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ORIGINAL ARTICLE

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Intra-operative cytology of ovarian tumours

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OBJECTIVE(S) : To establish the validity and reliability of imprint cytology in intraoperative diagnosis of ovarian tumors and to compare it with histopathology.

METHOD(S) : Multiple imprint smears were taken from the resected tumor masses during surgery in 67 patients. After staining, the findings were noted and compared with subsequent histopathology report.

RESULTS : There were 53 celomic epithelial ovarian tumors and 14 non-celomic ovarian tumors.There were 41(61.19%) benign and borderline tumors, and 26 (38.81%) malignant ones. Overall diagnostic accuracy was 89.55% .

CONCLUSION(S) : Imprint cytology is a less expensive, simple, fast and reliable method for diagnosis of ovarian tumors during surgery.

Key words - imprint cytology, ovarian tumors

Introduction

Ovarian neoplasms are a heterogenous group of benign and malignant tumors of epithelial, stromal and germ cell origin. Most of the ovarian tumors cannot be easily distinguished from one another on the basis of their clinical or gross characteristics alone. Therefore , cytologic interpretation of ovarian neoplasms is both interesting and challenging [1] .Fine needle aspiration cytology in the preoperative investigation of ovarian tumors has been discouraged since the puncture of a cystic carcinoma might cause intraperitoneal seeding. But intraoperative imprint cytology will provide a rapid diagnosis (within 20 minutes) without the fear of dissemination in case of ovarian cancer. Rapid intraoperative diagnosis of the nature of ovarian tumors in a young woman avoids unnecessary removal of contralateral ovary and helps preserve fertility. It can allow individualization of treatment like complete surgery in a case of malignancy and particularly the postoperative irradiation of anaplastic carcinoma. It can also be used for staging, for post-operative follow-up, and for recurrences. Materials obtained this way can be used for flow cytometry and cytogenetic studies. In spite of the various applicability, its use has not been widely recognized in diagnosis of ovarian tumors and there are only a few reports on diagnosis of ovarian tumors by imprint cytology.We undertook this study to find out the accuracy of imprint cytology in intraoperative ovarian tumor diagnosis by correlating it with histopathology which is taken as the gold standard in diagnosis of ovarian tumors.

Methods

In this prospective study, materials were obtained from patients undergoing surgery for ovarian tumours. Detailed clinical history was collected, physical examination was done and investigations were recorded. Multiple imprint smears were taken from resected tumor masses and immediately fixed with absolute alcohol. They were then stained with hematoxylin and eosin, examined under light microscope, and the findings reported. The resected masses were sent for histopathological study. Results of imprint cytology and histopathology were compared.

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Results

The total number of ovarian tumors studied was 67. These included 53 (78.95%) celomic and 14(21.05%) non-celomic ovarian neoplasms.Out of these, 41(61.19%) were benign and borderline tumors where as 26 (38.81) were malignant. The age group varied from 16 to 70 years. (Table 1). Serous tumors were found to be most common (37/67; 55.25%), followed by mucinous (13/67; 19.40%) and germ cell tumors (11/67; 16.41%) respectively. Most of the benign tumors were unilateral and cystic in nature. But malignant tumors including both the cases of metastatic adenocarcinoma were bilateral and mostly solid.The majority of mucinous cystadenocarcinomas were unilateral. (Table 2).

Imprint smears were compared with histopathological findings and correlation was found in 60 (89.55%) tumors.There were 22 cases of serous cystadenoma on imprint cytology, out of which 20 were confirmed on histopathology and the remaining two turned out to be of borderline malignancy. From 15 cases of serous cystadenocarcinomas, 12 were confirmed by histopathology but 3 were diagnosed as borderline papillary serous tumours. One case out of the six mucinous cystadenocarcinomas was found to be of endometrioid carcinoma. There were four dysgerminomas which included three cases of pure dysgerminoma while one case showed features of a combination of germ cell and sex cord-stromal tumor (Table 3). All the cases of benign mucinous tumor and benign cystic teratoma, one case of yolk sac tumor and both the cases of metastatic adenocarcinoma showed 100 % correlation with histopathology.

