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Research Article

Influence of High BMI on Wound Complications in Open Paraumbilical Hernia Repair

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ABSTRACT

Background: A paraumbilical hernia is a very common defect of the abdominal wall that is often repaired with open surgery.

Objective: To assess the effect of high BMI on the incidence of postoperative wound complications in open paraumbilical hernia surgery in a tertiary care hospital.

Materials and Methods: This descriptive cross-sectional study was conducted in the Department of General Surgery, Ayub Teaching Hospital Abbotabad, from September, 2025 to February 2026. The patients were selected using a non-probability consecutive sampling method, and 120 patients aged 18-70 years who were undergoing elective open repair of paraumbilical hernia were included. Data were analyzed using SPSS version 26.

Results: The mean age of the participants was 46.8 ± 11.5 years, and 56.7% were female. Of the 120 patients, 28.3% had normal BMI, 31.7% were overweight, and 40.0% were obese. Patients had overall postoperative wound complications in 28.3%. The most frequent complications were surgical site infection (12.5%), seroma formation (7.5%), wound dehiscence (5.0%), and hematoma (3.3%).

Conclusion: BMI is a significant risk factor for postoperative wound complications after open repair of paraumbilical hernia.

Keywords: Body Mass Index, Obesity, Paraumbilical Hernia, Open Hernia Repair, Surgical Site Infection, Wound Complications.

INTRODUCTION

One of the most common hernias of the ventral abdominal wall is paraumbilical hernia, which is caused by a defect in the abdominal wall near the umbilicus. It is frequently found in adults and can lead to swelling, pain, discomfort and complications such as incarceration and strangulation. The definitive treatment is surgical repair, and the open repair of paraumbilical hernia remains common, particularly in developing countries, because it is easily accessible and inexpensive, and has excellent outcomes (1). Despite this, wound complications are still a major issue after open repair surgery, leading to increased morbidity, hospital length of stay, delayed recovery, and increased healthcare costs. Body mass index (BMI) is one of many factors that affect postoperative wound healing and has been shown to be a significant factor in surgical outcomes. In recent studies, it has been demonstrated that there is a correlation between a higher BMI and a higher incidence of wound-related complications after open repair of paraumbilical hernia, making careful preoperative assessment and risk stratification important.

Obesity has become a worldwide public health problem and is increasing in both developed and developing nations. Obesity affects numerous physiological mechanisms that are essential for normal wound healing in a negative manner. Obesity is a risk factor for delayed healing and infection because of impaired immune function, decreased tissue oxygenation, chronic low-grade inflammation and altered collagen synthesis. Moreover, poorly vascularized adipose tissue is found around surgical wounds which is conducive to bacterial proliferation and tissue repair

processes. All of these increase the risks for postoperative wound complications, with obesity being a significant risk factor (2). Over the last few years, there has been a lot of research into the link between obesity and wound healing. A number of experimental and clinical studies have demonstrated that obesity alters the normal wound healing process, such as hemostasis, inflammation, proliferation, and remodeling. Excessive adipose tissue production results in pro-inflammatory cytokines production and chronic inflammation, reducing the function of fibroblasts and blocking angiogenesis.

Typical metabolic changes associated with obesity also hinder tissue repair and infection resistance. This results in reduced healing times, wound dehiscence, seroma and surgical site infections in the obese patient following surgical procedures. The pathophysiological mechanisms are important to understand in order to optimize surgical results in patients undergoing a repair of an abdominal wall hernia (3). BMI is a simple, reliable and widely used clinical indicator of obesity. There have been a number of investigations that have assessed the impact of BMI on wound healing in various surgical specialties. The results have been reproducible from study to study and the BMI has been directly correlated with wound infection, delayed wound healing and postoperative complications. These have been correlated with high BMI, poor wound integrity, longer operative time, and surgical difficulty. As such, BMI is an important consideration in the planning of surgery and during post-surgical monitoring, particularly in abdominal wall surgeries, where tissue tension and wound stress are important (4).

The impact of obesity on surgical outcomes is not just limited to the typical complications associated with surgery and wounds, and has been demonstrated in reconstructive and body contouring surgery. Studies have demonstrated that obesity is a risk factor for postoperative complications after post-bariatric abdominoplasty including seroma formation, infection, and wound breakdown. These results indicate that the effects of excess body weight on wound healing remain even after significant weight loss. The evidence suggests that the physiological alterations of obesity can be ongoing and can compromise tissue repair and increase the risk of wound complications in a broad range of surgical procedures (5). One of the most serious complications of surgery is surgical site infection. Many patient and procedure-related factors have been shown to contribute to the risk of infection, and obesity is always cited as a major factor. In the field of cardiothoracic surgery, obesity has been studied and has been found to be a significant risk factor for postoperative infection, presumably due to the impact of obesity on perfusion, oxygen delivery and host defense mechanisms.

