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PREVALENCE AND RISK FACTORS FOR INCISIONAL HERNIA FOLLOWING CESAREAN SECTION: A CROSS-SECTIONAL STUDY.

Sweta Rani[a], Anupam Ranjan[b*], Girija Kumari[b]
[a]Assistant Professor, Department of Obs & Gynae, ANMMCH, Gaya, Bihar, India
[b]Senior Resident, Department of General Surgery, ANMMCH, Gaya, Bihar, India
[c]Professor, Department of Obs & Gynae, ANMMCH, Gaya, Bihar, India

ABSTRACT

Background

Cesarean section (C-section) is a prevalent surgical procedure globally, essential for managing complicated deliveries. However, it carries risks, including the development of incisional hernias, which can significantly impact maternal health and healthcare costs. This study investigated the prevalence and risk factors associated with incisional hernia following cesarean sections.

Methods

A cross-sectional observational study was conducted. Eighty-six women who underwent C-sections were included. Data on demographics, medical history, surgical details, and postoperative outcomes were collected through structured questionnaires and medical record reviews. Participants were followed up at 6 weeks, 3-, 6-, and 12 months post-surgery for physical examinations. Statistical analysis was accomplished.

Results

The average age was 29.4 years (± 5.6) and BMI was 26.7 kg/m² (± 4.1). Most participants (62.8%) were middle-class, and 18.6% smoked. The prevalence of incisional hernia was found to be 14.0%. Significant risk factors included higher BMI (OR: 1.15, p=0.035), hypertension (OR: 3.67, p=0.036), vertical incision type (OR: 4.82, p=0.037), postoperative wound infection (OR: 7.23, p=0.002), and low physical activity (OR: 3.21, p=0.046). These factors highlight the need for targeted interventions to reduce hernia incidence.

Conclusion

Incisional hernia is a common complication post-C-section, with significant risk factors identified as higher BMI, hypertension, vertical incisions, postoperative wound infections, and low physical activity.

Recommendations

To mitigate the risk of incisional hernia, it is recommended to manage patient weight and hypertension effectively, prefer Pfannenstiel incisions, ensure rigorous infection control, and promote appropriate postoperative physical activity.

Keywords: *Incisional Hernia, Cesarean Section, Risk Factors, Postoperative Complications*
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Corresponding Author
Anupam Ranjan
*Email: **dr.anupammdpmc@gmail.com***
Senior Resident, Department of General Surgery, ANMMCH, Gaya, Bihar, India.

INTRODUCTION

Cesarean section (C-section) is one of the most commonly performed surgical procedures worldwide, with rates increasing significantly over the past few decades. While it is a life-saving intervention for both mothers and infants in cases of complicated deliveries, it is not without risks. Among the various complications that can arise postoperatively, incisional hernia (IH) stands out as a significant concern due to its impact on maternal morbidity and healthcare costs [1].

An incisional hernia occurs when the abdominal wall layers fail to heal properly after surgery, leading to the protrusion of intra-abdominal contents through the incision site. The prevalence of IH following C-sections varies widely in the literature, with rates reported between 1% and 20%, depending on the study population and follow-up duration [2]. This wide range highlights the necessity for further research to clarify the prevalence and identify modifiable risk factors.

The increasing rates of obesity and advanced maternal age are among the factors contributing to the rising incidence of IHs. Obesity, in particular, has been strongly associated with poor wound healing and increased intra-abdominal pressure, both of which are critical risk factors for hernia development [3]. Additionally, the surgical technique used during C-sections, including the type of incision, plays a crucial role. Pfannenstiel incisions are generally preferred over vertical incisions due to their association with lower hernia rates and better cosmetic outcomes [4].

Postoperative wound infections are another significant risk factor, as they can compromise wound integrity and promote hernia formation. Effective infection control

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measures, including the appropriate use of antibiotics and strict aseptic techniques, are essential in mitigating this risk. Furthermore, physical activity levels post-surgery has been found to influence recovery and hernia risk, with appropriate activity promoting better healing outcomes [5].

Despite the advancements in surgical techniques and postoperative care, the management of incisional hernias remains a challenge. The economic burden associated with additional surgeries for hernia repair and the impact on the patient's quality of life necessitate a deeper understanding of the underlying risk factors.

