

A Demographic Analysis of Inguinal Hernia Patients: A Retrospective Study in Southern Karnataka

Analisis Demografi Pasien Hernia Inguinalis: Sebuah Studi Retrospektif di Karnataka Selatan

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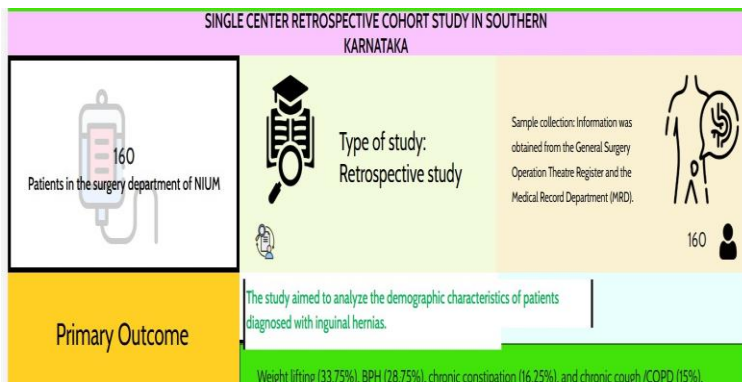
Abstract

Hernias impose significant economic and physical burdens on patients, with inguinal hernias commonly linked to risk factors such as increased abdominal pressure, weak abdominal muscles, straining during defecation, heavy lifting, obesity, and pregnancy. This study aims to evaluate the prevalence of various types of inguinal hernias and identify associated risk factors in the southern Karnataka region. The study aimed to analyze the demographic characteristics of patients diagnosed with inguinal hernias. This is a retrospective study involving 160 cases reviewed at the NIUM Hospital. Data were collected from medical records and analyzed using SPSS software version 17 for Windows. The majority of patients (43.1%) were aged 41-60 years, with 98.1% being male. Common risk factors included heavy weight lifting (33.8%), benign prostate hypertrophy (28.8%), and abdominal muscle weakness (25.6%). Less common factors were smoking (32.5%), diabetes (11.9%), and family history (4.4%). Most hernias were indirect (69.8%) and on the right side (67.6%). Elective surgeries (94.4%) were more common than emergency procedures (5.6%), with open hernioplasty being the main operation (96.6%). Some patients had open herniorrhaphy (2.7%), and pediatric patients underwent open hemiotomy (0.7%). These findings offer key insights into demographic trends, risk factors, and surgical outcomes of inguinal hernias, serving as a valuable reference for future research on their epidemiology and management.

Abstrak

Hernia memberikan beban ekonomi dan fisik yang signifikan pada pasien, dengan hernia inguinalis yang umumnya dikaitkan dengan faktor risiko seperti peningkatan tekanan perut, otot perut yang lemah, mengejan saat buang air besar, mengangkat beban berat, obesitas, dan kehamilan. Penelitian ini bertujuan untuk mengevaluasi prevalensi berbagai jenis hernia inguinalis dan mengidentifikasi faktor risiko terkait di wilayah Karnataka selatan. Penelitian ini bertujuan untuk menganalisis karakteristik demografi pasien yang didiagnosis dengan hernia inguinalis. Ini adalah penelitian retrospektif yang melibatkan 160 kasus yang ditinjau di Rumah Sakit NIUM. Data dikumpulkan dari rekam medis dan dianalisis menggunakan perangkat lunak SPSS versi 17 untuk Windows. Mayoritas pasien (43,1%) berusia 41-60 tahun, dengan 98,1% laki-laki. Faktor risiko yang umum termasuk angkat berat (33,8%), hipertrofi prostat jinak (28,8%), dan kelemahan otot perut (25,6%). Faktor yang kurang umum adalah merokok (32,5%), diabetes (11,9%), dan riwayat keluarga (4,4%). Sebagian besar hernia tidak langsung (69,8%) dan di sisi kanan (67,6%). Operasi elektif (94,4%) lebih sering dilakukan daripada prosedur darurat (5,6%), dengan hernioplasti terbuka sebagai operasi utama (96,6%). Beberapa pasien menjalani herniorrhaphy terbuka (2,7%), dan pasien anak menjalani hemiotomi terbuka (0,7%). Temuan ini memberikan wawasan penting mengenai tren demografi, faktor risiko, dan hasil pembedahan hernia inguinalis, yang berfungsi sebagai referensi berharga untuk penelitian di masa depan mengenai epidemiologi dan penanganannya.

