ORIGINAL ARTICLE

Burden of Obesity among Patients Attending General Surgery Clinic and its Impact on Post-Operative Morbidity in Patients Undergoing Surgery – A Prospective Cohort Study

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Abstract

Background: Obesity is a growing global concern, and the impact of obesity on surgical outcomes often remains under-recognized.

Objectives: The primary objective of the study is to evaluate the burden of obesity in patients attending a general surgery clinic at a tertiary hospital. The secondary objective is to compare post-operative morbidity among a subset of obese and non-obese patients undergoing surgery.

Methods: This cohort study was conducted at Patel Hospital from January 2022 to October 2022. Surgical residents recorded demographic data, BMI, comorbidities, diagnosis, and post-operative complications. Obesity was classified according to the WHO and Asia-Pacific BMI criteria. Comparisons between BMI categories and clinical variables, including post-operative complications, were performed.

Results: A total of 452 patients were included, with median (IQR) ages and BMIs of 45 (32.5-57) and 25.5 (22.9-29.4), respectively. The prevalence of overweight and obesity was 11.5% and 72.6%, respectively. Combined prevalence of overweight/obesity was found to be 84.1%, with more than half of the patients classified as obese II (53.8%) as per the Asia-Pacific classification. A subset of 210 patients underwent surgery, and in that subset, overweight/obese patients [197/210 (93.1%)] were more than normal/underweight [13/210 (6.9%)]. The frequency of complications was higher in Overweight/Obese patients than in normal/underweight patients, without statistical significance [11/197 (5.6%) *vs.* 0/13, p=0.381].

Conclusion: Obesity is highly prevalent among patients presenting to the general surgery clinic, and it increases the likelihood of comorbidities, specific surgical pathology (hepatobiliary, hernias), surgical interventions, and post-operative morbidity. These findings highlight the need for structured perioperative risk assessment and tailored management strategies for obese patients.

Keywords: *Obesity, overweight, BMI, post-operative complications, surgical outcomes.*

INTRODUCTION

Overweight and obesity rates have increased dramatically in recent decades, leading to serious public health issues [1]. In 2022, approximately 2.5 billion adults aged 18 years and above were classified as overweight, of whom over 890 million met the criteria for obesity. This corresponds to 43% of adults aged 18 or older who were overweight [2]. The World Health Organization (WHO) regards overweight and obesity as a global epidemic due to the high prevalence [3]. Obesity presents substantial issues for both patient outcomes and healthcare facilities. Several factors, such as a heightened inflammatory response and poor wound healing, cause obesity-related surgical risks. These risks are significantly increased by comorbid conditions, including Diabetes and cardiovascular disease [4]. There is evidence that obesity has a deleterious impact on postsurgical results in addition to its harmful effects on health. Excessive obesity reduces exposure to the operating field, thereby lengthening the duration of surgery [5]. Longer hospital stays, more frequent readmissions, and an increase in complications, such as surgical site infections following surgery, have all been linked to obese patients [6].

Numerous population-based epidemiological studies have been carried out to highlight adult obesity as a public health concern. According to prior studies, Asians have lower BMIs and smaller waist circumferences than Caucasians, which increases their risk of obesity-related morbidity and mortality [7]. These findings suggest that conceptual ambiguities still exist among Asian populations. According to a recent study, BMI (obese ≥ 27.0) underestimates the prevalence of obesity in Indonesia since it misclassifies 40% of obese individuals as normal or overweight [8]. In Pakistan, limited data exist showing the nationwide prevalence of obesity among adults. For instance, a study conducted in an urban slum in Karachi found that 58.7% of people had central obesity, 29% were overweight, and 21% were obese [9]. This finding also suggests that estimates of overweight and obesity in adults should be updated.

There are conflicting reports on the association between obesity and post-operative complications. Multiple studies have demonstrated that obese patients have a higher likelihood of requiring post-operative intensive

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care, along with an increased risk of respiratory complications such as extubation failure, pneumonia, atelectasis, and pulmonary embolism. In addition, they often face technical challenges during surgery, including prolonged operative duration and a higher probability of conversion from minimally invasive to open procedures, as well as an elevated incidence of surgical site infections. Infection rates may be higher due to impaired immune responses resulting from interactions between immune cells and adipocytes, increased wound tension after closure, trauma from retractor use to improve surgical visibility, and poor microcirculation in obese patients. Infections are also associated with longer operations, possibly due to intraoperative hypothermia. Other research, however, has refuted these conclusions, with some indicating no elevated risk of problems or operating times [10].

