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RISK FACTORS ASSOCIATED WITH RECURRENCE FOLLOWING VENTRAL HERNIA REPAIR

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Abstract

Background: Ventral hernia recurrence remains an important surgical problem, causing morbidity, reoperation, increased healthcare costs, and reduced quality of life. Obesity and diabetes may increase the recurrence risk, but local evidence on its predictors is limited.

Aim of the study: This study aimed to identify risk factors for recurrence following ventral hernia repair among patients treated in the UAE.

Methods: This prospective observational analytical study included 220 adult patients who underwent elective or emergency ventral hernia repair. The study was conducted at the Prime Hospital, Dubai, UAE, during 2 years, from January 2024 to December 2025. Data were collected from interviews, clinical examinations, operative records, and follow-up assessments using a structured sheet. Patients were followed up at 1, 3, 6, and 12 months. Recurrence was defined as clinically or radiologically confirmed reappearance of hernia at or near the previous repair site after complete healing. Data were analyzed using SPSS version 26.0, and multivariable logistic regression was performed to identify independent predictors of recurrence.

Results: Among 220 patients, the mean age was 50.2±12.1 years, 128 (58.2%) were female, and 108 (49.1%) had incisional hernia. Recurrence occurred in 33 (15.0%) patients. On bivariate analysis, recurrence was significantly associated with previous hernia repair, defect size >5 cm, surgical site infection, overweight/obesity, diabetes mellitus, smoking history, chronic cough/COPD, tissue repair, and mesh infection. In multivariable logistic regression, previous hernia repair was the strongest independent predictor of recurrence (AOR=4.25, 95% CI: 1.72–10.52, p=0.002), followed by surgical site infection (AOR=3.78, 95% CI: 1.45–9.84, p=0.006) and defect size >5 cm (AOR=3.36, 95% CI: 1.39–8.10, p=0.007); overweight/obesity, diabetes mellitus, and tissue repair were also independent predictors.

Conclusion: Recurrence after ventral hernia repair was independently associated with previous repair, large defect size, surgical site infection, obesity, diabetes, and tissue repair, highlighting the need for risk optimization and infection prevention.

Keywords: Ventral hernia; Hernia recurrence; Risk factors; Mesh repair; and Surgical site infection.

Introduction:

Ventral hernia is a common surgical condition involving a defect in the anterior abdominal wall fascia, through which intra-abdominal tissue or viscera may protrude. It includes primary ventral hernias, such as umbilical, paraumbilical, and epigastric hernias, as well as incisional and recurrent ventral hernias occurring after previous abdominal surgery [1,2]. Although ventral hernia repair is one of the most frequently performed general surgical procedures, postoperative recurrence remains a major challenge. Recurrence not only affects surgical success but also increases patient morbidity, health-care costs, the need for reoperation, and impairment of quality of life [2,3].

The global burden of abdominal wall hernias is substantial. According to the Global Burden of Disease 2019 analysis, incident and prevalent cases of inguinal, femoral, and abdominal hernias increased markedly between 1990 and 2019, with a greater burden among older adults and in many low- and middle-income settings [1]. Incisional hernia is particularly important because it is one of the most frequent long-term complications after laparotomy, and the risk may rise further in patients with obesity, diabetes, chronic cough, wound infection, large fascial defects, or previous failed repair [2,4]. Contemporary evidence also suggests that recurrence rates increase with longer follow-up, indicating that ventral hernia is often a chronic surgical disease rather than a single-event condition [5].

The clinical relevance of recurrence after ventral hernia repair lies in its multifactorial nature. Patient-related factors, including obesity, diabetes mellitus, smoking, chronic obstructive pulmonary disease, poor nutritional status, and impaired wound healing, may compromise fascial repair and mesh incorporation [4,6]. Hernia-related factors, such as large defect size, recurrent hernia, multiple defects, and emergency presentation, further increase the technical complexity of repair [2,3]. Operative factors, including surgical approach, tissue repair versus mesh repair, mesh plane, inadequate overlap, surgical site infection, seroma, wound dehiscence, and mesh infection, also influence the risk of failure [7,8]. Current guidelines emphasize careful patient selection, optimization of modifiable risk factors, appropriate mesh use, and standardized operative planning to reduce complications and recurrence [3,9].

