A Retrospective Study on the Accuracy of Sassone Lerner and IOTA Simple Rules in Determining Malignancy of Ovarian Masses in a Tertiary Hospital Ob-GYN Ultrasound Diagnostic Unit*

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ABSTRACT

Ultrasonography has been established as one of the important diagnostic tools in detecting and classifying ovarian masses. Several studies have been made in determining the sensitivity and specificity of the different scoring systems as to determining the malignancy of ovarian masses. In a tertiary hospital ultrasound diagnostic unit, three scoring systems are utilized namely Lerner, Sassone and IOTA simple rules. With this reason, it is important to determine and compare the sensitivity and specificity on the most utilized ultrasound scoring systems in determining malignancy of ovarian masses. A single center observational, analytical, cross-sectional study utilizing review of the transvaginal or pelvic ultrasound results of women with ovarian masses that were scored using Sassone, Lerner and IOTA Simple Rules in a tertiary hospital ultrasound diagnostics unit from January 2013 to June 2016 was done. The sensitivity, specificity, positive and negative predictive values of each scoring system utilized was determined and compared with the histopathologic result. Out of the 111 ovarian masses that were included in the study, 44 ovarian masses were scored using Lerner Scoring system with a sensitivity, specificity, positive and negative predictive values of 100%, 65% 22.2% and 100%. 105 ovarian masses screened using Sassone Scoring System showed a sensitivity, specificity, positive and negative predictive values of 100%, 68%, 20.5% and 100%. A total of 33 out of the 111 ovarian masses were scored using the IOTA scoring system with a sensitivity, specificity, positive and negative predictive values of 100%, 85.6%, 55.5% and 100%. In conclusion, IOTA simple rules had a high sensitivity and specificity compared to Sassone or Lerner Scoring System. However, we cannot fully conclude that individual specificity will be better than combined tests since there is limited number of ovarian masses analyzed.

Keywords: ultrasound, IOTA simple rules, sassone, lerners

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INTRODUCTION

Ultrasonography has been established as one of the important diagnostic tools in detecting and classifying ovarian masses. It is widely used because of its non–invasiveness and cost-effectiveness in producing quality imaging that can aid clinicians in diagnosing masses. Several scoring systems have been developed through the years in helping sonologists in determining whether a mass is benign or malignant. The scoring systems have utilized morphological characteristics of the masses and color flow in some cases. In the latest International Society of Ultrasound in Obstetrics and Gynecology (ISUOG), they have recommended the use of IOTA Scoring system in classifying adnexal masses. While the latest Philippine Society of Ultrasound in Obstetrics and Gynecology (PSUOG) guideline recommends assessment of tumors be initially done by pattern recognition using the ten simple rules in determining benign or malignant tumors. Further assessment of the tumors can be employed using IOTA which now includes color flow assessment. However in the absence of color flow capability, Sassone scoring may be used instead. Despite ultrasound being a necessary diagnostic modality, the gold standard in identifying malignancy among ovarian masses still is histopathology.

Several studies have been made in determining the sensitivity and specificity of the different scoring systems as to determining the malignancy of ovarian masses. However locally, several sonologists may still use different scoring systems based on their comfort and availability of color flow in their respective institutions. With this reason, it is important to determine and compare the sensitivity and specificity on the most utilized ultrasound scoring systems in determining malignancy of ovarian masses.

OBJECTIVES

General Objective:

To find out the accuracy of 3 scoring systems namely Sassone, Lerner and IOTA Simple Rules in determining malignancy of ovarian masses.

Specific Objectives:

1. To determine the sensitivity, specificity, positive predictive value, negative predictive value of Sassone Scoring System, Lerner Scoring System and IOTA Simple Rules in detecting malignancy in patients with ovarian mass.
2. To compare the accuracy of IOTA Simple Rules, Lerner, and Sassone in determining clearly benign, clearly malignant and borderline malignant in patients with ovarian mass with histopathology result as the gold standard.
3. To determine whether use of 2 or more scoring systems will have greater sensitivity, specificity, positive and negative predictive values compared to use of a single scoring system.

