Original Article

Indian Journal of Forensic Medicine and Pathology
Volume 13 Number 1, January - March 2020
DOI: http://dx.doi.org/10.21088/ijfmp.0974.3383.13120.3

Histopathological Spectrum of Ovarian Tumors: A 3-Year Retrospective Study in a Tertiary Care Centre in Southern India

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How to cite this article:
Anugnya P Ranjoalkar, Swati Sharma, Manna Valiathan et al. Histopathological Spectrum of Ovarian Tumors: A 3-Year Retrospective Study in a Tertiary Care Centre in Southern India. Indian J. Forensic Med Pathol. 2020;13(1):19-31.

Abstract

Introduction: Ovarian tumors are a group of diverse neoplasms with a varied clinical, morphological and histological feature. The varied anatomy, histogenesis and its peculiar physiology including the cyclical changes from puberty to menopause give rise to number of cell types, each of which may give rise to tumors. *Materials and methods:* A 3-year retrospective study of histologically proven ovarian neoplasms where the tumors were classified according to World Health Organization (WHO) 2014 classification and their clinical and histopathologic parameters were analyzed. *Results:* Of all 138 ovarian tumors studied, 94 (68.12%) were benign, 13 (9.42%) borderline and 31 (22.5%) were malignant in nature. Benign tumors chiefly presented with abdominal pain with median age of 39. Mature cystic teratoma was found to be the most common benign tumor. Borderline tumors presented at a median age of 37. Borderline serous and mucinous tumors (30.76%) were the most common borderline tumors. Malignant tumors presented frequently with abdominal mass and at median age of 48. According to WHO classification of tumors based on cell of origin, surface epithelial tumor were the most common ovarian neoplasms, accounting for 63.04% cases, followed by germ cell tumor (24%) and sex-cord stromal tumors (8.7%). *Conclusion:* Surface epithelial tumors were the most common histopathological subtype of ovarian tumors. Benign and borderline tumors were predominantly found in reproductive age, whereas malignant tumors were seen in perimenopausal and postmenopausal women. Since the prognosis, therapeutic strategies including multidisciplinary approach depend primarily on the histopathologic diagnosis, an accurate pathological evaluation and classification is of prime importance. The multidisciplinary approach employed has its own medico legal implications.

Keywords: Neoplasm; Epithelial Cancer; Ovarian

Introduction

Ovarian cancer is second most common genital tract malignancy accounting for 3% of total cancer in females[1] and 25% of all gynecological malignancies.[2,3] Ovarian tumors often go unnoticed or the patients present with nonspecific symptoms and present at advanced stage[1,4,5,6] with an overall survival rate of 30–40%.[7] Due to absence of early screening modalities, unknown precursor lesions and no specific clinical features, ovarian tumors are often missed.[8–10] These tumors are diverse with low and high grade subtypes and widely divergent clinicopathologic features which develop independently along different molecular pathways.[11] Histogenesis of ovarian tumors includes a wide spectrum of neoplasm depending upon the origin of cell, i.e. tumor arising from epithelium, germ cell, sex cord stromal and connective tissue.[12,13] Decreased risk is associated with increased parity, oral contraceptive pills and history of hysterectomy or tubal ligation.[7] Since ovarian tumors cannot

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Received on 27.08.2019, **Accepted on** 13.11.2019

be clearly differentiated from one another just on the basis of their clinical, radiological or gross characteristics, there is definitely a requirement to consider and study their histopathological pattern. This may help the clinician to decide appropriate treatment modality. The aims and objectives of this study are to study the prevalence and demographic characteristics of ovarian neoplasms, to classify the ovarian neoplasms according to WHO 2014 classification and to analyze the histomorphological spectrum of benign, borderline and malignant ovarian neoplasms.

Materials and Methods

This is a 3-year retrospective study of histologically proven ovarian neoplasms diagnosed at Department of Pathology, Kasturba Medical College, Manipal, India from January 2015 to December 2017. This study has been approved by Institutional Ethical committee (No: 90-2019) and informed consent has been obtained from the cases pertaining to this study. The tumors were classified according to the WHO classification of Ovarian tumors 2014.[14] The clinical data collected from Medical Records Department consisted of information about age and clinical presentation of the patient. Histopathological analysis including macroscopy and microscopy along with ancillary studies like immunohistochemistry (IHC) for cases wherever available were retrieved from the pathology database. *Inclusion criteria:* Resected specimens of histologically proven benign, borderline, malignant tumors of ovary. *Exclusion criteria:* Trucut/ non-resected biopsy specimens, non-neoplastic lesions of ovary, cases where clinical details could not be retrieved and cases of which H & E slides/ blocks were not available.

Results

One hundred and thirty-eight cases of ovarian tumors were studied retrospectively from January 2015 to December 2017.

Out of 138 cases, 94 (68.12%) were benign, 13 (9.42%) were borderline, 31 (22.5%) were malignant in nature (Fig. 1).

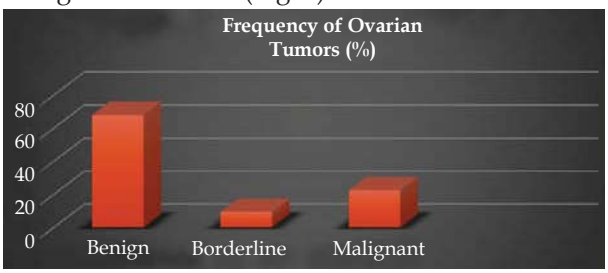

Fig. 1: Frequency of benign, borderline and malignant tumors (%)

The most common clinical presentation in benign tumors was pain in abdomen (58%) followed by other symptoms like urinary urgency and vomiting (18%). Patients with malignant tumors presented with mass per abdomen (40%) as the most common symptom followed by abdominal pain (24%) and others (24%) including menstrual irregularities and increased urinary frequency due to pressure symptoms (Figs. 2 & 3).

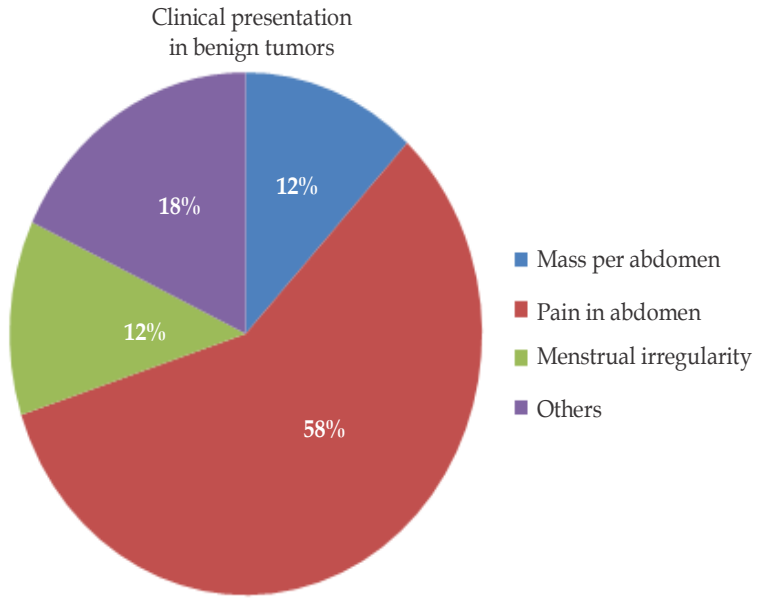

Fig. 2: Clinical presentation in benign cases.

