Original Article

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Unveiling Pelvic Organ Pathologies: A Laparoscopic Exploration of Female Infertility at a Tertiary Care Hospital

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ABSTRACT

The World Health Organization (WHO) estimates the global prevalence of infertility at 17.5% with little discrimination among regions, lifetime prevalence coming to 17.8% in high-income countries and 16.5% in low- and middle-income countries. In Pakistan, no large-scale multicenter studies have been conducted to assess the prevalence of infertility. The United Nations Population Fund (UNFPA) estimated it to be around 22% in 2003. No studies other than small-scale cross-sectional studies have been done. **Objective:** To investigate the causes of unexplained infertility in Pakistani women undergoing diagnostic laparoscopy. **Methods:** A cross-sectional study was conducted at Shalamar Medical College and Teaching Hospital from October 2023 to June 2024. All patients >18 years of age, who had a complete infertility workup (ultrasonography (USG), endocrine markers and male partner semen analysis negative or equivocal, resulting in no diagnosis, were included in this study. **Results:** Primary infertility (73%) was more frequent than secondary infertility (27%). The most common diagnoses for primary infertility were polycystic ovaries (22%) and endometriosis (16.4%). Tubal blockages (52.5%) were the most frequent tubal pathology. Laparoscopy confirmed the diagnosis of unexplained infertility and provided valuable information for treatment planning. **Conclusions:** This study suggests a high prevalence of primary infertility with delayed diagnosis in Pakistan. Traditional delays in seeking treatment and limited access to laparoscopy highlight the need for improvement in infertility care. Laparoscopy provides a panoramic and magnified view of the pelvic organs. It is a reliable tool to identify the causes of infertility that are usually missed on a non-invasive work-up.

INTRODUCTION

According to The International Glossary on Infertility and Fertility Care, 2017, infertility is a condition characterized by the failure to establish clinical pregnancy following 12 months of regular unprotected sexual intercourse or due to an impairment of a person's capacity to reproduce either as an individual or with his/her partner [1, 2]. World Health Organization (WHO) estimates the global prevalence of infertility at 17.5% with little discrimination among regions, lifetime prevalence coming to 17.8% in high-income countries and 16.5% in low- and middle-income countries [3]. In Pakistan no large-scale multicenter studies have been conducted to assess the prevalence of infertility, United Nations Population Fund (UNFPA) estimated it around 22% in 2003, no studies other than small-scale cross-sectional studies have been done, which show that in Islamabad and Lahore prevalence of infertility is around 7% [4-6]. The causes of infertility are multi-fold; it can be because of male factor, female factor, or both [7]. Common conditions affecting the male component include azoospermia, oligozoospermia, asthenozoospermia, teratospermia and mixed pathology [7,8]. Similarly, conditions affecting the female component include

anovulation, tubal factors, uterine factors, mixed pathology, polycystic ovarian syndrome, endocrine disorders, and premature ovarian failure [7, 8]. Furthermore, unexplained infertility was identified with no apparent cause [8]. Unexplained infertility, with an incidence of 10-30%, is diagnosed when all standard infertility testing does not reveal any abnormality [9]. Standard infertility testing includes hysterosalpingography (HSG), endocrine testing including LH, FSH, progesterone, and prolactin level, and semen analysis [10]. To determine the cause of infertility in such cases, laparoscopic evaluation of pelvic organs to visualize the pathologies is considered the gold standard [11, 12]. In two studies done in India, HSG was compared with the gold standard, i.e., laparoscopy, the sensitivity came around to be 64-91% and the specificity around 81-88.9%, to diagnose tubal pathologies [13, 14]. However, laparoscopy is a far superior technique than others in diagnosing pelvic floor adhesions, endometriosis, and tubal obstruction, including peri-tubal pathologies [15]. Furthermore, laparoscopy has allowed for the development of concomitant accessory therapeutic procedures, allowing it to be the best treatment and diagnostic intervention in an infertile couple [16]. Laparoscopy is an essential step for the assessment of the pelvic region. It acts as a preclude before future surgery, providing evidence for the nature and extent of surgery [15]. Laparoscopy is a minimally invasive investigation, not routinely performed in the assessment of infertility, only advised later once primary non-invasive, directed workup has been conducted [17]. But the use of laparoscopy in the assessment of pelvic pathologies is limited in the local setting, and data for the local populace is lacking.