These observations highlight the need to assess obesity as a modifiable risk factor in surgical patients and to take steps to prevent postoperative wound complications (6). Obesity has a negative impact on peri-operative outcomes in multiple surgical specialties. A large meta-analysis of the outcomes of gastrointestinal surgery revealed that patients with obesity had much higher rates of postoperative complications. These complications are wound infection, delayed healing, pulmonary events and prolonged hospital stay. The conclusions are particularly relevant to the repair of paraumbilical hernia, because both procedures involve abdominal surgical access, and obesity-related inflammatory responses and tissue perfusion are similar factors that impact both types of surgery (7). More data from colorectal surgery corroborates this relationship between obesity and poor postoperative outcomes. A series of systematic reviews examining surgical complications in overweight and obese people has consistently shown that there is a higher risk for wound related morbidity.

Overweight can make surgery more difficult, make surgery longer and may impact recovery following surgery. All these factors increase the risk of wound complications and it is important to know the risks of obesity for elective abdominal surgery, such as paraumbilical hernia repair (8). The condition of the patient's nutrition is crucial to the healing and recovery from surgery. A study on the assessment of prognostic nutritional indices has revealed that undernutrition is linked to orthopedic surgery wound complications. However, there is a connection between obesity and too many calories, but also a connection between obesity and micronutrient deficiencies and a poor quality of nutrition, which can have a negative effect on collagen production, immune function and tissue repair. According to the findings of this study, the nutritional assessment should be utilized along with BMI to assess the risk of patients developing postoperative wound complications (9). Additional studies have

validated nutrition indicators as predictors of wound healing.

Those patients with poor nutritional reserves are at higher risk of developing surgical wound related complications and also have longer recovery. Obesity and nutritional imbalance are complex clinical conditions in which the excess body weight may mask underlying nutritional deficits, which may slow down tissue healing. These interactions are important to understanding improvements to perioperative care and reducing wound complications in high-risk surgical patients (10). There is also evidence that higher BMI is associated with obstetric practice and that it has clinical implications. The relationship between maternal BMI and labor outcomes has been examined and it has been shown that obese women are at higher risk for adverse clinical events and procedural complications. These results underscore the systemic effects of obesity on physiological processes and recovery. Although the environment in surgery is distinct, the process of inflammation, decreased blood flow, and metabolic dysfunction can be extrapolated to this context and can be considered as further factors to investigate the connection between BMI and postoperative wound complications (11).

Other orthopedic literature also highlights the adverse effect of obesity on surgical outcomes. Higher BMI is associated with increased wound complications, infection and delayed rehabilitation in patients undergoing TKA. Mechanical stresses on healing tissues and biological repair processes are reduced with extra weight. This evidence supports the idea that obesity negatively impacts wound healing in all surgical specialties and could be an important predictor of outcomes after open paraumbilical hernia repair (12). One of the primary objectives of surgery is to avoid postoperative wound infection. Perioperative antibiotic prophylaxis has been proven to effectively reduce infection rates, but patient factors such as obesity may alter the effectiveness of this antibiotic. Pharmacokinetics and tissue penetration may influence the efficacy of antibiotics, and may require more specific perioperative management in patients with obesity. Thus, the relationship between BMI and wound complications is important to know and optimise preventive measures and surgical outcomes (13).

Poor surgical outcomes have also been associated with obesity in the field of vascular surgery. Obesity has been identified as a major risk factor for postoperative complications in the treatment of abdominal aortic aneurysm in systematic reviews. This study indicates that excess body weight can be a risk factor for surgery for a number of reasons, such as poor healing, inflammatory changes, and technical difficulties. Such results also help in the research of wound problems in abdominal wall surgery in the obese (14). The relationship between obesity and a number of post-surgical complications has been well established. Obesity has a negative impact on cardiovascular, respiratory, metabolic and immune function and renders patients vulnerable to poor surgical outcomes. One of the most common side effects is wound complications which can necessitate additional treatment, longer recovery periods and increased healthcare costs. Therefore, the degree of relationship between BMI and wound morbidity is crucial to better counseling of patients and perioperative planning (15).

