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# Diabetes and Obesity as Risk Factors for Surgical Site Infections in Laparoscopic Abdominal Surgery of Medicare age patients

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## Objective

The goal of this study was to determine if Diabetes Mellitus modifies the association between increasing Body Mass Index (BMI) and Surgical Site Infections in Medicare age patients who have undergone laparoscopic abdominal surgery.

## Methods

**Study Design:** A retrospective cohort study with data extrapolated from the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP).

**Study population:** Study criteria were met by 54,064 patients >45y/o who underwent laparoscopic abdominal surgery in 2016. We excluded records of patients missing key variables or patients <45y/o to improve confounder distributions between Medicare age and older patients.

**Independent Variables:** Exposure was measured as the presence of DM, Medicare age >65y/o, and the presence of the classification of obesity (BMI>30) as per Center for Disease Control (CDC) BMI guidelines. BMI was calculated using patient height and weight on record and classified as BMI normal (<25 kg/m<sup>2</sup>), overweight (25-30 kg/m<sup>2</sup>), or obese (>30 kg/m<sup>2</sup>). Diabetic status was acquired by previous physician diagnosis as listed in patient charts and recorded as “Diabetes Mellitus requiring insulin or oral agents.”

**Outcome Variables:** Any postoperative surgical site infection was recorded as an outcome event. Positive SSI in this study was defined if it met criteria defined by NSQIP as superficial incisional infection, deep incisional infection, or organ space infection.

**Statistical analysis:** Descriptive analysis was performed to check for missing variables. Bivariate analysis was performed according to the outcome and main exposure variable to check for possible confounders. Non-adjusted and adjusted logistic regression were used to assess the association between obesity, DM, and SSI.

## Results

Table 1. Characteristics of study participants from NSPQI undergoing laparoscopic surgery of the abdomen according to body mass index category during 2016.

BMI <sup>a</sup> Status					
	Under (n=858) %	Normal (n=13,552) %	Overweight (n=18,979) %	Obese (n=18,979) %	P-value
<u>Age(years)</u>					<0.001
45-65	76.87	82.47	88.4	94.1	
>65	23.13	17.5	11.6	5.9	
<u>Gender</u>					<0.001
Female	73.83	56.3	47.0	61.9	
Male	26.7	43.7	53.0	38.1	
<u>COPD<sup>b</sup></u>					<0.001
Yes	14.02	6.3	5.2	6.3	
no	85.98	93.7	94.9	93.7	
<u>History of CHF<sup>c</sup></u>					0.008
Yes	0.93	1.14	1.1	1.4	
No	99.07	98.86	98.9	98.6	
<u>Renal Failure post-op</u>					0.307
Yes					
no	0.58 99.42	0.36 99.64	0.30 99.70	0.40 99.6	
<u>Diabetes</u>					<0.001
Yes	5.84	11.3	16.8	28.4	
No	94.16	88.7	83.2	71.6	
<u>Previous sepsis</u>					<0.001
None	83.76	90.58	91.5	91.3	
SIRS <sup>d</sup>	0.64	4.89	4.8	5.0	
Septic	7.59	4.53	3.8	3.7	
<u>Emergency case</u>					<0.001
Yes	23.36	14.46	12.5	10.9	
No	76.64	85.54	87.5	89.1	

<sup>a</sup>Body Mass Index; <sup>b</sup>Chronic Obstructive Pulmonary Disease; <sup>c</sup>Congestive Heart Failure; <sup>d</sup>Systemic Inflammatory response syndrome. Emergency Cases defined as unplanned operations. Not listed (p<0.001); Ascites, Functional status, Hypertension, Disseminated Cancer. White Blood Cell Count. Smoking Status. Chronic Steroid use.

Table 2. Unadjusted and adjusted associations between BMI<sup>a</sup> and Diabetes Mellitus

Surgical Site Infection				
Characteristics	Unadjusted OR <sup>b</sup>	[95% Ci <sup>c</sup> ]	Adjusted <sup>d</sup> OR	[95% CI]
<u>BMI</u>				
Normal	Ref.	Ref.	Ref.	Ref.
Underweight	1.63	[1.13-2.34]	1.29	[0.89-1.88]
Overweight	0.96	[0.83-1.11]	1.02	[0.88-1.18]
obese	1.23	[1.07-1.40]	1.29	[1.12-1.49]
<u>Diabetes</u>				
Yes	Ref.	Ref.	Ref.	
no	1.32	[1.17-1.50]	1.24	[1.08-1.41]

<sup>a</sup>Body Mass Index; <sup>b</sup>Odds Ratio; <sup>c</sup>Confidence Interval; <sup>d</sup>Adjusted for age, sex, smoking, COPD hx, Ascites, Functional Status, CHF hx, Renal Failure, Hypertension, Disseminated Cancer, chronic steroid use, sepsis, emergency case, and White Blood Cell count.

Table 3. Adjusted associations between BMI<sup>a</sup> and SSI<sup>b</sup> according to Diabetes Mellitus Status

	All		DM <sup>c</sup> (n=10,564)		No DM (n=43,108)	
	OR <sup>d</sup>	95%CI <sup>e</sup>	OR	95%CI	OR	95%CI
BMI						
Normal	Ref	Ref	Ref	Ref	Ref	Ref
Under	1.30	[0.88-1.92]	1.11	[0.26-4.76]	1.30	[0.88-1.91]
Overweight	1.02	[0.87-1.20]	1.00	[0.69-1.45]	1.02	[0.87-1.20]
Obese	1.26	[1.08-1.48]	1.35	[0.96-1.90]	1.27	[1.08-1.49]

<sup>a</sup>Body Mass Index; <sup>b</sup>Surgical Site Infection; <sup>c</sup>Diabetes Mellitus; <sup>d</sup>Odds Ratio; <sup>e</sup>Confidence Interval. Adjusted for age, sex, smoking, COPD hx, Ascites, Functional Status, CHF hx, Renal Failure, Hypertension, Disseminated Cancer, chronic steroid use, sepsis, emergency case, and WBC count.

## Conclusion

- In this study we demonstrated that obesity and DM are independent risk factors for SSI in laparoscopic abdominal surgery.
- We found no evidence of effect modification by DM on obesity as a risk factor for SSI.
- The effect in our study when age was dichotomized to Medicare age was not statistically significant.
- We recommend surgeons not to use BMI as a predictor for SSI, but only when patients are obese BMI>30 kg/m<sup>2</sup> or have other comorbidities such as DM, CHF, COPD, disseminated cancer, and chronic steroid use.