This study aims to warrant the assessment of the causes of unexplained infertility in Pakistani women undergoing diagnostic laparoscopy.

METHODS

A cross-sectional study was conducted at the Department of Bacteriology and Gynaecology of Shalamar Hospital, Lahore, after approval from the institutional review board of Shalamar Medical College and Teaching Hospital with vide # SMDC-IRB/AL/29/2023. The data of the patients who underwent laparoscopic evaluation for primary or secondary infertility from October 2023 to June 2024 were analyzed. All patients >18 years of age, who had a complete infertility workup (ultrasonography (USG), endocrine markers and male partner semen analysis negative or equivocal (having lab values within normal range), resulting in no diagnosis, were included. Informed consent was taken. All the ultra-sonographies were performed by the same consultant to avoid personal bias, and decisions for negative scans were made on normal scans with no pelvic organic pathology and for ambiguous results, where further investigations were required, were defined as

equivocal, and where pathologies were noted were declared as affected individuals and were excluded. Moreover, exclusion criteria included abnormal semen analysis of the male partner or a positive preliminary infertility workup. Patients with missing or incomplete data were also excluded. A sample size of 101 was calculated by using the World Health Organization sample size calculator with the prevalence of primary infertility at 7% (5) with a confidence interval of 95% and margin of error of 5%. After approval from the Institutional Review Board, the data were retrieved from the hospital database and registers. A structured proforma was used to collect the data, which included age, partner's age, duration of infertility, treatment taken for infertility, laboratory, hysterosalpingography (HSG), ultra-sonographic findings, and laparoscopic findings. Laboratory findings included a hormonal profile, including LH, FSH, serum prolactin and TSH levels. On laparoscopy, the size of the uterus, fibroids and adhesions were recorded. Similarly, for the ovary and tubes, normality, cysts, adhesions and masses were looked at and recorded. The data were analyzed using Statistical Package for Social Sciences (SPSS) version 25.0 and were duly compared for errors and omissions. Quantitative data as age of study participants, age of husband and duration of infertility were presented in the form of mean and standard deviations and independent sample t test was employed for the comparison, while qualitative data regarding pelvic disease like findings of the uterus, fallopian tubes, ovaries, and dye test on laparoscopy was presented as frequencies and percentages chi-square test was employed. A p-value less than 0.05 was regarded as significant.

RESULTS

A total of 122 patients had diagnostic laparoscopy with a mean age of 32 ± 5.3 years. The patients were further divided into two groups based on the cause of infertility over diagnostic laparotomy findings, i.e. primary (n=89) and secondary (n=33), with no significant mean age difference (p-value 0.342) on application of the independent sample t test. Mean duration for the infertility was also compared, which was 7.13 ± 3.87 v/s 6.11 ± 2.90 years with a p-value of 0.052. Husbands' age in both study groups was compared, and it was observed that the secondary infertility group had a higher age of husbands, with a p-value of 0.027.

Table 1: Assessment of Age, Duration of Infertility and Husband's Age in Patients of Primary and Secondary Infertility Employing Independent Sample T Test

Study Parameters	Type of Infertility		p-Value
	Primary (n=89)	Secondary (n=27)	
Age	31.26 ± 5.33	34.24 ± 5.26	0.342
Duration of Infertility	7.13 ± 3.87	6.11 ± 2.90	0.052
Husband's Age	35.90 ± 4.78	39.89 ± 4.35	0.027*

Out of the patients reviewed, 84 (69%) had a regular

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menstrual cycle, while the remaining 38 (31%) had an irregular menstrual cycle. One hundred and twenty-two patients had undergone diagnostic laparoscopy as a part of infertility testing, and out of these patients, 89 (73%) had been diagnosed with primary infertility and 33 (27%) with secondary infertility (Figure 1).
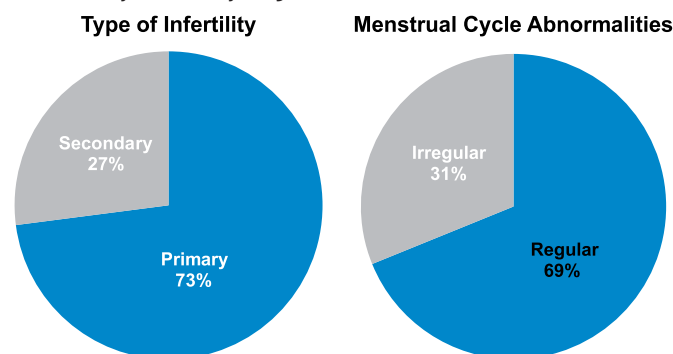

