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Postoperative Outcome of Abdominal Surgery in Obese Patients

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Abstract **Original Research Article**

Introduction: Obesity is a major health problem in western society with rapidly increasing prevalence in most countries. The healthcare burden of obesity is far reaching but many of the consequences are yet to be fully understood. While there is a perception that obesity negatively impacts on outcomes following abdominal surgery there is conflicting evidence for this. ***Aims:*** To identify the complications of post-operative obese patients. ***Methods:*** Between 1st September, 2016 and 28th February, 2017, patients undergoing GIT, Hepatobilliary and Urological surgery at Shaheed Ziaur Rahman Medical College Hospital in Bogura, Bangladesh were enrolled. Following informed consent, BMI was assessed. High risk patients and complications were identified according to established criteria. Patients were grouped according to BMI categories as Normal, overweight, Obese grade-I and Obese grade-II. A Cost analysis was performed on all patients treated at Shaheed Ziaur Rahman Medical College Hospital using a SQL database. The cost of treatment was analysed with respect to the same BMI catagories. ***Results:*** A literature review found evidence of increased risk of wound infection, anastomotic leak, and pulmonary and thrombo-embolic risk. There was mixed evidence or no evidence that obesity increases cardiac risk, sepsis, overall morbidity and mortality or overall cost. A cohort of 100 patients was analysed. Diabetes was more common with increased BMI (p=0.017). Other categories of operative risk were not different. There was no difference in overall morbidity (p=0.903). Obese patients were more expensive than normal weight patients ($9587 versus $5,786(p<0.05)). ***Conclusion:*** This study demonstrates that obesity, measured by BMI is associated with more severe morbidity. I have also demonstrated that excess body fat as measured by BMI is associated with a significantly increased cost of treatment (36%) for patients undergoing major abdominal surgery.

Keywords: Prevalence, Postoperative Outcome, Abdominal Surgery, Obese Patients.

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INTRODUCTION

Obesity is the abnormal accumulation of body fat to the extent that it may have an adverse effect on health. Obesity is now the most common nutritional disorder in the developed world and the incidence has trebled over the past three decades [1]. The developing world is not far away from that. The prevalence of obesity and overweight was found 13.5% and 14% for Nepal and 15.3% and 24.2% for Bangladesh respectively [2]. In the China obesity has increase from 3.6% to 7.1% over 10 years [3]. Many have described obesity as an epidemic and suggest the long term consequences of our rising rate of obesity may reverse the life expectancy of our population for the first time in history. Overweight and obesity are risk factors for a number of chronic and life limiting diseases including diabetes, heart disease and cancer. It has been estimated to be directly responsible for 3 million deaths annually [4]. While there is some evidence that the prevalence of obesity is beginning to plateau the rate of secondary diseases is expected to continue to rise [5]. The management of obese patients on a day to day basis is a challenge for all health care professionals however we need to prepare for the greater health needs of an increasingly obese population. It is therefore important that we better understand the impact of obesity on health outcomes both outside and within our health care system. Obesity is an incredibly complex disease with respect to its aetiology. At its simplest level obesity develops when there is longstanding surplus of caloric intake over energy expenditure. Unfortunately such a simplistic view ignores the many environmental, social, psychological, and genetic factors which play a roll. The difficulty when investigating obesity is separating these variables from each other. There is no doubt that there is a genetic component to the development of obesity and genetic pathways which lead to increased susceptibility to obesity have been described. The overwhelming body of evidence suggests that obesity is a polygenic condition and no single gene defect has been identified in humans that results in obesity [6]. Unfortunately the rapid increase in the prevalence of obesity over the last few decades cannot be explained by genetics and suggests that environmental factors are the primary cause of obesity [7]. Multiple studies of migrant populations have revealed significant differences in the rates of obesity of genetically similar populations. For example the Pima Indians living in the United States are on average 25kg heavier than those living in Mexico [8]. The environmental influences must act by either increased energy intake or decreased expenditure. Despite our increasingly sedentary lifestyle the evidence that decreased energy expenditure contributes much towards global obesity is not strong. Obese individuals require more energy to perform equivalent tasks and despite common misconceptions, obese individuals have a higher basal metabolic rate and total energy expenditure than non-obese. Obese individuals seem to have disconnected between energy requirement and intake while lean individuals are able to match their intake to wide variations of energy expenditure [9]. Obese individuals undoubtedly have an increased caloric intake however research into this is confounded by the difficulty in assessment due to significant underreporting of intake. Although the prevalence of obesity is rising, the change in body size is not just affecting one section of the population. The prevalence of overweight has increased at a similar rate and the mean BMI of the whole population has increased markedly over the past three decades [10]. Such changes aren't explainable by individual genetic or metabolic abnormalities and are better explained by the environmental impact on the human condition. Humans have developed predominantly through periods of food shortage rather than food excess and have therefore been "programmed" to accept and store food rather than refuse it [11]. The availability of larger amounts of heavily marketed calorie dense food has therefore had a major effect on society. In the United States the food supply chain produces more than 3,800 kcal per person per day which is nearly twice the recommended adult intake. Encouraging Americans to consume this amount of food has resulted in 30 billion dollars of advertising annually, more than any other industry. Other strategies the food producers have employed include increasing portion size, increasing availability and increasing fat and sugar content. In the United States only 38% of meals eaten are "homemade" and sugar and fat account for more than half the total dietary energy intake [12]. Fat and sugar are known to have poor satiating effects particularly in the obese [9]. While the aetiology of obesity is without a doubt multifactorial the overwhelming body of evidence points to societal over eating as the primary cause. Efforts to treat obesity on an individual level have had varied success and have had no impact on populations. From a public health perspective more effort must go into reversing the trends of consumption both by encouraging better personal choices but also through greater regulatory control of the food chain.

