

Original Research Article

# Role of ultrasound and MRI in evaluation of pelvic inflammatory disease

Dr. Nivedita Prajapati<sup>1</sup> (PG Resident 3<sup>rd</sup> Year), Dr. Amlendu Nagar<sup>2</sup> (Professor) & Dr. Sheetal Singh<sup>3</sup> (Prof. & HOD)

*Dept. of Radio diagnosis, Index Medical College Hospital and Research Centre, Indore<sup>1,2&3</sup>*

*Corresponding Author: Dr. Vinit Jain*

## Abstract:

**Background & Method:** The aim of this study is to study Role of ultrasound and MRI in evaluation of pelvic inflammatory disease. Patients with clinically suggested pelvic inflammatory disease who were referred to the Department of Radio Diagnosis are included in this study. After obtaining permission from medical research ethics committee and informed consent from the patients, they were subjected to transvaginal ultrasonography and MRI scan.

**Result:** Free fluid is most common finding which is seen in 22 patients out of 100 patients. Cervicitis and pyosalpinx were seen in 18 and 17 patients respectively. Tubo-ovarian abscess was finding in 15 patients. Pyometra and hydrosalpinx as findings were seen in 11 patients each. Salpingi-Oophoritis as MRI findings was seen in nine (09) patients. Other findings seen on MRI included: salpingitis (06), endometritis (06), tubal torsion (05), endometrioma (03), free fluid in Pouch of Douglas (03), no gynecological disorder (02), simple cyst (02), peritonitis (02), and dermoid cyst (01) patients respectively. Both TVS and MRI was positive in 80 patients. TVS had findings of pelvic inflammatory disease in four (04) patients with no findings on MRI. The difference was found to be statistically significant ( $p = 0.00$ ) by using Fisher's Exact test.

Sensitivity of TVS for diagnosing PID who are truly having it was 91.9% while specificity was 69.2% in ruling out PID in those who didn't have the disease in question. Similarly, the positive predictive value (PPV) for TVS was 95.2% and negative predictive value (NPV) was 56.2%. Overall, the accuracy of TVS for PID was 89%.

**Conclusion:** In women of reproductive age, pelvic inflammatory disease (PID) is a prevalent and significant disorder that can cause infertility, ectopic pregnancy, and chronic pelvic pain. Lower abdomen pain, fever, an elevated blood C-reactive protein level, and adnexal tenderness are common symptoms in patients, however the clinical diagnosis of PID has major drawbacks due to the wide range of symptoms and potential for atypical symptoms. PID may mimic gastrointestinal issues, urinary tract infections, and other gynecologic issues. Thus, making a clinical diagnosis of PID based solely on symptoms and physical characteristics is frequently incorrect. The danger of long-term problems rises when treatment is postponed. PID is becoming more common, especially in developing nations where there is a lack of understanding and hazardous sexual behavior.

**Keywords:** pelvic inflammatory disease, mri, tvs, infertility.

**Study Designed:** Prospective & Observational Study.

## 1. INTRODUCTION

Pelvic inflammatory disease (PID) refers to infection and inflammation of the upper female genital tract structures, involving any or all of the uterus, fallopian tubes and ovaries and it may involve adjacent pelvic organs. It encompasses a broad category of diseases, like cervicitis, endometritis, salpingitis, salpingo-oophoritis, tubo-ovarian abscess (TOA) and pelvic peritonitis.

It is one of the most common gynecological disorders of women all over the world. PID is most commonly seen in young women and rarely in postmenopausal women and is reported to occur in 1% of the 15- 25 year age group of young adults around the world and affects around 24%–32% of women in India [1]

In developed countries, the annual incidence is estimated to be 10-13 per 1000 women, with 20 per 1000 women being in the age group of 20-24 years.[2]

Young age of first coitus [3], multiple sexual partners, lower socioeconomic status, and lesser education levels and play a major role in the prevalence of Pelvic inflammatory diseases among women.

