RESEARCH ARTICLE

Comparative analysis between outcomes of minimally invasive gynaecological surgeries and traditional abdominal surgeries for benign gynaecological conditions

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Abstract

Objective: To compare outcomes of minimally invasive gynaecological surgeries with open gynaecological surgical techniques in a low-resource setting.

Method: The quasi-experimental study was conducted at a tertiary care public-sector hospital in Rawalpindi, Pakistan, from September 2022 to August 2023, and comprised women with benign gynaecological conditions. The subjects were divided into two groups. Group-I included participants who underwent minimally invasive gynaecological surgeries, while Group-II patients underwent open gynaecological surgical intervention. Outcome variables included pre-discharge pain score, post-operative mobility, operative time, blood-loss during surgery, length of hospital stay and intraoperative as well as postoperative complications. Data was analysed using SPSS 25.

Results: Of the 319 women, 146(45.7%) were in Group-I with mean age 30.83±5.47 years, and 173(54.2%) were in group-II with mean age 44.87±10.46 years. Body mass index, length of marriage, history of previous surgery, comorbidities and menopausal status were significantly different between the groups (p<0.05). Duration of surgery and hospital stay were lower in Group-I compared to Group-II (p<0.05). Intra-operative complications were not significantly different between the groups (p<0.05), while the differences in post-operative complications were significant (p<0.05).

Conclusion: Better clinical outcomes were observed for minimally invasive gynaecological surgeries than open surgeries among women diagnosed with benign gynaecological diseases.

Keywords: Minimally invasive surgical procedures, Operative surgical procedures, Laparotomy, Gynaecological diseases.

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Introduction

Benign gynaecological conditions[1] are the most frequent clinical presentation among patients visiting obstetrics and gynaecology outpatient and emergency worldwide. It includes benign uterine growth, like uterine fibroid, abnormal uterine bleeding, endometriosis, ovarian cyst, ovarian torsion, ectopic pregnancy and pelvic adhesions. Depending upon the indications, gynaecologists handle them both via open surgical approach and minimally invasive gynaecological surgical (MIGS) techniques.[2]

Minimally invasive surgery, also known as laparoscopic-assisted surgery, is gaining widespread acceptance as standard medical care in both developed and developing countries. It has been reported that postoperative quality of life is better in minimally invasive surgeries.[3] Well-known for small incisions along with minimal traumatic tissue damage and fewer surgical sutures, this technique has both diagnostic and therapeutic indications. The procedure makes use of a camera-assisted device and a number of small incisions, as a port of entry for operating instruments into the surgical cavity.[4] It also utilises a distinctive surgical approach for every procedure, depending upon the part of the body involved. For instance, particular body positions are required in upper abdominal and abdominoperineal surgeries called the European position and the Modified Lloyd Davies position, respectively. Before every laparoscopic-assisted abdominal surgical procedure, pneumoperitoneum is established in the abdomen along with special trocar positions particular to that surgery.[5] Different types of minimally invasive surgeries are available depending upon the part of the body and organ of interest. In gynaecology, this latest surgical approach is now considered a treatment option for many benign gynaecological conditions. These surgeries include hysterectomy, myomectomy, cystectomy, laser ablation, exploratory laparoscopy, etc.[6] Invention of this novel surgical approach and the role of gynaecologists in its advancement dates back to the 20th century. The laparoscopic procedure was first performed on dogs by George Kelling in 1901, but Swedish surgeon Christian Joseph performed the first laparoscopic surgery on humans in 1910. In 1944, a Paris-based gynaecologist

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looking for the treatment of sterility conducted the first minor laparoscopic surgical operation. In 1980, gynaecologist Stephan Semm, performed the first general surgery operative laparoscopy, showing general surgeons a way how to perform a laparoscopic appendectomy.[7]

Globally, 4.5% burden of disease is attributed to gynaecological morbidity.[8] About 20-80% of women by the age of 50 develop uterine fibroid. Endometriosis affects 5-17%, and adenomyosis affects 50-70% of women of the reproductive age group.[9] Further, 20% women develop one adnexal mass in their lifespan, and 4% get admitted to hospital for ovarian cyst by the time they reach the ripe age of 65.[10] Prevalence of ectopic pregnancy is 2% in all pregnancies, and 20% in women having a history of any pelvic surgery in the Western world.[11]

The current study was planned to compare MIGS with open gynaecological surgical techniques in a low-resource setting.