MATERIALS AND METHODS

Study Design

Prospective Cohort study.

Place of Study

Department of Surgery, Shaheed Ziaur Rahman Medical College Hospital, Bogura, Bangladesh.

Period of Study

September 2016 to February 2017.

Study Population

This study is conducted among the obese patients undergoing abdominal surgery in the Department of Surgery at Saheed Ziaur Rahman Medical College Hospital, Bogura, Bangladesh.

Sample Population

The patients having major abdominal surgery after admission in the Department of Surgery, Shaheed Ziaur Rahman Medical College Hospital, Bogura and fulfilling the inclusion and exclusion criteria were considered as sample.

Sample Size

100 cases.

Sampling Technique

Stratified random sampling method after dividing 4 homogenous groups.

Inclusion Criteria

1. All patients admitted in surgery department for routine abdominal surgery included in my study.
2. Patient age group: 18-55 yrs.

Exclusion Criteria

1. Patient with previous abdominal surgery.
2. Patient having emergency abdominal surgery.
3. Patient with inoperable or advanced metastatic disease.

4. Obese patient with non-abdominal surgery.

Data Collection

After taking informed written consent from the patient, he/she was interviewed by the researcher himself. As the questions were related to obesity and obesity associated complications, exclusion of other pathology and relevant physical examinations, privacy of the respondents during interview was given due attention. Before starting the interview rapport was built.

Study Procedure

Patients were divided into groups according to BMI in kg/m^2. A BMI of 18.5-24.9 was defined as normal weight, 25-29.9 as overweight, 30-34.9 as obese grade-I, and a BMI of 35-39.9 as obese grade-II. Complications were identified according to established criteria both during the hospital admission and subsequent outpatient clinic. Any readmission within 30 days was captured. The primary endpoint was overall morbidity and total cost. Secondary endpoints included mortality, length of stay, ICU stay, and operative time, infectious and wound complications, cardiac and pulmonary complications, DVT/PE, blood transfusion and anastomotic leak rates. All end points were well defined according to established criteria. Morbidity was graded according to the Clavien-Dindo classification of surgical complications. Length of stay, ICU stay and operative time were also recorded.

