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Efficacy of transabdominal pelvic ultrasound in the detection of pelvic inflammatory disease

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***Abstract*---**This research aimed to determine the efficacy of transabdominal pelvic ultrasound as a diagnostic tool for pelvic inflammatory disease (PID) in Pakistan. A qualitative research design was employed, utilizing a convenience sample of 100 female patients out of approximately 1200 patients who visited the Gara Tajik Hospital gynaecological unit in Peshawar, Khyber Pakhtunkhwa, Pakistan, from January to December 2022. Transabdominal pelvic ultrasound is commonly used as a cost-effective and non-invasive diagnostic technique for PID, with a high sensitivity for detecting the disease when performed by a skilled operator using high-quality equipment. The research results indicate that transabdominal pelvic ultrasound is a valuable diagnostic tool for PID in Pakistan, providing real-time images of the pelvic anatomy that can aid in prompt and appropriate treatment. However, further research is needed to evaluate its effectiveness in different populations and to compare its efficacy with other diagnostic techniques, such as computed tomography (CT) scans and magnetic resonance imaging (MRI).

***Keywords*---**pelvic ultrasound, pelvic inflammatory disease, CT, MRI.

Introduction

Pelvic inflammatory disease (PID) is a polymicrobial disease often developed in young or child-bearing aged women (Greydanus et al., 2022). PID is characterized by upper genital tract infection endometritis, metroendometritis, parametritis, salpingo-oophoritis, and pelvic peritonitis, which may lead to developing tubo-ovarian abscess (Eze et al. 2018). According to Xia et al. (2022), the diagnosis can be directly made by ultrasound, but 100% of it can only be confirmed by

hysteroscopy and histological examination of the endometrium. In the presence of these diseases, both men and women suffer, but women's health in terms of reproduction plays an important role. Inflammatory diseases are the most common cause of reproductive organ diseases and malformations, tubal-peritoneal infertility, and miscarriage, resulting in many surgical interventions.

In most patients with inflammatory diseases of the female genital area, the urinary organs are affected (Mala et al., 2021). The bladder is most often involved in the pathological process. This is due to the commonality of the vagina and the bladder triangle formation and extensive vascular anastomoses between the uterus and the bladder. As a rule, patients complain of frequent painful urination, and neutrophils, erythrocytes and other pathological impurities are found in the urine (Juganavar & Joshi, 2022). All these diseases require timely diagnosis and proper therapy. PID usually develop in connection with the penetration of various pathogens into the genital tract, subject to the presence of favorable factors for their reproduction and development (Wahid et al., 2022). Such factors are the weakened body of a woman after childbirth, abortion, menstruation, and intrauterine manipulations.

According to the Centers for Disease Control and Prevention (CDC), PID is a potential cause of infertility due to tubal pathology in females (CDC, 2021). Different diagnostic techniques are available to detect PID, for example, ultrasonic imaging, high vaginal swab tests, culture and sensitivity, and laboratory urine microscopy. The laboratory test confirms the presence of organisms that certainly lead to the development of disease and assist in selecting appropriate antibiotic therapy (Hillier et al., 2021). However, ultrasound detects the location and size of adnexal mass in the reproductive system.

A growing body of evidence reveals that timely and accurate detection of PID results in early diagnosis, detection, and treatment of the PID (Czeyda-Pommersheim et al., 2017; Foti et al., 2019; Greydanus et al., 2022; Revzin et al., 2016). Ultrasound of the pelvic organs is the most effective method for detecting various pathologies in the reproductive and urinary systems in women of different ages. The pelvic inflammatory disease may be detected by transabdominal or transvaginal sonography. These ultrasound techniques are proven effective in detecting suspected PID in cases where patients have an adnexal mass during the acute episode.

Naeem et al. (2022) pointed out that current diagnostic tools, such as ultrasonography, are preferred in Pakistan since they are accessible and cheap. Transabdominal pelvic ultrasound is commonly used in Pakistan as a diagnostic tool for PID (Fatima et al., 2022). Ultrasound is quick, accessible, and non-invasive, making it a cost-effective option for diagnosing PID. Using ultrasound imaging, the radiologist can detect remarkable findings in the female reproductive system, including the ovaries, fallopian tubes, vagina, cervix, and uterus.

In Pakistan, radiologists prefer real-time imaging over traditional diagnostic measures due to ultrasound's simplicity and early results (uz Zaman, 2022). The transabdominal ultrasound is a diagnostic method of choice followed by lab tests for accurately detecting the disease and the causative pathogens. However, the

pelvic ultrasound allows the health care professional to diagnose the volumetric formations in pelvic inflammatory disease, such as pyosalpinx, ovarian abscess, pyovar, and tubo-ovarian abscess (Siddiqui & Bari, 2021). According to ultrasound, inflammation of the appendages can only be judged indirectly in the early stages and in the absence of a purulent process.