Graphical Abstract



Keyword

hernia; herniorrhaphy; hypertrophy; inguinal; risk factors

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INTRODUCTION

The prevalence of inguinal hernias varies significantly across different regions globally, with notable trends observed in Asia and India. Globally, inguinal hernias account for approximately 75% of all abdominal wall hernias, with a lifetime risk of 27-43% in men and 3-6% in women (Silfhout et al., 2022). The Global Burden of Disease Study indicates that inguinal hernias represent a substantial portion of the disease burden, with significant variations in incidence and prevalence across regions (Ma et al., 2023).

In Asia, the prevalence of inguinal hernias is particularly high. For instance, a study reported a prevalence of 21.8% in India, with estimates suggesting that around 1.5 to 2 million individuals are affected (Almunifi et al., 2024). Inguinal hernias are more common among manual laborers and those engaged in strenuous physical activities, which is consistent with findings from various studies highlighting occupational risk factors (KS & Rao, 2021; Domingo & Nel, 2023). In India, the annual incidence of inguinal hernias is estimated at 1,957,850 cases, underscoring the public health significance of this condition (Nagula, 2021). Overall, the high prevalence of inguinal hernias in these regions necessitates effective management strategies to address the associated health and economic burdens.

Inguinal hernias represent a prevalent surgical condition, particularly among adults, with a lifetime risk of approximately 27% in men and 3% in women (Vasu, 2020). They are classified into direct and indirect types based on their anatomical presentation, with indirect hernias being more common (Pirvu et al., 2022; Wu et al., 2022). The condition arises from a weakness in the abdominal wall, leading to the protrusion of intra-abdominal contents through the inguinal canal (Mohtasib et al., 2023). Elderly individuals are particularly susceptible, with a prevalence rate of around 6% in this demographic (Gayathre et al., 2023). Complications such as incarceration and strangulation can occur in about 10% of cases, potentially leading to serious outcomes like intestinal obstruction (Gayathre et al., 2023; Ohene-Yeboah, 2022). Surgical repair is a routine procedure, with approximately 800,000 repairs performed annually in the United States alone (Mohtasib et al., 2023). Overall, inguinal hernias are the most common type of hernia, accounting for a significant portion of all abdominal wall hernias (Alegbeleye, 2020).

Hernias, particularly inguinal hernias, impose significant economic and physical burdens on individuals and healthcare systems. The direct costs associated with hernia treatment, including diagnosis, surgical procedures, and postoperative care, can be substantial. For instance, the annual cost of hernia treatment in the United States is estimated at approximately \$320 million (Serhiyovych & Pavlovych, 2021). In Sweden, the cost per treatment can reach up to 9060 Euros, highlighting the financial strain on healthcare resources (Mäkäräinen et al., 2022). Moreover, untreated hernias can lead to severe complications, such as incarceration and strangulation, which necessitate emergency interventions and further increase healthcare costs (Giordano et al., 2024). The economic impact extends beyond direct medical expenses; it also encompasses lost productivity due to prolonged recovery times and the potential for chronic pain, which affects quality of life (Nizar et al., 2021). In regions with

limited access to surgical care, such as Sierra Leone, the prevalence of untreated hernias exacerbates the economic burden on families and the healthcare system (Lwin et al., 2024; Lindenbergh et al., 2023). Thus, addressing the management of hernias is crucial for improving both economic and health outcomes.

The development of inguinal hernias is influenced by several key risk factors. Age is a significant contributor, with a higher prevalence observed in older adults due to factors such as sarcopenia, which leads to decreased abdominal wall strength (Kinoshita et al., 2022). Additionally, male sex is a well-established risk factor, as men are more likely to develop inguinal hernias compared to women (Cengiz et al., 2020; Ohene-Yeboah, 2022).