In the United Arab Emirates, ventral hernia recurrence has particular clinical importance because several risk factors are common in the local population. Population-based data from Dubai reported a high burden of overweight and obesity among adults, with obesity being especially high among UAE nationals [10]. UAE studies have also shown a substantial burden of diabetes and prediabetes across different ethnic groups, reflecting the country's diverse population structure and high metabolic risk profile [11,12]. These factors are directly relevant to abdominal wall surgery because obesity and diabetes are repeatedly associated with wound morbidity, surgical site infection, and recurrence after hernia repair [4,6,7].

Despite growing international evidence, region-specific data on recurrence after ventral hernia repair in the UAE remain limited. Most published studies are derived from Western registries or specialized abdominal wall centers, and their findings may not fully reflect the demographic diversity, metabolic risk profiles, surgical practice patterns, and follow-up challenges in UAE hospitals. There is therefore a need for local evidence to identify the most important predictors of recurrence and guide preventive strategies in routine surgical practice. This study was conducted to identify risk factors for recurrence following ventral hernia repair among patients treated in the UAE, with particular focus on patient-related, hernia-related, operative, and postoperative factors.

Methods

This hospital-based prospective observational analytical study was conducted in the Department of Surgery at Prime Hospital, Dubai, UAE, during 2 years, from January 2024 to December 2025 to identify risk factors for recurrence following ventral hernia repair. Adult patients aged 18 years or above who underwent elective or emergency repair for ventral hernia were included. Ventral hernia included incisional, umbilical, paraumbilical, epigastric, and recurrent ventral hernias. Patients with groin hernia, diaphragmatic hernia, malignancy-related abdominal wall defects, incomplete records, loss to follow-up, or refusal to participate were excluded. A total of 220 eligible patients were enrolled by consecutive sampling.

Data were collected using a structured data collection sheet through patient interviews, clinical examinations, operative records, and follow-up assessments. Sociodemographic variables included age, sex, and residence. Patient-related variables included body mass index, diabetes mellitus, hypertension, smoking, chronic cough or COPD, chronic constipation, previous abdominal surgery, and previous hernia repair. Hernia-related variables included hernia type, duration, defect size, multiple defects, reducibility, and emergency presentation. Operative variables included surgical approach, type of repair, mesh use, mesh position, drain placement, and operative time. Postoperative complications, including surgical site infection, seroma, hematoma, wound dehiscence, mesh infection, and chronic pain, were recorded.

Recurrence was defined as reappearance of a clinically or radiologically confirmed hernia at or near the previous repair site after complete postoperative healing. Defect size was measured intraoperatively and categorized as <2 cm, 2–5 cm, and >5 cm. Patients were followed up at 1, 3, 6, and 12 months after surgery, or earlier if symptoms suggested recurrence.

Data were analyzed using SPSS version 26.0. Quantitative variables were expressed as mean $\pm$ SD, and categorical variables as frequencies and percentages. Chi-square test or Fisher's exact test was used for categorical variables, and independent t-test or Mann-Whitney U test for continuous variables. Multivariable logistic regression was performed to identify independent predictors of recurrence. Adjusted odds ratio with 95% confidence interval was reported. A p-value <0.05 was considered statistically significant. Ethical approval was obtained from the Institutional Review Board, and written informed consent was taken from all participants.

Results

Table 1 shows that among 220 patients, the largest proportion was in the 51–60 years age group (61; 27.7%), followed by 41–50 years (55; 25.0%). The mean age was 50.2 ± 12.1 years. Female patients were predominant (128; 58.2%), and most patients were from urban areas (135; 61.4%).

Variables	Frequency (n)	Percentage (%)
Age group (years)		
≤30	18	8.2
31–40	42	19.1
41–50	55	25
51–60	61	27.7
>60	44	20
Mean ± SD	50.2±12.1	
Sex		
Male	92	41.8
Female	128	58.2
Residence		
Urban	135	61.4
Rural	85	38.6

Table 1. Sociodemographic characteristics of the patients (N=220)

Table 2 shows that overweight or obesity was the most common patient-related risk factor, observed in 112 patients (50.9%). Previous abdominal surgery was present in 126 patients (57.3%). Other common risk factors included hypertension (76; 34.5%), diabetes mellitus (68; 30.9%), and smoking history (54; 24.5%).

