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STUDY OF HISTOPATHOLOGICAL SPECTRUM OF OVARIAN TUMOURS IN A TERTIARY CARE HOSPITAL

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Abstract: Ovarian tumours are among the most common gynaecologic malignancies and represent a heterogeneous group with varied histopathological patterns. This study aimed to analyse the clinicopathological and histopathological spectrum of ovarian tumours in a tertiary care hospital. A retrospective descriptive study was conducted in the Department of Pathology, Shri Atal Bihari Vajpayee Medical College and Research Institute, Bengaluru, from January 2020 to December 2024. A total of 122 ovarian tumour cases were analysed and classified according to the WHO 5th edition (2020). Data were assessed for age distribution, laterality, histopathological type, and tumour nature. Among 122 cases, 111 (91%) were benign, 2 (1.6%) were borderline, and 8 (7.4%) were malignant. Surface epithelial tumours were the most common (73.7%), followed by germ cell tumours (22.9%) and sex cord-stromal tumours (3.2%). The majority occurred between 31–40 years of age. Right-sided tumours (55.5%) were slightly more common than left-sided ones. Most tumours were cystic (90.1%) on gross examination Surface epithelial tumours formed the majority of ovarian neoplasms, with serous histology being the most prevalent. Serous cystadenocarcinoma remained the leading malignant subtype. Comprehensive histopathological evaluation is vital for accurate classification and management.

Key words: Ovarian Neoplasms; Surface Epithelial Tumours; Germ Cell Tumours; Histopathology.

Introduction: Ovarian tumours represent a heterogenous group of tumours with varied clinical and histological features. In India, ovarian tumours account for nearly 80% of all the gynaecological malignancies [1]. The ovary, after the uterus and cervix, is the third common site for the development of gynaecological malignancy and prognosis remains poor [1].Ovarian tumours involve a variety of histologic tissues ranging from epithelial tissues, connective tissue, hormone secreting cells and embryonal cells [2].Ovarian tumours have distinctive features and are hormonally active, most are non-functional and tend to produce mild symptoms until they reach a large size [2].Most of the ovarian tumours are asymptomatic in nature in early stages [3].Ovarian cancer remains one of the most lethal gynaecologic malignancies due to its complex pathogenesis, late-stage diagnosis, and limited effective screening strategies [4]. It is the eighth most common cancer in women globally and ranks as the leading cause of gynaecologic cancer-related deaths [5]. Despite significant advancements in histopathological classification and molecular diagnostics, ovarian cancer continues to pose challenges in early detection, prognosis, and treatment [6]. Over the past decade, research has focused on refining the classification of ovarian tumours, understanding their molecular basis,

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and developing personalized therapeutic strategies [7]. Ovarian tumours are classified into three major categories: epithelial, germ cell, and sex cord-stromal tumours [8]. Among them, epithelial ovarian carcinoma (EOC) accounts for approximately 90% of all ovarian malignancies, making it the most prevalent and aggressive subtype [7].

The 2014 WHO classification of ovarian tumours introduced histological subtypes, while the 2020 WHO classification further refined the system by incorporating molecular subtypes, identifying key genetic alterations such as TP53 mutations in high-grade serous carcinoma (HGSC) and BRAF/KRAS mutations in low-grade serous carcinoma[6].While epithelial ovarian cancers are the most common, non-epithelial ovarian cancers (NEOCs), including germ cell tumours and sex cord-stromal tumours, represent a small but clinically significant subset. These tumours display distinct biological behaviours and require specialized diagnostic and therapeutic approaches [6]. A major obstacle in ovarian cancer management is the lack of reliable screening methods. Unlike cervical cancer, where Pap smears have significantly reduced mortality, no equivalent screening tool exists for ovarian cancer [9]. As a result, the disease is often diagnosed at advanced stages when prognosis is poor [8]. The silent nature of early-stage ovarian cancer and the absence of specific symptoms contribute to this late detection [5].