Majeed et al. (2020) evaluated various reasons for infertility among different ethnic groups in Pakistan, including 100 infertile females. The ultrasound technique was used along with supplementary information or detecting the leading causes of infertility. The research indicated an increased prevalence of the pelvic inflammatory disease among the Hazara and Pakhtoon groups in a total of 26 women from the sample. The research confirmed that ultrasonography is efficient in detecting, managing, and analyzing PID in females (Majeed et al., 2020). Ultrasonic imaging is a helpful tool in detecting different causes of infertility among Pakistani women.

On the other hand, Bashir et al. (2016) pointed out that the findings of ultrasound in detecting abnormalities in the female reproductive organs are sometimes questionable. The research discussed a case of abdominal pregnancy in Pakistan, where the patient remained undiagnosed till the 30th gestational week. Bashir et al. (2016) argued that although ultrasonic imaging is considered a gold standard investigative protocol for visualizing female reproductive organs, the results and appropriate detection depend on the ultrasound equipment's quality and the radiologist's experience. In this research, the radiologist has an experience of seven years working in the field. Moreover, the quality of the instrument is also significant.

The transabdominal ultrasound may be combined with urine culture and high vaginal swabs to accurately diagnose pelvic inflammatory disease (Darwish, 2020). In such cases, the transabdominal ultrasound may represent potential pathological areas, whereas laboratory analysis indicates specific causative pathogens that develop the pelvic inflammatory disease.

Overall, ultrasound plays an important role in investigating female pelvic visceral. Transabdominal sonography is performed on clinically diagnosed patients with pelvic inflammatory disease (uz Zaman, 2022). Though the findings may be sometimes non-specific, characteristic findings may be observed through transabdominal ultrasound that confirms and detect PID. For example, transabdominal ultrasound indicates thickened fluid-filled tubes, which are significant in diagnosing upper genital tract infections leading to PID. Eze et al. (2015) affirmed that ultrasonography is a widely used ultrasonic diagnostic technique to detect suspected PID. Additional diagnostic methods to detect PIC involve endometrial biopsy, urethral swab tests, endo-cervical swab tests, and laparoscopy (uz Zaman, 2022). A combination of these tests usually leads to an accurate diagnosis of the disease.

In short, ultrasonography remains a potential diagnostic tool in developing countries such as Pakistan mainly due to its easy accessibility, cost-effectiveness, non-invasiveness, and non-ionizing radiation. This research paper aims to determine the efficacy of transabdominal pelvic ultrasound in accurately detecting

pelvic inflammatory disease, keeping it the most preferred diagnostic tool in Pakistan. Although many researchers indicated that the transabdominal ultrasound presented significant findings for the detection of pelvic inflammatory disease, the efficacy of this technique is still debatable in certain cases.

Research Methodology

This research involves an inductive approach and utilizes a qualitative research design. According to McGowan et al. (2020), an inductive research approach allows the researcher to qualitatively analyze the data where specific evaluation objectives guide the analysis. Qualitative case study research focuses on the in-depth examination of a single case or a small number of cases, typically in a naturalistic setting, to gain an in-depth understanding of the phenomenon of interest (Alam, 2021). In medical research, qualitative case studies can explore the experiences and perspectives of patients, healthcare providers, and other stakeholders and shed light on complex healthcare issues (Alam, 2021). The qualitative research methods are based on gathering and evaluating non-numerical data to understand experiences, cases, opinions, and concepts. Moreover, qualitative research provides an in-depth insight into the research problems and assist in generating new research ideas.

This research involves the case studies of different patients visited the facility from January 2022 till December 2022. The patients were recruited through convenience sampling. A total of 100 female patients were assessed through transabdominal ultrasonography who visited the emergency and out-patient department and those who were admitted to the gynecological unit of Government Category D Gara Tajik Hospital Koachian Warsak Road, located in Peshawar, Khyber Pakhtunkhwa Pakistan. Gara Tajik Hospital is a Category B hospital that facilitates around 1000 visiting patients on a monthly basis. The ultrasound confirmed 100 cases of PID among the patients visited the hospital over the aforementioned period. The cases of six female patients have been discussed in this research.

A descriptive history was compiled, and diagnostic protocols were followed. Different variables, including a past history, signs and symptoms, age of the patient, and surgical history, were collected. The patients were asked about any associated illnesses, the presence of chronic diseases, infertility treatment, previous pelvic surgery, recurrent ectopic incidences, contraception, and abortion.

Ethical Considerations

According to Malmqvist et al. (2019), qualitative case study research involves collecting sensitive information from individuals and organizations, raising important ethical considerations. During this research, the following key ethical considerations were taken into account. The participants were asked to fill out the informed consent as participants in qualitative case study research must give their informed consent to participate in the study. This involved providing participants with information about the purpose of the study, the procedures involved, and the potential benefits and risks of participating. Participants must be allowed to ask questions and voluntarily agree to participate (Stoll et al., 2020).

Moreover, the confidentiality of the patients was also maintained, and no names were disclosed during or after the research. Qualitative case study research often involves collecting sensitive and personal information from participants (Hensen et al., 2021). It is important to protect this information's confidentiality and ensure that participants are aware of the measures that will be taken to protect their confidentiality.

