ROLE OF ULTRASOUND AS AN IMAGING MODALITY IN NEOPLASTIC OVARIAN MASSES IN A TERTIARY CARE HOSPITAL

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ABSTRACT

BACKGROUND

Traditionally, the preoperative radiological evaluation of patients suspected of having a uterine or adnexal mass was limited to barium enema examination and excretory urography to find out the mass effect on the bowel lumen or the urinary tract. Pelvic pneumatography, which showed the lesion directly was full of complications.[1] However, the evolution of new imaging techniques to display normal human anatomy over the past few decades has continued at an astounding pace. Accurate characterisation of adnexal and uterine lesions is of utmost importance in preoperative planning, because it facilitates the choice of therapy and assists the gynaecologists in the design of surgical approach.[2] Hence, this study was conducted to evaluate the role of ultrasound as an imaging modality in neoplastic ovarian masses in a tertiary care hospital.

This study was designed-

1. To study the clinico-radiological profile of patients presenting with uterine and adnexal masses by using sonography.
2. Pre-operative assessment of benign versus malignant tumours by sonography.
3. To characterise the number, location and extent of tumour masses.

MATERIALS AND METHODS

This prospective study was conducted over a period of one and a half years (May 2006 to September 2007) in the Department of Radiodiagnosis and Imaging, Acharya Shri Chander College of Medical Sciences and Hospital, Sidhra, Jammu. A total of 36 patients were referred to the Department of Radiodiagnosis for the evaluation of ovarian masses on the basis of high clinical suspicion. They were radiologically evaluated by ultrasound. The images were further evaluated clinically and radiologically.

RESULTS

A total of 36 patients were referred to the Department of Radiodiagnosis. They included the following cases- Serous cystadenoma (6), Mucinous cystadenoma (1), Benign cystic teratoma (8), Haemorrhagic ovarian cyst (1), Serous cystadenocarcinoma (2), Malignant teratoma (1), Endometrioma (6), Pyogenic abscess (1) and Mucinous cystadenocarcinoma (3).

CONCLUSION

Adnexal masses are a group of heterogeneous pathological conditions with distinctive radiological and clinical features. In the present study, ultrasound was used for localising and diagnosing adnexal masses. Thus, to conclude, ultrasound is an effective imaging technique for evaluation of uterine and adnexal masses and determining the consistency of the mass.

KEYWORDS

Ultrasound, Neoplastic Ovarian Masses, Sonography, Adnexal Mass, Ovarian Cancer.

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BACKGROUND

Traditionally, the preoperative radiological evaluation of patients suspected of having a uterine or adnexal mass was limited to barium enema examination and excretory urography to find out the mass effect on the bowel lumen or the urinary tract. Pelvic pneumatography, which showed the lesion directly was full of complications.[1] However, the evolution of new imaging techniques to display normal human anatomy over the past few decades has continued at an astounding pace.

The imaging modalities that are presently being used for evaluating patients with gynaecologic masses include ultrasound, computed tomography and magnetic resonance imaging.

Accurate characterization of adnexal and uterine lesions is of utmost importance in preoperative planning because it facilitates the choice of therapy and assists the gynaecologists in the design of surgical approach.[2]

Accurate evaluation of uterine and adnexal masses has become more feasible because of advances in imaging. Sonography is now considered an extension of the physical examination and is used as the primary imaging technique for the evaluation of any female pelvic mass.[3]

The signs and symptoms of the mass are determined by their location, size and relationship with their adjacent structures. A large mass may be asymptomatic, while a small

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mass may produce overt symptoms, especially if it becomes infected, bleeds or its pedicle undergoes torsion. Adnexal mass torsion is an uncommon but serious cause of lower abdominal pain in women and is often difficult to distinguish from other acute abdominal conditions. The possibility of adnexal torsion should be considered when an ovarian mass is discovered in the appropriate clinical setting.[4]

A reliable method with which to differentiate a benign from a malignant adnexal mass should provide a basis for optimal preoperative planning and may also reduce the number of unnecessary laparotomies patients undergo for benign disease.[5] In the preoperative diagnosis and management of patients with gynaecologic pelvic masses, gray scale ultrasound or computed tomography can provide significant clinical data.[1]

