Original Article

Spectrum of Ovarian Tumours: A 12-Year Retrospective Study in a Diagnostic Laboratory in Upper Assam

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DOI
10.21276/apalm.3792

Article History
Received: 21-12-2025
Revised: 31-03-2026
Accepted: 13-04-2026
Published: 01-05-2026

How to cite this article
Baruah MK, Baruah R, Gogoi R. Spectrum of Ovarian Tumours: A 12-Year Retrospective Study in a Diagnostic Laboratory in Upper Assam. Ann Pathol Lab Med. 2026;13(5):A231-A237.

Abstract

Background: Ovarian tumours exhibit a wide morphological spectrum and remain one of the most common neoplasms encountered in gynaecologic pathology. Understanding their prevalence and histopathological patterns is essential for improved diagnostic accuracy and clinical management.

Objective: To evaluate the incidence, age distribution, laterality, and histopathological spectrum of ovarian tumours in Upper Assam over a 12-year period using the WHO classification.

Materials and Methods: This is a retrospective study conducted in a stand-alone diagnostic laboratory located in Upper Assam. A total of 53,351 surgical pathology specimens were reviewed, out of which 1,354 cases were identified as ovarian tumours. Data on patient age, laterality, and histopathological subtype were collected.

Results: Epithelial tumours constituted the largest group (61.23%, n=829), followed by germ cell tumours (34.93%, n=473), sex cord-stromal tumours (2.95%, n=40), metastatic tumours (0.81%, n=11), and mesenchymal tumours (0.07%, n=1). The majority of tumours occurred in the 20–39 year peak reproductive age group (48.97%, n=663). Laterality analysis showed 88.26% unilateral and 11.74% bilateral cases. The most common benign tumours were serous cystadenoma (33.1%, n=448 cases) followed by mature cystic teratoma (18.5%, n=251 cases), while the most common malignant epithelial tumours were serous cystadenocarcinoma (4.1%, n=56 cases) and mucinous cystadenocarcinoma (1.6%, n=22 cases).

Conclusion: Ovarian tumours in Upper Assam are predominantly epithelial, followed by germ cell tumours. The peak incidence in reproductive-age women and the relatively high proportion of germ cell tumours underscore the importance of early detection and accurate morphological diagnosis.

Keywords: ovarian tumours; histopathology; retrospective study; Upper Assam

Introduction

Ovarian tumours constitute a significant portion of female genital tract neoplasms and display extensive clinical and histopathological diversity. Their diagnosis is often delayed due to vague clinical symptoms and deep abdominal location, contributing to unfavourable outcomes in malignant cases [1]. The incidence and pattern of ovarian tumours show geographical variations influenced by genetic, environmental, and demographic factors both globally and regionally [1, 2].

Histologically, ovarian tumours are categorized into epithelial, germ cell, sex cord-stromal, mesenchymal, and metastatic groups based on the WHO classification [3]. Accurate histopathological diagnosis remains crucial for guiding clinical management, prognostication, and therapeutic decision-making.

Understanding the regional epidemiological profile of ovarian tumours has important clinical implications. Knowledge of the relative frequency of tumours, as well as the distribution of major histological subtypes, assists clinicians and radiologists

in formulating differential diagnoses and planning appropriate preoperative evaluation. It may also influence surgical decision-making, including the extent of surgery and the need for referral to specialized oncological centres. Regional data are therefore valuable not only for epidemiological documentation but also for improving diagnostic accuracy, optimizing clinical management, and guiding healthcare planning [4].

The North-Eastern region of India represents a unique demographic and ethnic population with distinct genetic backgrounds, environmental exposures, dietary habits, and healthcare access patterns, all of which may influence the epidemiology and clinicopathological profile of ovarian tumours. Consequently, region-specific studies are essential to better understand local disease patterns and to generate data that may assist clinicians, radiologists, and pathologists in improving diagnostic and therapeutic strategies [5].

