



ORIGINAL RESEARCH PAPER

Obstetrics & Gynaecology

EVALUATION OF PELVIC MASSES BY TAS VS. TVS AND ITS OPERATIVE CORRELATION

KEY WORDS: TAS - Transabdominal Sonography, TVS -Transvaginal Sonography, pelvic mass

| | |
|---------------------------------|---|
| Dr.Mamata Soren | Associate Professor, Department of Obstetrics and Gynaecology, VSSIMSAR, Burla, Sambalpur |
| Dr.Arati Behera | Senior Resident, Department of Obstetrics and Gynaecology, VSSIMSAR, Burla, Sambalpur |
| Dr.Sudhanshu Sekhar Nath | Senior Resident, Department of Obstetrics and Gynaecology, VSSIMSAR, Burla, Sambalpur |

ABSTRACT

Introduction: Sonography is the diagnostic modality of choice for initial evaluation of most patients with a pelvic mass. The use of transvaginal sonography can add specificity in certain areas to the conventional transabdominal sonographic evaluation.

Aiims & objectives: To determine the accuracy of transabdominal sonography and transvaginal sonography in the diagnosis of different pelvic masses and their correlation with intraoperative findings and histopathological findings.

Materials and methods: 150 cases with pelvic masses were taken excluding the obstetric and nongynecologic ones during the period, Oct2012 to Sep 2014 at O&G Department of VSS Medical College Burla and their final intraoperative diagnosis alongwith histopathological confirmation were correlated with both abdominal and vaginal sonography findings.

Results: The diagnostic accuracy of pelvic masses by TVS was 97% as compared to TAS which was 90%. TVS is more sensitive, specific and accurate in detection of pelvic masses in comparison to TAS. Both were equivocal in (34%) of cases, TVS was superior in (62%) of cases and TAS was superior in 4% of cases.

Conclusion: Transvaginal sonography is superior to transabdominal sonography in most cases of pelvic pathologies. However TAS should still be the initial sonographic technique for routine evaluation of the female pelvis followed by TVS if indicated.

INTRODUCTION

Pelvic masses are very common findings in day to day gynecological practice and its accurate diagnosis remains a dilemma in clinical practice. X-ray was the first imaging technique developed. Subsequently, ultrasonography was followed and provided a simple, rapid, inexpensive and reliable method of imaging of pelvic organs and became the method of choice in diagnosing pelvic masses.

Introduction of transvaginal sonography by Kratochwill in 1969 was like a magic torch & its utilization has made it a more dependable investigation modality. Transvaginal sonography has the advantage of additional information about the internal architecture and anatomy of masses. By ultrasound scoring system of adnexal masses, it is possible to detect and differentiate benign and malignant lesion.

Newer noninvasive advanced imaging technologies include CT scan and MRI, which are quite costly and their limited availability decrease their use in routine investigation for diagnosis of pelvic masses leaving ultrasonography the preferred initial method of investigation modality of pelvic masses.

In addition to transabdominal ultrasonography, vaginal sonography has recently emerged as a valuable method of examining the pelvis. It is often adjunctive to transabdominal sonography. Transvaginal imaging utilizes a higher frequency imaging, which gives better resolution of the ovaries, uterus and endometrium (the fallopian tubes are generally not seen unless distended), but is limited to depth of image penetration, whereas larger lesions reaching into the abdomen are better seen transabdominally. The procedure is by definition invasive when performed transvaginally. Several studies have been made to note the diagnostic value of ultrasonography i.e. both TAS & TVS in diagnosis of pelvic masses.

The present study is aimed to evaluate the role of TAS as well as TVS in evaluation of pelvic masses and its intraoperative & histopathological correlation.

AIMS AND OBJECTIVE

The purpose of the study was to determine the accuracy of transabdominal sonography and transvaginal sonography in the diagnosis of different pelvic masses.

Correlation of clinical, transabdominal, transvaginal sonography with intraoperative findings as well as histopathological findings.

MATERIALS & METHODS

The study "Evaluation of pelvis masses by TAS vs TVS and its operative correlation" was conducted in the Department of Obstetrics and Gynecology, V.S.S.Medical College, Burla, during the period, Oct2012 to Sep 2014. Out of 239 patients, 150 cases were included in the study, as the rest of the patients were either lost to follow up or were not willing for the further procedure which could confirm the diagnosis

INCLUSION CRITERIA

1. All the patients of different age groups with relevant signs/symptoms of pelvic masses
2. Asymptomatic patients where pelvic masses detected at routine pelvic examinations or at the time of USG.

