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The Changing Trend of Diverticular Disease in a Developing Nation

Authors and Highest Qualifications:

Sau Shung, FONG, MMED (Surg)
Registrar
Tan Tock Seng Hospital

Ern Yu, TAN, MMED (Surg)
Registrar
Tan Tock Seng Hospital

Angel, FOO
Staff Nurse
Tan Tock Seng Hospital

Richard, SIM, FRCS (Edin) (Glasg)
Head, Colorectal Service
Tan Tock Seng Hospital

Denis Mun Onn, CHEONG, FRCS (Glasg)
Senior Consultant
Tan Tock Seng Hospital

All Authors Address:

Tan Tock Seng Hospital
Dept of General Surgery,

No 11 Jalan Tan Tock Seng,
Singapore 308433

Correspondence Author:

Sau Shung, FONG

Tel: +65 94742292 (mobile); +65 63577807 (work)
Fax: +65 63577809
E-mail: fongss@gmail.com

Abstract

Aim: Left sided diverticular disease (LDD) is associated with reduced dietary intake, while right sided diverticular disease (RDD) is more common amongst Oriental populations. We aimed to determine whether the prevalence, site and distribution of diverticular disease in our Oriental population has changed over the past two decades.

Methods: A total of 1663 barium enema studies done between January 2001 to August 2002 were reviewed retrospectively. The site of disease was correlated with age, gender and ethnicity of the patient.

Results: 45% of patients in the study population had diverticular disease. Older patients were more likely to have LDD while the Chinese ethnic group was more likely to have RDD. RDD peaks at in the 6th decade while for LDD this occurred in the 7th and 8th decades. RDD was more common in all age groups overall. When compared to two

barium enema studies carried out in Singapore two decades earlier, there was a statistically significant increase in the incidence of RDD and LDD.

Conclusion: There is a positive association of RDD and LDD with Chinese race and increasing age. There is an increasing incidence of both LDD and RDD compared with two decades previously.

Introduction

Previous studies done in the 1980s have shown a preponderance of right-sided diverticular disease (RDD) in Asian populations[1,2,3]. Growing affluence and globalization have resulted in marked lifestyle changes in Singapore's population reflected in a rise in cardiovascular disease, obesity and colorectal carcinoma now similar to Western populations[4]. There is a strong correlation between diet and the development of colonic diverticular disease, and we set out to see if there has been any corresponding impact on the incidence of diverticular disease in our population over the past two decades. The aim of our study was to investigate the incidence, site and distribution of diverticular disease in Singapore and to compare this with previous studies.

Materials and Methods

We examined the findings of all double contrast barium enemas performed in our institution (Tan Tock Seng Hospital) over a 20 month period from January 2001 to

August 2002. Incomplete studies where the patient was unable to tolerate the instillation of barium or when the study was terminated without the caecum being adequately visualised were excluded. Data included the patient's age, gender and ethnicity were collected from the clinical records.

Right Diverticular Disease (RDD) was defined as barium enema evidence of diverticula in the caecum and / or ascending colon with or without involvement of the rest of the colon. Left Diverticular Disease (LDD) was defined as diverticula in the sigmoid colon and / or descending colon with or without involvement of the rest of the colon. Pan-colonic diverticular disease (PCDD) was defined as the presence of diverticula in the right, transverse and left sections of the colon.

The specific sites of diverticula demonstrated on the barium enema were recorded and entered onto a computerised database. Correlation between distribution of diverticular disease and age, gender and ethnicity was analyzed using the Chi Square test and ANOVA as appropriate (GraphPadPrism Version 4.0, SPSS version 16.0). A p value of less than 0.05 was considered statistically significant.