Statistical Analysis

After collecting data it is processed and analyzed using computer software program SPSS V17.0 (Statistical Package for Social Science). The test statistics used to analyze the data were descriptive statistics, Chi-square (χ^2) Test and Student's t-Test. Data presented on categorical scale were compared between groups using Chi-square (χ^2) Test, while the data presented on continuous scale were compared between groups using Student's t-Test. For all analytical tests, a probability value of 5% or less ($p=0.05$ or $p<0.05$) was considered as significant.

RESULTS

Total 123 people were available and consented for this study. 15 patients were excluded; 8 did not have surgery (4 patient were unfit for surgery, 3 due to advanced metastatic disease and 1 patient declined surgery). The remaining 100 patients, 42 females and 58 males, included for analysis. The median age was 48 with a range from 18-55.

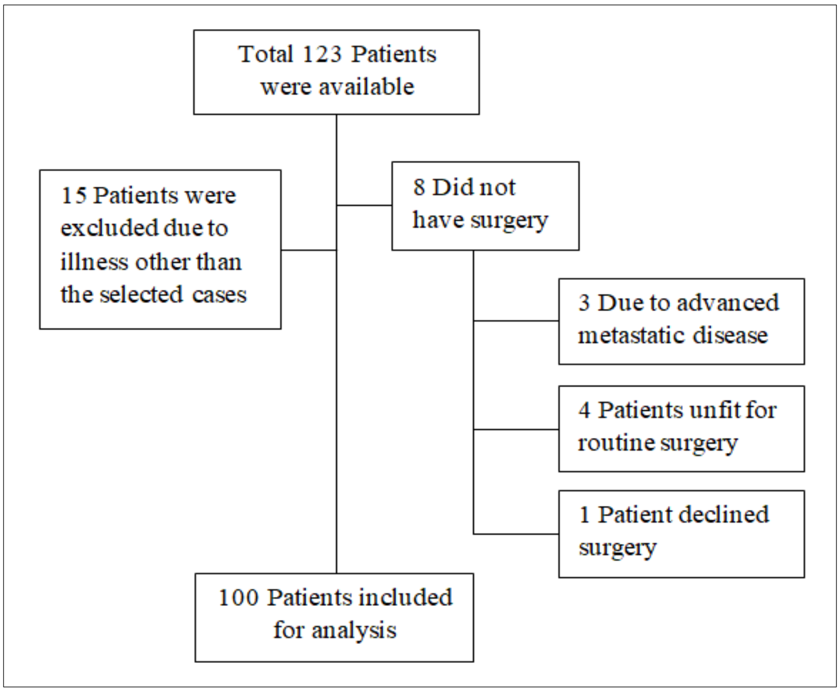

Figure 1: Study exclusion flow chart.

Increasing BMI was associated with increased rates of diabetes (p=0.017) however there was no significant increase in other comorbidities or P-POSSUM scores with increasing BMI.

Table 1: Baseline Characteristics (N=100)

	Normal Weight	Overweight	Grade-I	Grade-II	P value
N	32	29	23	16	
Age range (median)	39(28-48)	44(19-52)	41(31-54)	46(37-55)	0.952

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	Normal Weight	Overweight	Grade-I	Grade-II	P value
% Female	53	56	40	44	0.623
Median ASA	1	1	1	2	0.973
P-POSSUM Morbidity	47%	52%	43%	50%	0.903
P-POSSUM Mortality	0	0	0	0	
Comorbidity (%)					
Respiratory Disease	2 (6.25%)	2 (6.89%)	1 (4.35%)	2 (12.5%)	0.533
Heart Disease	**4 (12.5%)**	**3 (10.3%)**	**6 (26.08%)**	**5 (31.02%)**	**0.037**
Diabetes	**3 (9.37%)**	**5 (17.24%)**	**6 (26.08%)**	**6 (37.5%)**	**0.017**
Renal Impairment	0	1 (3.45%)	1 (4.35%)	0	
Case Mix (%)					
Gastrojejunostomy	4 (12.5%)	4 (13.8%)	3 (13%)	2 (12.5%)	
Hemicolectomy	4 (12.5%)	3 (10.3%)	3 (13%)	1 (6.2%)	
Cholecystectomy	9 (28.1%)	8 (28.6%)	7 (30.4%)	5 (31.2%)	
Choledocholithotomy	4 (12.5%)	4 (13.8%)	3 (13%)	1 (6.2%)	
Nephrolithotomy	6 (18.7%)	6 (20.7%)	4 (17.4%)	4 (25%)	
Ureterolithotomy	5 (15.6%)	4 (13.8%)	3 (13%)	3 (18.7%)	