EXCLUSION CRITERIA

1. Obstetric patients with relevant complaints.
2. Patients with pelvic mass suggestive of non gynaecological origin.

METHOD

After taking a detailed history and complete physical examination, including bimanual pelvic examination, per speculum examination and rectal examinations, a provisional diagnosis of different pelvic masses was made. After preliminary investigations, the patients were subjected to ultrasound examination i.e. both transabdominal sonography(TAS) and transvaginal sonography(TVS). The equipment used for ultrasonic diagnostic study is the "real time B mode scanner with M mode facility" with sector type of transducers. The frequency of TAS transducer is 3.5 Mhz and that of TVS is 7.5 Mhz.

SCANNING TECHNIQUE & PROCEDURE :

After taking history & clinical examination done and scanning was done as follows :

The ultrasound instrument used for this study is a real time B mode scanner with linear and sector type of transducer. The frequency of TAS transducer used is 3.5 Mhz which is present in V.S.S.M.C.H The examination was begun with a longitudinal scan in the midline

in order to identify major landmarks and to adjust to various controls for gain image size and the location on the monitor. Next transverse scans were obtained starting at the pubic symphysis moving cephalad at 1cm intervals to view successively the vagina, cervix body and fundus of the uterus. This was followed by scans with the transducer angled to the right and then left to visualize each adnexae optimally. The scans were labeled as to right left, transverse, longitudinal, oblique or angled. While performing scanning the length, width and echogenicity of uterus were recorded. If follicles were seen in the ovaries their number the size recorded. If any mass in the pelvis was seen, its echogenicity, size, location, origin, relation to uterus were recorded. Solid or cystic, free fluid in the douglas pouch etc. were noted. Liver was seen for secondaries in the parenchyma, size and patency of portal vein was seen, size and texture of spleen was observed, presence of ascites was noted.

After TAS was done, patient was asked to empty the bladder and then patient was put in lithotomy position for TVS. The transducer used was 7.5 MHz. The uterus was used as land mark for depiction of other adnexal structure.

OBSERVATION:

Out of total 150 cases, majority were multiparous and belong to 31-40yrs age group(32%) followed by the age group 41-50 yrs(28%).

Presenting symptom in pelvic masses in our series

| Symptoms | Number of cases |
|--------------------------|-----------------|
| Pain abdomen | 96(64%) |
| Menstrual Irregularities | 48(32%) |
| Lump abdomen | 39(26%) |
| Infertility | 18(12%) |
| Pressure symptoms | 15(10%) |
| White discharge | 20(13%) |
| Loss of appetite | 08(5%) |
| Virilisation | 01(1%) |
| Others | 03(2%) |

Pain abdomen was the predominant presenting symptom (64%) followed by menstrual irregularities (32%) and lump abdomen (26%). Loss of weight was complained by 5 cases and most of them were malignant pelvic masses.

Most common pelvic mass diagnosed clinically and ultrasonologically was fibromyoma of uterus (34%) followed by ovarian tumor (31.4%). Maximum of the fibroids were intramural (41.2%). Most of the fibromyoma were multiple in numbers (85.7%).

Pathological findings of pelvic masses

| Disease | Number | Percentage |
|------------------------|--------|------------|
| Myoma | 51 | 34 |
| Ovarian Tumor | 47 | 31.4 |
| Ectopic Pregnancy | 12 | 8 |
| Adenomyosis | 17 | 11.4 |
| Tuboovarian mass | 07 | 4.6 |
| PCOD | 02 | 02 |
| Pyometra | 03 | 02 |
| Haematometra | 01 | 01 |
| Fibrosarcoma | 01 | 0.6 |
| Endocervical Carcinoma | 02 | 1.4 |
| Endometrial Carcinoma | 03 | 02 |
| OHSS | 01 | 0.6 |
| Didelphus Uterus | 01 | 0.6 |
| Endometriosis Ovary | 02 | 1.4 |