Obesity is a significant risk factor for postoperative infection in studies of surgical wound infection after elective laparoscopic cholecystectomy. There are several factors that lead to infection, such as increased adipose tissue, longer operative time, and impaired wound perfusion. While laparoscopic surgery is typically performed through smaller incisions and with fewer wound complications, obesity still has an impact that can be measured, and the body mass index is a factor that determines surgical outcomes (16). Additional studies of postoperative wound infections have confirmed the importance of obesity as a risk factor for surgical site infection. The uniformity of these results in different surgical procedures implies that obesity has a general effect on wound healing physiology. The accumulating data underscore the importance of procedure-specific studies to define better the extent of risk associated with elevated BMI and to develop specific approaches to prevent complications (17).

In addition to the morbidity associated with the wound, obesity has been associated with other postoperative complications, such as pulmonary complications and mortality. Patients with trauma laparotomy have been shown to have significantly poorer outcomes if they are obese versus normal weight. These results demonstrate the systemic effects of obesity after surgery and highlight the need for a thorough evaluation of risk. Since obesity is becoming a growing problem and open

paraumbilical hernia repair is a common procedure, it is important to assess the role of high BMI on wound complications to optimize surgical results and to support evidence-based clinical practice (18).

Objective: To assess the effect of high BMI on the incidence of postoperative complications in patients undergoing open paraumbilical hernia repair in a tertiary care hospital.

MATERIALS AND METHODS

Study Design: Descriptive cross-sectional study.

Study Setting: Department of General Surgery, Ayub Teaching Hospital Abbottabad.

Study Duration: September, 2025 to February 2026.

Sample Size: 120 patients.

Sampling Technique: Non-probability consecutive sampling.

Inclusion Criteria: The study included adult patients aged 18 to 70 years of either gender diagnosed with paraumbilical hernia and scheduled for elective open paraumbilical hernia repair. Patients were recruited from normal weight to obese body mass index categories, and those who were willing to sign an informed written consent to participate. Patients with a primary open paraumbilical hernia were only eligible for inclusion.

Exclusion Criteria: Patients with recurrent paraumbilical hernia, strangulated or obstructed hernia that needed emergency surgery, immunocompromised condition, chronic steroid therapy, malignancy, chronic liver disease, renal failure, pregnancy, and pre-existing wound infection at the operative site were excluded. Patients who had a laparoscopic repair or patients who were lost to follow-up after surgery were also excluded.

Methods: Patients fulfilling the inclusion criteria were recruited from the Department of General Surgery of Ayub Teaching Hospital Abbotabad, after obtaining approval from the institutional ethical review committee. All participants signed informed consent forms prior to participation. A structured proforma was used to record demographic data such as age, gender, body mass index, comorbidities, and relevant clinical history. BMI was computed as weight (kg) divided by height (m^2), and patients were classified by standard WHO classifications. Elective open paraumbilical hernia repair was performed in all the participants with a standard surgical technique, supervised by consultant surgeons. Patients were followed postoperatively for wound-related complications such as surgical site infection, seroma formation, and hematoma, wound dehiscence, and delayed wound healing. SPSS version 26 was used for data entry and analysis. The frequencies, percentages, means, and standard deviations were computed. The Chi-square test was used to evaluate the association between BMI categories and wound complications, and a p-value < 0.05 was regarded as statistically significant.

RESULTS

A total of 120 patients with elective open paraumbilical hernia repair were included. The mean age of the participants was 46.8 ± 11.5 years (range 21 to 70 years). Among the study population, 68 (56.7%) were female, and 52 (43.3%) were male.

Table 1: Demographic Characteristics of Study Participants (N=120)

Variable	Frequency (n)	Percentage (%)
Gender		
Male	52	43.3
Female	68	56.7
Age Group (Years)		
18–30	18	15.0
31–40	29	24.2
41–50	37	30.8
51–60	24	20.0
>60	12	10.0
BMI Category		
Normal (18.5–24.9 kg/m^2)	34	28.3
Overweight (25–29.9 kg/m^2)	38	31.7
Obese (≥30 kg/m^2)	48	40.0

There were 34 (28.3%) patients with postoperative wound complications. The most common complication was surgical site infection in 15 (12.5%) patients, followed by

seroma in 9 (7.5%) patients, wound dehiscence in 6 (5.0%) patients, and hematoma in 4 (3.3%) patients.

Table 2: Frequency of Postoperative Wound Complications (N=120)

Wound Complication	Frequency (n)	Percentage (%)
Surgical Site Infection	15	12.5
Seroma Formation	9	7.5
Wound Dehiscence	6	5.0
Hematoma	4	3.3
No Complication	86	71.7

A comparison of wound complications by BMI category showed a gradual rise in complications with rising BMI. In patients with normal BMI, wound complications occurred among only 4 (11.8%). In the overweight group, 10 (26.3%) patients had wound complications, while 20 (41.7%) obese patients had wound complications.