Most cases of PID are caused by Chlamydia trachomatis or Neisseria gonorrhoeae. Co-infections of these organisms and other bacteria, including: Streptococcus species, Escherichia coli, Haemophilus influenza, Bacteroides species, Peptostreptococcus and Peptococcus are common.[4]

The common clinical symptoms include lower abdominal pain, foul smelling cervical discharge, and fever. Despite its relative frequency, pelvic infection can represent a diagnostic dilemma because the symptoms are often mild and nonspecific and may not direct the clinician toward the correct diagnosis.

The cost of PID to the health care system stems more from the major chronic complications than the cost of treating the acute infection. Chronic complications include infertility, ectopic pregnancy, and chronic pelvic pain, tuboovarian abscess, FitzHugh Curtis syndrome, due to scarring and adhesions that burden the healthcare system in an adverse manner. Prompt diagnosis and treatment of this condition are critical to prevent complications like infertility and ectopic pregnancy [5]. PID is treated first with antibiotics. Early administration of antibiotics, within 3 days of onset of symptoms, is essential for preservation of tubal functions.

## 2. MATERIAL & METHOD

This is a prospective study conducted in the Department of Radio Diagnosis, Index Medical College Hospital and Research Centre from February 2021 to September 2022. 100 patients with clinically diagnosed pelvic inflammatory disease that were referred from Obstetrics & Gynecology department were included in the study.

Patients with clinically suggested pelvic inflammatory disease who were referred to the Department of Radio Diagnosis are included in this study. After obtaining permission from medical research ethics committee and informed consent from the patients, they were subjected to transvaginal ultrasonography and MRI scan.

TVS was done using GE VOLUSON S8 and LOGIQ P9 Ultrasound machine with the help of 6.5 MHz frequency transvaginal probe. Lying supine, transabdominal ultrasound was first performed. The patient was asked to empty their bladder.

**Inclusion Criteria:**

Non pregnant females with clinically suggested diagnosis of PID referred from obstetrics and gynecology department of the Institute diagnosed as per the Clinical Diagnosis Criteria of PID (CDC 2015)

**Exclusion Criteria:**

- Pregnant females.
- General contraindication to MRI such as those with pace makers, cochlear implants and other electromagnetic implants in the body ,claustrophobia etc
- Patient not willing to sign informed consent form.

**3. RESULTS****Table 1: Age distribution of study participants**

Age (in years)	Frequency (n)	Percentage (%)
18 – 30	48	48
31 – 45	31	31
> 46	21	21
<b>Total</b>	100	100

The distribution of study participants according to their age. It can be seen from above table and figure that around one-half (48%) of study participants were in the age group of 18-30 years followed by 31% belonging to age group of 31 to 45 years. Approximately one-fifth (21%) patients were in the age bracket of >46 years.

**Table 2: Distribution of study participants according to presence or absence of pelvic pain**

Lower Abdominal Pain	Frequency (n)	Percentage (%)
Present	91	91
Absent	09	09
<b>Total</b>	100	100

The distribution of study participants according to their complaint of pelvic pain. Majority of study participants (91%) had pelvic pain as their presenting complaint while only nine (09) had no complaint of pelvic pain.

**Table 3: Distribution of Study participants according to foul smelling discharge**

Foul Smelling Discharge	Frequency (n)	Percentage (%)
Yes	78	78
No	22	22
<b>Total</b>	100	100

In our study, we found that foul smelling discharge at the time of presentation was present in 78% of study participants while remaining 22% of participants do not have any such complaint

**Table 4: Findings seen on Trans-vaginal sonography**

<b>Findings</b>	<b>Frequency (n)</b>
Pyosalpinx	17
Tubo-ovarian Abscess	17
Cervicitis	16
Pyometra	11
Hydrosalpinx	10
Free fluid	09
Salpingo-oophoritis	09
No Gynecological disorder	06
Salpingitis	06
Tubal torsion	04
Endometritis	03
Ovarian tumor	03
Simple Cyst	03