Materials & Methods: This is a retrospective descriptive study conducted in department of Pathology, Shri Atal Bihari Vajpayee Medical College and Research Institute from January 2020 to December 2024 to evaluate the clinicopathological and histopathological spectrum of ovarian tumours. The clinic data and laboratory investigations were sourced from request forms and electronic records. Gross findings were obtained from the histopathology record section of the institute, and haematoxylin and eosin-stained slides were retrieved from the archives and reviewed. Histopathological examination was performed. The excised specimens of ovaries were fixed in 10% formalin. The tumours were weighed and measured, and their exterior examined. From cysts upto 3 sections of 3mm were taken and from solid tumours, one section for each centimetre was taken especially from areas with papillary appearance and any unusual area (haemorrhagic, calcification or necrotic area). Also, one section of non - neoplastic ovary was taken where it was identifiable. After sectioning tissues were processed. After processing, paraffin blocks were made. The tissue sections of 5mm were cut and stained by Haematoxylin and Eosin. The sections were cleared with xylene and mounted on a glass slide. These slides were then examined under a light microscope for a histopathological examination. Immunohistochemical (IHC) markers were utilized where necessary to confirm histological subtypes. Data collected was analysed.

Results: In this study, a total of 122 cases of ovarian tumours were analysed to understand their distribution, classification, and clinical characteristics. The age range of patients diagnosed with ovarian tumours varied from 11 to 75 years, with a peak incidence observed in the 3rd decade of life. Patients aged between 31 and 40 years represented the largest proportion, accounting for 36% of the cases (n=44). Benign tumours were most commonly observed in individuals between 30 and 40 years of age, whereas malignant tumours tended to occur more frequently in older age groups. There were 14 cases in patients aged less than 20 years (n=14 (11.5%)) and above the age of 60 years, there were n=6 (5%) cases. Among the cases n=109 (89.3%) cases were found in premenopausal and n=15 (12.2%) cases were found in post-menopausal women **(Image 1).** Among the cases, majority of the cases n=111(91%), were

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classified as Benign tumours, Borderline tumours accounted for only 2 cases (1.6%), while 8 cases (7.4%) were malignant. Regarding the laterality of ovarian involvement, right-sided tumours were slightly more common than left-sided tumours, with 60 cases (55.5%) occurring on the right and 48 cases (44.4%) on the left. Bilateral ovarian involvement was observed in 14 cases (11.4%). Among these bilateral cases, 12 tumours (85.7%) were benign, 1 case (7.1%) was borderline, and 1 case (7.1%) was malignant. The predominance of benign tumours in bilateral cases further supports the generally favourable prognosis for the majority of ovarian neoplasms in this series. In the study of gross appearances of the lesions, the majority of cases were cystic in nature, accounting for 110 out of 122 cases (90.1%). Solid-cystic appearances were observed in 10 cases (8.1%), while purely solid appearances were noted in only 2 cases (1.6%).The ovarian tumours were classified according to the updated WHO classification (2020) and categorized according to age. Surface epithelial tumours (SETs) were found to be the most common, representing 73.7% (n=90) of the total tumours. Germ cell tumours followed as the second most frequent group with 28 cases (22.9%), while Sex cord-stromal tumours were comparatively rare, accounting for only 4 cases (3.2%). Notably, no cases of metastatic ovarian tumours or miscellaneous tumours were identified in this series.

A closer examination of surface epithelial tumours revealed that Serous tumours were the most predominant subtype (n=53, 43.5%) with, serous cystadenoma being the most frequently encountered lesion, comprising 40 cases (32.8%), there were n=7 (5.7%) cases of Serous Cystadenofibroma. Serous borderline tumour was seen in 1 case (0.8%). Among the malignant conditions, there were 4 cases of low-grade serous carcinoma and a single case of high-grade serous carcinoma, total n=5 (4.1%). Mucinous tumours accounted for a total of 37 cases (30.3%) with Mucinous cystadenoma being diagnosed in 36 cases (29.5%). Mucinous cystadenocarcinoma was observed in 1 case (0.8%), indicating that serous histology predominates even among the malignant tumours. We also encountered a single case (0.8%) of Borderline Seromucinous tumour in our study. Germ cell tumours were more commonly diagnosed in patients between 30 and 50 years of age, reflecting their prevalence among younger to middle-aged women. There were 25 (20.5%) cases of benign cystic teratoma. There was 1 case (0.8%) of dysgerminoma. Sex cord stromal tumours were most commonly diagnosed in patients between 30 to 50 years of age. There were 2 (2.7%) cases of Ovarian Fibroma and 1 (0.8%) case of steroid cell tumour. There was 1 (0.8%) case of adult granulosa cell tumour. Grossly all these tumours are solid to cystic with cut surface appearing grey white with few tumours showing areas of necrosis and haemorrhage. Collision tumour accounted for 1 (0.8%) case which characterized the combination of two or more histologically distinct and independent neoplasms. Comprised of histologic features of mucinous cystadenoma and teratoma (Table 1).

