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**Pattern and distribution of colonic diverticulosis: Analysis of 2877 barium enema in Thailand**

**Lohsiriwat V** *et al.* Pattern of colonic diverticulosis in Thailand

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**Abstract**

**AIM:** To determine the pattern and distribution of colonic diverticulosis in Thai adults.

**METHODS:** A review of the computerized radiology database for double contrast barium enema (DCBE) in Thai adults was performed at the Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand. Incomplete studies and DCBE examinations performed in non-Thai individuals were excluded. The pattern and distribution of colonic diverticulosis detected during DCBE studies from June 2009 to October 2011 were determined. The occurrences of solitary cecal diverticulum, rectal diverticulum and giant diverticulum were reported. Factors influencing the presence of colonic diverticulosis were evaluated.

**RESULTS:** A total of suitable 2877 DCBE examinations were retrospectively reviewed. The mean age of patients was 59.8 ± 14.7 years. Of those, 1778 patients (61.8%) were female and 700 patients (24.3%) were asymptomatic. Colonic diverticulosis was demonstrated in 820 patients (28.5%). Right-sided diverticulosis (641 cases; 22.3%) was more frequently reported than left-sided diverticulosis (383 cases; 13.3%). Pancolonic diverticulosis was found in 98 cases (3.4%). The occurrence of solitary cecal diverticulum, rectal diverticulum and giant diverticulum were 1.5% (42 cases), 0.4% (12 cases, and 0.03% (1 case), respectively. There was no significant difference in the overall occurrence of colonic diverticulosis between male and female (28.3% *vs* 28.6%, *P* = 0.85). DCBE examinations performed in patients with some gastrointestinal symptoms revealed more occurrence of colonic diverticulosis than those performed in asymptomatic individuals (29.5% *vs* 25.3%, *P* = 0.03). The symptom of bowel habit change was strongly associated with the presence of diverticulosis (a relative risk of 1.39; *P* = 0.005). The presence of diverticulosis was not correlated with age in neither symptomatic patients nor asymptomatic individuals (*P* > 0.05).

**CONCLUSION:** Colonic diverticulosis was discovered in 28.5% of DCBE examinations in Thai adults. There was no association between the presence of diverticulosis and gender or age groups.

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**Key words**: Colonic diverticulosis; Diverticular disease; Barium enema; Pattern; Thailand; Cecal diverticulum; Rectal diverticulum; Giant diverticulum

**Core tip:** Based on this study in the largest university hospital in Thailand, colonic diverticulosis was discovered in 28.5% of double contrast barium enema performed in Thai adults. This occurrence was remarkably higher than that previously published from a hospital-based data of colonic diverticulosis in Thailand in 1980. This study also demonstrated that there was no significant association between the presence of diverticulosis and gender or age group. However, colonic diverticulosis was more commonly reported in patients with some gastrointestinal symptoms, especially those with the symptom of bowel habit change.

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**INTRODUCTION**

Colonic diverticulosis is a common gastrointestinal condition in which the large intestine contains outpouchings of the mucosa and submucosa through a weak area of the colon[1]. However, the actual prevalence of colonic diverticulosis is difficult to determine because most people with colonic diverticular are asymptomatic[2]. Double contrast barium enema (DCBE) is regarded as the investigation of choice for demonstrating the presence and extent of colonic diverticulosis[3,4]. It is evident that the prevalence and pattern of colonic diverticulosis differ among ethnic groups and individual’s lifestyles[5,6]; left-sided diverticulosis is most common in Western and developed countries, while right-sided diverticulosis is more prevalent in Asian and developing countries[4,7,8].

Although some data of colonic diverticulosis from Asian countries are available[6,9,10], the information on colonic diverticulosis in the region of Southeast Asia has been limited and outdated[11]. Since the characteristics of colonic diverticulosis has changed over times[12,13], this study therefore aimed to determine the pattern and distribution of colonic diverticulosis in Thai adults during the recent years.