Adnexal and uterine masses present a special diagnostic challenge in part, because benign adnexal masses greatly outnumber malignant ones. Determination of a degree of suspicion is critical and is based largely on imaging appearance. Morphologic analysis of adnexal masses is accurate for identifying masses as either low risk or high risk. The most important morphologic features are non-fatty solid (vascularised) tissue, thick septations and papillary projections.[6]

Ovarian cancer is the deadliest gynaecologic malignancy with approximately 70% of patients having peritoneal involvement at the time of diagnosis.[7] The evolution of imaging techniques over the past few decades has continued at an astounding pace. Sonography is typically the initial imaging modality used in evaluating pelvic masses in women.[8]

Prior to the development of gray scale imaging, soft tissue masses could be characterised into only three major groups: Cystic, complex and solid depending upon their attenuation properties. Seldom were the findings on conventional bistable B-mode images specific for a particular type of pelvic mass. Since the advent of gray scale sonography, subtle interfaces within and around soft tissue masses are more apparent making more specific differential diagnosis possible.[9]

Malignant ovarian tumours rank third among gynaecologic malignancies in rate of occurrence, but first as a cause of death.[10] With few exceptions, the sonographic appearance of ovarian neoplasms is typically nonspecific. However, teratomas have several characteristics that allow a confident pre-operative diagnosis.[11]

The role of imaging modality is helpful in detecting ovarian cancer. It is suggested that an ovarian mass with ascites suggest peritoneal spread and ultrasound is the workhorse of initial investigation.[12] It is well known that pelvic disorders produce a number of common symptoms and it is often difficult to identify clinically the organ of origin.[13]

In spite of all the major advances in technology, the outcome of patients with pelvic masses remain obscure and controversial. The awareness of various disease processes afflicting the pelvic structures among radiologists and appreciation of usefulness of various radiological and imaging methods among physicians and surgeons is required. Thus, a team approach is required for the better understanding of uterine and adnexal masses. Evaluation of a patient with pelvic mass has to be tailored rather than adopting short gun approach.[14]

Hence, this study was conducted to evaluate the role of ultrasound as an imaging modality in neoplastic ovarian masses in a tertiary care hospital.

Aims and Objectives

This study was designed-

1. To study the clinico-radiological profile of patients presenting with uterine and adnexal masses by using sonography.
2. Pre-operative assessment of benign versus malignant tumours by sonography.
3. To characterise the number, location and extent of tumour masses.

MATERIALS AND METHODS

This prospective study was conducted over a period of one and a half years (May 2006 to September 2007) in the Department of Radiodiagnosis and Imaging, Acharya Shri Chander College of Medical Sciences and Hospital, Sidhra, Jammu. During this period, a total of 36 patients were referred to the Department of Radiodiagnosis for the evaluation of ovarian masses on the basis of high clinical suspicion. All the patients underwent ultrasound examination. These included both inpatients as well as outpatients.

Detailed history was recorded as per proforma. Ultrasonography was performed using Logiq 500 Pro Series using a curvilinear probe of 3.5 to 4.5 MHz. The patient was asked to lie down in supine position comfortably on the bed with distended urinary bladder for an acoustic window. Imaging of the uterus and adnexa was performed in both transverse and sagittal planes. An oblique angulation was taken when necessary to visualise the entire uterus and cervix.

Ultrasound images were evaluated and a differential diagnosis was reached on the basis of image characteristics, age of the patient and site of the lesion. Findings were correlated with surgical and histopathological examination wherever possible. The images were further evaluated clinically and radiologically.

RESULTS

A total of 36 patients were referred to the Department of Radiodiagnosis for the evaluation of ovarian masses on the basis of high clinical suspicion. They were radiologically evaluated by ultrasound. Detailed history was recorded as per proforma.

The age distribution of the patients is shown in Table No. 1. The peak age of occurrence of ovarian mass was 41 - 50 years' age group.

The clinical manifestations of the patients are shown in Table No. 2. The commonest presenting clinical feature in our study was pain (55.56%) followed by menorrhagia (52.78%). In majority of the patients the pain was dull and vague in the lower abdomen, while 4 patients had sharp localised pain in the pelvis.

