The Relationship Between Body Mass Index and Prevalence of Both Diaphragmatic and Abdominal Wall Hernias

Zachary N Weitzner MD, Hila Zelicha RD PhD, Douglas S Bell MD, Yijun Chen MD, Edward H Livingston MD

UCLA Health

INTRODUCTION

Obesity is a common risk factor for abdominal wall hernias. Despite this, there is a paucity of high evidence literature examining the relationship between obesity and primary abdominal wall hernias. The majority of literature regarding obesity and hernias relates to hernia recurrence.

Hernias are thought to be caused by factors that influence fascial integrity, mechanical pressure within the abdomen, and fetal development. Intraabdominal pressure increases with obesity. Additionally, men with obesity likely have greater intraabdominal pressure due to the propensity for central obesity compared to female fat distribution.

HYPOTHESIS

We hypothesized that factors that increase intraabdominal pressure, such as increasing body mass index and male gender, would be associated with a higher likelihood of diaphragmatic, ventral, and inguinal hernias.

METHODS

This is a retrospective review of all ambulatory patients diagnosed with abdominal wall hernias age 16 and above seen at UCLA Health clinics between 1/1/2018 and 6/6/2023. Abdominal wall hernias were defined and subcategorized as diaphragmatic hernias (paraesophageal and hiatal hernias), ventral hernias, and inguinal hernias. The presence of hernia was determined from ICD-10 diagnostic codes.

This cohort included a total of 41,703 patients with hernias from a total of 1,361,440 total patients examined during the study period. This study was approved by UCLA IRB #23-000174.

Clinical data was extracted from the institution's electronic health records database. Patients were divided into the following groups:

- Diaphragmatic hernia (K44.9)
- Ventral hernia, including umbilical, incisional, ventral, and other (K42, K43, K45, K46)
- Inguinal hernia, including femoral ((K40, K41)

Patient's BMI was also assigned to each individual patient within 6 months of initial hernia diagnosis. BMI was categorized into the following groups:

- Underweight (BMI ≤ 18.5 kg/m^2)
- Normal weight (BMI 18.5-24.9 kg /m^2)
- Overweight (BMI 25-29.9 kg /m^2)
- Obese (BMI 30-39.9 kg /m^2)
- Morbidly obese (BMI 40-49.9 kg /m^2)
- Super morbidly obese (BMI ≥ 50 kg /m^2)

The primary aim was to examine abdominal wall hernia prevalence and its relationship with obesity.

Figure 1: Flow chart of patient data processing

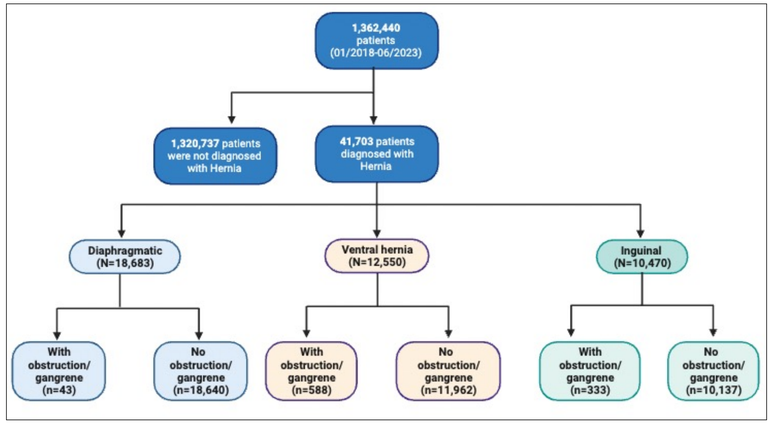


Table 1: Patient Demographics and Characteristics

	Total (N=41,703)	Men N=(24,005)	Women N=(17,693)	p value
Age, year	62.5 ± 16.1	61.5 ± 15.9	63.7 ± 16.4	<0.001
Hispanics, n (%)	6,146 (14.7)	3152 (13.1)	2993 (16.9)	<0.001
Race, n (%)				
White	19,730 (47.4)	11486 (47.8)	8243 (46.6)	<0.001
Black	2,321 (5.6)	1093 (4.6)	1226 (6.9)	0.006
Asian	2,113 (5.1)	1134 (4.7)	979 (5.5)	<0.001
American Indian or Alaskan	191 (0.5)	115 (0.5)	76 (0.4)	0.005
Unknown/Refused	14,889 (35.7)	8782 (36.6)	6106 (34.5)	<0.001
Middle Eastern/N. African	883 (2.1)	543 (2.3)	340 (1.9)	<0.001
Multiple races	1,451 (3.5)	780 (3.2)	670 (3.8)	0.004
Hawaiian or Pacific Isl.	74 (0.2)	36 (0.1)	38 (0.2)	0.8
Body mass index, kg/m^2	27.6 ± 5.8	27.5 ± 5.0	27.7 ± 6.8	0.02
BMI categories, n (%)				
Underweight	594 (1.9)	172 (1.0)	422 (3.2)	<0.001
Normal weight	10415 (33.5)	5567 (31.0)	4847 (37.0)	<0.001
Overweight	11555 (37.2)	7761 (43.2)	3794 (29.0)	<0.001
Obese	7371 (23.7)	4077 (22.7)	3293 (25.2)	<0.001
Morbidly obese	971 (3.1)	348 (1.9)	622 (4.8)	<0.001
Super morbidly obese	151 (0.5)	45 (0.3)	106 (0.8)	<0.001
Weight (kg)	80.5 ± 19.5	86.4 ± 17.6	72.3 ± 19.0	<0.001
Height (m2)	1.71 ± 0.1	1.77 ± 0.1	1.62 ± 0.1	<0.001
Recurrence, n(%)	867 (2.1)	764 (3.2)	103 (0.6)	<0.001

