

# Overweight and obesity as a risk factor for postoperative complications in patients undergoing inguinal hernia repair, cholecystectomy and appendectomy

Regina Faes-Petersen,\* Alejandro Díaz-Girón-Gidi,\*\* Francisco Velez-Pérez,\*\*  
Mario A. González-Chávez,\*\* Ramón Lemus,\*\* José M. Correa-Rovelo,\*\*<sup>\*\*\*</sup> Eduardo Villegas-Tovar\*\*

\* Mexican Faculty of Medicine, La Salle University, Mexico City. Mexico.

\*\* Specialization Course in General Surgery, Medica Sur Clinic and Foundation. Mexican Faculty of Medicine, La Salle University, Mexico City. Mexico.

\*\*\* General Surgery. Medica Sur Clinic and Foundation. Mexico City. Mexico.

## RESUMEN

**Introducción.** La obesidad se sabe que aumenta la morbilidad y la mortalidad en la población general y, por lo tanto, se percibe como un factor de riesgo para los resultados posquirúrgicos adversos. Existen pocos estudios que evalúan la morbilidad y mortalidad postoperatorias en pacientes obesos y no obesos. **Objetivo.** Realizar un registro de la incidencia, características clínicas, complicaciones postoperatorias de los pacientes con sobrepeso y obesidad en Médica Sur. **Material and métodos.** Estudio retrospectivo, observacional, descriptivo realizado en la Fundación Clínica Médica Sur. Se revisaron expedientes clínicos de pacientes sometidos a plastia inguinal, colecistectomía y apendicectomía abierta o laparoscópica, de enero de 2013 a diciembre de 2014, se clasificaron de acuerdo con peso normal, sobrepeso y obesidad. Se realizó un análisis bivariado y regresión logística. **Resultados.** Se registraron 1,430 casos, de los cuales 757 (53%) fueron en pacientes con sobrepeso u obesidad. En el grupo de peso normal fueron siete pacientes los que presentaron complicación (1%) mientras que 37 pacientes presentaron algún tipo de complicación en el grupo de sobrepeso/obesidad (5%): 17 infección del sitio quirúrgico, 10 dehiscencia de la herida y 10 complicación pulmonar, cuando se compararon técnica abierta vs. laparoscópica, el IMC > 34 kg/m<sup>2</sup> (OR 2.35, IC 95%: 1.04-5.30, p = 0.001) se asoció al mayor riesgo de presentar alguna complicación posquirúrgica. Con cirugía abierta se presentaron 22 complicaciones (60%), mientras que con laparoscópica hubo 15 (40%), sin alcanzar significancia estadística. **Conclusiones.** Los resultados obtenidos sugieren que los pacientes con sobrepeso u obesidad presentan más complicaciones postquirúrgicas. Se necesitan estudios prospectivos para aclarar la asociación entre complicaciones posquirúrgicas y sobrepeso-obesidad.

**Palabras clave.** Sobrepeso. Obesidad. Apendicectomía. Colecistectomía. Hernia. Inguinal.

## ABSTRACT

**Introduction.** Obesity is known to increase morbidity and mortality in the general population and therefore is perceived as a risk factor for adverse post-surgical results. There are few studies comparing postoperative morbidity and mortality in obese and non-obese patients. **Objective.** Characterize the incidence, clinical profile, post-operative complications in patients with overweight and obesity at Medica Sur Foundation and Clinic. **Material and methods.** Retrospective, observational, descriptive study at Medica Sur Clinic and Foundation. We reviewed the files of patients undergoing laparoscopic or open inguinal hernia repair, appendectomy, and cholecystectomy, between January 2013 to December 2014. Patients were classified according to the body mass index. Bivariate analysis and logistic regression were performed. **Results.** We reviewed 1430 cases, resulting in 757 (53%) obese or overweight patients. Seven (1%) patients with normal weight had some type of complication meanwhile 37 (5%) patients in the overweight group had some complication: 17 surgical infection site, 10 wound dehiscence and 10 pulmonary complications. BMI > 34 kg/m<sup>2</sup> (OR 2.35, IC 95% 1.04-5.30, p = 0.001) was associated with higher risk of postoperative complications. When compared open vs. laparoscopic technique, open resulted in 22 (60%) complications and laparoscopic in 15 (40%), with no significant differences. **Conclusions.** These results suggest that obese patients have higher levels of postoperative complications. Larger prospective studies are needed to clarify the association between obesity and postoperative complications.