Further, the researcher interacted with participants ethically and respectfully. Respect for participants included avoiding exploitation, manipulation, or coercion and treating participants with dignity and respect. Another important ethical consideration is anonymity; in this case, participants were concerned about their privacy and may not want to be identified (Hensen et al., 2021). Thus, the researcher ensured that participants were protected if anonymity was desired. Finally, the participants in qualitative case study research may be vulnerable due to their personal circumstances or the nature of the information they are sharing. Therefore, the researcher ascertained that participants were not subjected to harm as a result of their participation in the study. By considering these ethical considerations and taking appropriate steps to address them, researchers ensured that qualitative case study research was conducted in an ethical and responsible manner while also generating valuable insights into the phenomenon of interest.

Case Discussions and Results

The local females of Peshawar visit Gara Tajik Hospital for their abdominal examination with different complaints. This research focuses on cases of pelvic examination through transabdominal ultrasound.

Case 1

The first case shows the presence of inflammation in the pelvic region of a female patient aged 30. The patient visited the facility complaining of elevated body temperature, and the pulse was quickened and chilled. According to the clinical examination, there were all signs of an inflammatory process in the body. In general, child-bearing age females show approximately 1 mL to 3 mL fluid during their menstrual cycle in the POD. This quantity slightly increases in the ovulation phase, up to 4 - 5 mL. The pelvic examination was performed by MINDRAY digital ultrasonic imaging system, Model DP-5. The ultrasound showed that the quantity of fluid was increased in POD or Cul de sac, upto 10 mL. Figure 1 shows the presence of free fluid in the pouch of Douglas (POD) for this patient. The ultrasound remained helpful in determining the location of the inflammation in the pelvic region.

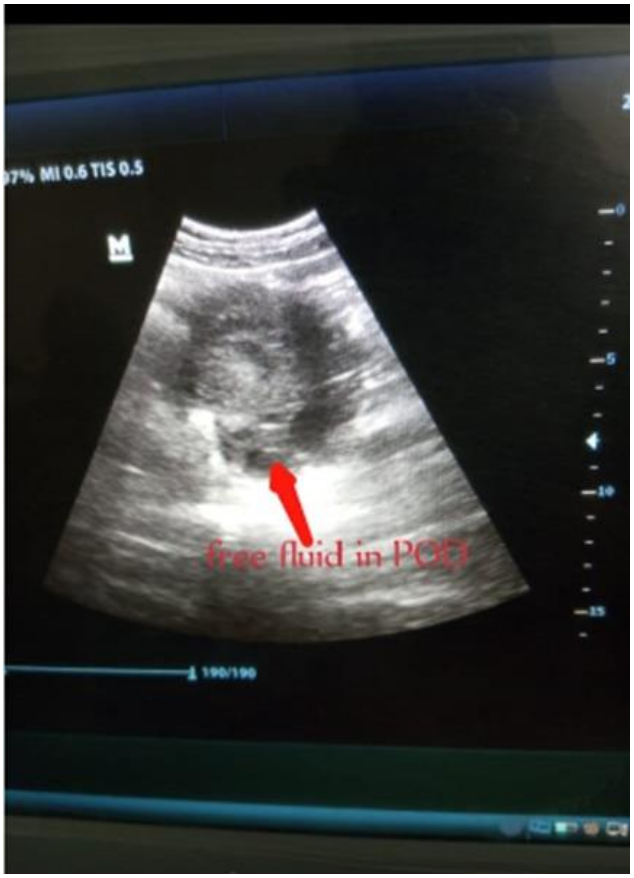

Figure 1: Ultrasound scan of Patient 1

Case 2

Another case was presented with acute pain in the pelvic region. The patient was 36 years old female who presented with throbbing pain in the pelvis. The ultrasound showed an enlarged fallopian tube with liquid contents. The case was suspected as acute salpingitis. The inflammation had not yet passed into the stage of purulent. It was planned to washing the abdominal cavity and small pelvis with solutions of antiseptics and antibiotics. Acute salpingitis is the predominant form of inflammatory diseases of the pelvic organs. The process may be a continuation of the inflammation, however, it is possible that at the beginning of the disease there were no symptoms inherent in the acute stage. Most often, salpingitis is the result of an acute inflammation. The ultrasonography was performed by MINDRAY digital ultrasonic imaging system, Model DP-5 as previous case. The ultrasound showed free fluid in POD (Figure 2).

Figure 2: Ultrasound scan of Patient 2

Case 3

Furthermore, a 25 years old unmarried girl came with the complaints of frequent fever, bleeding between periods and unusual discharge. The patient reported no previous history of gynecological issues. The patient was also experiencing pain during urination. The ultrasound was performed by MINDRAY digital ultrasonic imaging system, Model DP-5 which showed free fluid in the POD indicating pelvic inflammation (Figure 3). However, the accurate region of the inflammation was not confirmed.

