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Clinical Determinants and Operative Impact of Adhesions in Women Undergoing Laparoscopic Gynaecological Surgery: A Retrospective Analysis

S Gnanarathne¹, H Subasinghe¹, U.A Isurindi²

¹Department of Obstetrics and Gynaecology, Faculty of Medicine, University of Peradeniya, Sri Lanka

²Department of Anaesthesiology and Critical Care, Faculty of Medicine, University of Peradeniya, Sri Lanka

Correspondence:

S. Gnanarathne

E mail: sgresearchuop@gmail.com

 <https://orcid.org/0009-0007-6023-502X>

ABSTRACT

Background: Adhesions are abnormal fibrous bands that join two normally separate anatomical structures and remain one of the most frequent sequelae of gynecological surgery. They contribute to chronic pelvic pain, infertility, and bowel obstruction, making their recognition clinically important. **Objectives:** To determine the prevalence, severity, anatomical distribution, associated factors, and operative consequences of adhesions in women undergoing laparoscopic gynecological surgery at Teaching Hospital Peradeniya (THP). **Methods:** A retrospective analysis of operative notes and patient records was conducted for all women who underwent laparoscopic gynecological surgery at THP. Data collected included patient demographics, prior surgical history, presence and severity of adhesions, and intraoperative outcomes. **Results:** Of the 391 procedures reviewed, adhesions were present in 46.5% of patients. Pelvic adhesions were most common (54.4%), followed by abdominal (22.5%) and mixed abdominal-pelvic adhesions (20.3%). Thin/filmy adhesions accounted for 56%, while thick/fibrous bands comprised 43.4%. Severe adhesions were found in 42.62%. Previous abdominal or pelvic surgery ($\chi^2=79.331$, $p < 0.001$), endometriosis ($\chi^2=15.424$, $p < 0.001$), and subfertility ($\chi^2=6.149$, $p = 0.013$) were significantly associated with adhesion development. Intraoperative difficulties occurred in 30.6% of patients with adhesions, including increased bleeding, prolonged duration, and entry injuries. Conversion to open surgery occurred in 1.3% of cases, predominantly among those with moderate or severe adhesions. **Conclusions:** Adhesions are common among women undergoing laparoscopic gynecological surgery and are strongly associated with previous abdominopelvic surgery, endometriosis, and subfertility. Adhesion severity correlates with increased operative difficulty and conversion to open surgery. Understanding associated risk factors can help optimize surgical strategies to reduce adhesion-related morbidity.

Keywords: Adhesions, Laparoscopic gynecological surgery, Operative complications, Abdominopelvic surgery

INTRODUCTION

Adhesions are fibrous bands that connect normally distinct anatomical structures (1). They are among the most frequent findings encountered during gynaecological laparoscopic

surgery and remain a major cause of operative difficulty, risk, and morbidity worldwide. In gynaecological surgeries, the adhesions encountered are a result of previous abdominal or pelvic surgeries, inflammatory conditions,

endometriosis, pelvic infections, or any peritoneal insult (2,3).

The SCAR study has studied a wide variety of laparoscopic surgeries in relation to adhesion formation. As a conclusion, the study group has suggested using laparoscopic surgeries in order to minimize adhesions (4). Presence of adhesions significantly influences the safety and complexity of laparoscopic procedures. Laparoscopy, with its superior magnification and illumination, improves the detection of pelvic pathologies like adhesions. However, the initial entry into the abdominal cavity is usually performed blindly using a Veress needle or trocar, making undiagnosed adhesions a critical intraoperative concern.

The reported incidence of intraperitoneal adhesions after general abdominal operations ranges from 67% - 93% (5). When adhesions associated with laparoscopic gynaecological surgeries are considered, depending on the type and number of previous procedures, they are strongly associated with conditions such as endometriosis, pelvic inflammatory disease, and repeated caesarean sections (6). The presence of adhesions, particularly those involving the umbilicus or anterior abdominal wall, markedly increases the risk of entry-related complications, leading to unnecessary conversion to open surgeries and prolonged surgical procedures.

Despite their clinical significance, the true prevalence, anatomical distribution, and severity of adhesions in women undergoing gynaecological laparoscopy in Sri Lanka remain largely undocumented, and limited local data exist to guide surgeons in risk stratification and selection of the safest abdominal entry techniques. Understanding the patterns and predictors of adhesions in the local population is essential for optimising surgical planning, preventing avoidable injuries, and improving overall patient outcomes.