Majority of the tumors were in the age group 31–40 years (26.4%) and 41–50 years (26.08%) (Fig 3). Most of the benign tumors were falling in the age group 31–40 years (27.7%) followed by 41–50 years (23.4%). Borderline tumors mostly occurred in younger age group 21–30 years (38.5%) (Table 1). Majority of the malignant tumors were found to be in perimenopausal and postmenopausal age group i.e 41–50 (32.3%) followed by 51–60 (29%) (Table 1). The youngest case in our study was 1-year-old child with unilateral mature cystic teratoma and the oldest case was unilateral high grade endometrioid carcinoma seen in 79-year-old female.

In the present study, nearly 87.2% of benign tumors were unilateral, however 12.8% were found to be bilateral. Borderline tumors also had predominantly unilateral presentation as seen in 77% cases whereas malignant tumors presented with nearly equal number of unilateral and bilateral cases (Table 2).

Table 1: Distribution of tumors in different age group

Age distribution (years)	Benign (%)	Borderline (%)	Malignant (%)
<= 20	5 (5.6)	–	1 (3.2)
21–30	14 (14.9)	5 (38.5)	1 (3.2)
31–40	27 (27.7)	3 (23)	6 (19.4)
41–50	22 (23.4)	3 (23)	10 (32.3)
51–60	14 (14.9)	1 (7.7)	9 (29)
61–70	9 (9.6)	1 (7.7)	3 (9.7)
>= 71	3 (3.2)	–	1 (3.2)

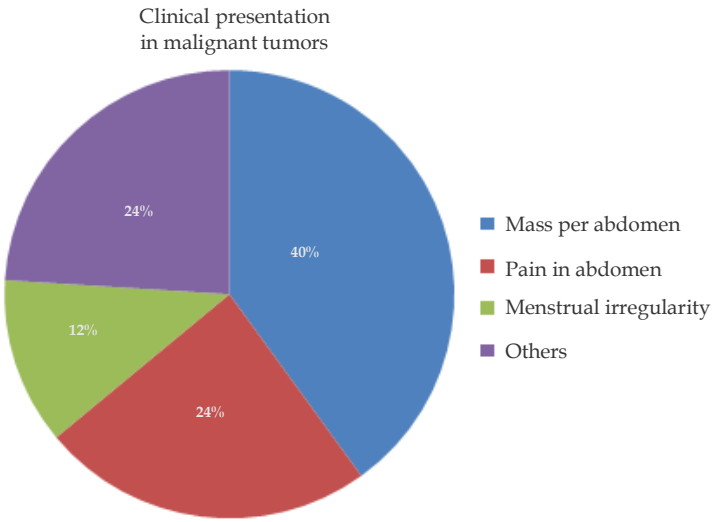

Fig. 3: Clinical presentation in malignant cases.

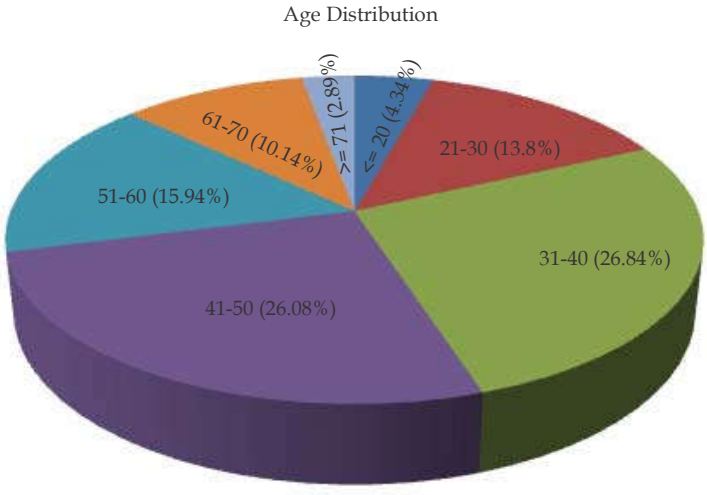

Fig. 4: Distribution of the tumors in different age groups.

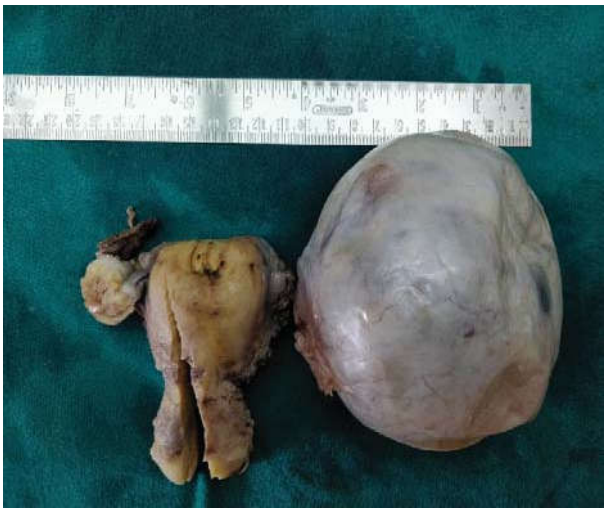

Fig. 5: Gross—Serous cystadenoma

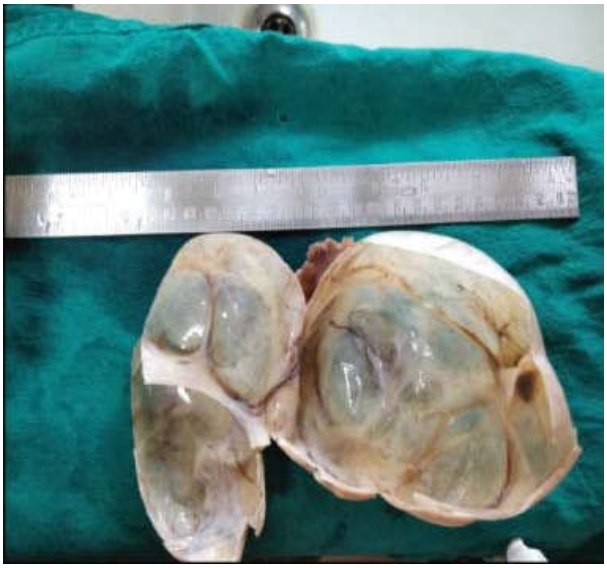

Fig. 6: Gross—Serous cystadenoma, c/s shows uniloculated cyst filled with serous fluid

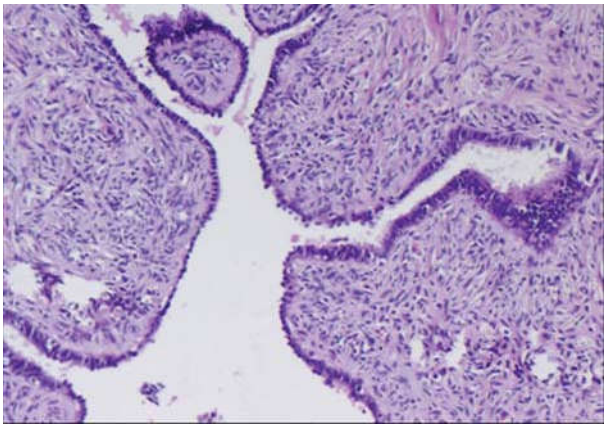

Fig. 7: Microscopy—Serous cystadenoma with cyst lined by benign cuboidal to columnar, focally ciliated epithelium H&E (400X)

