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Original Article

Obstetrics and Gynaecology Section

Ovarian Neoplasms: Clinicopathological Spectrum in Tribal Rajasthan, India

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ABSTRACT

Introduction: Ovarian neoplasms have increased in incidence in leading sites of cancer in five old population based cancer registries on comparing first ten and last ten years data. All three germ layers are afflicted in process of ovarian neoplasm-ceolomic epithelium, germ cell and sex chord/stromal cells. Due to this, ovarian masses are spread widely over all age groups. However, a correct pathological diagnosis goes a long way in management of the disease and consequent benefit to patient.

Aim: To assess the histopathological pattern, age, laterality and distribution of ovarian tumours in a tertiary care centre of tribal part of Rajasthan.

Materials and Methods: Retrospective hospital based study wherein 157 ovarian specimens received in Department of Pathology of Geetanjali Medical College and Hospital, Udaipur, Rajasthan over a period of three years were studied after obtaining permission from ethical committee. Details such as age, signs and symptoms, laterality were retrieved from patient file. Only benign, borderline or malignant ovarian neoplasm specimens removed surgically were included. Physiological cysts were excluded. Descriptive statistics were used and results were expressed as percentages.

Results: Out of 157 ovarian neoplasms, 42 (26.75%) were from hysterectomy specimen, 44 (28.03%) from planned cystectomy for mass, 71 (45.22%) from cytoreductive surgery or tissue obtained from Exploratory Laparotomy. A 63.06%, 33.76% and 3.18% of neoplasms were benign, malignant and borderline, respectively. Extremes of age lied between 14 to 84 years. Mean age for benign, malignant and borderline tumours respectively was 38.60 years (SD=15.21), 47.79 years (SD=14.53) and 38.4 years (SD=14.04), respectively. Unilateral tumours were clearly in abundance with 85.35%. Right-sided tumours were more (49.04%). Surface Epithelial Tumours (SET's), Germ Cell Tumour (GCT's) and Sex Chord Stromal Tumours (SCSCT's) were 59.24%, 34.39% and 6.37%, respectively. Out of 10 cases, 60% were malignant (Granulosa cell tumour). No metastatic tumour was seen during the study period.

Conclusion: To effectively reverse the trend in a developing country like India each and every gynaecologist should be aware and well versed with histo-morphological pattern of ovarian neoplasms specific to a region.

Keywords: Age, Benign, Borderline, Germ cell tumour, Malignant, Mass ovary, Sex chord stromal tumour

INTRODUCTION

Ovarian neoplasms have increased in incidence in leading sites of cancer in five old population based cancer registries viz., Barshi rural (1988-2016), Bangalore (1982-2014), Bhopal (1988-2015), Chennai (1982-2016) and Mumbai (1982-2015) on comparing first ten and last ten years data [1]. All three germ layers are afflicted in process of ovarian neoplasm-ceolomic epithelium, germ cell and sex chord/stromal cells. Also, ovarian masses are spread widely over all age groups. By the year 2040, the mortality rate of ovarian cancer will rise significantly [2].

Vague symptoms, being an internal organ, lack of screening protocols make timely diagnosis of ovarian masses an enigma. Early diagnosis being an issue, lack of access to specialised treatment, high incidence of recurrence and poor compliance to therapy are factors which result in increased morbidity associated with neoplastic ovarian masses [3]. However, a correct pathological diagnosis goes a long way in management of the disease and consequent benefit to patient. Borderline tumours further complicates already complex scenario of diagnosis that is there.

Epidemiological diversity of different pathogenic types is due to differing factors prevalent in a particular geographic area. The purpose of this study was to assess the histopathological pattern, age, laterality distribution of ovarian tumours in a tertiary care centre of tribal part of Rajasthan, India. To the best of knowledge, single study has been done on this topic in this region [4].

MATERIALS AND METHODS

This was a retrospective hospital-based study wherein 157 ovarian specimens received in Department of Pathology of Geetanjali Medical College and Hospital, Udaipur, Rajasthan, India over a period of three years (July 2017 to June 2020) and the data was studied from mid-June to mid-December (2nd June to 2nd December 2020). The Institutional Ethical committee approval was obtained prior to the study (IEC-948).

Inclusion criteria: All histologically proven cases of ovarian tumours whose surgery was done in institute were included.

Exclusion criteria: Physiological cysts and biopsies from surgery done outside the institute were excluded.

Consecutive sampling was done. Details such as age, signs and symptoms, laterality were retrieved from patient file. Only benign, borderline or malignant ovarian neoplasm specimens were taken. The World Health Organisation (WHO) classification of ovarian tumours was used [5]. Routine paraffin techniques used for processing of the paraffin blocks and sections stained with haematoxylin and eosin stain were examined microscopically in detail.

