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Original Research Article

Neoplastic and Non-Neoplastic Ovarian Mass Fine Needle Aspiration Cytology with Histological Correlation

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Abstract:

Background: Several variables affect the efficacy and accuracy of image-guided FNAC in the pre-operative identification of ovarian masses. However, this approach makes it challenging to diagnose borderline tumours. However, epithelial tumours can be correctly identified as benign or malignant. This study's primary goal was to evaluate the USG-guided FNAC's sensitivity, specificity, and diagnostic accuracy in neoplastic and non-neoplastic ovarian masses using histopathology as the gold standard.

Methods: This study comprised 80 patients who were identified as having probable ovarian masses by clinical and imaging methods between February 2022 and January 2023. FNA was carried out under USG guidance, and a diagnosis was made. Histopathological analysis supported the cytological diagnosis. To find the association between cytological and histological diagnosis, descriptive statistics were used.

Results: Twelve cases of benign non-neoplastic cysts were identified after investigation of the fine needle aspirated material. Thirteen instances could not be classified because of ambiguous results or insufficient cytological aspiration material. Except for one case of mucinous cystadenoma, which was diagnosed as borderline mucinous cystadenocarcinoma, all benign cases on histological investigation were classified as benign tumours. On histological inspection, a case that was first classified as borderline mucinous adenocarcinoma was shown to be mucinous adenocarcinoma. The FNAC's accuracy, specificity, and sensitivity were 82.3%, 92.3%, and 84.2%, respectively.

Conclusion: For the quick and reasonably accurate diagnosis of ovarian masses with good sensitivity and specificity, use image assisted FNAC. All ovarian tumours can be classified into benign and malignant lesions with meticulous cytological screening, reducing needless surgical morbidity.

Keywords: ovarian masses, fine needle aspiration, Histological correlation, diagnostic accuracy.

Introduction

Because there is a higher risk of cancer in older people, ovarian mass is a cause for concern. While benign ovarian masses can affect both young and old women, malignant ovarian tumours typically manifest at an advanced stage. Current diagnostic methods' inability to make a definitive diagnosis could be the root of

needless surgical morbidity.[1,2] Due to great patient compliance and a low complication rate, fine-needle aspiration cytology (FNAC) has some benefits for assessing ovarian tumours.[3] However, because to low cellularity or subsequent degenerative alterations, the prevalence of borderline tumours and false negative cytological analysis is high on cytology testing.[1,2] If FNAC analyses all varieties of ovarian masses in sufficient numbers, the diagnostic precision may increase. There is evidence that the FNA process has the potential to seed a tumour. Such a procedure may carry a significant amount of risk, although this is uncertain and not supported by strong data.[4,5] Image-guided The preoperative diagnosis of ovarian masses can be made quickly, with high sensitivity and specificity, using the cost-effective FNAC procedure, with the least amount of morbidity. Due to the late-stage presentation of most ovarian cancers, it may be useful in deciding whether to utilise neoadjuvant chemotherapy and preventing unnecessary surgical morbidity.[6-8] Previous studies have attempted to evaluate the accuracy of image-guided FNAC in pre-operative diagnosis of ovarian masses, despite the fact that histological exams continue to be the gold standard for the identification of ovarian masses.[9-17] This study primary goal was to evaluate the USG-guided FNAC sensitivity, specificity, and diagnostic accuracy in neoplastic and non-neoplastic ovarian masses using histopathology as the gold standard.

Materials and Methods

The current investigation was carried out between February 2022 and January 2023. During this time, 80 individuals were included in the study who had been identified as having probable ovarian masses by clinical examination (abdominal and per vaginal examination) and/or imaging modalities like USG. Under the supervision of the USG, these patients underwent a transabdominal percutaneous FNA evaluation. Using a 20 ml syringe and a 22 to 23 gauge needle, the bulk was localised and aspirated. A lumbar puncture needle was utilised for masses that were deeply seated.

Aspirated material was applied to glass slides right away. Leishman/Giemsa stain preparation included two air dried smears. Papanicolaou stain was used to colour two wet-fixed smears that were fixed in 95% alcohol. For diagnostic correlation, records of clinical and radiological information as well as blood tumour markers (cancer antigen 125 and alpha fetoprotein, when available) were kept. The following cytological characteristics of the smears were assessed: cellularity, cell arrangement, epithelial cell characteristics, foamy or hemosiderin-laden macrophages, and background material (proteinaceous, granular, greasy, or mucoid). The lesions were categorised as (1) benign nonneoplastic cysts, (2) benign neoplasms, and (3) malignant neoplasms based on cytomorphology. The outcomes were contrasted with the gold-standard histopathological diagnosis. As and when necessary, specialised stains (immunomarker, PAS, etc.) were used. When cyst fluid was extracted, material from cytocentrifugation was collected and stained using analogous procedures. To find the association between cytological and histological diagnosis, descriptive statistics were used. The gold standard for determining sensitivity and specificity for cytological diagnosis was histological confirmation.