Patients and Methods

The quasi-experimental study was conducted at a tertiary care public-sector hospital in Rawalpindi, Pakistan, from September 2022 to August 2023. It was ethically approved by ethical review committee of the respective hospital in August 2022. The sample size was calculated using the formula for comparison between two groups in case of quantitative variables.[12] The quantitative variable considered was intra-operative blood-loss between laparoscopic and open surgeries.[13] Two-tailed hypothesis was used with significance 0.05 and power 90%. The calculated sample size was 123 in each group, but the sample was inflated to cover for and anticipated 15% dropout. The sample was raised using non-probability convenience sampling technique from among the patients visiting gynaecology and obstetrics department. Those included were women aged 10-75 years presenting with benign gynaecological conditions that required surgical intervention. Those with a high risk of anaesthesia-associated complications, or with obesity, bleeding disorders, cardiac diseases, renal disorders, high-risk complicated benign gynaecological conditions, and metastatic diseases were excluded. After taking informed consent, the subjects were divided into two groups. Group-I included participants who underwent MIGS, while Group-II patients underwent open gynaecological surgical intervention.

The selection of participants was done only by professional gynaecologists. For recruitment, complete history, general physical examination along with abdominal and bi-manual pelvic examination was conducted. Investigations were advised depending upon the differential diagnosis on the basis of history and examination. After diagnosis, appropriate treatment options were suggested to the patients. Depending upon the willingness of the patients, the doctor proceeded with the treatment. The research team was not involved in all this process. Pre-operative and postoperative management was carried out as per hospital protocols and international guidelines.[14] Soft, liquid and regular diets were given to the patients, and they were kept under observation until they complained of no gastrointestinal tract symptoms. The patients were discharged as per hospital guidelines.

Of the nine outcomes of interest, 5 were primary outcomes, including blood-loss during surgery (in ml), post-operative mobility (in hours) from the end of anaesthesia to the first unassisted movement, pre-discharge pain assessment, which was calculated using visual analogue scale (VAS) ranging 1-10, operative time (in hours), defined as the time interval between giving the first incision and the closure of the last incision, and the length of hospital stay (LOS) (in hours), and was defined as the time ranging from admission till the discharge. It did not include any readmission. There were 4 secondary outcomes, including intra-operative complications, like bowel and bladder injury, injury to vessels, ureter injury and uterine perforation, postoperative complications, including surgical-site infection (SSI), abdominal distension, postoperative ileus, paraesthesia/ nerve lesion, vaginal discharge or bleeding, venous thrombosis, neurogenic bladder, abdominal haematoma, wound dehiscence, haemoperitoneum, febrile illness and lymphangitis. These complications were recorded only till discharge. The third variable was the duration of nil per oral (NPO) status, and the fourth was the duration of foleys catheter or drain retention post-surgery.

Data was analysed using SPSS 25. Data was expressed as frequencies and percentages, or as mean and standard deviations, as appropriate. Categorical data was analysed using chi-square and Fisher's exact tests. As the data was not normally distributed, continuous variables were analysed using Mann Whitney U test. $P<0.05$ was considered statistically significant.

Results

Of the 319 women, 146(45.7%) were in Group-I with mean age 30.83±5.47 years, and 173(54.2%) were in group-II with mean age 44.87±10.46 years. Body mass index (BMI), length of marriage, history of previous surgery, comorbidities, NPO and menopausal status were significantly different between the groups (Table 1).

In Group-I, surgeries had to be converted into open surgeries in 11(7.5%) cases, 135(92.5%) participants had

Table-1: Intergroup comparison of demographic and clinical data.

