

Original Research Article

Risk factors for primary anterior abdominal wall hernias and early recurrence: a retrospective study from Jordan

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ABSTRACT

Background: Anterior abdominal wall hernias are common worldwide and recurrence remains a significant clinical challenge. This study aimed to identify different risk factors associated with primary hernia occurrence and early recurrence in a tertiary hospital in Jordan.

Methods: A retrospective study was conducted for a total of 341 adult patients treated for anterior abdominal wall hernias within the Surgical Department of Al-Hussain New Salt Hospital between January 2022 and November 2023, using the open surgical approach. Collected variables included age, sex, smoking status, comorbidities, constipation, family history, anaemia, hernia type, and repair technique. Descriptive statistics, chi-square tests, and multivariable logistic regression were used, with $p < 0.05$ considered statistically significant.

Results: Among 341 cases, 329 (96.5%) patients presented with primary hernias. Most patients were male (78.4%), and the most common age group was 41–60 years. Inguinal hernias were the most frequently encountered (66.9%). In unadjusted analyses, primary hernia characteristics were significantly associated with sex, age group, smoking, and family history (all $p < 0.05$). Of 341 total cases, only 12 patients (3.5%) experienced recurrence, the majority were male (91.7%), and inguinal hernias accounted for most recurrences (83.3%). In multivariable analysis, constipation (aOR 5.99, 95% CI 1.59–22.62) and primary suture repair (aOR 5.20, 95% CI 1.37–19.40) were independently associated with recurrence, while mesh repair was protective (aOR 0.19, 95% CI 0.051–0.73). Sex, smoking status, and family history were not independently associated after adjustment.

Conclusion: In this cohort, inguinal hernias were the most frequent type, and recurrence was uncommon. Constipation and primary suture repair were independently associated with recurrence, while no significant associations were observed with sex, smoking status, or family history. These findings highlight the importance of addressing modifiable risk factors and optimizing surgical technique to reduce hernia recurrence.

Keywords: Anterior abdominal wall hernia, Hernia recurrence, Risk factors, Mesh repair, Suture repair, Constipation, Smoking, Multivariable analysis

INTRODUCTION

Hernia repair is among the most frequently performed surgical procedures in Jordan and worldwide. An anterior abdominal wall hernia is defined as the protrusion of intra-abdominal contents through a defect or weakness in the abdominal wall, typically contained within a hernia sac. These hernias include epigastric, umbilical, para-umbilical, inguinal, and femoral types. Groin hernias are

further classified into inguinal and femoral hernias, with inguinal hernias subdivided into direct and indirect according to their anatomical relationship to the inferior epigastric vessels.¹

Despite significant advancements in operative techniques, abdominal wall hernias continue to pose a substantial clinical challenge. Multiple risk factors have been associated with both primary hernia formation and

recurrence, and these can be broadly categorized into technical and patient-related factors. Technical factors include the method of repair, mesh-fixation technique, and surgeon experience. Patient-related factors include sex, smoking status, comorbidities, obesity, constipation, and family history.¹ Historically, recurrence rates following primary hernia repair exceeded 15% prior to the adoption of mesh-based techniques.

The introduction of tension-free mesh repairs, particularly the Lichtenstein technique, significantly reduced recurrence rates. However, failures still occur due to both modifiable and non-modifiable factors.² This highlights the continued need to investigate and understand the determinants of hernia development and recurrence.

Given that primary and recurrent hernias may arise from different risk profiles, analyzing them as a single group may obscure important distinctions. Nevertheless, regional data from Jordan regarding these risk patterns remain limited. Therefore, this study aimed to evaluate predictors of primary anterior abdominal wall hernias and identify independent predictors of early recurrence after primary repair, analyzing each group separately.

METHODS

Study design and setting

This retrospective observational study was conducted in the Department of Surgery at Al-Hussain New Salt Hospital, Balqa, Jordan. Medical records from January 2022 to November 2023 were reviewed.

