How to Cite:
Sherbekov, U. A., Kurbaniyazov, Z. B., Mardonov, B. A., & Radjabov, J. P. (2022). Post-operative complications in patients with ventral hernia: A retrospective cohort study. *International Journal of Health Sciences*, *6*(S10), 108–114.
https://doi.org/10.53730/ijhs.v6nS10.13338

Post-operative complications in patients with ventral hernia: A retrospective cohort study

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***Abstract*---**We evaluated potential predictors of 1-month postoperative complications after hernioplasty. All included patients in this retrospective cohort study underwent ventral surgery on repairment of ventral hernia in the 1st Clinic of Samarkand State Medical University between January 1, 2014, and January 1, 2021. In this study, we included 348 patients, of whom 87 (25%) patients had more than one complication within 1-month after surgery. According to the multivariable logistic regression analysis, older age was associated with slightly increased odds of postoperative problems (OR=1.09; 95% CI, 1.01-1.26, p<0.01). Furthermore, patients with BMI over 25 kg/m3 were more likely to experience post-hernioplasty complications (OR 1.12; 95% CI, 1.02-1.92, p=0.03). Interestingly, a larger size of hernia (OR 1.89; 95% CI, 1.22-3.49, p<0.01) and previous history of hernia surgery (OR 1.39; 95% CI, 1.12-2.72, p<0.001) were associated with a relatively higher risk of postoperative complications compared to other variables. Lastly, as longer surgery last more likely to experience postsurgical complications (OR 1.31; 95% CI, 1.07-2.19, p=0.03). Age, BMI, hypertension, previous history and size of the hernia, and duration of surgery were associated with complications. Clinicians should take into account the patient's age, BMI and high blood

pressure as the potentially important preoperative examination factors in individuals with a primary hernia.

***Keywords*---**ventral hernia, complications, risk factors, age, BMI, hypertension.

Introduction

The treatment of ventral hernia (VH) continues to be a problem for general practitioners, surgeons and patients. There is a wide variation in the treatment of VHs in such patients. Even under optimal conditions, VH occurs in up to 30% of patients who had any abdominal surgery (Curro et al., 2012; Eker et al., 2013). Some studies report high rates of hernia recurrence (from 24% to 43%), even when a mesh is used during primary hernioplasty. Hernial recurrence is associated with the increased cost of treatment and elevated morbidity in patients with a high risk of multiple plastic surgeries (Luijendijk et al., 2000). The European Hernia Society (EHS) classifies ventral hernias by type and size. This classification was developed to create a unique method of scientific and clinical description of hernias (Śmietański et al., 2014). It represents the perceived risk of complications and recurrence after primary hernioplasty. Despite the wide availability of the EHS classification, it has not yet undergone rigorous external validation.

Recent studies demonstrated that over 10% of all patients experienced short- or long-term complications that occurred after primary hernioplasty. Additionally short and longer term complications were correlated with the frequency of patient readmission (Holihan et al., 2015; Mardanov et al. (2020); Jolissaint et al., 2020). It is also hypothesized that a history of postoperative adhesion may lead to post-surgery complications of primary hernia repair (Weyhe et al., 2017). This finding demonstrates how important it is to identify potential risk factors for postoperative complications of ventral hernia.
The present study aimed to evaluate potential predictors of 1-month post-hernioplasty complications.

Materials and Methods

Study design

This study utilized a clinic-based, retrospective cohort study design. Patients who underwent primary ventral hernia surgery in the 1st Clinic of Samarkand State Medical University were included between January 1, 2013, and January 1, 2020.

Ethical review

This study was approved by the ethical review board of Samarkand State Medical University.

Data collection

Age, gender, body mass index (BMI), and smoking history were extracted from the hospital's registry. Diabetes mellitus, chronic obstructive pulmonary disease, hypertension, past corticosteroid usage and chemotherapy, connective tissue diseases, anticoagulant use, or coagulopathies were included as clinical features. Also, for analysis, we collected data on the previous history of hernias and hernia characteristics such as location, width, length, and class by EHS classification. Data grouped different features of hernia surgeries performed (open or laparoscopic, emergency surgery, the technique of mesh placement and duration).

Statistics

R studio 3.6.2 was used for all statistical studies. To examine the distribution of continuous variables, we applied the Kolmogorov–Smirnov criterion. For continuous data, mean values and related standard deviations (SDs) were provided, whereas absolute numbers and corresponding percentages were provided for categorical variables. To compare risk factors, we employed the Mann-Whitney U test for continuous variables and the chi-square test for categorical data. For a small number of groups, the Fisher exact test was applied. Multivariate regression analysis included clinically relevant covariates and putative risk factors linked with postoperative complications in the univariate analysis (p-value 0.05).