Figure 2: Prevalence of Hernia Type Stratified by BMI Category and Sex

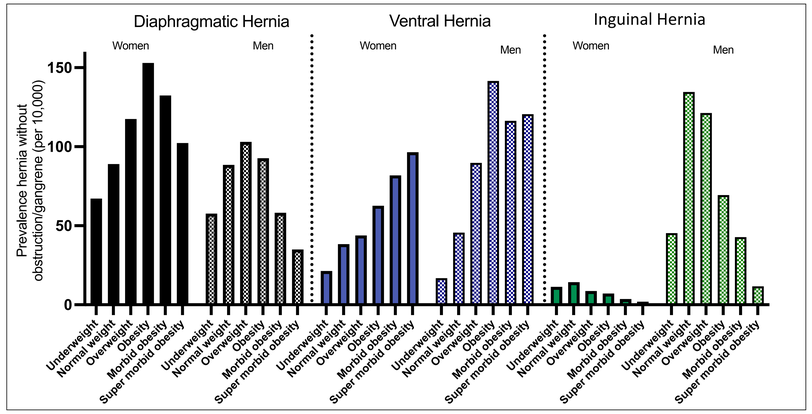
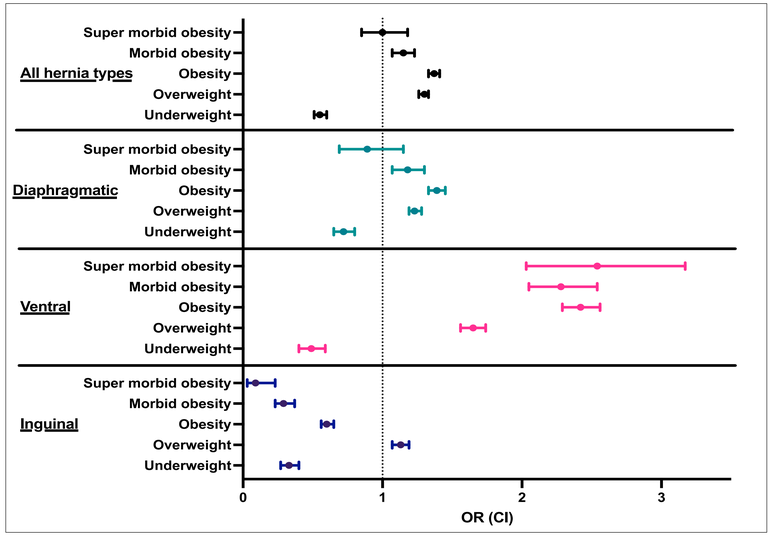


Figure 3: Forest Plot of Abdominal Hernias by BMI Categories



Results

The mean BMI for ventral hernia was significantly higher than inguinal or diaphragmatic hernias.

The OR for ventral hernia consistently increased with BMI, while the OR for inguinal hernia peaked with overweight BMI and decreased with higher BMI categories. The OR for diaphragmatic hernia peaked with obesity, but decreased with morbid obesity.

The overall prevalence of hernias was greater in men than women. However, OR for diagnosed diaphragmatic hernia was higher in women than men. Overall prevalence of hernia was 391.1 per 10,000 in men and 227.8 in women.

The peak of diaphragmatic hernia prevalence was reached in obesity with women and overweight in men. Among men, the highest prevalence of ventral hernia was seen in the obese category compared to super morbid obese in women.

Discussion

In this study, the overall prevalence of abdominal wall hernia was nearly twice that in men compared to women, mainly driven by differences in inguinal hernia prevalence. Most of the patients with hernias exceeded normal BMI. Interestingly, women tended to have a greater increase in hernia prevalence with increased BMI compared to men, who tended to have less hernia prevalence in morbid and super morbid obesity than obesity categories. Additionally, inguinal hernias tended to have decreased prevalence as BMI increased above normal weight.

Although increased BMI is associated with increased intraabdominal pressure, this alone does not explain the increase in hernia prevalence with obesity, as it prevalence does not appear to increase with morbid and super morbid obesity. This phenomenon may be explained by decreased ability to diagnose hernias by physical exam in morbidly obese patients or the increased presence of fat around visceral structures preventing easy herniation through hernia defects.

Conclusion and Future Directions

This study demonstrates that ventral hernias are more commonly diagnosed in obese patients, and increases in BMI are related to increased prevalence of ventral and diaphragmatic hernias. However, as BMI increases to morbid and super morbid obesity, the relationship between BMI and hernia prevalence appears to decrease.

This study demonstrates that it is likely that patients with morbid and super morbid obesity are less likely to be diagnosed with abdominal wall hernias, and increased effort to recognize these problems in this population may be warranted.