Association of Obesity With Complications of Acute Pancreatitis

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ABSTRACT

Objective — *To determine the association between obesity and complications of acute pancreatitis including mortality, pancreatic necrosis and organ failure.*

Study design — *Cohort study.*

Place & Duration of study — *This prospective study was done in the Department of General Surgery, Jinnah Postgraduate Medical Center (JPMC) Karachi, from February 2024 to June 2024.*

Methods — *The study included 184 patients with acute pancreatitis. Patients were divided into obese and non-obese categories based on their BMI. There were 92 obese individuals with body mass index (BMI) > 30 kg/m² and 92 individuals who were non-obese. Clinical, physiological, and biochemical data were collected and analyzed to assess any statistically significant association.*

Results — *The mean age of the patients was 54.33±11.22 years and 54.24±13.20 years for obese and non-obese groups. Majority (n=99-53.8%) of our patients had moderate category of pancreatitis. The in-hospital mortality rate among obese patients diagnosed with acute pancreatitis was higher (n=14 - 15.2%) as compared to non-obese patients (n=3 - 3.3%). Moreover, in comparison to non-obese patients, pancreatic necrosis and organ failure were more frequently observed in obese patients (n=17 - 18.5%) and (n=44 - 47.8%) respectively. The relative risk of mortality and organ failure were significantly elevated among obese individuals than non obese patients (RR=1.763 and 1.601, respectively).*

Conclusion — *Obesity significantly correlates with worse outcomes in patients with acute pancreatitis, including higher mortality and organ failure rates. This highlights the importance of BMI as a significant predictor of complications.*

Key words — *Pancreatitis, Respiratory distress syndrome, Multiple organ failure, Gallstones, Hospital mortality.*

INTRODUCTION:

Acute pancreatitis has a varied prognosis with high mortality.[1] It is characterized by the release and activation of an enzyme trypsinogen to trypsin that results in damage to the tissues. It presents with abdominal pain radiating to back, nausea, vomiting and fever.[2] Most people recover without any complication. However, number of complication like acute respiratory distress syndrome, systemic inflammatory response syndrome, sepsis, multiorgan failure with the necrosis of pancreas may occur.[3] Different scoring systems including Ransons's score, BISAP and APACHE II based on clinical and biochemical data have been used to predict the severity of acute pancreatitis. Moreover, Revised Atlanta classification has been used to categorize acute pancreatitis as mild, moderately severe and severe types.[4]

Acute pancreatitis poses a major global health challenge with a morbidity rate of 34 cases per 100,000 people.[5] Papachristou et al reported that obese individuals with BMI >30kg/m² are notably

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associated with higher rates of organ failure (31%), necrosis (17%) and death (14%) as compared to normal/non-obese individuals having BMI <30 kg/m^2, with organ failure, necrosis and death (14%, 8% and 1.4%) respectively.[6] High mortality rate is also reported in literature.[7]

Different studies conducted in Asian countries and Pakistan highlighted a significant relationship between obesity and outcomes in patients with acute pancreatitis.[8-10] This study was conducted to determine the association between obesity and complications of acute pancreatitis including mortality, pancreatic necrosis and organ failure.

METHODS:

Study design, place and duration: This prospective cohort study was carried out in the Department of General Surgery, Jinnah Postgraduate Medical Center Karachi, from February 2024 to June 2024.

Ethical considerations: The Institutional Review board approved the study (letter no.F.2-81/2024-GENL/258/JPMC). The informed consent was also obtained.

Inclusion criteria and exclusion criteria: The study included patients aged 20-years to 70-years, of either gender, diagnosed with acute pancreatitis on clinical ground as well as biochemical investigations (upper abdominal pain or localizing abdominal signs along with high plasma amylase and/or lipase levels). IL-6, MCP-1, and CRP of >10 mg/dl serum concentration were measured to evaluate the inflammatory responses. The serum samples were collected within 24-hours of hospital admission. The unexposed group consisted of acute pancreatitis patients with a normal body mass index, while the exposed group included those with BMI >30kg/m^2. Patients who were diagnosed as having chronic pancreatitis and those previously admitted for acute pancreatitis presenting with relapse or recurrence, were excluded.