MATERIALS

Study Design:

This is was a single center observational, cross-sectional study utilizing review of the transvaginal or pelvic ultrasound results of women with ovarian masses that were scored using Sassone, Lerner and IOTA Simple Rules by OB-GYN Sonologists who are fellows of Philippine Society of Ultrasound in Obstetrics and Gynecology in a tertiary hospital ultrasound diagnostics unit from January 2013 to June 2016. The sensitivity, specificity, positive and negative predictive values of each scoring system utilized for the ovarian masses in determining malignancy will be computed. The ultrasound findings of the ovarian masses will be compared to the final histopathological results.

Inclusion Criteria:

All transvaginal or pelvic ultrasound results of unilateral or bilateral ovarian masses that were scored using Sassone Score, Lerner Score and IOTA Simple Rules from January 2013 to June 2016 in a tertiary hospital ultrasound diagnostic unit and had undergone exploratory laparotomy or laparoscopic surgery with or without frozen section which have been done within 2 months of the performance of the scan. The final histopathology should show the result of one or both ovaries scored by the said scoring system.

Exclusion Criteria:

Ovarian masses that were scanned in the tertiary hospital OB-GYN ultrasound diagnostic unit but were not classified as benign or malignant using any of the following scoring systems, Sassone, Lerner or IOTA Simple Rules. Masses that were not operated on or was operated after 2 months from the time of scan. Masses that do not have any histopathologic report will be excluded.

Definition of Terms:

Sassone Scoring System

Morphology	1	2	3	4	5
Inner wall structure	Smooth	Irregularities (<3 mm)	Papillarities (>3 mm)	Not applicable, mostly solid	-
Wall Thickness	Thin <3 mm	Thick >3 mm	Not applicable Mostly solid	-	-
Septa	None	Thin < 3	Thick >3		
Echogenicity	Sonolucent	Low echogenicity	Low echogenicity with echogenic core; mixed echogenicity	-	High echogenicity

Cut off score suggestive of malignancy: > 9

Lerner Scoring System

Morphology	0	1	2	3
Wall Structure (mm)	Smooth or small irregularities (<3 mm)	-	Solid or not applicable	Papillarities (>3 mm)
Shadowing	Yes	No		
Septa (mm)	None or thin (<3 mm)	Thick (>3 mm)		
Echogenicity	Sonoluscent or Low level echo or echogenci core	-	-	Mixed or high

Cut off score suggestive of malignancy: > 3

Lerner Scoring System

IOTA Simple Rules:

A collection of 10 simple ultrasound based rules developed by the International Ovarian Tumor Analysis Group in determining ovarian malignancy. These rules are based on certain sonographic findings which may indicate malignancy (M-rules) or benignity (B-rules). If 1 or more M rules apply, in the absence of a B-rule, then the mass is classified as malignant. Likewise, if 1 or more B rules apply in the absence of an M rule, the mass is classified as malignant. However, if both M rules and B rules apply or if neither or the rules apply, the mass cannot be classified and is inconclusive.[6]

Rules for predicting a malignant tumor (M-rules)		
M1	Irregular solid tumor	☐
M2	Presence of ascites	☐
M3	At least four papillary structures	☐
M4	Irregular multilocular solid tumor with largest diameter ≥100 mm	☐
M5	Very strong blood flow (color score 4)	☐
Rules for predicting a benign tumor (B-rules)		
B1	Unilocular	☐
B2	Presence of solid components with the largest diameter <7 mm	☐
B3	Presence of acoustic shadows	☐
B4	Smooth multilocular tumor with largest diameter <100 mm	☐
B5	No blood flow (color score 1)	☐

Sensitivity *a/(a+c)*

A test's sensitivity is defined as the probability that the test says a person has the disease when in fact they do have the disease. It is a measure of how likely it is for a test to detect the presence of a disease in a person who has it.

Specificity *d/(b+d)*

Specificity of a test is defined as probability that a test says a person does not have the disease when in fact they are disease free.