To the best of our knowledge, numerous epidemiological studies reflect that the WHO classification can underestimate overweight/obesity in the Asian population by misclassifying 40% of individuals [11-13], and existing literature has not taken into account the revised Asia-Pacific classification for overweight and obesity, with limited data from low-income settings as mentioned. There is diverse socio-economic background representation at our setup, underscoring the need for further investigation. We therefore designed the present work. The primary objective of the study is to evaluate the burden of obesity in patients attending a general surgery clinic at a tertiary hospital. The secondary objective is to compare post-operative morbidity among a subset of obese and non-obese patients undergoing surgery.

MATERIALS AND METHODS

This cohort study was conducted in the Department of Surgery, Patel Hospital, Karachi over 10 months from January 2022 to October 2022, following ethical approval from the institutional review board (PH/IRB/2023/026). All adult patients (18-75 years) attending the general surgery clinic during the study period were enrolled. All patients who were visiting the clinic for weight-reduction surgery and those who were visiting the clinic for a second time were excluded. Patients enrolled in the study provided written informed consent.

Sample size was calculated using the WHO sample size determination in health studies software version 2, at a confidence level of 95% with an anticipated population proportion of 39.1% and an absolute precision of 4.5%; a sample size of 452 was required [14]. Non-probability consecutive sampling was employed.

Demographic data, including age, gender, BMI, comorbidities (Hypertension, Diabetes, cardiovascular disease, *etc*.), and diagnosis, were recorded by general surgery residents. Measurements of height and weight were performed at the clinic by the assigned outpatient staff using the same SECA scale for all patients. Body mass index (BMI) was calculated as weight in kilograms divided by the square of height in meters (kg/m^2). Obesity was classified as per Asian-pacific BMI cutoffs: Underweight (<18.5 kg/m^2), normal (18.5–22.9 kg/m^2), overweight (23.0–24.9 kg/m^2), obese I (25.0-29.9 kg/m^2), Obese II (>30.0 kg/m^2) and also with WHO classification as underweight (<18.5 kg/m^2), normal (18.5-24.9 kg/m^2), over weight (25.0-29.9kg/m^2), obese I (30.0-34.9 kg/m^2), obese II (35-39.9 kg/m^2) and obese III (>40kg/m^2) [15, 16].

For comparing post-operative outcomes between obese and non-obese patients, a subgroup of patients who underwent any surgical procedure during the study period was then classified according to Asia-Pacific BMI criteria into obese and non-obese groups. These patients were then followed for 30 days, and post-operative complications were documented in Performa through consultant clinic notes. Patients were instructed to report any complications sooner if they occurred before the scheduled follow-up visit. A follow-up assessment was conducted by treating consultants to maintain uniformity of data collection.

Data was analyzed using SPSS version 21 (IBM Corp., Armonk, NY). Qualitative variables were expressed as frequencies and percentages and compared between BMI categories using the Chi-square test or the Fisher Exact test. Normality of quantitative variables was assessed using the Shapiro-Wilk test, and non-normal variables were summarized as medians with interquartile ranges (IQR). Kruskal-Wallis test was applied to compare these variables among BMI categories.

All the patients who underwent surgical intervention were categorized into two groups, *i.e*., Normal/ underweight and overweight/obese, and post-operative complications were compared between these two groups by using Fisher's Exact test. A p-value of <0.05 was considered statistically significant.

RESULTS

A total of 452 patients were included. The median age and BMI were 45 (IQR=32.5-57) years and 25.5 (22.9-29.4) Kg/m^2, respectively (**Table 1**). Patients were categorized into BMI categories using the Asian-Pacific and WHO Classifications. Prevalence

Table 1: Demographics of the entire cohort of patients.