Family history also plays a crucial role, indicating a genetic predisposition to hernia formation (Yen et al., 2023). Furthermore, conditions that increase intra-abdominal pressure, such as chronic cough, obesity, and heavy lifting, are associated with a higher risk of hernia development (Melwani et al., 2020; Dalaf et al., 2024). Interestingly, while obesity is generally considered a risk factor for many health issues, some studies suggest that it may actually reduce the risk of inguinal hernias due to increased abdominal wall tension (Melwani et al., 2020; Fadista et al., 2021). Lastly, congenital factors, such as the presence of a patent processus vaginalis, can predispose individuals to hernias, particularly in younger populations (Watanabe et al., 2021).

Retrospective analysis is crucial in understanding epidemiologic trends as it allows researchers to utilize existing data to identify patterns and changes over time without the need for prospective data collection, which can be resource-intensive. This method is particularly effective in evaluating long-term trends and outcomes, as demonstrated in studies examining dementia prevalence in nursing home residents, which highlighted significant changes in care policies over a five-year period (Miranda et al., 2021). Moreover, retrospective studies can reveal associations between risk factors and disease outcomes, as seen in the analysis of dermatophytosis in Tehran, where various socio-economic and environmental factors were assessed over a decade (Aref et al., 2022). Such analyses can also enhance outbreak detection and source tracing, as illustrated by the integration of whole-genome sequencing in tracking Salmonella outbreaks (Deng et al., 2021). Furthermore, retrospective studies can provide insights into historical epidemiological patterns, such as the evolution of brucellosis in animals in China, which identified distinct epidemic stages over several decades (Liu et al., 2024). Overall, retrospective analyses are essential for informing public health strategies, guiding resource allocation, and shaping future research directions by leveraging historical data to understand current health challenges.

Recent studies have examined the epidemiology, risk factors and surgical outcomes of inguinal hernia, particularly in India. A study by Agarwal et al. (2023) reported that inguinal hernias are more common in elderly men, with major risk factors such as heavy lifting (55%), irregular bowel habits (36.36%), and

Table 1
The Characteristics of Respondents

Characteristics	Total Admission	Percentage (%)
Age group (years)		
0-20	13	8.125
20-40	37	23.125
41-60	69	43.125
>60	41	25.625
Gender		
Male	157	98.125
Female	3	1.87

respiratory diseases such as chronic obstructive pulmonary disease (COPD). In addition, smoking and diabetes were also identified as significant risk factors. The study also found that hernias were more common on the right side (63%) and were mostly of the indirect type. In addition, Sangwan et al. (2013) in their retrospective analysis found that out of 320 cases of abdominal wall hernia, inguinal hernia dominated with 77.81% of cases. The majority of patients were aged between 40 to 70 years, with a male to female ratio of 7:1. The incidence of inguinal hernia showed an increase with age. Furthermore, Fatima and Mohiuddin (2014) reported that out of 187 patients with inguinal hernia, 69% were male. Most patients were aged between 31 to 60 years, with 94% of hernia cases being unilateral and 80% being of the indirect type. Risk factors identified included strenuous physical activity and family history of hernia.

While these studies provide valuable insights, there are some gaps that need to be addressed. Specific data on the prevalence and demographic characteristics of inguinal hernia patients in South Karnataka are limited. In addition, in-depth evaluation of risk factors such as benign prostatic hypertrophy and family history has not been done. Comparative analysis between elective and emergency surgical procedures and their long-term outcomes are also underrepresented in the current literature. Therefore, this study aims to fill the gap by providing region-specific data, evaluating under-researched risk factors, and analyzing surgical trends and outcomes in South Karnataka.

METHODS

The study was conducted in the Department of Surgery, National Institute of Unani Medicine (NIUM), Bangalore, affiliated with Rajiv Gandhi University of Health Sciences, Karnataka, from October 2018 to October 2023, as a retrospective analysis. It included all 160 patients diagnosed with inguinal hernias in the surgery outpatient department during this period. Data were obtained from the General Surgery Operation Theatre Register and the Medical Record Department (MRD) and analyzed using SAS Version 9.2 on the per-protocol population. Statistical analysis described qualitative variables by frequency (%) and quantitative variables by mean, standard deviation, median, and extremes, with Kaplan–Meier estimates and Cox regressions summarizing hernia recurrence data. The study recorded patient demographics, including age, sex, risk factors, clinical presentation, type and side of hernia, and surgical technique.