Positive Predictive Value *a/(a+b)*

A positive predictive value of a test is the ability of the test to correctly predict the presence of disease.

Negative Predictive Value *d/(c+d)*

A negative predictive value of the test is the ability of the test to correctly predict the absence of disease

Limitations of the Study:

This study was limited to a retrospective single center study. The data gathered was limited to review of transvaginal and pelvic ultrasound results of ovarian masses that were scanned from January 2013 to June 2016 in a tertiary hospital OB-GYN ultrasound diagnostic unit. The final histopathologic results were limited to those surgeries done within the same tertiary hospital within 2 months of the date of the ultrasound result. The histopathologic report should classify the ovarian mass as benign or malignant. This study was limited to determining the sensitivity, specificity, positive predictive and

negative predictive values of Sassone, Lerner and IOTA Simple Rules scoring systems of ovarian masses. This study tackled some descriptions of the ovarian masses in determining benign or malignant features.

METHODOLOGY

This was a single center observational, analytical, cross-sectional study utilizing review of the transvaginal or pelvic ultrasound results of women with ovarian masses that were scored using Sassone, Lerner and IOTA Simple Rules by OB-GYN Sonologists who are fellows of Philippine Society of Ultrasound in Obstetrics and Gynecology in a tertiary hospital ultrasound diagnostics. Review of transvaginal and pelvic gynecologic ultrasound reports with ovarian masses done at a tertiary hospital OB-GYN ultrasound unit using Voluson E6 machine from January 2013 to June 2016 was done. The reports with ovarian masses that were classified as benign or malignant using Lerner, Sassone and IOTA Simple rules were tabulated and the sensitivity, specificity, positive and negative predictive values of Sassone, Lerner and IOTA Simple rules will computed. The results were compared to the final histopath result to determine malignancy.

Sample Size:

The study utilized the Epi Info Version 7, in determining the minimum sample size requirement and was estimated to be at least 101 based on sensitivity of IOTA in detecting malignancy in patients with ovarian mass = 82 % [6], with 95% confidence interval and 7.5% margin of error.

Statistical Analysis:

Data was analyzed using Stata SE Version 12. Quantitative variables were summarized as mean average and standard deviation, while qualitative variables were tabulated as frequency and percentage. Sensitivity, specificity, positive predictive value and negative predictive value of Sassone, Lerner and IOTA scoring system in detecting malignancy in patients with ovarian masses with histopathology result as gold standard.

RESULTS

A total of 111 ovarian masses were scanned in the Ultrasound Diagnostics Unit from June 2013 until June 2016 that were scored using Lerner, Sassone and IOTA Simple Rules with histopathologic reports from surgeries done within 2 months of the scan. The total mean (± SD) age of the women with ovarian masses is 41 ± 11.4 years (range 13-77 years). Among the gravidity and parity, majority of the subjects were nulligravid and nulliparous. Among the symptoms reported, 39 % of subjects noted a palpable abdominal mass, 22% complained of dysmenorrhea, 20% complained of abdominal pain, 13 % complained of irregular menses, 4% noted increase in abdominal girth, 4 % complained of vaginal bleeding, 2% complained of pelvic heaviness as seen in table 1.

Table 1. Demographics

Demographics	Mean ± SD or n (%)
Mean Age in Years	41.18 (± 11)
Gravidity 0	52 (46%)
1-2	31 (27.93%)
3-4	20 (18.02%)
≥ 5	8 (7.20%)
Parity 0	58 (52.25%)
1-2	27 (24.32%)
3-4	18 (16.21%)
≥ 5	8(7.20 %)
Symptoms	
Abdominal mass	44 (39.64%)
Abdominal pain	22 (20%)
Increase in abdominal girth	4 (3.77%)
Irregular menses	14 (12.61%)
Vaginal Bleeding	4 (3.64%)
Urinary Symptoms	0
Pelvic Heaviness	0

The final histopathology results of the 111 ovarian masses screened using the three different scoring systems showed 10 (9%) malignant findings and 101 (90%) benign findings. (Table 2). There were no borderline malignant findings seen. The majority of the benign masses were endometriomas (44.14%) and mature cystic teratomas (21.62%). There were also 15 (13.5%) mucinous cystadenomas and 10 (9%) serous cystadenomas .