This study aims to address this gap by systematically analysing the prevalence, severity, associated factors, and complications of adhesions encountered in gynaecological laparoscopic surgeries at Teaching Hospital Peradeniya.

METHODOLOGY

This retrospective descriptive cross-sectional study was conducted at the Professorial Obstetrics and Gynaecology Unit of the Teaching Hospital Peradeniya, Sri Lanka. Ethical approval for the study was obtained from the Ethics Review Committee of the Faculty of Medicine, University of Peradeniya (2025/EC/106). As the study involved a retrospective review of existing records, there was no direct patient involvement and no associated risk. The study covered procedures performed between January 2022 and July 2025, with data collection carried out over a period of 2 months.

The study population consisted of all women who were above 18 years old and who underwent diagnostic or operative gynaecological laparoscopy during the specified period. Women with complete documentation regarding the presence or absence of adhesions were included, while those with missing or incomplete bed head tickets (BHTs), laparoscopies performed for non-gynaecological indications were excluded from the study.

Data were extracted from BHTs, operative notes, anaesthetic charts, and theatre registers using a structured data extraction sheet. Variables collected included demographic details, clinical history, and operative details. Adhesions were assessed and graded using the Modified American Fertility Society classification, with severity categorised as mild, moderate, or severe based on density and involvement of critical structures (7). Adhesion locations documented included abdominal, pelvic and visceral organs. Intraoperative and postoperative complications, including entry-related bowel, bladder, or vascular injuries, bleeding during adhesiolysis, and duration of surgery, were also recorded.

Statistical analysis

Data were analysed using SPSS. Descriptive statistics summarised baseline characteristics and the prevalence of adhesions. Chi-square tests and t-tests/ANOVA were used to explore associations between adhesions and clinical or surgical variables. Complication rates were compared across different adhesion severity categories. A p-

value of <0.05 was considered statistically significant.

RESULTS

A total of 391 ASA I and II patients were included in the study. The mean age of the participants was 44.49 ± 4.86 years, with an age range of 30 to 60 years. The mean haemoglobin concentration was 11.28 ± 1.54 g/dL (range 7.1-14.5 g/dL). The distribution of comorbid diseases and the type of surgeries are summarized in Table 1.

Table 1. Baseline comorbidities and types of surgeries in the study population

Characteristics		N (%)
Comorbid disease	Hypertension	73 (18.67%)
	Bronchial asthma/ COPD	19 (4.85%)
	Diabetes Mellitus	65 (16.2%)
	Hypothyroidism	10 (2.55%)
	Ischaemic heart disease	4 (1.02%)
	Dyslipidaemia	34 (8.6%)
	Deep vein thrombosis	3 (0.76%)
	Neurological disorders	1 (0.25%)
	CKD/ Any other renal problems	2 (0.51%)
	Total	106 (27.12%)
	Laparoscopic cystectomy	102 (26.08%)
	Laparoscopic myomectomy	52 (13.29%)

Characteristics	N (%)
Diagnostic laparoscopy	73 (18.67%)
Lap and dye test	50 (12.78%)

The commonest indication to undergo laparoscopic surgery in the cohort was heavy menstrual bleeding, followed by dysmenorrhoea. Figure 1 shows the distribution of indications to undergo laparoscopic surgery in this cohort.