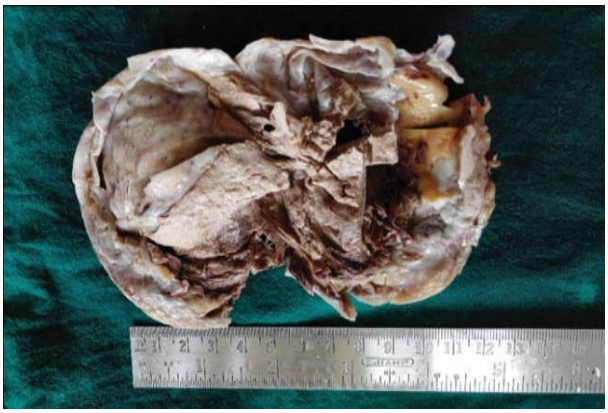

Fig. 8: Gross—benign mucinous tumor, multiloculated cysts filled with mucinous material

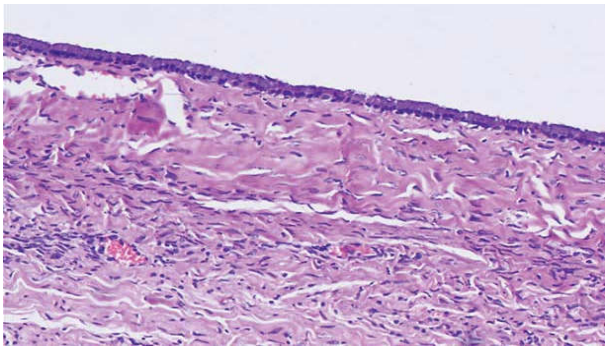

Fig. 9: Microscopy—Mucinous cystadenoma, cyst wall lined by tall columnar mucinous epithelium H&E (400X)

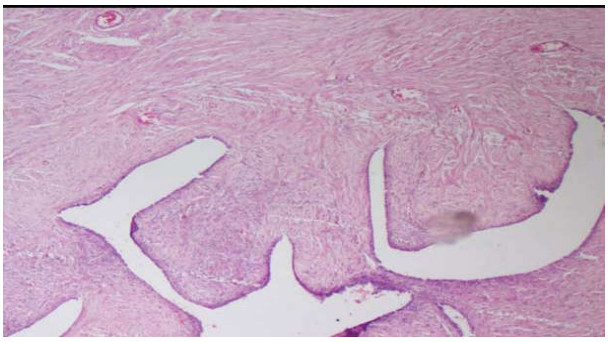

Fig. 10: Microscopy—serous cystadenofibroma, serous epithelium overlying fibrous ovarian stroma H&E (100X)

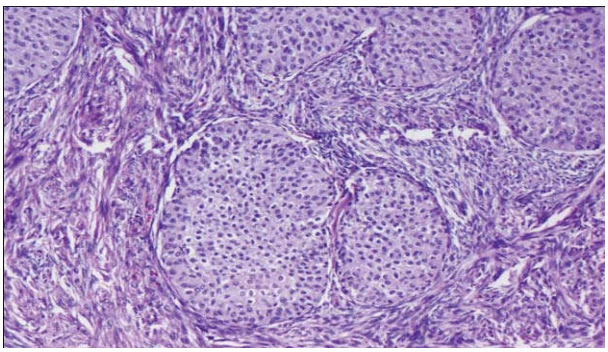

Fig 11: Microscopy—Brenner tumor, Oval to irregular nests of transitional type cells within fibromatous stroma H&E (100X)

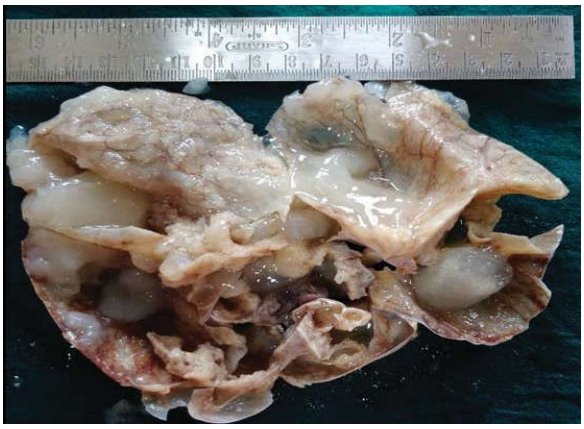

Fig. 12: Gross—Borderline mucinous tumor, cystic tumor with cut surface showing multiloculated cyst with mucinous material and focal papillary excrescences

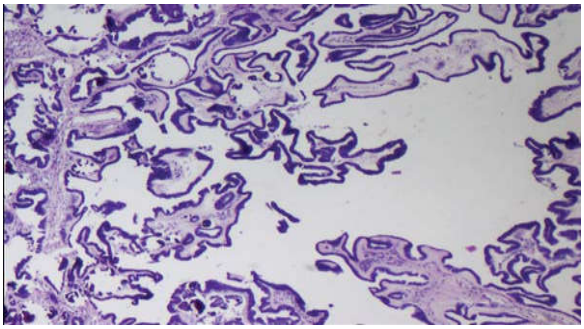

Fig. 13: Microscopy—Serous borderline tumor, branching architecture lined by cuboidal to columnar epithelium with minimal or no atypia H&E (100X)

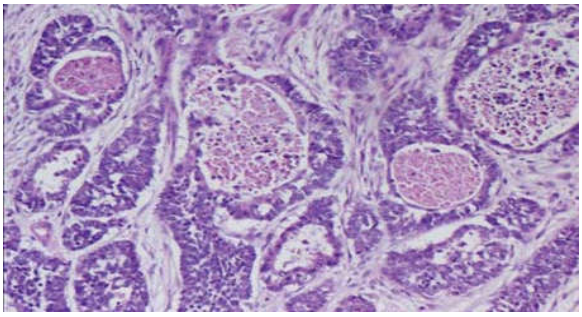

Fig. 14: Microscopy—Borderline endometrioid tumor, crowded glands lined by endometroid epithelium with mild to moderate cytological atypia H&E(400X)

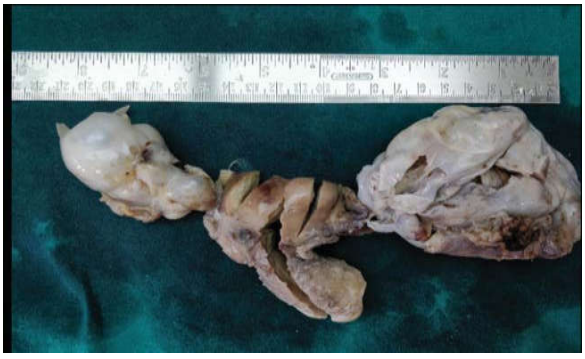

Fig. 15: Gross—Bilateral high-grade serous tumor, hysterectomy with bilateral salpingo-oophorectomy