Results

Table 1: Age distribution of patient with suspected ovarian masses

Age group	No. of cases	Percentage
11-20	1	1.2%
21-30	4	5%
31-40	19	23.8%
41-50	13	16.3%
51-60	22	27.5%
61-70	14	17.5%
71-80	6	7.5%
81-90	1	1.2%
Total	80	100%

There are 80 patients in the current study, ranging in age from 11 to 87, with a mean age of 53. (Table 1) With a peak in the fifth decade (n=22), patients with ovarian masses often presented during the third and sixth decades of life. Clinically, the majority of patients had stomach pain, edoema, and irregular menstrual cycles. Ultrasonography was used to determine the type of lesion (solid or cystic), size, location, and extent of the lesion.

Twelve cases of benign nonneoplastic cysts were identified after evaluation of the fine needle aspirated material; these cases were not further subdivided. Thirteen instances could not be classified because of ambiguous results or insufficient cytological aspiration material. The benign neoplasm included benign cystic teratoma (one case), serous cystadenoma (two cases), mucinous cystadenoma (four cases), and granulosa cell tumour (one case). The granulose cell tumour exhibited a cellular smear made up of tiny malignant cells with nuclear grooves and little cytoplasm. Straw coloured fluid and few cellular smears were aspirated from serous cystadenoma. Along with foamy macrophages and a few inflammatory cells, there were a few papillary clumps of the bland epithelial cells. Tall columnar cells with basally displaced nuclei and some with vacuolated cytoplasm were seen in cases of mucinous cystadenomas against a mucinous background. Except for one case of mucinous cystadenoma, which was diagnosed as borderline mucinous cystadenocarcinoma, all benign cases on histological investigation were classified as benign tumours.

On histological inspection, a case that was first classified as borderline mucinous adenocarcinoma was shown to be this type of cancer. (Table 2) Six instances out of 80 had blood aspirated during FNA. Three of these cases—leiomyoma, mucinous adenocarcinoma, and fibrothecoma—had surgical specimens received in them. Two of the seven instances that a cytological study deemed insufficient were later identified as granulosa cell tumour and mucinous adenocarcinoma. Surgical specimens were not received in 5 cases. Three instances were classified as having malignancy because they lacked certain characteristics. On histological evaluation, these were identified as serous adenocarcinoma in two cases and borderline serous adenocarcinoma in one case.

Table 2: Cytological diagnosis on FNA smears in ovarian masses

Diagnosis	No. of cases	Percentage
Benign	12	15%
Blood	6	7.5%
Inadequate	7	8.8%
Non-conclusive (neoplasm)	3	3.6%
Serous cystadenoma	2	2.5%
Mucinous cystadenoma	4	5%
Borderline Mucinous adenocarcinoma	1	1.2%
Serous adenocarcinoma	18	22.5%
Mucinous adenocarcinoma	16	20%
Granulosa cell tumor	1	1.2%
Poorly differentiated carcinoma	9	11.5%
Teratoma	1	1.2%
Total		100%

Table 3: Comparison of cytological and histopathological diagnosis in ovarian masses

Cytological examination		Histopathological examination		
Diagnosis	**No of cases**	**Specimen received**	**Diagnosis**	
Benign	12	-	-	-
Blood	6	3	1	leiomyoma
			1	Mucinous cystadenoma
			1	fibrothecoma
Inadequate	7	2	1	Granulosa cell tumor
			1	Mucinous adenocarcinoma
Non-conclusive- positive neoplasm	3	3	2	serous adenocarcinoma
			1	Borderline serous adenocarcinoma
Serous cystadenoma	2	2	2	Serous cystadenoma
Mucinous cystadenoma	4	4	3	Mucinous cystadenoma
			1	Borderline Mucinous adenocarcinoma
Borderline Mucinous adenocarcinoma	1	1	1	Mucinous adenocarcinoma
Serous adenocarcinoma	18	8	7	Serous adenocarcinoma
			1	Borderline Serous adenocarcinoma
Mucinous adenocarcinoma	16	4	4	Mucinous adenocarcinoma
Granulosa cell tumor	1	-	-	-
Poorly differentiated carcinoma	9	4	3	Serous adenocarcinoma
			1	Mucinous adenocarcinoma
Teratoma	1	-	-	-
Total	**80**	**31**		

