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ORIGINAL ARTICLE

Obesity and complicated diverticular disease of the colon[☆]



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KEYWORDS

Diverticular disease;
Complicated;
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Abstract

Background: The incidence of diverticular disease of the colon has been rising in recent years, and the associated factors are: low ingestion of fibre, age, lack of physical activity, and obesity. **Material and methods:** A retrospective, descriptive, observational study was conducted on patients with the diagnosis of complicated diverticular disease requiring surgical or interventional treatment, for a period of 12 years.

Results: A total of 114 patients (72 males, and 42 females), age range 28–91 years. More than three-quarters (88 patients; 77.19%) had a body mass index (BMI) between 25 and 40 kg/m², and 26 patients (22.8%) had a BMI between 20 and 25 kg/m². Among the patients with BMI less than 25 kg/m², 12 patients had Hinchey 1 (46%), 8 Hinchey 2 (30.7%), 4 Hinchey 3 (15.4%), and two Hinchey 4 (7.7%). Of the patients with BMI greater than 25 kg/m², 19 patients had Hinchey 1 (21.6%), 24 Hinchey 2 (27.3%), 27 Hinchey 3 (30.7%), and 18 Hinchey 4 (20.45%). A statistically significant difference ($p < 0.001$) was found between groups using Mann–Whitney *U* test. The BMI greater than 25 kg/m² as risk factor for complicated diverticular disease showed odds ratio of 3.4884 (95% confidence interval 1.27–9.55) with *Z* value of 2.44 ($p = 0.014$).

Conclusions: In this study, obesity was associated with an increased incidence and severity of complicated diverticular disease.

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PALABRAS CLAVE

Enfermedad
diverticular;
Complicación;
Obesidad

Obesidad y enfermedad diverticular del colon complicada**Resumen**

Antecedentes: La incidencia de la enfermedad diverticular del colon ha aumentado en los últimos años, los factores de riesgo identificados son: baja ingestión de fibra, edad, ausencia de actividad física y obesidad.

Material y métodos: Estudio retrospectivo, observacional y descriptivo en pacientes con diagnóstico de enfermedad diverticular complicada, que requirieron de tratamiento quirúrgico o intervencionista, durante un periodo de 12 años.

Resultados: Se incluyeron 114 pacientes (72 hombres y 42 mujeres), el rango de edad fue de 28 a 91 años. 88 pacientes (77.19%) tuvieron un índice de masa corporal (IMC) entre 25 y 40 kg/m² y 26 pacientes (22.8%) tuvieron un IMC entre 20 y 25 kg/m². Dentro de los pacientes con IMC menor a 25 kg/m², 12 tuvieron una clasificación de Hinchey 1 (46%), 8 Hinchey 2 (30.7%), 4 Hinchey 3 (15.4%), y 2 Hinchey 4 (7.7%). De los pacientes con IMC mayor a 25 kg/m², 19 presentaron Hinchey 1 (21.6%), 24 Hinchey 2 (27.3%), 27 Hinchey 3 (30.7%) y 18 Hinchey 4 (20.45%). Mediante prueba de U de Mann-Whitney se identificó una diferencia estadísticamente significativa ($p < 0.001$) entre ambos grupos. El IMC mayor a 25 kg/m² como factor de riesgo de enfermedad diverticular complicada mostró una razón de momios de 3.4884 (intervalo de confianza 95%, 1.27–9.55) con valor de Z de 2.44 ($p = 0.014$).

Conclusiones: En este estudio, la obesidad se relacionó con una mayor incidencia y gravedad de enfermedad diverticular complicada.

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Background

Currently, obesity constitutes a serious health problem in our country and worldwide.^{1,2} Obesity is defined as excess of body fat that results from the interaction of many environmental and genetic factors. In Mexico in 2006, an obesity prevalence of 34.5% was observed in Mexican women aged over the age of 20, while it reached 24.2% in men. As to overweight, the prevalence is higher in men with 42.5% versus 37.4% for the female population.² According to official figures from the World Health Organization, in 2008, 1500 million adults (aged 20 and more) were overweight. Within this group, more than 200 million men and nearly 300 million women were obese, worldwide.

