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Comparative Study of Uterine Adnexal Mass by Transabdominal And Transvaginal Ultrasonography

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I. Introduction

In our country poor living condition, social taboo and child marriage have resulted in increased incidence of diseases related to genitourinary system. Of these, adnexal mass forms a large proportion.The first major application of ultrasound was done in 1912 to search for Titanic. First ultrasonic generator was made in France in 1917. In 1950 first clinical use was done by Howry et al when he scanned the abdomen with subject immersed in water. In 1950 Ludwig & struthers used it to detect foreign body & gallstone. In 1956 Mudt & Hughes used Ophthalmic by A Scan. Together with Mac Vicar & Brown, Ian Donald of Glasgow developed the first 2-D contrast scanner in 1958. Kossof of Australia described the modern high resolution gray scale technique in 1972.

The first stage of Transvaginal Sonography (TVS) was the A-mode technique. First it was used by kratochwl (in 1969). The major breakthrough in TVS came in 1984-85 with the development of modern vaginal sector scanner. Since the advent of ultrasound, it has been applied to the imaging of pelvic organs, but the success was moderate. So, whereas ultrasound improved obstetrical management dramatically it merely added to the diagnostic armamentarium for the gynaecological patients. Early diagnosis of adnexal mass is essential to reduce morbidity. However, with the advent of modern scanner with high resolution & TVS, things have taken a better turn. Beginning with humble origin, TVS has now become an indispensible tool for gynaecological imaging. The fine details provided by TVS about the anatomy and pathology of pelvic viscera is unparalled by any other imaging modality.

Conventionally, Transabdominal ultrasonography (TAS) of female pelvis is performed. But, inadequate depth of penetration of ultrasound waves resulting in poor image quality of deep pelvis structures, need for full ladder & obesity limit its use. TVS overcomes some of the limitations of conventional TAS. The central placement of the pelvic structures especially in obese patients is a problem. Since the tranvaginal probe is placed in close proximity to the pelvic structures higher frequency ultrasound can be utilized which can improve morphologic details of pelvic structures with better resolntion (Frederick et al 1991).

However there are certain distinct advantages of TAS – larger field of vision, ability to image deeper structures better, simultaneous evaluation of other abdominal organs. TVS can not be used in virgins, children & elderly woman with narrow introitus. Thus it can be safely concluded that TAS & TVS are not competiting, but supplementary to each other

Other methods of imaging the adnexal region are Doppler, CT scan & MRI. Doppler sonography can determine pualitative and quantitative features of blood flow in the pelvic vessels. CT of the pelvis is unsuitable as a routine diagnostic measure for primary assessment of gynaecologic problems. It can be used for preoperative staging, diagnosis of local recurrence, monitoring, follow up in all gynaecological neoplasms & planning radio therapy in malignant neoplanms (Hall 1994). MRI is becoming the primary modality for evaluating gynaecological malignancy (Hricak 1983). The multiplanar imaging capability, excellent soft tissue contrast & large field of vision offer distinct advantages over USG & CT in the assessment of adnexal pathology.

II. Aims & Objectives

I) Evaluation of adnexal mass by transabdominal & tranavabjnal sonography.
II) Detection of specific sonomorphologic features which are better detected by TVS than TAS.
III) Determination of the usefulness of USG in the detection & specific diagnosis of adnexal masses in the study group.
IV) Identification of cases in which TVS yielded more, epual or less information than TAS & hence detection of cases in Which TVS provided diagnostic, contributory or worse information.
V) Evaluation of specificity & sensitivity of TAS & TVS.

III. Materials & Methods

The present study was undertaken in the Radiology Department of R.G.Kar Medical College in collaboration with the Gynaecology & Obstetrics department .

Materials:

a) Patients – The patients referred from G&O dept & diagnosed sonologically to be suffereing from adnexal mass were included in this study.
b) Machine – The machine used in this study included secter probe of 3.5 MHZ, 5MHZ. A multifocal automatic camera was used for taking picture. Transvaginal Scans were performed using 7.5 MHZ TVS probe.

Methods:

The patients who were clinically snspected of having an adnexal mass constituted the study group. All these patients were referred from G&O dept- both Indoor & Outdoor section. They were examined in the following way:

i) History & Clinical examination
ii) Transabdominal sonography
iii) Transvaginal sonography
iv) The patients were followed up, their FNAC and/or operative findings were collected and compared with the previous findings and diagnosis.
v) Rescan, whenever passible to reassess the sonological findings with final diagnosis.

TAS was performed on all the patients. In addition, TVS was done in a subset of patients in whom the mass was predominantly pelvic in location.

All TAS scans were performed using full bladeer as an acoustic window for opimum visualisation of pelvic ciscera. Adequate amount of coupling gel was applied to the skin surface. Scanning was done in longitudinal, transverse and oblique axes.

After completion of TAS, the procedure of TVS was briefly explained to the patient and verbal consent was obtained. Prior to the examination patient was asked to empty her bladder. Scanning was performed in the lithotomy position with the patient supine, her thighs abducted and knees flexed. The probe was covered with a condom containing small amount of gel. Additional gel was placed on the outside of the sheathed tip. In patients with complaint of infertility, water or saline was used instead of gel as the latter has spermicidal action (Timor-Trish 1994). Once the transducer was positioned in the vagina it was manipulated to obtain the appropriate image of uterus, ovaries, parametrium and pelvic side walls. Three basic maneuvers are possible which are :

1. Advancement or withdrawal of the transducer along the axis of the vagina.
2. Angling the transducer tip from side to side or anterior to posterior.
3. Rotating the transducer along its long axis.

When the transducer was inserted, the cervix and lower uterine segment were visualized initially. The probe was advanced cephaled until the uterine fundus came into view. The transducer was then oriented to obtain a long axis view of the uterus containing the endometrium. Side to side movement of the probe was done to visualise other areas of the uterus. Then the probe was angulated laterally to bring into focus. The ovaries and adnexae are evaluated in both long axis and short axis views. In case of anteriorly or highly placed ovaries, compression was applied to the lower abdomen in order to bring them within the range of ultrasound beam. To image the cul-de-sac, a steep posteror angulation of the probe was necessary. The lower uterine segment, the retroverted uterine fundus and the remaining pelvic could be evaluated only in near coronal and near sagittal planes due to the orientation of these viscera to the vaginal fornix. True transverse image could only be obtained in the anteverted uterine fundus (Lamde et al 1988). When real time scanning was performed, simultaneous pressure was applied to the pelvic organ under study both with the ultrasound probe and transabdominally with the sonographer's free hand in order to assess the presence of pelvic adhesions. En bloc motion of contiguous viscera, rather than independent motion of the uterus, ovaries and oviducts or fixation of bowel loops were considered a sign indicative of pelvic adhesions (Lande et al 1988).