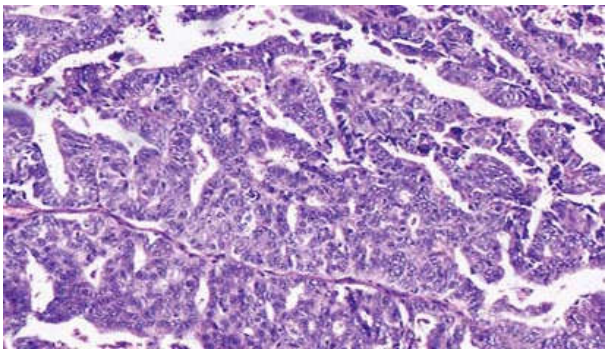

Fig. 16: Microscopy—Serous cystadenocarcinoma, confluent glandular growth with back to back arrangement and loss of intervening stroma H&E (100 X)

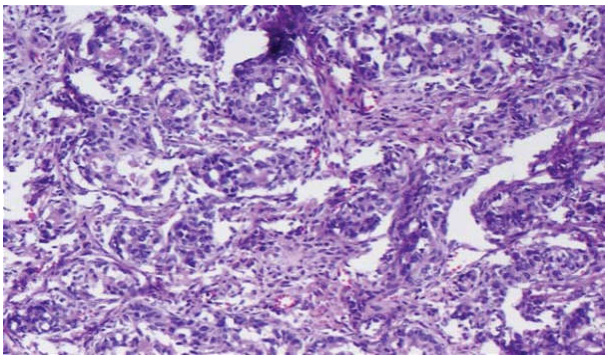

Fig. 17: Microscopy—Mucinous cystadenocarcinoma, infiltrative mucinous tumor invading ovarian stroma in small nests and single cells H&E (100X)

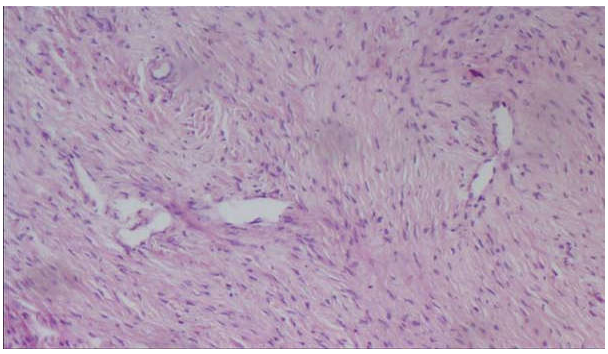

Fig. 18: Microscopy—Fibroma ovary, spindle cells with bland nuclei and scant cytoplasm arranged in intersecting bundles admixed with collagen H&E (100X)

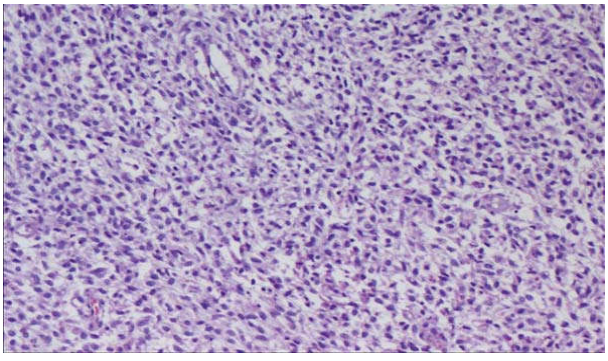

Fig. 19: Microscopy—Luteinized thecoma, spindle cells and weakly luteinized cells H&E (400X)

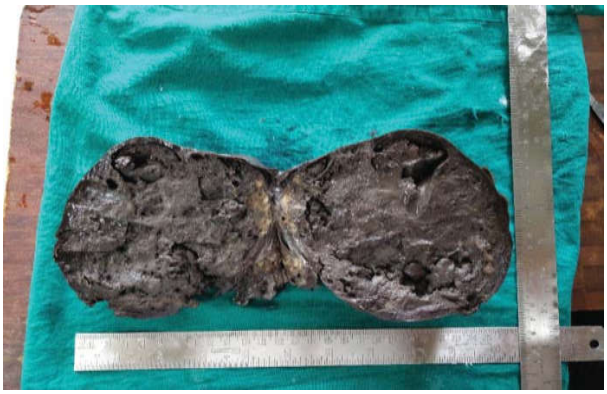

Fig. 20: Gross—Adult granulosa cell tumor, enlarged ovarian mass with cut section showing haemorrhagic and solid areas

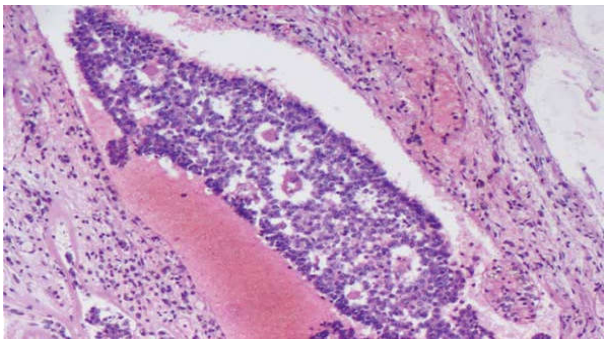

Fig. 21: Microscopy—Adult granulosa cell tumor, Call-Exner bodies- granulosa cells surround small spaces containing eosinophilic secretion H&E (400X)

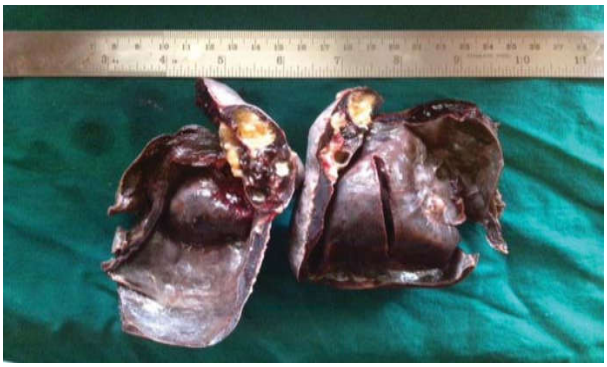

Fig. 22: Gross—Teratoma, Enlarged ovary with multiloculated cysts, c/s shows one cyst with luminal pultaceous and mucoid material

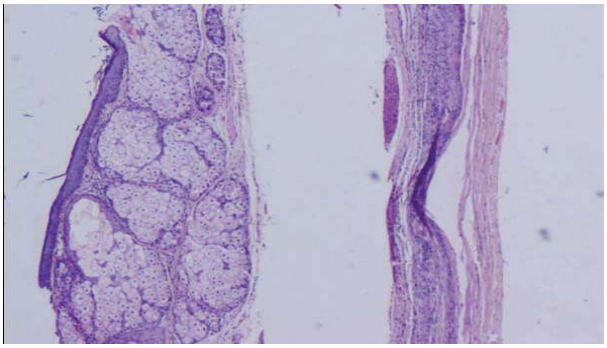

Fig. 23: Microscopy—Mature cystic teratoma, cyst wall lined by epithelium overlying epithelial components H&E (100X)

