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Original Article

Sensitivity of ultrasound sonography for the diagnosis of pelvic inflammatory disease among women.

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Background: Pelvic ultrasonography is the primary approach for evaluating patients who present with acute pelvic pain in an emergency situation. It has a high sensitivity and specificity for identifying pelvic illness, is affordable, widely available, does not generate ionising radiation, and is easy to use. Urine microscopy cultures and sensitivity (m/c/s) tests and high vaginal swab cultures are the two most common tests used to identify pelvic inflammatory diseases (PID). With vaginal swab/urine microscopy and culture serving as the gold standard in the lab, the goal of this study was to evaluate the diagnostic effectiveness of ultrasound in the diagnosis of PID. **Methods-** When patients with PID symptoms were referred between November 2019 and June 2022, the medical records departments of the Shri BM Patil Medical College & Research Center, Karnataka, gave the USS, high vaginal swab, and urine m/c/s reports. The diagnostic accuracy, sensitivity, specificity, positive predictive value, and negative predictive value were calculated using a performance characteristics test. Descriptive and inferential statistics were also used. Additionally used was the statistical programme for social sciences (SPSS) version 20.0 with

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Spearman rho nonparametric analysis. **Result-** The total number of patients whose PIDs were scanned was 116. The proportion of participants who were 79 or older was highest among those between the ages of 21 and 30. (68.1percent). Ultrasonography was found to have 100% sensitivity, 77.08% specificity, 91.34% accuracy, 100% negative predictive value, and 87.78% positive predictive value, respectively, when used to identify PIDs. The USS diagnosis of PID and the HVS/urine culture results did not substantially correlate ($p > 0.01$). **Conclusion-** Ultrasound is a helpful first line screening method that should be used in conjunction with other medical examinations in order to effectively diagnose PID.

Key words: Ultrasound, pelvic inflammatory disease, urine culture, high vaginal swab culture, diagnostic accuracy.

Introduction:

Women who have pelvic disease (PID), a polymicrobial infection that affects the upper vaginal tract and includes endometritis, salpingitis, and pelvic peritonitis, may occasionally develop tubo-ovarian abscesses.[1] it's an infection brought on by a continuum of inflammation extending from the cervix to the cavity.[2] it's a major side effect of varied sexually transmitted infections (STDs), particularly chlamydia and Neisseria gonorrhoeae in women who are childbearing age. Teenagers should be recommended to attend until they're a minimum of 16 years old before starting gender since they need an elevated risk for PID.[3] Through the operation or non-operative introduction of vaginal bacteria, it are often acquired non-sexually.[4,5] PID may also occur as a results of an unsterile abortion, childbirth, or the implantation of intrauterine contraceptive devices (IUCDs). The tissues in and round the uterus, ovaries, and fallopian tubes may get damaged if pelvic disease isn't properly treated. They'll also end in chronic pelvic pain, gestation, infertility, and a formation of abscesses.[6]

The single most important factor contributing to tubal pathology and infertility is pelvic inflammatory illness.[6] Women with acute salpingitis, those with endometritis but not acute salpingitis, and people with cervicitis but neither endometritis nor salpingitis typically share the identical signs and symptoms of PID.[7-10] Patients with PID may arrive with excruciating abdominal or pelvic discomfort or they'll show no symptoms the least bit.[11] they'll even have fever, adnexal mass or soreness, cervical motion tenderness, dyspareunia, lower abdomen or pelvic pain, emission, abnormal vaginal bleeding, dyspareunia, and adnexal or pelvic pain.[11] There are not any exact global statistics available for PID incidence. in line with estimates from the planet Health Organization (WHO) in 2005, people between the ages of 14 and 49 experience roughly 448 million new cases of treatable STDs p.a.. in line with Lon et al., the subsequent factors make it challenging to work out the precise incidence and prevalence of PID over the world:

a) The patient's failure to recognize their illness.
b) Access problems for medical care.
c) The frequently arbitrary approach to disease diagnosis.

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d) Many developing nations lack diagnostic and laboratory infrastructure.
e) An overworked and underfunded public health system.[12]