Data on the distribution of ovarian tumours in North-East India are limited. This study aims to fill that gap by providing a comprehensive overview of the frequency and pattern of ovarian tumours diagnosed over 12 years in Upper Assam.

Objectives: To determine the incidence of ovarian tumours diagnosed over a 12-year period. To analyse the age distribution and laterality of ovarian tumours. To classify ovarian tumours based on WHO broad categories and histopathological subtypes. To compare the findings with previously published regional and national studies.

Materials and Methods

Study design and duration

This is a retrospective observational study performed from January 2013 to December 2024 at a stand-alone diagnostic pathology laboratory in Upper Assam. The laboratory receives surgical pathology specimens from multiple private nursing homes, district hospitals, and corporate hospitals across Upper Assam and neighbouring districts of adjoining states, thereby serving a wide catchment population. During much of the study period, this laboratory was one of the few centres providing routine histopathology services in the region.

Data collection

All histopathologically diagnosed ovarian tumours were included (n=1354). Tumour-like lesions (functional cysts, luteomas, endometriotic cysts, follicular cysts) were excluded from the study. Clinical details, including age and laterality, were retrieved from requisition forms.

Histopathological processing

All specimens were fixed in 10% neutral buffered formalin, processed routinely, and stained with haematoxylin and eosin (H&E). The majority of tumours were diagnosed on the basis of histomorphology features. Immunohistochemistry (IHC) was performed selectively in diagnostically challenging cases through an external reference laboratory to confirm the morphological impression. For example: a poorly differentiated carcinoma showed immunoreactivity for PAX8, WT1, and oestrogen receptor confirming a serous carcinoma. IHC was also done in a case of metastatic tumour, Brenner tumour, and a neuroendocrine tumour for confirmation of morphologic diagnosis.

Classification

Tumours were classified according to the WHO Classification of Female Genital Tumours which is morphologic but follows the concept of embryological development of the ovary. Broad categories included: Epithelial tumours, Germ cell tumours, Sex cord-stromal tumours, Mesenchymal tumours, Metastatic tumours.

Data analysis

Data were analysed using descriptive statistics (frequency and percentage). Findings were compared across age groups, laterality and frequency of histopathological subtypes.

Results

A total of 53,351 surgical pathology specimens were reviewed, out of which 1,354 cases (2.53%) were identified as ovarian tumours.

Of the 1354 cases the majority of the tumours were in the 20–59 year age group and in the peak reproductive age group of 20–39 years (n=663, 48.97%) (Figure 1). The youngest patient was an 8-month-old child with Mixed Germ Cell Tumour (Mature Teratoma with Yolk Sac Tumour) and the eldest was a 92-year-old lady with Bilateral Mature Cystic Teratomas. The mean age was 38 years.

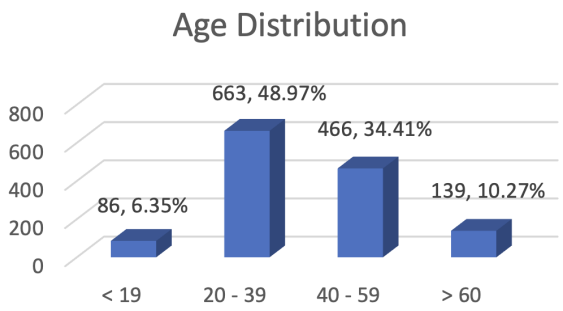

Figure 1: Age distribution of ovarian tumours.

Study of the laterality of the tumours showed a near-equal incidence with the right ovary (45.05%) marginally gaining over the left (43.21%). 1195 (88.26%) cases were unilateral; 11.74% were bilateral. (Figure 2)

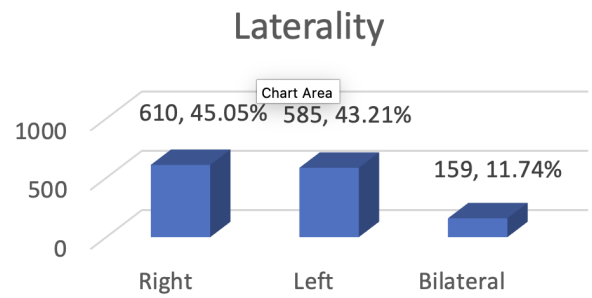

Figure 2: Laterality of ovarian tumours.