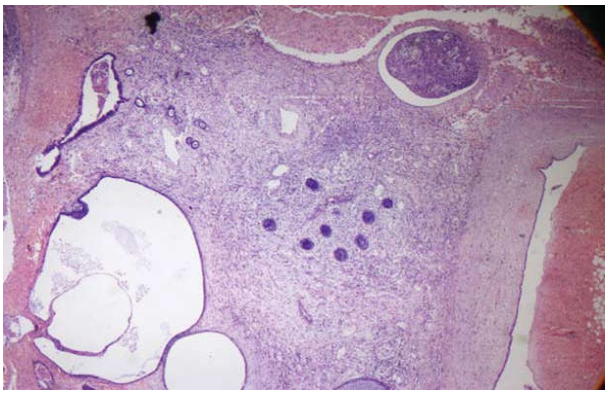

Fig. 24: Microscopy—Immature teratoma, cystic areas and stroma showing immature neural tissue H&E (100X)

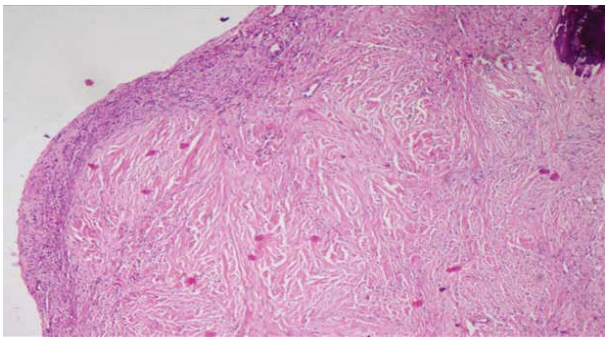

Fig. 25: Microscopy—Ovarian leiomyoma: well circumscribed tumor showing intersecting fascicles of smooth muscle fibers H&E (100X)

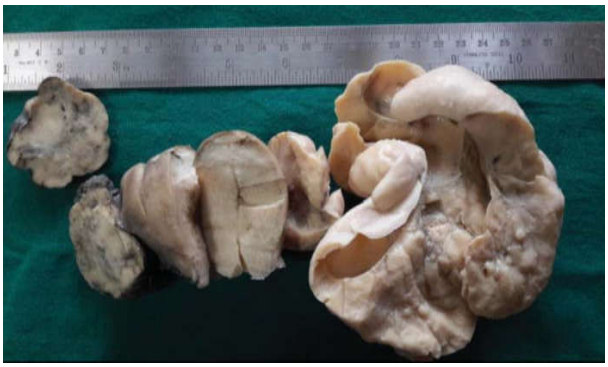

Fig. 26: Gross—Bilateral Krukenberg's tumor, hysterectomy with bilateral salpingo-oophorectomy, C/S of both the ovaries showing solid areas, cystic areas and hemorrhagic areas

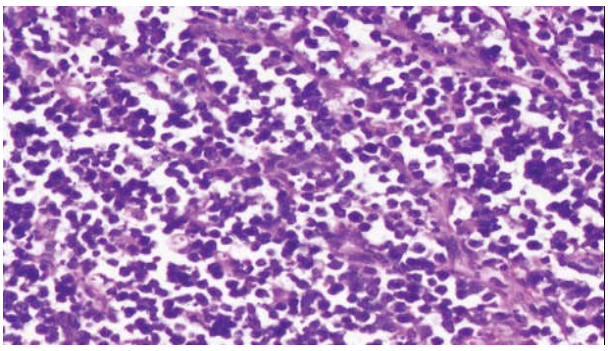

Fig. 27: Microscopy—Primary non- Hodgkin's Lymphoma, diffuse sheets of small to medium sized monomorphic lymphoid population H&E (400 X)

Largest dimension of the tumor was taken in account to categorize and to study the various size distribution of these tumors in benign, borderline and malignant tumors. Majority of the benign tumors were (39.78%) were falling into a size range of 5–9 cm (largest dimension) followed by a size range of 10–19 cm accounting for (26.9%). Borderline tumors had a size range of 5–19 cm, and among malignant tumors, maximum cases had a size rage of 10–19 cm in largest dimension (38.23%) (Table 3).

All the tumors were analyzed macroscopically based on the cystic or solid consistency on cut section with additional features like papillary excrescences if any. Majority of the benign tumors were cystic accounting for 58 cases followed by 29 cases with solid and cystic consistency. 5 cases had additional papillary excrescences. Majority of the borderline tumors had both solid and cystic component. Among the malignant tumors, 3 cases had predominantly solid and cystic morphology each, 18 had both solid and cystic components and 7 cases showed additional papillary excrescences (Table 4),

WHO has reclassified ovarian tumors in the consensus meeting in Lyon, where the borderline tumors were considered as a separate entity. This is because of the variable behavior of these tumors mimicking low grade serous tumor with nodal involvement or may be associated with malignant counterpart.[3] In our study, when classified according to WHO 2014 it was found that, surface epithelial tumor was the commonest tumor, accounting for 87 cases, followed by Germ cell tumor 33 cases and sex-cord stromal tumors being 12 cases. Others 6 cases included ovarian leiomyoma, bilateral Krukenberg tumor, metastatic mucinous adenocarcinoma of colon, neuroendocrine tumor and Non-Hodgkin lymphoma.

Among surface epithelial tumors, most common benign, borderline and malignant tumors were serous cystadenoma, borderline serous tumors and serous cystadenocarcinoma respectively (Table 5). Mature cystic teratoma was overall the most common benign ovarian neoplasm. It was also the most common germ cell tumor. Among secondary tumors, there were 3 cases (2.2%) of bilateral Krukenberg's tumor with 2 having primary from colon and 1 from stomach.

When classified according to WHO (2014), most common among all benign, borderline and malignant epithelial tumors with a largest dimension of ≥ 20 cm were found to be mucinous tumors. Thus, from this it was concluded that mucinous tumors had largest size overall and among surface epithelial tumors irrespective of the nature of the tumor. Mature teratoma which was the commonest germ cell tumor, predominantly had a size range of 5–9 cm (Figs. 5–27).

Table 2: Laterality of tumors

Laterality	Benign (%)	Borderline (%)	Malignant (%)
Unilateral	82 (87.2)	10 (77)	15 (48.4)
Bilateral	12 (12.8)	3 (23)	16 (51.7)
Total	94 (100)	13 (100)	31 (100)

Table 3: Size distribution of ovarian tumors

Size (cm)	≤4	5–9	10–19	≥20
Benign (%)	15.05	39.78	26.89	8.60
Borderline (%)	8.33	50	16.67	8.33
Malignant (%)	17.64	20.68	38.23	8.82

Table 4: Macroscopy of ovarian tumors

Nature of tumor	Solid (%)	Cystic (%)	Solid+cystic (%)	Solid+cystic+papillary excrescences (%)
Benign	2 (2.1)	58 (61.7)	29 (30.9)	5 (5.3)
Borderline	—	1 (7.7)	7 (53.8)	5 (38.5)
Malignant	3 (9.7)	3 (9.7)	18 (58.1)	7 (22.5)