Table 2. Histological Diagnosis

Histological Diagnosis	**n(%)**
Benign Lesions	
Endometrioma	49 (44.14%)
Mature Cystic Teratoma	24 (21.62%)
Mucinous Cystadenoma	15 (13.51%)
Serous Cystadenoma	10 (9%)
Struma Ovarii	1 (0.9%)
Fibroma	1 (0.9%)
Malignant Lesions	
Papillary Serous Cystadenocarcinoma	1 (0.9%)
Ovarian New Growth Malignant	1 (0.9%)
High grade Serous Papillary Carcinoma	2 (1.8%)
Adenocarcinoma	1 (0.9%)
Clear Cell Adenocarcinoma	1 (0.9%)
Endometriod Adenocarcinoma	1 (0.9%)
Granulosa Cell Tumor	1 (0.9%)
Signet Ring Adenocarcinoma	1 (0.9%)

Lerner, Sassone and IOTA Simple Rules were utilized in determining the malignancy of the 111 ovarian masses and was compared to the histopathologic result. In addition, those ovarian masses screened using combined scoring system were also identified and compared to the final histopath result. The sensitivity, specificity, positive and negative predictive values were computed for each scoring system and are shown in Table 3.

Table 3. Summary of Sensitivity, Specificity, Positive and Negative Predictive Values

Ultrasound Scoring	Sensitivity	Specificity	Positive Predictive Value	Negative Predictive Value
Lerner (n=44)	100%	65%	22.22%	100%
Sassone (n=105)	100%	68%	20.5%	100%
IOTA Simple Rules (n=33)	100%	85.6%	55.5%	100%
Lerner + Sassone (n=44)	100%	65%	22.2%	100%
Lerner + IOTA (n=7)	100%	50%	25%	100%
Sassone + IOTA Simple Rules (n=27)	100%	82.61%	50%	100%
Lerner + Sassone + IOTA Simple (n=7)	100%	50%	25%	100%

Out of the 111 ovarian masses that were included in the study, 44 ovarian masses were scored using Lerner Scoring system. The test was able to score correctly all ovarian cysts that were malignant on histopath. However, out of the 40 ovarian cysts that were benign, there were 14 ovarian cysts that were false positive. These 14 ovarian masses were interpreted as malignant using the Lerner scoring system although they were benign on final histopath. Among the 14 ovarian cysts, majority were mature cystic teratomas and endometriotic cysts.

Almost all ovarian masses were scored using Sassone scoring system. Out of the 105 ovarian masses screened, the test was able to identify correctly all malignant ovarian masses. Among the 97 ovarian masses that were benign, one third were identified as malignant and were false positive hence giving a specificity of only 68%.

A total of 33 out of the 111 ovarian masses were scored using the IOTA scoring system. All 5 malignant ovarian cysts were correctly identified hence the high sensitivity of the scoring system. Out of the 28 ovarian masses that were benign on final histopath, 4 were classified by IOTA simple rules as malignant hence the specificity of 85.6%

A combination of the scoring systems were utilized in order to determine the malignancy of the ovarian masses. The outcomes showed that there were 44 ovarian masses that were scored using both Lerner and Sassone. When both tests were utilized, the specificity of the test was at 65% which was similar to utilizing Lerner score alone but slightly lower than

using Sassone alone. The sensitivity of the tests in combination was similar to when used alone. Both tests were able to identify all malignant ovarian masses. Among the 40 benign ovarian masses, 14 out of 40 were scored by both as malignant. These masses were mostly dermoid and endometriotic cysts.

Among the 7 ovarian masses scored using combined Lerner and IOTA simple rules, there was 1 malignant ovarian cyst on histopath and this was correctly identified by both scoring systems. Half of the ovarian masses interpreted as benign on histopath were scored as malignant using both Lerner and IOTA hence decreasing the specificity of the combined test to 50%.