STATISTICAL ANALYSIS

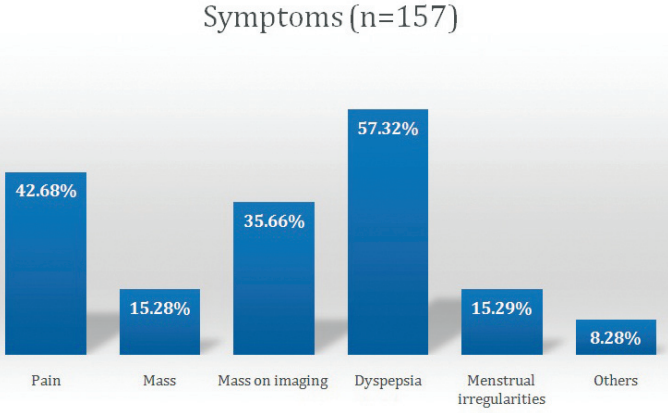
Descriptive statistics were used and results were expressed as percentages.

RESULTS

Among the specimens received, 157 ovarian tumours were investigated. Out of 157 ovarian neoplasms, 42 (26.75%) were from

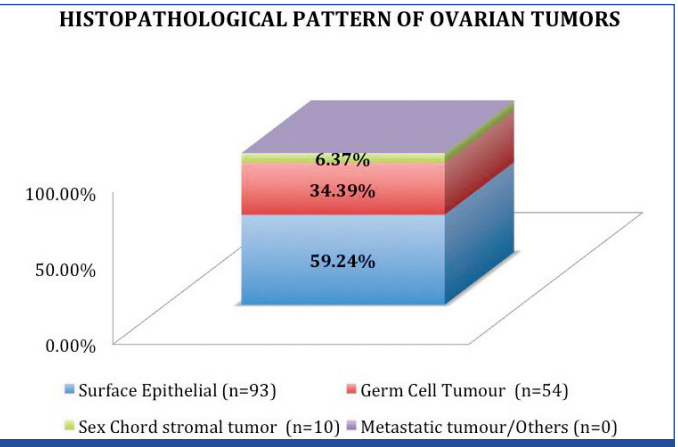
hysterectomy specimen, 44 (28.03%) from planned cystectomy for mass, 71 (45.22%) from cytoreductive surgery or tissue obtained from Exploratory Laparotomy.

Dyspepsia appeared as the most encountered symptom in 90 patients (57.32%) closely followed by pain 67 (42.68%). Mass abdomen in 24 (15.28%), menstrual irregularities in 24 (15.29%), bloating, nausea, headache in 13 (8.28%). Mass on imaging guided 56 (35.66%) to diagnose and get themselves operated. This is shown in [Table/Fig-1].



[Table/Fig-1]: Symptoms experienced by patients of ovarian tumours.

Benign, malignant and borderline ovarian neoplasms detected were 99/157 (63.06%), 53/157 (33.76%) and 5/157 (3.18%), respectively. Surface Epithelial Tumours (SET's) were most common comprising of 93 cases (59.24%), followed by Germ Cell Tumour (GCT's) and Sex Chord Stromal Tumours (SCSCT's) having 54/157 (34.39%), 10/157 (6.37%) each as shown in [Table/Fig-2].

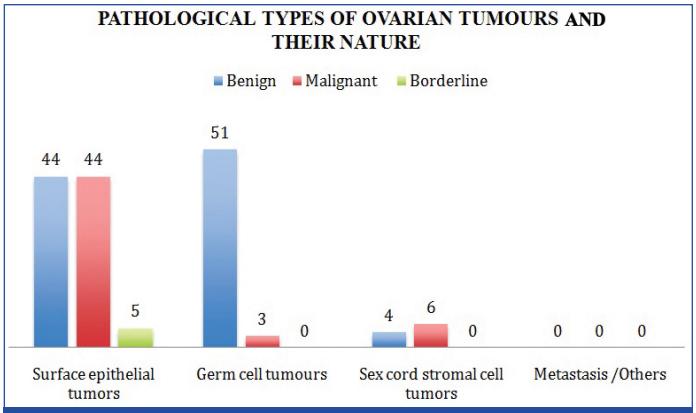


[Table/Fig-2]: Histopathological pattern of ovarian tumours.

Equal number of benign and malignant variety were found in SET's with 44/93 (47.31%) each while borderline tumours were 5/93 (5.37%). SCST's had 6/10 malignant and 4 benign tumours. GCT's had 51/54 (94.44%) benign and 3/54 (5.55%) malignant tumours. Neither any metastatic tumour nor any borderline tumours of GCT's or SCST's origin was found in study duration. Nature of three distinct hisopathological types are shown in [Table/Fig-3].

Serous cystadenoma 31 cases (33.33%) was most frequent SET closely followed by serous adenocarcinoma with 29 cases (31.18%). An important finding unearthed was that the SET's benign and malignant cases both were equal having 44 cases (47.31%) each. A single case of undifferentiated carcinoma was present. As in WHO classification [5], it is kept under SET's. Brenner's tumour had three benign, one borderline and one malignant histopathological type. One collision repored tumour Brenner tumour in one ovary with mucinous cystadenoma.