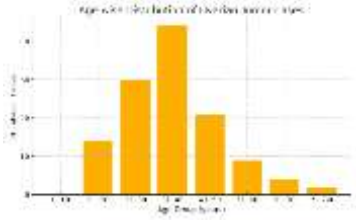
Image 1: 

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Table 1: Number of cases and percentage distribution of various types of ovarian tumours

Nature of Tumour	Histopathological Type	Number of Cases	Percentage
Benign	Serous cystadenoma	40	32.8%
	Serous cyst adenofibroma	7	5.7%
	Mucinous cystadenoma	36	29.5%
	Mucinous cyst adenofibroma	0	0
	Fibroma	2	1.6%
	Benign cystic teratoma	25	20.5%
	Collision tumour	1	0.8%
	Subtotal	111	91%
Borderline	Borderline serous tumour	1	0.8%
	Borderline seromucinous tumour	1	0.8%
	Subtotal	2	1.6%
Malignant	Adult granulosa cell tumour	1	0.8%
	Serous cystadenocarcinoma	5	4.1%
	Mucinous carcinoma	1	0.8%
	Dysgerminoma	1	0.8%
	Subtotal	8	6.5%
	Total	122	

Figure 1: Serous Cystadenoma

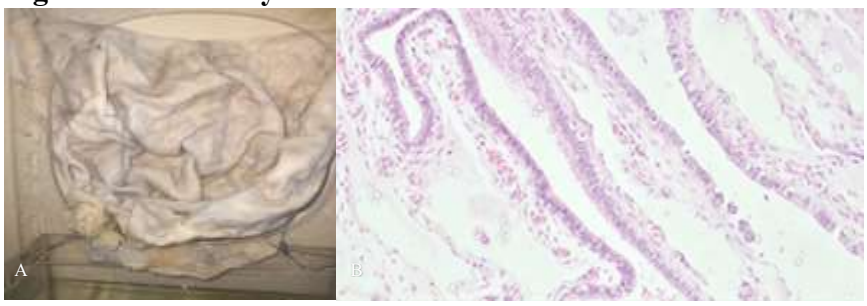

Fig 1: Grossphotograph (A) Shows large cyst and filled with serous fluid.
Microphotograph (B) (40x) shows cystic structure lined by ciliated columnar epithelium. (H&E)

Figure 2: Mucinous Cystadenoma

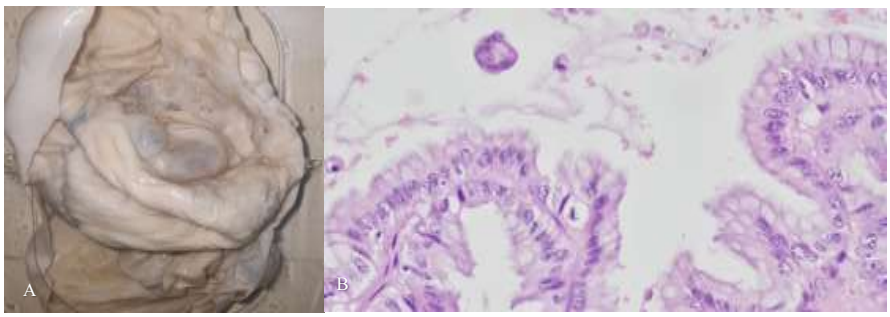

Fig 2: Grossphotograph (A) Shows a multiloculated cystic structure filled with mucinous material.
Microphotograph (B) (40x) Shows cystic structure lined by non-stratified mucinous epithelium. (H&Estain)

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Figure 3: Mature Cystic Teratoma

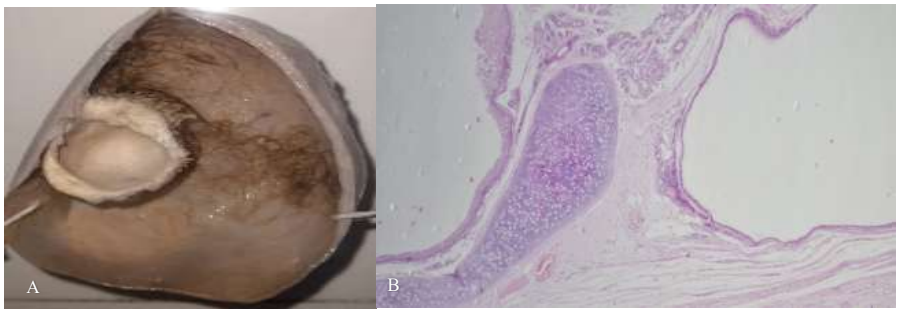

Fig 3: Grossphotograph (A) Cystic structure with hair tuft & solid nodule showing Rokitansky protuberance. Microphotograph (B) (10x) show tissue representing all three embryonic layers.