**MATERIALS AND METHODS**

After obtaining approval from our Institutional Review Board (SIRB 634/2554), a review of the computerized radiology database for DCBE in Thai adults (defined as individuals with the age of ≥ 18 years) was performed at the Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand. All findings of colorectal lesions detected at DCBE from June 2009 to October 2011 were analyzed. Incomplete studies, e.g. patients were unable to hold barium or DCBE being performed in patients with colonic obstruction, were excluded. The barium studies in non-Thai individuals were also excluded. Written informed consent was given by all the patients before they underwent a fluoroscopic DCBE. Detailed techniques and interpretation of standard fluoroscopic DCBE performed in our institute were previously discussed[14]. Basically, DCBE demonstrated a diverticulum as a barium-fill outpouching of the colon that is joined to the colonic wall by a neck. The findings of DCBE were interpreted and reported by a staff gastrointestinal radiologist.

Patients’ characteristics, indication for DCBE, and anatomical distribution of colonic diverticula were analyzed. In this study, the colon was divided into 3 parts: the right-side colon (the cecum, the ascending colon, and the hepatic flexure of the colon), the transverse colon, and the left-sided colon (the splenic flexure of the colon, the descending colon, the sigmoid colon, and the rectum). Right colonic diverticulosis was defined as a diverticulum, or diverticula, detected on DCBE in the right-sided colon regardless of the involvement of the remaining colon. Left colonic diverticulosis was defined as a diverticulum, or diverticula, detected on DCBE in the left-sided colon regardless of the involvement of the remaining colon. The presence of diverticula in all the three colonic segments was defined as pancolonic diverticulosis. Of note, rectal diverticulum was defined as a diverticulum found below the imaginary line between the sacral promontory and the pubic symphysis on the lateral pelvic view of DCBE. A giant diverticulum was defined as a diverticulum demonstrated on DCBE with a diameter of ≥ 4 cm.

***Statistical analysis***

All data were prepared and compiled using the Statistical Package for the Social Sciences program version 11.3 for Windows (SPSS Inc, Chicago, IL). The prevalence and distribution of colonic diverticulosis detected at DCBE were analyzed with 95%CI Analysis for Windows (Statistics with Confidence, 2nd Edition, BMJ Books, London 2000). The Mann-Whitney *U* test was used to compare the prevalence of diverticulosis between gender, and between symptomatic patients and asymptomatic individuals. Of note, asymptomatic individuals were defined as those without any symptoms of gastrointestinal tract. Correlation between age groups and the presence of colonic diverticular disease was analyzed using a regression analysis. A *P*-value of less than 0.05 was considered statistically significant.

**RESULTS**

A total of suitable 2877 DCBE examinations were retrospectively reviewed. The mean age of patients was 59.8 ± 14.7 years (range 18-100 years). Of those, 1778 patients (61.8%) were female and 700 individuals (24.3%) were asymptomatic. Colonic diverticulosis was demonstrated on DCBE in 820 patients (28.5%). Right-sided diverticulosis (641 cases; 22.3%) was more frequently found than left-sided diverticulosis (383 cases; 13.3%). Pancolonic diverticulosis and solitary cecal diverticulum was found in 98 cases (3.4%) and 42 cases (1.5%), respectively (Table 1). Rectal diverticulum was seen in 12 cases (0.4%), and it was exclusively associated with the presence of sigmoid diverticulosis. A giant sigmoid diverticulum was demonstrated on DCBE in one case (0.03%). Figure 1 shows the distribution of diverticulosis stratified by colonic segment. Beside colonic diverticula, other major findings included 25 advanced adenoma (0.87%), 76 colorectal cancer (2.64%; 18 in the right-sided colon, 28 in the left-sided colon and 30 in the rectum), and 4 ileocecal Crohn’s disease (0.14%).

There was no significant difference in the occurrence of colonic diverticulosis between male and female (28.3% *vs* 28.6%, *P* = 0.85). However, DCBE examinations performed in patients with some gastrointestinal symptoms revealed more occurrence of colonic diverticulosis than those performed in asymptomatic individuals (29.5% *vs* 25.3%; *P* = 0.03). The symptom of bowel habit change was strongly associated with the presence of diverticulosis (RR = 1.39, 95%CI: 1.14-1.70, *P* = 0.005), whereas the symptom of abdominal pain, constipation and bleeding per rectum were at non-significant increased risk for colonic diverticulosis. The presence of diverticulosis was not significantly correlated with age in neither symptomatic patients (*P* = 0.62) nor asymptomatic persons (*P* = 0.52) (Figure 2).

