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THE DIAGNOSTIC UTILITY OF ULTRASOUND IN PELVIC INFLAMMATORY DISEASE (PID)

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ABSTRACT

Background: Pelvic Inflammatory Disease (PID) is a global health issue caused by bacterial infections and can lead to infertility, chronic pain, and ectopic pregnancy if untreated.

Objective: To examine the capabilities of ultrasound in diagnosing PID and the use of the method to improve the clinical results and prognosis

Methodology: This study used a cross-sectional model to assess the efficiency of ultrasound for diagnosing PID. These participants included women aged 18-45years with symptoms of PID as well as those who went through preliminary investigations including high vaginal swabs and urine samples and sign informed consent. Pelvic ultrasound examinations were conducted with the aid of Toshiba Aplio 200 system equipped with a high frequency convex array of 3–5 MHz thereby providing detailed images of pelvic structures.

Results: The study involved 139 female oral contraceptive users with PID, with a mean age of 34.64 years (SD: 9.14). Most patients (64.1%) were aged 26–45 years. Severe pelvic pain was reported by 33.1%, and 53.2% experienced abnormal menstruation. Vaginal discharge was noted

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in 56.1%, of which 52.5% was foul-smelling. Ultrasonography revealed an average endometrium thickness of 10.47 mm, with hydrosalpinx present in 54.7% of cases. Uterine echogenicity was homogeneous in 51.1% and heterogeneous in 48.9%, correlating with marital status. Weak, statistically insignificant correlations were found between age, marital status, and endometrium thickness.

Conclusion: This study proved that ultrasound is an efficient and inexpensive modality of imaging in establishing the relation between PID and its complications.

KEYWORDS: PID, Ultrasound, TVS, infection, infertility, ectopic pregnancy.

Introduction

Pelvic Inflammatory Disease (PID) has been categorized as a major health concern that affects millions of women globally every year [1]. It is an inflammation of the upper part of the female genital tract, affecting the uterus, fallopian tube, and ovaries, and it is caused by bacteria like Chlamydia trachomatis or Neisseria gonorrhoeae [2, 3]. If PID is not treated, it can lead to infertility, chronic pelvic pain, and increase the chance of ectopic pregnancy [3-5]. To avoid financial expenses and quality of life, it is very important to have early diagnosis and intervention to avoid future complications of the condition [6].

Although PID is common and can become serious, the disease is extremely obscure to diagnose. Predisposing factors of PID may be characterized by non-specific or highly amplified symptoms, which include light pelvic pain, high fever, severe acute pelvic pain, and/or arching abnormally foul-smelling vaginal discharge [7]. Compounding this difficulty, these manifestations are frequently similar to other gynecological illnesses like ovarian cysts, appendicitis, or ectopic pregnancies [8]. In its absence, numerous tumors may be unrecognizable, and patients with such conditions may receive inadequate care, which, in turn, will result in reproductive system-related complications.

Ultrasound has become invaluable in the assessment of PID. Even though clinical diagnosis remains a fundamental tool of management, there are cases in which physical examination and patient history may not provide enough confidence [9]. This is particularly the case if low and

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therefore generic symptoms compound or when clinicians are hopeful to distinguish PID from other pelt pathology. It is at such a stage where ultrasound serves as a noninvasive, effective, and readily available imaging tool to augment clinical assessment [10]. Due to its capability to visualize soft tissues, ultrasound helps evaluate pathological changes (Figure 1) in the pelvic organs and define significant signs of PID, such as thickened fallopian tubes, fluid-filled masses (tubo-ovarian abscess), or increased vascularity within the pelvis. Also, it can help to eliminate other diseases, which can help start the right treatment without any delay [11].