All the 36 patients were radiologically diagnosed as neoplastic ovarian masses. Histopathologically and at surgery, the diagnosis was confirmed in 29 cases. Three cases of tubo-ovarian mass, 2 cases of broad ligament fibroid and 1

case each of retroperitoneal lymphangioma and retroperitoneal schwannoma were incorrectly diagnosed as neoplastic ovarian masses. Features observed on ultrasound examination are given in Table No. 3.

All the cases had masses more than 5 cms except one case each of haemorrhagic cyst and infected tubo-ovarian masses in which size was 4 cm and 3 cm respectively.

Cystic masses were exclusively benign, while complex masses were mostly malignant. All cases of dermoid cysts (9 cases) showed complex echotexture except in one case, which was cystic. Highly echogenic material was seen exclusively in dermoid cysts, except one case of dermoid cyst which did not show echogenic material.

Papillary projections were seen in malignant ovarian masses except one case of benign serous cystadenoma, which also showed papillary projections. Low level echoes were seen in 2 cases of endometrioma. Thick septae were seen in malignant masses and in one case of serous cystadenoma. Ascites and liver metastasis were seen in malignant masses.

Table No. 4 shows the sonographic types of ovarian masses and features of ovarian masses. All the cases (7 cases) of benign cystic teratoma were correctly diagnosed based on their characteristic ultrasound features which included:

1. Complex echotexture with a highly reflective solid component within the wall of a cystic mass called as a dermoid plug.
2. Well-defined borders.

In one case, the diagnosis was confirmed by demonstrating tooth on a plain x-ray pelvis. Eleven cases revealed sonographic features of benign ovarian masses. All the cases were either completely cystic or predominantly cystic with thin septae. These included 2 cases of endometrioma, 2 cases of serous cystadenoma, 1 case of benign cystic teratoma and 1 case of tubo-ovarian mass.

Four cases exhibiting these features were erroneously diagnosed, which on subsequent histopathological examination came out to be 2 cases of broad ligament fibroid, retroperitoneal lymphangioma and malignant cystic teratoma invading the urinary bladder. Three cases of endometrioma were correctly diagnosed, because of low level echoes. One case of haemorrhagic ovarian cyst was incorrectly diagnosed, which on subsequent examination came out to be pyogenic abscess. Three cases of cystic serous cystadenoma were correctly diagnosed because of completely cystic, well-defined borders and thin septae.

Ultrasound Features which suggested Malignant Masses were-

1. Irregular and thick septae.
2. Ill-defined ragged appearance of borders.
3. Echogenic solid contents or papillary projections in the mass.

Based on these findings, ultrasonic diagnosis was correct in 5 cases. These included 2 cases of serous cystadenocarcinoma and 3 cases of mucinous cystadenocarcinoma. Four cases were incorrectly diagnosed. They included 1 case each of retroperitoneal schwannoma, infective tubo-ovarian mass, serous cystadenoma and mucinous cystadenoma. Ascites was observed in 5 cases, 4 of which were malignant and 1 benign. It indicates that absence of ascites was not a diagnostic indicator of benign ovarian mass.

Table No. 5 shows the histological types of ovarian masses. Four cases of benign ovarian masses on histopathology came out to be 2 cases of broad ligament fibroids and one case each of retroperitoneal schwannoma and retroperitoneal lymphangioma.

Age (In Years)	Number of Cases	Percentage (%)
10-20	2	5.56%
21-30	5	13.89%
31-40	10	27.78%
41-50	13	36.11%
51-60	6	16.67%
Total	36	

Table 1. Age Distribution of Patients

Clinical Features	Number of Cases	Percentage (%)
Lump abdomen	8	22.22
Pain	20	55.56
Menorrhagia	19	52.78
Post-menopausal bleeding	3	8.33
Intermittent bleeding	6	16.67
Fever	2	5.56
Weight loss	2	5.56
Loss of appetite	2	5.56
Haematuria	1	2.78
Dysuria	2	5.56
Vomiting	2	5.56
Amenorrhoea	1	2.78

Table 2. Clinical Features of Patients

SL. No.	Features	No. of Cases
1.	Size > 5 cm	34
2.	Echotexture A) Cystic B) Solid C) Complex - Predominantly cystic - Predominantly solid	 5 7 4 20
3.	Borders A) Well-defined B) Ill-defined	 25 11
4.	Septae A) Absent B) Thin (< 1 mm) C) Thick (> 1 mm)	 17 11 8
5.	Low density echoes	2
6.	Highly echogenic material	7
7.	Papillary projections	5
8.	Loculi A) Unilocular B) Multilocular	 7 8
9.	Fluid A) POD B) Ascites	 3 5
10.	Enlarged lymph nodes A) Iliac chain B) Para-aortic chain	 1 0
11.	Liver metastasis	1

