6	1.3
Mayo & Blunt	(1950)	202	0	98	0.5	0.5	0	1
Horner	(1952)	364	0	91.5	48	16.5	11.8	4.1
Case & Shea	(1953)	431	4	75	8	7	5	1.7
Lloyd Williams	(1960)	300	0	80	31.7	13.3	9.7	4.7
Maratka et al.	(1965)	90		64.7	19.8	6.9	6.0	2.6
Present Survey	(1972)	259	1.1	84	46	7.3	7.3	1.9

Table II

Location of Diverticula (in percentages)

Author		No. in Series	Sigmoid	Sigmoid and Desc. Colon	Sigmoid not involved	R. Colon only	Whole Colon
McGrath	(1912)	27	74	0	22.1	–	0
Rankin & Brown	(1930)	111	29	–	3	–	–
Ochsner & Bargen	(1935)	208	47	19	6.25	3.8	11
Willard & Bockus	(1936)	72	39	–	–	5.5	5.5
Brown & Marcley	(1937)	518	56	24	2.5	–	8
Horner	(1952)	364	47.9	29.6	8.5	–	2.7
Horner	(1958)	503	47	33	5	–	1
Brassinne et al.	(1960)	86	51	18.6	25.4	11.6	4.6
Slack	(1962)	26	88	4	0	–	–
Torsoli et al.	(1966)	152	34	–	16	–	–
Molteni	(1967)	154	–	–	–	4	6
Parks	(1968)	111	44	27	6.3	2.7	5.4
Hughes	(1969)	90	40	30	7	5	16
Parks	(1969)	461	65.5	18	4	0	6.8
Tagart	(1969)	98	78.6	16.3	2	1	3
Painter et al.	(1972)	70	44.3	34.3	8.6	1.4	5.7
Present Survey	(1972)	259	48	24.4	16	0.8	0

The sigmoid colon is the site of election for diverticula because its specialised function is to hold up the faecal stream by segmentation. A deficiency of dietary fibres alters the viscosity and speed of transit of the stools and may cause the sigmoid to segment excessively (Painter, 1969). Thickening of both longitudinal and circular layers of muscle occurs and appears to precede the development of diverticula (Morson, 1963). The circular muscle and mucosa are thrown into ridges which surround and narrow the lumen like incomplete sphincters (Painter, 1968) causing obstruction to outflow and producing zones of high pressure by contraction of the muscle wall in the segmented region; the pulsion force generated drives the mucosa through the inner segmental wall (Painter and Truelove, 1964). In diverticular disease limited to the right colon, hypertrophy of the colonic musculature has not been observed (Peck et al., 1968).

Weak areas in the colon wall are exploited. The circular muscle coat is fasciculated and diverticula are usually situated between the muscular fascicles in the parts of the colonic wall not strengthened by the taeniae. The relation of diverticula to the blood vessels has been much disputed. According to Fleischner et al. (1964) arteriography shows that the relation of the diverticula to the penetrating vessels is inconstant; this was confirmed by Noer's studies (1955). In contrast, Edwards (1954) related the site of the diverticula to the point of entry of the blood vessels, and Slack (1962), studying the location of sigmoidal diverticula reached a comparable conclusion. He observed that sigmoidal diverticula occur principally in 4 rows on both sides of the mesenteric taenia, though smaller diverticula are occasionally present between the 2 antimesenteric taeniae.

The clinical manifestations and complications of diverticular disease of the colon are intimately related to the anatomical distribution of the diverticula — thus, pain is usually referred to the left lower quadrant, haemorrhage, if it occurs, is often massive due to the close relation of diverticula to large blood vessels (Nigro, 1966), and the disease in the caecum and ascending colon often mimics acute appendicitis;

fistulae open into neighbouring organs, usually the bladder.

Conclusion

The literature on the anatomical distribution of diverticula in the large intestine has been reviewed and compared with the findings from a survey of 259 barium investigations in which diverticula were present. Though there is general agreement that the commonest sites of involvement are the sigmoid and descending colon the anatomical distribution of diverticula as reported by various authors shows considerable variations; possible reasons for these variations are mentioned. The relation of the age of the patient to the extent of involvement and to the number of diverticula and the age and sex differences between patients with right sided and those with left sided colonic diverticula are discussed.

References

ANDERSON, L. (1967). *Surgery, 22,* 479.

BRASSINNE, A., RUYTERS, L. & NAOME, J. (1960). *Acta gastro-ent. belg., 23,,* 828.

BROWN, P.W. & MARCLEY, D.M. (1937). *J. Amer. med. Ass., 109,* 1328.

CASE, T.C. & SHEA, C.E., Jr. (1953). *Amer. J. Surg., 92,* 616.

EDWARDS, H.C. (1954). *Ann. roy. Coll. Surg. Engl., 14,* 371.

FLEISCHNER, F.G., SI-CHUN MING & HENKEN, E.M. (1964). *Radiology, 83,* 859.

GOODWIN, F.H. & COLLINS, E.N. (1948). *Cleveland Clin. Quart., 15,* 194.

HORNER, J.L. (1952). *Gastroenterology, 21,* 223.

HORNER, J.L. (1958). *Amer. J. dig. dis., 3,* 343.

HUGHES, L.E. (1969). *Gut, 10,* 336.

LLOYD WILLIAMS, K. (1960). *Brit. J. Surg., 47,* 351.

MARATKA, Z., ROUBKOVA, H. & KOCIANOVA, J. (1965). *16th Congress of the Italian Society of Gastroenterology, Bologna,* 916.

MAYO, C.W. & BLUNT, C.P. (1950). *Surg. Clin. N. Amer., 30,* 1005.

McGRATH, B.F. (1912). *Surg. Gynec. Obstet., 15,* 429.

MOLTENI, F., PEDRONI, G., CARESANO, A., SCOTTI-FOGLIENI, C. & DE SANTIS. L.A. (1967). *Chir. Ital., 19,* 209.

MORSON, B.C. (1963). *Brit. J. Radiol., 36,* 385.

NIGRO, N.D. (1966). *Sth. med. J., 59,* 1019.

NOER. R.J. (1955). *Ann. Surg., 141,* 674.

OCHSNER, H.B. & BARGEN, J.A. (1935). *Ann. Intern. Med., 9,* 282.

PAINTER, N.S., & TRUELOVE, S.C. (1964). *Gut. 5,* 201.

PAINTER, N.S. (1968). *Brit. med. J., 3,* 475.

PAINTER, N.S. (1969). *Lancet, 2,* 586.

PAINTER, N.S., ALMEIDA, A.Z. & COLE-BOURNE, K.W. (1972). *Brit. med. J., 2,* 137.

PARKS, T.G. (1968). *Proc. roy. Soc. Med., 61,* 932.

PARKS, T.G. (1969). *Brit. med. J., 4,* 639.

PECK, D.A., LABAT, R. & WAITE, V.C. (1968). *Dis. Colon Rect., 2,* 49.

RANKIN, F.W. & BROWN, P.W. (1930). *Surg. Gynec. Obstet., 50,* 836.

SLACK, W.W. (1962). *Brit. J. Surg., 50,* 185.

TAGART,, R.E.B. (1969). *Brit. J. Surg. 56,* 417.

TORSOLI, A., ALESSANDRINI, A., RAMORINO, M.L., AMORUSO, R., ARULLANI, P. & CASSANO, C.C. (1966). *Arch. ital. Mal. Appar. dig., 33,* 202.

WILLARD, J.H. & BOCKUS, H.L. (1936). *Amer. J. dig. Dis., 3,* 580.