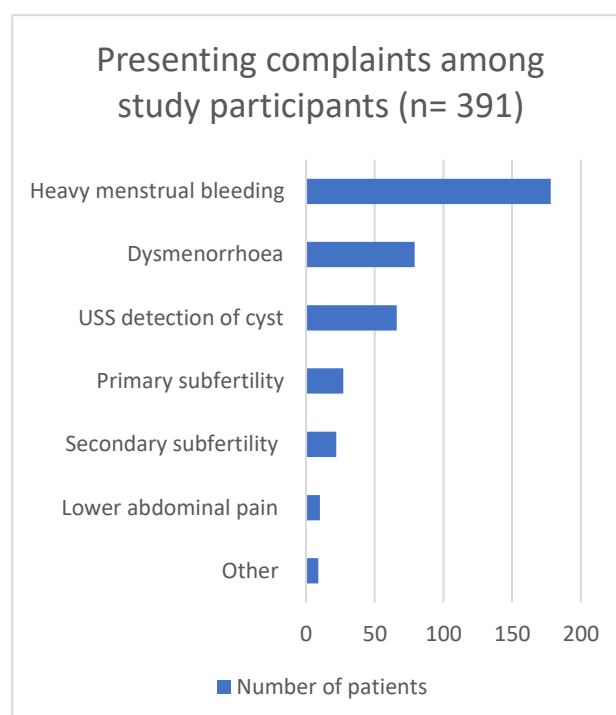


Figure 1. The horizontal bar graph illustrates the distribution of presenting complaints among patients who underwent laparoscopic surgery.

Prevalence, severity, and characteristics of adhesions

Adhesions were identified in 182 patients (46.5%), while 208 patients (53.2%) had no adhesions. Among those with adhesions, pelvic adhesions were the most common (54.4%), followed by abdominal (22.5%) and mixed abdomino-pelvic adhesions (20.3%) of the identified adhesions, thin/filmy adhesions accounted for 56%, while thick/fibrous bands accounted for 43.4%. Severity

grading demonstrated mild adhesions in 15.94%, moderate in 41.44 %, and severe in 42.62% of cases. A strong and statistically significant association was observed between adhesion type and severity ($\chi^2 = 22.523$, $p < 0.001$). Thin adhesions were largely mild or moderate, whereas thick adhesions were predominantly severe.

Demographic and Clinical Factors Associated with Adhesions

Age and BMI showed non-normal distribution. No significant association was observed between age (MWU $z = -1.654$, $p = 0.098$) or BMI (MWU $z = -0.291$, $p = 0.771$) and the presence of adhesions. Comorbidities such as diabetes, hypertension, dyslipidaemia, asthma/COPD, hypothyroidism, and cardiovascular disease showed no significant associations with the presence of adhesions or their severity. However, previous abdominal or pelvic surgery (73.1% among adhesion-positive patients; $\chi^2 = 79.331$, $p < 0.001$) and endometriosis (15.4%; $\chi^2 = 15.424$, $p < 0.001$) were significantly associated with adhesions. Subfertility showed a weaker but significant association ($\chi^2 = 6.149$, $p = 0.013$). Table 2 highlights the association of demographic and clinical factors with the formation of adhesions. In our cohort, previous abdomino-pelvic surgery and endometriosis are the strongest predictors of the formation of adhesions.

Table 2. Demographic and Clinical Factors Associated with Adhesions

Variable	Total N (%)	Adhesion + N (%)	p-value
Age (Mean $\pm$ SD)	38.19 $\pm$ 9.76	—	MWU $z = -1.654$, $p = 0.098$
BMI (Mean $\pm$ SD)	24.10 $\pm$ 3.81	—	MWU $z = -0.291$, $p = 0.771$
Past abdominal/pelvic surgery	191 (48.8)	133 (73.1)	$\chi^2 = 79.331$, $p < 0.001$
Endometriosis	36 (9.2)	28 (15.4)	$\chi^2 = 15.424$, $p < 0.001$

Variable	Total N (%)	Adhesion + N (%)	p-value
Subfertility	62 (15.9)	40 (11)	$\chi^2 = 6.149$, $p = 0.013$
Comorbidities			
DM	39 (10)	40 (11)	$\chi^2 = 0.371$, $p = 0.543$
HTN	73 (11.3)	42 (11.5)	$\chi^2 = 0.022$, $p = 0.881$
DL	15 (3.8)	14 (3.8)	$\chi^2 = 0.000$, $p = 1.000$
BA/COPD	18 (4.6)	14 (3.8)	$\chi^2 = 0.459$, $p = 0.498$
Hypothyroidism	17 (4.3)	9 (4.9)	$\chi^2 = 0.281$, $p = 0.596$
CVS disease	10 (2.6)	8 (2.2)	$\chi^2 = 0.183$, $p = 0.669$

Intraoperative Complications Associated with Adhesions

Conversion to open surgery occurred in 1.3% ($n = 5$) of all cases, with 4 occurring in adhesion-positive patients. Although the finding is clinically significant, it was not found to be statistically significant. ($\chi^2 = 2.261$, $p = 0.133$). Adhesion-positive patients experienced higher rates of increased bleeding (11%) and longer surgery duration (20.2%). These findings are clinically significant in our context. However, statistical significance was not reached. Entry injuries (0.8%) and solid organ injuries (0.3%) were rare and occurred only in adhesion-positive patients.