As an individual tumour, mature teratoma was most common neoplasm of total 51/157 (32.48%) and 94.44% of GCT's. It was the most prevailing of all benign neoplasm in current search.



[Table/Fig-3]: Histopathological pattern of ovarian tumours.

Dysgerminoma being second most frequent GCT with 3 cases (5.56% of GCT's). Out of 10 cases of SCST's, 60% were Granulosa cell tumour i.e., malignant. Two cases of fibrothecoma and one each of thecoma and steroid (lipid) cell tumours were observed. Current survey did not observe any case of immature teratoma or metastatic neoplasm. These findings are shown in [Table/Fig-4].

Type of ovarian tumours	Number (n)	Percentage (%)
Surface epithelial- Stromal tumours		
a) Serous tumours		
Benign (cystadenoma)	31	19.75
Borderline tumours (serous borderline tumour)	3	1.91
Malignant (serous adenocarcinoma)	29	18.47
b) Mucinous tumours, endocervical-like and intestinal type		
Benign (cystadenoma)	10	6.37
Borderline tumours (mucinous borderline tumour)	1	0.64
Malignant (mucinous adenocarcinoma)	9	5.73
c) Endometrioid tumours		
Benign (cystadenoma)	0	0
Borderline tumours (endometrioid borderline tumour)	0	0
Malignant (endometrioid adenocarcinoma)	0	0
d) Clear cell tumours		
Benign	0	0
Borderline tumours	0	0
Malignant (clear cell adenocarcinoma)	2	1.27
e) Transitional cell tumours		
Brenner tumour	3	1.91
Brenner tumour of borderline malignancy	1	0.64
Malignant Brenner tumour	1	0.64
Transitional cell carcinoma (non Brenner type)	0	0
e) Epithelial-stromal		
Adenosarcoma	0	0
Carcinosarcoma (formerly mixed Müllerian tumours)	2	1.27
Undifferenciated carcinoma	1	0.64
Sex cord-Stromal tumours		
Granulosa tumours	6	3.82
Fibrothecomas	2	1.27
Thecomas	1	0.64
Fibromas	0	0
Sertoli cell tumours:	0	0
Leydig cell tumours	0	0
Sex cord tumour with annular tubules	0	0
Gynandroblastoma	0	0
Steroid (lipid) cell tumours	1	0.64
Germ Cell Tumours (GCT)		
Teratoma Immature	0	0
Teratoma Mature	51	32.48
Dysgerminoma	3	1.91
Monodermal (e.g., strumaovarii, carcinoid)	0	0
Yolk sac tumour (endodermal sinus tumour)	0	0
Mixed GCTs	0	0

Malignant, not otherwise specified		
Metastatic cancer from non ovarian primary	0	0
Colonic, appendiceal	0	0
Gastric	0	0
Breast	0	0

[Table/Fig-4]: Frequency of various pathological types of ovarian tumours (N=157).

Age distribution is shown in [Table/Fig-5]. Mean age for benign, malignant and borderline tumours were 38.60 years (SD=15.21), 47.79 years (SD=14.53) and 38.4 years (SD=14.04) respectively. Extremes of age lied between 14 years to 84 years. Majority of benign lesions presented in age group 20-49 years, 50/99 cases (50.50%). Maximum malignant lesions 29/53 (54.72%) were found in 4th and 5th decade. Reproductive age i.e., 20-49 years 78.43% (40/51) tumours were mature teratoma. In age group 14-19 years; total 6 cases, out of which four were benign and two malignant. Age 70 years and above had five benign and three malignant cases with eight cases in total.

Type of tumours	Age (years)							Total
	14-19	20-29	30-39	40-49	50-59	60-69	70 and above	
Surface epithelial-stromal tumours								
Serous tumours								
Benign (cystadenoma)	-	8	6	7	4	3	3	31
Borderline tumours (serous borderline tumour)	-	1	1	1	-			3
Malignant (serous adenocarcinoma)	-	-	3	10	10	5	1	29
Mucinous tumours, endocervical-like and intestinal type								
Benign (cystadenoma)	3	2	4	-	1	-	-	10
Borderline tumours (mucinous borderline tumour)	-	-	1	-	-	-	-	1
Malignant (mucinous adenocarcinoma)	1	2	-	1	4	1	-	9
Clear cell tumours								
Malignant (clear cell adenocarcinoma)	-	-	-	2	-	-	-	2
Transitional cell tumours								
Brenner tumour	-	-	-	-	3	-	-	3
Brenner tumour of borderline malignancy	-	-	-	-	1		-	1
Malignant Brenner tumour	-	-	-	-	-	1	-	1
Epithelial-stromal								
Carcinosarcoma (formerly mixed Müllerian tumours)	-	-	-	-	-	2	-	2
Undiffrentiated carcinoma	-	-	-	-	1	-	-	1
Sex cord-stromal tumours								
Granulosa tumours:	-	1	1	1	-	1	2	6
Fibromas								
Fibrothecomas	-	-	1	-	1	-	-	2
Thecomas	-	-	-	-	-	-	1	1
Steroid (lipid) cell tumours	-	-	1	-	-	-	-	1
Germ cell tumours (GCT)								
Teratoma:								
Mature	2	17	12	11	3	5	1	51
Dysgerminoma	1	1	1	-	-	-	-	3