Myoma as per size, site and number

| Fibromyoma | Clinical diagnosis | TAS | TVS | Laparotomy |
|-------------|--------------------|-----|-----|------------|
| Size 2-4 cm | 15 | 19 | 22 | 23 |
| 4-8 cm | 18 | 15 | 19 | 20 |
| > 8 cm | 12 | 12 | 00 | 08 |

| Site | Anterior | 28 | 21 | 23 | 26 |
|-----------------|----------|----|----|----|----|
| Posterior | 20 | 09 | 12 | 15 | |
| Fundal | 00 | 15 | 11 | 05 | |
| Cervical | 02 | 02 | 03 | 03 | |
| Broad ligament | 00 | 00 | 02 | 02 | |
| Number Multiple | 30 | 30 | 30 | 30 | |
| Single | 30 | 22 | 21 | 21 | |

Most of the myoma were of 2-4 cm size and size more than 8 cm were not visualised by TVS. Maximum of the myoma were anterior and most of them were multiple.

Distribution of different types of tubo-ovarian masses

| Types of TO mass | Clinical diagnosis | TAS | TVS | Intra operative diagnosis | HP Study |
|----------------------|--------------------|-----|-----|---------------------------|----------|
| Hydrosalpinx | 00 | 00 | 00 | 01 | 01 |
| Pyo Salpinx | 00 | 01 | 01 | 01 | 01 |
| Tubo ovarian complex | 00 | 03 | 03 | 03 | 03 |
| Tubo ovarian abscess | 01 | 01 | 01 | 02 | 02 |

This table highlights the clinical, ultrasonological, operative, and histopathological correlation of different tubo-ovarian masses. Clinically it was not possible to diagnose categorically the TO mass as well as by TAS. TVS was able to diagnose all variety accurately.

Adenomyosis

| Clinical diagnosis | TAS | TVS | Intra operative diagnosis | Histopathological diagnosis |
|--------------------|-------|-------|---------------------------|-----------------------------|
| 11 | 13 | 15 | 17 | 17 |
| 64.7% | 76.4% | 88.2% | 100% | 100% |

Clinical examination had an accuracy of 64.7%, TAS 76.4% & TVS 88.2% in detecting cases of Adenomyosis.

Clinical accuracy in endometrial carcinoma was 33% where as TVS detects endometrial carcinoma in 66% of cases unlike TAS which detects only half of the cases.. there were 2 cases of endocervical carcinoma which were clinically not detected where as TAS detected only 1 case but TVS was able to diagnose all the cases. There was one case of chocolate cyst of ovary which was diagnosed as ovarian tumor clinically. But both type of sonography diagnosed it properly.

Types of ovarian tumor.

| Type | Number | TAS | TVS | Percentage |
|------------------------------|--------|-----|-----|------------|
| Serous cystadenoma | 16 | 16 | 17 | 34.1 |
| Serous cystadeno carcinoma | 05 | 09 | 06 | 10.6 |
| Mucinous cystadenoma | 15 | 17 | 15 | 31.9 |
| Mucinous cystadeno carcinoma | 03 | 03 | 03 | 6.4 |
| Granulosa cell tumor | 01 | 00 | 01 | 2.1 |
| Dermoid | 03 | 07 | 07 | 14.8 |
| Fibrothecoma | 00 | 00 | 01 | 2.1 |

The above table shows the histological diagnosis of ovarian tumor. The commonest tumor on histology was serous cyst adenoma (34.1%) followed by mucinous cyst adenoma (31.9%). Ovarian malignancies were serous cystadenocarcinoma (10.6%) and mucinous cystadenocarcinoma (6.4%).

Age distribution of Benign and Malignant ovarian tumors

| Age | Benign | Malignant |
|-------------------|------------|-----------|
| <20 | 5(10.6) | 02(4.3%) |
| 20-50 | 28(58.6%) | 00 |
| >50 | 6(13.7%) | 06(12.8%) |
| Total = 47 (100%) | 39 (82.9%) | 8 (17.1%) |

Most of the benign tumors (58.6%) occurs in reproductive age

group i.e. 20-50 years of age. Almost all the malignant tumors occur after 40 years of age.