Overweight and obesity are risk factors associated with increases in chronic diseases such as type 2 diabetes mellitus, high blood pressure, dyslipidaemias, gout, cardiovascular diseases, osteoarthritis, restrictive pneumopathy, depression, breast cancer, prostate cancer and gastrointestinal diseases, among others.^{3,4}

The incidence of the diverticular disease of the colon seems to have increased in recent years, particularly in Occidental countries with a low consumption of fibre in their diet. Other associated factors are age, absence of physical activity and obesity.⁵ Several prevalence figures are reported worldwide based on the population group studied and the geographical situation, reaching 60% in people over the age of 70 and 65% in those over the age of 85. Its frequency is low in people under the age of 40, with an incidence of 5–10%. Notwithstanding, it is estimated that 70% of the patients with diverticular disease of the colon are asymptomatic.⁶

Purpose

To assess the correlation between obesity and overweight with complicated diverticular disease, which appears as acute abdominal symptoms and requires surgical treatment or urgent interventional treatment to be resolved.

Material and methods

A retrospective, observational and descriptive study was carried out of the patients seen at Hospital Juárez in Mexico, with a diagnosis of acute abdomen secondary to complicated diverticular disease of the colon, who required surgical or urgent interventional treatment for its resolution, during the period between 1 July, 2002 and 30 June, 2014.

Patients with complicated diverticular disease of the colon who did not require surgical or interventional treatment and those who were surgically intervened electively due to recurring diverticular disease were not included in this study. Neither were those patients whose complicated diverticular disease manifestation was distal digestive tract haemorrhaging, since the purpose of this study was to compare the degree of complication of the diverticular disease of the colon (according to the Hinchey classification) among obese and non-obese patients that required surgical or urgent interventional treatment.

Inclusion criteria were: all those patients who presented acute abdomen due to complicated diverticular disease and required surgical or urgent interventional treatment, and those who showed in their history the anthropometric measurements corresponding to weight and size, as well as

Table 1 Hinchey classification.

Stage I: Abscesses confined to the mesenteric or pericolic space.
Stage II: Partitioned pelvic abscess.
Stage III: Generalised purulent peritonitis.
Stage IV: Generalised faecal peritonitis.

the classification via computed tomography and/or intraoperatively of the severity degree of the complication of the diverticular disease of the colon, according to the Hinchey classification (Table 1).

Non-inclusion criteria were: those patients with diagnosis of complicated diverticular disease who were medically handled and did not require surgical or interventional treatment, those who were surgically intervened in an elective manner, and those cases of complicated diverticular disease that appeared as distal digestive tract haemorrhaging. In addition, patients with associated diseases that could modify the course of the complicated diverticular disease, such as diabetes mellitus, high blood pressure, connective tissue diseases, patients on treatment with corticosteroids, and HIV-positive patients were also excluded.

From the records reviewed, the following variables were analysed: patients' age, gender, weight and size; as well as their history and the complication degree of their diverticular disease, according to the Hinchey classification based on computed tomography findings and/or intraoperative findings confirmed by surgeon and registered in the record's surgical note.

Based on the weight and size information, the body mass index (BMI) was calculated for each patient. According to the World Health Organization, the BMI is a simple indicator of the relationship between weight and size and is usually used to identify overweight and obesity in adults. This is calculated by dividing a person's weight in kilos by the square of height in metres (kg/m^2).

Based on BMI results, patients were classified in 2 groups: groups of patients without overweight and group of patients with overweight.

Results

Between 1 July 2002 and 30 June 2014, 114 patients complied with the inclusion criteria for this study.

As to gender, 72 patients were male gender (63.16%) and 42 female (36.84%).

The patients' age range was 28–91 years, with an average of 56.07 years; patients' weight varied between 52 and 97 kg, with a mean of 72.9. As to the patients' size, the range was 1.45–1.75 m, with an average of 1.63 m.

The patients' BMI showed a range of 20.19–38.79 kg/m^2 , and a mean of 27.46 kg/m^2 .

A total of 26 patients (22.8%) had a BMI between 20 and 25 kg/m^2 (group of patients without overweight), whereas 88 patients (77.19%) had a BMI between 25 and 40 kg/m^2 (group of patients with overweight). This indicates that the complications of the diverticular disease of the colon were 3.38 times more frequent in patients with BMI above 25 kg/m^2 .

Out of the 88 patients with overweight, 66 had mild obesity (25–30 kg/m^2), 19 had moderate obesity (30–35 kg/m^2), and 3 presented severe obesity (35–40 kg/m^2).

In our series, we did not have patients with BMI below 20 kg/m^2 , or patients with indexes above 40 kg/m^2 . That is, we did not have patients with malnutrition or patients with morbid obesity or super obesity.