Sample size estimation and sampling technique: WHO sample size calculator was used to calculate the sample size. BMI was defined according to WHO guidelines.[11] Based on the prevalence of death (14% vs. 1.4%) among BMI >30 kg/m^2 vs <30 kg/m^2 associated with acute pancreatitis, mortality rate in patients with acute pancreatitis and BMI >30 kg/m^2 (Exposed groups) =14%, mortality rate in patients with acute pancreatitis and normal body mass index (non-exposed group) = 1.4%,[6] power of the study = 90%, type of error = 5%, the sample size was 92 for each group (aggregate sample size was 184). Patients were enrolled in the study using the non-probability consecutive sampling technique.

Study protocol: Ninety-two patients, in each exposed (obese) and unexposed (non-obese), were included. Clinical, physiological, and biochemical parameters were recorded. Patients were divided into three groups (mild, moderate and severe acute pancreatitis) on the basis of Atlanta classification.[12] Patients were followed for 10-days to observe the outcomes of acute pancreatitis.

Statistical analysis: Statistical packages for social science version 26.0 (SPSS Inc., Chicago, IL) was used for data entry and analysis. The normality of the data was checked by applying the Shapiro-Wilk test. Age, weight, height, BMI and duration of ICU stay were reported as mean and standard deviation. Gender, comorbid conditions like hypertension, diabetes mellitus, family history of acute pancreatitis, in-hospital mortality, necrosis and organ failure were reported using frequency and percentages. Outcomes of acute pancreatitis were compared between exposed and unexposed groups by Chi-square or Fisher exact test as appropriate, considering $p<0.05$ as statistical criteria for significance and RR > 1 as significant association. Stratification was done to control confounders like age, gender, family history of acute pancreatitis and comorbid to observe the effect of these on outcomes of exposure and non-exposed groups.

RESULTS:

The mean age of the patients was 54.33±11.22 years and 54.24±13.20 years for obese and non-obese groups that was almost similar. A significant difference was found in weight and height between the groups. (obese - 90.30±7.27 Kg and non-obese 72.64±10.90 Kg) and height (obese - 164.93±6.59 cm and non-obese - 172.41±8.26 cm). Regarding gender distribution, there were slight male preponderance among the non-obese group (n=56 -60.9%) compared to the obese group (n=47-51.1%), contributing to an overall gender distribution of 103 (56.0% males and 81 (44.0%) females. There were 58 (31.5%) patients with mild pancreatitis, 99 (53.8%) moderate and 27 (14.7%) with severe pancreatitis.

In reference to comorbid, a higher proportion of non-obese individuals had diabetes mellitus (n=59 vs 49 64.1% vs. 53.3%) than obese individuals, while the prevalence of hypertension and family history of acute pancreatitis were similar between the groups. The average hospital stay was 8.80±4.69

Table I: Demographic Profile of the Patients

Study Variables	Obese (n=92)	Non-Obese (n=92)	Overall (n=184)
Age (years - Mean SD)	54.33±11.22	54.24±13.20	54.28±12.22
Weight (kg- Mean SD)	90.30±7.27	72.64±10.90	81.47±12.80
Height (cm- Mean SD)	164.93±6.59	172.41±8.26	168.67±8.34
Male	47 (51.1%)	56 (60.9%)	103(56.0%)
Female	45 (48.9%)	36 (39.1%)	81 (44.0%)
18-30 Years	06 (6.5%)	08 (8.7%)	14 (7.6%)
31-40 Years	06 (6.5%)	04 (4.3%)	10 (5.4%)
41-50 Years	13 (14.1%)	14 (15.2%)	27 (14.7%)
51-60 Years	42 (45.7%)	38 (41.3%)	80 (43.5%)
61-75 Years	24 (26.1%)	27 (29.3%)	51 (27.7%)
>75 Years	1 (1.1%)	01 (1.1%)	02 (1.1%)
Diabetes Mellitus	49 (53.3%)	59 (64.1%)	108 (58.7%)
Hypertension	38 (41.3%)	43 (46.7%)	81 (44.0%)
Family History of AP	17 (18.5%)	14 (15.2%)	31 (16.8%)
Hospital Stay (days)	8.46±4.54	9.15±4.83	8.80±4.69
Length of ICU Stay (days)	2.85±1.38	2.93±1.40	2.89±1.39