**DISCUSSION**

In this study, colonic diverticulosis was discovered in nearly 30% of DCBE examinations performed in Thai adults. Right-sided diverticulosis was more frequently found than left-sided diverticulosis. Our findings of colonic diverticulosis remained consistent with other observations; in which right-sided colonic diverticulosis is most commonly involved in Asians whereas sigmoid diverticulosis predominates in Western population[6,7,15]. Compared with a previous hospital-based study of colonic diverticulosis in Bangkok Thailand in 1980s[11], the present study revealed a remarkably higher rate of such a condition but a similar proportion of disease in a relatively young individual. It is difficult to explain why there is a relatively high frequency of colonic diverticulosis in Thai young adults. It is possible that, apart from some differences in dietary intake and lifestyle, racial and genetic predisposition could play an important role in developing colonic diverticulosis[16]. Apparently, genetic influence on the development of diverticulosis in Asian population has a stronger impact than that in Western population, especially for right-sided colonic diverticulosis[17].

Moreover, we found no significant difference in the rate of colonic diverticulosis detected in DCBE between genders, which is consistent with several recent reviews of the literature[8,17,18]. Yet, there have been a few reports of an increased risk of colonic diverticulosis in male[19,20]. In addition, we cannot identify any significant correlation between the presence of diverticulosis and age group. Notably, the frequency of pancolonic diverticulosis in our study was 3.4%, which was fairly constant among different age groups. Contrary to these findings, many authors has repeatedly reported that the prevalence of diverticulosis increases with age[4,21,22]. An interesting study by Takano and colleagues also showed that diverticulosis progressed with time from the proximal colon to the distal colon[13]. Although the prevalence and extent of colonic diverticulosis is largely age-dependent, its widespread appearance in Asian population could be as early as in adolescence[20] with the peak prevalence at the age of 50-60 years[10]. This could be in part an explanation of our findings that we found a relatively high rate of colonic diverticulosis in fairly young age groups; therefore, we cannot identify a significant increment of colonic diverticulosis in advanced age groups.

Regarding cecal diverticulosis which is mostly of multiple lesions, we found 42 cases of solitary cecal diverticulum; accounting for 1.5% of all DCBE studied. Solitary cecal diverticulum is a fairly rare and asymptomatic lesion unless it becomes hemorrhagic or inflamed (mimicking of acute appendicitis). Its incidence in Asian population seems higher than that in Western population[10,23]. Also, we identified 12 cases (0.4%) of rectal diverticulum which was exclusively associated with the presence of sigmoid diverticulosis. The true incidence and pathogenesis of rectal diverticulum remain unknown since it is rarely reported[24]. As such lesions were present together with the diverticula of sigmoid colon, rectal and sigmoid diverticulosis might share the same pathogenesis.

More interestingly, we found a single 5-cm diverticulum at the sigmoid colon in a 51 year-old healthy male. The giant diverticulum was first described in 1946 and, so far, fewer than 200 cases have been reported in the literature[25,26]. It mainly affects sigmoid colon, and can be divided into 3 distinct histological types: true diverticulum, false diverticulum, and pseudo-diverticulum (scar tissue without any layer of colonic wall)[27]. Management of giant diverticulum depends on patient’s symptoms and underlying disease. Diverticulectomy or segment resection of affected colon is a favored choice of treatment in symptomatic patients.

Lastly, we demonstrated that the DCBE examinations performed in patients with some gastrointestinal symptoms (*e.g.,* bowel habit change, constipation, abdominal pain and hematochezia) revealed more prevalence of colonic diverticulosis than those performed in asymptomatic individuals. It is obvious that many patients with colonic diverticulosis experience chronic gastrointestinal symptoms sometime in their life[28]. However, it is difficult to know whether colonic diverticulosis is a cause or a result of such symptoms.

In conclusion, the present study examined the frequency and distribution of colonic diverticulosis from a relatively large number of fluoroscopic DCBE performed in Thai adults. Colonic diverticulosis was discovered in nearly 30% of DCBE examinations. Right-sided diverticulosis was more common than left-sided diverticulosis. There was no association between the presence of diverticulosis and gender or age groups. Yet, colonic diverticulosis was more commonly reported in patients with some gastrointestinal symptoms especially those with the symptom of bowel habit change.