Results

A total of 1698 barium enema studies were performed during this period, of which 1663 were suitable for inclusion in this study. Thirty-five incomplete barium enema examinations were excluded in accordance with the criteria stated above. The mean patient age was 59 years. The proportion of females to males was 53:47. The racial distribution was as follows: Chinese (84%,n=1399), Malay (6%), Indian (7%) and other ethnic groups(3%). The racial distribution in Singapore according to the 2000 Singapore census is 77.8% Chinese, 14% Malays, 7.1% Indian and 1.1% of other races. Therefore there was a significantly higher proportion of Chinese in our study population compared with the 2000 Singapore census[5] ($p<0.05$ one tailed, CI 0.0971 – 0.1381). This reflects the referral pattern of the population serviced by our hospital where the Malay ethnic group is under-represented.

Diverticular disease was demonstrated on barium enema in 45% (751 of 1663) of the patients evaluated. Of the 751, 79.5% (597 of 751) were found to have RDD. Of these, 169 patients had concomitant LDD. LDD was found in a total of 297 (40%) patients (Table 1). There was a greater proportion of RDD compared with LDD (35.9% vs 17.9%). Eight percent (63 of 751) of patients were found to have pancolonic diverticular disease (PCDD). Patients with PCDD were significantly older (mean age 69.years versus 62 years, $p<0.05$).

There was a significantly higher incidence of RDD in the Chinese ethnic group compared with the non-Chinese population (37.8% versus 25.8%, $p<0.05$). For LDD,

there was no difference in incidence between the Chinese and the non-Chinese studied (17.7% versus 18.6%). There was no difference in the incidence of PCDD between all races (Chi-square, p=0.491), or between Chinese and non-Chinese (Fisher's exact test, p=0.350, one tailed).

Patients with diverticular disease were also older than those without colonic diverticula, (mean age 63 years vs 56 years ($P < 0.05$; Table 2). There was no gender bias. The location of diverticular disease found in patients also appeared to be related to age. Individuals with isolated RDD were significantly younger than those with isolated LDD (61.2 versus 67.1, $p < 0.05$). The incidence of RDD was 19% in patients less than 40 years whereas the incidence of LDD was only 3.7% in this age group. RDD increased with each subsequent decade of life to reach a peak of 44.4% in patients in their sixties. ($p<0.05$, figure 1A). The incidence of LDD however only begins to show a marked rise in individuals above the age of 50 and continues to increase into the 8^{th} decade. ($p<0.05$, figure 1B).

A multivariate analysis of the patients' age, gender and race indicated that age was the only significant variable for LDD (but not RDD). Taking the Chinese separately from the other races in Singapore, there was a significant variable for RDD but not LDD. No variable was significant for the development of PCDD (Table 3)

Discussion

The distribution pattern of diverticulosis differs significantly between Western and Oriental populations. While sigmoid diverticular disease predominates in Western populations, the right colon is most commonly involved in Asians[1,2,3,6,7,8,9,]. Our results were consistent with these observations. It had also been postulated that Right Colonic Diverticulosis is congenital, which is unlike the development of sigmoid diverticular disease thought to be acquired as a result of raised intraluminal pressure within the colon[10] attributable to inadequate dietary fibre intake[11,12,13,14,15].

In this study, we found a distinct racial link to the occurrence of RDD. Ethnic Chinese in our population had a statistically higher chance of having RDD, compared with the other ethnic groups. On the other hand, all ethnic groups appeared to be equally susceptible to LDD. This concurs with the general literature, that Asians, specifically the ethnic Chinese, have a hereditary predisposition in the development of RDD.

We could not control for the specific racial mix seen in our hospital, which resulted in a higher proportion of Chinese patients and lower proportion of Malays. This low proportion of Malays most likely reflects the referral pattern to our hospital, but may possibly be due to reticence in seeking medical attention among the Malay population, a trait that has been observed in other studies in Singapore[16].

It is difficult to ascertain the true prevalence of diverticular disease in the general population, given that most will remain asymptomatic and may not present for colonic evaluation. It is also possible that the changing preference for colonoscopy in lower gastro-intestinal tract evaluation presents a systematic bias. Even though colonoscopy is now increasingly used in Singapore to evaluate patients with bowel symptoms, barium enema studies were commonly utilized during the period of study and were the more sensitive modality for the diagnosis of diverticular disease[2,3]. Short of performing an autopsy study, we believe that we can best determine the trend of development of diverticular disease in our population by comparing the results of the present barium enema studies with those performed in the past.