The overall morbidity was 48% and although it was highest in the obese group it was not statistically different between groups (p=0.903). Significant differences were noted between groups in infectious complications (p=0.029). Although wound complications were found more in obese patient, it is not statistically significant (p=0.194). There was no statistical difference detected in specific complications including pneumonia (p=0.876), respiratory failure (p=0.793), cardiovascular events (p=0.748), anastomotic leaks or gastrointestinal failure (0.529). I recorded no DVT or pulmonary embolus events (Table-2).

Table 2: Complications (N=100)

	Normal	Overweight	Grade-I	Grade-II	p value
N	32	29	23	16	
Infectious complication	**4 (12.5%)**	**5 (17.24%)**	**7 (30.43%)**	**6 (37.5%)**	**0.029**
Wound complication	3 (9.4%)	6 (20.7%)	5 (21.7%)	4 (25%)	0.194
Anastomotic leak	0	1(3.45%)	1 (4.35%)	0	
Respiratory Failure	1 (3.13%)	2 (6.9%)	1 (4.35%)	1 (6.25%)	0.793
Cardiovascular Event	2 (6.25%)	2 (6.9%)	2 (8.7%)	2 (12.5%)	0.748
GI Failure	1 (3.13%)	1(3.45%)	2 (8.7%)	1 (6.25%)	0.529
Inflammation/Sepsis	3 (9.4%)	2 (6.9%)	1 (4.35%)	1 (6.25%)	0.802
Pneumonia	1 (3.13%)	1(3.45%)	1 (4.35%)	1 (6.25%)	0.876
DVT	0	0	0	0	
PE	0	0	0	0	

There was no statistically significant difference between groups with respect to blood transfusion (p=0.741), length of stay (p=0.977), ICU stay (p=0.912), and operative time (p=0.766). Obese patients tended to have a greater length of stay (8 days versus 6 days) and operative time (116 mins versus 98 mins) when compared to normal weight patients but those differences were not statistically significant (Table-3). Overall there were 42 women and 58 men with a median age of 48 years (range 18 to 55). The mean cost per admission was $7,810. Total cost was significantly different between BMI groups with normal weight patients being the least expensive with a mean cost of $5786 per admission and obese patients were significantly more expensive with a mean cost of $9587 per admission (p=0.001).

Table 3: Outcomes (N=100)

	Normal	Overweight	Grade-I	Grade-II	p value
N	32	29	23	16	
Blood Transfusion	4 (12.5%)	5 (17.24%)	2 (8.7%)	12.20%	0.741
Mean hospital Stay (days)	6	7	6	8	0.977
ICU Required	2 (6.25%)	1 (3.45%)	1 (4.35%)	1 (6.25%)	0.768
Mean ICU Stay (days)	2	1	2	3	0.912
Readmit	1 (3.13%)	1 (3.45%)	1 (4.35%)	1 (6.25%)	0.877
Operative time (min)	98	96	102	116	0.766

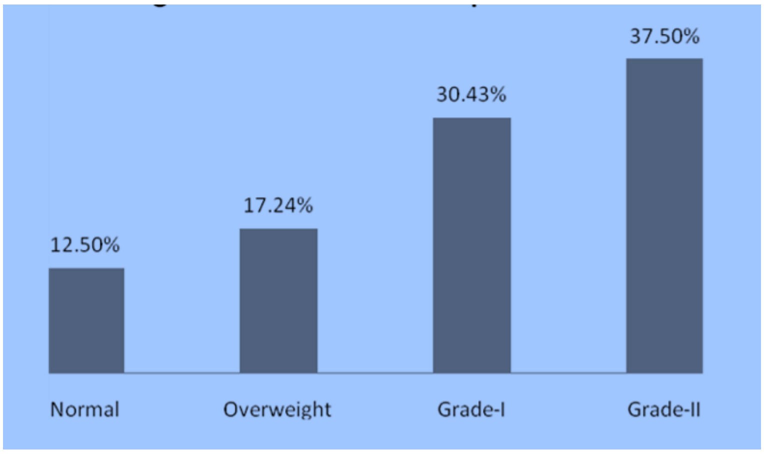

Figure 2: Infectious complications.