Detection of different parameters of ovarian tumors

| Ovarian tumor | Clinical diagnosis | TAS | TVS | Laparotomy | H.P study |
|--------------------|--------------------|-----|-----|------------|-----------|
| Size 3-5cm | 14 | 04 | 10 | 10 | 0 |
| 5-8cm | 33 | 35 | 30 | 30 | 0 |
| >8cm | 04 | 05 | 00 | 07 | 0 |
| Nature | | | | | |
| Benign | 42 | 35 | 39 | 39 | 39 |
| Malignant | 10 | 14 | 10 | 08 | 08 |
| Consistency | | | | | |
| Cystic | 30 | 30 | 30 | 30 | - |
| Solid | 17 | 13 | 12 | 12 | - |
| Varigated | 00 | 02 | 05 | 05 | - |

FINAL CORRELATION OF DIFFERENT DISEASES

| Disease | Clinical | TAS | TVS | Intraoperative | HP study |
|------------------------|----------|-----|-----|----------------|----------|
| Fibromyoma | 52 | 54 | 54 | 51 | 51 |
| Ovarian Tumor | 43 | 51 | 49 | 47 | 47 |
| Ectopic Pregnancy | 12 | 10 | 11 | 12 | 12 |
| Adenomyosis | 11 | 17 | 17 | 17 | 17 |
| Tuboovarian mass | 07 | 06 | 06 | 07 | 07 |
| PCOD | 01 | 02 | 02 | 02 | 02 |
| Pyometra | 01 | 03 | 03 | 03 | - |
| Haematometra | 00 | 00 | 01 | 01 | - |
| Fibrosarcoma | 00 | 00 | 00 | 01 | 01 |
| Endocervical Carcinoma | 00 | 01 | 02 | 02 | 02 |
| Endometrial Carcinoma | 01 | 01 | 02 | 03 | 03 |
| OHSS | 01 | 01 | 01 | 01 | 0 |
| Didelphus Uterus | 00 | 00 | 01 | 01 | 0 |
| Endometriosis Ovary | 00 | 00 | 01 | 02 | 02 |

This table shows the final correlation of clinical, ultrasonological, intraoperative & histopathological findings. Clinically 47 no. of fibromyoma were detected correctly. But there was over diagnosis in 4 cases. 3 cases adenomyosis and one case of fibrosarcoma were diagnosed as fibroid. TAS & TVS detected 2 cases of adenomyosis correctly but unable to diagnose one case of fibrosarcoma. Clinically 43 ovarian tumours were detected, there was misdiagnosis in 4 cases as tubo ovarian mass and overdiagnosis in 2 cases of tubo ovarian mass and one case of endometriosis ovary. TAS & TVS were able to diagnosed all cases correctly. One case of didelphus uterus was diagnosed as ectopic pregnancy clinically but TVS diagnosed it correctly unlike TAS.

DISCUSSION: We found maximum number of patients in the age group of 21-50 years (72%) which is similar to the findings by **Sood and others, 1994** (76%) who also reported pain abdomen as the most frequent chief complaint (50 cases). In our study, pain was the most frequent presenting symptom complained by 64% of patients having pelvic masses. **O Dowd et al (1990)** studied 546 cases and as per his study menstrual irregularities were present in 30.5% of patients and infertility in 9.3% of cases. In our series, menstrual irregularities were seen in 32% and infertility in 12% of cases.

In our series there was over diagnosis of fibroid in 6 cases clinically. The sensitivity and specificity by TAS was 90.1% and 91.9% respectively. But the sensitivity and specificity of fibroid detection by TVS were 94.1% and 93.9% respectively. These values are comparable with the findings of **Coutradis et al (1990)** who scanned 224 leiomyoma and came up with sensitivity and specificity of 94.5% and 95.3% respectively.

In retrospective studies, the incidence of adenomyosis is 29% (**Molitom J.J. 1958**), but in a study by **Owolabi et al (1977)** the prospective diagnosis was only 10%. In our study, 11 out of 17 cases i.e. 64.7% were diagnosed by clinical examination. 13 cases

(76.4%) were diagnosed by TAS but 15 cases were diagnosed by TVS (88.2%). Here TVS is definitely superior to TAS in diagnosis of adenomyosis which is also suggested by **Balbie GC et al(2000)**, **Bazot et al (2002)**, **Dueholm et al (2006)**, **Meredith et al(2009)** and **Hanafi et al (2013)**..