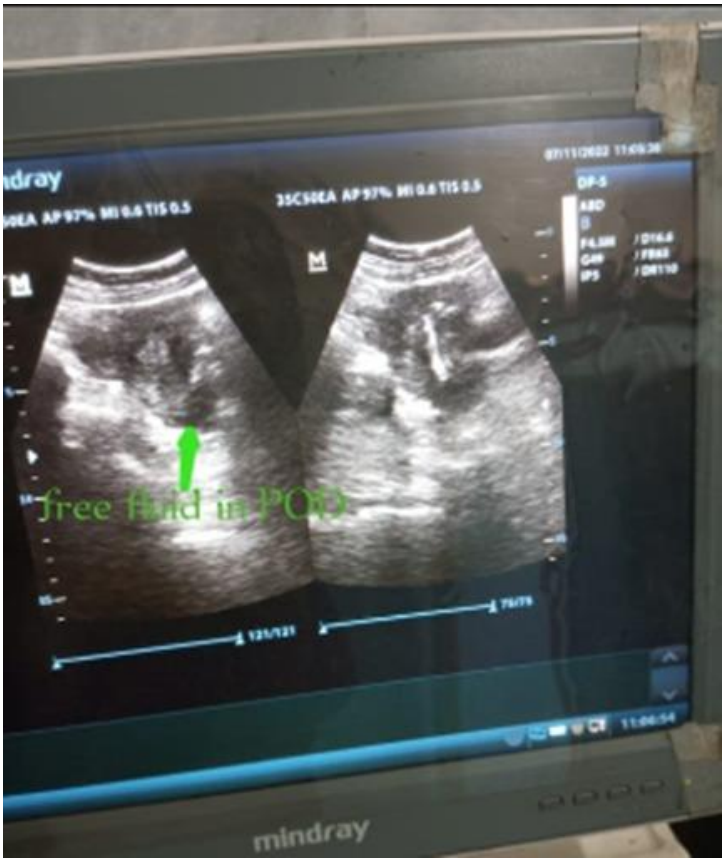

Figure 3: Ultrasound scan of Patient 3

Case 4

The fourth case was related to a 30 years old married female who came with acute pain in the pelvis and irregular bleeding and was discharged with a foul smell. The patient was experiencing severe pain in the abdominal region and had persistent fever. Her lower abdominal pain or discomfort was severe and persistent. Moreover, she was also experiencing urinary symptoms, such as painful urination and frequent urination. The patient also complaint about general malaise and fatigue. The physical examination revealed tenderness in the pelvic area, cervical motion tenderness, and adnexal tenderness. The MINDRAY digital ultrasonic imaging system, Model DP-5 was used to perform ultrasonography which showed the presence of free fluid in the pelvic region (Figure 4). Further laboratory analysis was recommended to confirm the type and nature of disease and the presence of pathogens.

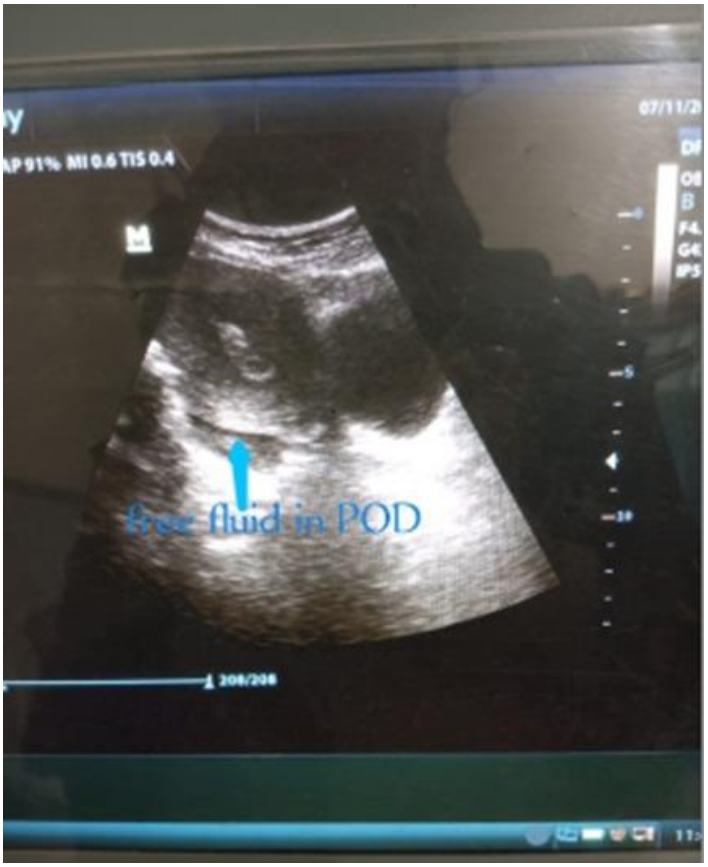

Figure 4: Ultrasound scan of Patient 4

Case 5

Similarly, 5th case involved a case of 32 years old married female who visited the hospital with the complaint of irregular and painful menstruation. The patient had a history of endometriosis and had a recent episode of Chlamydia, which was treated with antibiotics. However, she failed to complete the full course of antibiotics and reports that her symptoms have not improved. The patient reported having lower abdominal pain, which is constant and sharp in nature. She also reported heavy vaginal discharge that is yellow-green in color and has a foul odor.

