Epidemiological Evaluation of Colonic Diverticulosis and Dietary Fiber in Japan

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MUNAKATA, A., NAKAJI, S., TAKAMI, H., NAKAJIMA, H., IWANE, S. and TUCHIDA, S. Epidemiological Evaluation of Colonic Diverticulosis and Dietary Fiber in Japan. Tohoku J. Exp. Med., 1993, 171 (2), 145-151 —— The incidence of colonic diverticulosis was examined in 5 hospitals geographically isolated from each other in Japan during the period between mid '70s and 1986. The incidence rapidly increased in all hospitals from 3.5-9.0% in mid '70s to 8.4-23.2% in 1986. The ratio of right-sided type colonic diverticulosis was approximately 70-80% in each hospital and the ratio did not fluctuate significantly during the period. Birth cohort analysis revealed that although the incidence of right-sided diverticula had increased with aging, in groups born in more recent decades right-sided diverticula appeared in younger age than other groups. It was suggested that environmental factors rather than congenital factors may cause the increase of the incidence of right-sided colon diverticula. ——— dietary fiber; colonic diverticulosis

There are striking difference among the prevalences of colon diverticula in various geographic areas. The diverticulosis is rare in Africa (Cambell 1967; Archampomg et al. 1978), Asia (Kang et al. 1975; Vajrabukka et al. 1980; Munakata et al. 1982; Pan et al. 1985; Lee 1986), and many parts of South America. The residents of these areas subsist on diet high in vegetable fiber content and low in refined carbohydrate; for the denizens of Western cities the reverse is true.

In the Western world, colon diverticula are commonly found in the left-sided colon and rarely in the right-sided one (Mayo 1950; Ponka et al. 1958; Smith and Christensen 1959; Kohler 1963; Parks 1969; Havia 1971; Magness et al. 1975; Brodribb and Humphreys 1976; Eide and Stalsberg 1979). On the other hand, in Japan proximal colon is the dominant site, though diverticular disease is seldom encountered. The rates reported were 77.4% by Ohmori et al. (1979), 70.9% by Ikenaga et al. (1980), and 74.3% by Tada et al. (1974). The right-sided type is also dominant in Korea (90% by Kang et al. (1975)), and Singapore (66.4% by Lee...
(1986)). Reports from other countries showed that the right-sided type is low; 22.4% in Israel (Levy et al. 1977), 0% in Iran (Dabestani et al. 1981), 22.9% in Jordan (Fatayer et al. 1983), and Antia and Jayant (1985) has also reported that almost all diverticulosis on the left side in India. It is noteworthy that difference in the dominant site is observed, among diverse populations occupying the same geographic area. For example, Stemmermann and Yatani have pointed out that the dominant site is in right-sided colon among Japanese Hawaiian, though, no difference is found in occurrence of diverticula and diverticular disease between Japanese Hawaiian and native Hawaiian (Stemmermann and Yatani 1973).

These results suggest that racial and congenital factors may be related to the pathogenesis of the site in colon diverticula.

**MATERIALS AND METHODS**

*Incidence of colonic diverticular disease*

Five hospitals, which were located over 500 km apart from each other in Japan participated in this study (Hirosaki University School of Medicine, Niigata City Hospital, Tokyo Metropolitan Fuchu Hospital, Hyogo Medical School, and Fukuoka University.

![Fig. 1. Location of the hospital where the incidence of colonic diverticulosis was examined, and of the blocs where food intake of habitants was surveyed. Bloc A is Tohoku district represented by Aomori. Bloc B is Hokuriku district represented by Niigata. Bloc C is Kanto district represented by Tokyo. Bloc D is Kinki district represented by Hyogo. Bloc E is Kyusyu district represented by Fukuoka.](image)
School of Medicine) (Fig. 1). The incidence was estimated by examining 6,301-11,084 in- and out-patients per year in each hospital from 1974 to 1986, who underwent double contrast barium enema examination. Three thousand eight hundred and ten patients were detected possessing colon diverticula during the period. Colonic diverticulosis was classified into three types by the location of diverticula; right-sided type, left-sided type, and both-sided type, and both-sided type was combined type of the former two types.

Birth cohort analysis

Birth cohort analysis was performed in 428 patients with diverticular disease diagnosed at Hirosaki University for 15 years from 1972 to 1986. Patients were classified into 5 groups according to birth-year, and chronological change of the incidence was analyzed in each group.