The patients included in this study were those who required surgical or urgent interventional treatment due to complicated diverticular disease that manifested itself as acute abdomen symptoms. Among the 26 patients with BMI below 25 kg/m^2 , 12 had a Hinchey classification of I (46%), 8 patients had a Hinchey II (30.7%), 4 cases with a Hinchey III (15.4%), and 2 patients showed a Hinchey IV (7.7%).

In addition, of the patients with BMI above 25 kg/m^2 , 19 presented Hinchey I (21.6%), 24 had Hinchey II (27.3%), 27 cases with Hinchey III (30.7%) and 18 patients with Hinchey IV (20.45%).

A covariate analysis was carried out comparing the BMI as dichotomous variable defined as (a) BMI between 18 and 25 kg/m^2 and (b) BMI between 25.1 and 40 kg/m^2 , and, in turn, the diverticular disease was categorised as mild for Hinchey stages I and II and severe for stages III and IV of the same classification (Fig. 1). This was performed in a way that 76.92% of the patients with BMI between 18 and 25 kg/m^2 had mild diverticular disease (Hinchey stages I and II), and 23.07% had severe diverticular disease (stages III and IV). As to patients with BMI between 25.1 and 40 kg/m^2 , 48.86% had mild diverticular disease, and 51.13% had severe diverticular disease.

The Shapiro–Wilk test was performed to verify the normal distribution by degrees based on BMI, and the result was $p=0.04$, so it was not possible to imply a normal distribution between both groups, so the Mann–Whitney U test was applied as a non-parametric test to compare 2 independent samples. In both cases, when comparing the severity of the diverticular disease based on the Hinchey classification, a statistically significant difference was identified with a p value of <0.001 in both groups (Fig. 2).

Moreover, an odds ratio measurement was performed to assess the BMI above 25 kg/m^2 as a risk factor for presenting diverticular disease, and an odds ratio of 3.4884 was obtained (confidence interval of 95%: 1.27–9.55) with a Z value of 2.44, which translates into $p=0.014$, clearly interpreted as a statistically significant result.

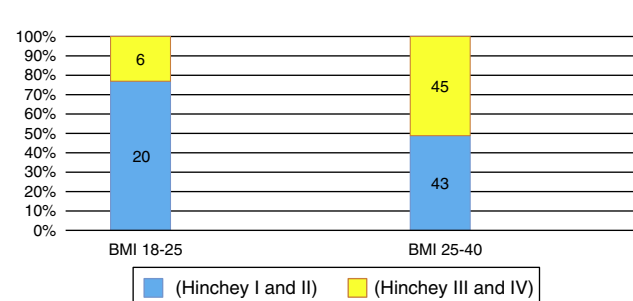


Figure 1 Percentage comparison of diverticular disease by degree based on body mass index.

Table 2 Association between obesity and overweight with complicated diverticular disease of the colon, according to different authors.

Author and year	Country	Type of study	Measurement method	Conclusions
Dobbins et al. ¹³ (2006)	Australia	Retrospective	BMI	Patients with recurrent diverticulitis and perforation are significantly more obese than asymptomatic patients and those with only one episode ($p = 0.001$ and $p = 0.002$)
Rosemar et al. ¹⁴ (2008)	Sweden	Prospective cohort	BMI	Excess weight and obesity are correlated with a higher incidence of diverticulitis, which requires hospitalisation (RR of 3 to 4.4)
Strate et al. ¹² (2009)	United States	Prospective cohort	BMI, waist circumference and waist-hip ratio	Excess weight and obesity are associated with a higher incidence of diverticulitis and haemorrhage (RR 1.78 and 3.19)
Jeong et al. ¹⁵ (2011)	Korea	Retrospective	BMI, CT-determined visceral fat	Visceral obesity is significantly associated with complicated diverticular disease ($p = 0.32$)
Yamada et al. ¹⁶ (2013)	Japan	Retrospective	BMI, CT-determined visceral fat	Visceral obesity is significantly associated with left diverticulitis ($p = 0.0390$)
Rodríguez-Wong et al. (this study)	Mexico	Retrospective	BMI	Excess weight and obesity are associated with more severe complications of the diverticular disease (OR 3.48, $p = 0.014$)

BMI: body mass index, CAT scan: computerised axial tomography scan, RR: relative risk, OR: odds ratio.