Additionally, she reported having painful intercourse and irregular menstrual cycles. Upon physical examination, the patient's abdomen is tender to the touch, particularly in the lower quadrants. A pelvic exam reveals a tender uterus and fallopian tubes. The ultrasound also showed free fluid in the POD, presenting pelvic inflammatory disease. The patient undergoes a number of diagnostic tests, including a pelvic ultrasound, which reveals fluid-filled fallopian tubes, and a laparoscopy, which reveals inflammation of the pelvic organs (Figure 5). Additionally, the patient undergoes laboratory testing, which confirms the presence of Chlamydia and Neisseria gonorrhoeae.

Figure 5: Ultrasound scan of Patient 5

Case 6

The patient is a 28-year-old unmarried woman who presented with lower abdominal pain and abnormal vaginal discharge. The patient reported no previous history of STIs or gynecological issues. The patient reported having lower abdominal pain that is dull and persistent. She also reported abnormal vaginal discharge that is yellowish in color and has an unpleasant odor. Upon physical examination, the patient's abdomen was tender to the touch, particularly in the lower quadrants. A pelvic exam revealed tenderness in the uterus and the ultrasound indicated the inflammation in the pelvis with free fluid (Figure 6). However, the location of the fluid was not confirmed.

Figure 6: Ultrasound scan of Patient 6

Discussion

Pelvic inflammatory disease is an ascending infection of the uterus, its appendages, and the pelvic peritoneum, including endometritis (inflammation of the uterine mucosa); metroendometritis (inflammation of the mucous and muscular membranes of the uterus); parametritis (inflammation already spreads to the periuterine space); salpingo-oophoritis (inflammation of the uterine appendages - tubes and ovaries); and pelvioperitonitis (common inflammation, including the pelvic peritoneum) (Mikhailiuk et al., 2022). Chronic PID is characterized by an asymptomatic and asymptomatic course, a change in the etiological structure towards the dominance of viral and opportunistic flora and often cause reproductive dysfunction, failure of assisted reproductive technology programs, and reproductive losses.

Ultrasonography (USG) is a non-invasive diagnostic tool for pelvic inflammatory disease (Khan et al., 2022). It has the advantage of being quick, accessible, and does not expose patients to ionizing radiation. Compared to other diagnostic techniques such as computed tomography (CT) scans, USG is less expensive for the patient. CT scans emit ionizing radiation and are generally only used if a more

detailed evaluation of the pelvis is needed. Magnetic resonance imaging (MRI) is also a diagnostic option, but it is more expensive and less accessible than USG. MRI can provide more detailed images than USG, but it is not the first-line option for diagnosing PID due to the costs and availability (Santos et al., 2020). Laparoscopy is a more invasive diagnostic technique for PID and involves making small incisions in the abdomen to visualize the pelvic organs (Zeb & Malik, 2022). Laparoscopy is a highly accurate diagnostic method, but it is also more invasive and carries more risks than USG. Therefore, ultrasound is a cost-effective and non-invasive diagnostic tool for PID, and it is usually the first diagnostic test performed in patients with suspected PID (Khan et al., 2022). Other diagnostic techniques, such as CT scans and MRI, may be used if a more detailed evaluation is needed, but USG is often sufficient for the initial evaluation.

As mentioned by Fatima et al. (2022), almost in all countries, including Pakistan, transabdominal pelvic ultrasound is commonly used to detect PID, which is considered a cost effective method. PID can cause serious long-term health problems, including infertility, ectopic pregnancy, and chronic pain. Transabdominal pelvic is a non-invasive and quick test that can detect changes in the pelvic anatomy that may indicate the presence of PID (Fatima et al., 2022). Transabdominal pelvic ultrasound allows the doctor to determine the size, shape, location and detect signs of diseases or anomalies in the development of the female pelvic organs, including cervix, uterus; ovaries; fallopian tubes; and bladder. The cases discussed in the above section clearly showed the presence of pelvic inflammatory disease in the reproductive organs. All examinations were performed by MINDRAY digital ultrasonic imaging system, Model DP-5. In most of the cases, the ultrasound technique remained.

However, it must be emphasized that the efficacy of Transabdominal pelvic ultrasound in detecting PID is influenced by several factors, including the experience of the operator, the quality of the equipment, and the presence of other conditions that can mimic the symptoms of PID (Wall et al., 2020). In general, transabdominal pelvic ultrasound has a high sensitivity for detecting PID, especially when performed by a skilled operator using high-quality equipment. However, transabdominal pelvic ultrasound is not perfect and can miss some cases of PID, especially when the disease is in its early stages.

One of the main advantages of transabdominal pelvic ultrasound is that it provides real-time images of the pelvic anatomy, which can help the clinician to quickly identify changes that may indicate the presence of PID (Topper & Winokur, 2021). This can allow for prompt and appropriate treatment, which can help prevent the disease's progression and its long-term consequences.