Variables	Categories	Statistics n (%)
Sex, n (%)	Male	239 (52.9)
	Female	213 (47.1)
Weight median	(IQR)	70 (61-80)
Height median	(IQR)	164 (158-172)
BMI group, n (%)	Underweight (<18.5)	10 (2.2)
	Normal (18.5-22.9)	62 (13.7)
	Overweight (23-24.9)	52 (11.5)
	Obese 1 (25-29.9)	85 (18.8)
	Obese 2 (>30)	243 (53.8)
Comorbid, n (%)	Yes	137 (30.3)
	No	314 (69.5)
Comorbid Category, n (%)	None	315 (70.3)
	DM	41 (9.2)
	HTN	62 (13.8)
	IHD	9 (2.0)
	Others	11 (2.5)
Diagnosis, n (%)	Hepatobiliary	189 (41.8)
	Perianal	74 (16.4)
	Inguino-scrotal hernia	46 (10.2)
	Ventral hernia	33 (7.3)
	Appendicitis	11 (2.4)
	Obstruction	5 (1.1)
	Miscellaneous	75 (16.6)
	Non-Specific*	19 (4.2)
Surgery, n (%)	No	241 (53.30)
	Yes	211 (46.7)

BMI: Body mass index, DM: diabetes mellitus, HTN: Hypertension, IHD: ischemic heart disease.

of overweight and obesity was found to be 11.5% and 72.6%, respectively, with more than half of the patients classified as Obese II (53.8%) as per the Asia-Pacific classification (**Table 2**). Prevalence of overweight/obesity was higher under the Asia-Pacific criteria (84.1%) than under the WHO criteria (56.4%) (**Table 2**). Overweight/obese patients had a higher frequency of comorbidities (Diabetes, Hypertension) and specific pathologies (cholelithiasis & hernias) as compared to normal/underweight (**Table 3**). Although we have taken patients attending the General Surgery clinic, the majority of our cases were hepatobiliary and hernia cases.

A subset of 210 patients underwent surgery. To compare complications, this subset was categorized into two groups: Normal/Underweight (n=13) and Overweight/Obese (n=197). In this subset, the number of Overweight/Obese patients [197/210 (93.1%)] was higher than that of normal/underweight [13/210 (6.9%)]. The occurrence of complications was higher in overweight/obese patients than in normal/underweight patients [11/197 (5.6%) *vs.* 0/13, p = 0.381], and all complications were surgical site infections. However, this difference did not reach statistical significance but reflected a higher trend towards overweight/obese (**Table 4**).

DISCUSSION

This study reports a high prevalence of overweight and obesity among patients attending a general surgery clinic using Asia-Pacific criteria. More than half were categorized as Obese II, reflecting a substantial burden within this clinical population. The comorbid conditions, specific pathologies (hepatobiliary, hernias), surgical interventions, and complications (in surgical patients only) showed a non-significant trend toward being higher in overweight/obese as compared to normal/underweight. While obesity impacts all surgical disciplines, its effects are most pronounced in abdominal and hepatobiliary surgeries due to challenges in surgical field exposure and wound tension. This study primarily evaluates patients with hepatobiliary diseases and hernias, which constitute the bulk of general surgical volume in our setting.

A study conducted by Asif *et al*. in 2020 5.1% of our population is obese, and 22.8% are overweight [3]. The National Center of Health Statistics reports that the prevalence of adult obesity was 40.3% between August 2021 and August 2023, with no discernible variations. Adults between the ages of 40-59 years had a higher prevalence of obesity than those between the ages of 20-39 years and 60 years and older [17].

The observed association between obesity and comorbid conditions aligns with existing literature, particularly regarding cardio-metabolic disorders [18].

Table 2: Prevalence of obesity as per WHO and Asia-Pacific Classifications.

BMI classification	Underweight n (%)	Normal n (%)	Overweight n (%)	Obese I n (%)	Obese II n (%)	Obese III n (%)	Total n (%)
Asian-Pacific	10 (2.2)	62 (13.7)	52 (11.5)	85 (18.8)	243 (53.8)	-	452 (100)
WHO	13 (2.9)	184 (40.7)	148 (32.7)	73 (16.2)	23 (5.1)	11 (2.4)	452 (100)

Table 3: Association of obesity.