\* Findings are not mutually exclusive

The distribution of findings seen on trans-vaginal ultrasonography. Pyosalpinx and tuboovarian abscess were seen in 17 patients each and were most common finding seen on trans-vaginal ultrasonography followed by cervicitis which was seen in 16 patients. Pyometra, hydrosalpinx, free fluid and salpingo-oophoritis were present in 11, 10, nine (09) and nine (09) patients each respectively. Other findings seen included salpingitis (06), tubal torsion (04), ovarian tumor (03), simple cyst (03), and endometritis (03).

**Table 5: Findings seen on MRI**

<b>Findings</b>	<b>Frequency (n)</b>
Free fluid	22
Cervicitis	18
Pyosalpinx	17
Tubo-ovarian Abscess	15
Pyometra	11
Hydrosalpinx	11
Salpingo-oophoritis	09
Salpingitis	06
Endometritis	06
Tubal torsion	05
Endometrioma	03
Simple Cyst	02
Peritonitis	02
No Gynecological disorder	02
Dermoid cyst	01

\* Findings are not mutually exclusive

It can be seen from above table that free fluid is most common finding which is seen in 22 patients out of 100 patients. Cervicitis and pyosalpinx were seen in 18 and 17 patients respectively. Tubo-ovarian abscess was finding in 15 patients. Pyometra and hydrosalpinx as findings were seen in 11 patients each. Salpingi-Oophoritis as MRI findings was seen in nine (09) patients. Other findings seen on MRI included: salpingitis (06), endometritis (06), tubal torsion (05), endometrioma (03), free fluid in Pouch of Douglas (03), no gynecological disorder (02), simple cyst (02), peritonitis (02), and dermoid cyst (01) patients respectively.

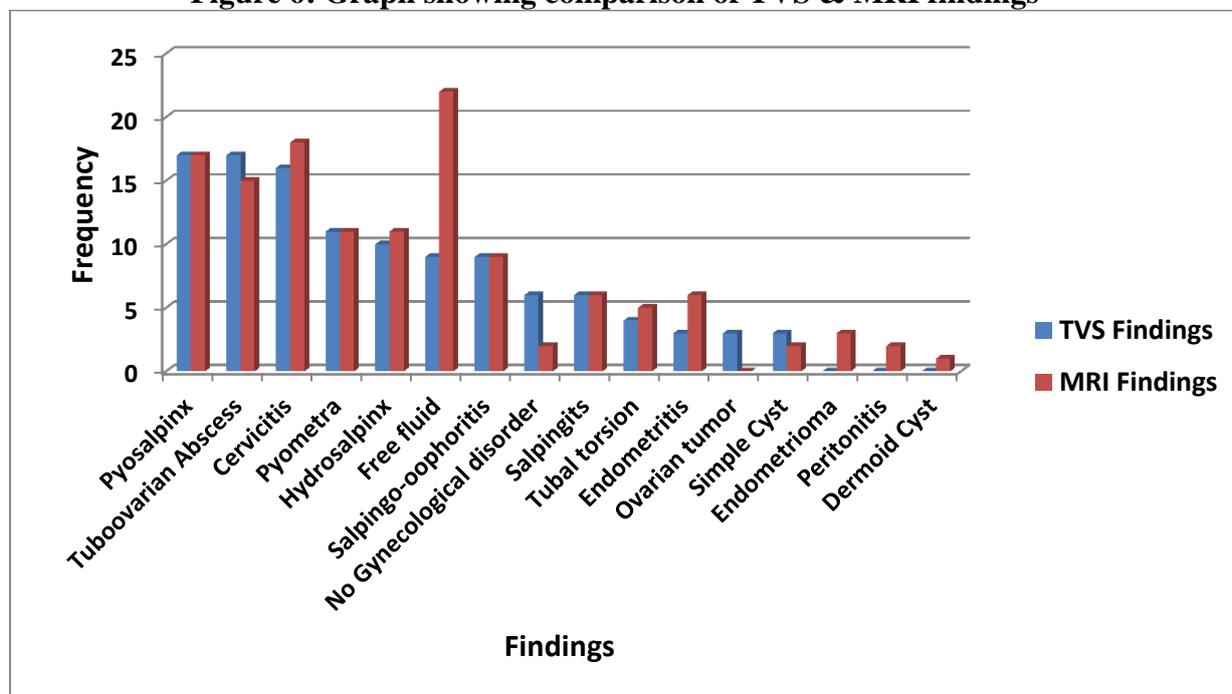
**Table 6: Association between trans-vaginal ultrasonography (TVS) and Magnetic resonance image (MRI)**