Table 3. Ultrasonographic Features in Neoplastic Ovarian Masses

SL. No.	Features	No. of Cases	(%)
1.	Ovarian teratoma	7	19.4%
2.	Benign ovarian masses	11	30.5%
3.	Malignant ovarian masses	9	25%
4.	Endometrioma	3	8.3%
5.	Haemorrhagic ovarian cyst	2	5.5%
6.	Serous cystadenoma	4	11.1%
	Total	36	100

Table 4. Sonographic Types of Ovarian Masses

Sl. No.	Type	No. of Cases
1.	Serous cystadenoma	6
2.	Mucinous cystadenoma	1
3.	Benign cystic teratoma	8
4.	Haemorrhagic ovarian cyst	1
5.	Serous cystadenocarcinoma	2
6.	Malignant teratoma	1
7.	Endometrioma	6
8.	Pyogenic abscess	1
9.	Mucinous cystadenocarcinoma	3

Table 5. Histological Types of Ovarian Masses

DISCUSSION

It is well known that pelvic disorders produce a number of common symptoms and it is difficult to identify the organ of origin. Conventional investigating modalities that use ionising radiation such as plain radiography, angiography, intravenous urography have been supplanted by newer imaging techniques in many instances. Ultrasound remains the study of choice in the initial evaluation of suspected adnexal masses, because it is relatively inexpensive, non-invasive and widely available.[6]

A total of 36 patients were referred to the Department of Radiodiagnosis for the evaluation of ovarian masses on the basis of high clinical suspicion.

We took into account the chief complaints, age distribution, site of lesion, characteristic of lesion and differentiation between benign and malignant causes. In our study, pain abdomen was the most common finding. This was consistent with the findings of Couto et al. They also reported pain abdomen as the most common finding.[15] They reported loss of weight and appetite exclusively in malignant masses. This was also consistent with our findings.

Deland et al showed that > 90% patients had mass, 45% had abdominal pain.[16] These findings are in contrast to our study. We reported abdominal mass in 22.22% cases and abdominal pain in 55.56 cases.

Another study has stated that symptoms of ovarian cancer are non-specific and patient may present with dyspepsia, loss of appetite, abdominal fullness as the result of increased abdominal pressure from ascites or involvement of omentum.[17] The same was noted in our study. Many patients present with vague symptoms of vomiting, loss of appetite etc.

In our study, the peak age of occurrence of adnexal mass was 5th decade. The same finding was also seen by Deland et al.[16] They reported a mean age of 50 years for malignant lesions and 34 years in patients with benign tumours.

We reported 25% malignant ovarian neoplasms and 19.44% cases of ovarian teratoma. Killacky et al[18] and Couto et al[15] reported 20% and 19.4% malignant ovarian neoplasms in their studies. We observed that average age of presentation for malignant ovarian neoplasms was 50.33 years. Moyle et al[19] recorded the mean age of 62 years for these neoplasms, while Deland et al[16] showed mean age of 50 years for malignant masses.

Serous Cystadenoma

As per our findings the incidence of serous cystadenoma was 16.6%, while other studies have shown the incidence to be 9.4%, 40%, 16.8%, 22% respectively.[9],[20],[21],[22] Sonographically, findings characteristic of serous cystadenomas had predominant anechoic pattern, well-defined walls, posterior wall enhancement and a few thin septa in it (< 3 mm). This was observed in 4 cases (66.6%). This finding was consistent with Buy et al, who reported characteristic findings in 70% cases.[23] One case was diagnosed as serous cystadenoma, came out to be retroperitoneal lymphangioma on histopathology.

