Section: Surgery

Original Research Article

PREVALENCE AND ASSOCIATED FACTORS OF VENTRAL HERNIA IN ADULTS PRESENTING TO A TERTIARY CARE CENTRE IN RURAL HIMACHAL PRADESH: A RETROSPECTIVE STUDY

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ABSTRACT

Background: Ventral hernia is a commonly encountered abdominal wall condition in general surgical practice. Its distribution and underlying risk factors vary across different populations, with noticeable differences between rural and urban settings. Data from rural regions of North India remain relatively limited. **Objective:** To evaluate the prevalence, pattern, and associated factors of ventral hernia among adults presenting to a tertiary care centre in rural Himachal Pradesh. **Materials and Methods:** This retrospective study included 353 patients diagnosed with hernia between June and December 2023. Clinical records were reviewed for demographic variables, comorbid conditions, prior surgical history, and type of hernia. Logistic regression analysis was used to assess associations between selected risk factors and the presence of ventral hernia. **Results:** Of the 353 patients, 64 (18%) were diagnosed with ventral hernia. The mean age was 53 ± 4.63 years, and 51.3% were female. Umbilical hernia was the most frequent subtype (41.1%), followed by incisional hernia (14.2%), while epigastric and supra-umbilical hernias each accounted for 3.1%. Increasing age, prior abdominal surgery, COPD, chronic constipation, and occupational heavy lifting showed significant association with ventral hernia. No significant association was found with BMI ≥25 or male gender. **Conclusion:** In this rural cohort, ventral hernia formed a substantial proportion of abdominal wall hernias, with umbilical hernia being the most common subtype. The findings suggest that physical and environmental factors may play a more prominent role than metabolic factors in this population.

INTRODUCTION

A ventral hernia refers to the protrusion of intra-abdominal contents through a defect in the anterior abdominal wall and includes both primary defects, such as umbilical and epigastric hernias, as well as incisional hernias that develop at the site of previous surgery.[1] These conditions are frequently encountered in general surgical practice and contribute significantly to operative workload.[2]

The etiology of ventral hernia is multifactorial. Conditions associated with repeated or sustained increases in intra-abdominal pressure—such as chronic cough, constipation, and heavy manual work—are known to contribute to hernia formation. Previous abdominal surgery also plays an important role by disrupting fascial continuity and weakening the abdominal wall.[3,6] In addition, alterations in connective tissue structure have been implicated, particularly changes in collagen composition that reduce tissue strength.[4]

The pattern of ventral hernia varies between populations. Differences in occupation, lifestyle, and access to healthcare may influence both the type of hernia and the associated risk factors. In Indian settings, some studies have suggested that rural populations may have a higher proportion of primary ventral hernias, possibly related to sustained physical labour and chronic respiratory conditions.[10,11]

Despite these observations, data from Himachal Pradesh are limited. This study was undertaken to better understand the prevalence, distribution, and associated factors of ventral hernia in patients presenting to a tertiary care centre in this region.

MATERIALS AND METHODS

This retrospective study was carried out in the Department of Surgery at Maharishi Markandeshwar Medical College and Hospital, Solan, Himachal Pradesh.

All patients diagnosed with hernia between June and December 2023 were included in the study.

Sample size:

A total of 353 patients were analyzed.

Data collection:

Patient records were reviewed for demographic details (age, sex), comorbidities (including COPD and constipation), history of previous abdominal surgery, occupational factors (heavy lifting), and type of hernia.

Classification:

Hernias were classified as inguinal, umbilical, incisional, epigastric, or supra-umbilical.

Statistical analysis:

Logistic regression analysis was performed to identify factors associated with ventral hernia. Odds ratios (OR) with 95% confidence intervals (CI) were calculated. A p-value <0.05 was considered statistically significant.

RESULTS

Out of 353 patients presenting with hernia, 64 (18%) were diagnosed with ventral hernia.

The mean age of the study population was 53 ± 4.63 years. Females constituted 51.3% of the cohort.

Distribution of hernia types:

- Umbilical hernia: 41.1%
- Inguinal hernia: 38.5%
- Incisional hernia: 14.2%
- Epigastric hernia: 3.1%
- Supra-umbilical hernia: 3.1%

Risk factor analysis:

The following variables showed significant association with ventral hernia:

- Age ≥50 years: OR 1.82, 95% CI 1.22–2.67, p = 0.015
- Previous abdominal surgery: OR 2.18, 95% CI 1.59–3.67, p <0.001
- COPD: OR 1.41, 95% CI 1.07–2.47, p = 0.009
- Chronic constipation: OR 1.34, 95% CI 1.04–1.61, p = 0.041
- Heavy lifting: OR 1.77, 95% CI 1.24–2.13, p = 0.014

The following variables were not significantly associated:

- Male gender: OR 0.82, 95% CI 0.51–1.14, p = 0.67
- BMI ≥25: OR 0.74, 95% CI 0.48–1.29, p = 0.43

Table 1: Baseline Demographic and Clinical Characteristics (N=353)

Characteristic	Ventral Hernia (n=64)	Non-Ventral Hernia (n=289)
Mean Age ± SD (years)	53 ± 4.63	—
Female sex, n (%)	33 (51.6%)	148 (51.2%)

Note: Data are presented as mean ± SD or n (%). The overall sex distribution (51.3% female) applies to the full cohort.