**Key words.** Overweight. Obesity. Appendectomy. Cholecystectomy. Hernia. Inguinal.

## Correspondence:

Eduardo Villegas-Tovar, M.D.  
Lluvia, No. 211 C3, Jardines del Pedregal, Z.P. 01900, Mexico City. Tel.: (01 55) 6586-7443  
E-mail: eduardovillegas9@gmail.com

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## INTRODUCTION

The worldwide annual volume of major surgery is estimated 187 to 281,000,000 case; about 1 surgery per 25 people.<sup>1</sup> In the developed world, the major morbidities such as cancer, obesity, diabetes mellitus complicated between 3% and 21.9% of surgical procedures.<sup>2,3</sup> From a surgical perspective, obesity has been considered a risk factor for post-surgical adverse outcomes.<sup>4-5</sup> Another consequence of excess adipose tissue, specifically excessive intra-abdominal or visceral fat is metabolic syndrome, where there is a prothrombotic state, proinflammatory and is associated with insulin resistance.<sup>5</sup>

Previous studies have reported that obese patients have adverse surgical outcomes, including more operating time, high rate of postoperative and longer duration of hospitalization.<sup>1,2</sup> On the other side, some studies have shown no difference between obese patients and those who they are not.<sup>3-5</sup> However most of these studies have been conducted in populations at high surgical risks, such as cardiac surgery, colon cancer, or cancer patients. The most common method for measuring overweight or obesity is calculating the body mass index (BMI).<sup>6-9</sup>

In Mexico, according to ENSANUT 2012, the prevalence of overweight and obesity is 71.28% (representing 48.6 million people). The prevalence of obesity (BMI  $\geq 30$  kg/m<sup>2</sup>) was 32.4% and 38.8% for overweight. Obesity is higher in females (37.5%) than males (26.8%), unlike the overweight, where the male had a prevalence of 42.5% and 35.9% female.<sup>10</sup> Therefore its prevalence continues to rise it is regarded as the leading preventable cause of death.

There are few cohort studies comparing obese with non obese.<sup>11-16</sup> In one study, 17 adults with multiple trauma cases (7 with obesity, BMI  $> 30$  kg m<sup>2</sup>, and 10 non-obese, BMI  $< 30$  kg m<sup>2</sup>) were examined within 2-4 days of hospitalization in intensive care unit 17. All patients had at least one serious injury and multiple minor injuries received maintenance fluids and electrolytes, but no calories. Obese patients showed a significant decrease in the efficiency of protein synthesis, coupled with an increase in protein metabolism, hair loss and nitrogen excretion methylhistidine, changes indicative of muscle catabolism.<sup>17-21</sup>

The previous study published, that morbidly obese patients had a mortality rate twice as high as that of the other patients, as well as cardiac arrest.<sup>22</sup> A retrospective review of an operative adult of the Department of Anesthesiology database evaluated 6,773 patients. Of these, about 33% were obese. It was found that obese patients experiencing five times the cardiovascular events than

other.<sup>23</sup> However, most studies examining the influence of obesity on the post-surgical mortality have shown no association.<sup>24,25</sup>

In addition to lung disorders related to obesity such as sleep apnea and hypoventilation syndrome, obesity is also associated with a decrease in vital capacity, functional residual capacity, forced expiratory volume in 1 second, and oxygen blood pressure.<sup>26-29</sup>

Atrial fibrillation is the most common form of cardiac arrhythmia and is the most common complication after cardiac surgery. The onset of atrial fibrillation is associated with increased postoperative morbidity and mortality. The risk of arrhythmia is proportional to the degree of obesity.<sup>30</sup>

Wound dehiscence is a serious complication after surgery and is associated with increased morbidity and mortality. It has been proposed that obesity increases the risk of dehiscence, both directly, by increasing the tension in the fascial edges at the time of wound closure, and indirectly, by increasing the risk of wound infection that it is also a risk factor for dehiscence.<sup>31,32</sup>

Surgical site infection is more common in obese patients compared to those without this disorder. A study by Choban, et al.<sup>31</sup> retrospectively compared the rate of nosocomial infection in 849 obese and non-obese patients undergoing various surgical procedures. The incidence of infections in the normal weight group was 0.5% vs. 2.8% in obese,  $p < 0.05$ ) and 4.3%, in the group with severe obesity,  $p < 0.0131$ . Wound infection is a major cause of morbidity in various types of surgery and is associated with greater mortality<sup>31-36</sup> wound dehiscence<sup>37</sup> and increased inpatient stay.<sup>38-40</sup> The aim of this study was to characterize the incidence, clinical profile and, post-operative complications in patients with overweight and obesity at Medica Sur Foundation and Clinic.