There were 27 ovarian masses screened using both Sassone Score and IOTA simple rules. All malignant ovarian masses were correctly interpreted by both scoring systems. Out of the 23 benign masses, there were 4 masses that were read as malignant. The specificity of the combined Sassone and IOTA was higher than utilizing Sassone alone but slightly lower than using IOTA simple rules alone. The 4 masses showed histopathologic finding of mature cystic teratoma.

IOTA Simple Rules, Lerner and Sassone Scoring was used in 7 ovarian masses. The combination of the three showed a high sensitivity since there was only 1 malignant ovarian mass and it was detected by all three scoring systems. However, half of the benign masses were scored as malignant hence decreasing the specificity to 50%. The specificity of all three combined is lower than the specificity of the individual tests alone. Comparing the specificity of combined tests, the combination of IOTA and Sassone had higher specificity than the combination of IOTA Simple rules and Lerner as well as Lerner and Sassone. This can be attributed to the increase in the number of ovarian masses analyzed with IOTA and Sassone compared with the other combination tests with only 7 samples.

DISCUSSION

Significance of the Study:

In the advent of technology, ovarian masses can be diagnosed earlier. At present, there are a lot of morphological scoring systems that are utilized in determining the malignant potential of ovarian masses. Several studies made on these different scoring systems have established different sets of sensitivity and specificity in diagnosing ovarian masses as benign or malignant. Moreover, some ovarian masses may be classified as borderline malignant histopathologically while exhibiting benign features on ultrasound. Some borderline characteristics include unilocular cysts with cresent sign and extensive papillations or a cyst with a well-defined multilocular nodule.[11] Locally, in a tertiary hospital setting, three scoring systems are being utilized in determining malignant potential of ovarian masses, namely Sassone, Lerner and IOTA simple rules. These three scoring systems have different sensitivities and specificities as seen in the different studies worldwide. The study will be helpful in determining the accuracy of each scoring system utilized by OB-GYN sonologists in a local tertiary ultrasound diagnostics unit in terms of sensitivity, specificity and predictive values. The determination and comparison of the sensitivity and specificity of the three scoring systems done in the local setting will help in determining the best scoring system to be utilized in the tertiary hospital ultrasound unit. Further recommendation can be given as to which among the three scoring systems can be utilized better or if the specificity or sensitivity will be increased if they are utilized together. Moreover, this study helped identify the possible ultrasound features of benign ovarian masses which turn out to be borderline masses on histopathology. This can help clinicians in accurately diagnosing borderline ovarian tumors pre-operatively.

In this present study, we determined the accuracy of detecting ovarian malignancy in the ultrasound department of a tertiary hospital utilizing three scoring systems namely Lerner, Sassone and IOTA Simple Rules. Several studies have showed various sensitivity and specificity of the different tests. The ultrasound machine utilized in the study was Voluson E10 and E8 which are both capable in providing clear and resonant ultrasound images. Both machines are also capable of color flow as well as Doppler studies. Most of the sonologists in the tertiary hospital ultrasound diagnostics unit were all fellows of the PSUOG and have experience years of scanning from 3 to 25 years.

The study done by Lerner et al in 1994 modified the previously devised morphologic system by removing variables which they deemed unnecessary and added another variable called shadowing. The parameters tested were wall structure, shadowing, septal thickness and echogenicity. It established a cut-off of 3 for malignancy. This study yielded a sensitivity of 96.8% and a specificity of 77%. It also