Results and Discussions

In all, 348 individuals who had a primary ventral hernia and had had surgical treatment were included in the research study. Table 1 outlines the patients' initial features for comparison going forward. According to the results, patients with postoperative complications were older (67.2 ± 16.1 years vs 54.8 ± 12.2, p<0.001). Higher BMI was also observed among patients with postoperative complications (31.3 ± 9.6 kg/m2 vs 25.1 ± 8.6 kg/m2, p<0.001). More patients with postoperative complications had hypertension (42.5% vs 27.9% p<0.01) and previous history of abdominal hernia (19.5% vs 8.4%, p<0.01). Anticoagulant use was also statistically significant (26.4% vs 16.1%, p<0.001). We found no significant association in patient characteristics.

Table 1
Baseline characteristics

Variables	With complication (n= 87)	Without complication (n = 261)	P value
Demographic characteristics			
Age, in years (SD)	67.2 ±16.1	54.8 ±12.2	<0.001
Gender, male (%)	49 (56.3)	167 (63.9)	0.26
BMI, kg/m2 (SD)	31.3 (8.70)	27.58 (6.97)	<0.001
Smoking (%)	33 (37.9)	79 (30.2)	0.08
Clinical characteristics			
Diabetes mellitus (%)	13(14.9)	26 (9.9)	0.25
Coronary artery disease (%)	14 (16.1)	29 (11.1)	0.39

COPD	4 (4.6)	11 (4.2)	0.79
Chronic kidney disease			
Hypertension (%)	37 (42.5)	73 (27.9)	<0.01
Corticosteroid use (%)	5 (5.8)	18 (6.9)	0.47
Connective tissue disorder (%)	4 (4.6)	15 (5.7)	0.72
Anticoagulants use (%)	23 (26.4)	42 (16.1)	0.03
History of abdominal wall hernia (%)	17 (19.5)	22 (8.4)	<0.01
Previous any abdominal surgery (%)	18 (20.7)	48 (18.4)	0.49

Post-hernioplasty complications

Within the first month after surgery, 25% of patients (87 out of 348) had more than one postoperative problem. Of them, 49 patients (56.3%) had a wound, 14 patients (16.1%) experienced problems after surgery, and 24 patients (27.6%) had various issues. The average length of stay was 2.43 days, with a standard deviation of 3.6 days. 11 patients, or 12.6%, required further surgery as a result of serious complications (see Table 2).

Table 2
Complications and postoperative outcomes

Characteristic	Frequency
Admission duration, d (SD)	2.43 ±3.6
Patients with >1 complication (%)	87 (25%)
Surgical complications (%)	14 (16.1)
Wound complications (%)	49 (56.3)
Other complications (%)	24 (27.6)

Characteristics

There was either an epigastric or umbilical hernia present in each patient, which accounted for 70% of the total patient population. However, there were no variations in the kinds of hernia that were present between persons who had issues and those who did not, other than the rates of other types of hernia. There was a significant difference in the EHS size category between the two groups, with a higher prevalence of small hernias in the group of patients who did not have complications and a higher prevalence of large-size ventral hernias in the group of patients who had postoperative complications ($p<0.01$).

Table 3
Characteristics of hernia by type and size

Characteristic	With complication (n = 87) n (%)	Without complications (n = 261) n (%)	P value
Types of hernia			
Umbilical or infraumbilical (%)	59(67.8)	199(76.2)	0.06
Epigastric (%)	11(12.6)	47 (18.0)	0.17

Other types of hernia	17 (19.5)	15 (5.7)	<0.01
Hernia size (EHS)			
Small size (<2 cm, %)	19(21.8)	88(33.7)	0.03
Medium size, (2-4 cm, %)	46(52.9)	136 (52.1)	0.87
Large size (>4 cm, %)	22(25.3)	37(14.2)	<0.01

Surgical characteristics

Patients who had difficulties had a greater degree of postoperative wound complexity (14.9% vs 5.7%), while patients who did not experience complications had cleaner postoperative wounds (p=0.04). In the group of patients who had complications, the incidence of surgical site occurrence was shown to be significantly higher (p = 0.03). There were no variations in any other aspects of the surgical procedure. In the group of patients who had problems, antibiotics were administered more often with the goal of preventing infections via the use of prophylaxis. Patients who had problems required more time in the operating room (p<0.001) and spent significantly more time in the hospital (p<0.01).

