



Aging, Obesity, and the Incidence of Diverticulitis: A Population-Based Study

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Abstract

Objective: To understand why the population-based incidence of diverticulitis has increased over time, we studied temporal changes in age, body mass index (BMI), and diverticulitis in Olmsted County, Minnesota.

Participants and Methods: We compared the BMIs of 2967 patients with diverticulitis and 9795 people without diverticulitis from January 1, 1980, through December 31, 2007. Because BMI is a surrogate for adipose tissue, computed tomographic estimations of abdominal fat content were compared between 381 diverticulitis cases and 381 age- and sex-matched controls.

Results: Between 1980 and 2007, the prevalence of obesity increased from 12% to 49% in the population and from 19% to 40% in patients with diverticulitis ($P < .001$ for both). Temporal trends in age, BMI, and the increased incidence of diverticulitis in people with normal BMI accounted for 48%, 47%, and 20%, respectively, of corresponding trends in diverticulitis. The secular decline in the proportion of people with normal BMI was partly offset by an increased incidence of diverticulitis in such people. In the case-control study, BMI was greater in cases than in controls ($P = .001$). However, after incorporating abdominal visceral (odds ratio [OR], 2.4; 95% CI, 1.6-3.7) and subcutaneous (OR, 2.9; 95% CI, 1.7-5.2) fat content (both associated with diverticulitis), BMI was associated with lower risk (OR, 0.8; 95% CI, 0.7-0.8) of diverticulitis.

Conclusion: Aging, increasing obesity, and the increased incidence of diverticulitis in people with normal BMI account for the temporal increase in diverticulitis. Rather than BMI per se, increased abdominal visceral and subcutaneous fat are independently associated with diverticulitis. The incidence of diverticulitis, which is among the most common gastrointestinal diagnoses in hospitalized patients, has increased markedly since 2000. This study suggests that aging, increasing obesity, and the increased incidence of diverticulitis in people with normal BMI account for the temporal increase in diverticulitis.

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In the United States, the most common gastrointestinal tract diagnoses among hospitalized patients are diverticulitis and diverticular hemorrhage.¹ From 1998 through 2005, the number of patients who were admitted for diverticulitis or who underwent elective surgery related to diverticulitis increased by more than 25% overall and by more than 70% among younger patients (<45 years old).² In a previous population-based study from Olmsted County, Minnesota, we observed a statistically significant increase in the incidence of diverticulitis per 100,000 person-years over 28 years (115 in

1980-1989; 123 in 1990-1999; and 188 in 2000-2007).³ In that study, the increased incidence was partly explained by increased utilization of computed tomography (CT) of the abdomen over time to investigate abdominal pain.³ Temporal trends in aging⁴ and obesity⁵ may also explain the increasing incidence of diverticulitis. However, the increased incidence of diverticulitis over time was most pronounced in people younger than 50 years.³

Between 1980 and 2006, the US prevalence of obesity increased from 15% to 34%.⁵ A meta-analysis observed that obesity

and physical activity were associated with an increased and reduced risk of diverticular disease, respectively.⁶ However, most studies in this meta-analysis relied on self-reported weight, and only 2 studies specifically addressed diverticulitis rather than diverticular disease in general. Among 47,228 health professionals in a prospective cohort study,⁷ the risks of self-reported diverticulitis and diverticular bleeding were highest in those with high body mass index (BMI; calculated as the weight in kilograms divided by the height in meters squared), waist circumference, or waist-hip ratio. Age and BMI were risk factors for hospitalization for diverticulitis in a Norwegian population.⁸

Although these studies suggest that there is an association between BMI and diverticulitis, several questions remain because previous studies that evaluated the link between BMI and diverticulitis relied on self-reported diverticulitis⁷ or diverticulitis requiring hospitalization.⁸ Because abdominal pain related to irritable bowel syndrome may be misattributed to diverticulitis, a clinical assessment may increase the specificity of a diagnosis of diverticulitis.⁹ Inpatient series exclude most patients with uncomplicated disease, who are treated as outpatients.¹⁰ Self-reported BMI may not be accurate. In other studies (eg, among 2222 patients with asymptomatic diverticulosis in a US Department of Veterans Affairs system), BMI was not a risk factor for diverticulitis.¹¹

Finally, all these studies used BMI. However, BMI is an imperfect surrogate marker for obesity because the correlation between BMI and visceral adipose tissue, which is the proximate risk factor for metabolic abnormalities (eg, insulin resistance and glucose intolerance) and inflammation, is imperfect.¹²

A better understanding of the risk factors for diverticulitis may be helpful for reversing these temporal trends and planning future health care needs, particularly as the population ages. Following through on a previous population-based study,³ we analyzed incidence trends from 1980 through 2007 as a function of age, sex, and BMI. Thereafter, we assessed the contribution of abdominal visceral and subcutaneous fat to diverticulitis through a case-control study. The primary aim was to evaluate the contribution of temporal trends in age, BMI, and the BMI-specific

incidence of diverticulitis to temporal trends in incident diverticulitis.

METHODS

Setting

Through the population-based data resources of the Rochester Epidemiology Project, we identified individuals who were diagnosed as having diverticulitis while resident in Olmsted County from January 1, 1980, through December 31, 2007.¹³ Patients were excluded from the study if they did not allow research use of their medical records. This project was approved by the Mayo Clinic and Olmsted Medical Center institutional review boards.

As described elsewhere,¹⁴ residents of Olmsted County receive nearly all their medical care at the outpatient and inpatient facilities of Mayo Clinic and Olmsted Medical Center, and population-based epidemiologic research is possible because medical records with indexed diagnoses have been maintained for more than 100 years. Because the Rochester Epidemiology Project also indexes medical records of county residents' other providers, the epidemiology of several medical conditions can be documented.¹⁵

Identification of Patients and Review of Case Records

This study includes all Olmsted County patients diagnosed as having diverticulitis between January 1, 1980, and December 31, 2007. Diagnoses were established using the Berkson Coding System from January 1, 1980, through December 31, 1987, and *International Classification of Diseases, Ninth Revision, Clinical Modification* codes from January 1, 1988, through December 31, 2007.³ In a subset of patients, the medical record diagnosis was confirmed by physician review of medical records. All 100 randomly selected patients satisfied American Society of Colorectal Surgeons clinical criteria for sigmoid diverticulitis,¹⁶ that is, acute-onset abdominal pain and left lower quadrant tenderness on examination; however, surgery disclosed acute appendicitis in 1 patient. In addition, the diagnosis was confirmed by review in all 839 patients with complicated or recurrent diverticulitis or who required surgery for diverticulitis.³ The medical records of all the patients were

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