[Table/Fig-5]: Distribution of ovarian tumours as per WHO classification 2014 [5] and age.
Malignant, not otherwise specified; Metastatic cancer from non ovarian primary: 0

Unilateral tumours were in majority of cases 134/157 (85.35%). Among the 23 bilateral tumours, one was undifferentiated malignancy, three of mucinous malignancy and 14 of serous malignancy. A meager three out of 23 bilateral tumours were benign. All bilateral tumours were surface-epithelial type. Two tumours were of borderline serous variety. Right sided tumours were more 77/157 (49.04%). Laterality of tumour types as in [Table/Fig-6].

Type of ovarian tumours	Laterality			
	Right (n)	Left (n)	Bilateral (n)	Total (n)
Surface epithelial- Stromal tumours				
Serous tumours				
Benign (cystadenoma)	14	14	3	31
Borderline tumours (serous borderline tumour)	1	0	2	3
Malignant (serous adenocarcinoma)	11	4	14	29
Mucinous tumours, endocervical-like and intestinal type				
Benign (cystadenoma)	4	6	0	10
Borderline tumours (mucinous borderline tumour)	0	1	0	1
Malignant (mucinous adenocarcinoma)	4	2	3	9
Clear cell tumours				
Malignant (clear cell adenocarcinoma)	1	1	0	2
Transitional cell tumours				
Brenner tumour	2	1	0	3
Brenner tumour of borderline malignancy	1	0	0	1
Malignant tumour	0	1	0	1
Epithelial-stromal				
Carcinosarcoma (formerly mixed Müllerian tumours)	2	0	0	2
Undifferentiated carcinoma	0	0	1	1
Sex cord- Stromal tumours				
Granulosa tumours	3	3	0	6
Fibrothecomas	1	1	0	2
Thecomas	0	1	0	1
Steroid (lipid) cell tumours	1	0	0	1
Germ Cell Tumours (GCT)				
Teratoma				
Immature				0
Mature	30	21	0	51
Dysgerminoma	2	1	0	3

[Table/Fig-6]: Distribution of ovarian tumours as per WHO classification 2014 [5] and laterality.
Malignant, not otherwise specified; Metastatic cancer from non ovarian primary: 0

DISCUSSION

Ovarian neoplasms are a cataclysm which spares none i.e., pre-pubertal, pubertal, reproductive age group, postmenopausal, even women with hysterectomy done. Ovarian neoplasms raise concerns regarding fertility, hormonal irregularities, marital relationships, cardiac and bone health related issues in general population. Analysis of histopathological pattern in a region specific is important as it unearths changing trends, most frequent, clinical course of tumours to empower primary as well as specialist physicians alike to provide speciality patient care.

As depicted in [Table/Fig-7] [6-17], a significant contrast study done in region of Valsad, Gujarat which showed 49.40% malignant tumours and 10.50% borderline tumours [13].

Present study done in tribal Rajasthan had benign, borderline and malignant tumours 63.06%, 3.18% and 33.76%, respectively. Overall, these findings are in accordance with studies done in Pune, Varanasi, Jaipur and Rawalpindi; Pakistan [6,9,13,15]. SETs were most common (59.24%) in analysis, followed by GCTs (34.39%) and then SCST's (6.37%) cell tumours and one was found to be poorly differentiated which is placed in SETs group as per WHO classification [4].

This paper confirms SET's to be most frequent histopathological class. The findings are in line with previous work done by Cheema MK et al., and Kaur A et al., [13,15]. They differ with Singh M et al., only,