It is revealing to compare the findings of our study with two similar studies performed 20 years ago to evaluate the changing trend of diverticular disease in Singapore (Table 4). Yap et al[3] looked at 361 unselected barium enemas performed in a tertiary Singapore hospital between 1988 and 1989. They found that the proportion of RDD was 20% and that of LDD was 4%. These findings were very similar to that of Chia et al[2], who, from 1987-1988, evaluated 524 consecutive barium enemas done in a different tertiary hospital in Singapore. In this study, the proportion of RDD was 14% and that of LDD, 4%.

It is also interesting to compare the above results with an autopsy study performed by Lee et al[6] which was done at approximately the same time (1985). The proportion of

RDD was 15% and LDD 3%. We may expect the barium enema studies performed at the same time (by Chia and Yap et al) to over-represent the incidence of diverticular disease due to selection bias. However, a Chi-square comparison between the autopsy study by Lee et al and the barium enema studies by Chia and Yap et al did not demonstrate a significant difference for RDD or LDD ($p>0.05$), indicating that the barium enema studies performed in the late 1980s is not an unreasonable approximation to the prevalence of diverticulosis in the population.

When the barium enema studies performed in the late 1980s are compared with the current study (Table 4), one striking finding of was the considerably higher proportion of diverticular disease (45% of the population studied) in 2001. This is almost double that of 19 to 24% as previously reported in the barium enema studies by Chia and Yap[1,2]. The higher incidence of colonic diverticula was contributed to by statistically significant increases in both RDD and LDD disease. The mean age of our study population was slightly older (59.1 versus 53.3, which probably reflects the improving health care and ageing population in Singapore, but that alone should not account for the marked difference.

Singapore is an island state and is the most highly developed nation in South east Asia. It has undergone rapid growth and changes since achieving its independence in 1965. It has one of the lowest infant mortality rates in the world (CIA worldbook 2007) and has consistently achieved more than 7% year on year growth for the past two decades.

According to the Gross Domestic Product *per capita* and the purchasing power parity, it ranks number 8 of 225 nations (CIA worldbook 2007). As a result of these lifestyle and dietary changes, Singaporeans are increasingly plagued with obesity, cardiovascular disease and colorectal cancer[4]. With the increasing life expectancy, the Singapore population is also noted to be ageing[17]. Being a relatively uniform environment on the forefront of development in South East Asia, Singapore offers an ideal model to study the impact of affluence and urbanization on other Asian populations.

We postulate that the marked increase in colonic diverticulosis seen in our study is the impact of increasing affluence in Singapore over the past 20 years consequent on a change in lifestyle and an associated ageing population. Because of the racial predisposition of the Majority population in Singapore (predominantly Chinese) there is a marked increased development of RDD affecting individuals in their 40s. These same drivers for the development of diverticulosis continue to impact on the population as it ages leading to increased LDD amongst patients in their 7^{th} and 8^{th} decades.

In conclusion, our results show a positive association of RDD with the Chinese race and of LDD with increasing age. There is also a significant increase in the proportion of both RDD and LDD over the two decades between the late 1980s and our paper based on data in 2001. This rising trend may be related to increasing affluence in the country. As other Oriental populations benefit from economic development and suffer from an

ageing population, we may see the same trends occur, that is of a rising incidence of diverticulosis affecting both the right and left colon.

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Table 1. Distribution of diverticular disease by location.

