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Original Research Article

A Retrospective Analysis of Incisional Hernia Incidence and Associated Risk Factors in Gynecological Surgeries

Sumit Raj[1], Saumya[2], C. M. Narain[3]

[1]Assistant Professor, Department of General Surgery, Netaji Subhas Medical College and Hospital, Bihta, Patna, Bihar, India

[2]Senior Resident, Department of Obstetrics and Gynecology, ESIC Medical College and Hospital, Bihta, Patna, Bihar, India

[3]Department of General Surgery, Netaji Subhas Medical College and Hospital, Bihta, Patna, Bihar, India

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Corresponding Author: Dr. Saumya

Conflict of interest: Nil

Abstract:

Background: Incisional hernia is one of the most common complications in the long-term follow-up of patients who have undergone abdominal surgery. However, data on its incidence and risk factors for gynecological surgeries are limited.

Aim: To assess the incidence of incisional hernia after open gynecological surgery and assess patient- and surgery-related factors contributing to incisional hernia.

Method: This is a retrospective cohort study of 1,025 women who underwent open gynecological surgery at Netaji Subhas Medical College and Hospital, and ESIC, Bihta, Patna, Bihar, India. Patient characteristics, comorbidities, surgical parameters and postoperative outcomes were collected from hospital records. Cox proportional hazard regression was used to evaluate independent predictors of incisional hernia.

Results: The mean age of participants was 53.1 years, and the mean BMI was 26.8 kg/m^2. The midline incision type was performed in 46.6% of the cases. Multivariate analysis risk factors for incisional hernia identified in the study were age >60 years (HR 1.54), obesity as BMI ≥30 (HR 3.58), smoking (HR 1.88), rheumatologic disease (HR 1.31), liver disease (HR 1.45), kidney disease (HR 1.58), diabetes (HR 1.40), and midline incision (HR 2.22)."

Conclusion: The risk of incisional hernia post-gynecological surgery is of high severity concerning patient factors of age, obesity, smoking, chronic comorbidities, and midline incision. Risk stratification, comprehensive planning, and surgical delivery are recommended to avoid postoperative hernias.

Keywords: Incisional Hernia, Gynecological Surgery, Risk Factors, Midline Incision, Retrospective Study.

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Introduction

Incisional hernia constitutes one of the most prevalent long-term complications after abdominal surgical procedures. Estimates indicate that between 5% and 20% of individuals who have undergone such operations ultimately develop an incisional hernia, thus representing a significant clinical and economic challenge on a global scale. In Sweden specifically, around 2,500 patients receive incisional hernia repair annually, highlighting both the frequency and the ongoing difficulties associated with this complication. Despite substantial progress in surgical techniques and materials in recent decades, the prevention of incisional hernia formation continues to be a primary area of interest, given that its occurrence not only results in patient morbidity but also incurs elevated healthcare expenses. Notably, preventive measures are regarded as more cost-effective than subsequent surgical interventions once hernias are clinically identified. For instance, Poulose et al. [1] illustrated that a mere 1% decrease in hernia recurrence rates could result in annual savings of approximately US $32 million in procedural costs.

Numerous patient- and surgery-related factors have been found to contribute towards the pathogenesis of incisional hernia. These encompass advanced age, smoking habits, obesity, concomitant diseases, postoperative wound infection, and more importantly, the surgical method that was used during abdominal wall closure [2,3]., Israelsson and associates' studies [4] have been instrumental in developing evidence-based approaches towards the closure of midline incisions so as to emphasize how precise operative technique can lower the incidence of dehiscence subsequent to a later development towards hernia formation. Still, although gastrointestinal as well as general surgery has been widely examined under this context, gynecologic surgery has been

less intensely studied when considering the development towards incisional hernia formation.

Prevalence following gynecologic surgery has not been as rigorously studied as following gastrointestinal surgery. A likely reason is that gynecologists, compared with general surgeons, do not directly encounter incisional hernias under their own care since they often become apparent years following the index procedure. It can then be contended that understanding of the issue in gynecologic practice may be relatively limited. Second, new approaches to closing the abdominal wall diffusing just as quickly among general surgeons as a group are less widespread in gynecologic practice, by extension perhaps contributing towards heterogeneity in outcomes between specialties. Gaps in knowledge here make this area particularly in need of attention in terms of research among the gynecologic surgical population so as to gain a stronger sense of the burden as well as risk factors of incisional hernia.

