Impact of obesity on endoscopy

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The current obesity epidemic has resulted in increased numbers of overweight and obese patients seeking care for medical conditions exacerbated by excess body fat. Many common GI disorders are associated with excess weight, including GERD, gallstone disease, and neoplasia of the esophagus, colon, and pancreas. GI endoscopy plays a role in the diagnosis or management of each of these conditions, suggesting that resolution of the current global obesity crisis could lead to a decrease in need for associated endoscopic procedures.

The concept of body mass index (BMI), defined as an individual's weight in kilograms divided by height in meters squared, has become an important concept in the pathogenesis of many medical disorders. Obesity has been defined as a BMI greater than 30 kg/m^2. Data from the National Health and Nutrition Examination Surveys show that the prevalence of obesity has been dramatically increasing. Fourteen percent of the U.S. population were considered to be obese between 1976 and 1980 compared with 30.5% of the population from 1999 to 2000.[1] Approximately 65% of adults in the United States were considered to be overweight or obese (BMI $>$25 kg/m^2) from 1999 to 2000, and this percentage did not change from 2001 to 2002.[2] Future predictions regarding the prevalence of obesity have projected that by 2030, 86% of U.S. adults will be overweight or obese, with 51% in the obese category.[3]

The impact of obesity on GI disorders and the subsequent demand for increased numbers of endoscopic procedures deserves careful consideration. For example, as a result of obesity, more individuals may experience gastroesophageal reflux, which could increase the number of endoscopic examinations performed for evaluation of heartburn and screening for Barrett's esophagus (BE). Obesity has been linked to the presence of colonic adenomas, which could lead to an increased need for screening colonoscopy or adjusted guidelines for screening and surveillance in obese patients. The purpose of this article is to outline the potential impact of obesity on a variety of common GI disorders and the need for endoscopic evaluations.

Abbreviations: AR, attributable risk; BE, Barrett's esophagus; BMI, body mass index; OR, odds ratio; PAR, population-attributable risk; RR, relative risk.

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GASTROESOPHAGEAL REFLUX AND ASSOCIATED COMPLICATIONS

Population surveys in the United States have demonstrated that symptoms of GERD are very common, affecting approximately 44% of all Americans at least once per month[4] and 14% to 30% on a weekly basis.[5,6] Obesity has been demonstrated to be a risk factor for chronic GERD.[7] In a large Swedish population cohort study, the risk of symptomatic reflux was significantly greater in subjects who were severely obese (BMI $>$35 kg/m^2) compared with normal patients (BMI $<$25 kg/m^2). The risk of GERD was greater for women compared to men (OR [odds ratio] 3.3 for men; 95% CI, 2.4-4.7 and OR 6.3; 95% CI, 4.9-8.0 for women).

In the Nurses' Health Study, a dose-dependent relationship was observed between increasing BMI and frequent reflux symptoms in univariate and multivariate analyses.[8] Compared with women with a BMI in the normal range (20-22 kg/m^2), the multivariate OR for the presence of GERD was 2.2 (95% CI, 1.81-2.66) for overweight patients with a BMI of 25 to 27.4 kg/m^2 and 2.9 (95% CI, 2.35-3.62) for obese patients with a BMI of 30 to 34.9 kg/m^2. A dose-dependent relationship between weight gain and new or increased frequency of reflux symptoms was also observed. An increase in BMI of more than 3.5 kg/m^2 compared with no changes in weight was associated with an increased risk of frequent GERD symptoms with an OR of 2.8 (95% CI, 1.63-4.82), even among women with a normal baseline BMI.

Although GERD and obesity are both common conditions, the relationship between the 2 disorders appears to be causal rather than one of a temporal association. Obesity has been speculated to cause GERD symptoms owing to multiple factors including an increased gastroesophageal pressure gradient,[9] greater likelihood of associated hiatal

hernia,[10,11] increased intra-abdominal pressure,[12] increased output of bile and pancreatic enzymes compared with normal controls,[13] and increased levels of estrogen and other hormonal factors that are observed to be associated with obesity.[7,14]

The presence of obesity has also been linked to complications of GERD, including erosive esophagitis,[15] BE,[16] and the subsequent development of esophageal adenocarcinoma.[17] In a meta-analysis examining publications from 1966 to 2004, 9 studies were identified confirming relationships between elevated BMI and GERD.[18] In 6 of 7 studies describing complications of GERD, an elevated BMI was found to be significantly associated with the presence of erosive esophagitis and/or esophageal adenocarcinoma.