Figure 4: Mucinous carcinoma

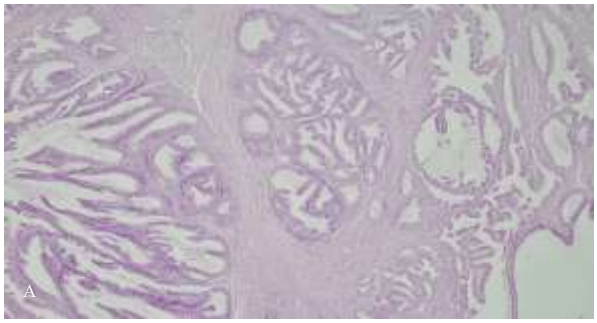

Fig 4: Microphotograph (A) (20x) shows cystic structure lined by cuboidal to columnar epithelium with foci of stratification and papillary projections. Tumour cells show moderate to severe degree nuclear pleomorphism, open chromatin, prominent nucleoli.(H&Estain)

Figure 5: Dysgerminoma

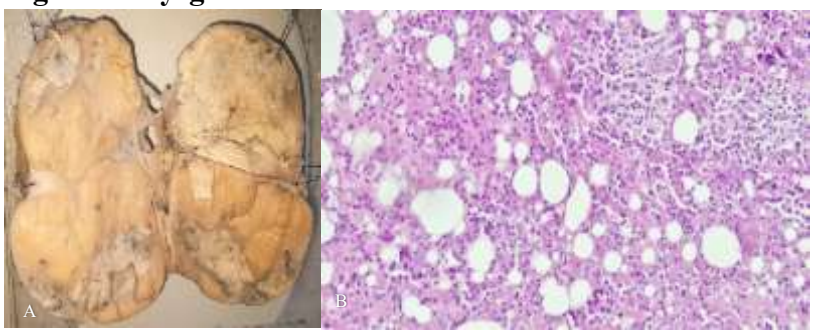

Fig 5: Grossphotograph of Dysgerminoma ovary (A) shows fleshy, yellow or pale white, solid and lobulated. Microphotograph (B) (40x) Sheets and nests of monotonous tumour cells, polygonal with well-defined cell borders, abundant clear or eosinophilic cytoplasm, central nucleus with one or two prominent nucleoli.

Figure 6: Granulosa Cell Tumour

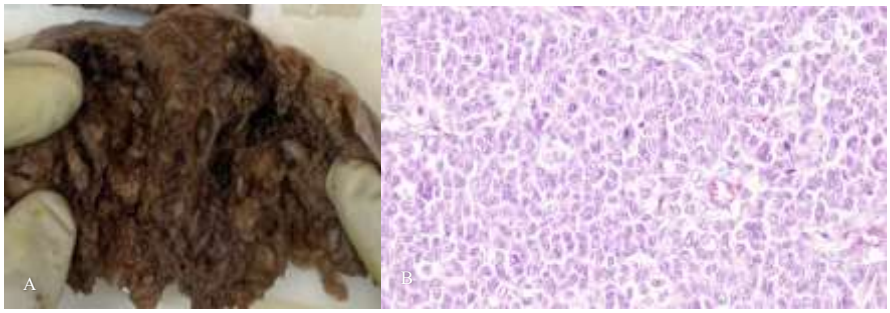

Fig 6: Grossphotograph of Granulosa cell tumour (A) showing grey-white cut surface with friable & papillary areas.
Microphotograph (B) (40x) Tumour cells arranged in cords, trabeculae, multi follicular pattern. Tumour cells are round to oval with coffee bean shaped nucleus and scant cytoplasm (H&E stain).

Figure 7: Collision Tumour

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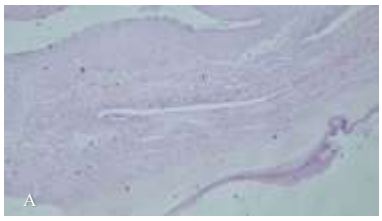

Fig 7: Microphotograph(A) (10X) shows cystic structure with foci showing mucinous epithelium and foci of germ cell layer (H&E stain)

Discussion : Ovarian neoplasms are particularly intriguing due to their diverse origins, varied clinical presentations, and differing degrees of malignancy. Despite their relative rarity, they contribute significantly to cancer-related mortality, accounting for nearly half of all deaths caused by malignancies of the female reproductive system. Histomorphological analysis plays a crucial role in the assessment and diagnosis of these tumours.