Variables		BMI					p-values
		Underweight (<18.5) (n=11)	Normal (18.5-22.9) (n=62)	Overweight (23-24.9) (n=52)	Obese I (25-29.9) (n=85)	Obese II (>30) (n=243)	
Age (years); Median (IQR)		31 (23-47)	40 (25-60)	45 (31-55)	45 (33-59)	46 (34-57)	0.100[a]
Sex, n(%)	Male	5 (50)	37 (59.7)	27 (51.9)	50 (58.8)	120 (49.4)	0.463[b]
	Female	5 (50)	25 (40.3)	25 (48.1)	35 (41.2)	123 (50.6)	
Comorbid category, n(%)	None	9 (90)	54 (87.1)	46 (90.2)	53 (63.1)	153 (63.5)	0.021[c]
	DM	0 (0)	2 (3.2)	3 (5.9)	12 (14.3)	24 (10)	
	HTN	0 (0)	3 (4.8)	1 (2)	12 (14.3)	46 (19.1)	
	IHD	0 (0)	0 (0)	0 (0)	3 (3.6)	6 (2.5)	
	Others	1 (10)	2 (3.2)	0 (0)	1 (1.6)	7 (2.9)	
Diagnosis, n(%)	Non-specific	0 (0)	4 (6.5)	0 (0)	7 (8.2)	8 (3.3)	0.125[c]
	Hepatobiliary	3 (30)	23 (37.1)	27 (51.9)	27 (31.8)	109 (44.9)	
	Inguino-scrotal hernia	1 (10)	6 (9.7)	5 (9.6)	11 (12.9)	23 (9.5)	
	Ventral hernia	0 (0)	2 (3.2)	1 (1.9)	5 (5.9)	25 (10.3)	
	Obstruction	0 (0)	1 (1.6)	0 (0)	0 (0)	4 (1.6)	
	Perianal	3 (30)	8 (12.9)	8 (15.4)	22 (25.9)	33 (13.6)	
	Miscellaneous	3 (30)	16 (25.8)	10 (19.2)	12 (14.1)	34 (14)	
	Appendicitis	0 (0)	2 (3.2)	1 (1.9)	1 (1.2)	7 (2.9)	
Surgery, n(%)	Yes	1 (10)	13 (21)	14 (26.9)	8 (9.4)	175 (72)	<0.001
	No	9 (90)	49 (79)	38 (73.1)	77 (90.6)	68 (28)	

IQR-interquartile ranges; a= Kruskal wallis test; b=chi-square; c=fisher exact test

According to a study by Bae *et al*. the two most common comorbidities among obese individuals are dyslipidemia and Hypertension [19]. Obese individuals showed a greater burden of comorbidities than those without obesity in the younger age group of 18-39 years: prediabetes (17.1% *vs.* 4.4%), dyslipidemia (28.1% *vs.* 9.9%), and Hypertension (29.0% *vs.* 7.1%) [19]. According to data from the National Health and Nutrition Examination Survey (NHANES, 2017-2018), the prevalence of Hypertension was almost twice as high in obese individuals (61.0%) as in normal-weight individuals (33.1%) [20]. In the US, obesity can be attributed to 30-53% of cases of Diabetes Mellitus [21, 22]. Marked obesity is linked to a heightened risk of mortality from cardiovascular causes [23]. The well-established relationship between excess body weight and various cardio-metabolic disorders underscores obesity as a key target in strategies aimed at preventing cardiovascular disease.

In our study, more pathologies were in the overweight/obesity group, consistent with our results. Prior research has demonstrated that, in actuality, being overweight or obese significantly increases the chance of developing conditions including Hypertension, dyslipidemia, diabetes mellitus, coronary heart disease, cerebral

Table 4: Implications of obesity on post-operative complications in subgroups of patients who underwent surgery.

Variables	Category	Normal	Overweight/Obese	p-value
Complications (30 days)	No	13 (100)	186 (94.4)	0.381
	Yes	0 (0)	11 (5.6)	
	Total	13 (100)	197 (100)	

vasculopathy, cholelithiasis, arthropathy, polycystic ovarian syndrome, sleep apnea syndrome, and some neoplasms [24].

Obesity is widely recognized as a significant contributor to increased post-operative morbidity in general surgical practice, as demonstrated by our findings and previous research. A multicenter study conducted by Mashayekhi *et al*. in Pakistan evaluating patients undergoing elective general surgical procedures demonstrated that increasing BMI was significantly associated with a greater likelihood of post-operative complications, particularly pulmonary events and surgical site infections [25]. Obese patients had the highest overall complication rate (36.4%), followed by overweight patients (26.2%) [25]. In our subset of 210 surgical patients, all recorded complications (5.6% in the overweight/obese group) were Surgical Site Infections. Studies have repeatedly shown that obese people have higher rates of wound complications, because of variables like excess adipose tissue, decreased vascularity, and impaired oxygen diffusion - all of which contribute to delayed healing and greater susceptibility to infection [25, 26], warranting the need for tailored perioperative strategies, including optimized wound care and careful management of comorbidities like Hypertension (13.8%) and Diabetes (9.2%). Enhanced Recovery After Surgery (ERAS) protocols effectively mitigate these risks through prehabilitation, carbohydrate loading, multimodal analgesia, and early mobilization. Implementation of ERAS protocols has been associated with a 32% reduction in post-operative morbidity, shorter hospital stays, a 20% decrease in readmission rates, and improved overall recovery [27].