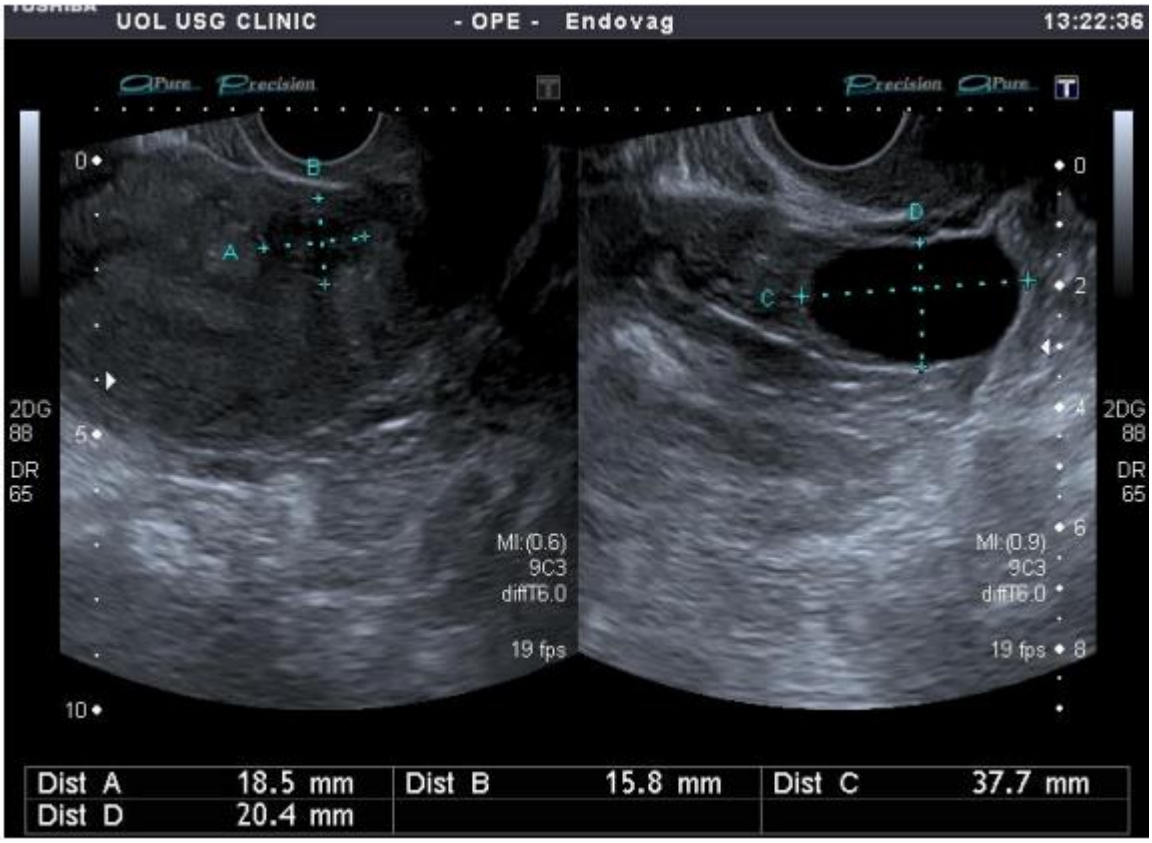

Figure 1: Transvaginal grey scale image showing, uterine fibroid measuring 18.5x 15.8mm and simple adnexal cyst measuring 37.7x 20.4mm

The aim of this study is to examine the capabilities of ultrasound in diagnosing PID and the use of the method to improve the clinical results and prognosis. Therefore, the imaging modality


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presented herein can substantially return many of the diagnostic problems related to PID and subsequently enhance the rate of compliance of doctors in the treatment of affected patients.

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Methodology

This study used a cross-sectional model to assess the efficiency of ultrasound for diagnosing PID. The data were collected at the Popular Diagnostic Center in Peshawar to selected due to larger patient turnover, availability of latest ultrasound machineries, and specialized gynecologic services. The targeted sample included 139 who were to be recruited based on an anticipated 10% prevalence of PID, confidence level of 95% and a margin of error of 5%, participants randomly selected by convenience sampling, aged between 18–60 years.

These participants included women aged 18-45years with symptoms of PID as well as those who went through preliminary investigations including high vaginal swabs and urine samples. Women who were pregnant, had chronic pelvic pain not associated with PID, had recently undergone pelvic surgery or could not give informed consent were excluded from the study. Permission to carry out this research was sought and obtained accordingly from the ethical committee of Superior University Lahore and written informed consent was obtained from all the participants. Issues of privacy and confidentiality were respected strictly during the study.

Pelvic ultrasound examinations were conducted with the aid of Toshiba Aplio 200 system equipped with a high frequency convex array of 3–5 MHz thereby providing detailed images of pelvic structures. Enhancements like color and power Doppler added more information about vascular and inflammatory alteration to the study. Observation included longitudinal and transverse sweeps of uterus, adnexa, and the pelvic cavity and recording of findings such as endometrial thickness, tubo-ovarian abscess, free pelvic fluid and adhesions.