In order to spot and make sure the presence of organisms which will be the infection's cause and to decide on the foremost effective antibiotic therapy for treatment, laboratory urine microscopy, culture and sensitivity (m/c/s), and high vaginal swab (HVS) tests are used.[13] because of their low cost; these tests are frequently utilized in our area. The uterus, cervix, vagina, fallopian tubes, and ovaries may now be viewed and simply analyzed due to the event of real-time sonography. Thanks to its ease and accuracy in assessing the feminine reproductive organs, real-time imaging is preferred to other conventional diagnostic techniques. The popular imaging technique is ultrasound, with resonance imaging coming in second.[14] For the diagnosis and confirmation of pelvic inflammatory illness; it's also used as a further diagnostic tool to high vaginal swab and urine m/c/s tests. The utilization of ultrasound to scan the body can reveal regions with aberrant anatomy and pathology, which can help in making a selected diagnosis or provide further evidence to copy the findings of other techniques for detecting pelvic disease. So as to analyze the visceral organs of the pelvis, ultrasound is sort of important. Patients with a clinical diagnosis of PID frequently undergo pelvic sonography. Despite the study being normal or perhaps non-specific, there are variety of findings that are typical of this process.[15] However, the actual detection of thicker fluid-filled tubes by ultrasonography supports the diagnosis of upper genital tract infection despite the actual fact that pelvic ultrasonography's sensitivity for the diagnosis of PID is restricted.[16] The most frequently requested imaging test when pelvic inflammatory disease (PID) is suspected is ultrasound.[17]

Laparascopy, endo-cervical/urethral swab tests, and endometrial biopsy are other diagnostic techniques for examining PID. No one test is sensitive enough or specific enough to identify PID. Cervical motion discomfort as a minimal common criterion increased the CDC diagnostic criterion's sensitivity from 83 to 95 percent, according to a significant multisite United States study. However, the 2002 CDC criteria revisions do not distinguish between women with subclinical illness.[18] Because it is affordable, widely accessible, and uses no ionising radiation, ultrasonography continues to be a diagnostic method for evaluating pelvic inflammatory disease in India.

Methodology:

This investigation validated documented records cross-sectionally. From November 2019 to June 2022, a span of two and a half years was covered by this study. Within the Shri BM Patil Medical College & Research Center, Karnataka,, the folders of patients who had undergone USS, urine m/c/s, and HVS tests and were suspected or diagnosed as having PID were examined.

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Within the two.6 year study period, 120 patient folders in total were received from the hospital's medical records department. Folders including reports from the ultrasound, HVS, and urine m/c/s were included during this study, while those containing only one or none of them were excluded. the data the hospital and personnel documented in patient files, request cards, and ultrasound scans served because the primary sources of knowledge. The procedure involved rummaging through the ultrasound registers to spot all pelvic imaging cases with a clinical indication of PID. With consent from the hospital directors, the folders were then tracked to the medical records departments using their hospital numbers.

The folders also contained information on the patients' names and ages. Data analysis- The statistical package for social sciences (SPSS) Version 20.0 and Spearman rho's non-parametric analysis were wont to determine the correlation between ultrasound diagnosed cases of PID and laboratory high vaginal swab and urine m/c/s findings, while performance characteristics were accustomed determine the sensitivity, specificity, accuracy, positive predictive value, and negative predictive value of ultrasound scans within the diagnosis of PID using high vaginal swab because the gold standard.

Results:

In order to compare the ultrasound scan (USS) diagnosis of PID with laboratory urine m/c/s and HVS diagnosis, as well as to analyze the sensitivity, specificity, and accuracy of ultrasound in the diagnosis of PID, medical records of 116 female individuals were examined. Their average age was 28 years, and they ranged in age from 11 to 60. 68.10% of them were between the ages of 21 and 30, making up the majority. The study's youngest age group, between 51 and 60, made up 3.44% of the population [table 1]. Using ultrasonography to make the diagnosis, it was determined that 26 (22.41%) of the 90 patients did not have PID [table 2]. Staphylococcus species were found to be the most common causal organism for this illness utilizing HVS and urine cultures [table 3 & 4]. The HVS culture diagnosis of PID and the ultrasound diagnosis did not significantly correlate ($r = 0.029$). In the diagnosis of PID, there was no significant connection between ultrasound and urine culture ($r = 0.119$).

Discussion:

When the upper genital tract of a woman's reproductive organ becomes infected, it is known as pelvic inflammatory disease. If left untreated, this condition can have major side effects such as infertility, ectopic pregnancy, abscess formation, and chronic pelvic pain.[6] These infections typically progress upward through the vagina or cervix and into the cavity. The uterus' surface or parametrially may both experience lymphatic spread. Additionally, the bowel or blood might carry an infection.[19] The most frequently requested imaging test when pelvic inflammatory disease is suspected is ultrasonography.[17] Its benefit is that it's secure, non-intrusive, and simply accessible. The diagnosis of PID is additionally made easier by combining high-resolution ultrasound with laboratory high vaginal swab culture and urine culture. These