Tabel 1. Age group and to morphological type.

Morphological type	Age group (years)					
	0-20	21-40	41-60	61-80	Total	(Percentage)
Epithelial tumours	**-**	**22**	**28**	**3**	**53**	**(79.10)**
Serious	-	*16*	*18*	*3*	*37*	*(55.22)*
Benign	-	12	6	2	20	(29.99)
Borderline	-	1	4	-	5	(07.46)
Malignant	-	3	8	1	12	(17.91)
Mucinous	-	*6*	*7*	-	*13*	*(19.40)*
Benign	-	4	4	-	8	(11.94)
Malignant	-	2	3	-	5	(07.46)
Endometrioid	-	-	*3*	-	*3*	*(04.47)*
Benign	-	-	2	-	2	(02.98)
Malignant	-	-	1	-	1	(01.49)
Germ cell tumor	**4**	**5**	**2**	**-**	**11**	**(16.41)**
Yolk sac tumor	1	-	-	-	1	(1.49)
Mature cystic teratoma	-	4	2	-	6	(8.95)
Dysgerminoma	3	1	-	-	4	(5.97)
Sex cord stromal tumor	**-**	**1**	**-**	**-**	**1**	**(1.49)**
Granulosa cell tumor	-	1	-	-	1	(1.49)
Metastatic adenocarcinoma	**1**	**-**	**1**	**-**	**2**	**(2.98)**
Total	5 (7.46)	28 (41.79)	31 (46.28)	3 (4.47)	67 (100)	

Table 2. Gross findings.

Morphological type	Number	Consistency			Laterality	
		Solid	Cystic	Mixed	Unilateral	Bilateral
Epithelial tumours	**53**	**4**	**35**	**14**	**38**	**15**
Serous	*37*	*3*	*26*	*8*	*25*	*12*
Benign	20	-	20	-	18	2
Borderline	5	-	4	1	4	1
Malignant	12	3	2	7	3	9
Mucinous	*13*	-	*7*	*6*	*10*	*3*
Benign	8	-	6	2	6	2
Borderline	-	-	-	-	-	-
Malignant	5	-	1	4	4	1
Endometrioid	*3*	*1*	*2*	-	*3*	-
Benign	2	-	2	-	2	-
Borderline	-	-	-	-	-	-
Malignant	1	1	-	-	1	-
Germ cell tumors	**11**	**3**	**4**	**4**	**10**	**1**
Yolk sac tumor	1	1	-	-	1	-
Mature cystic teratoma	6	-	4	2	6	-
Dysgerminoma	4	2	-	2	3	1
Sex cord stromal tumor	**1**	**-**	**-**	**1**	**1**	**-**
Granulosa cell tumour	1	-	-	1	1	-
Metastatic adenocarcinomas	**2**	**2**	**-**	**-**	**-**	**2**

Table 3. Cytohistological correlation.

Intra-operative imprint cytology	Number	Histopathology	Number
Epithelial Tumors			
Benign			
Serous cystadenoma	22	\Serous cystadenoma	20
		Borderline serous tumor	2
Mucinous cystadenoma	8	Mucinous cystadenoma	8
Endometrioid cyst	2	Endometeriod cyst	2
Malignant			
Papillary serous cystadenocarcinoma	15	Papilomatous serous cystadenocarcinoma	12
		Borderline serous tumor	3
Mucinous cystadenocarcinoma	6	Mucinous cystadenocarcinoma	5
		Endometrioid carcinoma	1
Non-Epithelial Tumours			
Benign			
Mature cystic teratoma	6	Mature cystic teratoma	6
Malignant			
Yolk sac tumor	1	Yolk sac tumor	1
Dysgerminoma	4	Dysgerminoma	3
		Dysgerminoma with granulosa cell tumor	1
Adenocarcinoma	1	Granulosa cell tumor	1
Metastatic tumor	2	Adenocarcinoma	1
		Kruckenberg tumor	1