had a positive and negative predictive value of 96.8% and 77%. Conversely, our study yielded a higher sensitivity but slightly lower specificity. The positive predictive value was slightly lower and the negative predictive value were also the same. In another study by Klangsin et al, which studied the comparison of five sonographic scoring systems in malignant ovarian tumors among 146 patients, the sensitivity of Lerner score was 82.2 % and specificity of 68.3%.[12] Among the 44 ovarian masses screened by lerner's scoring system, there were 14 ovarian masses that were scored to be malignant but were benign on final histopath result. These masses were dermoid cysts, endometriotic cyst and mucinous cystadenoma. The ovarian cysts that were mature cystic teratomma on histopathology were described as having mixed echoes with hyperechoic focus, thick wall (1.17 cm) and thick capsule (0.71 cm). Another had a reticular pattern with medium level echoes, thick capsule (0.37) and septum (0.83 cm) and an irregularity measuring 0.4x0.4 cm. Another mass was described as a complex mass predominantly cystic with scanty flow at the inferior pole and high resistance index. There were 2 ovarian masses that were endometriotic cysts on histopath but was scored as 7 using lerner scoring system and was interpreted as malignant. The masses were described as mixed echogenicity with thick capsule (0.3 cm) and thick septum (0.4 cm), with no solid areas but with multiple echogenic stipplings and posterior shadowing.

The study done by Sassone et al in 1991, provided promising results when their study yielded a specificity of 83% and sensitivity of 100%, positive and negative predictive values of 37 and 100% respectively. Moreover, since they were able to rigidly and explicitly define each characteristic of the adnexal mass, their approach was more sensitive compared to other morphologic scoring system.[3] Sassone scoring system describes adnexal masses based on inner wall structure, wall thickness, septum thickness, and echogenicity. The maximum score for an adnexal mass is 15 while the minimum score is 4. A score of greater than or equal to 9 is considered malignant. This scoring system may be useful particularly in countries with low resources since it relies on 2D scans and it doesn't need the use of color flow.

Most of the sonologists in this study utilized the sassone scoring system compared with that or IOTA and Lerner. The cut off size of the wall thickness, papillarities and irregularities was 3 mm. Those greater than 3 mm received a higher score. The sonolucency on the other hand was graded according to echogenicity. Those with higher echoes scored greater compared to the anechoic masses. Since the cut off for malignancy is 9, there were several ovarian cysts that were scored malignant despite showing benign results on histopathology. Other masses that scored 7 or 8 were interpreted as borderline malignant. 14 out of 105 ovarian masses were interpreted as borderline malignant with a sassone score of 7 or 8. These masses exhibited the following characteristics, first, the wall thickness were more than 3 millimeters, second they were characterized as having mixed echogenicity or low echogenicity with echogenic cores. Third, some masses were solid. The final histopathologic results of these borderline masses were endometriotic cyst, mucinous cystadenoma and mature cystic teratoma which are all benign. Also, 5 ovarian masses were Similarly, our study had higher sensitivity than specificity making sassone a good screening tool in detecting malignancy in adnexal masses. In the study of Sassone, although other studies identified tumor size as a risk factor for malignancy, they concluded that it's addition in their scoring system did not improve the test's sensitivity since there are large benign tumors. They also noted the source of their large false positive test were the benign teratomas since their characteristics overlapped with that of malignant tumors. In this study, 24 of the ovarian masses were mature cystic teratomas.

The International Society of Ultrasound in Obstetrics and Gynecology (ISUOG), they have recommended the use of IOTA Scoring system in classifying adnexal masses. While the latest Philippine Society of Ultrasound in Obstetrics and Gynecology (PSUOG) guideline recommends assessment of tumors be initially done by pattern recognition using the ten simple rules in determining benign or malignant tumors. Further assessment of the tumors can be employed using IOTA which now includes color flow assessment. In this study, the sensitivity and specificity of IOTA Simple rules was at 100% and 85% respectively. The sensitivity was higher in IOTA compared to that of Sassone and Lerner. It also has a higher positive predictive value compared to the other scoring system. Comparing it to the study done by Tantipalakorn in 2014, IOTA was found to have higher specificity in their study as compared to the sensitivity. Out of the 34 ovarian masses scored using IOTA Simple Rules, only 4 ovarian masses were interpreted as having malignant features but with

benign final histopath result. The masses exhibited irregular multilocular solid tumor and with presence of at least 4 papillarities. The histopathologic result was mature cystic teratoma. Current recommendation for classifying ovarian or adnexal masses utilize pattern recognition the n application of the IOTA simple rules. Timmerman et al in 2014 established there set of ultrasound simple rules in order to be more practical and make the assessment more simplified. Due to the relative novelty of this scoring system, many of the sonologist in the study were more comfortable in utilizing other scoring systems such as Sassone and Lerner scoring System.