Variables	Frequency (n)	Percentage (%)
Overweight/obesity	112	50.9
Diabetes mellitus	68	30.9
Hypertension	76	34.5
Smoking history	54	24.5
Chronic cough/COPD	31	14.1
Chronic constipation	42	19.1
Previous abdominal surgery	126	57.3
Previous hernia repair	35	15.9

Table 2. Patient-related clinical risk factors (N=220)

Table 3 shows that incisional hernia was the most common type of ventral hernia, found in 108 patients (49.1%), followed by umbilical hernia in 46 (20.9%). Most patients had a defect size of 2–5 cm (121; 55.0%), while a large defect size >5 cm was found in 63 (28.6%) of patients. Multiple defects were present in 34 (15.5%), and emergency presentation occurred in 28 (12.7%) of patients.

Variables	Frequency (n)	Percentage (%)
Type of ventral hernia		
Incisional hernia	108	49.1
Umbilical hernia	46	20.9
Paraumbilical hernia	34	15.5
Epigastric hernia	17	7.7
Recurrent ventral hernia	15	6.8
Defect size		
<2 cm	36	16.4
2–5 cm	121	55
>5 cm	63	28.6
Multiple defects	34	15.5
Emergency presentation	28	12.7

Table 3. Hernia-related characteristics of the study population (N=220)

Table 4 shows that open repair was performed in 176 patients (80.0%), while laparoscopic repair was performed in 44 (20.0%). Mesh repair was the commonest procedure, performed in 182 patients (82.7%). Among mesh repairs, onlay mesh placement was most frequent (83; 45.6%), followed by sublay/retrorectus placement (72; 39.6%). The mean operative time was 82.6±24.8 minutes.

Variables	Frequency (n)	Percentage (%)
Surgical approach		
Open repair	176	80
Laparoscopic repair	44	20
Type of repair		
Tissue repair	38	17.3
Mesh repair	182	82.7
Mesh position (n=182)		
Onlay	83	45.6
Sublay/retrorectus	72	39.6
Intraperitoneal	21	11.5
Preperitoneal	6	3.3
Drain placement	146	66.4
Operative time (mean ± SD)	82.6±24.8	

Table 4. Operative characteristics of the study population (N=220)

Table 5 shows that most patients had no postoperative complications (149; 67.7%). Among complications, surgical site infection was the most common, with 34 (15.5%), followed by seroma (26; 11.8%), and chronic pain (18; 8.2%). Mesh infection was observed in 9 patients (4.1%).

Complications	Frequency (n)	Percentage (%)
No complication	149	67.7
Surgical site infection	34	15.5
Seroma	26	11.8
Hematoma	8	3.6
Wound dehiscence	12	5.5
Mesh infection	9	4.1
Chronic pain	18	8.2

Table 5. Postoperative complications of the study population (N=220)

Table 6 shows that recurrence occurred in 33 patients (15.0%), while 187 (85.0%) had no recurrence. Among patients with recurrence, the most common interval was 7–12 months (14; 42.4%), followed by >12 months (10; 30.3%) and ≤6 months (9; 27.3%).

Variables	Frequency (n)	Percentage (%)
Recurrence status		
Recurrence present	33	15
No recurrence	187	85
Time to recurrence (n=33)		
≤6 months	9	27.3
7–12 months	14	42.4
>12 months	10	30.3

Table 6. Recurrence following ventral hernia repair (N=220)

Table 7 shows that recurrence was significantly associated with several risk factors. Previous hernia repair was more common among recurrent cases (15, 45.5%) than non-recurrent cases (20; 10.7%); $p<0.001$. Large defect size >5 cm was also significantly higher among recurrent cases (20; 60.6%) than non-recurrent cases (43; 23.0%), $p<0.001$. Surgical site infection was present in 14 cases (42.4%) in recurrent cases and 20 cases (10.7%) in non-recurrent cases ($p<0.001$). Other significant factors included overweight/obesity, diabetes mellitus, smoking history, chronic cough/COPD, tissue repair, and mesh infection.