The category of surgical incision represents a critical factor influencing the risk of hernia development. The Pfannenstiel incision, which is a low transverse incision commonly employed in gynecology and obstetrics, is correlated with a comparatively low occurrence of incisional hernia, documented at 0–2% [5,6]. This characteristic renders it an advantageous choice for interventions such as cesarean sections or benign hysterectomies, wherein extensive exposure of the abdominal cavity is not necessitated. Conversely, in more intricate or expansive gynecological procedures, especially those pertaining to oncological surgery, a midline incision is frequently requisite to ensure sufficient surgical access. Unfortunately, this specific type of incision is associated with a higher rate of hernia formation. Franchi et al. [7] reported an incidence of incisional hernia of 16.9% in a long-term follow-up study in which women underwent extended abdominal hysterectomy with bilateral salpingo-oophorectomy. They reported that incisional hernias in their extensive ten-year follow-up assessment could be falsely regarded as asymptomatic or not detected until a specific size was evident (e.g., >3 cm).

Beyond the incision type, patient-related factors such as obesity, smoking, poor nutrition, and chronic medical conditions can contribute to weakened abdominal walls and delayed wound healing. Additionally, post-operative complications, especially wounds, have been strongly associated with hernia formation [8]. The multifactorial nature of these principles indicates the importance of reviewing both modifiable and non-modifiable risk factors in

Although the clinical significance is tremendous, actual data on gynecologic procedures remain quite limited. While large observational studies as well as a few randomized controlled trials regarding prevention and treatment of incisional hernia focused predominantly on gastrointestinal surgery or general surgical populations, there is a gap in literature for women undergoing open gynecologic surgery. Furthermore, given the continuing improvements in life expectancy as well as the increasing prevalence of chronic diseases in older women such a obesity and diabetes mellitus, more women are undergoing major gynecologic surgery late in life and may be more predisposed to postoperative hernia.

In this context, it is essential to conduct focused studies specifically looking at the incidence of incisional hernias and risk factors associated with gynecologic surgical procedures. This work is needed to raise awareness amongst gynecologists, influence surgical decisions, and inform tactics for abdominal wall closure and patient management. Identifying populations at higher risk would allow for interventions to reduce the impact of this complication through altered closure patterns, consideration for the use of mesh reinforcement in select cases, and more diligent identification of high-risk patients with appropriate management.

The current study has been designed with the primary objective of establishing the prevalence of incisional hernia in women undergoing open gynecologic surgeries. The second equally important objective is to identify and explore the risk factors implicated in the development of incisional hernia, which may occur from patient factors or surgical factors. It is our hope that this retrospective study will continue to build the scarce but growing body of literature in this area and lead to improved patient outcomes and more cost-effective surgical practice in gynecologic surgery.

Materials and Methods

Study Design: This study was a retrospective observational cohort analysis conducted to evaluate the incidence of incisional hernia and its associated risk factors following gynecological surgeries.

Study Area: The study was carried out in the Department of General Surgery, Obstetrics & Gynecology, Netaji Subhas Medical College and Hospital and ESIC Medical College and Hospital, Bihta, Patna, Bihar, India for nine months

Study Population: The study population included women who underwent open gynecological surgeries (e.g., abdominal hysterectomy, myomectomy, adnexal surgery, gynecological oncological procedures) during the study period.

Sample Size: All eligible cases from hospital records during the study period were included. Based on hospital operative registers and discharge summaries, approximately 1025 cases were retrieved and analyzed.

Inclusion Criteria

- Female patients undergoing open gynecological surgery during the study period.
- Availability of complete medical records including demographic data, operative notes, and postoperative follow-up.
- Minimum 1-year postoperative follow-up available.

Exclusion Criteria

- Patients who underwent laparoscopic or robotic procedures.
- Obstetric surgeries (e.g., cesarean section) as they fall outside the scope of gynecological surgeries in this analysis.
- Incomplete records or patients lost to follow-up before 1 year.
- Patients with a previous history of incisional hernia repair.