In the study of Jung in 2015, described ultrasound of ovarian masses using pattern recognition approach. The study described the classical features of endometrioma are homogenously low level echoes in the cyst commonly called as ground glass appearance which signifies hemorrhages within the cyst. However some atypical findings of endometriomas include fluid – fluid level, hyperechoic mural heterogeneity or calcification. In this study there were several ovarian masses that were endometriomas on histopath. Mature cystic teratoma, usually shows focal high echogenic nodules, heterogeneous internal echoes in the cyst with acoustic shadows, and multiple hyperechoic fine lines and dots, which are due to reflection by clumps of hair, sebum, or fat component within the mass . The hyperechoic area is not usually as intensely echogenic as calcification and may be confused with the echo of adjacent bowel gas.

A study done by Tongsson et al in 2008 determined the validity of pattern recognition in diagnosing ovarian mature cystic teratomas. They concluded that ultrasound pattern recognition using transabdominal ultrasound with color extended-flow mapping can accurately diagnose mature cystic teratoma with a sensitivity of 94% and a specificity of 98%. Moreover, they concluded that, subjective evaluation of an adnexal mass by an experienced sonographer is a highly accurate method for diagnosis of cystic teratomas. Also, training should be done to focus on recognizing the morphologic features of a mass, rather than on any particular scoring system.[13]

Review of Related Literature:

Precise diagnosis of ovarian masses is important in clinical decision making in the practice of gynecology. Currently, ultrasonography is the widely utilized diagnostic modality in identifying adnexal masses because of its relative simplicity and non-invasiveness. According to the Royal College of Obstetricians and Gynaecologists Green-top Guidelines, a pelvic ultrasound is the single most effective way of evaluating an ovarian mass with transvaginal sonography being preferable due to its increased sensitivity over a transabdominal ultrasound.[1] Some studies show that an ultrasound can accurately characterize about 90% of adnexal masses and the reported sensitivity and specificity of ultrasound for detecting ovarian malignancies is 88%-96% and 90%-96%, respectively.[2]

In the past, several morphological scoring systems have been utilized in determining benign and malignant adnexal masses. These scoring systems classify ovarian masses based on several characteristics namely wall thickness, inner wall structures, echogenicity and presence or absence of solid areas. In a study done by Sassone et al in 1991, it provided promising results when their study yielded a specificity of 83% and sensitivity of 100%, positive and negative predictive values of 37 and 100% respectively. Moreover, since they were able to rigidly and explicitly define each characteristic of the adnexal mass, their approach was more sensitive compared to other morphologic scoring system.[3] Sassone scoring system describes adnexal masses based on inner wall structure, wall thickness, septum thickness, and echogenicity. The maximum score for an adnexal mass is 15 while the minimum score is 4. A score of greater than or equal to 9 is considered malignant. This scoring system may be useful particularly in countries with low resources since it relies on 2D scans and it doesn't need the use of color flow. In a prospective study done by Shende V. et al (2016) in India, where they utilized the Sassone scoring system in 56 patients with adnexal masses in determining benign from malignant adnexal masses, they concluded that there is a highly significant association between the Sassone score and type of adnexal masses (P value is <0.000001).[4]

Over time, several other morphological scoring systems have been developed. However, these scoring systems were found to be subjective since some of them failed to show a systematic description of the lesions and would require extra effort to properly classify each lesion into the scoring system.[5]