The broad classification of the tumours showed that the Epithelial tumours constituted the largest group (61.24%, n=829), followed by Germ Cell tumours (34.93%, n=473), Sex Cord-Stromal tumours (2.95%, n=40), Metastatic tumours (0.81%, n=11), and Mesenchymal tumours (0.07%, n=1). (Table 1). 1148 (84.8%) tumours were benign, 20 (1.5%) Borderline and 186 (13.7%) were malignant (Table 2).

Table 1: Broad classification of ovarian tumours.

Category	Number	Percentage
Epithelial Tumours	829	61.24%
Germ Cell Tumours	473	34.93%
Sex Cord Stromal Tumours	40	2.95%
Metastatic Tumours	11	0.81%
Mesenchymal Tumours	1	0.07%

Histopathological subtype distribution

Majority of the tumours of the Ovary as classified by the WHO Classification, were encountered in this study (Table 2). Not seen were benign and borderline tumours of the Endometrioid and Clear Cell tumours. We have also not come across the rarer variants of the Sex-cord stromal tumours including Gynandroblastomas, and the rare Germ cell tumour namely Gonadoblastoma.

The commonest benign tumour was Serous Cystadenoma (n=448, 33.1%) followed by Mature Cystic Teratomas (n=251, 18.5%), and the commonest malignant tumour was Serous Cystadenocarcinomas (n=56, 4.1%) followed by Mucinous Cystadenocarcinomas (n=22, 1.6%). 20 (1.47%) cases of Borderline malignancies were seen, 9 serous, 11 mucinous. Sex-cord stromal tumours showed predominance of Granulosa Cell tumours (n=16). 11 Metastatic tumours were encountered, out of which 8 were bilateral. One of the rare metastatic tumours was a bilateral Metastatic endometrial stromal sarcoma (Fig. 3G). Other rare histologic tumours encountered were lipomas (n=3) and Carcinoid (n=2) in Mature Cystic Teratomas (Fig. 3F). The lone Mesenchymal tumour was a Leiomyoma of the Rt. Ovary in a 71-year-old lady (Fig. 3C). 16 Collision tumours and 11 bilateral synchronous tumours were also documented. Collision tumours refer to the coexistence of two histologically distinct neoplasms within the same ovary without histologic admixture, whereas synchronous tumours represent independent primary tumours occurring simultaneously in both ovaries.

Table 2: Frequency of histopathological subtypes of ovarian tumours.