The papillary aggregates of malignant epithelial cells in the smears of malignant papillary serous cystadenocarcinoma have large hyperchromatic nuclei and a high nuclear-cytoplasmic (N/C) ratio. Highly indicative of mucinous cystadenocarcinoma were sheets and papillary clusters of columnar mucin-

producing cells with malignant characteristics in the background of mucin. On the basis of cytological analysis, serous adenocarcinoma was diagnosed in 18 patients. We collected samples from them in 8 of the cases. Seven cases were diagnosed with the same outcome, although one case was classified as borderline serous adenocarcinoma because it lacked invasion-related characteristics. Based on cytological characteristics, mucinous adenocarcinoma was diagnosed in sixteen patients. For histological confirmation, only 4 specimens were received, and they were all found to be mucinous adenocarcinomas. Due to the lack of characteristics unique to any tumour and the lack of supporting immunohistochemical staining data, nine cases were determined to be poorly differentiated carcinomas. In four cases, we received a surgical specimen. Three of these four instances had mucinous adenocarcinomas, while one had serous adenocarcinomas as their diagnosis. (Table 3) The FNAC's accuracy, specificity, and sensitivity were 82.3%, 92.3%, and 84.2%, respectively.

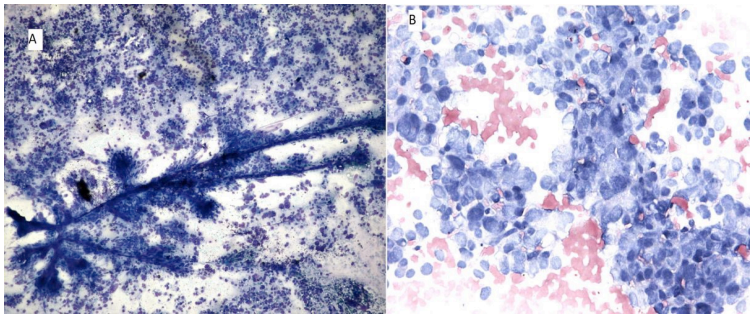

Fig.1: FNA smears A) showing features of papillary serous adenocarcinoma and B) mucicarmine negative tumor cells

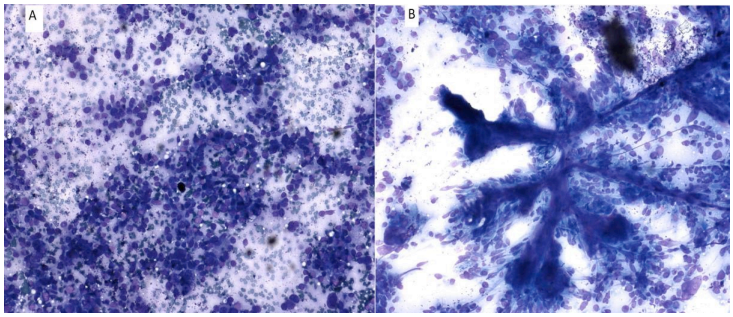

Fig.2: FNA smear A) and B) revealing features of mucinous adenocarcinoma

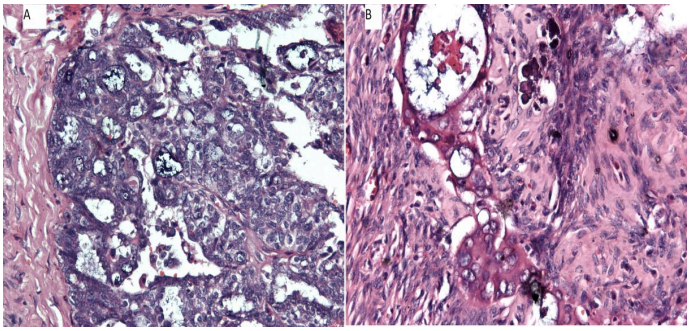

Fig.3: A) H&E stained sections showing histomorphological features of mucinous adenocarcinoma, and B) H&E stained sections showing tumor foci with psammoma bodies

Discussion

Regarding the diagnostic efficacy of FNA in ovarian masses, there are conflicting findings. The improved accuracy of FNAC in recent years has also been attributed to new cutting-edge radiologic guidance techniques. Due to its better accuracy, FNAC has been used for both the initial diagnosis and follow-up of malignant ovarian lesions.

Cytological examination of ovarian lesions is a challenging problem because of the complicated cytological features and the vast range of diagnostic categories. [8] On cytological inspection, borderline tumours were challenging to identify and frequently misdiagnosed as well-differentiated cystadenocarcinomas or even benign cystadenomas. Due to greater inter-observer variability, this subset of ovarian neoplasms represents a grey area. Histopathology is required to determine if stromal invasion is present or absent in borderline tumours. For this reason, a high index of suspicion and a thorough analysis of cytological characteristics are crucial for the identification of borderline tumours.[1,2]

We obtained excised ovarian masses for histological analysis in 31 out of 80 cases. Except for one case of mucinous cystadenoma, which was identified as borderline mucinous cystadenocarcinoma, all benign tumour cases on histological investigation were benign. On histological inspection, a case that was first classified as borderline mucinous adenocarcinoma was shown to be mucinous adenocarcinoma. On histology, one serous adenocarcinoma case out of eight was classified as borderline malignancy. The most frequent category in numerous research that causes misleading positive and negative results on cytological examinations is borderline malignancy. The FNAC's accuracy, specificity, and sensitivity were 82.3%, 92.3%, and 84.2%, respectively.