Trans-vaginal Ultrasonography (TVS)	Magnetic Resonance Imaging (MRI)		Total
	Yes	No	
Yes	80	04	84
No	07	09	16
<b>Total</b>	87	13	100

\* p <0.05 significant; Fisher’s Exact test applied

The association between trans-vaginal ultrasonography (TVS) and magnetic resonance imaging (MRI). It can be seen from table that both TVS and MRI was positive in 80 patients. TVS had findings of pelvic inflammatory disease in four (04) patients with no findings on MRI. The difference was found to be statistically significant (**p = 0.00**) by using Fisher’s Exact test.

**Figure 6: Graph showing comparison of TVS & MRI findings**



Both TVS and MRI was positive in 80 patients. TVS had findings of pelvic inflammatory disease in four (04) patients with no findings on MRI. The difference was found to be statistically significant (**p = 0.00**) by using Fisher’s Exact test.

Sensitivity of TVS for diagnosing PID who are truly having it was 91.9% while specificity was 69.2% in ruling out PID in those who didn't have the disease in question. Similarly, the positive predictive value (PPV) for TVS was 95.2% and negative predictive value (NPV) was 56.2%. Overall, the accuracy of TVS for PID was 89%.

#### 4. DISCUSSION

Even the most skilled clinicians may find it difficult to make the diagnosis of acute pelvic inflammatory disease (PID), which is typically based on clinical criteria. A diagnosis of cervicitis or a suspicion of acute PID should prompt the administration of antibiotics, despite the advocacy for diagnostic accuracy. Laparoscopy cannot be advised as a first line technique for PID diagnosis as no single test or set of diagnostic markers has yet been shown to consistently predict PID[6]. As a result, the clinician is left with the task of maintaining a high index of suspicion for the diagnosis while assessing the pelvic organs for pain and lower genital tract inflammation in women who have genital tract symptoms and a risk for sexually transmitted infection.

The preferred imaging technique is ultrasound, with magnetic resonance imaging coming in second (MRI). For assessing the severity of PID in the abdomen and interventional therapy, computed tomography (CT) is used. Ultrasonography is a useful diagnostic tool to have in a doctor's toolbox for PID diagnosis because it is noninvasive, widely accessible, and affordable. Timor-Tritsch and Rottem [7] have reported the typical ultrasound features in acute PID, and it has been discovered that adding Power Doppler to transvaginal ultrasound increases its sensitivity in the diagnosis of PID. To guide needles to drain abscesses, transvaginal ultrasonography is preferable to a transabdominal method.

Though pricey, MRI is more accurate. In 30 in-patients hospitalized in Finland with clinically suspected PID, Tukeyva et al [8] compared transvaginal ultrasonography, MRI, and laparoscopy. They found that MRI diagnoses were 95% accurate in 21 women with laparoscopically acute salpingitis compared to transvaginal sonogram, which was only 81% accurate.

Pyosalpinx and tuboovarian abscess were seen in 17 patients each and were most common finding seen on trans-vaginal ultrasonography followed by cervicitis which was seen in 16 patients.