Correlated – 60 (89.55%) Not correlated – 7 (10.45%)

Discussion

Imprint cytology has been widely used in intraoperative diagnosis of various tumors [2,3]. But its use in intraoperative diagnosis of ovarian neoplasms has not been widely recognized. There are only a few reports describing its accuracy and validity. We have done intraoperative cytology in 67 cases and followed it up histologically. Out of them 61.19% were benign tumors and 38.81% malignant.This is comparable to the findings of Ramachandran et al [4] who reported 68.9% of benign tumors. In our study the most common type of epithelial tumor was serous tumor (37/67; 55.22%). Pravakar and Maingi [5] also found it to be the most common epithelial ovarian tumor but their incidence was 32.7%.

Serous cystadenoma comprised 20 cases (20/67; 29.85%) of all ovarian tumors. Similar incidence is quoted by Saxena et al [6],Verma and Bhatia [7] and Tyagi et al [8]. Age range was between 23 and 55 years. All of them were unilateral, cystic and contained clear fluid. Imprint cytology was 90.98% accurate. Malignant serous tumors accounted for 17.94% of all ovarian tumours (Figure 1). Ramachandran et al [4] found a lower incidence of 7.09%. Since benign tumors, in most instances, are asymptomatic, seldom cause abdominal swelling, and acute pain occurs only due to torsion of the mass, patients tend to neglect them and come to the hospital only after development of features of malignancy like ascitis, menstrual disturbances, pain etc. In our study, the serous tumors of borderline malignant potential were diagnosed either as benign (two cases) or malignant (three cases). In the absence of complex branching, nuclear pleomorphism and hyperchromasia, the overall morphology of cells closely resembles that of a benign serous tumor.And also, it is extremely difficult to separate epithelial tumors of low malignant potential from well differentiated carcinomas [9,10].

Mucinous tumors formed the second most common epithelial tumour of the ovary (13/67; 19.40%). Pravakar and Maingi [5] reported them to be 25%. They are the largest tumors among the ovarian tumors. The largest tumor seen in our study was of 13 kg which was a mucinous cystadenoma. (Figure 2). Imprint cytology has shown 100% diagnostic accuracy in case of mucinous cystadenoma and mucinous cystadenocarcinoma. All cases of benign endometrioid tumors were correctly diagnosed by imprint cytology. In the three endometrioid carcinomas one was misinterpreted as mucinous adenocarcinoma giving a 66.6% correlation with histopathology.

Among germ cell tumors, the most common in our study was benign cystic teratoma and imprint cytology showed 100 % diagnostic accuracy (Figure 3). Most of them showed benign squamous epithelial cells, cyst macrophages, and foreign body giant cells produced in response to keratin released by the squamous cells. Glandular epithelial cells, fat and skeletal muscle were occasionally found. All cases of dysgerminoma were accuratetely diagnosed by imprint cytology. Only one case was a mixed tumor viz., germ cell tumor with sex cord stromal tumor; the second component was missed by cytology.The age ranged from 17 to 23 years and all were solid and unilateral with smooth or bosselated external surface. Although yolk sac tumor is the second most common malignant germ cell tumor we had only one case which was in a 16 year old girl (Figure 3). The tumor showed large areas of hemorrhage and necrosis. It was diagnosed by presence of loosely clustered glandular epithelial cells with prominent cytoplasmic vacuolation and occasional eosinophilic hyaline globules. There was only one case of granulosa cell tumor which was misdiagnosed as adenocarcinoma.The monomorphic round cells around