Based on detailed histories and clinical reviews, inguinal hernias were initially diagnosed, and the data were compiled into a master chart. The analysis of demographic and statistical data provided insights into the clinical characteristics and outcomes of patients admitted to surgical wards and undergoing hernia repair procedures

RESULTS

Table 1 presents the highest number of patients belongs to 41-60 years age group (43.125%). Only 8.125% patients were of pediatric and younger age group. Gender—98.125% of the 160 patients were male, and 1.87% of the patients were female.

Figure 1 illustrates that most risk factors associated with inguinal hernia in the present study include increased intra-abdominal pressure due to heavy weight lifting (33.75%), benign prostate hypertrophy (28.75%), chronic constipation (16.25%), and chronic cough /COPD (15%). Other common risk factors are increased abdominal wall muscle weakness due to older age (25.62%) and previous Inguinal hernioplasty (8.12%). Less common risk factors are smoking (3.25%), Diabetes (11.87%), positive family history (4.37%) and unknown (3.75%).

Table 2 illustrates the demographic analysis of inguinal hernias patients in which 108 patients (67.50%) had a normal BMI, 39 patients (24.35%) were overweight, and 11 patients (6.875%) had a low BMI. Merely 2 individuals, or 1.25 percent, had a BMI greater than 30. In this current study, swelling was the clinical presentation in all patients. Groin pain with swelling was seen in 21.87% of patients. Period of swelling was less than one year for majority of the patients, while the least of them had swelling for more than 2 years.

In Figure 2 shows the present study 56.25% patients were diagnosed as indirect inguinal hernia. Only 33.125% patients were diagnosed as direct inguinal hernia. In certain instances, an inguinal hernia's direct and indirect components were discovered (2.5%). In the paediatric age range, congenital hernias affected 13% of individuals. Right inguinal hernias accounted for 48.75% of the cases in the current study, with left hernias coming in second at 28.75% and bilateral hernias at 22.50%. On the basis of ultrasound reports, the contents of the sac were the omentum in 110 (68.75%) patients and the small bowel in 50 (31.25%) other

Table 2
Demographic Analysis of Inguinal Hernias

Variables	Number of patients	Percentage (%)
BMI		
<18.5 (underweight)	11	6.875
18.5-24.9 (normal weight)	108	67.5
25.0-29.9 (overweight)	39	24.375
30.0-34.9 (obesity class I)	2	1.25
Symptoms		
Swelling	160	100
Pain with swelling	35	21.87
Period of swelling		
< 1 years	93	58.125
1-2 years	45	28.125
>2 years	22	13.75
Side of inguinal hernia		
Right	78	48.75
Left	46	28.75
Bilateral	36	22.5
Content		
Omentum	110	68.75
Bowel loops	50	31.25
Procedures		
Open Herniotomy	9	5.625
Open Herniorrhaphy	14	8.75

patients. The majority of inguinal hernias in the current study (85.6%) were treated with tension-free open mesh hernioplasty. Only 8.75 percent of the patients underwent open herniorrhaphy. For pediatric patients (5.6%) with congenital inguinal hernias, open herniotomy was the preferred technique.