In the advent of new technology, doppler flow has been used to further classify ovarian masses as benign or malignant. In a study done by Tantipalakorn C. et al (2014) where the International Ovarian Tumor Analysis (IOTA) group, proposed simple ultrasound-based rules in predicting ovarian malignancy. The rules were based on the simple demonstration of certain sonographic findings, some of which are indicative of malignancy (M-features) and others of benignity (B-features).[6] In addition to the morphological characteristics, they also accounted for the blood flow within the adnexal masses, utilizing color flow parameters. The IOTA Group has published the largest study to date looking into the use of ultrasound in distinguishing benign and malignant ovarian masses. Utilizing the data derived from the IOTA Group, simple ultrasound rules were developed to help classify the masses as benign (B- rules) or malignant (M-rules). The B - rules included the following characteristics such as unilocular cysts, presence of solid components where the largest component measures < 7 mm, presence of acoustic shadowing, smooth multilocular tumor with a largest diameter of <100 mm, and no blood flow. The M- rules on the other hand included irregular solid tumor, presence of ascites, presence of at least four papillary structures, Presence of irregular multilocular soild tumor with largest diameter ≥ 100 mm and a very strong blood flow. Using this rules, the reported sensitivity was 95%, specificity 91%, positive likelihood ratio of 10.37 and a negative likelihood ratio of 0.06. [7]

In a study done by Valentin in 2000, it determined the sensitivity and false positive rate of Lerner's score and Doppler variable utilizing time average maximum velocity. The study tested prospectively earlier defined cut-off values for Lerner's score and Doppler variables and verified whether the combination of Doppler variable and Lerner's score had better sensitivity and specificity in determining malignancy than the use of each alone. The study compared the ultrasound examinations with those of the histologic examinations of the specimens. The study defined the best diagnostic method as the one who can detect the most malignancy with the lowest false positive rate. The study concluded that a combination of Lerner's score and measurement of time averaged velocity were best diagnostic tests with a sensitivity of 92% and a false positive rate of 19%.[8] A study done by Lerner et al in 1994 tried to simplify the determination of ovarian malignancy by Sassone. The group removed the determination of wall thickness and replaced it with shadowing in order to differentiate the features of Dermoid cyst from ovarian malignancy. The cut off value for Lerner was 3 in determining malignancy with a specificity of 77% and a sensitivity of 96.8%.[9]

The Philippine Society of Ultrasound in Obstetrics and Gynecology (PSUOG) recommends that assessment of ovarian tumors be initially done using the ten simple rules for identifying a benign from a malignant tumor. Further assessment should then be done by IOTA scoring which includes color flow assessment. In the absence of color flow capability, Sassone Scoring may be used instead. [10]

CONCLUSION

In conclusion, the ultrasound diagnostic unit of the tertiary hospital can accurately determine benign ovarian masses utilizing any of the three scoring systems. All three scoring systems had high sensitivity. However, in determining malignancy, use of IOTA Simple rules has a higher specificity (85%) compared to Sassone and Lerner Scoring. Borderline interpretation of ovarian masses may vary depending on the scoring system used. Combination of the scoring system (double and triple) showed persistently high sensitivity. Moreover, the combination of Sassone and IOTA simple rules had higher specificity than combination of Lerner and Sassone or Lerner and IOTA. When all three scoring systems were combined, it showed lower specificity compared to the sensitivity of the individual scoring systems. However, we cannot fully conclude that individual specificity will be better than combined tests since there is limited number of ovarian masses analyzed.

RECOMMENDATION

Due to the limited number of ovarian masses analyzed, further study should be done with increased number of ovarian masses. We recommend that at least 101 ovarian masses be analyzed by Sassone, Lerner and IOTA simple rules individually so as to come up with a greater number of sample size. We also recommend to determine the experience years of the sonologists and find out how it affects the accuracy of the ultrasound unit in determining the malignant potential of ovarian masses utilizing Sassone, Lerner and IOTA Simple rules. A prospective study can be done in order to ensure that the sampled ovarian masses will be scored utilizing all three

scoring systems to be able to compare the accuracy of each test. A detailed examination of the ovarian masses can also be done to describe the differences in the features of the most commonly mistaken masses as malignant.

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