All were unilocular except one. All had size > 5 cm. Buy et al also reported mean size of 8.5 cm.[23] One case was diagnosed as malignant ovarian mass, i.e. true negative case showed complex echotexture, thick septa > 3 mm and 3 in number, papillary projections which on histopathology came out to be serous cystadenoma. Buy et al and Ghossain et al reported similar findings.[23],[22]

Mucinous Cystadenoma

The incidence of mucinous cystadenoma in our study was 2.8% (1 case) only. Buy et al, Ghossain et al and Yamashita et al recorded 20%, 12.3%, 8.7% incidence respectively.[23],[22],[2] Sonographically, the mass was multilocular, 12 cm in size, had complex echotexture, ill-defined borders and had thick septae (> 3 mm). It also had fluid in Pouch of Douglas. It was erroneously diagnosed as malignant ovarian neoplasm on ultrasonography, but histopathological diagnosis was of mucinous cystadenoma. The size of the lesion correlated with Buy et al and Ghossain et al, who reported respective mean sizes of 12.6 cm and 9.7 cm.[23],[22]

Benign Cystic Teratoma

We reported 8 cases (22.2%) of benign cystic teratoma, while Yamashita et al and Sohaib et al reported an incidence of 20% and 7.9% respectively.[2] It occurred in age group of 30 to 75 years. Similar findings were reported by Togashi et al and Gupta et al.[24],[25] Tooth like radiopaque structure was seen in 1 case (12.5%). Stern recorded dentigerous element in 33% dermoids.[26]

We observed completely cystic anechoic (1 case- 2.5%), complex predominantly cystic mass with solid mural nodule with posterior acoustics, i.e. dermoid plug (5 cases- 62.5%), cystic mass with multiple linear hyperechogenic surfaces i.e. dermoid mesh (1 case- 12.5%), homogeneous predominantly hyperechoic solid mass (1 case- 12.5%). Similar observations were made by Gupta et al.[25]

Endometriosis

We encountered 6 cases (16.6%) in 30 - 50 years' age group and 1 case at 15 years age. Woodword et al reported mean age of 25 - 29 years.[27] Morley et al, Yamashita et al[2] and Sohaib et al[5] reported an incidence of 30%, 12.5% and 14.7% respectively. Ovary was reported as the most common site by Woodword et al.[27] We also reported the same.

As per Jeong et al and Woodword et al[27], low level internal echoes and echogenic wall foci are more specific ultrasound features of endometriosis. In our study, 4 cases showed cysts of size varying from 4 to 6 cm, homogeneous hypoechoic masses with low level echoes. Two cases were hypoechoic with no low level echoes and were diagnosed as benign ovarian cysts. Ultrasound sensitivity in detecting endometrial cysts in our study was 66.6%. Fleischer et al reported sensitivity of 71%.[9]

Haemorrhagic Ovarian Cyst

One case (2.7%) was studied in this group. The patient presented with acute pelvic pain and amenorrhoea. Sonographically, it was 5 cm in size, had heterogeneous echotexture and showed posterior wall enhancement. The age group was 35 years. Balatrowich et al[28] reported mean age of 30 years and acute pelvic pain in most of the patients. They observed similar ultrasound findings in 83% cases.

Cystadenocarcinoma

Five cases (13.9%) were encountered in 40 - 70 years' age group. It included 2 cases of serous cystadenocarcinoma and 3 cases of mucinous cystadenocarcinoma with size between 10 to 12 cm. Sonographically, all were multiloculated with a heterogeneous complex echotexture, ill-defined margins and echogenic material as papillary excrescence along the borders. Similar findings were reported by Requard et al[10] and Iyer et al.[8]

As per Woodward et al, intraperitoneal dissemination is the most common mode of tumour spread in ovarian cancer with 70% presenting as ascites. As per our study, ascites had a positive predictive value of 72% - 80% as a sign of peritoneal metastases.

CONCLUSION

Adnexal masses are a group of heterogeneous pathological conditions with distinctive radiological and clinical features. In the present study, ultrasound was used for localising and diagnosing adnexal masses. Thus, to conclude, ultrasound is an effective imaging technique for evaluation of uterine and adnexal masses and determining the consistency of the mass.

REFERENCES

[1] Walsh JW, Rosenfield AT, Jaffe CC, et al. Prospective comparision of ultrasound and computed tomography in the evaluation of gynecologic pelvic masses. Am J Roent 1978;131(6):955-60.

[2] Yamashita Y, Torashima M, Hatanaka Y, et al. Adnexal masses: accuracy of characterization with transvaginal US and precontrast and postcontrast MR Imaging. Radiology 1995;194(2):557-65.