DISCUSSION

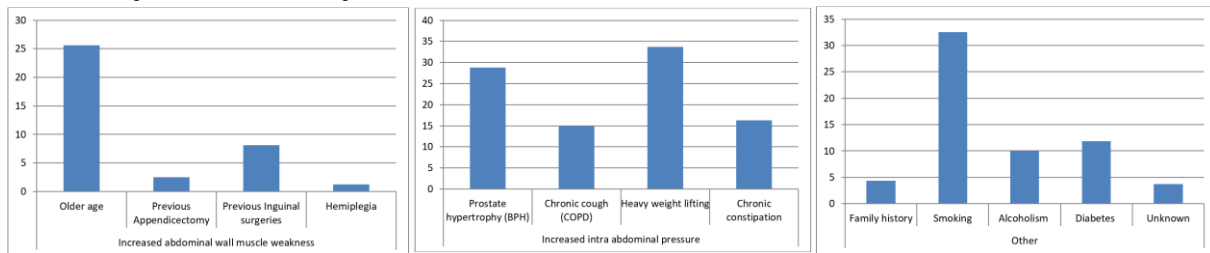
Inguinal hernias are influenced by several major risk factors, including heavy lifting, benign prostatic hypertrophy (BPH), and muscle weakness. Heavy lifting is widely recognized as a significant contributor to the development of inguinal hernias. Studies have shown that individuals engaged in physically demanding jobs that require lifting heavy objects have a higher incidence of inguinal hernias, with one study reporting an adjusted odds ratio (AOR) of 7.39 for those lifting heavy objects [Kibret et al. \(2022\)](#). This correlation is attributed to the increased intra-abdominal pressure generated during such activities, which can lead to herniation through weak points in the abdominal wall ([Kala et al., 2022](#)). Benign prostatic hypertrophy (BPH) is another notable risk factor, particularly in older men. Research indicates that BPH is associated with an increased risk of inguinal hernia formation, likely due to the pressure effects of an enlarged prostate on the pelvic floor and abdominal wall ([Yen et al., 2023](#)). This condition can exacerbate the weakening of the abdominal muscles, further predisposing individuals to hernias.

Muscle weakness, particularly in the abdominal wall, is a critical risk factor for inguinal hernias. Factors such as aging, genetic predisposition, and previous surgical interventions can contribute to muscle weakness, making individuals more susceptible to hernias ([Patel et al., 2022](#); [Agarwal, 2023](#)). The presence of low-lying pubic tubercles and abnormal muscle insertions can also compromise the integrity of the inguinal canal, increasing the likelihood of hernia development ([Purohit et al., 2022](#); [Rao et al., 2020](#)). Thus, addressing these risk factors through lifestyle modifications and medical interventions is essential for preventing inguinal hernias.

Less common risk factors for inguinal hernias, such as smoking, diabetes, and family history, play significant roles in the development and management of this condition. Smoking is associated with increased intra-abdominal pressure and impaired wound healing, which can lead to higher rates of complications post-surgery. Research indicates that current smokers have an odds ratio of 4.226 for developing surgical site infections (SSIs) following inguinal hernia repair, highlighting the need for smoking cessation programs as part of preoperative care ([Du et al. 2023](#); [Zhuo et al., 2020](#)).

Diabetes mellitus is another critical risk factor, as it is linked to delayed wound healing and a higher incidence of postoperative complications, including SSIs and hernia recurrence. Diabetic patients have been shown to have a recurrence rate of 7.8%, compared to 2.8% in non-diabetics, emphasizing the importance of glycemic control prior to surgery ([Behiery et al., 2021](#); [Mannion et al., 2021](#)).

Figure 1
 The Percentage of Risk Factors for Inguinal Hernia



Furthermore, diabetes can complicate the surgical management of hernias, necessitating careful monitoring and potentially altering surgical approaches to minimize risks (Prameshti et al., 2021). Family history also contributes to the risk of developing inguinal hernias. Genetic predisposition can influence connective tissue integrity and abdominal wall strength, making individuals with a family history of hernias more susceptible (Patel et al., 2022; Hinterseher et al., 2021). Understanding these less common risk factors is essential for developing targeted prevention strategies and optimizing surgical outcomes for patients at higher risk.