Participants

All adult patients aged >18 years who presented with anterior abdominal wall hernias were eligible for inclusion. Eligible hernia types comprised inguinal, femoral, umbilical, para-umbilical, and epigastric hernias. Primary and recurrent hernias were analyzed as separate groups. Patients aged ≤18 years, those with incisional hernias, or those presenting with multiple concurrent abdominal wall hernias were excluded from the study. Patients were followed until November 2023 to identify early recurrence. Recurrence is defined as any patient who developed hernia at the same site within the study period.

Data collection and variables

Data were retrieved from the hospital information system. The collected variables included sex, age, smoking status, and comorbidities such as diabetes mellitus, hypertension, asthma, chronic obstructive pulmonary disease (COPD), and ischemic heart disease. Additional clinical factors recorded were constipation, family history of hernia, and anaemia. Hernia-related variables included the type of hernia, the type of primary repair, and the

surgical approach. Anaemia was defined as haemoglobin <130 g/l for males and <120 g/l for females.

Ethical considerations

The study was approved by the Ethics Committee of Al-Hussain New Salt Hospital. Informed consent for the use of clinical data was obtained from all patients in accordance with institutional guidelines. Patient confidentiality was ensured by anonymizing all records prior to analysis.

Statistical analysis

Statistical analyses were performed using IBM SPSS Statistics, version 29.0.2.0 (2023). Primary and recurrent hernia cases were analyzed independently and not combined. Descriptive statistics summarized patient characteristics. Chi-square tests assessed associations between categorical variables and hernia type. Given the small number of recurrent cases (n=12), chi-square results in this subgroup were interpreted cautiously. Multivariable logistic regression identified independent predictors of recurrence, including sex, age group, comorbidities, smoking status, constipation, family history, anaemia, and repair technique. Adjusted odds ratios (aORs), 95% confidence intervals (CIs), and p values were reported.

RESULTS

Primary hernias

Among 341 cases, 329 (96.5%) presented with primary anterior abdominal wall hernias. The majority were male (258, 78.4%). The most frequent age group was 41–60 years (153, 46.5%), followed by 25–40 years (89, 27.1%), ≥61 years (72, 21.9%), and 19–24 years (15, 4.6%). These findings indicate that middle-aged adults are the most affected population (Table 1). Inguinal hernias predominated (220, 66.9%), followed by umbilical (54, 16.4%), para-umbilical (39, 11.9%), supra-umbilical (14, 4.3%), femoral (9, 2.7%), and epigastric (7, 2.1%). All primary hernias were repaired by open approach; 208 (63.2%) underwent mesh repair and 121 (36.8%) underwent suture repair (Table 1).

Comorbidities were present in 125 patients (38%). Active smoking was reported by 208 (63.2%). Constipation was present in 107 (32.5%). Family history was positive in 152 (46.2%). Anaemia was present in 18 (5.5%) (Table 1). Primary hernia type was significantly associated with sex ($p<0.001$), age group ($p<0.001$), smoking ($p<0.001$), and family history ($p=0.006$). No significant associations were observed with comorbidities, constipation, or anaemia (Table 1). Cross-analysis between sex and the hernia type showed that epigastric hernias were more common in females (85.7%), while inguinal hernias were overwhelmingly more common in males (93.6%). Umbilical hernias were slightly more common in females

(59.3%), and supra-umbilical hernias were distributed equally between both sexes. Femoral hernias were more common in males (6, 66.7%) than females (3, 33.3%), this opposes the known fact that femoral hernia is more common in females, this may be explained by the larger number of male patients included in this study (Table 1).

Recurrent hernias

A total of 12 patients presented with recurrent abdominal wall hernias. Most were male (11, 91.7%), and more than half belonged to the third age group (7, 58.3%). In contrast, the first age group had the lowest incidence of recurrence (2, 16.7%). Inguinal hernias had the highest recurrence rate (10, 83.3%). Nine patients (75%) had undergone suture repair during their first operation, compared to only three patients (25%) who had mesh repair (Table 2). Among recurrent cases, six (50%) had comorbidities, seven (58.3%) were smokers, eight (66.7%) reported constipation, nine (75%) had a positive family history, and two (16.7%) had anaemia. Due to small numbers, subgroup chi-square results were interpreted cautiously and showed no consistent statistically significant associations between recurrent hernia type and patient factors (Table 2). In the analysis

of age groups and recurrent hernia type, the third age group had the highest number of recurrent inguinal hernias (6, 60%), while the first age group the lowest incidence of inguinal hernias (1<10%). Recurrent umbilical hernias recurred primary in the first age group (1, 100%). Epigastric hernias recurred primary in the third age group (1, 100%). The association between hernia type and age groups was not statistically significant (p=0.193) (Table 2).