In all of the aforementioned literature, the WHO classification of obesity was taken into consideration; hence, its generalizability is rather controversial, as it underestimates the overall prevalence of overweight/obesity in the Asian population. A study by Ashraf *et al*. [28] in Pakistan compared the WHO and Asia-Pacific classifications of obesity to determine the prevalence of overweight and obesity among healthcare workers and reported 54.8% and 38.7%, respectively, in line with our results.

Based on our findings, we propose that surgeons should provide thorough preoperative counseling to obese patients regarding their increased risk of post-operative complications. When feasible, weight reduction should be recommended before surgery, while following available conservative measures to mitigate that pathology temporarily. If surgery is urgent and important for any reason, a minimally invasive approach should be considered to reduce the operative burden in Overweight/obese patients. Surgical protocols should be optimized for obese patients, focusing on perioperative risk reduction, wound care, and careful management of comorbidities to improve outcomes—a study of adequate power to compare the complications between overweight/obese and normal/underweight patients.

LIMITATIONS

This study has certain limitations. It was conducted at a single center using non-probability consecutive sampling, which may limit generalizability. Post-operative complications were recorded from outpatient records, potentially leading to an underestimation of their true incidence. The follow-up duration was also relatively short (30 days), preventing assessment of long-term outcomes, *e.g.,* hernia recurrence. In our subset of 210 patients, only 13 were in the underweight/normal group, limiting comparison and statistical validity. The higher incidence of complications, though statistically insignificant, may be attributed to an underpowered study design. Potential confounding variables, including age, comorbidities, sex, and type of surgery, may significantly influence the interpretation of these findings. Future studies incorporating robust adjustment for these factors—through multivariable regression, propensity score matching, or stratified analyses—are warranted to better delineate the independent effect of obesity on post-operative outcomes.

Despite these limitations, the study provides robust evidence that obesity is related to comorbidities & surgical risk, emphasizing the need for tailored perioperative strategies. Additionally, this study also emphasizes the relevance of adopting Asia-Pacific criteria for a more accurate assessment of BMI and to better capture associated health consequences.

CONCLUSION

Obesity is highly prevalent among patients presenting to the general surgery clinic, and our study showed a notable clinical trend towards comorbidities, specific surgical pathology (hepatobiliary, hernias), surgical interventions, and post-operative morbidity. However, larger studies are needed to confirm this association. These findings highlight the need for structured perioperative risk assessment and tailored management strategies for obese patients. Surgeons should provide targeted preoperative counseling to obese patients, emphasizing their elevated perioperative risks. Where feasible, preoperative weight optimization should be encouraged before elective surgery.

RECOMMENDATIONS

Additionally, minimally invasive surgical approaches should be preferentially considered in this population, as they may reduce operative burden and enhance intraoperative visualization. Enhanced Recovery After Surgery (ERAS) protocol has emerged as a robust perioperative strategy to mitigate these risks and enhance surgical outcomes. Integrating ERAS protocols - a multidisciplinary and individualized approach, into perioperative care for obese patients is essential for minimizing complications and enhancing recovery.

ETHICAL APPROVAL

Ethical approval was obtained from the Institutional Ethics Committee of Patel Hospital, Karachi (REF letter No. PH/IRB/2023/026 Dated: October 6th, 2023). All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/ or national research committee and the Helsinki Declaration.

CONSENT FOR PUBLICATION

Written informed consent was obtained from patients.

AVAILABILITY OF DATA

The data set may be acquired from the corresponding author upon a reasonable request.

FUNDING

None.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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AUTHORS' CONTRIBUTION

DJ: Conceptualisation, literature review, study design, data collection, data interpretation, manuscript writing, and critical revision.

OA: Manuscript writing and critical revision of the manuscript.

MA: Manuscript writing, data interpretation.

RW: Data collection, data entry, and manuscript drafting.

GM: methodological oversight, statistical analysis, data interpretation, critical appraisal, critical review, and revision.

All authors provided the final approval on the final manuscript draft.

GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

During the preparation of this work, the author(s) limitedly used ChatGPT (GPT-4, OpenAI) to edit and refine the language of the manuscript along with minor proofreading. After using this tool/service, the author(s) reviewed and edited the content as needed and take full responsibility for the content of the publication.

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