Table 4
Surgical characteristics

Characteristic	With complication (n = 87)	Without complications (n = 261)	P value
Postoperative wound characteristics			
Clean (%)	74(85.1)	246(94.3)	0.04
Site infection (%)	5(5.7)	7(2.7)	0.32
Surgical site occurrence	8 (9.2)	8 (3.0)	0.03
Antibiotic use			
Prophylactic (%)	69(79.3)	128 (49.0)	<0.001
Therapeutic (%)	8 (9.2)	19(7.3)	0.42
Not used (%)	10(11.5)	114(43.7)	<0.001
Treatment duration			
Length of stay (days)	7.9±3.5	3.2±2.7	<0.001
Surgery duration, min (SD)	42.6±21.9	28.2±17.4	<0.01

Multivariable analysis

In the multivariable analysis, we utilized every variable that had a Significance level of less than 0.05 as well as any clinically meaningful factor. The EHS size classifications were used in order to analyze the hernia size. The results of the investigation into many variables are shown in Table 5. According to the multivariable logistic regression analysis, older age was associated with slightly increased odds of postoperative problems (OR=1.09; 95% CI, 1.01-1.26, p<0.01). Furthermore, patients with BMI over 25 kg/m^3 were more likely to experience post-herniplasty complications (OR 1.12; 95% CI, 1.02-1.92, p=0.03). Interestingly, the larger size of the hernia (OR 1.89; 95% CI, 1.22-3.49, p<0.01) and previous history of hernia surgery (OR 1.39; 95% CI, 1.12-2.72, p<0.001) were associated with a relatively higher risk of postoperative complications

compared to other variables. Lastly, as longer surgery last, they are more likely to experience post-surgical complications (OR 1.31; 95% CI, 1.07-2.19, p=0.03).

Table 5
Multivariable analysis

	Adj.OR	95% CI	p-value
Age (years)	1.09	1.01-1.26	0.008
BMI (kg/m^3)	1.12	1.02-1.92	0.03
Hypertension (mm.Hg)	1.41	1.02-3.67	0.02
Family history of hernia	0.71	0.18-1.93	0.28
Previous history of hernia	1.39	1.12-2.72	<0.001
EHS type			
Epigastric	Ref.		
Umbilical/lnfraumbilical	1.48	0.87-2.89	0.52
EHS size class			
Small (<2 cm)	Ref.		
Medium (>2-4 cm)	1.18	0.62-2.71	0.36
Large (>4 cm)	1.89	1.22-3.49	<0.01
Duration of surgery	1.31	1.07-2.19	0.03
Wound characteristics			
Clean	1.000		
Contaminated	1.99	0.81-7.15	0.41

This study shows that patient characteristics such as age, BMI, hypertension, previous history and size of the hernia, as well as the surgery duration were found to be the risk factors for post-hernioplasty complications at one month. In contrast to previous studies, our analysis showed that larger hernia size correlated with a higher incidence of postoperative complications, which could be explained by the relatively high number of patients with complications in this study. The most significant correlation was seen between BMI and surgical complications. This link has been proven in previous studies [6-8], and it is essential for determining the patient's status before the operation, even though the precise mechanism behind this relationship is unknown. Patients should be informed about potential risks and encouraged to lose weight prior to hernia surgery. Patients who have postoperative difficulties often have longer operation times and remain in the hospital for more extended periods of time.

Although a family history of hernia, a medium-sized hernia, and a postoperative wound infection were all anticipated to be related to problems, these factors were not shown to be significantly different in this research (Eker et al., 2013; Holihan et al., 2015; Mardanov et al., 2020). These results may have several plausible explanations, one of which is that the incidence of postoperative complications is relatively low, which indicates the possibility that some of these characteristics may turn out to be associated with postoperative complications in subsequent studies with bigger cohorts. There is a possibility of bias in patient selection due to the use of the patients' registry in this research. In addition, this cohort includes patients who have had surgery performed by many general surgeons,

resulting in the possibility of varying levels of skill and a variety of approaches to the technical aspects of the procedure.

Conclusion

Age, BMI, hypertension, prior history and size of hernia, as well as the length of operation, are significantly linked with postoperative problems following VH surgery. We observed no statistically significant correlation between the hernia size and surgical complications. Clinicians should take into account the patient's age, BMI and high blood pressure as the potentially important preoperative examination factors in individuals with a primary hernia. Postoperative complications may lead to increased spending for patients and the hospital as it might necessitate extended operation length and hospital stays.

Conflict of interest

The authors declared having no conflict of interest.

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