Figure 1: Primary and Secondary Infertility, and Irregular Menstrual Cycles

Laparoscopic findings of the uterus revealed a bulky uterus in 18 (20.2%) and 6 (18.2%) of cases with primary infertility and secondary infertility, respectively. Adhesions were more common in patients with primary infertility, 16 (17.9%), as compared to only 4 (12.1%) in the secondary infertility group, with a p-value of 0.003. Conversely, fibroids were more common in secondary infertility cases, 9 (27.3%), compared with primary 5 (5.6%). Normal uterine findings were seen in the rest of the 64 (52.5%) cases. In terms of ovarian findings, only half, 56 (45.9%), were normal. PCOS was the most common finding, 24 (19.7%), particularly in primary infertility, 20 (22.5%). Endometriotic findings were present in 20 (16.4%) of women, more frequently in patients diagnosed with primary infertility. Most identified abnormalities in these patients were chocolate cysts 6 (6.7%) and endometriotic spots 10 (11.2%). Normal fallopian tubes were observed in 54 (44.3%) of women. Tubal adhesions were the most frequent abnormality in 24 (26.9%), exclusively seen in women with primary infertility. Other tubal pathologies included hydrosalpinx 18 (14.8%), parafimbrial cysts 6 (4.6%), and convoluted tubes 16 (13.1%). Notably, a small number of women had complete tubal blockage due to tubercles 4 (3.3%). Tubal patency testing revealed blockages in 64 (52.5%) of women. Unilateral 12 (9.8%) and bilateral blockages 52 (42.6%) were identified, with a higher prevalence of bilateral blockages 43 (48.3%) in the primary infertility group. Among the 36 patients who underwent HSG before laparoscopy, 20 (55.6%) had bilateral tubal blockages, and 4 (11.1%) had unilateral obstruction. Fisher's exact tests indicated a significant association between HSG findings and laparoscopic dye test results (p<0.001) (Table 2).

Table 2: Comparison of Findings of the Uterus, Fallopian Tubes, Ovaries, and Dye Test on Laparoscopy on Application of Chi-Square Test

Study Parameters		Type of Infertility		p-Value
		Primary (n=89)	Secondary (n=27)	
Uterus on Laparoscopy	Normal	50 (56.2%)	14 (42.4%)	0.003*
	Bulky	18 (20.2%)	6 (18.2%)	
	Fibroid	5 (5.6%)	9 (27.3%)	
	Adhesions	16 (17.9%)	4 (12.1%)	
Ovaries on Laparoscopy	Normal	35 (39.3%)	21 (63.6%)	0.0001
	Chocolate Cyst	6 (6.7%)	0 (0.0%)	
	PCOS	20 (22.5%)	4 (12.1%)	
	Endometriotic Spots	10 (11.2%)	4 (12.1%)	
	Tubo-Ovarian Mass	12 (13.4%)	2 (6.0%)	
	Complex Cyst	6 (6.7%)	2 (6.0%)	
Tubes on Laparoscopy	Normal	34 (38.2%)	20 (60.6%)	0.002
	Adhesions	24 (26.9%)	0 (0.0%)	
	Hydrosalpinx	12 (13.5%)	6 (18.2%)	
	Parafimbrial Cyst	4 (4.5%)	2 (33.3%)	
	Convoluted Tubes	11 (12.4%)	5 (6.1%)	
	Tubercles	4 (4.5%)	0 (0.0%)	
Dye test	Negative Spill	43 (48.3%)	9 (27.3%)	0.001
	Unilateral Positive	10 (11.2%)	2 (6.1%)	
	Bilateral Positive	36 (40.4%)	22 (66.7%)	