The study aimed at investigating the prevalence and risk factors associated with incisional hernia following cesarean sections.

METHODOLOGY

Study Design

A cross-sectional observational study.

Study Setting

The study was conducted in the Department of Obstetrics and Gynecology at Anugrah Narayan Magadh Medical College and Hospital (ANMMCH), Gaya, Bihar. The study duration spanned from January 2023 to March 2024.

Participants

A total of 86 participants were included in the study.

Inclusion Criteria

- Women who had undergone a cesarean section, and
- aged 18-45 years.

Exclusion Criteria

- Women with a history of previous hernia surgery,
- who had undergone emergency cesarean sections due to complications, and
- with known connective tissue disorders.

Sample size

To calculate the sample size for this study, the following formula was used for estimating a proportion in a population:

$$n = \frac{Z^2 \times p \times (1-p)}{E^2}$$

Where:
- n = sample size
- Z = Z-score corresponding to the desired level of confidence
- p = estimated proportion in the population
- E = margin of error

Bias

To minimize selection bias, all eligible participants were included in the study consecutively. Information bias was reduced by standardizing the data collection process and training data collectors. Confounding factors were addressed through statistical adjustments.

Variables

Variables included incidence of IH post-cesarean section, patient demographics, medical history, surgical factors, and postoperative factors.

Data Collection

Data collection involved several steps to gather comprehensive information on each participant. A structured questionnaire was administered to collect demographic data (such as age, BMI, and socioeconomic status) and medical history (including diabetes, hypertension, and smoking status). Medical records were reviewed to extract details about the cesarean section, including the type of incision, duration of surgery, and the operating surgeon's experience level. Postoperative outcomes, such as wound infection, use of postoperative antibiotics, and levels of physical activity during recovery, were also recorded.

Procedure

Participants were scheduled for follow-up visits at 6 weeks, 3-, 6-, and 12 months post-cesarean section. During each visit, trained medical personnel conducted a physical examination to check for signs of IH using a standardized protocol. This consistent approach ensured reliable detection and recording of hernia cases.

Statistical Analysis

SPSS version 21.0 was used for data analysis after being imported into a database. For continuous data, descriptive statistics were computed; for categorical variables, frequencies and percentages were computed. To compare factors between patients with and without IH, chi-square tests and t-tests were employed. To find important risk factors connected to IH, logistic regression analysis was used. Statistical significance was attained when the p-value was less than 0.05.

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Ethical considerations

The study protocol was approved by the Ethics Committee and written informed consent was received from all the participants.

RESULT

A total of 86 women who underwent cesarean sections participated in this study. The mean age was 29.4 years (± 5.6), and the mean BMI was 26.7 kg/m² (± 4.1). The majority of participants (62.8%) belonged to a middle socioeconomic status, and 18.6% were smokers.

Regarding surgical details, 63.9% of the cesarean sections were performed using a Pfannenstiel incision, and 36.1% used a vertical incision. The mean duration of surgery was 85.7 minutes (± 15.2). Experienced surgeons performed 74.4% of the surgeries. Postoperative wound infection was observed in 19.8% of the participants, and 73.3% received postoperative antibiotics.

A comparison between participants with and without IH revealed significant differences in several variables. Table 3 summarizes these comparisons.

Using logistic regression analysis, a number of important risk variables for IH were found. The findings of the multivariate logistic regression analysis are shown in Table 4.

Table 1a: Demographic Features

Variable	Mean (SD) / n (%)
Age (years)	29.4 (± 5.6)
Socioeconomic Status	
- Low	18 (20.9%)
- Middle	54 (62.8%)
- High	14 (16.3%)
Smoking Status	
- Smoker	16 (18.6%)
- Non-smoker	70 (81.4%)

Table 1b: Clinical Features

Variable	Mean (SD) / n (%)
BMI (kg/m²)	26.7 (± 4.1)
Diabetes	14 (16.3%)
Hypertension	20 (23.3%)

Table 2: Surgical and postoperative variables

Variable	Mean (SD) / n (%)
Type of Incision	
- Pfannenstiel	55 (63.9%)
- Vertical	31 (36.1%)
Duration of Surgery (minutes)	85.7 (± 15.2)
Surgeon Experience	
- Resident	22 (25.6%)
- Attending Physician	64 (74.4%)
Postoperative Wound Infection	17 (19.8%)
Postoperative Antibiotics	63 (73.3%)
Physical Activity (low)	34 (39.5%)