After detection of a mass by sonography, first of all, attempt was made to determine whether it is ovarian or extraovarian in location. Size of the mass was noted (Maximum of the 3 dimensions was considered for reporting the Size). If the size was less than 10cm, TVS was performed in addition. The ovarian masses thus detected were initially grouped as cystic, complex of solid depending on their sonographic appearance. Following criteria were used (Luxman 1991).

Cystic: Anechoic or with diffuse low level internal echoes without mural nodules, solid parts or septations.
Complex: Mixed echogenecity with presence of mural nodules or septations or irregular solid parts.
Solid: Predominantly solid in echogenecity.

In case of a cystic or complex mass, presence or absence of internal echoes, thin septations (<3mm), thick septations (> 3mm), mural modules, daughter cysts, irregular solid areas were noted. In a predominantly solid lesion, it was noted whether it showed homogeneous or heterogeneous echopattern. The sonographic criteria for diagnosing different ovarian masses were adopted from Fried (1985) and Rottem et al (1990). Malignant pattern was suggested in the presence of thick septae, irregular solid parts, mural nodulations ascites

and bowel adhesions. Benign pattern was suggested when the mass was unilocular / multilocular with thin septa, few or no internal eshoes and no mural modules. Abdominal ultrasound was done to detect secondaries, ascites, hydronephorosis, bowel adhesions or any other significant finding. In the cases in which TVS was also done, the type of extra information available if any, was noted. The proportion of cases in which TVS provided more, equal or less information were recorded. The cases in which TVS could provided unique diagnostic information or contributory information were also noted. Unique diagnostic information was defined as the information obtained by TVS which provided a specific diagnosis not suggested on TAS. Contributory information was defined as the extra information provided by TVS which confirmed a diagnosis already suggested by TAS.

Considering all the findings, the sonographic opinion was stated regarding the origin and specific diagnosis of a mass the whether it appeared benign or malignant. Detection of solid ovarian masses was considered to be correct if the soild echopattern and benign or malignant nature were correctly predicted by USG.

The final diagnosis was established in some patient by surgery and histopathology. In the rest, clinical and USG follow up or HSG provided the final diagnosis. Follow up study was done at an interval of 6-8 wks. especially to detect nonneoplastic functional cysts which showed regression during this time interval unlike neoplastic masses. The true negative and false positive cases were excluded from further analysis.

In all the cases, U.S.G. diagnosis was correlated with the final diagnosis to infer the accuracy, sensitivity and specificity of the present study. Role of TVS was evaluated and its advantages if any, over TAS were also assessed.

IV. Anatomy And Pathology

The adnexa comsists of fallopian tube ovary, broad ligament & mesovarium. Fallopian tube – There are two fallopian tubes. Each tube ranges from 7 -12cm in length, runs laterally from the uterus. The normal fallopian tube is difficult to identify by TAS or TVS unless it is surrounded by fluid. The normal fallopian tube is an undulating echoginic structure of approximately 8 -10mn in width, lie within the cul-de-sac near the ovary. Developmental abnormality is rare.

Ovary – Ellipsoid structure with the long axis oriented vertically when the bladder is empty, appears as oval highly echogenic mass typically containing few anechoic areas penipherally – the follicles. In nulliparous women, oraries are situated in the ovarian fossa bounded by the obliterated unbilical artery anteriorly, the ureter & internal ilical artery posteriorly & the external iliac vein superiorly.Typical location is between the uterus & pelvic side wall. It may be displaced in cul-de-sac, upper pelvis or adjacent to the uterus.Size varies on age, menstrual status, pregnancy status. Mean ovarian volume (length x breadth x width x 0.5) is $9.8cm^3$, $3.0cm^3$ x $5.8m^3$ in menstruating, prepubertal & postmenopausal women respectively (Holt et al 1994)

On TVS, ovaries can be identified by trypical location & multiple peripheral follicles. 1-2mn size follicles can be discretely seen.On TVS, ovary is seen separated from the surrounding organs by a light echo stripe corresponding to the fibrous tumica albugenia. It allows an exact measurement of size.In postmenopausal woman the atrophic, ovaries are difficult to see even by TVS. Localization may be difficult with TVS with extreme lateral or anterior location of the ovaries or after hysterectomy. Application of pressure on the anterior abdominal wall improves visualization.

Shortly after ovulation, corpus luteum can be seen which characteristically appears as a cystic mass with a highly echogenic portion. Multiple septae or numerous components of different echogenicity. It is best seen on TVS.Laterally, the peritoneal reflection forms the borad ligament which extended from the lateral aspect of the uterus to the lateral pelvic side walls.The ovarian artery arises from the aorta laterally, slightly inferior to the renal arteries. The ovarian veins leave the ovarian hilum form a plexus of veins in the broad ligament.The lymph vessels of ovary accompany the ovarian artery to the lateral aortic and periaortic lymph nodes.

Sonopathology of different adnexal masses:

a) Endometrioma (Chocolate cyst)

- Variable in size with diffuse low level internal echoes or septations & enhanced through transmission of sound.
- Variability of echopattern is due to various stages of hemorrhage.
- It may resemble acute haemorrhagic cyst but the latter presents with acute pelvic pain, resolve or decrease in size on follow up & shows reticular pattern & heamatocrit effect more commonly. Endometrioma presents with more chronic pain & dose not show regression on follow up (Grant 1992).
- Diffuse low level internal echoes are best evaluated by TVS. These echoes show movement with gentle ballotment .

b) Dermoid

- Highly reflective solid adnexal mass.