Strength and Weaknesses of the Research

Every research study has its own strengths and weaknesses, and it is important to identify and acknowledge the limitations of the research. There are several strengths of this research, including: (i) Inductive research approach: The inductive research approach used in this research allowed for the qualitative analysis of data, providing valuable insights into the phenomenon of interest. (ii) Convenience sampling: The convenience sampling method used in this research

helped to select a representative sample of patients who visited the Gara Tajik Hospital and required a pelvic examination. (iii) Real-time imaging: Transabdominal pelvic ultrasound provides real-time images of the pelvic anatomy, which can help the clinician to quickly identify changes that may indicate the presence of pelvic inflammatory disease. (iv) Non-invasive diagnostic tool: Ultrasonography is a non-invasive diagnostic tool for PID and has the advantage of being quick, accessible, and not exposing patients to ionizing radiation. (v) Cost-effective: Compared to other diagnostic techniques such as computed tomography (CT) scans and magnetic resonance imaging (MRI), USG is less expensive and less harmful to the patient. (vi) High sensitivity: The research findings indicate that transabdominal pelvic ultrasound has a high sensitivity for detecting PID, especially when a skilled operator uses high-quality equipment. (vii) Prompt treatment: The real-time imaging capability of transabdominal pelvic ultrasound can allow for prompt and appropriate treatment, which can help to prevent the progression of PID and its long-term consequences. (viii) Operators' experience: The experience of the operator performing the transabdominal pelvic ultrasound is an important factor in the accuracy of the results. The experience of the operator in this study was seven years. (v) Equipment quality: The quality of the equipment used for the transabdominal pelvic ultrasound is also an important factor in the accuracy of the results. The quality of the equipment used in this study was upto the mark, which assures the accuracy of the results.

On the other hand, following are some of the weaknesses of this research: (i) Sample size: The sample size of this research is relatively small, with only 100 female patients being assessed through transabdominal ultrasonography, whereas the research presented the cases of six female patients. While this study provides valuable insights, a larger sample size would have increased the generalizability of the results. (ii) Convenience sampling: The patients were recruited through convenience sampling, which may not be representative of the general population. A more representative sample, such as a random sample, would have increased the validity of the results. (iii) Single center study: This research was conducted at a single center, which may limit the generalizability of the results to other settings. A multi-center study would have increased the external validity of the results.

To sum up, while this study provides valuable insights into the efficacy of transabdominal pelvic ultrasound in detecting pelvic inflammatory disease, its limitations should be considered when interpreting and generalizing the results. Further research, with larger sample sizes, multi-center studies, and increased operator's experience and more advanced equipment is needed to confirm the results of this study.

Conclusion

In conclusion, this research paper aimed to determine the efficacy of transabdominal pelvic ultrasound in accurately detecting pelvic inflammatory disease, and establish it as the preferred diagnostic tool in Pakistan. Through qualitative research design and inductive approach, the research analyzed the female patients who visited the Gara Tajik Hospital in Peshawar, Khyber Pakhtunkhwa, Pakistan from January 2022 to December 2022. The total number

of patients with PID was around 100, whereas six patients were selected for inclusion in this research. The results of the research indicate that transabdominal pelvic ultrasound is a cost-effective and non-invasive diagnostic tool for PID, and is considered the first diagnostic test performed in patients with suspected PID.

However, the accuracy of transabdominal pelvic ultrasound in detecting PID is influenced by several factors, including the experience of the operator, the quality of the equipment, and the presence of other conditions that mimic PID symptoms. Nevertheless, this diagnostic tool has a high sensitivity for detecting PID, especially when performed by a skilled operator using high-quality equipment. Moreover, transabdominal pelvic ultrasound provides real-time images of the pelvic anatomy, which can help the clinician to quickly identify changes that may indicate the presence of PID and allow for prompt and appropriate treatment.

To sum up, transabdominal pelvic ultrasound is an important diagnostic tool for PID, and its use can lead to timely and appropriate treatment, thereby reducing the risk of long-term consequences such as infertility, ectopic pregnancy, and chronic pain. It is recommended that healthcare providers in Pakistan prioritize the use of transabdominal pelvic ultrasound in the diagnostic process for PID and ensure that the equipment is of high quality and that the operators are skilled to maximize the accuracy of the diagnostic results.

Despite its high sensitivity, Transabdominal pelvic ultrasound is not always a reliable test for PID. The accuracy of Transabdominal pelvic ultrasound can be influenced by several factors, including the position of the uterus and ovaries, the presence of fluid or other obstructions, and the presence of other conditions that can mimic the symptoms of PID. Transabdominal pelvic ultrasound is a useful tool for detecting PID, but it is not a perfect test. The efficacy of Transabdominal pelvic in detecting PID will depend on several factors, including the operator's experience, the equipment's quality, and the presence of other conditions that can mimic the symptoms of PID. It is important for clinicians to consider the results of Transabdominal pelvic ultrasound in the context of other clinical and laboratory findings and to use a combination of diagnostic tests to make an accurate diagnosis of PID.