Table 5: Distribution of ovarian tumors according to WHO classification 2014

Histological subtypes	Number of cases	n (%)
Surface epithelial tumors (n = 87)		
Serous cystadenoma	22	15.9
Serous cyst adenofibroma	8	5.8
Serous surface papilloma	1	0.72
Serous borderline tumor	6	4.4
Low-grade serous carcinoma	1	0.72
High-grade serous carcinoma	17	12.32
Mucinous cystadenoma	19	13.8
Mucinous borderline tumor	4	2.9
Mucinous adenocarcinoma	3	2.2
Borderline endometrioid tumor	3	2.2
Endometrioid carcinoma	1	0.72
Brenner tumor	2	1.5
Sex-cord stromal tumors (*n* = 12)		
Fibroma	5	3.62
Thecoma	3	2.2
Luteinized thecoma	1	0.72
Adult granulosa cell tumor	3	2.2
Germ cell tumors (*n* = 33)		
Mature teratoma	31	22.5
Immature teratoma	1	0.72
Mixed germ cell tumor	1	0.72
Soft tissue tumors (*n* = 1)		
Ovarian leiomyoma	1	0.72
Lymphoma (n = 1)		
Non-Hodgkin Lymphoma: Diffuse large B cell lymphoma (DLBCL)	1	0.72
Secondary tumors (*n* = 4)		
Krukenberg-tumor	3	2.2
Neuroendocrine tumor	1	0.72

Table 6: Size distribution of ovarian tumors in various histological subtypes

Histological subtypes	<=4 cm	5–9 cm	10–19 cm	>=20 cm
Surface epithelial tumors				
Serous cystadenoma	6	10	6	–
Serous cyst adenofibroma	2	4	2	–
Serous surface papilloma	1	–	–	–
Serous borderline tumor	2	4	1	–
Low-grade serous carcinoma	–	1	–	–
High-grade serous carcinoma	5	5	4	–
Mucinous cystadenoma	1	7	9	5
Mucinous borderline tumor	–	3	1	1
Mucinous adenocarcinoma	–	1	2	2
Borderline endometrioid tumor	–	–	3	–
Endometrioid carcinoma	1	–	–	–
Brenner's tumor	–	–	1	1
Sex-cord stromal tumor				
Fibroma	1	1	3	2
Thecoma	–	1	–	–
Luteinized thecoma	–	1	–	–
Adult granulosa cell tumor	–	–	3	–
Germ cell tumor				
Mature teratoma	4	18	5	–
Immature teratoma	–	–	1	–
Mixed germ cell tumor	–	–	1	–
Soft tissue tumor				
Ovarian leiomyoma	1	–	–	–
Lymphomas				
DLBCL				
Secondary tumors				
Krukenberg's tumor	–	–	2	1
Neuroendocrine tumor	–	–	1	–

Discussion

The ovary has a compound embryological and histological structure, shows steroidogenesis, with its high potential for malignancy, with different components like epithelial tissue, germ cells, follicular cells and mesenchymal tissue each having different capability to form various tumors.[11,13,16–18] Its history has been known scientifically for over 150 years, not much change has been seen since then in its mortality rate and increased incidence especially in developing countries.[13] Most of the benign tumors are detected as an incidental finding and are more common in reproductive age group.[16] Risk factors for ovarian malignancy can be non-hereditary and hereditary. Among non-hereditary risk factors, strong association is seen with increased age with a peak in fifth decade, low or nulliparity, early menarche and late menopause.[16] Other non-hereditary risk factors include Ashkenazi Jewish population (16–60%), dietary factors like high-fat diet, obesity and use of ovarian -stimulating drugs.[13,20] The hereditary risk factors include BRCA1 and BRCA2 mutations (27–44%), familial syndromes like Li–Fraumeni syndrome and Lynch syndrome (9–12%).[20,21] Factors known to have a protective role against ovarian malignancies are the use of oral contraceptive pills (OCPs) and multiparity.[22]

The clinical features of ovarian tumors are very imprecise and non-specific which include abdominal distention, loss of appetite, abdominal pain.[18] And hence often go overlooked and diagnosed at a very later stage. The laterality of the tumor may also provide a clue to their nature, for example, tumors in the sex cord stromal

category are almost always unilateral while most of the metastatic tumors are bilateral.[22] Biochemical markers and radiological assistance may help in early diagnosis.[23]

Grossly, these tumors vary from being solid or cystic in consistency (with serous/mucinous or serosanguineous fluid) or may have additional features like papillary excrescences or any calcified areas. Benign tumors usually have a smooth contour externally and are primarily cystic in nature.[24] Serous cystadenomas/adenofibromas are commonly uniloculated and filled with clear serous fluid. However, large size multiloculation of the cyst (on cut section) and mucinous material are peculiar features pertaining to mucinous tumors. Mature cystic teratoma may have solid areas suggestive of calcification or bony areas (Rokitansky's-protuberans), cystic areas, may contain hairs and pultaceous material. Borderline and malignant tumors tend to have an irregular contour and are usually solid in consistency. An exception to this is, Krukenberg's tumor having bilateral involvement with smooth external contour.

Histologically, benign tumors are lined by serous (with papillary arrangement), mucinous or may be lined by epidermis as seen in mature cystic teratomas. Mucinous cystadenomas are more commonly associated with Brenner's tumor which shows nests of cells resembling transitional epithelium. The term 'borderline tumor' was introduced by FIGO and approved by WHO in 1973, implicating that these tumors have morphological and clinical behavior intermediate between benign cystadenoma and carcinoma.[3] This was further substantiated in 2014 at Lyon. Along with these clinical and histomorphological factors, features like serum biomarkers and immunohistochemistry (IHC) aids in diagnosis.

In our study, out of 138 cases studied, the clinical and histopathological findings were analyzed in detail and co-related with different studies available in the literature. These tumors were classified according to WHO 2014 classification of ovarian tumors. In concordance with the literature, the frequency of benign ovarian tumors was more than the malignant tumors in present study.

In the present study, 94 (68.12%) cases were benign, 13 (8.7%) were borderline, 31 (22.5%) were malignant in nature which was similar to the studies Garg et al.[1], Sarangan et al.[2] Manoja et al.[5], Singh et al.[25] and Bindal et al.[26] and Phukan et al.[31] However, these studies have reported a higher incidence of benign cases compared to the present study. Our study reports a greater number of borderline and malignant cases (Table 7), this can be probably due to many oncology cases are referred to our center.

Comparing the age distribution, majority of ovarian tumors were found in reproductive age

Table 7: Comparison of frequency of benign, borderline and malignant tumors

Study (*n*)	Benign (%)	Borderline (%)	Malignant (%)
Manoja et al. (*n* = 120)[5]	90	–	10
Sarangan et al. (*n* = 135)[2]	89	4	7
Singh et al. (*n* = 120)[25]	80.83	1.67	17.5
Garg et al. (*n* = 85)[1]	81.2	1.2	17.6
Bindal et al. (*n* = 130)[26]	79.23	1.53	19.23
Hota et al. (*n* = 230)[19]	83.4	2.6	14
Jha and Karkhi et al. (*n* = 135)[27]	83.9	–	16.1
Phukan et al. (*n* = 84)[31]	75	3.6	21.4
Present study (*n* = 138)	68.12	8.7	22.5

Table 8: Comparison of Age distribution with various other studies

Age in years	Priya et al. (%)[23] *n* = 77	Garg et al. (%)[1] *n* = 85	Sarangan et al. (%)[2] *n* = 135	Manoja et al. (%)[5] *n* = 120	Hota et al.(%) [19] *n* = 230	Present study (%) *n* = 138
Upto 20	**3.9**	**7.1**	**2**	11.7	8.69	4.34
21–30	20.8	17.6	24	25	34.34	13.8
31–40	22.1	41.2	29	29.2	17	26.84
41–50	27.2	22.3	27	18.3	19.5	26.08
51–60	16.9	10.6	13	9.2	4	15.94
61–70	7.8	1.2	3	5.8	5.2	10.14
>70	1.3	–	2	0.8	1.7	2.89

group as also noted in other studies. The highest number of cases were seen between 30–40 years in present study (Table 8).