In our series the difficulty posed by TAS was cleared by TVS. By TVS it was possible to differentiate the complex tuboovarian masses into one case of hydrosalpinx, 1 case of pyosalpinx, and 3 cases into tuboovarian complex. 2 cases were detected as tuboovarian abscess.

In our series one case of endometrial carcinoma was detected clinically and transabdominally in one case but TVS detected two cases. Hence TVS 66% sensitive and 100% specific in diagnosis as compared to TAS (33% sensitive and 100% specific). There were 2 cases of endocervical carcinoma. Both were not detected clinically. TVS detected both cases where as TAS detected only one case. Hence TVS is more accurate in diagnosis of endocervical carcinoma as told by **Wu et al 1999**, **Ruangvutlert et al (2004)** in 111 patients of endometrial carcinoma found sensitivity, specificity and ppv of TVS as 69.4%, 70.6% and 53.2% respectively. In **2008, Fotopoulou et al**, studied thirty patients with endometrial cancer prospectively. Systematic staging regarding tumor size (T), infiltration of the cervix (Cx) and ovaries (OV), peritoneal carcinomatosis (PC), bladder invasion (BI), intestinal invasion (II) and ascites (A) was assessed using TVS. Preoperative diagnosis was correctly made by TVS in 93.4% of the patients. So, TVS is a sensitive and non-invasive method for preoperative diagnosis of suspected endometrial cancer.

Accuracy of ultrasound in predicting malignancy by various authors are as follows :

| Authors | No. of cases | Sensitivity | Specificity |
|--------------------------------|--------------|-------------|-------------|
| Kobayashi (1976) | 406 | 71 | 73 |
| Meire et al (1978) | 51 | 83 | 91 |
| Pussel (1980) | 25 | 83 | 84 |
| Hermann et al (1987) | 240 | 82 | 93 |
| Finkler et al (1988) | 102 | 62 | 95 |
| Benacerraf et al (1998) | 100 | 80 | 87 |
| Gran berg et al (1989) | 180 | 82 | 92 |
| Sassone et al (1991) | 143 | 100 | 83 |
| Our study | 47 | TAS 100 | 90.6 |
| | | TVS 100 | 97.5 |

Diagnostic accuracy of ultrasound has been reported is as follows

| Authors | Diagnostic Accuracy |
|--------------------------------|---------------------|
| Fleisher et al | 71% |
| Morley Barnett | 79% |
| Jones, Walsh and others | 79% |
| Thomas L Lawson | 91% |
| Sood et al | 90% |
| Our study TAS TVS | 94.6% 96.6% |

CONCLUSION:

Real time ultrasound thus can be help in:

Pre and postoperative follow up of pelvic masses and for therapeutic purposes and thus obviating the need of surgery in many cases.

So it may be said that ultrasonography is a valuable aid in assessing pelvic masses. Being noninvasive, free from radiation hazard, cheap and time saving it may be employed in all cases, as an investigation of choice in pelvic masses.

In conclusion the question is whether we will do only TVS because of high accuracy as evident in our study? Each type of sonography has its merits and demerits. Hence we can say that TAS and TVS are complimentary technique which should be used together for evaluation of pelvic masses.