Author	Total number of cases (n)	Place of study	Benign	Malignant	Borderline
Kanthikar SN et al., [8] (2014)	70	Dhule, Maharashtra	78.57%	20%	1.42%
Agrawal P et al., [6] (2015)	226	Pune, Maharashtra	61.10%	31.86%	7.08%
Sharadha S et al., [7] (2015)	205	Chennai, Tamil Nadu	87.80%	10%	2.20%
Gupta N et al., [9] (2019)	214	Varanasi, Uttar Pradesh	63.70%	31.10%	5.20%
Agarwal D et al., [10] (2018)	152	Sonipat, Haryana	78.28%	18.42%	3.29%
Phukan A et al., [11] (2018)	84	Assam	75%	21.40%	3.60%
Singh M et al., [12] (2017)	522	Nepal	94%	4%	2%
Cheema MK et al., [13] (2019)	420	Rawalpindi, Pakistan	59.50%	34.80%	5.70%
Patel AS et al., [14] (2018)	162	Valsad, Gujarat	40.10%	49.40%	10.50%
Kaur A et al., [15] (2017)	633	Jaipur, Rajasthan	73.90%	22.40%	3.60%
Mondal SK et al., [16] (2020)	2100	West Bengal	71%	12%	17% (non neoplastic)
Itha MB and Veeragandham S [17]. (2019)	50	Guntur, Andhra Pradesh	76%	14%	10%
Present study	157	Udaipur, Rajasthan	63.06%	33.76%	3.18%

[Table/Fig-7]: Nature of tumour in studies done in varying geographic location.

who reported GCT's to be the predominant tumour [12]. Comparing with other studies, contrastingly GCT's in current probe had higher incidence [5,7,9,12,13,16], as shown in [Table/Fig-8] [6,8-15,17].

Most common benign tumour revealed to be mature cystic teratoma which contrasts with various studies [5-7,9,10,12-14,16,17]. Similar pattern found only in studies done by Singh M et al., and Karki LRC et al., [12,19]. Serous cystadenocarcinoma was the most common malignant tumour. Patel AS et al., Mondal SK et al., Kant RH et al., were the only ones differed with this [14,16,18] while many others showed similar results [5-13]. These are shown in [Table/Fig-9] [6-14,18,20].

Author	SET's	GCT's	SCSCT's	Metastatic/ Others
Kanthikar SN et al., [8] (2014)	67.14%	22.86%	5.71%	4.28%
Agrawal P et al., [6] (2015)	72.1%	19.3%	7.1%	0.9%
Singh M et al., [12] (2017)	32.64%	64.77%	2.07%	0.52%
Kaur A et al., [15] (2017)	63.94%	30.96%	4.43%	
Agarwal D et al., [10] (2018)	75%	20.39%	3.28%	1.31%
Phukan A et al., [11] (2018)	66.7%	23.9%	7.1%	2.3%
Patel AS et al., [14] (2018)	77.7%	18.5%	3.8%	
Gupta N et al., [9] (2019)	71.7%	22.2%	3.8%	2.3%
Cheema MK et al., [13] (2019)	63.8%	23.8%	6.9%	2.9% (2.6 misc.)
Itha MB and Veeragandham S [17] (2019)	76%	16%	8%	
Present study	59.24%	34.3%	6.37%	

[Table/Fig-8]: Distribution of histopatholocal types in various studies.

Author	MC Benign	MC Malignant	Borderline	Metastatic
Kanthikar SN et al., [8] (2014)	Serous cystadenoma (35.71%) Mature cystic teratoma (18.57%) Mucinous cystadenoma (10%)	Serous cystadenocarcinoma (8.57%) Mucinous cystadenocarcinoma (4.28%) Dysgerminoma (2.85%)	1 serous	3
Agrawal P et al., [6] (2015)	Serous cystadenoma (22.5%) Mucinous cystadenoma (19.4%) Mature teratoma (22.90%)	Serous cystadenocarcinoma (7.10%) Mucinous cystadenocarcinoma (4.43%) Granulosa cell tumour	3 serous 2 mucinous	2
Sharadha S et al., [7] (2015)	Serous cystadenoma (67%) Mucinous (19%).	Serous cystadenocarcinoma (42.9%) Mucinous cystadenocarcinoma (28.6%).	-	-
Singh M et al., [12] (2017)	Mature cystic teratoma (63.4%) Serous cystadenoma (20.8%) Mucinous cystadenoma (7.8%)	Serous cystadenocarcinoma (1%) Mucinous cystadenocarcinoma (0.5%) Immature teratoma (0.5%)	2 serous 1 mucinous	1
Kant RH et al., [18] (2017)	Serous cystadenoma (22.5%) Mucinous cystadenoma (19.4%) Mature teratoma (5.0%)	Mucinous cystadenocarcinoma (10.6%) Serous cystadenocarcinoma (8.1%)	3 serous	5 (3.1%)
Agarwal D et al., [10] (2018)	Serous cystadenoma (68/152) Mature teratoma (19.07%)	Serous cystadenocarcinoma (13/152) Mucinous cystadenocarcinoma (3/152)	3 serous 2 mucinous	2
Phukan A et al., [11] (2018)	Serous cystadenoma (36.8%) Mature teratoma (17.9%) Mucinous cystadenoma (10.7 %)	Serous cystadenocarcinoma (9%) Mucinous cystadenocarcinoma (2-2.4%) Dysgerminoma (2-2.4%) Immature teratoma (2-2.4%)	1 serous 1 mucinous	2
Kaur A et al., [15] (2018)	Serous cystadenoma (24.18%) Mature teratoma (22.90%) Mucinous cystadenoma (12%)	Serous cystadenocarcinoma (7.10%) Mucinous cystadenocarcinoma (4.43%)	3 serous 0.47% 5 mucinous 0.79% 15 granulosa cell tumour2.37%	0.80% undifferentiated or poorly differentiated 3 metastatic tumour.
Patel AS et al., [14] (2018)	Serous cystadenoma (57.4%) Mucinous cystadenoma (16%) Mature teratoma (16%)	Mucinous cystadenocarcinoma (1.9%) Serous cystadenocarcinoma (1.3%)	1 mucinous	0
Gupta N et al., [9] (2019)		Serous carcinoma (31.8%) Mucinous carcinoma (19.7%)		
Cheema MK et al., [13] (2019)	Serous cystadenoma (19.5%) Mature teratoma (17.4%) Mucinous cystadenoma (14%)	Serous cystadenocarcinoma (11.4%) Endometroid adenocarcinoma (4.8%) Mucinous cystadenocarcinoma (3.6%) Granulosa cell tumour (3.6%)	Serous 13 (3.1%) Mucinous 15 (3.6%)	12 (2.9%)
Karki LRC et al., [19] (2019)	Mature cystic teratoma (49.5%) Serous cystadenoma (27.7%)	Serous cystadenocarcinoma (2.7%%) Mucinous cystadenocarcinoma (1.6%).	2 mucinous 1 serous	2 metastatic
Mondal SK et al., [16] (2020)	Serous cystadenoma (32.57%) Mucinous cystadenoma (15.71%) Mature teratoma (12.86%)	Mucinous cystadenocarcinoma (7.61%) Serous cystadenocarcinoma (3.33%) Immature Teratoma (0.43%)	-	-
Present study	Mature cystic teratoma (32.48%) Serous cystadenoma (19.75%)	Serous cystadenocarcinoma (18.47%) Mucinous cystadenocarcinoma (5.73%).	3 serous 1 Mucinous 1 Brenner	-