[3] Hricak H. Gray-Scale ultrasound in 204 proved gynaecologic masses: accuracy and specific diagnostic criteria. Radiology 1992;130:391-7.

[4] Rha SE, Byun JY, Jung SE, et al. CT and MR imaging features of adnexal torsion. Radiographics 2002;22(2):283-94.

[5] Sohaib SA, Sahdev A, van Trappen P, et al. Characterization of adnexal mass leisions on MR Imaging. Am J Roent 2003;180(5):1297-304.

[6] Jeong YY, Outwater EK, Kang HK. From the RSNA refresher courses: imaging evaluation of ovarian masses. Radiograhics 2000;20(5):1445-70.

[7] Woodward PF, Hosseinzadeh K, Saenger JS. From the archives of the AFIP: radiologic staging of ovarian carcinoma with pathologic correlation. Radiographics 2004;24(1):225-46.

[8] Iyer R. Imaging of gynaecologic malignancy. Seminars in Roentgenology 2004;39(3):428-36.

[9] Fleischer AC, James AE, Millis JB, et al. Differential diagnosis of pelvic masses by Gray-Scale sonography. Am Jour Roent 1978;131(3):469-76.

[10] Requard CK, Mettler FA, Wicks JD. Pre-operative sonography of malignant ovarian neoplasms. Am Jour Roent 1981;137(1):79-82.

[11] Quinn SF, Erickson S, Black WC. Cystic ovarian teratomas: the sonographic appearance of the dermoid plug. Radiology 1985;155(2):477-8.

[12] Spencer JA. A multidisciplinary approach to ovarian cancer at diagnosis. Brit Journ Radiol 2005;78 Spec No 2:S94-102.

[13] Trenta A, Pavlica P, Stasi G. Ovarian masses. Diagnostic ultrasound of lower abdomen. Butterworth 1985.

[14] Fleischer AC, Walsh JW, Jones HW. Sonographic evaluation and role of pelvic masses. Radiol Clin North Am 1982;20:397-412.

[15] Couto F, Nadkarni NS, Rabello MJP. Ovarian tumors in Goa: a clinicopthological study. J Obstet & Gynaec India 1993:408-12.

[16] Deland M, Fried A, Van Nagell JR, et al. Ultrasonography in the diagnosis of tumors of ovary. Surg Gynec & Obstet 1979;148(3):346-8.

[17] Cannistra SA. Cancer of ovary. The New Eng J Med 2004;351(24):2519-29.

[18] Killackey MA, Neuwirth RS. Evaluation and management of the pelvic mass: a review of 540 cases. Obst & Gynaecol 1988;71(3 Pt 1):319-22.

[19] Moyle JW, Rochester D, Sider L, et al. Sonography of ovarian tumours: predictability of tumor type. Am J Roent 1983;141(5):985-91.

[20] Kapoor R, Mittal KP, Rabubidri V. Ultrasonographic appearance of benign ovarian masses. Ind J RadiolImag 1990;44:193-6.

[21] Morley P, Barnett E. The use of ultrasound in the diagnosis of pelvic masses. Br J Radio 1970;43(513): 602-16.

[22] Ghossain MA, Buy JN, Ligneres C, et al. Epithelial tumours of the ovary: comparison of MR and CT findings. Radiology 1991;181(3):863-70.

[23] Buy JN, Ghossain MA, Sciot C, et al. Epithelial tumors of the ovary: CT findings in correlation with US. Radiology 1991;178(3):811-8.

[24] Togashi K, Nishimura K, Itoh K, et al. Ovarian cystic teratomas: MR imaging. Radiology 1989;171:531-4.

[25] Gupta AK, Madan R, Agarwal M. Sonographic spectrum of ovarian dermoid. J Obstect & Gynaecol 2005;55(2):170-3.

[26] Stern QZ. Radiology of ovary. Obstet and Gynaecol Survey 1979.

[27] Woodward PJ, Sohaey R, Mezzetti TP. From the archives of AFIP; edometriosis: radiologic-pathologic correlation. Radiographics 2001;21(1):193-216.

[28] Balatrowich OK, Kurtz AB, Pasto ME. The spectrum of sonographic findings in haemorrhagic ovarian cysts. Am J Roent 1988;151:725-8.