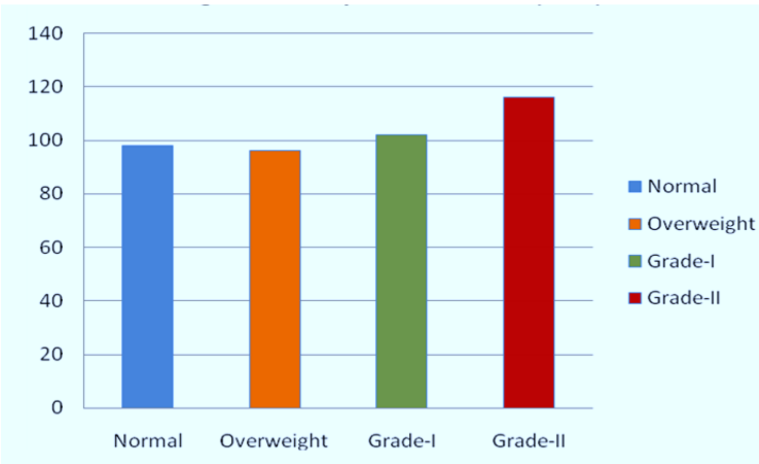

Figure 3: Operative time (min).

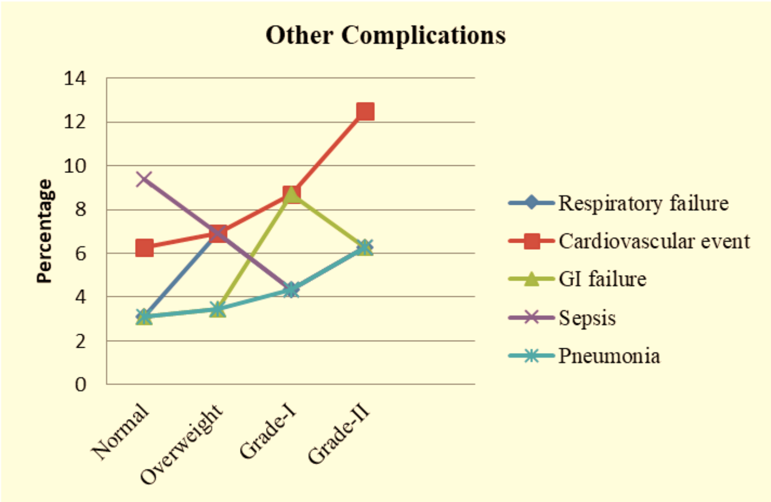

Figure 4: Other Complications.

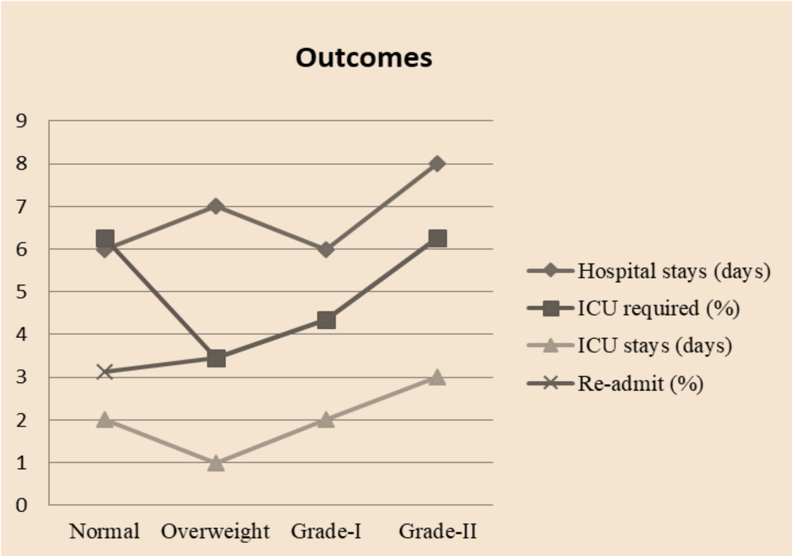

Figure 5: Outcomes.