[Table/Fig-9]: Histopathological pattern in various studies.

According to the classification of WHO tumours, borderline tumours are an interesting class [5]. Peculiar feature being that they are benign with low malignant potential. So, surgery is the definitive treatment. In present study, incidence of borderline tumours was 3.18%. Brenner's tumour presented as benign, malignant as well as borderline. Hashmi AA et al., found mucinous borderline tumours of higher frequency while serous borderline was more frequent in this probe [20]. Collision tumour (Brenner tumour in one ovary and mucinous cystadenoma in other) was unearthed in one case. Ten cases were reported by Wang Y et al., [21]. They speculated Brenner is an intermediate step in formation of mucinous tumours; a clonal relationship. Similar, 2 cases were reported by Modepalli N and Venugopal SB, [22].

In age group 14-19 years, six patients were found. Benign cystadenoma was present in three girls and in one benign cystic teratoma. Malignancy found in two patients - one of germ cell origin (dysgerminoma) and other a mucinous adenocarcinoma. In extreme of age, 70 years and above among total 8 cases 37.5% were malignant. Out of 5 benign; three belonged to SET's and one each to GCT's and SCST's. Puri S et al., reported 24.4% of cases to be in age group of 50-59 years followed by 24.0% in 40-49 years age group [23]. Extremes of age noticed in probe was similar to Agrawal P et al., i.e., 12-80 years while Singh M et al., Kaur A et al., Itha MB and Veeragandham S, Kant RH et al., had 13-72 years, 15-70 years, 9 months -72 years and 15-65 years, respectively [6,12,15,17,18]. Gupta N et al., observed a six-day-old child having GCT [9]. Malignant tumours were reported to be more common in 5th decade of life by Cheema MK et al., as well as Mondal SK et al., [13,16]. Mean age of more than 50 years was reported by Agarwal D et al., and Prasad AE et al., [10,24]. Mean age among all histopathological types was 33.9 years in work by Kant RH et al., and 41 years by Garg R et al., [18,25]. Present study reported no case of borderline tumour in age less than 21 years. Similar findings were reported by Xu M et al., [26].

Sharadha S et al., reported age of malignancy as 41 years [7]. Mean age for of benign tumours was 39 years. Rathore R et al., in 25-year study in adolescent and childhood found 112 cases below 20 years age. A 34.8% were malignant and 65.2% benign. Mature cystic teratoma was most frequent in their study and 71.1% of all malignancies were GCT [27]. Bilateral tumours in current study were 14.01%. Similar findings were observed in work of Patel AS et al., and Kant RH et al., [14,18] whereas, Itha MB and Veeragandham S, and Garg R et al., depicted double the frequency of bilateral tumours in their work [17,25].