DISCUSSION

Infertility is becoming ever so common in the lower- and middle-income countries (LMICs), with estimates suggesting 1 in 6 women suffer from this condition [3]. Studies have further estimated that the prevalence of infertility in LMICs may be double (9-30%) that of those in the high-income countries (15%) [18]. Primary infertility in our study was almost 3 times (73%) more frequent as compared to secondary infertility (27%). This is in line with other cohorts of patients, undergoing laparoscopic evaluation for infertility in Pakistan, where the ratio of primary to secondary infertility was 2:1, with a predominance of primary infertility [19, 20]. This is in contrast to the global prevalence of primary (0.6-3.4%) and secondary infertility (8.7%-32.6%) [21]. The median age of participants with primary infertility was 31, and with secondary infertility was 35 years. Which is higher compared to other studies showing mean ages of 26-28 and 31-32 years amongst primary and secondary infertility subgroups [19, 20]. It may be attributed to changing societal norms in regards to marriage and child rearing in the region [22]. The duration of primary and secondary infertility was 6-10 years and >10 years, respectively, before these patients underwent laparoscopy to find out a definitive cause for their infertility. The mean duration before patients underwent laparoscopy varied among different regions. in Pakistan, a study showed mean duration to be 1.95-3.7 and 2.70-7.3 years for primary and

secondary infertility, respectively [19, 21]. In Egypt and India, this duration was between 4 and 6 years [23, 24]. The difference amongst the regions exists due to varying cultural factors as partial access to healthcare facilities and societal taboos, the type and the duration during which the respective studies were conducted. Diagnostic laparoscopy (DL) has been hailed as the gold standard investigation to evaluate unexplained infertility (UEI) and visualize pelvic anatomy to diagnose tuboperitoneal disease. To visualize the uterine and tubal pathologies, hysterosalpingography (HSG) has also been employed. However, it has a sensitivity of only 65%. Furthermore, a study also showed that 25% of patients with unexplained infertility, with normal HSG, had stage 3 or 4 endometriosis, mandating a laparoscopic evaluation for confirmation [25]. Amongst our findings, the most common diagnoses for primary infertility were polycystic ovaries (20) and endometriotic findings including chocolate cysts (6), endometriotic spots (10) and uterine adhesions (16). These findings are in line with the findings from another study that revealed PCO and endometriosis as the most common diagnoses amongst those undergoing DL for UEI [19, 21]. Uterine fibroids (9) were the most common diagnosis amongst those with secondary infertility. Tubal pathologies were most common amongst those with primary infertility, ranging from adhesions (27%), hydrosalpinx (13%), convoluted tubes (12%) to parafimbrial cysts (4%). Pelvic adhesions are the leading cause of tubal factor infertility. The European Society for Gynaecological Endoscopy (ESGE) has found a clear correlation between adhesions and infertility [26]. Furthermore, diagnostic laparoscopy can offer a therapeutic approach as lysis surgery can be performed simultaneously to improve chances of conception [26]. Care must be taken to perform this surgery in select cases to prevent further exacerbation of disease through iatrogenic adhesion formation. Hydrosalpinx is a pathological abnormality shape of the tubes; laparoscopic salpingotomy can be utilized in mild cases to improve fertility. Convoluted and distorted tubes are another factor for infertility, with minimal data on recommendations. Lastly, fimbrial pathologies, including cysts, resulted in the highest rate of ectopic pregnancy (22.5%) in a study done in China [26]. Our study also revealed a positive association between the dye test performed during laparoscopy and HSG findings on tubal patency (p<0.001). However, to identify the type and nature of pelvic pathology, DL is preferred to confirm the diagnosis and start definitive treatment. In Pakistan, there is a traditional delay in accessing infertility treatment, and further escalation of treatment to DL. These factors need to be addressed to improve access and compliance for diagnostic laparoscopy.

CONCLUSIONS

It was concluded that primary infertility was more frequent, with a delayed diagnosis. Polycystic ovaries, endometriosis, and tubal blockages (adhesions, hydrosalpinx and convoluted tubes) were the most common diagnoses. Laparoscopy proved a valuable tool for diagnosis and treatment, which provides a detailed, magnified and panoramic view of the pelvic organs. It is a reliable tool to identify the causes of infertility that are usually missed on a non-invasive work-up.

Authors Contribution

Conflicts of Interest

All the authors declare no conflict of interest.

Source of Funding

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