Recommendations

Based on the findings of this study, the following recommendations are suggested to enhance the use of transabdominal pelvic ultrasound in detecting PID:

1. Combination of diagnostic techniques: To increase the accuracy of PID diagnosis, it is recommended to use transabdominal pelvic ultrasound combined with other diagnostic techniques such as transvaginal ultrasound or laparoscopy.
2. Skilled operators: To ensure accurate results, it is crucial to have skilled operators perform the ultrasound. Operators should receive proper training and certification to guarantee high-quality results.
3. High-quality equipment: The quality of the ultrasound equipment used is essential to obtaining accurate results. It is recommended to use state-of-the-art equipment to ensure the best possible images.

4. Regular monitoring: Regular monitoring of the patient through ultrasound can help to detect any changes in the pelvic anatomy, which can indicate the presence of PID.

In brief, transabdominal pelvic ultrasound is an effective and cost-efficient diagnostic tool for PID, but it is crucial to consider the operator's experience and the equipment's quality to increase its accuracy. The combination of transabdominal pelvic ultrasound with other diagnostic techniques can also help to improve the accuracy of PID diagnosis. In addition, future research must include an increased number of participants to retrieve generalizable results.

To address the high prevalence of PID in Pakistan, it is important to promote awareness of the condition and to improve access to healthcare. This includes education about STIs' risks and the importance of seeking prompt treatment if symptoms develop. Additionally, healthcare facilities in Pakistan should strive to provide high-quality diagnostic tools and training for healthcare providers to improve the accuracy of PID diagnosis. By taking these steps, it may be possible to reduce the burden of PID in Pakistan and improve the health and well-being of women of reproductive age.

Conflict of Interests

The author assures that this research was conducted objectively and without any biases or conflicts of interest that could influence the results. The author takes full responsibility for the accuracy and validity of the data and the results presented in this paper. The author declare that they have not published or submitted this work to any other journal or platform. The author did not receive any financial support or funding from any organization or individuals for conducting this research. The author do not have any personal relationships or connections with individuals or organizations that could influence the results of this research. Finally, the author do not have any professional conflicts of interest that could impact the results of this research.

References

Alam, M. K. (2021). A systematic qualitative case study: questions, data collection, NVivo analysis and saturation. *Qualitative Research in Organizations and Management: An International Journal*, *16*(1), 1-31.

Bashir, F., Naz, R., Zaman, S., & Zafar, F. (2016). Abdominal Pregnancy. *Biomedica*, *32*(1).

CDC. (2021). Pelvic Inflammatory Disease: Guidelines for Prevention and Management. https://www.cdc.gov/mmwr/preview/mmwrhtml/00031002.htm

Czeyda-Pommersheim, F., Kalb, B., Costello, J., Liau, J., Meshksar, A., Arif Tiwari, H., & Martin, D. (2017). MRI in pelvic inflammatory disease: a pictorial review. *Abdominal Radiology*, *42*(3), 935-950.

Darwish, A. (2020). Pelvic Inflammatory Disease: An Underestimated Serious Health Problem. In *Clinical Diagnosis and Management of Gynecologic Emergencies* (pp. 81-92). CRC Press.

Eze, J. C., Ohagwu, C. C., Ugwuanyi, D. C., Chiegwu, H. U., & Onyeugbo, E. (2018). Diagnostic accuracy of ultrasound scans for the diagnosis of pelvic inflammatory disease keeping laboratory high vaginal swab/urine microscopy culture as gold standard in Anambra State, Nigeria. *International Journal of Medicine and Medical Sciences*, *10*(8), 94-99.

Fatima, N., Hina, G. E., Imran, A., & Khalid, Q. (2022). The Role of Ultrasound in the Diagnosis of Pelvic Pain in Non-Pregnant Females: Role of Ultrasound in the Diagnosis of Pelvic Pain. *Pakistan BioMedical Journal*, 08-11.

Foti, P. V., Tonolini, M., Costanzo, V., Mammino, L., Palmucci, S., Cianci, A., ... & Basile, A. (2019). Cross-sectional imaging of acute gynaecologic disorders: CT and MRI findings with differential diagnosis—part II: uterine emergencies and pelvic inflammatory disease. *Insights into Imaging*, *10*(1), 1-19.

Greydanus, D. E., Cabral, M. D., & Patel, D. R. (2022). Pelvic inflammatory disease in the adolescent and young adult: An update. *Disease-a-Month*, *68*(3), 101287.

Greydanus, D. E., Cabral, M. D., & Patel, D. R. (2022). Pelvic inflammatory disease in the adolescent and young adult: An update. *Disease-a-Month*, *68*(3), 101287.

Hensen, B., Mackworth-Young, C. R. S., Simwinga, M., Abdelmagid, N., Banda, J., Mavodza, C., ... & Weiss, H. A. (2021). Remote data collection for public health research in a COVID-19 era: ethical implications, challenges and opportunities. *Health Policy and Planning*, *36*(3), 360-368.