Demographics	Group-I	Group-II	*p*-value
Mean Age (yrs)	30.83±5.476	44.87±10.462	<0.001*
Mean BMI	24.58±3.176	27.33±4.0356	<0.001*
Married for (yrs)	6.00±5.772	20.54±10.891	<0.001*
History of previous surgery n(%)	15(10.3)	46(26.6)	<0.001*
NPO before surgery (hrs)	20.70±8.078	6.11±8.020	<0.001*
Comorbidity	**n (%)**	**n (%)**	
Diabetes	1 (0.7)	13 (17.5)	
HTN	11 (7.5)	40 (23.1)	
HTN and diabetes	1 (0.7)	33 (19.9)	<0.001*c
None	133 (91.1)	86 (49.7)	
Hepatitis C	Nil	1 (0.6)	
Menopausal status			
Pre-menopausal	144 (98.6)	114 (65.9)	
Post-menopausal	2 (1.4)	59 (34.1)	<0.001*

Group-I: Minimally invasive gynaecological surgery, Group-II: Open gynaecological surgeries, BMI: Body mass index, NPO: Nil per oral, HTN: Hypertension.

Table-2: Comparison of intra-operative outcomes.

Intraoperative outcomes	Group-I	Group-II	p-value
Mean Duration of surgery (hrs)	0.83±0.39	1.81±0.59	<0.001*
Mean Blood loss (ml)	177.57±104.160	475.6±123.684	<0.001*
Complications	**n (%)**	**n (%)**	
Bowel injury	1 (0.7)	7 (4)	0.120b
Bladder injury	1 (0.7)	5 (2.9)	0.303b
Uterine perforation	Nil	1 (0.6)	>0.999b
Nerve injury	1 (0.7)	Nil	0.932b
Vessel injury	Nil	1 (0.6)	>0.999b

* statistically significant p-value. b represented p-value calculated by continuity correction. Group-I: Minimally invasive gynaecological surgery, Group-II: Open gynaecological surgeries, SD: Standard deviation.

port incisions only, 10(6.8%) had both Pfannenstiel and port incisions, and 1(0.7%) case had both mid-line and port incisions. In group-II, 167(96.5%) cases had only Pfannenstiel incisions and 6(3.5%) had mid-line incisions only.

Duration of surgery and LOS were lower in Group-I compared to Group-II ($p<0.05$). The incidence of the most common intraoperative complications was comparable between the two groups with no significant difference (Table 2).

The differences in postoperative complication, including vaginal bleeding, abdominal distension, blood-stained urine, postoperative ileus, febrile illness, epigastric burning, nausea and vomiting, were significant (Table 3).

Discussion

The current study found that laparoscopic technique was an advantageous surgical procedure for gynaecological surgeries with benign diseases, which was in line with earlier studies that had a retrospective design.[15-18] A prospective observational study comparing surgical approaches on female patients with gynaecological

Table-3: Comparison of post-operative outcomes.

Postoperative outcomes	Group-I	Group-II	*p*-value
Mean Post-operative hospital stay (days)	1.26±0.678	2.61±0.821	<0.001*
Mean Post-operative pain score (VAS)	0.88±0.711	1.90±0.882	<0.001*
Mean Drain retained after surgery (days)	0.50±0.606	1.52±0.931	<0.001*
Mean Foley catheter retained after surgery at (hrs)	14.42±12.098	30.27±23.459	<0.001*
Mobility	**n (%)**	**n (%)**	
6h to 12h	74 (50.7)	4 (2.3)	
12h to 24h	69 (47.3	123 (71.1)	<0.001*
24h to 48h	3 (2.1)	46 (26.6)	
Complications			
Vaginal discharge	3 (2.1)	4 (2.3)	>0.999[b]
Vaginal bleeding	4 (2.7)	17 (9.8)	0.020* [b]
Surgical site infection	2 (1.4)	9 (5.2)	0.119[b]
Abdominal distension	14 (9.6)	46 (26.6)	<0.001*
Blood stained urine	Nil	8 (4.6)	0.023* [b]
Post operative ileus	3 (2.1)	33 (19.1)	<0.001*
Venous thrombosis	Nil	Nil	NA
Neurogenic bladder	Nil	Nil	NA
Haematoma	1 (0.7)	1 (0.6)	>0.999[b]
Wound dehiscence	Nil	8 (4.6)	0.230[b]
Haemo-peritoneum	Nil	1 (0.6)	1.000[b]
Febrile illness	22 (15.1)	44 (25.4)	0.026*
Lymphangitis	Nil	1 (0.6)	>0.999[b]
Nausea	38 (26)	90 (52)	<0.001*
Vomiting	18 (12.3)	71 (41)	<0.001*
Bleeding from the drain	3 (2.1)	3 (2.1)	>0.999[b]
Epigastric burning	23 (15.8)	59 (34.1)	<0.001*