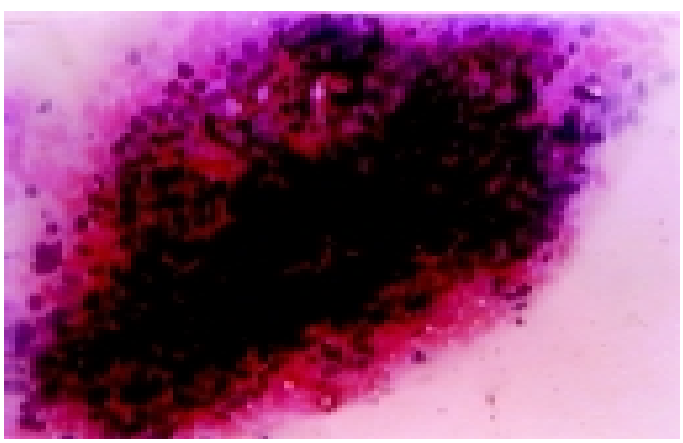

Figure 1. Papillary serous cystadenocarcinoma showing psammoma bodies. Magnification 400X.

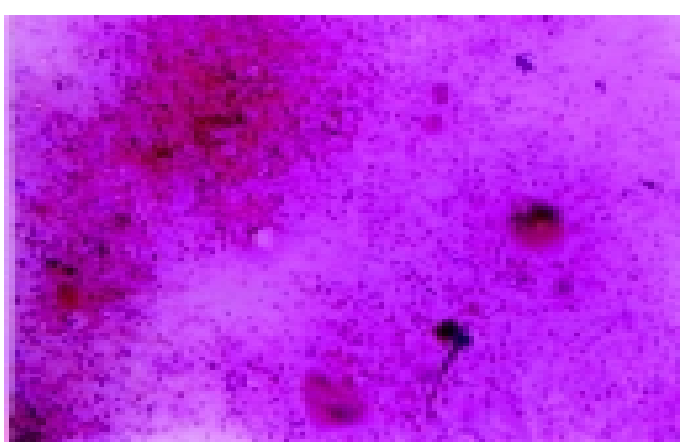

Figure 2. Mucinous cystadenoma filling the abdominal cavity.

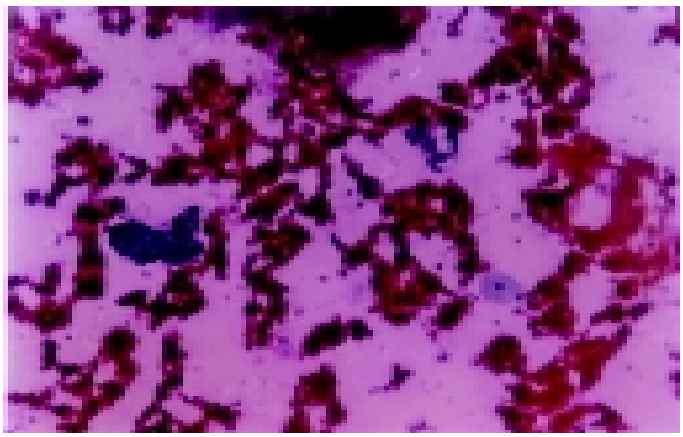

Figure 3. Dermoid cyst showing foreign body giant cells and cyst macrophages. Magnification 100X.

central eosinophilic material (Call-Exner body) were misinterpreted as glands with luminal secretion.

There were two cases of metastatic adenocarcinoma. Both were bilateral and solid, and on cytology showed pleomorphic epithelial cells with glandular pattern in a necrotic background. On histopathological examintion, one was diagnosed as Kruckenberg tumor due to presence of signet ring cells, the primary being in the stomach, and the other as a simple metastatic adenocarcinoma.

In our study, by imprint cytology 89.55% of ovarian tumors were classified correctly. The sensitivity was (93%) and specificity (92 %). Nadji et al [11] had 96.4 % sensitivity and 92.9% specificity in their study. Kjellgren et al [12] did fine needle aspiration biopsy of ovarian carcinoma and found 90% sensitivity and 85% specificity.

Imprint cytology is the only method which gives intraoperative dignosis of ovarian tumors within 20 minutes. It is helpful especially in young patients who need conservative surgery in order to preserve fertility. It does not alter the quality of the biopsy specimen [13]. Imprint cytology is a less expensive, simple and quick method of diagnosis, and is reliable in terms of accuracy, sensitivity, specificity and positive predictive value. It does not affect the utility of the specimen for histopathology.

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