Left sided lesion was predominant in studies by Patel AS et al., and Kant RH et al., while Itha MB and Veeragandham S, and Rathore R et al., observed right sided frequency more [14,18,17,27]. Mature cystic teratoma, the most frequent tumour in present study was 100% unilateral with right sided predeliction. While in studies by Rathore R et al., it was 8.9% bilateral [27].

Granulosa cell tumour reported benign with malignant potential [26] or borderline [16] or benign [11] is termed as malignant by WHO latest classification [28]. Granulosa cell tumour in this study was reported in 2nd decade, 3rd decade, 4th decade, 6th decade and even after that. So, for granulosa cell tumour no age preferences were found. Dridi M et al., stated that GCT's are notorious for relapsing even years after curative treatment [29].

Brenner tumour can be benign, borderline or malignant. Current analysis reports three benign, one malignant and one borderline Brenner tumour. No case of Endometroid tumour, Yolk sac tumour or metastatic tumour was found in study.

Studies done on the basis of WHO classification were easier to search within. WHO classification of tumours of reproductive organ 2014 has attempted to integrate the histologic diagnosis with molecular diagnosis. 2-tier system of grading of serous carcinoma is used and epithelial borderline tumour is also called as atypical proliferative tumour in it [30]. WHO has been tirelessly working on modification of it and WHO Classification of Tumours of Reproductive organs has been updated in 2020. It emphasises on unique synthesis of histopathological diagnosis with digital and molecular pathology [28]. Hence, the importance of such studies so that evidence-based medicine can be employed for future of patient.

Limitation(s)

The main limitation of this study is it is a single center experience and thus referrals may be a bias. Also, tumour markers, immune-phenotype is not correlated in current enquiry. Future studies could elaborate incidence of ovarian neoplasms formation after removal of fallopian tubes during hysterectomy or due to any other reason.

CONCLUSION(S)

In female reproductive organs, there is a premalignant lesion for all organs (vagina, vulva, cervix, uterus and ovary) but not for ovary. Ovary is one organ where all benign neoplasms with malignant potential or frank malignant tumours are sighted. To effectively reverse the trend in a developing country like India each and every gynaecologist should be aware and well versed with histomorphological pattern of ovarian neoplasms specific to a region.

REFERENCES

[1] https://www.ncdirindia.org/All_Reports/Report_2020/resources/NCRP_2020_2012_16.pdf.
[2] Bray F, Ferlay J, Soerjomataram I, Siegel RL, Torre LA, Jemal A. Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin. 2018;68(6):394-424.
[3] Basu P, De P, Mandal S, Ray K, Biswas J. Study of 'patterns of care' of ovarian cancer patients in a specialised cancer institute in Kolkata, eastern India. Indian J Cancer. 2009;46:28-33.
[4] Sharma P, Rao PS, Mogra N, Talreja K. Histopathological study of ovarian tumours in a tertiary healthcare centre of southern Rajasthan. Indian J Pathol Oncol. 2020;7(4):561-66.
[5] Kurman RJ, Carcangiu ML, Herrington CS et al (2014). WHO Classification of Tumours of Female Reproductive Organs. In WHO Classification of Tumours. 4. Aufl. Lyon: WHO Press.
[6] Agrawal P, Kulkarni DG, Chakrabarti PR, Chourasia S, Dixit M, Gupta K. Clinicopathological spectrum of ovarian tumours: A 5-year experience in a tertiary health care center. J Basic Clin Reprod Sci. 2015;4:90-96.
[7] Sharadha S, Sridevi TA, Renukadevi TK, Gowri R, Binayak D, Indra V. Ovarian masses: Changing clinicohistopathological trends. Journal of obstetrics and gynaecology of India. 2015;65(1):34-38. https://doi.org/10.1007/s13224-014-0575-7.
[8] Kanthikar SN, Dravid NV, Deore PN, Nikumbh DB, Suryawanshi KH. Clinico-histopathological analysis of neoplastic and non- neoplastic lesions of the ovary: A 3-year prospective study in Dhule, North Maharashtra, India. J Clin Diagn Res. 2014;8(8):04-07.
[9] Gupta N, Yadav M, Gupta V, Chaudhary D, Patne SCU. Distribution of various histopathological types of ovarian tumours: A study of 212 cases from a tertiary care center of Eastern Uttar Pradesh. J Lab Physicians. 2019;11:75-81.
[10] Agarwal D, Kaur S, Agarwal R, Gathwal M. Histopathological analysis of neoplastic lesions of the ovary: A 5-year retrospective study at tertiary health care centre. International Journal of Contemporary Medical Research. 2018;5(5):E14-E17.
[11] Phukan A, Meghna B, Ghosh S. Histopathological spectrum of ovarian tumours: An institutional perspective. International Journal of Research in Medical Sciences. 2018;6(8):2639-43.
[12] Singh M, Jha KK, Kafle SU, Rana R, Gautam P. Histopathological analysis of neoplastic and non-neoplastic lesions of ovary: A 4 year study in eastern Nepal. BJHS. 2017;2(2)3:168-74.
[13] Cheema MK, Nadeem A, Khan SA, Sarfraz T, Intikhab K, Shahzad T. Evaluation of histo-pathogical patterns of ovarian masses in relation to age in Rawalpindi-Islamabad region- Lab Research. The Journal of the Pakistan Medical Association JPMA. 2019;69(2):285-89.
[14] Patel AS, Patel JM, Shah KJ. Ovarian tumours- Incidence and histopathological spectrum in tertiary care center, Valsad. International Archives of Integrated Medicine. 2018;5(2):84-93.
[15] Kaur A, Faujdar M, Kariya T, Gupta S. Histomorphological spectrum of Ovarian tumours in a tertiary care hospital AWCH. 2017;3(4):A52-61. Doi: 10.21276/AWCH.1804.
[16] Mondal SK, Bhattacharya S, Mandal S, Panda UK. Histological spectrum, bilaterality, and clinical evaluation of ovarian lesions- A 10-year study in a rural tertiary hospital of India. Indian J Health Sci Biomed Res. 2020;13:28-31.
[17] Itha MB, Veeragandham S. Study of histopathological spectrum of ovarian neoplasms: An experience at a tertiary care hospital. International Journal of Clinical and Diagnostic Pathology. 2019;2(2):408-13.
[18] Kant RH, Rather S, Rashid S. Clinical and histopathological profile of patients with ovarian cyst presenting in a tertiary care hospital of Kashmir, India. International Journal of Reproduction, Contraception, Obstetrics and Gynecology. 2017;5(8):2696-700.