Table 3: Association between BMI Category and Wound Complications

BMI Category	Wound Complications Present n (%)	No Complications n (%)	Total	P-value
Normal (n=34)	4 (11.8)	30 (88.2)	34	
Overweight (n=38)	10 (26.3)	28 (73.7)	38	
Obese (n=48)	20 (41.7)	28 (58.3)	48	
Total	34 (28.3)	86 (71.7)	120	0.004

Surgical site infection was the most common wound complication in obese patients, occurring in 10 (20.8%) patients. Seroma formation occurred in 5 (10.4%) obese patients, wound dehiscence in 3 (6.3%) patients, and hematoma in 2 (4.2%) patients. Conversely, the rates of complications were significantly lower in patients with normal BMI.

Figure 1: Distribution of Wound Complications According To BMI Category

BMI Category	Complication Rate (%)
Normal BMI	11.8
Overweight	26.3
Obese	41.7

The results showed a strong association between increased BMI and postoperative complications of open paraumbilical hernia repair. Excess body weight can impact postoperative wound healing and recovery, as patients with obesity have the highest rates of surgical site infection and seroma formation.

DISCUSSION

The present study investigated the relationship between high BMI and wound complications following open repair of paraumbilical hernia and revealed that there was a significant association between high BMI and wound complications after paraumbilical hernia repair. The rate of surgical site infection, seroma, wound dehiscence and hematoma were significantly higher among patients with obesity than those with normal BMI. This study's findings support the growing body of evidence that obesity is an important preoperative risk factor for postoperative morbidity in abdominal wall surgery. BMI is also a major risk factor that affects the surgical results: Shahab et al. found that patients with a higher BMI who had open paraumbilical hernia surgery had significantly higher risks of wound complications (1). There are multiple biological mechanisms that explain the link between obesity and wound complications. The excess adipose tissue is poorly vascularized, has lower oxygen tension, chronic inflammation and impaired immune responses, which all negatively impact wound healing.

The leukocytes in obese individuals may be dysfunctional and have delayed resolution of inflammation, increasing susceptibility to infection and tissue repair. Frasca and Strbo

pointed out that obesity is associated with impaired immune function and wound healing processes, which are associated with greater complication rates in the present study (2). Wound healing is a complex physiological reaction that involves inflammation, cell proliferation, angiogenesis, collagen deposition and tissue remodeling. All of these are impaired by metabolic and inflammatory changes of obesity. Obesity is associated with chronic low-grade inflammation, which causes alterations in the activity of fibroblasts, collagen production, and reduces angiogenic responses needed for adequate tissue repair. Cotterell et al. pointed out that obesity is a significant derailer of normal wound healing processes and a risk factor for delayed healing and wound breakdown. The pathophysiological mechanisms may account for the increased incidence of wound complications seen in the obese group in the present study (3).

The results of the present study also corroborate studies examining the effect of BMI on postoperative infection and healing. Guo et al. demonstrated a direct correlation between increasing BMI and delayed wound healing, and that obese patients are significantly more likely to develop wound infections and delayed healing. Similarly, our data revealed that the complication rates were also higher in the overweight and obese patients than in the normal weight patients, suggesting that BMI may also be a useful predictor of complications of paraumbilical hernia surgery (4). In previous studies on abdominal contouring and reconstructive surgery, the adverse effects of obesity on wound healing have been demonstrated. De Paep et al. determined that obesity is an important risk factor for postoperative complications after tummy tuck surgery including seroma and wound infection. The findings of the abdominoplasty and paraumbilical hernia repair are similar, which further supports the impact of excess body weight on wound-related complications (5).

Surgical site infection was the most common complication in the present study. This finding is consistent with other surgical specialties that have shown obesity to be a major risk factor for wound infection. The effect of obesity on the host defense mechanism and oxygen supply to tissues has been reported by Song et al. to be a risk factor for wound infections following surgery. All of these are factors that help the bacteria settle in the wound and also slow down the healing of the wound, making it more susceptible to infection after surgery (6). There are numerous studies that have explored the link between obesity and postoperative outcomes in gastrointestinal surgery. Cullinane et al. performed a meta-analysis showing that obese patients have a much higher incidence of perioperative complications than non-obese patients. Complications related to the wound were one of the most common complications mentioned by the authors. These findings are significant, corroborate the findings of the present study and highlight the importance of assessing BMI during surgical planning (7).