Multivariable analysis

A multivariable logistic regression model was performed to identify independent predictors of recurrent hernia following primary anterior abdominal wall hernia repair (Table 3). The covariates included sex, age group, comorbidities, smoking status, constipation, family history, anaemia, and technique of primary repair. After adjustment, constipation (aOR 5.99, 95% CI 1.59–22.62; p=0.008) and primary suture repair (aOR 5.20, 95% CI 1.37–19.40; p=0.015) were independent predictors of recurrence, while mesh repair was protective (aOR 0.19, 95% CI 0.051–0.73; p=0.015). Sex, age group, comorbidities, smoking, family history, and anaemia were not independently associated with recurrence.

Table 1: Primary cases.

Patient characteristics		Hernia (primary) (n=329)	P value
Sex (Male)		258 (78.4%)	0.001
Age group (in years)	19-24	15 (4.6%)	0.001
	25-40	89 (27.1%)	
	41-60	153 (46.5%)	
	≥61	72 (21.9%)	
Comorbidities (yes)		125 (38%)	0.110
Smoking (yes)		208 (63.2%)	0.001
Constipation (yes)		107 (32.5%)	0.543
Family history (yes)		152 (46.2%)	0.001
Anaemia (yes)		18 (5.5%)	0.273
Technique of repair	Mesh	208 (63.2%)	-
	Suturing	121 (36.8%)	
Hernia type	Inguinal	220 (66.9%)	-
	Femoral	9 (2.7%)	
	Umbilical	54 (16.4%)	
	Para-umbilical	39 (11.9%)	
	Epigastric	7 (2.1%)	

Table 2: Recurrent cases.

Patient characteristics		Hernia (recurrent) (n=12)	P value
Sex (Male)		11 (91.7%)	0.001
Age group (in years)	19-24	2 (16.7%)	0.193
	25-40	0 (0%)	
	41-60	7 (58.3%)	
	≥61	3 (25%)	
Comorbidities (yes)		6 (50%)	0.301
Smoking (yes)		7 (58.3%)	0.186
Constipation (yes)		8 (66.7%)	0.091

Continued.

Patient characteristics		Hernia (recurrent) (n=12)	P value
Family history (yes)		9 (75%)	0.670
Anaemia (yes)		2 (16.7%)	0.787
Technique of primary repair	Mesh	3 (25%)	0.177
	Suturing	9 (75%)	
Hernia type	Inguinal	10 (83.3%)	
	Umbilical	1 (8.3%)	
	Epigastric	1 (8.3%)	

Table 3: Multivariable analysis.

Covariate		Primary hernia	Recurrent hernia	aOR	95% CI	Adjusted P value
Sex (male)		258	11	6.7	0.82–52.6	0.073
Age group (in years)	19-24	15	2	4.19	0.83–21.0	0.083
	25-40	89	0	0	0–1.14	0.065
	41-60	153	7	1.61	0.51–4.99	0.42
	≥61	72	3	1.19	0.31–4.14	0.79
Comorbidities (yes)		125	6	1.63	0.51–5.16	0.41
Smoking (yes)		208	7	0.812	0.253–2.63	0.73
Constipation (yes)		107	9	5.99	1.59–22.62	0.008
Family history (yes)		152	9	3.49	0.93–13.1	0.064
Anaemia (yes)		18	2	2.95	0.60–14.47	0.18
Technique of repair	Mesh	208	3	0.192	0.051–0.73	0.015
	Suturing	121	9	5.2	1.37–19.4	0.015

DISCUSSION

This single-centre retrospective study evaluated the main risk factors associated with primary anterior abdominal wall hernias as well as the characteristics of patients who presented with recurrent hernias. By analyzing primary and recurrent cases separately, findings provide clearer insight into the patterns of hernia presentation and recurrence within our region. In the primary hernia group, most patients were male (78.4%), which is consistent with several studies that reported a similar male predominance. Burcharth et al found that males constituted (88.6%) of groin hernia patients, and Sharma et al also showed that males were the majority (79%).^{3,4} These similarities support the fact that male sex remains one of the strongest predictors of abdominal wall hernias, possibly due to the anatomical and physiological differences in connective tissue strength.