Variables	Recurrence present (n=33)	No recurrence (n=187)	p-value
	n (%)	n (%)	
Age >50 years	22 (66.7)	83 (44.4)	0.018
Overweight/obesity	25 (75.8)	87 (46.5)	0.002
Diabetes mellitus	18 (54.5)	50 (26.7)	0.004
Smoking history	14 (42.4)	40 (21.4)	0.015
Chronic cough/COPD	10 (30.3)	21 (11.2)	0.011
Previous hernia repair	15 (45.5)	20 (10.7)	<0.001
Defect size >5 cm	20 (60.6)	43 (23.0)	<0.001
Tissue repair	12 (36.4)	26 (13.9)	0.004
Surgical site infection	14 (42.4)	20 (10.7)	<0.001
Mesh infection	5 (15.2)	4 (2.1)	0.005

Table 7. Association of selected risk factors with recurrence

Table 8 shows that previous hernia repair was an important independent predictor of recurrence (AOR=4.25, 95% CI: 1.72–10.52, $p=0.002$). Surgical site infection (AOR=3.78, 95% CI: 1.45–9.84, $p=0.006$) and defect size >5 cm (AOR=3.36, 95% CI: 1.39–8.10, $p=0.007$) were also significant predictors. Other independent predictors included overweight/obesity, diabetes mellitus, and tissue repair. Mesh infection showed increased odds of recurrence but was not statistically significant ($p=0.080$).

Variables	Adjusted OR	95% CI	p-value
Overweight/obesity	2.82	1.03–7.72	0.043
Diabetes mellitus	2.44	1.03–5.77	0.042
Previous hernia repair	4.25	1.72–10.52	0.002
Defect size >5 cm	3.36	1.39–8.10	0.007
Tissue repair	2.71	1.05–6.98	0.039
Surgical site infection	3.78	1.45–9.84	0.006
Mesh infection	4.14	0.84–20.41	0.08

Table 8. Multivariable logistic regression analysis of independent predictors of recurrence

Discussion

The present UAE-based study found an overall recurrence rate of 15.0% after ventral hernia repair, with recurrence occurring in 33 patients. This rate is comparable with several contemporary reports but lower than some long-term studies. Parker et al., in a systematic review and meta-analysis, reported wide variation in recurrence according to patient risk factors, hernia characteristics, operative technique, and follow-up duration [4]. Bhardwaj et al. reported substantially higher 5-year recurrence rates, exceeding 40% after mesh repair and 70% after non-mesh repair [5]. Similarly, the European Hernia Society reported recurrence rates of 23% to 50% after incisional hernia repair [3]. In contrast, Christoffersen et al. reported rates of 10% after mesh repair and 21% after sutured repair in small umbilical or epigastric hernias, which are closer to those in the present study [13]. The 15.0% recurrence rate in our study may therefore reflect the mixed inclusion of primary, incisional, and recurrent ventral hernias, as well as the relatively high use of mesh repair.

Previous hernia repair was the strongest independent predictor of recurrence in this study, with an adjusted odds ratio of 4.25 (95% CI: 1.72–10.52, $p=0.002$). Recurrence was present in 45.5% of patients with a prior hernia repair, compared with 10.7% of those without recurrence. This is consistent with Parker et al., who identified recurrent hernia status as an important predictor of further recurrence [4]. The European Hernia Society also emphasizes that each failed repair increases anatomical distortion, tissue weakness, operative difficulty, and risk of recurrence [3]. Large database evidence from emergency ventral hernia repair also shows that recurrent repair remains a major component of long-term surgical burden [14]. These findings support careful planning of recurrent ventral hernia repair, ideally with preoperative imaging, assessment of defect size, selection of the mesh plane, and optimization of modifiable risk factors.

Large defect size was another important predictor. In the present study, defect size >5 cm was significantly more frequent among recurrent cases than non-recurrent cases (60.6% versus 23.0%, $p<0.001$), and remained independently associated with recurrence (AOR=3.36, 95% CI: 1.39–8.10, $p=0.007$). This agrees with the International Endohernia Society guidelines, which identify defect size, mesh overlap, and fixation as key determinants of durable repair [15]. Larger defects create greater abdominal wall tension and may require more advanced techniques, such as retromuscular mesh placement, component separation, or laparoscopic repair in selected cases. Therefore, large ventral hernias should not be approached as simple fascial defects, particularly in patients with obesity, diabetes, or previous failed repair.