## MATERIAL AND METHODS

We performed a retrospective review of medical records at Medica Sur Foundation and Clinic. The study was conducted from 1st January 2013 to 31st December 2014. The search was conducted identifying patients with normal weight, overweight, and obesity undergoing to inguinal hernia repair, cholecystectomy and appendectomy. We included men and women patients between 16-99 years old. We review the electronic medical record to obtain demographic data, preoperative and postoperative diagnosis. For the analysis, patients were classified according to BMI and various surgical procedures.

## Statistics

Mean values and standard deviations were calculated for the quantitative variables and, proportions for qualitative data. To study the risk factors the chi-square test and the coefficient of Phi-Cramers was used. A bivariate and multivariate analysis logistic regression were performed. Risk measure: odds ratio (OR) with 95% confidence interval. A  $p < 0.05$  was considered statistically significant. Statistical calculations and graphs were performed using SPSS version 22 program.

## RESULTS

We reviewed 1430 medical records of patients undergoing appendectomy, cholecystectomy or inguinal repair. The median age of both groups was  $15 \pm 40$  years; the majority of patients were female with 858 (60%) cases. The most common surgery was appendectomy in 572 (40%) followed by inguinal hernia repair 486 (34%) and cholecystectomy in 321 (26%).

We found 673 (47%) normal weight, and 757 (53%) overweight or obese patients (42% overweight, 33% obesity grade 1, 15% obesity grade 2, and 10% obesity grade 3).

Twenty-one percent ( $n = 158$ ) of overweight or obese patients had some other comorbidity, including type-2 diabetes mellitus (50%), systemic arterial hypertension (25%), chronic obstructive pulmonary disease (15%), renal failure (5%), cardiac failure (3%) and, hepatic insufficiency (2%).

The average American Society of Anesthesiologists (ASA) score was 2 in the group of overweight and obesity as it was 1 in the group with normal weight. When conducting the analysis of baseline characteristics it was found that there was a significant difference between the overweight and obese population and normal weight in terms of BMI, hypertension, DM and preoperative surgical risk ( $p < 0.05$ ) (Table 1). Median postoperative days were 4 (1-20) in the group with overweight and obesity days and 3 (1-17) in the normal weight group.

In the group with normal BMI, 7 patients (1%) had complications meanwhile in the overweight or obese group 37 patients (5%) had complications (Table 2). When we categorized complications rates according to BMI, overweight group resulted in 4%, obese group in 5% and, normal BMI in only 1%. We did not find significant differences between open vs. laparoscopic technique, 22 (60%) vs. 15 (40%).

**Table 1.** Population basal characteristics.

	Normal BMI n (%)	Increased BMI (n = 757) n (%)	p
Male	269 (40)	340 (45)	0.065
Age (median $\pm$ SD)	40 $\pm$ 15	43 $\pm$ 16	0.057
< 65 years	275 (41)	450 (60)	
$\geq 65$ years	398 (59)	297 (40)	
BMI			0.002
18-24.9	673 (100)	-	
25-29.9	-	317 (42)	
30-34.9	-	249 (33)	
35- 39.9	-	113 (15)	
> 40	-	75 (10)	
Hypertension	15 (2)	39 (6)	0.003
Diabetes	30 (6)	79 (10.5)	0.001
ASA score	638 (95)	595 (79)	
I-II	35 (5)	162 (21)	0.003
III-IV			
Surgery			0.076
Elective	605 (90)	667 (88)	
Urgency	68 (10)	90 (12)	
Technique			0.067
Open	28 (5)	45 (7)	
Laparoscopic	645 (95)	712 (93)	

**Table 2.** Operative morbidity in patients with overweight and obesity.

Morbidity	n (%)
Wound infection	17 (46)
Dehiscence	10 (28)
Atelectasis	6 (16)
Pulmonary embolism	4 (10)
Total	37 (100)

**Table 3.** Risk factors univariate logistic regression for postoperative complications in patients undergoing inguinal hernia repair, cholecystectomy and appendectomy.

Variable	OR	Morbidity IC 95%	P
BMI > 34 kg/m <sup>2</sup>	2.35	1.04-5.30	<b>0.003</b>
Diabetes > 180 mg/dL	2.95	1.25-5.90	<b>0.001</b>
Hypertension	1.1	0.8-1.4	0.75
ASA Score III-IV	2.1	1.01-3.9	<b>0.04</b>

**Table 4.** Risk factors multivariate logistic regression for postoperative complications in patients undergoing inguinal hernia repair, cholecystectomy and appendectomy

Variable	OR	Morbidity IC 95%	P
BMI > 34 kg/m <sup>2</sup>	1.7	0.94-3.30	0.063
Diabetes > 180 mg/dL	4.5	1.59-7.30	<b>0.001</b>
Hypertension	1.11	0.9-1.7	0.75
ASA score III-IV	1.5	0.89-3.1	0.081

In the univariate logistic regression, BMI over 25 kg/m<sup>2</sup>, hypertension, uncontrolled diabetes and ASA score III-IV were risk factors for pos-operative morbidity (Table 3). In multivariate analysis, only the present of uncontrolled diabetes (> 180 mg/dL) was a risk factor (Table 4).