This study analysed a total of 122 ovarian tumour cases, with the majority being benign, representing 91% of the cases. Malignant tumours accounted for 6.5%, and a small proportion of 1.6% were classified as borderline. These findings are in line with similar studies, such as the one conducted by Shafiki et al., who reported 80.7% benign, 17.6% malignant, and 1.54% borderline tumours [(19)]. Sampurna K et al. also found a comparable distribution with 66% benign, 30.5% malignant, and 3.5% borderline tumours [(2)].

Surface epithelial tumours were the most prevalent in our study, constituting 73.8% of ovarian neoplasms. This is followed by germ cell tumours (22.1%) and sex cord-stromal tumours (3.3%), which reflects the general distribution observed in other studies. For instance, Mahalakshmi S et al. reported that surface epithelial tumours made up 80.29%, germ cell tumours 14.28%, and sex cord-stromal tumours 4.6% of their cases[(20)]. Notably, our study demonstrated a lower malignancy rate of 7.38%, which contrasts with higher malignancy rates seen in some other studies. The comparatively lower proportion of malignant tumours in our series, when compared with other studies, may be attributed to differences in the study population and hospital referral patterns. As our institute caters mainly to a general or non-oncology population, many malignant cases might be referred directly to higher oncology centres, leading to underrepresentation in our data. In addition, the inclusion of a wider age range, including younger women who are more likely to develop benign lesions, could have contributed to this distribution. Variations in sample size, duration of study, and geographical or genetic factors might also account for the differences observed among various studies.

Our study also analysed the age distribution of ovarian tumours, with the highest incidence found in the 31–40-year age group, representing 36 % of the cases. This was followed by the 21–30-year age group, accounting for 24.59%. Benign tumours were predominantly observed in the reproductive age group, ranging from 20 to 40 years, while malignant tumours were more frequently diagnosed in postmenopausal women, particularly in the 41–60-year age group. These patterns align with global and regional studies. Mahalakshmi S et al study found most tumours were in the premenopausal age group 66.74% and postmenopausal age group 33.25% [(20)]. According to Paswan MK et al, the increased prevalence of malignancy in postmenopausal women suggests that age-related hormonal changes, such as the decline in estrogen, coupled with accumulated genetic mutations, may contribute to the development and progression of ovarian malignancies [(17)]. This concept is supported by research, including studies by Amita S. Patel et al [(13),] which emphasize the role of hormonal and genetic factors in ovarian tumour pathogenesis, particularly in older women. Few studies of Agrawal P[(3)] **et al and** Patel N et al [(18)] show high incidence between the age group of 41 to 50 years.

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Our study implemented the 2020 WHO classification [21] to classify the tumours. In terms of tumour subtypes, the most common benign tumours in our study were serous cystadenoma (40%), mucinous cystadenoma (32.43%), benign teratoma (21.62%), Steroid cell tumour (11.11%). Among the malignant tumours, the most frequently observed subtypes were serous cystadenocarcinoma (5 cases, 55.56%), mucinous cystadenocarcinoma (1 case, 11.11%), dysgerminoma (1 case, 11.11%), granulosa cell tumour (1 case, 11.11%). These findings are similar to a study compared to Sampurna K et al with most common benign tumour being serous cystadenoma (30%), mucinous cystadenoma (21.5%), benign teratoma (10.5%) [2]. The predominance of serous cystadenocarcinoma among malignant tumours is consistent with findings from other studies, such as those by Amita S. Patel [13], which report that high-grade serous carcinoma remains the most common and aggressive form of ovarian malignancy and similar findings were noted in studies as Sampurna et al [2] and Mahalakshmi S et al [20]. The dominance of serous cystadenocarcinomas underscores the clinical importance of early detection and aggressive treatment of this tumour subtype, as it tends to have a poorer prognosis if not identified and treated at an early stage. Among the germ cell tumours. In our study the most common tumour was Benign cystic teratoma of n=25 consisting of ectoderm, mesoderm and endoderm components followed by 1 case (0.8%) of dysgerminoma. These findings are similar to the study compared to Batool A et al with most common being Benign Cystic teratoma and Dysgerminoma [22] amongst benign and malignant tumours respectively. Our study also reported a rare case of Collision tumour which showed combination of histological features of mucinous cystadenoma and teratoma. Regarding tumour laterality, unilateral tumours were found to be much more common than bilateral tumours, accounting for 89% of all cases, compared to 11% bilateral cases. This finding aligns with previous studies by Sampurna K et al which highlights the predominance of unilateral tumours comprising (88%) [2] and similarly by Mahalakshmi S et al which consistently report unilateral ovarian tumours as being more frequent. Even among malignant tumours, 89% were unilateral, with only 11.11% of malignant cases showing bilateral involvement. The occurrence of bilateral tumours in malignant cases supports existing literature, which suggests that bilaterality is more often observed in metastatic and high-grade epithelial tumours. This observation highlights the potential significance of bilateral involvement as an indicator of more advanced or aggressive disease, especially in cases of malignant tumours. It emphasizes the need for a thorough evaluation of both ovaries, particularly in cases with high clinical suspicion of malignancy (Table 2 &3).