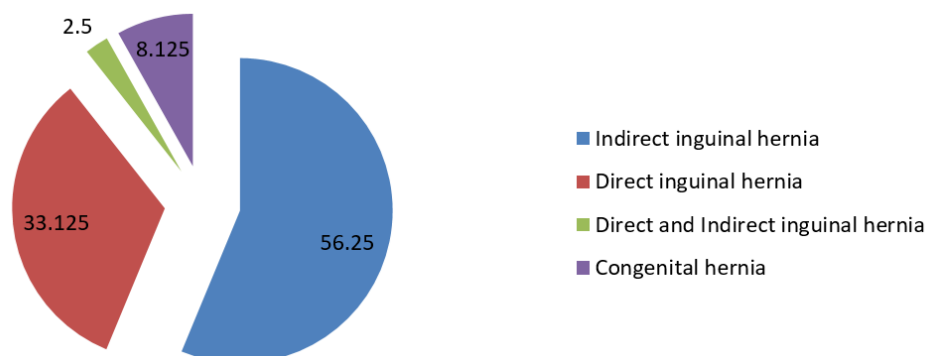
Inguinal hernia cases exhibit notable similarities and differences when compared to previous studies conducted in various regions. For instance, a study by Saeed et al. reported that 70% of inguinal hernias were right-sided, aligning with findings from Balam, who noted that 62.3% were right-sided (Melwani et al., 2020). This trend of right-sided predominance is consistent across multiple studies, reinforcing the anatomical predisposition observed globally. In a different context, Chiu et al. highlighted those inguinal hernias accounted for 83.08% of all hernias in patients with end-stage renal disease (ESRD) receiving dialysis, indicating a high prevalence in this specific population (Chiu et al., 2022). This contrasts with the general population, where inguinal hernias are more common among males engaged in heavy lifting occupations, as noted in studies from South Africa (Domingo & Nel, 2023). Jha and Pankaj's study further emphasizes the diverse types of hernias, including indirect and direct inguinal hernias, which are prevalent in various demographics (Jha & Pankaj, 2020). In contrast, Köckerling et al. noted that direct inguinal hernias had a higher risk of reoperation for recurrence compared to indirect hernias, suggesting that surgical outcomes may vary based on the type of hernia (Köckerling et al., 2019).

Overall, while the prevalence and characteristics of inguinal hernias show some consistency across studies, regional factors such as occupational hazards, demographic characteristics, and underlying health conditions contribute to variations in incidence and outcomes. This underscores the importance of localized studies to inform prevention and management strategies tailored to specific populations.

Inguinal hernias are more prevalent on the right side due to several anatomical and developmental factors. One primary reason is the later descent of the right testis during embryological development, which can lead to a higher incidence of failure in the closure of the processus vaginalis on the right-side (Ramji (2019). Studies indicate that approximately 60-70% of inguinal hernias occur on the right side, reinforcing this anatomical predisposition (Mathew et al., 2022). Additionally, the anatomical position of the appendix contributes to the prevalence of right-sided hernias. The occurrence of Amyand's hernia, where the appendix is found within the hernia sac, is significantly more common on the right side due to the appendix's normal anatomical location (Nowrouzi, 2021). This condition is rare overall, but its association with right-sided inguinal hernias further emphasizes the anatomical factors at play. Moreover, various studies have consistently reported a higher incidence of right-sided inguinal hernias across different populations. For instance, a retrospective analysis found that 63% of patients had right-sided hernias, aligning with the literature that highlights this trend (Akay & Akici, 2020). The predominance of right-sided inguinal hernias is thus a multifactorial phenomenon rooted in embryological development, anatomical positioning, and consistent clinical observations.

To effectively prevent inguinal hernias, it is crucial to implement risk factor-based strategies that address both modifiable and non-modifiable risk factors. Education and awareness play a significant role in prevention by informing

Figure 2
 Percentage of Types of Inguinal Hernia



individuals about common risk factors such as heavy lifting, smoking, and obesity. Educational programs can help promote safe lifting techniques and emphasize the importance of maintaining a healthy weight (Almunifi et al., 2024; Mahfouz & Aljuaid, 2021). Additionally, engaging in regular strength training and physical conditioning can enhance abdominal wall strength, reducing the risk of hernia formation. This is particularly important for individuals with physically demanding jobs, who should incorporate core-strengthening exercises into their routines (Almunifi et al., 2024; Domingo & Nel, 2023).

Another key preventive measure is smoking cessation, as smoking has been linked to impaired collagen synthesis, which weakens the abdominal wall. Implementing smoking cessation programs can significantly reduce the likelihood of hernia development (Mahfouz & Aljuaid, 2021). Furthermore, managing chronic conditions such as benign prostatic hypertrophy and chronic cough is essential, as these conditions contribute to increased intra-abdominal pressure, thereby raising the risk of hernias. Providing appropriate medical management for these conditions can help mitigate their impact (Malviya et al., 2019).