Table 2: Distribution of Hernia Types Among All Patients (N=353)

Hernia Type	n	% of Total (N=353)	% of Ventral (n=64)
Inguinal Hernia	136	38.5%	—
Umbilical Hernia	26	7.4%	41.1%
Incisional Hernia	9	2.5%	14.1%
Epigastric Hernia	2	0.6%	3.1%
Supra-umbilical Hernia	2	0.6%	3.1%
Total Ventral Hernia	**64**	**18.1%**	**100%**

Note: Percentages in the final column are calculated among the 64 ventral hernia patients. Inguinal hernia is included for comparison. Total ventral hernia proportion = 18.1% of all hernia cases.

Table 3: Logistic Regression – Significant Risk Factors for Ventral Hernia

Risk Factor	OR	95% CI	p-value	Sig.
Age ≥50 years	1.82	1.22 – 2.67	0.015	*
Previous abdominal surgery	2.18	1.59 – 3.67	<0.001	***
COPD	1.41	1.07 – 2.47	0.009	**
Chronic constipation	1.34	1.04 – 1.61	0.041	*
Heavy lifting (occupation)	1.77	1.24 – 2.13	0.014	*

Note: Odds ratios (OR) with 95% confidence intervals (CI) from multivariable logistic regression. * p<0.05; ** p<0.01; *** p<0.001. Previous abdominal surgery showed the strongest association (OR 2.18, 95% CI 1.59–3.67).

Table 4: Logistic Regression – Non-Significant Variables

Variable	OR	95% CI	p-value	Sig.
Male gender	0.82	0.51 – 1.14	0.67	ns
BMI ≥25	0.74	0.48 – 1.29	0.43	ns

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Note: Neither male gender nor BMI ≥25 reached statistical significance. ns = not significant. These findings contrast with Western literature where obesity is a recognised risk factor.

Table 5: Subtypes of Ventral Hernia – Classification and Pathological Basis (n=64)

Hernia Subtype	Category	n (of 64)	% of Ventral	Pathological Basis
Umbilical	Primary	26	41.1%	Congenital/fascial weakness
Incisional	Secondary	9	14.1%	Post-surgical fascial defect
Epigastric	Primary	2	3.1%	Linea alba weakness
Supra-umbilical	Primary	2	3.1%	Para-umbilical fascial defect
Total	—	**64**	**100%**	—

Note: Primary hernias arise at anatomically weak points (umbilical ring, linea alba) without prior surgery. Secondary (incisional) hernias develop at sites of fascial disruption from previous abdominal operations. Percentages sum to 100% of classified ventral hernias.

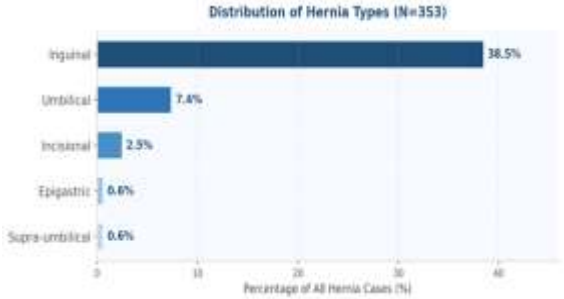


Figure 1: Horizontal Bar Chart – Distribution of Hernia Types (N=353)

Figure 1. Horizontal bar chart showing the percentage of each hernia type among all 353 patients. Inguinal hernia was the most common (38.5%), followed by umbilical (7.4%), incisional (2.5%), and epigastric and supra-umbilical hernias (0.6% each). All ventral hernia subtypes combined accounted for 18.1% of cases.