- Cystic with solid echopaltern similar in appearonce to uterus or pedunculated fibroid.
- Cystic mass with scattered echoes located only in the dependent portion or distributed diffusely throughout the mass.
- Entirely echofree or cystie appearance with shaggy, irregular wall
- Solid mass with a cystic component within
- Hair fluid or fat fluid level which may show changes with patient position.
- Dermoid plug sign – produced by hyperechoic rounded areas within a hypoechoic mass also known as Rokitans ky protuberance.
- Target bull's eye sign – produced by a hyperechonic centre and a hypoechoic rim.
- Tip of the iceberg sign – hair floating on sebum is strongly reflective which obscures the deeper tissues.

c) Cystadenoma

- Large smooth walled cyst, sometimes loculated with criss-cross pattern of internal septations.
- May be totally cystic without internal echoes or septation.
- Mucinous cystadenoma may show fine diffuse low level internal echoes with layering.
- Serous type is typically large, thin walled cystic masses occasionally containing septae & few internal echoes.
- Pseudomyxoma peritonei can occur with intraperitoneal spread of the mucinons variety.
- Due to large size these tumours are best evaluated by TAS.

d) Pelvic inflammatory diseases

- Endometritis – endometrial thickening or fluid
- PUS in cul-de-sac – particulate fluid
- Periovarian inflammation – enlarged ovaries with multiple cysts & indistinct margins.
- Pyosalpinx or hydrosalpinx – fluid filled fallopian tube with or without internal echoes.
- Tubo – ovarian complex – Fusion of the inflammed, dilated tube and ovary.
- Tubo ovarian abscess – Complex multiloculated mass with variable septations, irregular margins and scattered internal echoes.

e) Ectopic pregnancy

- Specific feature – Live embryo in the adnexa
- Non-specific features (correlate with B-HCG): empty uterus, pseudogestational sac of ectopic pregnancy, particulate ascites, adnexal mass, ectopic tubal ring.
- Non-supportive features – Live intrauterine pregnancy, intradecidual sign & double decidual sing of early uterine pregnancy, peritrophoblastic blood flow.

f) Follicular and corpus luteal cysts

- Smoothly outlined, well difined thin walled with a characteristic "empty look" on the screen (Morley and Barnett 1970)
- Spontaneous regression occurs within 6-8 wks. Corpus luteal cysts may appear more complex than follicular cysts due to haemorrhage (Hall 1983).
- Corpus luteal cysts are larger (5-10m) and have thicker walls than follicular cysts which may reach 4cm in size. (Fried 1985).
- Usually unilateral with single chamber. On TVS, wall is seen as homogeneous echodense structure of consistent thickness.
- Differentiation of follicular and corpus luteal cysts is very difficult and sometimes impossible purely on the basis of ultrasound image.
- On TVS, intraovarian location of cyst can be identified by displacement of ovarian parenchyma forming a "back" of normal ovarian tissue around the cyst. (Fleischer 1991).

G) Haemorrhagic cysts

- Characteristically, most of them show increased through transmission.
- Extremely variable in appearance however, the commonest form is that of a heterogeneous mass with thick rim, septae, variable internal echoes and cul-de-sac fluid (Baltarowich et al 1987).
- "Octopus'' like appearance can be seen where the centre is occupied
  by blood clot with some highly echogenic branches ramifying form it into the cyst fluid. (Rottem et al 1990).
- If ruptured, can produce haemoperitoneum (Coleman 1992).

- Echogenic lines of vrying chickness which show multilayering with different configuration (Sabbagha et al 1994).
- Haematocrit effect.

H) Theca lutein cysts
- Large cysts, usually bilateral showing spontaneous regression.
- Multiple thin septations are characteristic (Rosenberg and Trought 1981, fried 1985).
- Associated with molar pregnancies, twins and high HCG level states.

I) Cystadenocarcinomas
- Thickened irregular areas projecting into the lumen from the cyst wall, irregularly thickened septae within the cyst (Morley and Barnett 1970).
- Serous variety is predominantly cystic but containing complex or solid areas with fixatin and thickening of wall.
- Mucinous variety show more complex echopattern and greater wall irregularity with fixation to the pelvic side walls.
- Ascits commonly associated (Williams et al 1983).

J) Ovarian fibroma
- Predominantly solid with areas of haemorrhage and necrosis. Resembles uterine fibroid (Williams 1983).
- Attenuate sound beam markedly (Fried 1985).
- Triad of solid ovarian tumor, ascites and pleural effusin is known as Meig's syndrome. The fourth characteristic is cure of the condition by removal of the tumor (Morley and Barnett 1985).

K) Endometrioid carcinoma
- Typically cystic with papillary projections.
- Most of them are malignant. In one third cases, both ovaries involved.
- May be completely solid with few areas of haemorrhage and necrosis (Williams 1983).

L) Dysgerminoma
- Ovarian counterpart of seminoma of the testis.
- Predominantly solid and echogenic with few eystic areas (Williams 1983).
- All of them are considered to be malignant and highly radiosensitive (Morley and Barnett 1985)

M) Ovarian metastases
- Usually bilateral. If unilateral, more on right side.
- Mostly solid or complex in echogenecity.
- Frequently fixed and cannot be differentiated from primary ovarian tumours by ultrasound (Morley and Barnett 1985).

N) Endodermal sinus tumor
- Highly malignant and can develop in associatin with a teratoma, dermoid cyst or choriocarcinoma.
- Young women mostly affectd.
- Recurrence accurs within few months of excision (Morley and Barnett 1985).

O) Clear cell (Mesonephroid) tumors
- Cellular strucure resembles clear cell carcinoma of the kidney.
- Predominantly solid or eystic, occasionally bilateral.
- May be benign, broderline or malignant (Morley and Barnett 1985).

P) Granulosa – Theca _ Luteal cell tumors
- Usually solid and unilateral.
- Vary largely in size.
- Show homogeneous echopattern, similar to uterine fibroid. (Morley and Barnett 1985).

V. Review Of Literature

Meire et al (1978) had scanned 255 patients referred with clinical diagnosis of pelvic mass to diastinguish benign from malignant ovarian mass. The ultrasonic images were reviewed & the following criteria noted.

i) Size of lesion
ii) Unilocular or multilocular
iii) Thick septa (>3 mm)
iv) Solid nodule
v) Invasin of capsule
vi) Fixation of mass

Using these criteria, correct diagnosis was sehivehieved in 63 out of 69 patients (91%).