Category	Subtype	No.	%
Epithelial Tumours			
Serous Tumours	Serous cystadenoma	448	33.1
	Papillary Serous cystadenoma	36	2.7
	Adenofibroma	2	0.1
	Borderline Serous cystadenoma	9	0.7
	Serous Cystadenocarcinoma	56	4.1
Mucinous Tumours	Mucinous cystadenoma	179	13.2
	Papillary Mucinous cystadenoma	10	0.7
	Borderline Mucinous cystadenoma	11	0.8
	Mucinous cystadenocarcinoma	22	1.6
Endometrioid Tumours	Endometrioid carcinoma	20	1.5
Clear cell Tumours	Clear cell carcinoma	13	1.0
Brenner Tumours	Brenner Tumour	6	0.4
	Malignant Brenner tumour	1	0.1
Other carcinomas	Undifferentiated Carcinoma	12	0.9
	Carcinosarcoma	3	0.2
	Mesonephric Carcinoma	1	0.1
Mesenchymal Tumours			
Smooth Muscle tumours	Leiomyoma	1	0.1
Sex Cord Stromal Tumours			
Pure Stromal Tumours	Fibroma	15	1.1
	Thecoma	2	0.1
	Malignant Steroid Cell Tumour	1	0.1
	Fibrosarcoma	1	0.1
Pure Sex cord Tumours	Granulosa cell tumour	16	1.2
	Sertoli cell tumour	1	0.1
Mixed sex cord stromal tumours	Sertoli Leydig cell tumour	1	0.1
	Sex Cord Stromal tumour, NOS	3	0.2
Germ Cell Tumours			
	Mature Cystic Teratoma	251	18.5
	Immature Teratoma	2	0.1
	Dysgerminoma	7	0.5
	Yolk Sac Tumour	9	0.7
	Embryonal Carcinoma	3	0.2
	Choriocarcinoma	2	0.1
	Mixed Germ Cell Tumour	8	0.6
	Struma Ovarii	4	0.3
	Carcinoid Tumour arising from a Dermoid cyst	2	0.1
	Monodermal Cystic Teratoma (Dermoid Cyst)	184	13.6
	Teratoma with Malignant Transformation (Squamous cell carcinoma)	1	0.1
Metastatic Tumours			
	Metastatic Carcinoma	11	0.8
TOTAL		**1354**	**100.0**