BIBLIOGRAPHY

1. Arthur, et al: TVS of post menopausal ovaries, JUM,1990; 9:637-44.
2. Bazot M, Daraï E, Rouger J, Detchev R, Cortez A, Uzan S. :Ultrasound Obstet Gynecol. 2002 Dec;20(6):605-11.
3. Bazot M, Thomassin I, Hourani R, Cortez A, Daraï E. :Ultrasound Obstet Gynecol. 2004 Aug;24(2):180-5.
4. Blasch J, Barri P. Treatment of ectopic pregnancy : the new gynecologic dilemma. Hum Report 1994; 9:547.
5. Bohm-Velez M, Fleischer AC, Andreotti RF, et al. ACR Appropriateness Criteria® on the Suspected Adnexal Masses. American College of Radiology Web site, 2005
6. Cannon L, Jesionowska H. Mthotrexate treatment of tubal pregnancy. Fertile Steril 1991; 55:1033.
7. Campbells, Royston P, Bhan V. Whitehead MJ, Collins WB. Novel Screening Strategies for early ovarian cancer by transabdominal ultrasonography. Br. J. Obstet Gynecol 1990; 304:311.
8. Chechia A, Koubaa A, Terras K, Bahri N, Makhlof T. :Tunis Med. 2000 Oct; 78(10):589-94. French.
9. Dörum A, Blom GP, Ekerhovd E, et al.. Prevalence and histologic diagnosis of adnexal cysts in postmenopausal women: an autopsy study. Am J Obstet Gynecol. 2005; 192: 48–54
10. Donald I, MacVicar J, Brown TG: Lancet 1963; 1:1188-95.
11. Depries PD, Varner E, Powell J, Fried A, Puls L, Higgins R, et al : The efficacy of a sonographic morphology index in identifying ovarian cancer; A multi institutional investigation. Gynaecol oncol 1994; 55:174-8.
12. Dipi RM, Amin MS, Islam MN, Khan NA, Chaiti MM, Hossain MM. Comparison of transabdominal and transvaginal sonography in the evaluation of uterine mass with histopathological correlation.
13. Mymensingh Med J. 2013 Jan;22(1):69-74.
14. Dicitrak. P., Powolny. M., : Comparative study of observe agreement as location and size of ovarian tumors in transvaginal and transabdominal ultrasonic examinations with intra operative evaluations from material of patients operated on in the Gynaecol and Obstetric dept., of the ministry of internal affairs clinic in the year 1991-94; Ginekol pol 1996, Mar.;67(3): 140-3.
15. Dueholm M. :Best Pract Res Clin Obstet Gynaecol. 2006 Aug;20(4):569-82. Epub 2006 Mar 20. Review.
16. Eschelman DJ, Sulivan KL. Use of Colapinto needle in US guided transvaginal drainage of pelvic abscesses. Radiology 1993; 186:893.
17. Fleischer AC, Kalemur CE: Jaclin JE : J Ultrasound Med 1986; 5:445.
18. Fleischer A, Brown M, Wilds P : Gray-Scale Sonography in the morphological diagnosis of selected gynaecologic tumors in ultrasound in Medicine, edited by White D. New York Vol. II, 1976, pp-213-218.
19. Fotopoulou C, Sehouli J, Scheffold JC, Wolf C, Denkert C, Lichtenegger W, Henrich W. Preoperative transvaginal ultrasound (TVS) in the description of pelvic tumor spread in endometrial cancer: results of a prospective study; Anticancer Res. 2008 Jul-Aug;28(4C):2453-8.
20. Granberg S, Norstrom A, Wikland M. : Tumors in the lower pelvis imaged by vaginal sonography. Gynecol Oncol 1990; 37:224-9.
21. Graham D, Sanders RD. Ultrasound guided transvaginal aspiration biopsy of pelvic masses. J Ultrasound Med 1982; 165:872.
22. Hanafi M. Ultrasound diagnosis of adenomyosis, leiomyoma, or combined with histopathological correlation: J Hum Reprod Sci. 2013 Jul;6(3):189-93. doi: 10.4103/0974-1208.121421.
23. Henrich W, Fotopoulou C, Fuchs I, Wolf C, Schmider A, Denkert C, Lichtenegger W, Sehouli J. : Anticancer Res. 2007 Nov-Dec;27(6C):4289-94.
24. Hudelst G, Oberwinkler KH, Singer CF, Tuttlies F, Rauter G, Ritter O, Keckstein J. Combination of transvaginal sonography and clinical examination for preoperative diagnosis of pelvic endometriosis: Hum Reprod. 2009 May; 24(5):1018-24. doi: 10.1093/humrep/dep013. Epub 2009 Feb 6.