Eight of the 38 serous cystadenoma instances in the study by Khan N. et al. turned out to be false negatives, mostly because the cell material was sparse and degraded. Due to the presence of thick mucoid material covering the cellular features, four out of 12 instances (mucinous cystadenoma) turned out to be false negatives. In the malignant category, there were three false-positive cases: one case each of borderline serous cystadenocarcinoma, mucinous cystadenocarcinoma, and metastatic carcinoma that were all incorrectly diagnosed as serous cystadenocarcinoma due to the absence of obvious malignant features and an abundance of mucin in the background. Therefore, ovarian mass diagnosis with cytology had a sensitivity and specificity of 79.2% and 90.6%, respectively. [13]

In the study by Mehdi G and colleagues, a cytological diagnosis was made for each of the 42 ovarian lesions, with a correct diagnosis being made in 34 cases, yielding a diagnostic accuracy of 80.9%. The majority of patients with conflicting diagnoses were surface epithelial tumours with little malignant potential, and a final diagnosis required histological testing. On cytological investigation, three cases of serous and two cases of mucinous cystadenocarcinomas with low malignant potential could not be appropriately recognised. [14] When examining ovarian masses histologically and cytologically, Bandyopadhyay A and colleagues discovered discrepancies. The histological diagnosis was the same in 8 of the 10 benign serous cystadenomas, although 2 were borderline serous tumours. Six mucinous cystadenomas that were identified by cytology corresponded well with histology. Out of 18 instances identified as serous adenocarcinoma, 15 cases had a consistent histological diagnosis, 2 cases had a histopathological diagnosis of questionable malignancy, and one case was identified as undifferentiated

carcinoma. Only one of the nine mucinous adenocarcinoma diagnosis made by cytology turned out to be a Krukenberg tumour, while another was a borderline mucinous tumour. The other seven instances corresponded well. [15]

A total of 584 ovarian mass cytological smears were evaluated by Gupta N et al. 180 (30.8%) of the 584 lesions were classified as non-cancerous, 249 (42.6%) as cancerous (81 benign lesions/tumors and 168 malignant), and 155 (26.5%) as insufficient. The cases were separated into concordant and discordant groups based on the following histology, which was available in 121 (20.7%) of the cases. 92 of the 121 cases were concordant (76%) while 29 of the 121 cases were discordant (24%). 14 surface epithelial tumours, including one cystadenofibroma, one borderline mucinous tumour, and 12 carcinomas, were found to be in disagreement with histological examination out of these discordant cases. The FNAC has a sensitivity of 85.7%, a specificity of 98.0%, a positive predictive value of 97.7%, and a negative predictive value of 87.7% for a diagnosis of cancer. [16]

In the Ray S et al. investigation, all 83 ovarian lesions had cytological diagnoses; of these, 56 were benign, 6 were possibly benign, 3 were suspected of malignancy, and 18 were malignant. In their cytology investigation, three cases of borderline tumors—one borderline serous tumour, two borderline mucinous tumours, and one borderline mucinous cystadenocarcinoma—were incorrectly identified. Therefore, the sensitivity and specificity of cytological diagnosis were 83% and 97%, respectively.[17] Various aspiration methods and smear preparation methods may be to blame for the contradictory results on the accuracy of cytological evaluation of ovarian masses. Lack of useful clinical data from the patients, such as serum indicators and USG results, may be significant. A poor cyto-histopathological correlation may be explained by a number of additional reasons. The fluid from an ovarian cyst may occasionally contain unusual cells, foamy macrophages, or neither, which makes it impossible to accurately diagnose the disease. Additionally, borderline epithelial tumours on aspiration cytology are challenging to interpret.

Conclusion

The high percentage of insufficient samples is one of the main drawbacks for the use of FNAC in ovarian tumours. Occasionally, aspirates may contain peritoneal fluid rather than cystic fluid as a result of improper lesion localisation. Low cellularity and subsequent degenerative alterations are typically to blame for false-negative FNAC results in ovarian cystic lesions, particularly in borderline malignancy.

None of the diagnostic approaches for ovarian masses—clinical examination, pelvic ultrasonography, and FNAC—was sufficient on its own. For a certain diagnosis, all clinical and sonographic evidence should be taken into account in conjunction with cytological findings. The sensitivity of FNAC for the diagnosis of ovarian masses is constrained by insufficient or inconclusive data.

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