Overall, the clinical features were divided into 4 main categories–Abdominal mass, pain in abdomen, menstrual irregularities and others including non-specific. It was seen that in our study predominantly patients presented with dull and vague abdominal pain, this was also documented by Lina Baru et al.[28] however they reported higher percentage (Table 9). On further categorization as benign and malignant tumors and comparing with various studies (Table 10 and 11), our study had pain abdomen as the most common presentation in benign tumors whereas other studies showed abdominal mass as the principle presentation. Similarly, for malignant ovarian tumors also our data was different from other researches done. These differences can be explained by the fact that ovarian neoplasms have a wide range of overlapping clinical presentations and may be non-specific.

In our study 87.2% of benign and 48.4% of malignant ovarian tumors were unilateral. In other studies also, benign tumors were found to be predominantly unilateral. However, we had more of bilateral presentation for malignant ovarian tumors which is not concordant with the other studies (Table 12 and 13).

In this study, surface epithelial tumors (63.04%) constitute the most prominent type of ovarian tumors followed by germ cell tumors (24%) and then by, sex-cord stromal tumors (8.7%), this is in concordance with majority of the studies analyzed (Table 14). Overall, in our study we found mature cystic teratoma was the most common benign tumor and germ cell tumor comprising of 31 cases. This feature was comparable to study by Okugawa et al.[(15)] and Shiekh et al.[35], however most of the other studies by Rajavigneshwari et al.[29] and others have found serous cystadenoma to be the most common benign tumor. Serous cystadenocarcinoma out numbered other malignant tumors (58.06%) which was similar to findings of the studies by Jain et al.[30] and Atanda et al.[32]

According to our study, benign ovarian tumors were more common than malignant tumors.

Surface epithelial tumors are the most common variant based on cell of origin. And Krukenberg's tumor was the most common secondary tumor of ovary. In such cases, clinical data and co-relation with radiological findings aid in precise diagnosis. The ovarian tumors manifest a wide and varied range of clinical and morphological features. Histopathological study along with ancillary techniques like IHC, molecular studies along with radiological corelation, serum tumor biomarkers, together aids in appropriate diagnosis, proper classification and management of ovarian neoplasms. Since the overall mortality of malignant ovarian tumors is high there is a need for screening test to detect ovarian cancer at an early stage.

Table 9: Comparison of clinical presentation of all ovarian neoplasms

Symptoms	Lina baru et al. (%) [28] *n* = 108	Hota et al. (%)[19] *n* = 230	Present study (%) *n* = 138
Abdominal mass	31.17	44	18.84
Pain in abdomen	79.55	31	43.4
Menstrual irregularities	9.1	17.4	12.3
Others	0	0	0

Table 10: Comparison of clinical presentation of benign ovarian neoplasms

Symptoms	Manoja et al.[5] (%) *n* = 108	Mohapatro et al.[36] (%) *n* = 59	Jain et al.[30] (%) *n* = 162	Present study (%) *n* = 94
Abdominal mass	42.6	55.93%	28.04	12
Pain in abdomen	38.9	23.7	23.07	58
Menstrual irregularities	9.3	18.6	2.95	18
Others	9.2	9.6	34.91	12

Table 11: Comparison of clinical presentation of malignant ovarian neoplasms

Symptoms	Manoja et al. (%)[5] *n* = 12	Mohapatro et al. (%)[36] *n* = 32	Jain et al. (%)[30] *n* = 80	Present study (%) *n* = 31
Abdominal mass	25	73.68	17.5	40
Pain in abdomen	25	50	40	24
Menstrual abnormalities	8.3	12.5	–	12
Others	25	–	22.5	24

Table 12: Comparison of laterality of benign tumors

Laterality	Jha and Kharkhi et al.[27] (%) *n* = 135	Pilli et al.[34] (%) *n* = 212	Present study (%) *n* = 94
Unilateral	93.3	92.2	87.2
Bilateral	6.67	7.8	12.8

Table 13: Comparison of laterality of malignant tumors

Laterality	Jha and Kharkhi et al.[27] (%) *n* = 135	Rajgopal et al.[16] (%) *n* = 200	Present study (%) *n* = 31
Unilateral	57.69	64.6	48.4
Bilateral	42.3	35.4	51.7

Table 14: Comparative analysis of frequency of ovarian neoplasms based in cell of origin

Tumor type	Sarangan et al. (%)[2] *n* = 135	Garg et al. (%)[1] *n* = 85	Parmar et al (%)[3] *n*=	Ahmed et al. (%)[33] *n* = 186	Manoja et al. (%)[5] *n* = 120	Agrawal et al. (%)[22] *n* = 226	Akakpo et al. (%)[37] *n* = 706	Hota et al. (%)[19] *n* = 230	Present study (%) *n* = 138
Surface epithelial tumor	81	70.6	62	61.83	84.2	72.1	40.07	64.5	63.04
Sex cord stromal tumors	4	8.2	9.33	6.45	4.2	7.1	15.2	27	8.7
Germ cell tumors	15	18.8	24.67	30.64	10	19.2	41.9	5.2	24
Secondary tumors	0	0.83	4	1.08	0.8	0.9	1.1	2.6	2.9
Miscellaneous	0	0	0	0	0.88	0	1.1	0.8	1.44

Conclusion

This is an institution based the study and with a small sample size, the demographic data as well as histological distribution of the tumors may differ from other areas. Hence, further studies in different regions are required to analyze and compare the prevalence, demography in different populations and regions. The multifaceted nature of these ovarian neoplasms require multidisciplinary approach which many institutes are adopting in their management, poses some medicolegal concerns.[38–40] These concerns like consent from the patient for such approach, fixing liability for the proposed management, responsibility of documenting the facts with consensus are the challenges to the physician involved in ovarian cancer care. The complex nature, unpredictable behaviour and prognosis, debated management make ovarian neoplasms a difficult problem for clinicians. The histogenesis of many tumors is interrelated and precise histopathological diagnosis is of utmost importance for effective treatment.

Prior publication: Nil

Conflicts of interest: Nil

Source(s) of support: Nil

Presentation at a meeting: Nil

Conflicts of interest: None to declare

Permissions: Institutional Ethics Committee permission taken

References

1. Garg N, Anand AS, Annigeri C. Study of histomorphological spectrum of ovarian tumors. International Journal of Medical and Health Research 2017 Oct;3(10):12–20.
2. Sarangan A, Kilpauk G, Andal N. Clinicopathological and Histological Features of Ovarian Tumor— A Study. IOSR Journal of Dental and Medical Sciences (IOSR-JDMS) 2017;16(9):56–60.
3. Parmar P, Sehgal S, Mathur K, Yadav A. Histopathological Study of Ovarian Tumors in Tertiary Care Center. International Journal Of Medical Research Professionals 2017;3(2003):96–8.
4. Pradhan A, Upreti D. Original Article Histopathological patterns of ovarian tumors at BPKIHS. Health Renaissance 2012;10(2):87–97.
5. Manoja V, Pramood M, Jyothi V, et al. Clinicopathological Study of Ovarian Tumors: A 2-year Study. International Journal of Scientific Study 2017 Jun;5(3):300–5.
6. Pachori G, Meena U, Sunaria R, et al. Histopathological study of ovarian tumors in Ajmer region. Int J Med Sci Public Heal. 2016;5(7):1400.
7. Farooq F, Noman D, Humayun N, et al. Demographic Differentials and Histopathological Patterns of Ovarian Masses. Biomedica Apr. – Jun., 2015;31(2):118–23.
8. Parvatala A, Rajendra Prasad J, Rao NB, et al. Study of Neoplastic Lesions of the Ovar. IOSR Journal of Dental and Medical Sciences 2015;14:92–96.