Pyometra, hydrosalpinx, free fluid and salpingo-oophoritis were present in 11, 10, nine (09) and nine (09) patients each respectively.

Other findings seen included salpingitis (06), tubal torsion (04), ovarian tumor (03), simple cyst (03), and endometritis (03).

It can be seen from above table that free fluid is most common finding which is seen in 22 patients out of 100 patients. Hence MR Imaging was more sensitive in detecting even small amounts of free fluid in POD[9]. Cervicitis and pyosalpinx were seen in 18 and 17 patients respectively. Salpingitis were seen in 06 patients while tubo-ovarian abscess was finding in 15 patients. Pyometra and hydrosalpinx as findings were seen in 11 patients each. Salpingo-oophoritis as MRI findings was seen in nine (09) patients. Other findings seen on MRI included: endometritis (06), tubal torsion (05), endometrioma (03), free fluid in Pouch of Douglas (03), no gynecological disorder (02), simple cyst (02), peritonitis (02), and dermoid cyst (01) patients respectively.

## 5. CONCLUSION

In women of reproductive age, pelvic inflammatory disease (PID) is a prevalent and significant disorder that can cause infertility, ectopic pregnancy, and chronic pelvic pain. Lower abdomen pain, fever, an elevated blood C-reactive protein level, and adnexal tenderness are common symptoms in patients, however the clinical diagnosis of PID has major drawbacks due to the wide range of symptoms and potential for atypical symptoms. PID may mimic gastrointestinal issues, urinary tract infections, and other gynecologic issues. Thus, making a clinical diagnosis of PID based solely on symptoms and physical characteristics is frequently incorrect. The danger of long-term problems rises when treatment is postponed. PID is becoming more common, especially in developing nations where there is a lack of understanding and hazardous sexual behavior.

## 6. REFERENCES

1. Bang RA, Baitule M, Sarmukaddam S, Bang AT, Choudhary Y, Tale O. High prevalence of gynaecological diseases in rural Indian women. *The Lancet*. 1989;333(8629):85-8.
2. Weström L. Incidence, prevalence, and trends of acute pelvic inflammatory disease and its consequences in industrialized countries. *Am J Obstet Gynecol*. 1980;138;7(2):880-92.
3. Grech ES, Everett JV, Mukasa F. Epidemiologic aspects of acute inflammatory disease. *Trop Doct*. 1973;101:123-27.
4. Suss AL, Homel P, Hammerschlag M, Bromberg K. Risk Factors for Pelvic Inflammatory Disease in Inner-City Adolescents. *Sexually Trans Dis*. 2000;27(5):289-91
5. Hillis SD, Joesoef R, Marchbanks PA, Wasserheit IN, Cates W Jr, Westrom L. Delayed care of pelvic inflammatory disease as a risk factor for impaired fertility. *Am J Obstet Gynecol* 1993; 168:1503– 1509.
6. Czeyda-Pommersheim F, Kalb B, Costello J, Liau J, Meshksar A, Arif Tiwari H, Martin D. MRI in pelvic inflammatory disease: a pictorial review. *Abdom Radiol (NY)*. 2017 Mar;42(3):935-950. doi: 10.1007/s00261-016-1004-4. PMID: 27933478.
7. Timor-Tritsch IE, Lerner JP, Monteagudo A, et al. Transvaginal sonographic markers of tubal inflammatory disease. *Ultrasound Obstet Gynecol*. 1998;12:56–66.
8. Forstner R, Sattlegger P. In: *Abdominal and pelvic MRI*. Heuck A, Reiser M, editors. Berlin: Springer-Verlag; 1998. pp. 247–281
9. Tukeva TA, Aronen HJ, Karjalainen PT, Molander P, Paavonen T, Paavonen J. MR imaging in pelvic inflammatory disease: comparison with laparoscopy and US. *Radiology*. 1999 Jan;210(1):209-16. doi: 10.1148/radiology.210.1.r99ja04209. PMID: 9885610.