## DISCUSSION

In our population the presence of overweight and obesity was associated with a greater likelihood of having some other comorbidity such as hypertension, diabetes mellitus, as a constellation of metabolic syndrome, so the results we obtained can go in the sense that the set of as resulting metabolic disorders have as many complications in this population and not only is the fact of being overweight and thus could be explained that there are conflicting data in the literature.

Studies have reported that between 46-54% of hospitalized patients are overweight, that is, the body mass

index (BMI) > 25 kg m<sup>2</sup>, and 32% are obese (BMI > 30 kg/m<sup>2</sup>).<sup>6-8</sup> In the US, currently one in three adults is obese and one in 20 adults are morbidly obese (BMI > 40 kg/m<sup>2</sup>).<sup>9,10</sup> Which it is similar to what we found in our study because we found that 317 patients (22%) of the total were overweight while 362 (25%) obesity, also worth mentioning that 75 patients (5%) had morbid obesity, demonstrating the public health problem so serious that afflicts our country and in our center is now a reality. A large prospective cohort study conducted by Mullen, et al.<sup>24</sup> examined the impact of BMI on perioperative outcomes in patients (n = 2,258) undergoing surgery for intra-abdominal cancer of 14 university hospitals participating in the Study of Patient Safety Improvement Program of the National Quality Surgery (NSQIP). The study included patients who were at greater resections, including esophageal-gastric, liver, pancreatic resections and rectal resections, after adjusting for other risk factors, obesity (BMI > 30 kg/m<sup>2</sup>) was not a risk factor for mortality.<sup>23,24</sup> This difference could be because the type of surgical treatment was different and in the majority of cases laparoscopic and low-risk surgeries.

Although obesity is an individual clinical condition, it has become a serious public health problem that is increasing in epidemic proportions around the world. Given the high incidence and prevalence of this disease, which leads to great economic and social impact of the consequences characteristics of this disease, it is necessary to continue research in this area. It is known that obese who undergo surgery suffer a higher rate of cardiovascular complications, surgical site infection, peripheral nerve injury and urinary tract infection than their normal weight. Now it has made significant progress in understanding the pathophysiology of this disease so, but there are still many doubts and conflicting results due to the complexity of such a process. Although studies show that the death rate does not vary between obese and non-obese patients, mortality is much higher in patients with morbid obesity.

Postoperative complications are major challenges to health and/or health care costs for patients. Regarding the surgical procedure and the presence of overweight and obesity and those with normal weight, had previously studied 547 patients who underwent elective general surgery; finding that 28% of them had a BMI > 30 kg/m<sup>2</sup>, postoperative complications occurred in 5.5% of all patients which is consistent with our study (5%); however there was no difference between obese and non-obese, finding that diverges with our results since in the population without altering BMI complication rate was 1%, after testing we found no differences in the study groups and

the proportion of complications according to the type of surgery or technique, apart from the presence of BMI > 34 kg/m<sup>2</sup>, a variable that must be taken into account is the presence of uncontrolled diabetes mellitus what if it increases the risk of complications in this population, such as was observed in the results with increased risk significantly after performing the multivariate analysis, it is important to note that the analysis found that the greater the degree of obesity BMI > 34 kg/m<sup>2</sup> there is a tendency to increase risk of complications.

Limitations of this work include the small population and the retrospective methodology.

In conclusion, the rate of complications was categorized according to BMI in the overweight group 4% of patients had some type of complication, in the obese group 5% and in the group with normal BMI only 1%. Complications most frequently presented were surgical site infection, followed by dehiscence and pulmonary complications. We found no differences when comparing open vs. laparoscopic technique. These results suggest that obese patients have higher levels of post-surgical complications especially BMI > 34 kg/m<sup>2</sup>. Whether this relationship is causal or is generated by confounding variables such as uncontrolled diabetes mellitus. Large prospective investigations are needed to clarify the association between postoperative complications and obesity.

## HIGHLIGHTS

- BMI > 34 kg/m<sup>2</sup> (OR 2, 35, IC 95%: 1.04-5.30, p: 0.001) was associated with higher risk of postoperative complications.
- The results suggest that obese patients have higher levels of postoperative complications.

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