25. Kepkep K, Tuncay YA, Göynümer G, Tural E. Transvaginal sonography in the diagnosis of adenomyosis: which findings are most accurate?: Ultrasound Obstet Gynecol. 2007 Sep;30(3):341-5.
26. Kobayashi M, Hellman BM, Fililisti LP: Amer J Obst Gyn 1969; 1131-40.
27. Kratochwil A, Urban G, Freidrich F : Ann Chir Gynecol Fenn 1972; 61: 211-14.
28. Kilman L, Rame Rm, Fortune DW. Low malignant potential tumors of the ovary as today of 76 cases Obstet Gynecol 1986 : 68, 338-344.
29. Kapoor R. Mital K.P., Padibidri V. Saha M. Madan Ultrasonographic appearances of Benign Ovarian masses. IJRT, 44 : 3, 193-196.
30. Kupfer MC, Schwimer SR, Lebavic J: Transvaginal sonographic appearance of endometriomata: spectrum of findings, J Ultrasound Med 1992; 11: 129.
31. Kurjak A, Predanic M. Now scoring system for prediction of ovarian malignancy based on transvaginal color Doppler. J Ultrasound Med 1992, 11:631-8.
32. Lawson TL, Albarelli JN : Amer J Radiology 1977; 128: 1003-6.
33. Lerner JP, Timor tritsch IE, Federman A, Abramovich G, Transvaginal ultrasonographic characterization of ovarian masses with an improved, weighted scoring system Amj. Obstet. Gyn. 1994; 170 : 170-81.
34. Luxman D, Bergman A, Sagi J, David MP. The post menopausal adnexal mass correlation between ultrasonic & pathologic findings Obstet Gynecol 1991; 77:726-8.
35. Laing FC, Daisen VF, Maeks Wm, Barton JL : Dermoid Cysts of ovary their ultrasonographic appearances, Obst. & Agynae. 1981; 57: 99-104.
36. Manivasakan J, Arounassalame B.A study of benign adnexal masses: Int J Reprod Contracept Obstet Gynecol. 2012 Dec;1(1):12-16
37. Meredith SM, Sanchez-Ramos L, Kaunitz AM. Diagnostic accuracy of transvaginal sonography for the diagnosis of adenomyosis: systematic review and metaanalysis: Am J Obstet Gynecol. 2009 Jul;201(1):107.e1-6. doi: 10.1016/j.ajog.2009.03.021. Epub 2009 Apr 26. Review.
38. Mohony BS, Filly RA, Nyberg MD et al: sonographic evaluation of ectopic pregnancy : J Ultrasound Med 1985; 4: 221-8.
39. Munn CS, Kisser LC, Wetzner SM et al : Ovary volume in young and premenopausal adults US determination, Amer J Radiology 1986; 144: 415.
40. Maklad NF, Wright CH : Gray scale ultrasonography in the diagnosis fo ectopic pregnancy, Radiol. 126: 221 – 225, Jan- 1978.
41. Morley P, Barnett E : The use of ultrasound in the diagnosis of pelvic masses. Br. J. Radil, 43: 602-616, Sept. 1970.
42. Mendelson EB, Bohm-Velez M, Joseph N, Neiman HL. Radiology 1988 Feb; 166(2):321-4.
43. O'Brien WF, Buck DR, Nash JD: Amer J Obst Gyn 1984; 149: 598.
44. O'Dowd MJ : Contempt Reviews in Obst Gyn 1990; 2:47.
45. Okai J., Kagawa. H., Masude. H., Kosuma Mizuno. : Assessment of ovarian tumors by transvaginal scanning and clinical significance of ultrasonic examination in post operative follow up; Rinsho Byori, 1992, April : 40(4) :363-8.
46. Padilla LA, Radosevich DM, Milad MP. Accuracy of the pelvic examination in detecting adnexal masses. Obstet Gynecol. 2000; 96: 593–598.
47. Pardo J., Kaplan, B., Rozenberg. C., Ovadia. Y., Neri. A.: A modified transvaginal sonographic technique for better ovarian evaluation; J clinical ultrasound, 1993 Oct. 21(8); 503-5.
48. Patel MD, Acord DL, Young SW. Likelihood ratio of sonographic findings in discriminating hydrosalpinx from other adnexal masses. Am J Roentgenol. 2006; 186: 1033–1038.
49. Pourissa M, Refahi S, Moghangard F. The Diagnostic Accuracy of Abdominal Ultrasound Imaging for Detection of Ovarian Masses: Iran. J. Radiol., Winter 2007, 4(2) 103