**COMMENTS**

***Background***

Colonic diverticulosis is a common gastrointestinal condition. The prevalence and distribution of colonic diverticulosis differ among ethnic groups and individual’s lifestyles; left-sided diverticulosis is more common in Western and developed countries, while right-sided diverticulosis is more prevalent in Asian and developing countries. Moreover, the characteristics of colonic diverticulosis have changed over times.

***Research frontiers***

Although some data of colonic diverticulosis from Asian countries are available, the information on colonic diverticulosis in the Southeast Asia has been limited and some are outdated. Double contrast barium enema (DCBE) is a reliable investigation tool for demonstrating the presence and extent of colonic diverticulosis.

***Innovations and breakthroughs***

This paper demonstrates that colonic diverticulosis was discovered in 28.5% of DCBE performed in Thai adults. Right-sided diverticulosis was more common than left-sided diverticulosis. Pancolonic diverticulosis was found in 3.4%. There was no association between the presence of diverticulosis and gender or age groups, but DCBE examinations performed in patients with some gastrointestinal symptoms revealed more occurrence of colonic diverticulosis than those performed in asymptomatic individuals. The symptom of bowel habit change was strongly associated with the presence of diverticulosis.

***Applications***

The study results show that the occurrence of colonic diverticulosis in Thailand, a developing country in Asia, is surprisingly prominent and remarkably higher than that previously reported from a hospital survey in Bangkok about 30 years ago. In addition, the rate of colonic diverticulosis in the present study is equally reported among different age groups *i.e.,* its widespread appearance could be seen as early as in adolescence. These findings may urge physicians to include or consider colonic diverticular disease as one of the causes of gastrointestinal symptoms in every patient, including young individuals.

***Terminology***

Colonic diverticulosis is usually described the presence of outpouching(s) of the mucosa and submucosa through a weak area of the large intestine. When a diverticulum (or multiple diverticula) becomes symptomatic, infected or bleeding, this gastrointestinal condition may be called ‘colonic diverticular disease’.

***Peer review***

This is a good descriptive study in which authors analyze the pattern and distribution of colonic diverticulosis from a third world country, where the frequency of such a condition is expected to be low. In fact, this study showed an unexpectedly high number of colonic diverticulosis in Thai adults. The distribution of colonic diverticulosis is brilliantly shown in great details. The results are also interesting and suggest that colonic diverticulosis can be seen in adolescence as well as it occurrence is not age-dependent. Some findings are different from those shown in Western populations.

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**Figure 1** **Distribution of colonic diverticulosis stratified by colonic segment (total number of colonic diverticulosis = 820 cases).**



**Figure 2 Pattern and distribution of colonic diverticulosis between asymptomatic individuals and symptomatic individuals stratified by age group.** DIV: Diverticulosis; RCD: Right-sided colonic diverticulosis; TCD: Transverse colonic diverticulosis; LCD: Left-sided colonic diverticulosis; PCD: Pancolonic diverticulosis.



**Table 1** **Percentage and distribution of colonic diverticulosis by location (from total number of 2877 double contrast barium enema studied)**

|  |  |  |  |
| --- | --- | --- | --- |
| Location | Number of cases | Percentage of total 820 colonic diverticulosis | Percentage of total 2877 DCBE studied  (95%CI) |
| Right-sided only1  Left-sided only  Transverse only  Extended right-sided (right + transverse)  Extended left-sided (left + transverse)  Bilateral (right + left)  Pancolonic (right + transverse + left)  Total  Right colonic diverticulosis  Left colonic diverticulosis  Transverse colonic diverticulosis | 383  153  10  44  16  116  98  820  641  383  168 | 46.7  18.7  1.2  5.4  2.0  14.1  12.0  100  78.2  46.7  20.5 | 13.3 (12.1-14.6)  5.3 (4.6-6.2)  0.3 (0.2-0.6)  1.5 (1.1-2.0)  0.6 (0.3-0.9)  4.0 (3.4-4.8)  3.4 (2.8-4.1)  28.5 (26.9-30.2)  22.3 (20.8-23.8)  13.3 (12.1-14.6)  5.8 (5.0-6.8) |

1Right-sided only diverticulosis included 42 cases of solitary cecal diverticulum. DCBE: Double contrast barium enema.