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TABLE 2 : **Comparison of the percentage incidence of ovarian tumours in various studies**

	Our Study	Sampurna et al	TriptiMishra et al	MahalakshmiS et al	K.B.Gautam et al	Shafiki et al
Total no of cases	122	200	50	406	80	260
I. BENIGN	90.98%	66%	64%	81.03%	66.2%	80.7%
Epithelial Tumors	73.77%	77%	64%	80.29%	66.6%	75%
Non Epithelial Tumors	27.04%	18.5%	36%	19.7%	32.5%	25%
II.BORDERLINE	1.64%	3.5%	6%	2.95%	5%	1.54%
III.MALIGNANT	6.55%	30.5%	10%	16.0%	28.7%	17.69%
Median age	30-40	30-40	34-43	21-60	31-40	20-39
Laterality						
Unilateral	89%	88%	-	86.9%	-	93.5%
Bilateral	11%	12%	-	13.05%	-	6.5%

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Table 3 : **Comparison of different histopathological types of ovarian tumours**

	Our Study	Sampurna et al	Tripti Mishra et al	MahalakshmiS et al	K.B.Gautam et al	Shafiki et al
Total no of cases	122	200	50	406	80	260
TYPE OF LESION:						
Serous Cystadenoma (%)	40%	30%	44.6%	33.4%	46.9%	27.3%
Serous Cystadenofibroma (%)	6.3%	2%	0%	0%	0%	5.38%
Serous Cystadenocarcinoma(%) • Low Grade • High Grade	50% 12.5%	11%	0%	8.12%	68.8%	9.23%
Mucinous Cystadenoma (%)	32.4%	21.5%	18%	25.8%	46.9%	23.07 %
Mucinous Carcinoma (%)	11.1%	6%	0%	1.23%	25%	5.38%
Mature Teratoma(%)	21.6%	10.5%	12%	12.06%	77.27%	19.61 %
Dysgerminoma (%)	11.1%	2.5%	0%	0.49%	2.5%	0.77%
Granulosa Cell Tumour (%)	0.9%	5%	4%	1.97%	4.3%	1.54%
Ovarian Fibroma (%)	2.7%	0%	0%	0%	3.7%	0.38%
Steroid cell tumor (%)	0.9%	0%	0%	0%	0%	0%
Borderline tumor (%)	1.6%	3.5%	6%	33.3%	0%	0.7%

Limitation of Study : The study's primary limitations stemmed from a relatively small sample size, which restricted the ability to effectively categorize tumour cases. Furthermore, the study was significantly constrained by resource restrictions that necessitated the omission of critical ancillary studies. Specifically, the researchers were unable to include biochemical assessments of tumour markers, immunohistochemistry, or genetic studies. This omission is particularly notable given that such techniques are routine for diagnosis—for example, TP53 mutations are identified in almost all high-grade serous carcinomas etc. Therefore, the findings must be interpreted strictly within the framework of these inherent limitations, underscoring the need for further research incorporating molecular and genetic studies for more precise tumour classification

Conclusion : The predominance of surface epithelial tumours aligns with global trends, confirming their importance in ovarian neoplasia research. The lower malignancy rate in this study compared to other regions highlights the role of early detection and access to care. Serous cystadenocarcinoma remains the most common malignant subtype, reinforcing the

need for enhanced surveillance and targeted therapies. The study underscores the importance of regional comparisons in understanding ovarian tumour epidemiology and improving diagnostic and therapeutic strategies. Future research should focus on genomic profiling, biomarker-driven screening, and improving early detection strategies to reduce ovarian cancer mortality rates.

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