Data Collection: Patient information was gathered from the operative logs, inpatient notes, discharge summaries, and follow-up outpatient department (OPD) records from the Department of General Surgery, obstetrics and Gynaecology at Netaji Subhas Medical College and Hospital and ESIC, Bihta, Patna. Demographic information extracted from all records included age and body mass index (BMI) and relevant comorbidities such as diabetes mellitus, hypertension, and chronic obstructive pulmonary disease. Details of the surgery collected included the type of gynecological procedures performed, type of incision (midline, Pfannenstiel or paramedian), length of surgery, and whether the surgery was elective or an emergency case. Postoperative outcomes, specifically wound complications and infections at the surgical site were reviewed. The development of incisional hernias was determined either by physical examination notes about the patient during follow-up visits or by imaging reports when available. All patients were followed for at least a year for determination of an incisional hernia status.

Procedure: All hospital records of participating institutions were screened for eligible cases. Following the application of inclusion and exclusion criteria, patient charts were reviewed in detail to obtain baseline, perioperative, and postoperative data. Each case was reviewed for incisional hernia, defined as palpable or radiologically confirmed abdominal wall defect at the site of previous surgical incision. For patients who had been diagnosed with an incisional hernia, the data included date of diagnosis, clinical presentation, and whether the patient underwent surgical repair. Data were collected by trained investigators to minimize bias, and discrepancies were mutually resolved. Cases with incomplete records or inadequate follow-up were excluded from analysis, based on the researchers' clinical judgment, to keep the data valid.

Statistical Analysis: The data was entered into Microsoft Excel and analyzed with IBM SPSS Statistics for Windows, Version 25.0. Descriptive statistics were used to summarize patient and surgical characteristics, including the means and standard deviations for continuous variables, and frequencies with percentages for categorical variables. To compare differences between patients who developed an incisional hernia and those who did not, Chi-square test (or Fisher's exact test for categorical variables) independent t-tests or ANOVA were used in comparison groups for continuous variables. Independent predictors of incisional hernia development were determined using a Cox proportional hazard regression model, adjusted for potential confounders including age, BMI, comorbidities, surgical site infection, and type of incision. The incidence of incisional hernia was reported as a proportion of the total study population, and survival analysis methods were implemented to acknowledge the time-to-event aspect of hernia development. A pvalue less than 0.05 was prescribed to determine statistical significance.

Result

Table 1 summarizes the baseline characteristics of 1,025 patients. The mean age was 53.1 years (SD 13.8) and the mean BMI was 26.8 (SD 6.1). Regarding smoking habits, 162 patients (15.8%) were smokers, while 861 (84.0%) were non-smokers. Chronic disorders were present in a subset of patients, including diabetes in 59 (5.8%), hepatic disease in 61 (5.9%), renal disease in 40 (3.9%), pulmonary disease in 190 (18.5%), and rheumatologic conditions in 98 (9.6%). Surgical approach varied, with 161 patients (15.7%) undergoing Cohen incision, 388 (37.8%) Pfannenstiel incision, and 478 (46.6%) midline incision.

Table 1: Baseline characteristics (N = 1025)

Baseline characteristics	**N (%)**
Mean age, years (standard deviation)	53.1 (13.8)
Mean BMI (standard deviation)	26.8 (6.1)
Smoking habits	
Smokers	162 (15.8%)
Non-smokers	861 (84.0%)
History of chronic disorders	
Diabetes	59 (5.8%)
Hepatic disease	61 (5.9%)

Renal disease	40 (3.9%)
Pulmonary disease	190 (18.5%)
Rheumatological conditions	98 (9.6%)
Method of approach	
Cohen	161 (15.7%)
Pfannenstiel	388 (37.8%)
Midline incision	478 (46.6%)