[19] Karki LRC, Bogati N. Age specific clinicopathological profile of ovarian mass. Journal of Patan Academy of Health Sciences. 2019;6(2):18-22.
[20] Hashmi AA, Hussain ZF, Bhagwani AR, Edhi MM, Faridi N, Hussain SD, et al. Clinicopathologic features of ovarian neoplasms with emphasis on borderline ovarian tumours: An institutional perspective. BMC Res Notes. 2016;9:205. https://doi.org/10.1186/s13104-016-2015-5.
[21] Wang Y, Wu RC, Shwartz LE, Haley L, Lin MT, Shih Ie M, et al. Clonality analysis of combined Brenner and mucinous tumours of the ovary reveals their monoclonal origin. J Pathol. 2015;237(2):146-51. Doi: 10.1002/path.4572. Epub 2015 Jul 23. PMID: 26095692; PMCID: PMC4703556.
[22] Modepalli, N, Venugopal SB. Clinicopathological study of surface epithelial tumours of the ovary: An institutional study. J Clin Diagn Res. 2016;10(10):EC01-04. https://doi.org/10.7860/JCDR/2016/21741.8716.
[23] Puri S, Chadha V, Pandey AK. Epidemiology of ovarian tumours in Northern India-A tertiary hospital based study. Indian J Community Fam Med. 2018;4:37-41.
[24] Prasad AE, Nandennava M, Ganesh MS, Karpurmath SV, Hatti J. Demographic and clinicopathologic profile of malignant epithelial ovarian tumours: An experience from a tertiary cancer care centre in Bangalore, South India. Int J Reprod Contracept Obstet Gynecol. 2017;6:856-60.
[25] Garg R, Singh S, Rani R, Agrawal M, Rajvanshi R. A clinicopathological study of malignant ovarian tumours in India. J South Asian Fed Menopause Soc. 2014;2:09-11.
[26] Xu M, Wang B, Shi Y. Borderline ovarian tumour in the pediatric and adolescent population: a clinopathologic analysis of fourteen cases. International Journal of Clinical and Experimental Pathology. 2020;13(5):1053-59.
[27] Rathore R, Sharma S, Arora D. Clinicopathological evaluation of 223 cases of mature cystic teratoma, ovary: 25-year experience in a single tertiary care centre in India. Journal of Clinical and Diagnostic Research: JCDR. 2017;11(4):EC11-14. https://doi.org/10.7860/JCDR/2017/23909.9612.
[28] Female Genital Tumours WHO Classification of Tumours, 5th Edition, Volume 4; IARC Publications; 09/09/2020. https://whobluebooks.iarc.fr/news/index.php.
[29] Dridi M, Chraiet N, Batti R, Ayadi M, Mokrani A, Meddeb K, et al. Granulosa cell tumour of the ovary: A retrospective study of 31 cases and a review of the literature. International Journal of Surgical Oncology. 2018;2018:4547892. https://doi.org/10.1155/2018/4547892.
[30] Hatano Y, Hatano K, Tamada M, Morishige KI, Tomita H, Yanai H, et al. A Comprehensive review of ovarian serous carcinoma. Advances in Anatomic Pathology. 2019;26(5):329-39. https://doi.org/10.1097/PAP.0000000000000243.

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