Hillier, S. L., Bernstein, K. T., & Aral, S. (2021). A review of the challenges and complexities in the diagnosis, etiology, epidemiology, and pathogenesis of pelvic inflammatory disease. *The Journal of Infectious Diseases*, *224*(Supplement_2), S23-S28.

Juganavar, A., & Joshi, K. S. (2022). Chronic Pelvic Pain: A Comprehensive Review. *Cureus*, *14*(10).

Khan, N., Rehana, K., Saeed, S., Gul, H., Nawab, K., & Shoaib, I. (2022). Diagnostic Accuracy of Sonosalpingography for Assessing Tubal Patency in Women with Infertility Taking Laparoscopy as Gold Standard. *Pakistan Journal of Medical & Health Sciences*, *16*(08), 839-839.

Majeed, A., Bajwa, M. A., Saddozai, S., Rafiq, N., Ijaz, A., Taj, M. K., ... & Azam, S. (2020). 10. Diagnosis of oligomenorrhea and amenorrhea in females (infertility) of different ethnic groups of Quetta Balochistan. *Pure and Applied Biology (PAB)*, *10*(2), 438-444.

Mala, A., Foteinogiannopoulou, K., & Koutroubakis, I. E. (2021). Solid extraintestinal malignancies in patients with inflammatory bowel disease. *World Journal of Gastrointestinal Oncology*, *13*(12), 1956.

Malmqvist, J., Hellberg, K., Möllås, G., Rose, R., & Shevlin, M. (2019). Conducting the pilot study: A neglected part of the research process? Methodological findings supporting the importance of piloting in qualitative research studies. *International Journal of Qualitative Methods*, *18*, 1609406919878341.

McGowan, L. J., Powell, R., & French, D. P. (2020). How can use of the Theoretical Domains Framework be optimized in qualitative research? A rapid systematic review. *British Journal of Health Psychology*, *25*(3), 677-694.

Mikhailiuk, I. P., Shandanovina, Y. A., Gadjibalaevna, D., Ramazanova, A. A. B., Dzhalaeva, K. S., Abdulaeva, R. S., ... & Katchieva, E. K. S. (2022). Uterine Fibroid in Combination with Adenomyosis. Purulent-Inflammatory Diseases of the Female Genital Organs and Their Effect on Reproductive

Function. *International Transaction Journal of Engineering, Management, & Applied Sciences & Technologies*, *13*(11), 1-10.

Naeem, A., Waseem, H., Ali, S., Usman, J., Gilani, M., & Javed, A. (2022). Molecular Detection of Chlamydia Trachomatis in Patients with Pelvic Inflammatory Disease Visiting a Tertiary Care Hospital in Pakistan. *Pakistan Armed Forces Medical Journal*, *72*(4), 1253-57.

Revzin, M. V., Mathur, M., Dave, H. B., Macer, M. L., & Spektor, M. (2016). Pelvic inflammatory disease: multimodality imaging approach with clinical-pathologic correlation. *Radiographics*, *36*(5), 1579-1596.

Santos, M. A. (2020). *Towards Overcoming Limitations on MRI-Guided Focused Ultrasound Hyperthermia-Mediated Drug Delivery Using Thermosensitive Liposomes*. University of Toronto (Canada).

Siddiqui, S., & Bari, V. (2021). Accuracy of MRI pelvis in the diagnosis of ovarian endometrioma: using histopathology as gold standard. *Cureus*, *13*(12).

Stoll, J., Müller, J. A., & Trachsel, M. (2020). Ethical issues in online psychotherapy: A narrative review. *Frontiers in psychiatry*, *10*, 993.

Topper, S. R., & Winokur, R. S. (2021). Imaging of Pelvic Venous Disorders (PeVD); Should Every Patient Get an MRI?. *Techniques in Vascular and Interventional Radiology*, *24*(1), 100731.

uz Zaman, M. (2022). Abstracts-38th Annual RSP Conference-Karachi (25th-27th November 2022). *PJR*, *32*(4).

Wahid, M., Dar, S. A., Jawed, A., Mandal, R. K., Akhter, N., Khan, S., ... & Rattan, R. (2022, November). Microbes in gynecologic cancers: Causes or consequences and therapeutic potential. In *Seminars in cancer biology* (Vol. 86, pp. 1179-1189). Academic Press.

Wall, D. J., Reinhold, C., Akin, E. A., Ascher, S. M., Brook, O. R., Dassel, M., ... & Glanc, P. (2020). ACR appropriateness criteria® female infertility. *Journal of the American College of Radiology*, *17*(5), S113-S124.

Xia, E., Yu, D., Xia, E., Yu, D., & Xia, E. (2022). Diagnostic Hysteroscopy. In *Practical Manual of Hysteroscopy* (pp. 73-181). Singapore: Springer Nature Singapore.

Zeb, L., & Malik, A. (2022). Role of Laparoscopy in Female Infertility. *Fortune Journal of Health Sciences*, *5*(2), 205-210.