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Table 3: Risk Factors for Incisional Hernia

Variable	Hernia Present (n=12)	Hernia Absent (n=74)	p-value
Age (years)	330.2 (± 6.0)	29.2 (± 5.5)	0.593
BMI (kg/m²)	28.5 (± 4.5)	26.4 (± 4.0)	0.045
Socioeconomic Status			
- Low	3 (25.0%)	15 (20.3%)	0.742
- Middle	7 (58.3%)	47 (63.5%)	0.746
- High	2 (16.7%)	12 (16.2%)	0.964
Smoking Status			
- Smoker	4 (33.3%)	12 (16.2%)	0.171
- Non-smoker	8 (66.7%)	62 (83.8%)	0.171
Diabetes	4 (33.3%)	10 (13.5%)	0.088
Hypertension	6 (50.0%)	14 (18.9%)	0.020
Type of Incision			
- Pfannenstiel	2 (16.7%)	53 (71.6%)	0.018
- Vertical	10 (83.3%)	21 (28.4%)	
Duration of Surgery (minutes)	90.2 (± 18.4)	84.8 (± 14.5)	0.283
Surgeon Experience			
- Resident	4 (33.3%)	18 (24.3%)	0.423
- Attending Physician	8 (66.7%)	56 (75.7%)	
Postoperative Wound Infection	7 (58.3%)	10 (13.5%)	0.001
Postoperative Antibiotics	7 (58.3%)	56 (75.7%)	0.207
Physical Activity (low)	8 (66.7%)	26 (35.1%)	0.041

Table 4: Multivariate Logistic Regression Analysis of Risk Factors for Incisional Hernia (IH) After Cesarean Section

Variable	Crude Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
BMI (per kg/m² increase)	1.15	1.01-1.31	0.035
Hypertension	3.67	1.09-12.33	0.036
Vertical Incision	4.82	1.10-21.11	0.037
Postoperative Wound Infection	7.23	2.01-26.03	0.002
Low Physical Activity	3.21	1.02-10.07	0.046

DISCUSSION

The study identified an overall prevalence of 14.0% for IH among women who underwent cesarean sections. This finding indicates that approximately one in seven women in this cohort developed an IH postoperatively. Such a prevalence rate highlights the significance of IH as a common complication following cesarean sections, necessitating increased awareness and preventative measures in clinical practice.

Several significant risk factors for developing IH were categorized through both comparative analysis and logistic regression. One notable factor was body mass index (BMI). The study found that a higher BMI was correlated with an increased risk of IH (OR: 1.15, p=0.035). This suggests that as BMI increases, the likelihood of developing an IH also rises, likely due to increased abdominal pressure and potential challenges in wound healing faced by obese patients.

Hypertension was another significant risk factor (OR: 3.67, p=0.036). The correlation between hypertension and increased risk of IH might be attributed to impaired wound healing and elevated intra-abdominal pressure observed in hypertensive patients. This finding underscores the importance of managing hypertension effectively in patients undergoing cesarean sections to mitigate this risk.

The type of surgical incision also played a critical role. Vertical incisions were significantly more likely to result in hernias compared to Pfannenstiel incisions (OR: 4.82, p=0.037). This suggests that the choice of incision type is crucial in minimizing the risk of hernia, with Pfannenstiel incisions being preferable due to their association with a lower risk of hernia development.

Postoperative wound infections dramatically increased the risk of IH (OR: 7.23, p=0.002). This finding highlights the importance of stringent infection control measures and prompt treatment of infections to reduce the likelihood of hernia formation. Effective infection prevention and management strategies are essential components of postoperative care.

Additionally, low levels of physical activity were related with a higher risk of IH (OR: 3.21, p=0.046). Encouraging appropriate physical activity post-surgery could be beneficial in reducing this risk. Patients should be guided on safe levels of activity to promote healing without overstraining the surgical site.