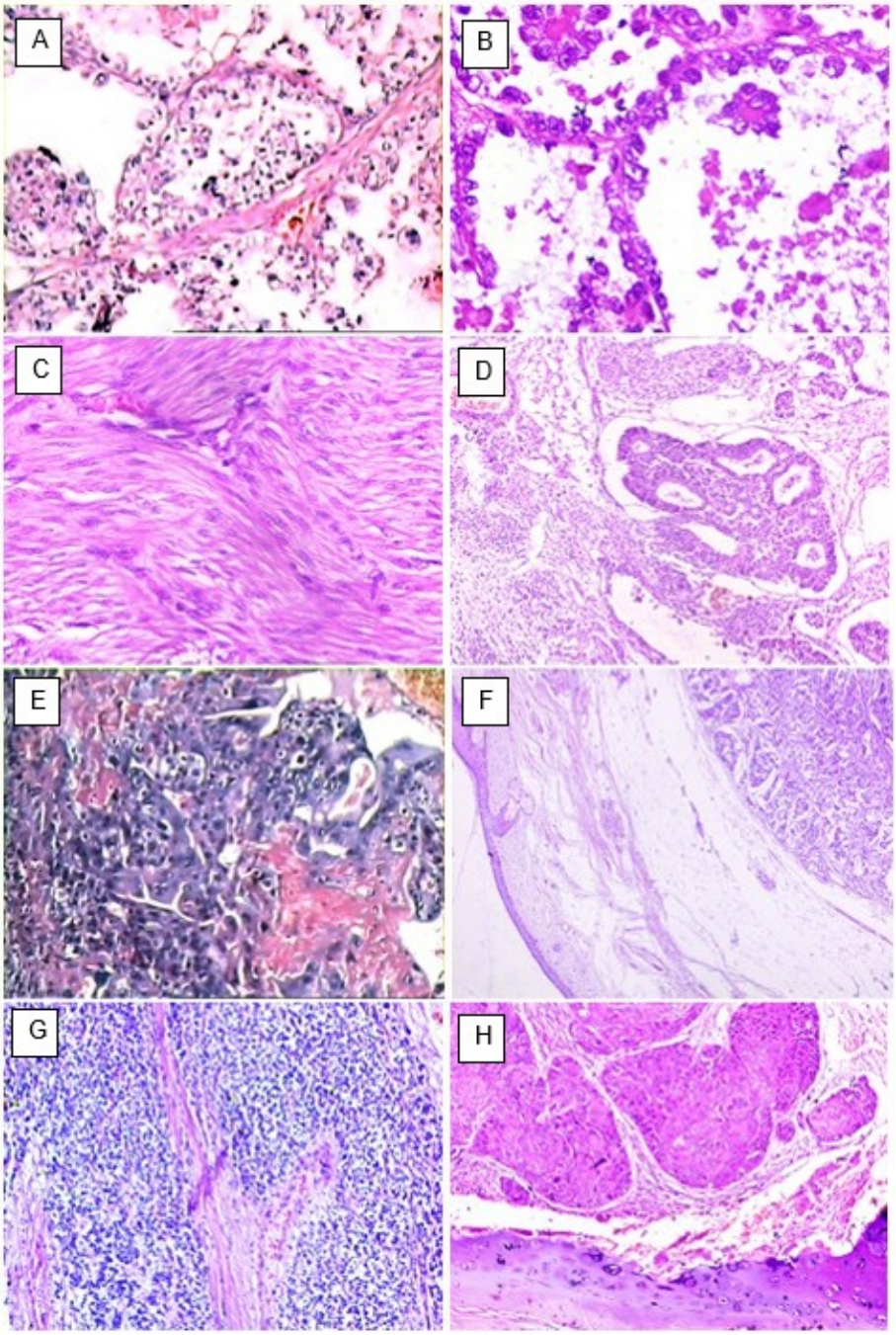

Figure 3: Less common tumours of the ovary. A) Clear cell carcinoma H&E, ×100; B) Mesonephric carcinoma H&E, ×100; C) Leiomyoma H&E, ×100; D) Immature teratoma H&E, ×40; E) Choriocarcinoma H&E, ×200; F) Carcinoid in a mature cystic teratoma H&E, ×40; G) Metastatic endometrial stromal sarcoma H&E, ×100; H) Squamous cell carcinoma in a mature cystic teratoma H&E, ×100.

Discussion

Ovarian tumours constitute a heterogeneous group of neoplasms with considerable variation in incidence, age distribution, and histopathological spectrum across different regions both globally and regionally [2, 3]. In the present 12-year retrospective study from a stand-alone diagnostic laboratory in Upper Assam, 1,354 ovarian tumours were seen out of a total of 53,351 surgical pathology specimens in a period of 12 years.

Majority of the cases were unilateral with 11.4% bilateral. This is similar to other studies [4]. Maximum cases were seen between 20 to 59 years age group with the majority seen in the peak reproductive age group of 20–39 years (48.97%), similar to that seen by Das et al [7]. The Indian Cancer Registry Programme suggests a higher age adjusted rates of ovarian cancers in Urban Centres than in the North Eastern States, and the peak incidence is in the younger age group (40–44 years) in the North Eastern states than in other parts of the country (55–64 years) [2].

Ovarian tumours demonstrated a wide morphological spectrum, with epithelial tumours forming the predominant category (61.24%). This aligns with national and international studies reporting epithelial tumours as the largest group, generally forming 60–80% of all ovarian neoplasms [8, 9, 10, 11]. The incidence of epithelial tumours followed by Germ Cell tumours and Sex cord tumours and Metastatic Tumours have been reported by nearly all studies [8, 9, 10, 11]. Mesenchymal tumours were rarely documented. We have observed a case of Leiomyoma which is extremely rare [12]. Other rare tumours encountered were 3 cases of Lipomas in Mature Cystic Teratoma [13] and 2 cases of Carcinoid [14]. Discussion on the extremely rare Collision and Synchronous tumours is beyond the scope of the present study.

Benign tumours constituted 84.8%. Serous Cystadenoma was the commonest benign tumour (33.1%) followed by Mature Cystic Teratoma (18.5%). These figures are similar to other studies [7, 8, 9, 10, 11]. Borderline Tumours were less common in our study (1.47%) compared to the higher figures (4%–14%) in the literature [4]. However, similar figures (1.6%) were also found by Chelladurai V et al [9]. Interestingly, no benign or borderline variants of endometrioid or clear cell tumours were encountered in our series. These tumours are known to be relatively uncommon compared with their malignant counterparts, and their absence in the present study may reflect their rarity as well as because of the retrospective nature of the study and the referral patterns inherent to a stand-alone diagnostic laboratory.