The age group most affected in the study was 41–60 years, which reflects the age-related changes in collagen composition and weakening of the abdominal wall structures. This finding is in line with Sharma et al., who reported that the most common age group for inguinal hernias was (46–60 years) accounting for (34.7%).⁴ Similar trends have been reported internationally, indicating that middle-aged adults continue to have the highest risk for developing abdominal hernias. Inguinal hernias were the most commonly encountered in the sample (66.9%), which aligns with the study by Burcharth et al who reported that inguinal hernias accounted for the vast majority (97%) of groin hernias.³

Other hernia types, such as epigastric and femoral hernias, showed much lower prevalence in our study, which is also consistent with global patterns. Comorbidities such as Diabetes Mellitus and Hypertension were present in 38% of patients. This is different from other studies, such as Sharma et al., who reported higher rates of COPD and diabetes among groin hernia patients.⁴ These differences may be due to the variations in population characteristics, sample size, and the specific types of hernias included in each study. Smoking was a very common factor in our study (62.9%), much higher than the rates reported in Sharma et al (36.2%).⁴ This may reflect the high smoking prevalence in Jordan. The significant relationship between smoking and hernia type in our results supports the known effect of smoking on tissue integrity and collagen metabolism, which can predispose individuals to hernia formation.

Constipation was present in (32.5%) of the patients, which is slightly lower than the (47.7%) reported by Sharma et al.⁴ Although constipation was not significantly associated with hernia type in our analysis, it remains an important clinical factor due to its known role in increasing intra-abdominal pressure. Family history was found to be a significant risk factor in our study (53.8%), and this finding is strongly supported by Lau et al who reported that a positive family history is one of the strongest independent predictors of inguinal hernias (odds ratio≈8.7).⁵ This supports the idea that genetic susceptibility plays an important role in hernia development. Among the recurrent hernia group, the

majority were males (91.7%), similar to Jansen et al who also found higher recurrence rates in males (67 male vs 8 female patients).⁶ The recurrence was most common in the 41–60-year age group, which mirrors the findings reported by Jansen et al who observed recurrence mainly in patients older than 50 years.⁶ This could be due to the associated comorbidities associated with increasing age. Inguinal hernias showed the highest recurrence rate (83.3%), which is consistent with Burcharth et al who reported that most recurrences occur in inguinal hernias.⁷ Most of our recurrent cases had previously undergone suture repair (75%), confirming findings from international studies that tension-free mesh repair significantly reduces recurrence risk. Although smoking, constipation, and family history were common among recurrent cases, only constipation and suture repair remained significant after adjustment. This suggests that chronic straining and surgical technique play a dominant role in early recurrence, while other factors may act as confounders or show effects only in larger samples.

However, some of the findings differ from the literature. For example, Jansen et al reported that family history and smoking had no significant effect on recurrence rates, whereas coronary heart disease and hypertension were stronger predictors.⁶ Differences in patient samples, population characteristics, and surgical techniques between studies may explain these variations.

CONCLUSION

Primary anterior abdominal wall hernias in this cohort were most common among middle-aged males, with inguinal hernias predominating. Sex, age group, smoking status, and family history were associated with hernia characteristics in unadjusted analyses. Recurrence was uncommon but was independently associated with constipation and primary suture repair. Other factors such as sex, smoking status, comorbidities, and family history did not retain significance after adjustment. These findings emphasize the importance of addressing modifiable behaviours and optimizing surgical technique

to reduce hernia recurrence. Overall, the findings emphasize the combined influence of biological predisposition and modifiable lifestyle behaviours in the development and recurrence of hernias. These results may help guide preventive strategies, patient counseling, and surgical decision-making. Further studies with larger samples and inclusion of laparoscopic repairs are recommended to build on these findings and improve patient outcomes.

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