The findings provide valuable insights into the factors contributing to IH following cesarean sections. The high prevalence observed indicates that IH is a common complication, necessitating the implementation of preventive strategies in clinical practice. The identification of higher BMI, hypertension, vertical incisions, postoperative wound infections, and low physical activity as significant risk factors offers clear targets for intervention.

Optimizing preoperative weight management, controlling hypertension, choosing appropriate incision types, ensuring rigorous infection control, and promoting suitable postoperative physical activity could collectively reduce the incidence of IH. These results can inform clinical guidelines and patient management protocols, emphasizing a multifaceted approach to minimize the risk of IH in post-cesarean section patients.

Incisional hernia is a notable complication following abdominal surgeries, including cesarean sections. A systematic review reported that the incidence of IH post-cesarean section ranges between 0.0% to 5.6%, with a low overall risk observed even after extended follow-up periods. This review included 275,878 women across five studies, highlighting the variability in reported incidence rates [6].

Several key risk factors contribute to the development of IH. Postoperative wound infection has been identified as a significant risk factor, with studies showing a high correlation between wound infections and subsequent IH formation. In a study involving 52 individuals with IH, 84.9% had postoperative wound infections, and 40.38% were obese [7]. Another retrospective analysis found that infants who developed IH post-abdominal surgery had a higher incidence if they had wound infections, with an odds ratio (OR) of 5.3 (95% confidence interval [CI]: 2.9-9.5) [8].

Obesity is consistently identified as a critical risk factor for IH. A study found that obesity was the most common risk factor, present in 72.9% of cases, followed by wound sepsis at 57.0% [9]. Similarly, a study reported an overall IH incidence of 0.37% following lower segment cesarean sections, with a significant association between hernias and lower midline incisions [10].

Emergency surgeries, including emergency cesarean sections, also present a higher risk for IHs compared to elective procedures. For instance, emergency midline laparotomies resulted in a higher incidence of hernias (16.66%) compared to surgeries for haemoperitoneum (8.3%) [11].

Further compounding the risk are pre-existing conditions such as diabetes, smoking, and multiple cesarean deliveries. A population-based cohort study revealed that cesarean sections are related with an increased risk for complications like IH, with smoking and obesity significantly exacerbating the risk [12]. Additionally, a study on the development of a risk prediction model for IH found that a history of abdominal surgeries (87.5%) and smoking (75%) were common risk factors [13].

Age and sex also influence the risk of complications following IH repair. A registry-based study noted that female sex was an independent risk factor for chronic pain post-hernia repair, with higher rates of pain on exertion, pain at rest, and pain requiring treatment in females compared to males [14].

Generalizability

The findings of this study, while based on a relatively small cohort, suggest that certain modifiable risk factors significantly contribute to the incidence of incisional hernia following cesarean sections. Given the prevalence of cesarean deliveries globally, these insights are highly applicable to larger populations. By addressing factors such as higher BMI, hypertension, incision type, postoperative wound infection, and physical activity, healthcare providers can potentially reduce the incidence of this complication in a broader patient population. The study underscores the importance of personalized preoperative assessments and postoperative care strategies that could be implemented widely to enhance maternal health outcomes and reduce healthcare costs associated with incisional hernias.

CONCLUSION

This study identified a significant prevalence of IH (14.0%) following cesarean sections, highlighting it as a common postoperative complication. Key risk factors included higher BMI, hypertension, vertical incision type, postoperative wound infection, and low physical activity. These findings underscore the importance of targeted interventions such as effective weight management, hypertension control, careful surgical technique, stringent infection prevention, and appropriate postoperative physical activity to reduce the risk of incisional hernia. Implementing these strategies in clinical practice can improve patient outcomes and minimize the incidence of this complication.

LIMITATIONS

The limitations of this study include a small sample population who were included in this study. Furthermore,

the lack of comparison group also poses a limitation for this study's findings.

RECOMMENDATION

To mitigate the risk of incisional hernia, it is recommended to manage patient weight and hypertension effectively, prefer Pfannenstiel incisions, ensure rigorous infection control, and promote appropriate postoperative physical activity.

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LIST OF ABBREVIATIONS

C-section - Cesarean Section
IH - Incisional Hernia
BMI - Body Mass Index
OR - Odds Ratio
CI - Confidence Interval

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CONFLICT OF INTEREST

The authors have no conflicting interests to declare.

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