Retrospective studies have demonstrated a relationship between BE and obesity. In the first study, mean visceral adipose tissue, measured by using abdominal CT scan, was found to be approximately 1.5-fold greater in patients with BE compared with controls. The authors estimated that each 10-cm^2 increase in visceral adipose tissue was associated with a 9% increase in the risk of BE.[19] In a subsequent case-control study, the OR for BE was 2.43 (95% CI, 1.12-5.31) for patients with a BMI of 25 to 30 kg/m^2 and the OR was 2.46 (95% CI, 1.11-5.44) for those with a BMI greater than 30 kg/m^2.[16]

Based on the above studies, the obesity epidemic would be expected to result in an increased population prevalence of GERD and subsequent complications including erosive esophagitis, BE, and esophageal carcinoma. The rate of esophageal adenocarcinoma has been increasing rapidly since the 1970s, with obesity a likely contributing factor.[20] The increased population prevalence of GERD and associated complications would likely result in a greater need for endoscopic evaluations, including upper GI endoscopy, ambulatory pH monitoring, and motility assessments. More patients might be involved in programs for screening, surveillance, and endoscopic therapy for BE. Increasing numbers of patients diagnosed with esophageal adenocarcinoma would likely result in a greater demand for EUS for tumor staging, endoscopic therapy for early intramucosal carcinoma, and/or esophagectomy for surgical candidates. In addition to weight loss, bariatric surgery has been demonstrated to be an effective therapy for the management of pathologic GERD[21,22] and may become the preferred surgical intervention for obese patients with GERD compared to Nissen fundoplication.

GALLSTONE DISEASE AND COMPLICATIONS

The teaching that ''fat, female, forty, and fertile'' are predominant risk factors for the development of symptomatic cholelithiasis is based on findings from previous retrospective studies. Women, particularly of Native American descent,[23] face a significantly higher risk of gallstones compared with men.[24] The prevalence of gallstones and rate of cholecystectomy have been shown to increase with age, particularly in subjects older than 40.[25] Symptomatic gallstone disease has been shown to increase with the frequency and number of pregnancies.[26] The duration and dose of estrogen therapy have also been associated with the need for cholecystectomy.[27]

Because of enhanced cholesterol synthesis and secretion, an elevated BMI is an important risk factor for the development of cholesterol gallstones, particularly in women with morbid obesity.[28] In a large retrospective study from Sweden, the OR for the development of symptomatic cholelithiasis was 1.9 (95% CI, 1.5-2.3) for overweight subjects and 3.4 (95% CI, 2.3-5.0) for obese individuals.[29]

The presence of obesity and weight gain during pregnancy has been shown to be a risk factor for hospitalization post-delivery for gallstone-related disease.[30] In a cohort of 6211 women in Washington State, subjects with a diagnosis of biliary tract–related diseases, at either the delivery hospitalization or hospitalizations within 1 year postpartum, were identified by using relevant International Classification of Diseases Ninth Revision diagnosis codes. The median time to hospitalization postpartum was 95 days (interquartile range 46-191 days), with a median length of stay of 3 days. Seventy-six percent had a diagnosis of uncomplicated cholelithiasis, 16% pancreatitis, 9% acute cholecystitis, and 8% cholangitis. Cholecystectomy was performed in 4542 (73%) and ERCP in 326 (5%) of the women in the cohort. Independent risk factors for hospitalization included maternal race, age, body mass index prepregnancy, weight gain associated with pregnancy, and estimated gestational age.

Studies have also suggested that the presence of obesity is associated with increased morbidity from acute biliary pancreatitis.[31] In a prospective study of 250 patients with acute biliary pancreatitis, patients with a BMI greater than 25 had an increased risk of the development of severe pancreatitis compared with patients with normal body weight (OR 3.55; 95% CI, 1.50-8.40). Risk of organ failure, metabolic complications, and length of hospital stay increased with severity of obesity.

In summary, the increase in obesity in the United States may result in a greater need for endoscopic and surgical intervention for symptomatic gallstone disease. Whether the presence of obesity will result in complicated gallstone disease presenting at a younger ages deserves further study.

COLONIC POLYPS AND COLORECTAL CANCER

The presence of obesity will likely lead to a greater need for screening and surveillance colonoscopy because of an increased risk of neoplasia associated with increased body mass. Physical inactivity and obesity have been demonstrated to be risk factors for the development of colorectal cancer in some,[32,33] but not all, studies addressing