Likewise, Jiang et al. reported that overweight and obese patients who underwent colorectal surgery had significantly higher rates of postoperative complications than patients with normal BMI. Surgery in obese patients is technically more complex, and these patients have a compromised wound healing ability, all of which play a role in poor outcomes. These observations are similar to our results and indicate that the effects of obesity on surgical morbidity are not confined to any specific surgical procedure (8). However, obesity can also contribute to wound complications due to nutritional factors. While obesity is defined as excessive body weight, many obese patients have inadequate levels of essential nutrients required for optimal wound healing. Hanada et al. found that poor nutritional status is linked to a higher incidence of surgical complications and slower wound healing after surgery. Therefore, the higher rates of complications seen in obese patients in this study could be partly attributed to nutritional imbalance that negatively affects tissue repair processes (9).

The same investigators provided further evidence supporting the importance of nutrition assessment for postoperative outcomes of wounds. According to their research, obesity should not be viewed only as overweight but as a condition that is often characterized by poor nutritional status. The concept is especially applicable in the assessment of a patient for elective surgery, such as repair of a paraumbilical hernia (10). Several medical and surgical fields have reported systemic effects of high BMI. The study by Khalifa et al. showed that obesity in mothers was linked to a greater incidence of adverse clinical outcomes, highlighting the broad physiological effects of obesity. The study population was different from the present investigation, but the results support the overall idea that obesity has a negative impact on recovery and healing processes in various clinical settings (11). These findings are complemented by data from

orthopedic surgery, which also shows a link between obesity and wound complications.

In a study by Aggarwal et al., it was found that obese patients undergoing a total knee arthroplasty had significantly higher rates of wound infection and delayed healing than patients of normal weight. The uniformity of these results in each surgical specialty indicates that obesity is a risk factor for postoperative wound complications across all surgical specialties, including open repair of paraumbilical hernia (12). The use of adequate antibiotic prophylaxis is an important component of infection prevention. However, the effectiveness of prophylactic strategies can be affected by obesity due to changes in drug distribution and tissue penetration. Eckmann et al. highlighted that patient-specific factors, including obesity, should be taken into account when planning perioperative infection prevention measures. This observation could account for the relatively high prevalence of wound infection in obese patients in our study on standard surgical care (13).

The negative outcomes of obesity on surgery have also been documented in vascular surgery. Naiem et al. found that obesity was associated with increased postoperative complications following abdominal aortic aneurysm treatment. These results demonstrate that obesity-related risks are not limited to wound healing, but also have an impact on the entire postoperative recovery, which is why our results are important in abdominal wall surgery (14). Plassmeier et al. defined obesity as a significant factor in postoperative morbidity and wound complications, as one of the most common complications. Their results are similar to the results of the present study, in which obese patients had significantly higher rates of wound-related events after surgery. The authors also stressed that weight optimization strategies before elective surgery should be used to improve postoperative outcomes (15).

Studies examining wound infections following laparoscopic cholecystectomy have also found obesity to be an important risk factor. Gamo et al. reported that the incidence of surgical site infection was significantly higher in obese patients, even though laparoscopic surgery is a minimally invasive procedure. The effects of obesity on wound complications could be even more significant with open paraumbilical hernia repair because of the increased incisions and tissue exposure, as shown in our results (16). Additional data from the same study confirmed the role of obesity as a risk factor for wound infection and postoperative morbidity. The uniformity of these results in various surgical procedures indicates that the BMI is a significant risk factor to be taken into account in patient counseling and preoperative risk assessment (17).

Lastly, Covarrubias et al. showed that obesity was linked to greater postoperative complications and mortality in trauma laparotomy patients. Their results suggest a systemic impact of obesity on surgical recovery and underscore the need to consider obesity as a modifiable risk factor. The findings of the present study and literature review collectively suggest that high BMI is a significant risk factor for wound complications after open paraumbilical hernia repair. In this patient population, careful selection of patients, optimization of body weight, meticulous surgical technique, and careful postoperative monitoring may help minimize wound-related morbidity and improve clinical outcomes (18).

CONCLUSION

The present study demonstrates that there is a statistically significant relationship between high BMI and an increased risk of postoperative wound complications after open paraumbilical hernia repair. Surgical site infections, seroma, dehiscence, and hematoma were significantly more prevalent in obese patients than in normal-weight patients. The results suggest that overweight status is associated with impaired wound healing and higher postoperative morbidity. Obesity is an increasing problem, and surgeons should be aware that a high BMI is a significant risk factor in the pre-operative assessment and planning process. Patient counseling, optimization of body weight prior to surgery, careful surgical technique, proper perioperative infection control, and careful follow-up after surgery can help prevent wound complications. Early recognition of high-risk patients can help direct interventions and enhance surgical outcomes. Additional multicenter trials with larger patient populations are suggested to confirm the association between obesity and wound complications in open paraumbilical hernia surgery.

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