The study period lasted four months which comprised of pre-recruitment, recruitment, data collection and data analysis. Instruments standardized their recording of demographic data and results of clinical and routine ultrasound examinations. Outcomes were aggregated and blinded to ensure the participants' anonymity to maintain ethical conduct.

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Results

A cross-sectional study was undertaken on 139 oral contraceptive using female patients with histologically confirmed PID. The patients' mean age was 34.64 years (SD: 9.14), the ages of these patients were between 18 and 49 years (Table 1). Patients were classified into five age groups: 18–20 years made up 7.2% of the population, 21–25 years 15.1%, 26–35 years 28.8%, 36–45 years 35.3%, and 46–49 years 13.7%, and the highest proportion of PID was noted in patients aged between 26 and 45 years (Table 2). It was also found that most of the patients were married 56.1%, while others were unmarried 43.9%. For the dimensional pelvic pain, 33.1% of patients reported severe pain, 24.5% moderate pain, 19.8% mild pain, and 23% no pain (Figure 2). Concerning menstruation, 53.2% of patients had abnormal menstruation while 46.8% patients had normal menstruation. The findings of this study were that 56.1% of patients complained of a vaginal discharge, while 43.9% did not. For those who were discharged, 52.5% said they had foul-smelling discharge and 47.5% said they had no smell discharge.

Table 1: Descriptive Statistics of Age and Endometrium Thickness

Measure	N	Minimum	Maximum	Mean	Std. Deviation
Age (years)	139	18	49	34.64	9.14
Endometrium Thickness (mm)	139	5.11	15.00	10.47	3.08

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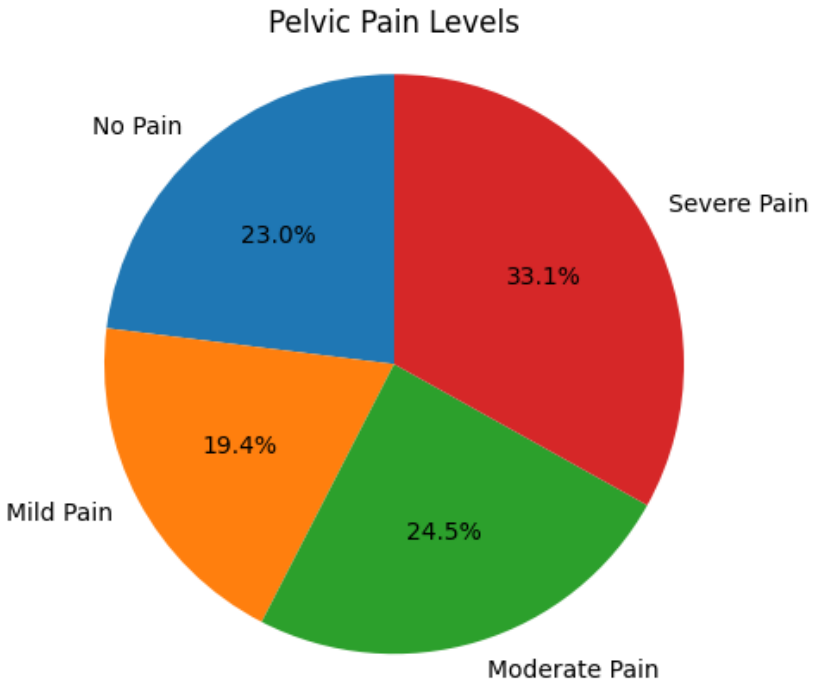

Figure 2: Pie chart representing the pelvic pain levels based on the demographic data

Table 2: Age Group of PID Patients

Age Group (years)	Frequency	Percent (%)	Cumulative (%)
18–20	10	7.19	7.19
21–25	21	15.11	22.30
26–35	40	28.78	51.08
36–45	49	35.25	86.33
46–49	19	13.67	100.00
Total	139	100.00	100.00

Ultrasonographic results showed an average endometrium thickness of 10.47 mm (±3.08 SD), with values ranging from 5.11 to 15.00 mm. Uterine echogenicity was homogeneous in 51.1% of patients and heterogeneous in 48.9%. Cul-de-sac free fluid was present in 48.9% of cases and absent in 51.1%. Hydrosalpinx, a condition of blocked or dilated fallopian tubes, was observed in

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54.7% of patients, with the remaining 45.3% unaffected. A cross-tabulation of marital status and uterine echogenicity revealed that married patients were more likely to exhibit heterogeneous echogenicity, while unmarried patients predominantly displayed homogeneous patterns.