RESULTS

Incidence of colonic diverticular disease

The colon diverticula were detected in 3,810 patients out of 39,219 double contrast barium enema examination during the study period. The value of detection rate 8.4% in 1986 at Hirosaki was close to the value obtained by autopsy, 8% in the same year. Therefore, we used the value obtained by roent-
genography as incidence of colonic diverticulosis in the study. The incidence in 1976 was 2.2% in Hirosaki, 3.8% in Niigata, 7.1% in Fukuoka, 9.5% in Tokyo and 3.8% in Hyogo, and those increased to 8.4%, 10.6%, 23.2%, 17.7%, and 21.5% in 1986, respectively (Fig. 2). The incidence in 1986 in Fukuoka, Tokyo, and Hyogo was 2.8 times, and 2.6 times higher, respectively, than that in Hirosaki.

Among the patients with diverticula, the right-sided type occupied 70-80% in all hospitals, and 20-30% was left-sided or both-sided type (Fig. 3). Ratios of right-sided type were similar among all 5 hospitals, and did not change during the period.

**Birth cohort analysis**

To characterize the increase of incidence during past 15 years, birth cohort analysis was performed among the patients examined at Hirosaki University. Patients were classified into 5 birth-year groups; 1905–1914, 1915–1924, 1925–1934, 1935–1944, and 1945–1954 (Fig. 4). This analysis revealed that the incidence of right-sided diverticulosis had increased in any birth-groups as they grew older, and that in the groups born in more recent decades, right-sided type colon diverticula appeared in younger age (Fig. 4A). The age when the incidence of right-sided diverticulosis attained to 5% was different in each group: 35-year in the group born in '45-'54, 43 in '35-'44, 55 in '25-'34, 61 in '15-'24, and 78 in '05-'14. This result shows that the recent increase of incidence may be partly due to the appearance in young ages. In left-sided and both-sided diverticulosis the incidence was not significantly different in any birth-year group and increased

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**Fig. 3.** Percent of right-sided type colon diverticula in 5 hospitals. Figures in parentheses show numbers of patients with colon diverticula.
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Fig. 4. Birth cohort analysis of the patients at Hirosaki University Hospital. A, incidence of diverticulosis of right-sided type; B, incidence of left-sided type; C, incidence of both-sided type. Each curve shows a cohort of patients who were born in 1945-1954 (△—△), 1935-1944 (▲—▲), 1925-1934 (●—●), 1915-1924 (○—○), and 1905-1914 (□—□), respectively.

slightly as they grew older (Fig. 4B 4C).

**DISCUSSION**

The present study shows that the incidence of colon diverticula in Japan has been markedly increasing and that the ratio of right-sided one has not changed during the study period; right-sided type occupied about 70-80%. Birth cohort analysis revealed that environmental factors rather than congenital factors may contribute to the increase of incidence of right-sided type colon diverticula in the birth-year groups of more recent decades. The contribution of environmental factors to the incidence of left-sided colon diverticula was less obvious.

Several reports (Hughes 1969; Murayama and Baba 1980; Sasaki et al. 1985) suggested the mechanism of development of right-sided type one: Hughes indicated the presence of pseudodiverticula in the right-sided colon. Murayama and Baba reported that the right-sided type diverticula were associated with redundant fold of mucosa and thickening of taenia coli. Sasaki et al. (1985) reported that in patients with right-sided diverticulosis intraluminal pressure was significantly higher in the proximal colon than those in the distal colon.

Our previous study (Munakata et al. 1987) indicated the negative correlation between dietary fiber intake and the incidence of colon diverticula. Intake of protein and fat do not affect the development of colon diverticula. These results
suggest that dietary fiber is involved in pathogenesis of colon diverticula and support the opinion that the sites of colon diverticula are determined by racial and congenital factor (Lim et al. 1988; Kwoen et al. 1988; Son et al. 1990; Hayashi et al. 1992). The sharp decrease of fiber intake was observed in the 50's and we considered that the incidence of colon diverticula drastically increased in the 70's. The interval of 20 years or so may suggest the latent period of colon diverticula. This interval is much shorter than 40 years reported by Painter and Burkitt (1971).

Intake of dietary fiber in Japan has been gradually decreasing, because consumption of rice, which was a main source of dietary fiber for long time, has been decreasing. It is suggested that increase of right-sided type diverticula in Japan will continue.

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References