Table 2 presents the univariate and multivariate Cox proportional hazard analysis assessing risk factors for incisional hernia. In univariate analysis, age >60 years (HR 2.04, 95% CI 1.67–2.51, p<0.001), BMI ≥30 (HR 4.07, 95% CI 3.30–5.02, p<0.001), smoking (HR 1.50, 95% CI 1.18–1.90, p=0.001), pulmonary disease (HR 1.61, 95% CI 1.28–2.02, p<0.001), rheumatologic disease (HR 1.69, 95% CI 1.18–2.43, p=0.004), liver disease (HR 1.94, 95% CI 1.42–2.66, p<0.001), kidney disease (HR 1.71, 95% CI 1.15–2.55, p=0.008), diabetes (HR 1.82, 95% CI 1.30–2.56, p=0.001), and midline incision compared with Cohen/Pfannenstiel incision (HR 2.86, 95% CI 2.30–3.56, p<0.001) were all significantly associated with increased risk. In multivariate analysis, after adjusting for confounders, age >60 years (HR 1.54, 95% CI 1.22–1.95, p<0.001), BMI ≥30 (HR 3.58, 95% CI 2.88–4.45, p<0.001), smoking (HR 1.88, 95% CI 1.45–2.42, p<0.001), rheumatologic disease (HR 1.31, 95% CI 1.03–1.66, p=0.028), liver disease (HR 1.45, 95% CI 1.04–2.02, p=0.030), kidney disease (HR 1.58, 95% CI 1.05–2.38, p=0.029), diabetes (HR 1.40, 95% CI 1.02–1.92, p=0.038), and midline incision (HR 2.22, 95% CI 1.73–2.84, p<0.001) remained independent predictors, while pulmonary disease was no longer statistically significant (HR 1.18, 95% CI 0.92–1.51, p=0.184).

Table 2: Univariate and multivariate Cox proportional hazard analysis of risk for incisional hernia

Variable	Univariate HR (95% CI)	p	Multivariate HR (95% CI)	p
Age > 60 years	2.04 (1.67–2.51)	<0.001	1.54 (1.22–1.95)	<0.001
BMI ≥ 30	4.07 (3.30–5.02)	<0.001	3.58 (2.88–4.45)	<0.001
Smoker	1.50 (1.18–1.90)	0.001	1.88 (1.45–2.42)	<0.001
Pulmonary disease	1.61 (1.28–2.02)	<0.001	1.18 (0.92–1.51)	0.184
Rheumatologic disease	1.69 (1.18–2.43)	0.004	1.31 (1.03–1.66)	0.028
Liver disease	1.94 (1.42–2.66)	<0.001	1.45 (1.04–2.02)	0.030
Kidney disease	1.71 (1.15–2.55)	0.008	1.58 (1.05–2.38)	0.029
Diabetes	1.82 (1.30–2.56)	0.001	1.40 (1.02–1.92)	0.038
Midline incision (Ref: Cohen/Pfannenstiel)	2.86 (2.30–3.56)	<0.001	2.22 (1.73–2.84)	<0.001

Discussion

This study examined a cohort of 1,025 individuals undergoing gynecologic surgical interventions to assess both incisional hernia outcomes and relevant risk factors. In accordance with the existing literature, the study demonstrated that increasing age, obesity, smoking, medical conditions accompanying chronicity, and the utilization of midline incisions in the surgical operation are also relevant independent predictors of acquiring incisional hernias. These findings further validate the comprehensive research that have emphasized the complex mechanism of hernia formation with the interplay of patient-related factors and surgical factors (Fischer et al., 2016) [9]."

Age has long been documented as a possible risk factor for incisional hernia. For patients in our cohort, patients over 60 years demonstrated a significantly greater risk upon univariate analysis (HR 2.04) and this association was significant after multivariable adjustment (HR 1.54). These observations concur with the observations by Nilsson et al. (2016) [10] that demonstrated that elderly adults undergoing abdominal surgery had a raised risk for postoperative hernia, predominantly as a result of the ageing-related decline in collagen quality as well as impaired wound-healing capabilities. Despite this, however, the influence of age frequently diminishes when one takes an account of comorbidities since elderly individuals often possess more chronic disease that independently elevates the risk of developing a hernia. Similarly, Fischer et al. (2016) [9] identified that age was a weaker discriminator after they adjusted for obesity, diabetes mellitus, as well as smoking.