Alpern et al (1984) reported sonographic features of 11 parovarian cysts-

Average size was 6.4 cm. There was no specific feature of parovarian cyst. Failure of these cysts to regress with time or hormonal therapy suggests their presence. They concluded that parovarian cyst & its complication should be included in the differential diagnosis of cystic adnexal mass.

Coleman et al (1988) compared TVS & TAS in a prospective study regarding their usefullness in patients with suspected obstetric & gynaecologic disorders. In 230 examinations (126 pelvic, 104 pregnancy) of 215 patients ranging in age from 14-80 years. The TA approach was supplemented by TV scanning. TV scans were classified according 2 whether they provided new information not available on TA scans or provided worse image quality or less information than TA scams. Unique diagnostic information was provided by TV scans in 138 (60%) examinations (77 pelvic, 61 pregnancy), The superior quality of the TV images in 51 (22%) examinations (23 pelvic, 28 pregnancy) increased the diagnostic confidence of the examiner. 36 (16%) TV examinations (21 pelvic, 15 pregnancy) had the same information & clarity on the TA scans. 5 (2%) TV examination (all pelvic) gave lass information & were of poor quality than the TA studies. Statistical analysis showed TV scanning to be significantly better in visnalization of the ovaries in patients with leiomoiomas ($p<0.005$). The ability of TV Scanning to display detailed internal anatomoi of the ovaries is a distinct advantage. The precise location, size and echo texture of the ovaries can be determined & high resolution images of ovarian, tubal & cul-de-sac masses could be obtained by TVS.

Leibman et al (1988) conducted aretrospective study in which they compared TVS with TAS in 67 women with palpable pelvic masses. The diagnosis included ovarian cyst (27), endometrioma (12), complex cyst (4), dermoid (3), infection (3), ovarian malignancy (2) & uterine fibroid (3). Final diagnosis was made surgically in 41 patients (61%) and by a combination of sonographic & clinical correlation in the remaining patients. TVS provided more information about the internal architecture of the mass than TAS in 51(76%) of patients. TAS did not provide more diagnostic information in any of the patients examined. 6 simple cysts & 4 complex pelvic masses were identified solely on TVS.

Mendelson (1988) reviewed the sonographic findings in 200 patients who underwent concurrent TAS & TVS examination. The two techniques were compared for image quality, was better in 79% - 87% of scans. TAS image quality was better in 3% - 5% scans. Both techniques were equally good in 10% - 18% of cases regarding image quality. The techniques provided equivalent diagnostic information in 60% - 89% of cases. They found TVS to be particularly helpful in excluding ectopic pregnancy.

Lande et al (1988) studied the role of TVS in comparison to TAS for the evaluation of adnexal & cul-de-sac masses. 67 patients selectively chosen from 354 undergoing conventional TAS for evaluation of suspected adnexal mass underwent TVS either because TAS were technically suboptimal or for better characterization. TVS added diagnostically useful information in 25 out of 28 patients with adnexal cysts , 8 of 12 patients with tuboovarian abscess & non- specific adnexal masses seen on TAS were diagnosed as pyosalpinx on TVS. In all 7 patients with cel-de-sac diseases, TVS added diagnostically important information. Diagnosis of tubal pregnancy & pelvic adhesions was better with TVS.

Fleischer (1991) compared the role of TAS & TVS in the evaluation of ovarian masses. Accrding to him, TVS provided detailed imaging of the normal ovary & masses that were confined to the true pelvis. However, masses over 10 cm in size are best evaluated by TAS. Their study showed that TVS has most likely does not have an ovarian tumour.

Luxman et al (1991) evaluated adnexal mass in 102 postmenopausal women with TAS before surgery. 29 (28%) had malignant tumours and 73 (72%) had benign tumours. 2 of the 33 patients with a simple cyst smaller than 5 cm in diameter had malignant ovarian tumours. 5 of 17 solid masses were malignant.Abdominal ultrasound as a predictor of malignancy in postmenopausal women with adnexal mass had a sensitivity of 93% but a specificity of only 42%. The positive predictive volume for malignancy was 39% & the negative predictive value 94%. If a negative sonogram had been relied upon, 6% malignant ovarian tumour in postmenopausal women might have been missed. They concluded that applying a non- laparotomi approseh in postmenopausal women with adnexal mass based on TAS not be safe.

Coleman (1992) stated that the improved resolution afforded with the higher frequency vaginal probes used in close proximity to the pelvic orgams has made TVS an integral part of evaluating the adnexa. He classified adnexal masses as cystic complex and solid. Hydrosol pinx on TVS is characterized by four distinct features- tubular shape, folded configuration, well defined echogmic wall & short, linear echoes protruding into

the lumen. Among the complex adnexal masses, ovarian remnant syndrome is a rare entity in which a complex appearing functional cyst is produced in a patient with bilatenal oophorectomy.

Sabbagha et al (1994) discussed the sonographic evaluation of the adnexae using both TAS & TVS because ovarian and adnexal pathology is best delineated by this combined approach. A large ovarian mass cannot be fully visualized by TVS as part of it will fall outside the fotal length of probe. TAS allows for global visualization of any large mass. Conversely, the internal characteristic of an ovarian mass can only be clearly appreciated by TVS.Endometriomas are best appreciated on TVS showing internal homogenous low level echoes with acoustic with enhancement & smooth walls. Haemorrhagic corpus luteal cyst characteristically shows echogenic linesof varying density which show multilayering with different configurations. Serous cystadenomas are homogeneously cystic whereas the mucin in mucinous cystadenonas reflect "soft or hazy" echodensity. As these tumour are large, they are imaged best by TAS.

Barloon et al (1996) retrospectively studied the TAS & TVS findings in 15 patients consecutively diagnosed of having praovarian (10 cases) or paratubal cysts (5 cases) by surgical pathology. In only the 1 of 15 patients was a paraovarian or paratubal cysts suggested before surgery. Paraovarian cysts were misdiagnosed as ovarian cysts. They concluded that paraovarian or paratubal cysts are difficult to diagnose before surgery with the use of TAS & even TVS. When there is close proximity of a paraovarian cysts to the ovary an ovarian cystic mass cannot be reliably differentiated from a paraoravian cyst.