Discussion

There is no exact information on the frequency of the diverticular disease of the colon in Mexico. According to Raña-Garibay et al.⁶ in 1976, de la Vega and team reported a prevalence of 4.1% in radiological studies and of 1.9% in autopsies at the Instituto Nacional de Nutrición "Salvador Zubirán", whereas at the Hospital Español of México the frequency reached 9.2% in radiological studies. On the other hand, the same authors state that at the Hospital Juárez de México no cases of diverticular disease of the colon were found in a review of 2286 autopsies.

Several diseases have been described in the digestive system as associated with overweight and obesity,^{4,7} among which are: gastroesophageal reflux disease, Barrett's oesophagus, adenocarcinoma of oesophagus, non-alcoholic hepatic steatosis, steatohepatitis, hepatocellular

carcinoma, acute pancreatitis, adenocarcinoma of pancreas, and bladder cancer, among others.

Likewise, several colon conditions related to obesity have been described, such as: colon adenomas, colon cancer and diverticular disease of the colon.^{8,9} On the other hand, a great variety of gastrointestinal symptoms have been associated with overweight and obesity, such as constipation, faecal incontinence, faecal urgency, diarrhoea and anorectal obstruction.⁷

Some studies have found a relation between overweight and obesity with diverticular disease, particularly in regards to the appearance of complications.^{10,11} In a prospective study by Strate et al.¹² of 47,228 subjects, 801 of which presented diverticulitis and 383 presented diverticular disease haemorrhaging during a follow-up period of 18 years, it was determined that people with BMI above 30 had a relative risk of 1.78 (with confidence interval of 95%: 1.08–2.94) of suffering diverticulitis when compared with non-obese subjects. Whereas the relative risk of diverticular haemorrhaging in obese subjects was 3.19 (with confidence interval of 95%: 1.45–7), in our study, we observed an incidence of complicated diverticular disease 3.38 times higher in obese patients in comparison with those non-obese. Similarly, the statistical analysis comparing the proportions between the 2 groups showed a statistically significant difference ($p < 0.001$).

In another study carried out by Dobbins et al.¹³ in 61 patients, it was determined that obese patients had a higher incidence of perforation and haemorrhaging due to diverticular disease. Rosemar et al. in Sweden¹⁴ studied a sample

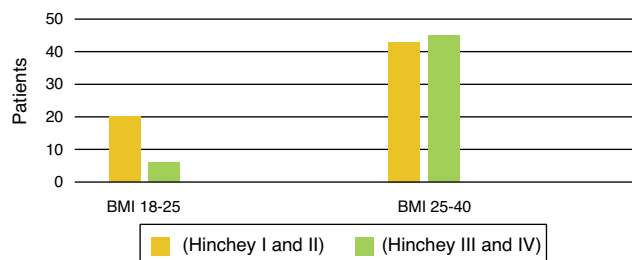


Figure 2 Prevalence of diverticular disease based on severity and body mass index.

of 7494 subjects, 112 of which were hospitalised due to some diverticular disease complication. Patients with BMI between 25 and 27.5 had a relative risk of 3 (confidence interval of 95%: 1.2–7.6) whereas patients with BMI above 30 had a more severe diverticular disease and a higher relative risk of 4.4 (1.6–12.3).

Also, some studies have measured the amount of visceral fat in patients with diverticular disease, via computed tomography, and an association was found between the amount of visceral fat and the presence of diverticular disease complications.^{15,16}

In the group of patients analysed in this study, a higher severity of the complicated diverticular disease was found in the group of patients with overweight compared to those who were not overweight (Table 2).

There are some factors that could explain the higher incidence of complications of the diverticular disease of the colon in obese patients and overweight patients. The adipose tissue secretes a large amount of proinflammatory cytokines that may precipitate the inflammatory process.¹⁷ Moreover, it has also been suggested that the intestinal microbial flora is different in obese subjects.¹⁸

Conclusions

Currently, obesity constitutes a severe health problem in our country. There are different diseases that have been related to obesity, and among them, some colon alterations such as colon cancer, colon adenomas and diverticular disease complications.

In this study, we found an odds ratio of 3.48 as a risk factor for the appearance of complications of the diverticular disease of the colon in patients with BMI between 25 and 40 kg/m², compared with those patients with a BMI below 25 kg/m². The mechanisms through which the complicated diverticular disease of the colon could be more frequent in patients with obesity have not yet been clarified.

Conflict of interest

The authors declare that there are no conflicts of interest.

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