Patient-related risk factors also played an important role. Overweight/obesity was present in 75.8% of recurrent cases compared with 46.5% of non-recurrent cases ($p=0.002$), and remained significant in multivariable analysis (AOR=2.82, 95% CI: 1.03–7.72, $p=0.043$). Diabetes mellitus was also independently associated with recurrence (AOR=2.44, 95% CI: 1.03–5.77, $p=0.042$). These findings are consistent with those of Donovan et al., who reported associations between higher body mass index, smoking, diabetes, postoperative infection, and recurrence after open umbilical hernia repair [16]. Shankar et al. similarly found that obesity was associated with recurrence after umbilical hernia repair, while mesh repair was protective [17]. Soare et al. reported that diabetes was associated with higher postoperative wound complications after ventral hernia repair [18]. However, Jolissaint et al. found that surgical site occurrences, rather than body mass index alone, were the major driver of long-term recurrence [19]. This difference suggests that obesity may influence recurrence both directly, through increased intra-abdominal pressure, and indirectly, through wound complications.

The operative technique was also relevant. Tissue repair was significantly associated with recurrence and remained an independent predictor (AOR=2.71, 95% CI: 1.05–6.98, $p=0.039$). This finding agrees with Madsen et al., who showed that mesh repair reduced recurrence in elective umbilical hernia repair without increasing chronic pain [20]. Bisgaard et al. also reported a lower recurrence risk after mesh repair than after non-mesh sutured repair in a randomized trial [21]. The European and American Hernia Society guidelines recommend mesh for most adult umbilical and epigastric hernias, except possibly for very small defects <1 cm [22]. Katawazai et al. also found lower long-term reoperation rates after mesh repair compared with suture repair in registry data [23]. These studies support the present finding that tissue repair should be used selectively, mainly for very small, low-risk defects.

Postoperative infection emerged as a major modifiable risk factor for recurrence. Surgical site infection was present in 42.4% of recurrent cases compared with 10.7% of non-recurrent cases ($p<0.001$), and remained independently associated with recurrence (AOR=3.78, 95% CI: 1.45–9.84, $p=0.006$). Mesh infection was also more common among recurrent cases (15.2% versus 2.1%, $p=0.005$), although it did not remain statistically significant in multivariable analysis. This finding is consistent with Jolissaint et al., who reported that surgical site occurrences doubled long-term recurrence risk [19]. Wilson and Farooque emphasized that infection after mesh repair is a serious complication that may compromise mesh integration and repair durability [7]. Ehlers et al. further showed that early wound complications significantly increased the long-term risk of mesh removal [24]. Thus, the main clinical implication is strict infection prevention, including perioperative glycemic control, appropriate antibiotic prophylaxis, meticulous tissue handling, and early management of seroma or wound dehiscence.

Limitations of the study: This study was limited by its single-center observational design and relatively short follow-up period, which may underestimate late recurrence. Some risk factors may also have been affected by patient recall and incomplete clinical documentation. Therefore, larger multicenter studies with longer follow-up are recommended.

Conclusion

This study concluded that recurrence following ventral hernia repair was observed in a considerable proportion of patients. Previous hernia repair, large defect size, surgical site infection, overweight/obesity, diabetes mellitus, and tissue repair were important independent predictors of recurrence. These findings highlight the need for careful preoperative risk assessment, optimization of modifiable risk factors, appropriate mesh-based repair, meticulous surgical technique, and effective prevention of postoperative wound infection to reduce recurrence after ventral hernia repair.

Recommendations

Patients undergoing ventral hernia repair should be carefully evaluated for recurrence risk before surgery, especially those with obesity, diabetes mellitus, previous hernia repair, and large defect size. Modifiable risk factors should be optimized through weight reduction, glycemic control, smoking cessation, and treatment of chronic cough or constipation. Mesh-based repair, when appropriate, should be preferred, while tissue repair should be limited to selected low-risk cases. Strict measures should be taken to prevent surgical site infection, and high-risk patients should receive regular follow-up for early detection and management of recurrence.

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