Criteria of differentiation between benign & malignant ovarian masses

Ovarian malignancy ranks third in occurrence among all gynaecological cancers but is the leading one to cause death . So, once an ovarian mass is detected, it is of utmost importance to know about its nature . Ultrasound can be extremely helpful for this purpose. Llawson and Albarelli (1977) were of the opinion that presence of ascites along with an ovarian mass highly suggests that the mass is malignant.According to Meire et al (1978) benign lesions are unilocular or multilocular with thin septa and no nodules. Malignant lesions are multilocular with thin septa and nodules or multilocular with thick septa; with or without nodules. Walsh et al (1979) reported that hydronephrosis is a veary valuable sign of malignancy.

Rosenberg and Trought (1981) were of the opinion that margins of benign lesions appear clear and sharp whereas indistinct margins are suggestive of malignancy. They did not find thickness of septa much helpful in differentiating between a binign and malignant mass.Thick septa, complex internal structure, irregular solid parts, indefinite margins, ascites and matter bowel loops were regarded as malignant pattern by Morley and Barnett (1970, 1985) Fried (1985), Rottem et al (1990), Granberg et al (1990).Finkler et al (1988) used a new ultrasound scoring system for characterisation of ovarian masses considering the echogenic pattern, characteristics of the borders, presence of secpa, nodules and ascites. Score of I denoted a benign mass (simple cyst). Score of 2-3 stood fer endometriosis/dermoisd. Score of 4-6 was equivocal for malignancy, score of 7-9 was considered to be probably malignant and score of 10 was labelled as malignant.

However, in general, prediction of benign and malignant nature of a mass according to its sonographic appearance is only moderately reliable. This determination is still in the domain of gynaecologic surgeon and pathologist (Fleischer et al 1985).According to Granberg et al (1990) it is difficult to differentiate between a benign and malignant mass especially in case of complex masses. Even by vaginal ultrasound with excellent imaging, many a time it is difficult to exclude malignancy except for unilocular cystic tumors. The clinical details should be well known to the sinologist and the ultrasound diagnosis must be correlated with it.

Sassone et al (1991) developed a scoring system to characterise ovarian masses using TVS. The variable considered were inner wall structure, wall thickness, sbepta and echogenecity. A score of 9 or more was considered to be malignant. Tumor-tritsch et al (1993) were of the opinion that colour doppler flow measurements along with a scoring system based on TVS can be very helpful to differentiate between benign and malignant mass. Less (1994) laid down the following criteria to differentiate between benign & malignant – ovarian tumors.

	Benign	**Malignant**
Size	<10cm	>10cm
wall	smooth	irregular, poorly defined
cyst	unilocular	complex with solid component
debris	No	Yes
	Mass effect	Ascites
		metastatic node
Mobility	Yes	fixed to pelvic said wall or omentum

Lerner et al (1994) developed a modified scorings system to differentiate between benign & malignant masses based on wall structure, shadowing, septar & echogericity. Scoring of 1.8, 3.9 & 5.6 were attributed to

benign masses, masses with low malignant potential & malignant masses respectively according to them complex & solid masses had greatin risk of malignancy.

TVS has rapidly developed from an interesting adjunct to an indispensable technique in the evalution of female pelvis.

TVS – advantages :

i) Full blodder is not required
ii) High frequency transducer can be placed close to the region of interest permitting display of detailed internal anatomy of the ovaries with excellently high resolution images of ovarian and other adnexal masses.
iii) Provides valuable information regarding the masses confined to true pelvis & less than 10cm in size. TVS has significant negative predictive value in detecting ovarian mass.
iv) Diagnostic images can be obtained in the presence of obesity, bowel adhesion, bowel gas & retroverted uterus. Not possible with TAS.
v) Simple & noninvasive process for preoperative evaluation of ovarian tumor.

Limitations

i) Global overview of pelvic anatomy not possible.
ii) Lesion outside the short range of transvaginal probe may be missed.
iii) Masses located in the false pelvis or those exceeding 10cm in size can not be fully imaged.
iv) Con not be used in virgins and elderly patients.
v) Confusion with anatomic orientation.
vi) Abdominal metastasis, hydronephrosis cannot be imaged.

TAS – advantages :

i) Panoramic view of the pelvic anatomy can be obtained.
ii) Abdominal metastasis, hydronephrosis can be imaged
iii) Larger mass can be evaluated
iv) Can be used in all age groups.

Combined approach:

TVS & TAS have their own advantages & disadvantages. TAS is essential for imaging of larger masses & ancilliary findings e.g. abdominal metastasis, hydronephrosis". But conversely, the internal characteristics of an ovarian mass can only be appreciated by TVS. But TVS, if used alone, may miss many findings in cases of large abnormalities, distorted anatomy & anomaly further away from TV probe. So TAS should be performed first, followed by TVS in a case of suspected ovarian mass. TVS is best used as an adjunct to TAS (Lande et al 1988, Fleischer 1991, Coleman 1992).

VI. Observations

The present study was conducted on 55 patients clinically suspected of having an adnexal mass in order to asses the role of TAS & TVS.

Total no of patients referred – 50
Total no of adnexal masses found – 50
Total no of adnexal masses evaluated by TAS & TVS – 50
Total no of patients having adnexal mass – 48

Table – I Distribution of the finally diagnosed ovarian massesAccording to various age groups.

Age group	Total mass
20 – 30yrs	20 (40%)
31 – 40 yrs	25 (50%)
41 – 50 yrs	15 (30%)

Table I shows maximum adnexal mass in "31 – 40" yrs age group.

Table – II Efficiency of ultrasound in detecting the presence of an adnexal mass

adnexal mass lesion	Final diagnosis		Total
	+ve	**-ve**	
Sonography +ve	50	2	52
-ve	0	2	2
Total	50	4	54

Table II shows that out of the 52 positive diagnoses, 50 were true positive, 2 were false positive. Out of the 2 negative diagnoses all were true negative & there were no false negative diagnoses.