9. Bhagyalakshmi A, Sreelekha A, Sridevi S, et al. Prospective study of histopathological patterns of ovarian tumors in a tertiary care centre. Int J Res Med Sci 2014;2(2):448.
10. Danish F, Khanzada MS, Mirza T, et al. Histomorphological spectrum of ovarian tumors with immunohistochemical analysis of poorly or undifferentiated malignancies. Gomal J Med Sci 2012;10(2):209–15.
11. Gangaraju S, Sarella LK, Gurugubelli S, et al. Scenario of ovarian mass lesions at a teaching hospital in Andhra Pradesh, India. International Journal of Reproduction, Contraception, Obstetrics and Gynecology 2015 Aug;4(4):982–9.
12. Jindal U. Pattern of ovarian neoplasm in rural population: a five-year study from tertiary care hospital. Journal of Evolution of Medical and Dental Sciences 2014 Feb 24;3(8):24.
13. Vargas AN. Natural history of ovarian cancer. Ecancermedicalscience 2014;8:465.
14. Wd T, Brambilla E, Hermelink HK, et al. World Health Organization Classification of Tumors 2008;(4th edition):8–83.
15. Okugawa K, Hirakawa T, Fukushima K, et al. Relationship between age, histological type, and size of ovarian tumors. Int J Gynecol Obstet 2001;74(1):45–50.
16. Rajagopal L, Ravikumar U. Diagnostic utility of clinicopathological correlation in ovarian tumors: An analysis of 200 cases. Int J Pharma Bio Sci 2015;6(1):B1054–73.
17. Patel AS, Patel JM, Shah KJ. Ovarian tumors - Incidence and histopathological spectrum in tertiary care center, Valsad. IAIM 2018;5(2):84–93.
18. Patil RK, Bhandari BJ, Kittur SK, et al. Histomorphological Study of Ovarian Tumors at a Tertiary Care Centre. Annals of Pathology and Laboratory Medicine 2017 Nov-Dec;4(6):0–7.
19. Hota R, Panda KM, Bhuyan T. Clinical and Histopathological Correlation of Ovarian Tumor. IOSR Journal of Dental and Medical Sciences (IOSR-JDMS) 2018;17(7):66–71.
20. Shen F, Chen S, Gao Y, et al. The prevalence of malignant and borderline ovarian cancer in pre- and post-menopausal Chinese women. Oncotarget 2017;8(46):80589–94.
21. Hawaldar R, Sodani S, Patidar E. Histopathological spectrum of ovarian tumors- A two year retrospective study. Indian Journal of Pathology and Oncology July-September 2017 Sep;4(3):450–53.
22. Agrawal P, Kulkarni DG, Chakrabarti PR, et al. Clinicopathological Spectrum of Ovarian Tumors: A 5–Year Experience in a Tertiary Health Care Center. Journal of Basic and Clinical Reproductive Sciences 2015 Jul-Dec;4(2):90–96.
23. Priya RP, Sundari KPM, Rani RA. Overview of ovarian masses. Int J Reprod Contracept Obstet Gynecol 2016 Nov;5(11):3770–72.
24. Malli M, Vyas B, Gupta S, et al. A histological study of ovarian tumors in different age groups. Int J Med Sci Public Heal 2014;3(3):338.
25. Singh S, Saxena V, Lata S, et al. Histopathological Evaluation of Ovarian. Chemotherapy Research and Practice 2016;2015(4):435–9.
26. Bindal J, Bankey S. Prevalence of ovarian tumors among ovarian mass lesions in Gajra Raja Medical College,Gwalior,India.IntJReprodContraceptObstet Gynecol 2017 Sep;6(9):3907–10.
27. Jha R, Karki S. Histological pattern of ovarian tumors and their age distribution. Nepal Med CollJ 2008;10(2):81–5.
28. Baru L, Patnaik R, Singh KB. Clinico Pathological Study of Ovarian Tumors. Int J Reprod Contracept Obstet Gynecol 2017 Aug;6(8):3438–44.
29. Rajavigneshwari N, Kotasthane DS, Koteeswaran G. Clinicopathological Spectrum of Ovarian Tumors in a Tertiary Care Hospital. J Evol Med Dent Sci 2017;6(36):2948–52.
30. Jain G, Mankar D. Histopathological profile of ovarian tumors. A twelve-year institutional experience. Muller J Med Sci Res 2015;6(2):107.
31. Phukan A, Borgogoi M, Ghosh S. Histopathological spectrum of ovarian tumors: an institutional perspective. Int J Res Med Sci. 2018 Aug;6(8):2639–43.
32. Atanda TA, Mohammed AZ, Zakari MS. A Seven-Year Histopathological Review of Malignant Ovarian Tumors Seen in Kano. Trop J Obstet Gynaecol October 2009;26(2).
33. Ahmed M, Afroze N, Sabiha M. Morphological Pattern of Ovarian Tumor: Experience in a Tertiary Level Hospital. Journal of Bangladesh College of Physicians and Surgeons 2018 Jan;36(1):5–10.
34. Pilli GS, Suneeta KP, Dhanded AV, et al. Ovarian tumors: a study of 282 cases. J Indian Med Assoc 2002;100:420, 432-4, 447.
35. Sheikh S, Bashir H, Farooq S, et al. Histopathological spectrum of ovarian tumors from a referral hospital in Kashmir valley, Jammu and Kashmir, India. India. Int J Res Med Sci 2017 May;5(5):2110–14.
36. Mohapatro. M, Dash. D, Rao ES. A study on clinicopathological spectrum of ovarian tumors in a tertiary care centre. J. Evid. Based Med.Healthc 2017;4(37):2223–30.
37. Akakpo PK, Derkyi-Kwarteng L, Gyasi RK, et al. A pathological and clinical study of 706 primary tumors of the ovary in the largest tertiary hospital in Ghana. Journal of Bangladesh College of Physicians and Surgeons 2017;17(1):1–6.
38. Clinical Oncological Society of Australia; Cancer Council Australia; National Cancer

Control Initiative. Optimising cancer care in Australia. Melbourne: NCCI, 2003. http://www.canceraustralia.gov.au/media/3419/ optim_ cancer_care.pdf (accessed Feb 2008).

39. Victorian Government Department of Human Services. Ministerial taskforce for cancer: achievements 2003–2007. Melbourne: DHS, 2007. http:// www.health.vic.gov.au/cancer/docs/mtfc/mtfcachievements.pdf (accessed Feb 2008).
40. Ruhstaller T, Roe H, Thurlimann B, et al. The multidisciplinary meeting: an indispensible aid to communication between different specialities. Eur J Cancer 2006 Oct;42(15):2459–62.