Obesity became the highest risk factor in our series with a multivariate HR of 3.58 for BMI ≥30. This result agrees with previous literature reporting that a raised BMI impairs wound healing by increasing intra-abdominal pressure as well as by inducing tissue hypoperfusion (Israelsson, 1996) [4]. Our prevalence rates observed for obesity (mean BMI 26.8 with 14% obese) reflect the growing trend

internationally documented by the Swedish Public Health Agency in 2014 [11]. Retrospective comparable studies by Tecce et al. (2017) [12] found a four times enhanced risk for incisional hernia in obese women undergoing hysterectomy as evidence supporting preoperative weight optimizing programs. In contrast, a few studies implicate that overweight grade I (25–29.9 BMI) might not carry such a high risk as highlighted by our result that the highest risk clusters in BMI ≥30 patients (Lee et al., 2012) [13].

In our study, smoking was identified as another significant predictor with an 88% increased risk based on a multivariate analysis. This supports currently published literature that smoking impairs collagen synthesis as well as tissue oxygenation and thus impairs wounds' ability to heal (T et al., 2014) [14]. The percentage of current smokers in our material (15.8%) closely reflects that found in the female Swedish population during the period examined (Hälsa, 2017) [15] thereby increasing the generalizability of our result. It has been established that preoperative smoking cessation programs can reduce postoperative complications such as incisional hernias as a result highlighting the need for specific interventions (T et al., 2014) [14].

In our multivariate model, rheumatologic disease, liver disease, kidney disease, and diabetes mellitus came up as independent predictors for the development of hernia with hazard ratios ranging between 1.31 and 1.58. Our finding coincides with that of Henriksen et al. (2013) [16], who observed that systemic disorders involving collagen synthesis and tissue repair were common causes of enhanced susceptibility for hernia formation. Since pulmonary disease was significant on univariate analysis but lost significance on adjustment, confounding effects by age or other comorbid diseases could be implicated. These findings remind us that a precise preoperative assessment must be performed in order to recognize individuals at specific risk.

The type of surgery performed is a key factor in determining postoperative hernia formation. In the cohort we examined, if midline incisions are factored in, there was about double the risk of hernia formation than that observed with Pfannenstiel or Cohen incisions. This evidence complements the available literature, both old (HJ P, 1900) [17] and new (Lee et al., 2012) [13], that transverse or lower abdominal incisions reduce incisional hernia rates. Pfannenstiel incisions are a benefit for elective gynecology because of the reduced hernia rates; however, when oncologic cases make access difficult, midline incisions are warranted. It is important to note that in studies using traditional imaging techniques, such as computed tomography scanning, to detect hernias, a high prevalence of hernias was reported (Nilsson et al., 2016) [10]; therefore, it can be argued that clinically detected hernias identified in our study do not reflect the true rate of hernia occurrence.

We confirm the cumulative effect of modifiable risk factors. Obese, smoking, or pre-existing chronic comorbidity patients are at greatest risk, and preoperative interventions against these factors can potentially lower incisional hernia incidence. This aligns with a call by Rosen et al. (2015) [18] for multidisciplinary preoperative optimization, such as weight loss and smoking cessation, as a prelude to complex abdominal surgery. Choice of surgical incision must also strive to balance exposure requirements necessary for minimization of the risk of hernia with a preference for Pfannenstiel incision where practicable.

Overall, this investigation supports the multifactorial cause of post-gynecologic surgery incisional hernias and concurs with available literature documenting age, obesity, smoking, comorbid disease, and incision type as important risk factors. Following specific preoperative steps, optimizing surgical techniques, and increasing postoperative surveillance may all reduce the occurrence and impact of incisional hernias independently. Future prospective studies with imaging follow-up may better estimate the incidence of hernias and may optimize stratification of risk.

Conclusion

This research illustrates the incidence and risk factors associated with incisional hernia following gynecologic surgery, demonstrating that patient factors, comorbidities, and surgical techniques have a significant impact on results. Advanced age, higher body mass index, smoking, and pre-existing comorbidities such as diabetes, liver disease, kidney disease, and rheumatologic diseases were noted as additional risk factors of importance, while midline incisions also posed a higher risk as an independent variable. At any rate, while some factors were shown to be significant outcomes as a result of univariate testing (for example, pulmonary disease), they could not be established as independent outcome correlates, demonstrating a complex interaction between the patient's condition and surgical technique. Overall, the study emphasizes the importance of individualized pre-operative work-up, modifications of risk factors, and consideration of incision type in an attempt to decrease post-operative complications and optimize long term outcomes.

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