For individuals with a family history of inguinal hernias, proactive screening and monitoring can be beneficial in identifying those at higher risk and allowing for early intervention strategies (Köckerling et al., 2019; Khalaf, 2021). Additionally, weight management plays a crucial role in prevention, as excess weight increases intra-abdominal pressure. Encouraging weight loss through nutritional counseling and lifestyle modifications can significantly reduce the risk of hernia formation (Mahfouz & Aljuaid, 2021; Malviya et al., 2019). Finally, occupational health programs should be implemented in workplaces where heavy lifting or strenuous activities are common. Employers should adopt ergonomic practices and provide proper training on safe lifting techniques to reduce the incidence of hernias among workers (Almunifi et al., 2024; Domingo & Nel, 2023). By integrating these multifaceted strategies, the burden of inguinal hernias can be significantly reduced through proactive prevention and risk management efforts.

From an Islamic perspective, health preservation and seeking treatment are strongly emphasized in the Qur'an and Hadith. Allah commands believers to maintain their well-being, as stated in the Qur'an:

"And spend in the way of Allah and do not throw [yourselves] with your [own] hands into destruction [by refraining]. And do good; indeed, Allah loves the doers of good." (Al-Baqarah 2:195).

This verse underscores the importance of seeking medical care and preventing diseases. Moreover, the Prophet Muhammad (peace be upon him) said:

"Indeed, Allah has not made a disease without appointing a remedy for it, except for old age." (Sunan Abu Dawood, Hadith No. 3855).

These teachings align with the necessity of timely surgical intervention for symptomatic hernias to prevent complications, thereby ensuring a better quality of life.

This study provides valuable insights into the demographic distribution, risk factors, and surgical management

of inguinal hernias, contributing to the existing body of knowledge on hernia epidemiology. The strengths of this study include a well-defined sample from a reputable institution, comprehensive data collection, and the use of robust statistical analyses to assess risk factors and outcomes. However, several limitations must be acknowledged. First, as a retrospective study, the findings are subject to information bias due to reliance on medical records. Second, the study population is limited to a single institution, which may affect the generalizability of the results to broader populations. Third, the study does not explore long-term patient outcomes post-surgery, which is essential for understanding recurrence rates and complications. Future research should incorporate multicenter data, prospective designs, and long-term follow-ups to provide a more comprehensive understanding of inguinal hernias and their management.

CONCLUSIONS

One of the most prevalent disorders observed in general surgery clinics among senior male patients is inguinal hernia. Heavy weight lifting and intense activity are two of the most common risk factors for inguinal hernias. Additionally noted as risk factors were BPH, smoking, chronic obstructive pulmonary disease (COPD), abnormal bowel movements, or constipation. The majority of patients' BMIs were normal. The most typical clinical presenting style is inguinal swelling. Some of the patients had groin pain and swelling. There were more indirect hernias than direct ones. Bilateral inguinal hernias were the least prevalent, but right-sided hernias were more common than left-sided ones. Bowel loops were seen in the hernial sac after omentum in the majority of patients. Symptomatic hernia always warrants surgery as delay in treatment leads to complications. Patients should be educated for early operative treatment to prevent complications. Future research should explore long-term outcomes, prevention strategies, comparative surgical techniques, genetic and environmental risk factors, cost-effectiveness, and emerging technologies like robotic-assisted repairs, while also focusing on pediatric hernias and the impact of surgeon expertise.

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AUTHORS' CONTRIBUTIONS

Umer H. Wani wrote the manuscript, acquired the data, revised the manuscript, and read and approved the final manuscript. Saiyad S. Alam reviewed the manuscript, Benish B. Bhat enrolled

participants, collected data, and Ajaz A. Bhat analyzed the data. All authors designed the study, formulated the concept, revised the manuscript, and performed the field work.

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COMPETING INTERESTS

The author(s) declare no potential conflict of interest with respect to the research, authorship, and/or publication of this article.

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