DISCUSSION

Despite many outcomes not being statistically significant, when using BMI as a measure of obesity most of the endpoints had a reproducible J shaped distribution with greater numbers with increasing weight as demonstrated in figures 4.4 and 4.5. In this study I found that obese patients undergoing abdominal surgery need to expense more than normal weight patients. This difference was not small with obese patients costing 36% more to treat than that of normal weight patients. In the literatures the effect of obesity on outcomes following general and colorectal surgery is less clear cut with several studies on morbidity following general and colorectal procedures, have failed to show any effect of obesity on outcomes [13]. I believe that total cost may be a good surrogate for overall outcome as it indirectly gives weighting to morbidity as well as other aspects of treatment such as hospital stay and ICU stay. The cause of this increased cost may be that, obese patients create greater anxiety amongst medical staff due to their comorbidity and the difficulties that exist in their assessment and therefore have more tests, imaging, procedures, and more attention from staff and are effectively over treated. In this study there was no difference in the overall morbidity or anastomotic leak rates however infectious complications were significantly more common in the obese group. Diabetes and heart disease were also more common in the obese group making however obesity was still an independent predictor of increased cost even when this was controlled for. The other interesting finding was that for most data points the overweight group tended to have the lowest rates of complication. This suggests that, as has been shown in other series, there may be some protective effect from surgical complications of being moderately overweight [14]. The overall complication rate was very high (45%) which probably reflects the fastidious nature of our follow-up which included minor complications such as superficial SSIs, UTIs and blood transfusions. This resulted in a higher than expected rate of complications in the normal weight group, most of which were minor (75%), particularly when compared to the obese group (59% minor). This highlighted the benefit of using a validated scoring system such as the Clavien-Dindo classification to assess severity of morbidity. I chose Clavien-Dindo grade 3 as a cut-off because complications of this grade require intervention and are highly likely to alter the clinical course following major abdominal surgery while grade 1 and 2 complications include lesser issues such as those mentioned above. Any future research should take care to use some method of assessing severity of complications. There is evidence from our study and others that complications increase at both extremes of BMI and therefore future studies should categorise patients appropriately to determine exactly who is at increased risk of complications. Obesity is an increasing problem in our society and the various health related consequences of obesity pose a significant burden to health care provision in developing countries. A number of studies have previously failed to show an increase in post-operative morbidity due to obesity however there is still a belief among many surgeons that this is not the case [13].

Limitations of this Study

There are some limitations of this study which I acknowledge.

1. There are a number of comorbid illnesses associated with obesity such as diabetes and heart disease which may play a role in outcomes and could not be controlled statistically due to our modest sample size.
2. The operations were done by different surgeons that may interfere the surgical outcome significantly and may not reflect the exact result.

3. The study period was very short and sample size was small which make it difficult to give a final conclusion.
4. There may be some inherent bias in the costing calculation which would lead to greater costs in obese patients.

Conclusion

It is an important issue that obesity is increasing in our new generations. This study should take into account for the future health care researcher. This study has summarized the current body of literature and added to it by demonstrating in our cohort that obese patients were at increased risk of complications. I have also provided the evidence that patients with increased BMI undergoing abdominal surgery are associated with significantly greater cost to the healthcare system. These results are important for clinicians and healthcare professionals who together will be responsible for provision of care to the increasingly obese patients. The effect of obesity on the outcomes of treatment is essential because with better understanding we will be able to provide better service in the future.

Recommendations

It may be more appropriate to compare multiple groups such as underweight, normal weight, overweight, obese, and morbidly obese for the actual outcome. However, once again grouping into so many categories requires larger numbers to show a difference. Ideally a large multi centre prospective database with particular attention to obesity and proper collection of post-operative outcome data would provide us the best evidence possible.

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