Table 3: Crosstabulation for Marital Status and Uterine Echogenicity

Crosstabulation		Uterine Echogenicity		Total
		Homogeneous	Heterogeneous	
Marital Status	Married	35	43	78
	Unmarried	36	25	61
Total		71	68	139

Statistical analysis of correlations between age, marital status, and endometrium thickness revealed weak and statistically insignificant relationships. The correlation between age and marital status was weakly negative (-0.083, p = 0.332), while age and endometrium thickness had a weak positive correlation (0.080, p = 0.347). Similarly, the correlation between marital status and endometrium thickness was weakly positive (0.145, p = 0.089) (Table 5). Despite the lack of significant relationships, PID remains a critical gynecological condition, with demographic and ultrasonographic variables providing valuable insights into its prevalence and associated risk factors.

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Table 4.13: Correlation between Age, Marital Status, and Endometrium Thickness

		Age	Marital Status	Endometrium Thickness (mm)
Age	Pearson Correlation	1	-.083	.080
	Sig. (2-tailed)		.332	.347
	N	139	139	139
Marital Status	Pearson Correlation	-.083	1	.145
	Sig. (2-tailed)	.332		.089
	N	139	139	139
Endometrium Thickness (mm)	Pearson Correlation	.080	.145	1
	Sig. (2-tailed)	.347	.089	
	N	139	139	139

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Discussion

This research evaluated the role of ultrasound in diagnosing Pelvic Inflammatory Disease (PID), focusing on its ability to detect critical indicators such as endometrial thickening, uterine echogenicity, and cul-de-sac free fluid. The study revealed that 48.9% of participants exhibited heterogeneous uterine echogenicity, and 48.9% had cul-de-sac free fluid, both of which are strongly indicative of PID. These findings align with existing studies, reinforcing the effectiveness of ultrasound in clinical settings.

The age distribution observed in this study, with the highest prevalence of PID in women aged 26–45 years, is consistent with findings by Farah Naaz et al. Their work highlighted that the highest incidence of PID occurred in women aged 25–29 years, emphasizing the vulnerability of this demographic. While our study did not explore socioeconomic or educational factors, their observations about these influencing variables support the need for comprehensive public health strategies [12].

Endometrial thickening, a key diagnostic feature identified in our research, resonates with findings by Sharon et al., who highlighted its association with endometritis—a common aspect of PID. Sharon et al. also emphasized the growing reliance on ultrasound for detecting inflammatory changes, findings mirrored in this study's outcomes.

The detection of cul-de-sac free fluid in nearly half of the participants aligns with the work of Uzma Eram et al., who recognized its significance in diagnosing PID. Their study also stressed the role of ultrasound in differentiating PID from other pelvic conditions, an essential capability demonstrated by our findings [13].

Heterogeneous uterine echogenicity, noted in 48.9% of cases in this research, was similarly highlighted by Sheza Waseem et al., who reported its diagnostic relevance in conditions such as PID and adenomyosis. Their observations validate the capability of ultrasound to provide detailed imaging that facilitates early and accurate diagnosis [14].

The findings also echo the research of Revzin et al., who advocated for a multimodal imaging approach to PID. While their study focused on the complementary roles of CT and MRI [15], our research confirms ultrasound as a practical and efficient first-line diagnostic tool, particularly

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valuable in resource-constrained environments. The similarities in identifying features like free fluid and altered echogenicity across these studies underscore the reliability of ultrasound in initial diagnostic efforts.

Conclusion:

This study evaluated the use of ultrasound in the diagnosis of PID with specific reference to endometrial thickness, uterine contrast and cul-de-sac fluid. This study proved that ultrasound is an efficient and inexpensive modality of imaging in establishing relation between PID and its complications. Findings are consistent with previous research, emphasizing the benefits of using ultrasonic in initial diagnoses followed by immediate treatment and better prognosis in reproductive health with reference to developing countries.

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