The incidence of malignant tumours (13.7%) is similar to the world literature [1, 2, 9]. Epithelial malignancies were dominated by serous cystadenocarcinoma, a finding that has been found in all studies [1, 9]. In germ cell tumours, malignant subtypes were rare, Yolk sac tumours being the commonest in our study. Dysgerminoma is the commonest in the world literature [17]. Granulosa cell tumour was the commonest malignant Sex-cord stromal tumour, whereas the commonest benign tumour was Fibroma. According to the literature, adult granulosa cell tumour is the most common sex cord–stromal tumour, accounting for approximately 70–80% [3].

Metastatic tumours constituted 0.81% in this study. This is similar to other case series studies [20].

The proportion of germ cell tumours in the present study (34.93%) is notably higher than that reported in many tertiary-centre series, where germ cell tumours typically constitute approximately 10–25% of ovarian neoplasms [8, 9, 10]. However, similar observations have been reported in studies from geographically comparable regions. For example, a study from Upper Assam reported germ cell tumours accounting for nearly 40% of ovarian tumours [20], while another study from Nepal documented a proportion of 42.2% [10]. These findings suggest that the relatively high frequency of germ cell tumours in our study may reflect regional demographic and referral patterns rather than a true epidemiological anomaly. Germ cell tumours, particularly mature cystic teratomas, are known to occur predominantly in younger women, and the high proportion of patients in the reproductive age group (20–39 years) in our series may partly explain their increased representation. From a clinical perspective, the high proportion of germ cell tumours underscores the importance of considering fertility-preserving surgical approaches in young women and highlights the need for continued awareness of germ cell neoplasms in the differential diagnosis of ovarian masses in this region.

The broad similarity with other Indian and Asian studies underscores the reliability of our regional dataset, while differences in germ cell tumour proportions might suggest unique demographic variations.

As this study is based on material received in a stand-alone diagnostic laboratory, referral patterns may influence the spectrum of tumours encountered. In particular, some advanced or complex oncologic cases may be preferentially referred to nearby tertiary care centres, which could introduce a degree of selection bias. However, in spite of the referral bias, our data appears to be more or less at par with global and regional studies.

Conclusion

This 12-year retrospective study provides valuable insights into the histopathological spectrum of ovarian tumours in Upper Assam, a region for which published data are limited. The findings demonstrate that ovarian tumours predominantly affect women in their peak reproductive years, with epithelial tumours constituting the largest group, followed by a relatively higher proportion of germ cell tumours compared to many published series. The predominance of tumours in younger women and the significant representation of germ cell neoplasms underscore the importance of early diagnosis, appropriate surgical planning, and consideration of fertility-preserving management strategies.

The study also highlights the utility of routine histopathological evaluation, supported by selective use of immunohistochemistry, in accurately classifying ovarian neoplasms according to WHO criteria. Furthermore, the observed patterns may reflect regional demographic characteristics and referral practices, emphasizing the importance of interpreting institutional data within the context of local healthcare systems.

Regional datasets such as the present study are essential for improving diagnostic awareness, guiding clinical decision-making, and contributing to epidemiological understanding. Continued documentation of such data, along with multicentric collaboration, may help in better delineating regional variations and optimizing management strategies for ovarian tumours.

Acknowledgements: Nil

Funding: Nil

Competing Interests: Nil

Statement of Ethical Approval for the study: Ethical approval was obtained from Assam Medical College Institutional Ethics Committee (H) (Approval No.: AMC/EC/2026/251). As this was a retrospective study based on archived histopathological records with no direct patient interaction, the requirement for individual written informed consent was waived by the Institutional Ethics Committee.

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