Location of Diverticulosis	Frequency	Percent
Right sided only	428	57.0
Left sided only	128	17.0
Right and left (includes pan-colonic)	169	22.5
Transverse only	26	3.5
Total	751	100.0
RDD (Right sided only + right and left)	597	79.0
LDD (Left sided only + right and left)	297	40.0

Right sided only refers to diverticulosis involving the caecum and/or ascending colon with or without transverse colon involvement, excluding cases which involve the sigmoid or descending colon; **Left sided only** refers to diverticulosis involving the descending colon and/or sigmoid colon with or without transverse colon involvement, excluding cases which involve the caecum or ascending colon; **Right and left** refers to pan-colonic diverticular disease or diverticular disease involving caecum, ascending colon, descending colon and sigmoid colon (all inclusive); **RDD** refers to caecum and/or ascending colon involvement regardless of involvement of any other part of the colon (ie, “right sided only” plus “right and left”); **LDD** refers to descending colon and/or sigmoid colon involvement regardless of involvement of any other part of the colon (ie. “left sided only” plus “right and left”)

Table 2. Presence of diverticular disease by patient age, sex and ethnic group (n = 1663).

	Diverticular disease present (n = 751)	**Diverticular disease absent (n = 912)**	
Mean patient age	63.0	56.0	p< 0.0001
Patient gender			
Male	393	484	
Female	358	428	
Ethnic group			
Chinese	647	752	46%
Malay	36	61	37%
Indian	46	69	40%
Others	22	30	42%

Tabe 3. Multivariate analysis of variables against the presence of RDD, LDD and PCDD. The variable ‘race’ compares Chinese versus non Chinese.

Multivariate Analysis

	Variable	**p-value**
RDD		
	Age	0.182
	Race	0.000*
	Gender	0.924
LDD		
	Age	0.000*
	Race	0.477
	Gender	0.353
PCDD		
	Age	0.090
	Race	0.177
	Gender	0.965

* indicates a p value of <0.05.

Table 4: Comparison of proportions with diverticular disease between the current paper and results from barium studies (Chia et al and Yap et al) and autopsy studies (Lee et al) performed two decades earlier.

	Current Paper **2001**	**Chia et al**Error! Bookmark not defined. **1987**	**Yap et al**Error! Bookmark not defined. **1988**	**Lee et al**Error! Bookmark not defined. **1985**
Mean Age	59.1	50.7	57	Not available
Proportion with Diverticular Disease	45% (751/1663)	20%* (105/524)	24%* (88/361)	19%* (194/1017)
Proportion with Left sided Diverticular Disease	18% (297/1663)	4%* (23/524)	4%* (16/361)	3%* (33/1017)
Proportion with Right sided Diverticular Disease	36% (597/1663)	14%* (73/524)	20%* (72/361)	15%* (151/1017)

* indicates a significant difference ($p<0.05$) between proportions of diverticular disease from previous studies compared to the current paper.