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laboratory tests help in identifying the organisms that cause PID and also help determine how sensitive they're to antibiotic therapy, which is employed to treat PID, while sonography reveals the extent of the damage and effects on surrounding tissues.[13, 20] The cohort of 21 to 30 years saw the best proportion of patients from this study referred for sonography exams for PID-related symptoms. The findings are in line with those of Njoku et al.,[20] who discovered the next frequency of PID in women between the ages of 20 and 30 and this group is sexually active.[20] he HVS material was frequently accustomed isolate Staphylococcus species, Candida albican, and Streptococcus species. The findings contrast from those of the Centers for Disease Control and Prevention, which focused totally on N. gonorrhoea and C. trachomatis, but are like those of Njoku et al. and Olowe et al.[20, 21] hlamydia couldn't be isolated, which is in line with other reports that it's difficult to cultivate. Staphylococcus and Streptococcus species were the foremost typical microorganisms to be isolated from the urine culture. The diagnosis of PID using HVS culture and ultrasound failed to significantly correlate ($p > 0.01$). The diagnosis of PID using urine culture and ultrasound didn't significantly correlate. These factors are accountable for this:

a) Thanks to the actual fact that ultrasound findings don't seem to be specific to anybody disease condition, characteristics that are indicative of PID in ultrasound may be indicative of other diseases or physiological processes. For example, fluid within the pouch of Douglas, the foremost prevalent sonographic finding that's indicative of PID, may also be seen in females during the ovulatory period because because the graffian follicle ruptures, fluid is additionally released. Inflammation of the organs surrounding the feminine sex organ may additionally cause fluid to accumulate.[20]

b) The stage of the disease (PID): within the early stages of PID or in uncomplicated situations, the findings on pelvic sonograms frequently seem normal.[22] this might end in a negative diagnosis by ultrasound examination, but the end result could also be positive when examined using other diagnostic techniques, like laboratory HVS culture. Per the findings, ultrasonography diagnosis of PID is accurate 89.2 percent of the time but encompasses a low specificity rate (65.8 percent). This could be results of the infection stage at the time of diagnosis. In cases of early or mild PID, ultrasound findings can be generic, and linkage with clinical and laboratory results can help to enhance accuracy. The sensitivity and specificity of sonography are influenced by the standard of the equipment and also the sonographers' training. The study's findings that there have been a big number of false positive results indicate that PID diagnosis isn't specific. This means that rather than using ultrasonography as a confirmatory test within the diagnosis of PID, it should be used as a primary line of inquiry (a screening technique) before conducting other investigations. This result's in line with that of Njoku et al.[20] In conclusion, the results of HVS and urine cultures don't significantly correlate with ultrasound findings for PID diagnosis. There's not one diagnostic assay which will identify PID with sufficient sensitivity and specificity. Per our findings, we advise that, so as to enable an accurate diagnosis, ultrasound, HVS culture, and urine culture investigations are dole out by trained and experienced sonographers, sonologists, and laboratory scientists. When unsure, additional research employing

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different diagnostic techniques should be worn out the PID diagnosis. So as to diagnose PID early before it becomes problematic, routine pelvic ultrasound scanning in females of reproductive age is totally required. It's necessary to extend the effectiveness of record-keeping at the ultrasonography unit and therefore the medical records department.

Conflict of Interests: The authors have not declared any conflict of interests.

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Table 1- The age distribution of subjects that had USS, HVS and Urine M/C/S investigation.

Age (Years)	Frequency	Percentage
10-20	12	10.34
21-30	79	68.10
31-40	16	13.83
41-50	5	4.31
51-60	4	3.44
Total	116	100

Table 2- Ultrasound diagnosis of PID.

Parameter	Frequency	Percentage
PID	26	22.41
Without PID	90	77.60
Total	116	100

Table 3. Organisms yielded using high vaginal swab (HVS) culture.

Organisms	Frequency	Percentage
No bacterial growth	37	31.89
Staphyloccus aureus	41	35.34

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Candida albicans	17	14.65
Staphyloccus aureus and *Candida albicans*	5	4.31
Escherichi colli	3	2.58
Streptococcal Spp	12	10.34
Coliform and staph. Spp.	1	0.86
Total	116	100

Table 4. Organisms yielded in urine culture.

Organisms	Frequency	Percentage
No bacteria growth	58	50.00
Staphyloccus aureus	33	28.44
Coliform and Staph. Spp	1	0.86
Coliform	5	4.31
Candida albicans	1	0.86
C. albicans and Staph. Spp	1	0.86
Strept. Spp	16	13.79
Proteus Spp.	1	0.86
Total	116	100

Table 5- Correlations of Ultrasound diagnosis and HVS culture/Urine culture.

Investigations	P value
Ultrasonography and HVS culture	0.685
Ultrasonography and urine culture	0.174
***P>0.01 (Not significant)	

Table 6. Performance test characteristics of ultrasonography against HVS culture taken as gold standard.

Diagnostic measure	Positive	Negative	Sensitivity	Specificity	Positive predictive value	Negative Predictive value	Accuracy
Ultrasonography	90	26	100%	77.08%	87.78%	100%	91.34%
HVS culture	79	37	100%	100%	100%	100%	100%