1. Positive predictive value for the presence of an adnexal mass - 96.1%
2. Negative predictive value for thee presence of an adnexal mass - 100%
3. Sensitivity for detection of an adnexal mass - 100%

Table – III Relative evaluation of TAS & TVS with regard to the amount of Information available in the assessment of an adnexal mass

Amount o information	No. of masses	%
TVS > TAS	35	70
TVS = TAS	13	26
TVS < TAS	2	4

Table no III shows that TVS provided more information that TAS in 70% of the masses, equal information in 26% &less information that TAS in 4% of the masses evaluated by both TVS & TAS.

Table – IV Distribution of the messes in which TVS yielded more informationregarding whether it was unique diagnostic information orcontribution information

Type of information	No. of masses(n = 35)
Unique diagnostic	15
Contribution	20

Note:

Unique diagnostic information masses the information by virtue of which TVS could yield a diagnosis not suggested on TAS. Contribution information masses TVS provided some more information then TAS which increased the confidence of the examiner confirmed a diagnosis already suggested by TAS

Table – V Distribution of cases in which TVS provided unique diagnostic Information Total No. 15

Type	No.	Remarks
1. Simple ovarian cyst (25)	6 (24%)	TVS showed complete echofree nature of mass
2. Endometrioma (8)	4 (50%)	TVS showed characteristic diffuse low level internal echoes
3. Cyatadenoma (5)	1 (20%)	Multiple septae seen on TVS
4. Cystadenocarcinoma (9)	4 (44.4%)	Mural nodules seen on TVS

Table V shows that urique diagnosis information was provided by TVS most commonly in cases of Endometrioma (50%) followed by cystadeno carcinomas (44.4%)

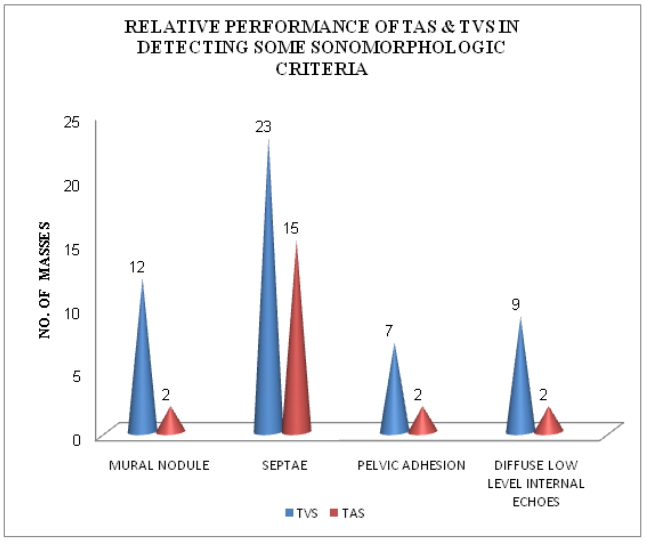


Table – VI Relative performance of TAS & TVS in detecting certain Sonomorphologic criteria in the 50 adnexal masses evaluated by both techniques

Sonomorphologic criteria	No of masses in which TVS detected it	No of masses in which TAS detected it
1. Mural nodule	12 (24%)	2 (4%)
2. Diffuse low level internal echoes	9 (18%)	2 (4%)

3. Septae	23 (46%)	15 (30%)
4. Pelvic adhesion	6 (12%)	2 (4%)

Table VI shows that mural nodule, septae, pelvic adhesions & diffuse low level internal echoes were detected in more cases by TVS then TAS.

Note: In detecting mural nodule & diffuse low level echoes TVS was significantly better than TAS ($P<0.05$).

In detecting septae & pelvic adhesions, performance of TVS was better but not in a significant manner ($p>0.05$).

Table – VII Frequency of occurrence of different adnexal masses (final diagnosis)

Types of Masses	No	%
1. Simple ovarian cyst	23	46
2. Haemorrahgic cyst	2	4
3. Cystadenomas	5	10
4. Cystadenocarcinoma	9	18
5. Dermoid	1	2
6. Endometrioma	8	16
7. Hydrosalpinx	2	4

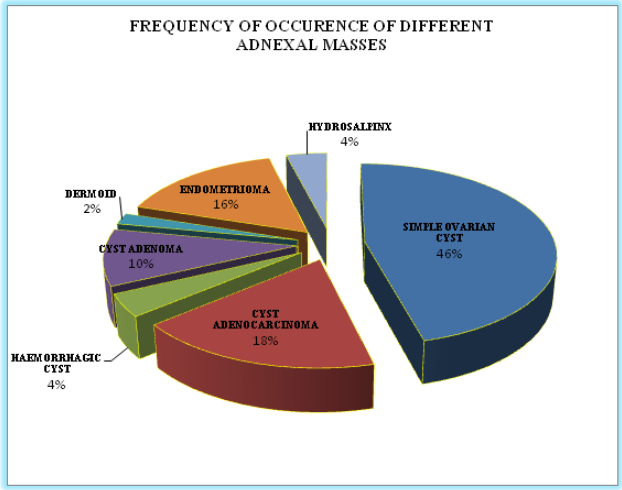


Table VII shows that simple ovarian cysts occurred most frequently (46%). The least common in our series were dermaid (2%) & hydrosalpinx (4%).

VII. Discussion

Adnexal masses have always posed diagnostic dilemmas for the clinicians. Physical examination findings are variable. Ultrasound has assumed an important position in the evaluation of adnexal masses. However the ability of ultrasound to make accurate diagnosis in the case of adnexal mass has become controversial. In the recent past with increasing experience, improvements in sonographic equipments & advent of TVS the situation has changed dramatically. In this background, present study was conducted to asses the advantages of TVS over TAS in the evaluation of adnexal masses.

4.1 Age incidence & menstrual status:

The age of the patients ranged from 20-50 yrs. Maximum i.e. 25 (50%) out of the finally diagnosed 50 adnexal masses were found in the age group of 31-40 yrs. out of the 50 finally diagnosed adnexal masses 48 of them were in the premenopasel women the rest 2 in post menopasel age.

Left Ovarian Cyst

Our findings one consistent with Disantis et al (1993) who found 13 adnexal masses out of 22 premenopausal patients and 6 adnexal masses were detectad in 37 post menopausal patients.