* statistically significant *p*-value. [b] represented *p*-value calculated by continuity correction. NA, statistical significance test not applicable. Group-I: Minimally invasive gynaecological surgery, Group-II: Open gynaecological surgeries, VAS: Visual analogue scale.

disorderscomplaints mainly associated with adnexal masses concluded that the use of laparoscopy for adnexal mass was better than laparotomy, with no observed difference in perioperative adverse events.[19] Another study on pelvic exenteration conducted on patients with gynaecological complaints reported findings consistent with the current study, but the operative time reported for laparoscopic surgery for pelvic exenteration was less than open surgery (935 vs. 883 min). However, the difference noted was not statistically significant ($p=0.398$),[20] which was in contrast to the current study. This difference can be explained by the indication of gynaecological surgery of the earlier study.[20]

Conversion of planned laparoscopic surgery to open surgery was observed in 9(4.4%) participants in a study[17], which was a finding similar to what the current study noted. A randomised controlled trial (RCT)[21] on patients undergoing surgical staging for uterine cancer reported conversion of laparoscopic surgery in 25.8% patients. This higher conversion could have been due to malignancy-associated complications.[21] In low-resource settings, a study in Bhutan reported that conversion from

laparoscopic to open surgery was needed in 1.9% patients only.[22]

In the current study, mean postoperative pain score measured at discharge was significantly less in the laparoscopic group than in open surgery ($p<0.001$). The finding was consistent with a prospective cohort study reporting pre-discharge pain score of 3.5 in the laparoscopic group compared to 6.7 in open surgery cases.19 Another study comparing laparoscopy and laparotomy reported that pain score immediately after surgery and 24-hour post-surgery were similar in both groups.[23] This difference could be explained as the study was done on patients with endometrial cancer, and pain sensitivity was found to be higher among cancer patients.

For postoperative mobility, the current study found that most patients were mobile in the laparoscopic group within 6-12 hours postoperatively, while in the laparotomy group, most cases were mobile 12-24 hours after the surgery. Foley's catheter was retained till 15 hours post-surgery in laparoscopic surgeries, whereas for open surgery the duration was 30 hours. A study discussing outcomes of laparoscopic hysterectomy in Pakistan reported that median duration of postoperative foley's catheterisation was approximately 7 hours. Also, it reported that most patients were mobilised 6 hours after surgery.[24] These contrasting findings could be due to the statistical parameter chosen to describe the outcomes which was median in the earlier study.[24] The current study also compared the duration of NPO before surgery and the duration of abdominal drain, which was found to be significantly less in laparoscopic surgeries. No study was found comparing these outcomes in literature.

The current study had limitations. It was a single-centre study, and the population was not randomised. Although being quasi-experimental, the study should have had patients having similar variables for both groups, such as age, BMI, duration of sexual activity and menopausal status. It was not practically possible because patients of older age group mostly had history of some previous surgery, had usually greater BMIs and were at menopause or near it. These factors usually led to the possibility of adhesions in the pelvis, and the surgical view through laparoscopic cameras is not very clear, making it difficult to operate with increased risk of bleeding.

Multi-centre studies are recommended to compare outcomes among patients with similar characteristics. Besides, healthcare costs should also be compared in developing countries for both procedures.

Conclusion

Laparoscopic surgeries were found to be more advantageous than open surgeries in the management of patients with benign gynaecological diseases.

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Author Contribution:

AIM: Design, drafting and final approval.
WN: Design, data entry, statistical analysis, data interpretation and writing.
NK: Design, data collection, entry and literature review.
SA: Data collection, entry and literature review.
AAM: Editing and final approval.