Relationship Between Adhesion Severity and Operative Outcomes

Conversion to open surgery occurred in 1 patient with moderate adhesions and 2 patients with severe adhesions, while no conversions were observed in patients with mild adhesions.

DISCUSSION

Our findings demonstrate that adhesions were a common intraoperative finding in this cohort. In global literature, similar values were reported. The risk of abdominopelvic adhesions following open surgeries ranges from 35 to 60%. (1,8,9,10). Similarly, the distribution and anatomical patterns observed in our cohort closely resemble findings from global literature, indicating that adhesion formation remains a widespread challenge across diverse surgical settings.

In our population, previous pelvic or abdominal surgery and endometriosis were found to be the major clinical determinants of adhesions. Both of these factors are well-established contributors to peritoneal inflammation and fibrosis. Previous studies also reported that previous pelvic surgeries are known to be associated with findings of adhesions (9,11,12). Most studies have shown that caesarean sections are common among surgeries leading to adhesions. In contrast, a study done in Nigeria has shown that open myomectomy has the highest risk of adhesions (13). Few studies support this finding, highlighting the possibility of high chances of re-surgery in this cohort for the same indication or fertility alterations.

In our study, the presence of endometriosis was also found to be a predictor for the development of adhesions. A randomised controlled study performed by Parker et al confirmed that not only endometriosis, but any surgery performed for endometriosis will lead to the formation of new adhesions (14).

Adhesions were also associated with increased operative time, higher blood loss, and an increased likelihood of conversion to open surgery. Although not statistically significant, there are clinically significant findings that will alter the patient outcome, length of stay, and hospital cost. These outcomes align with previous studies, which show a significant association which is observed in non-gynecological surgeries as well (15). In routine surgery, unplanned adhesiolysis will increase the risk of unintended organ injury, prolonged pneumoperitoneum, hypothermia, and increased postoperative pain, all of which may further impact surgical morbidity. The clinical impact is particularly

relevant in the context of minimally invasive surgery, where conversion to laparotomy carries implications for recovery, wound complications, and patient satisfaction. Therefore, the presence of adhesions raises the question of whether open surgery for benign indications is justifiable, especially when minimally invasive alternatives may still be feasible with appropriate expertise and preoperative planning.

Overall, this study highlights the importance of identifying women at risk of adhesions and adopting intraoperative strategies that minimise tissue injury, inflammation, and ischemia. Even though our statistically non-significant findings limit definitive causal conclusions, the clinical relevance is clear: adhesions not only complicate laparoscopic procedures but may affect patient outcomes, health-care resources, and long-term reproductive and pain-related morbidity. This study has several limitations. Its retrospective design limits causal inference, and some operative variables, such as detailed operative time and blood loss, were incompletely recorded. In addition, this was a single-center study, which may limit generalizability. A key strength of this study is the relatively large sample size and inclusion of a wide range of laparoscopic procedures, providing useful insight into adhesion patterns in a local population. Future prospective studies with larger sample sizes and standardised adhesion scoring systems are warranted to better characterise these associations and evaluate preventive strategies in the Sri Lankan surgical context.

CONCLUSION

This retrospective study demonstrates that adhesions are a common finding among women undergoing laparoscopic gynaecological surgery, with patterns and prevalence comparable to international data. Previous pelvic surgery and endometriosis were the most important clinical determinants, and although associations with increased operative time, blood loss, and conversion to open surgery were not statistically significant, they remain clinically meaningful. Adhesions continue to pose a substantial challenge to minimally invasive surgery, increasing operative complexity and the risk of complications. Further prospective research is needed to better quantify

these risks and evaluate the effectiveness of prevention methods in our local setting.

Author declaration

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Authors' contributions:

SG: Conceptualization, providing clinical oversight, reviewing the final manuscript. HS: Data collection, data analysis, writing the manuscript; UAI: Data collection, data analysis, writing the manuscript.

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The authors declare that there is no financial or non-financial conflict of interest.

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Data will be available on request from the corresponding author.

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