50. Quinn SF, Erickson S, Blach WC: Cystic ovarian teratomas: the sonographic appearance of the dermoid plug. Radiology 1985; 155:477-478.
51. Qureshi IA, Ullah H, Akram MH, Ashfaq S, Nayyar S. Transvaginal versus transabdominal sonography in the evaluation of pelvic pathology. J Coll Physicians Surg Pak. 2004 Jul;14(7):390-3.
52. Rottem S, Levit N, Thaler I: Classification of ovarian lesions by high frequency transvaginal sonography J Clin Ultrasound 1990; 18: 359-63.
53. Rajan R, Rajan V: Endovaginal sonography in infertility Gynaecology and Obstetric 2nd edition, 199121
54. Rajan R: Endovaginal sonography in infertility post graduate reproductive endocrinology, 3rd edition, 1992;628
55. Rajan R: Changing concepts in Gynaecological diagnosis. Editorial. J Obstet Gynecol India, 43 Aug. 1993.
56. Showkat MS, Nabi S, Khondker L, Bhowmik B, Tushar SN, Jahan MU. Role of transvaginal sonography in the detection of endometrial carcinoma: Bangladesh Med Res Coun Bull. 2013 Aug;39(2):80-5.
57. Subramanyam BR, Raghabendra BN, Walun CA: J Ultrasound Med 1984; 3: 391-3.
58. Sengoku K, Satosh-T, Saitosh S, Abe M, Ishikawa M. Evaluation of transvaginal Color Doppler sonography. TVS & CA 125 for prediction of ovarian malignancy: International Journal of Gyn & Obs, 1994 jul; 46(1) :39-43.
59. Sladkevics. P, Valentin L, Marshal K.: Transvaginal Doppler examination for differential Diagnosis of solid pelvic tumors, journal of ultrasound in MED, 1995, May;14(5):377-80
60. Sassone M, Timor-Tritsch IE, Astner A, West Hoff C, Warren WB. Transvaginal sonographic characterization of ovarian disease evaluation of a new scoring system of predict ovarian malignancy. Obstet Gynaecol 1991; 78: 70-6.
61. Savelli L, Ghi T, De laco P, et al. Paraovarian/paratubal cysts: comparison of transvaginalsonographic and pathological findings to establish diagnostic criteria: Ultrasound Obstet Gynecol. 2006; 28: 330–334.
62. Swanson M, Sauerbrei EE, Cooperberg PL: Medical implication of ultrasonically detected polycystic ovaries. JCU 1981; 9: 219-222.
63. Voss SC, Lacey CG, Pupkin M et al : J Repr Medicine 1983; 28: 233-7.
64. vanNagell JR Jr, DePriest PD, Ueland FR, et al.. Ovarian cancer screening with annual transvaginalsonography: findings of 25,000 women screened. Cancer. 2007; 109: 1887–1896.
65. Tessler, et al : TVS in Adnexal masses AJR : 153, 1989.
66. Timor-Tritsch IE, Rottern S, Levitt N: The fallopian tubes, P. 131-144. In Transvaginal Sonography. End Ed. Timor-Tritsch IE, Roettem S (Eds): chapman & Hall, New York, 1991.
67. vanNagell JR, DePriest PD. Management of adnexal masses in postmenopausal women: Am J Obstet Gynecol. 2005; 193: 30–35.
68. Verit FF, Pehlivan M. Transvag nat Ultrasound And Computed Tomography Comb ned W th Ca-125 Determ nat ons In Preoperat ve Evaluat on Of Ovar an Masses In Premenopausal Women: Harran University Faculty of Medicine 2007; 4 (2) :50-54.
69. Von Micsky Ll.: Ultasonic tomography in Obstetrics and Gynaecology. In Grossman CC, Holmer JH, Joyner C, Purnek E: Diagnostic Ultrasound. New York. Plenum Press 1966, P348-368.
70. Walsh JW, Rosenfield AT, Jaffe CC et al; Radiology 1978; 131 : 955-60.
71. Walsh JW, Taylor KJW, Wasson JFM et al: Radiology 1979 ; 130: 391-7.
72. Wade RV, Smythe AR, Watt GW: Amer J Obstet Gynec 1985; 153: 86.
73. Williams AG, Mettler FA, Wicks JD. Cystic and Solid ovarian neoplasm. Semin Ultrasound 1983;4:166.
74. Woodward PJ, Sohaey R, Mezzetti TP Jr. Endometriosis: radiologic-pathologic correlation. Radiographics. 2001; 21: 193–216.