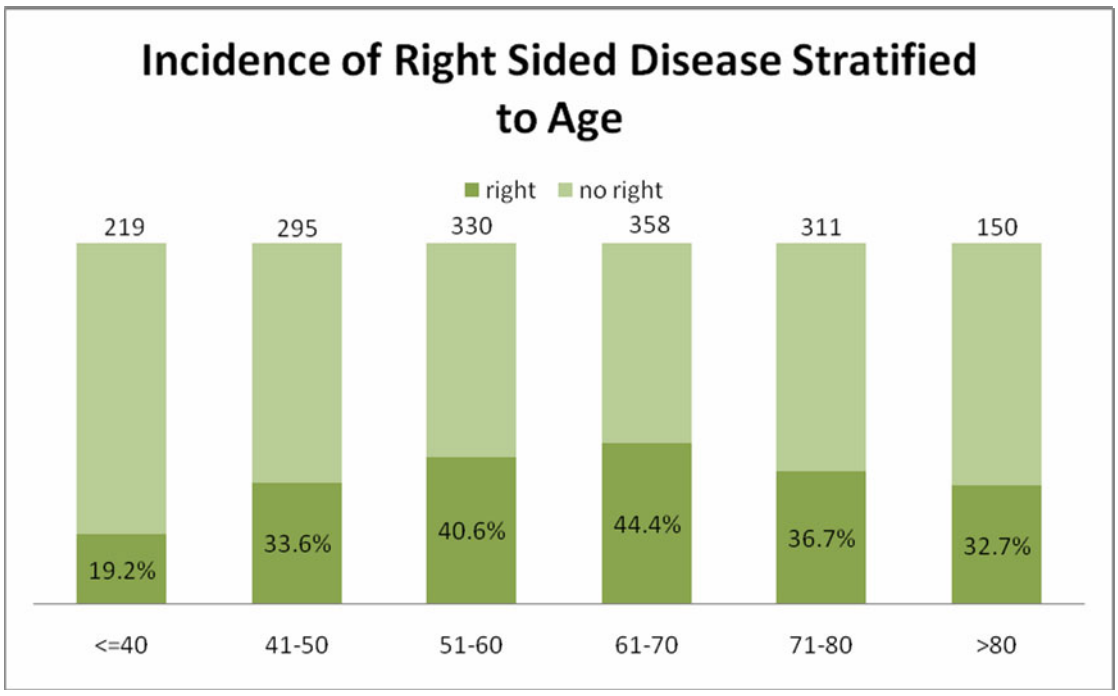

Figure 1A. Incidence of right sided disease stratified for age group. p<0.001.

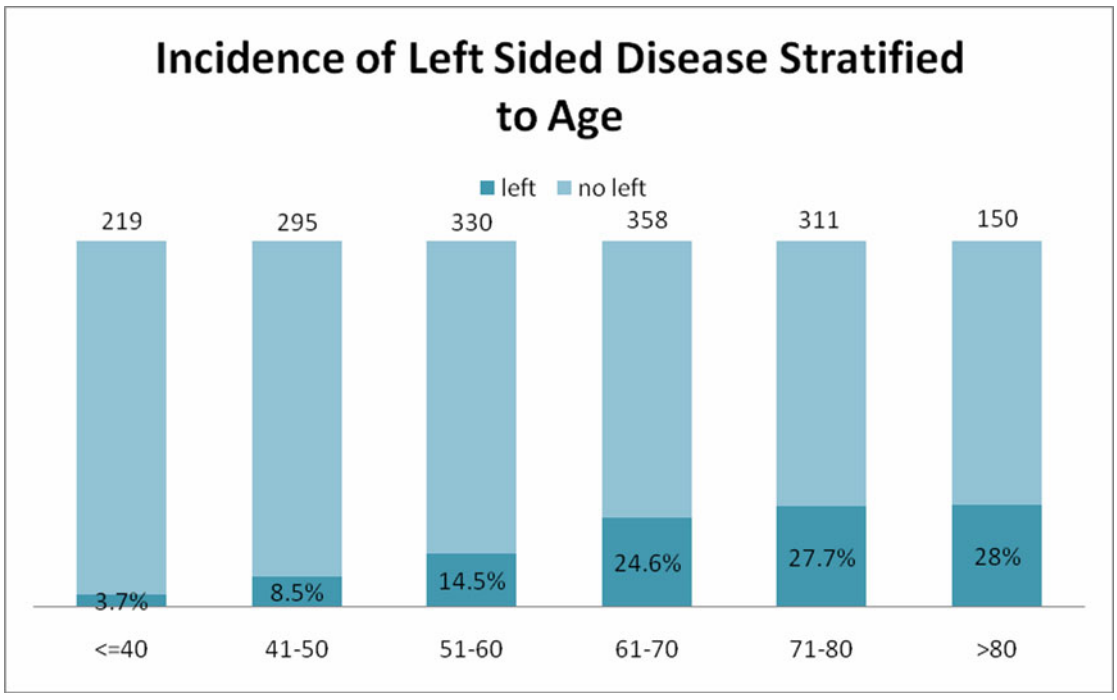

Figure 1B. Incidence of left sided disease stratified for age. p<0.001.