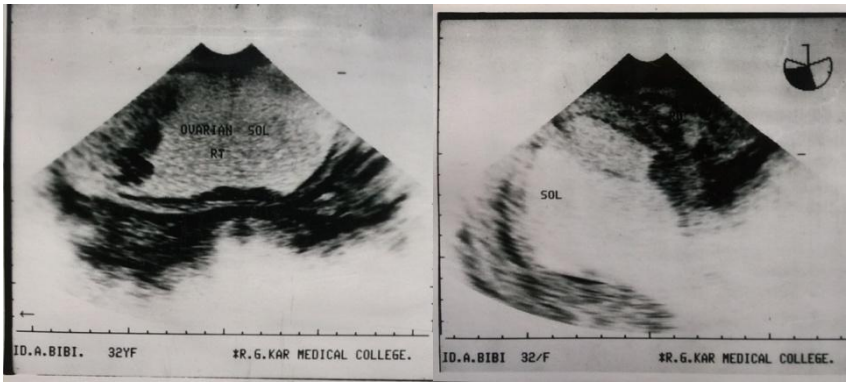
4.2 Occurence of different adnexal masses:

Among the total 50 masses finally diagnosed, 25 were ovarian cysts. Of these 20 were simple cysts & 5 were hacmorrhagic cysts. Endometrioma constituted 8 of the total masses. There were 5 cystadenomas & 9 cystadenocarcinomas. Hydrosalpinx were 2 in number. Dermoid was one in number.

Commonest adnexal mass in our series was ovarian cyst & least common was dermoid tumour. Morley & Barnett (1970), Cochrane & Thomas (1974),lawsan & Abraeli (1977) also found ovarian cysts as the most frequently occurring mass in their series.

4.3 Role of TVS in the evaluation of adnexal masses

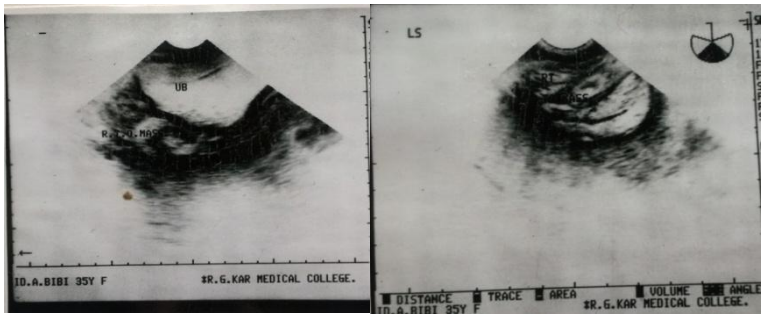
TVS was performed in 50 patients in whom mass was less then 10 cm in size. 50 masses were evaluated. In 35 masses (70%) TVS provided more information than TAS regarding site of origin & characteristic of a lesion. In 13 masses (26%) TVS & TAS provided equal information.



Right Ovarian Cyst

In 2 masses (4%) TVS imaging was poorer and it provided less information than TAS. Our study is in agreement with Leibman et al (1988) who obtained more information using TVS in 76% cases & equal information in 24% cases. In the masses where TVS provided equal information, our confidence increased & the diagnosis suggested by TAS was firmly established.More information was provided by TVS in 35 masses regarding site of origin of the mass & its internal architectural pattern e. g. presence of septae, mural nodules, diffuse low level internal echoes,pelvic adhesion etc.

Among these cases, unique diagnostic information was obtained in 15 cases (30%) which comprised of 6 ovarian simple cysts, 4 chocolate cysts, 4 cystadenocarcinomas & cystadenoma. 4 of the simple cysts appeared as hypoechoic lesions with diffuse internal echoes on TAS. TVS showed complete ancehogenicity of the masses . Exact location of the other 2 cysts was unclear on TAS. On TVS, “beak”sign was seen in both the masses suggesting their intraovarian location. In the 4 chocolate cysts, TVS demonstrated characteristic diffuse low level internal echoes which was missed on TAS. 4 cystadenocarcinomas could be detected only by TVS since they showed small irregular mural nodules & local thickening of septae on TVS but not on TAS. If only TAS was done, we

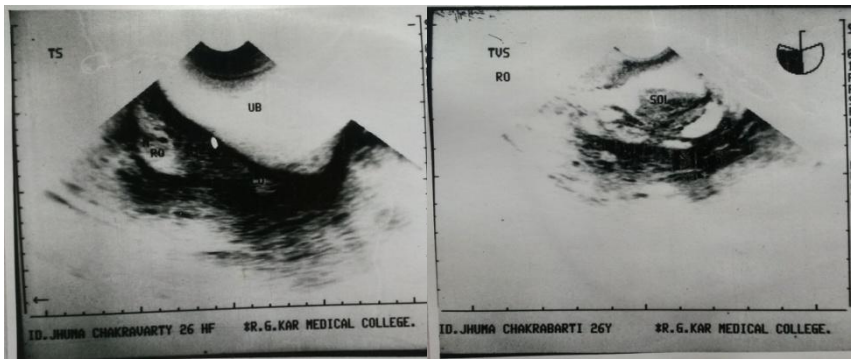


Right T.O Mass (Infective)

would have labelled them as benign cysts or cyst adenomas. On TAS,the cystadenoma which was misdiagnosed had appeaned as a completely echofree cystic lesion. On TVS few this septae were noted. If TVS was not done, the sonographic diagnosis would have been an ovarian simple cyst. TVS offered unique diagnostic information most freqnently in cases of chocolate cyts (50%) folloved by cystadeno carcinomas . Sabbagha et al (1994) were also of the same opinion that chocolate cysts were best evaluated transvaginally.

There is large variations among the results of different authors regarding amount of unique diagnostic information obtained using TVS. It ranges from 15% obtained by leibman et al (1988) to 37% reported by Mendelson et al(1988) to 60% result obtained by coleman et al (1988). This variability may be due to lack of uniform definition of "unique diagnostic information". Using our strict criteria adopted from mendelson et al (1988) we obtained unique diagnostic information in 30% of the masses which correlated best with Mendelson et al (1988). In our study TAS & TVS provided information of equivalent diagnostic value in 33 masses (66%). This is in agreement to Mendelson et al (1988).