Numerical Data presented in Mean ± Standard Deviation
AP = Acute Pancreatitis, ICU = Intensive Care Unit

Table II: Comparison of Outcomes of Acute Pancreatitis between Obese and Non-Obese Groups

Outcomes	Obese (n=92)	Non-Obese (n=92)	Relative Risk (95% C.I.)	P-Value
In-hospital Mortality	14 (15.2%)	03 (3.3%)	1.763 (1.342 - 2.317)	0.0452*
Necrosis	17 (18.5%)	10 (10.9%)	1.318 (0.945 - 1.838)	0.145
Organ Failure	44 (47.8%)	23 (25.0%)	1.601 (1.212 - 2.113)	0.0018*

C.I. = Confidence Interval
*p (<0.05) is statistically significant.

days and length of ICU stay 2.89±1.39 days. This was comparable between obese and non-obese individuals. Details are given in table I.

Table II shows details of in-hospital mortality, organ necrosis, and organ failure. Raised BMI was found to be significantly associated with in-hospital mortality and organ failure. However, no significant association was found between raised BMI and pancreatic necrosis.

DISCUSSION:

In this study the impact of BMI on the outcome of acute pancreatitis was compared between obese and non-obese groups. The key findings revealed that the in-hospital mortality was significantly higher among obese patients as compared to non obese with a relative risk of 1.763. Organ failure was also significantly more prevalent among obese compared to non-obese patients with a relative risk of 1.601. Although in obese patients, the incidence of necrosis was greater, it did not reach statistical significance. This showed a correlation between obesity and poorer outcomes, such as greater rates of organ failure and death in the hospital, in patients with acute pancreatitis.

Obesity is a recognized risk indicator for acute pancreatitis in all age groups, just like it is for many other disorders. In a study by Thavamani et al from the United States on pediatric population the influence of morbid obesity on the clinical consequences of acute pancreatitis was analyzed. This showed obesity as a co morbid independent predictor of unfavorable consequence in pediatric population in relation to acute pancreatitis.[13] In contrary to our study, another research that included patients of 65-years of age and above found that older age and obesity did not correlate with more serious complications in patients with acute pancreatitis.[14] Patients enrolled in our study had the mean age of 54.28±12.22 years. The obese patients

were more likely to die during hospitalization and suffer from severe complications.

A systematic review and meta-analysis to find out the correlation between various BMI subgroups was conducted to determine the severity and mortality of acute pancreatitis.[15] A breakdown of the data showed a distinct association between the severity of acute pancreatitis and BMI. The severity of acute pancreatitis was not significantly affected by a BMI of less than 18.5 Kg/m^2, while a BMI of more than 25 Kg/m^2 almost doubled the chance of severe disease when compared to people with a normal BMI (OR=2.87 - 95% CI: 1.90-4.35, p< 0.001). Further it was reported that the individuals with BMI greater than 30 Kg/m^2 were at threefold increased risk of mortality than others. Similar results are reported in other study from China.[16] However, a study conducted by Dahiya et al showed higher in-patient mortality and complications such as pancreatic pseudocyst and pancreatic necrosis in patients with normal weight as compared to patients with high BMI.[17]

A study by the Spanish Association of Pancreatology and the Spanish Association of Gastroenterology explored the influence of demographic factors, overweight, and concurrent health conditions on the progression of acute pancreatitis and found that coexisting health conditions, pancreatic necrosis, and those who underwent open surgical necrosectomy within 30-days, were significantly inter-linked with mortality within 30 days as well as chronic organ failure.[18] These findings are quite similar to our study. However, a reverse association between obesity and mortality was reported in another Spanish study.[19] According to Revised Atlanta classification majority of our patients had moderate pancreatitis. Other scoring systems are also reported in literature.[20] Atlanta classification is simple and more clinical. It focusses on both clinical and radiological criteria and has a higher predictive value for organ failure. This was used in this study.

Limitations of the study: The study did not explore the potential mechanisms underlying the relationship between obesity and adverse outcomes. Additionally, the present study did not include other confounding variables such as genetic factors, lifestyle choices, or specific medical histories that could have influence on the outcomes.

CONCLUSION:

This study found significant correlation between obesity and adverse outcomes in acute pancreatitis. The obese patients faced elevated risks of in-hospital mortality, and organ failure compared to their non-obese counterparts.

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