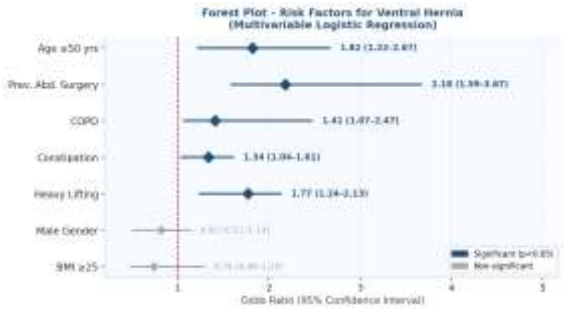


Figure 2: Forest Plot – Odds Ratios for Risk Factors Associated with Ventral Hernia

Figure 2. Forest plot of adjusted odds ratios (OR) with 95% confidence intervals (CI) from multivariable logistic regression. Navy diamonds represent statistically significant factors ($p<0.05$); grey diamonds indicate non-significant variables. The red dashed line marks the null value (OR=1.0). Previous abdominal surgery had the largest effect (OR=2.18, 95% CI 1.59–3.67, $p<0.001$).

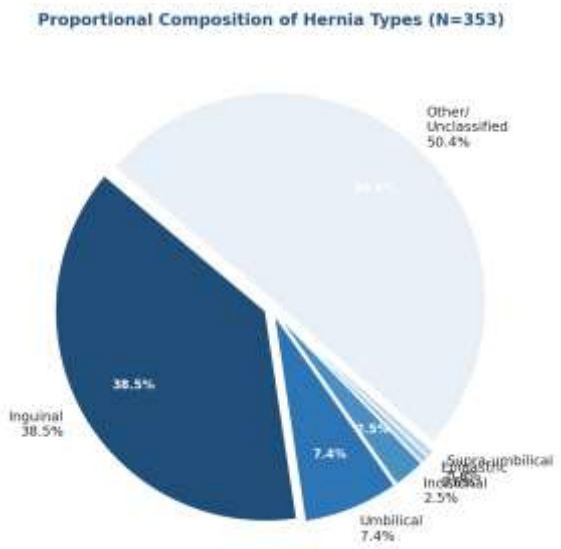


Figure 3: Pie Chart – Proportional Composition of Hernia Types (N=353)

Figure 3. Pie chart illustrating the proportional composition of hernia types in the study population. The largest segment represents inguinal hernia (38.5%). Among ventral hernias, umbilical (7.4%) was the most frequent subtype, followed by incisional (2.5%), epigastric and supra-umbilical hernias (0.6% each). The remaining proportion reflects other or unclassified hernias.

DISCUSSION

In the present study, ventral hernia accounted for 18% of all hernia cases seen at a rural tertiary care centre. This figure appears somewhat higher than that reported in certain hospital-based studies, although such comparisons should be interpreted cautiously due to differences in study populations and referral patterns.

Umbilical hernia was the most frequently encountered subtype in this cohort. Similar findings have been reported in some Indian rural studies,[10] where primary ventral hernias are more common. In contrast, incisional hernia is often reported more frequently in centres with higher surgical volumes.

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This variation may reflect differences in patient exposure to risk factors as well as patterns of healthcare utilization.[2,8]

The associations observed in this study—namely increasing age, prior abdominal surgery, COPD, constipation, and heavy lifting—are consistent with established mechanisms of hernia formation. Repeated increases in intra-abdominal pressure, whether due to chronic cough or straining, can contribute to progressive weakening of the abdominal wall. Previous surgery further predisposes to fascial defects.[3,6]

From a biological perspective, changes in connective tissue structure have also been implicated. A reduction in the ratio of type I to type III collagen has been associated with decreased tensile strength, making the abdominal wall more susceptible to herniation.[4,5]

An interesting finding in this study was the lack of association between BMI and ventral hernia. While obesity is considered an important risk factor in many Western studies, similar associations have not been consistently demonstrated in Indian populations.[10,11] It is possible that in this setting, physical strain and occupational exposure play a more prominent role than metabolic factors.

COPD showed a significant association in this cohort. Chronic cough leads to repeated spikes in intra-abdominal pressure, which over time may contribute to hernia formation.[3] This may be particularly relevant in rural areas where exposure to smoking and biomass fuel remains common.

Overall, the findings suggest that in rural populations, ventral hernia is influenced by a combination of mechanical stress, prior surgical factors, and chronic respiratory conditions.

Limitations

This study has certain limitations. It was retrospective in design and conducted at a single centre, which may limit generalizability. The duration of the study was relatively short, and long-term outcomes such as recurrence could not be assessed. Larger prospective studies would help to provide a more comprehensive understanding of the epidemiology of ventral hernia in similar settings.

CONCLUSION

In this rural Himachal Pradesh cohort, ventral hernia constituted 18% of hernia cases, with umbilical hernia being the most common subtype. Increasing age, prior abdominal surgery, COPD, constipation, and heavy physical activity were identified as associated factors, whereas BMI and gender were not significantly associated. These findings suggest that environmental and mechanical factors may play a greater role than metabolic factors in this population.

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