Contributory information was obtained in the rest 20 cases. Among these cases were 10 simple ovarian cysts, 5 cystadenomas, 3 cystadenocarcinomas &

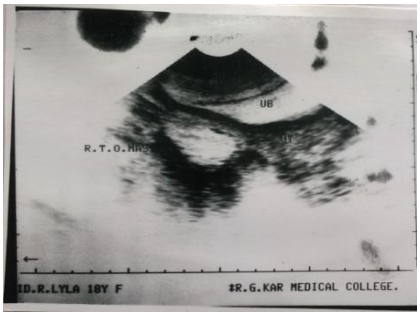


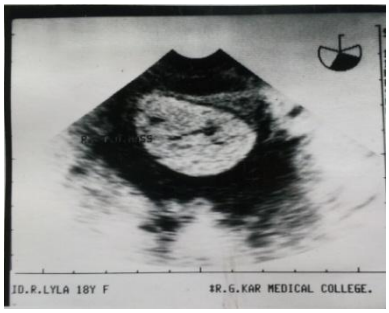
Right Ovarian SOL

2 haemorrhagic cysts. In the ovarian cysts, TVS showed their regular smooth walls. Additional septae were detected in cystadenomas. Fluid level was demonstrated in the haemorrhagic cysts using TVS.In the cyst adenocarcinomas, additional mural nodules were detected by TVS. In all these cases, the diagnosis was suggested by TAS. TVS provided some extra information which confirmed the diagnosis already offered by TAS.

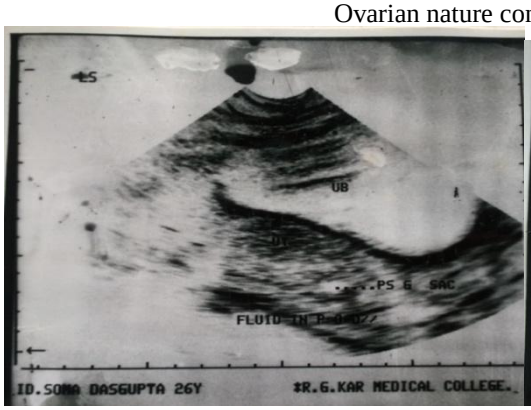
In the two cases in which TVS fared worse, the ovaries were very highly placed making it difficult to image them by TVS even after applying pressure on anterior abdominal wall. We compared the relative ability of TAS & TVS to detect certain sonomorphologic features e.g. mural nodules, diffuse low level internal echoes, septae, pelvic adhesions in the 50 masses evaluated by both techniques .

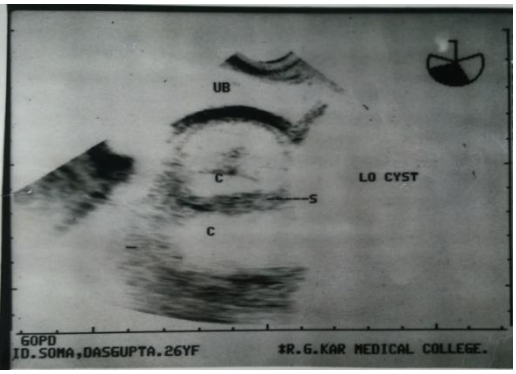
We found that TVS could detect these features regarding the internal architectural pattern of a mass more consistently than TAS. This has also been suggested by Mendelson et al (1988), Rottem et al (1990),Leibman et al (1988),Lande et al (1988), Fleischer (1991) & Granberg et al (1990). Statistical evaluation. Revealed the TVS is significantly better than TAS in detecting mural nodules & diffuse low level internal echoes ($p<0.05$). In the detection of septae & pelvic adhesions, although TVS fared better than TAS, still the results were not





Diagnosis as T.O. Mass by TAS
Ovarian nature confirmed by TVS





Cystic SOL in left adnexa diagnosed outside as ectopic pregnancy, here early intrauterine gestation confirmed by TVS & Cystic SOL of Ovarian Origin diagnosed.

Statistically significant ($p>0.05$). However since our sample size was less these findings cannot be emphasized upon very firmly. It requires extensive research involving a larger population in order to ascertain the comparative ability of TAS & TVS regarding detection of sonomorphologic features of adnexal masses from statistical point of view.

Summary

1. Total number of patients suspected of having an adnexal mass & referred to us for sonolgical assessment was 55.
2. Age of the subjects ranged from 20-50yrs. Maximum patients were in the range of 31-40yrs.
3. The final diagnosis was established by surgical & histopathological findings in 35 patients. Clinical & ultrasound follow up provided the final diagnosis in 20 patients.
4. Total number of adnexal masses finally proved in these patients were 50. 48 of them (96%) occurred in premenopausal women & 2 (4%) in postmenopausal group.
5. Total number of true negative diagnosis were 2 each.
6. Number of adnexal masses evaluated by both TAS & TVS was 50.
7. Most common correct diagnosis occurred in cases of ovarian cysts and endometrioma. Cystadenomas were correctly detected in least no. of cases.

8. TVS detected mural nodule, septae, diffuse low level internal echoes & pelvic adhesions more consistently than TAS.
9. TVS provided more information than TAS in 70% cases, equal information in 26% & less information in 4% of the cases.
10. Unique diagnostic information was provided by TVS in 15 (30%) cases most of which were endometriomas.

VIII. Conclusion

Ultrasound can be extremely helpful regarding detection & specific diagnosis of an adrexal mass. TVS provided new information in many of the cases as it can show the fine internal sonomorphological characteristics of a mass better than TAS, thereby increasing latter's accuracy. TAS also has its own advantages. Hence a combined approach using both TAS & TVS gives the best results.

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Annexure

Abbreviations

TAS	-	Transabdominal sonography
TVS	-	Transvaginal sonography
Ca	-	Carcinoma
OV.	-	Ovarian
SOC	-	Simple Ovarian cyst
HC	-	Haemorrhagic cyst
CA	-	cystadenoma
CAC	-	cystadenocarcinoma
DM	-	Dermoid
EM	-	Endometrioma
SOM	-	Solid ovarian mass
U.S.G.	-	Ultrasonography
HSG	-	Hysterosalpingography