DIFFERENT HISTOPATHOLOGIC SPECTRUMS OF OVARIAN TUMOR IN JIMMA UNIVERSITY MEDICAL CENTER; SOUTH WEST ETHIOPIA: A FIVE YEARS RETROSPECTIVE CROSS-SECTIONAL STUDY

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Different Histopathologic Spectrums of Ovarian Tumor In Jimma University Medical Center; South West Ethiopia: A Five Years Retrospective Cross-Sectional Study

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Abstract

Background: Ovaries are one of the common sites of neoplasm in females. These neoplasms affect women of all age groups and manifest in wide spectrum of clinical, morphological and histological features. Even though there are geographical and racial differences in the frequency, types and age distribution of primary ovarian tumors, currently there is increament of morbidity and mortality due to ovarian tumors worldwide and it is the third most common site of primary malignancy in female genital tract. However, data about the clinical and pathological characteristics of ovarian tumors in Ethiopia and its neighboring countries is limited.

Objective: The aim of this study was to examine different histopathologic types and associated factor of primary ovarian tumors in Jimma University Medical Center, Jimma, from September 2015-August 2019.

Methods and materials: A five years retrospective cross sectional study design was employed. Data was gathered from ovarian biopsy diagnosis reports from samples submitted to pathology department as of September 11, 2015 - September10, 2019 by using prepared checklist and data was entered to Epi data version 3.1, analyzed by SPSS version 26 and finally presented using narration, tables and graphs.

Result:Majority(73.04%) of the ovarian tumors were benign followed by malignant(20.58%) and borderline tumor(6.38%). Among which, Surface epithelial tumors were the most common (64.64%), followed by germ cell tumor (25.80%) and sexcord stromal tumor (8.12%). The commonest benign tumor was Serous cystadenoma (42%) followed by mature teratoma (20.9%). Serous cystadenocarcinoma (8.1%) was the most common malignant ovarian tumor. Most (65%) malignant tumors occurred in age greater than 40 years. Most malignant tumors (71%) had solid component. About 11.42% of ovarian tumors were bilateral out of which 20.5% were malignant. Most (69.8%) malignant tumor had large size greater than or equal to15cm. Of all malignant ovarian tumors more than a quarter (29%) showed omental involvement and Serous cystadenocarcinoma accounted for most (77.8%) of the cases. Out of the malignant

tumors majority 83.3% had papillary excrescence and presence of papillary excrescence(p=**0.013,** AOR = 11.911, 95% CI = 1.703–83.324) was the most important predictor of malignant surface epithelial ovarian tumor.

Conclusion: In this study benign tumors outnumbered malignant and borderline tumor. Most ovarian tumors were surface epithelial tumors with predominance of serous, followed by germ cell tumors. The commonest histopathologictypes of benign and malignant ovarian neoplasm wereserous cystadenoma and serous cystadenocarcinoma respectively. Age, size, consistency, laterality and presence of papillary excrescence were variables that affected the malignant nature of tumor, out of which the most powerful independent predictor of malignant nature of surface epithelial tumors was the presence of papillary excrescence.

Key words: Ovarian tumor, Ovarian cancer,Histopathology, Jimma University, Ethiopia

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Abbreviations and Acronyms

ACS	American Cancer Society
AOR	Adjusted Odds Ratio
ASR	Age Standardized Rate
CI	Confidence Interval
COVID19	Corona Virus Disease 2019
COR	Crude Odds Ratio
FGT	Female Genital Tract
FIGO	International Federation of Gynecologists and Obstetricians
GCT	Germ Cell Tumor
H&E	Hematoxylin and Eosin
HDI	High Development Index
HRT	Hormonal replacement therapy
IJWH	International Journal of Women's Health
JUMC	Jimma University Medical Center
LDI	Low Development Index
OC	Ovarian Cancer
OCP	Oral Contraceptive Pills
PPE	Personal Protective Equipment
SPSS	Statistical Package for Social Studies
WHO	World Health organization

1. Introduction

1.1 Background

The ovaries are paired pelvic organs located on the sides of the uterus close to the lateral pelvic wall, behind the broad ligament and anterior to the rectum. During the reproductive period, their average size is 4 × 2 × 1 cm and their average weight is 5–8 g; after menopause, they shrink to one half or less of this size(1). Ovaries are sites for various pathologies which can be non-neoplastic or neoplastic lesions. Ovarian neoplasms exhibit a wide difference in morphology and biologic behavior (2). The classification of ovarian tumors is primarily morphologic and based on the cytologic features of the tumor cells (1). World Health Organization (WHO) 2014 classifies ovarian tumors as Epithelial, Mesenchymal, Mixed epithelial and mesenchymal, Sex cord-stromal, Mixed sex cord-stromal, Germ cell, Monodermal teratoma and somatic-type tumors arising from a dermoid cyst, Germ cell - sex cord-stromal, Miscellaneous, Secondary and some other tumors not specific to ovaries (3). The three main categories of primary ovarian tumors are Epithelial, Sex cord–stromal and Germ cell (4).

Epithelial tumors, which originate from the surface epithelium of the ovary, epithelial inclusions, or endometriosis(recently it has been proposed that some of these may actually be of tubal origin), are the most common of all ovarian tumors comprising about 60% (4).Epithelial ovarian tumors are sub-classified based on cell type as Serous, Mucinous, Endometrioid, Clear cell, Brenner, Seromucinous and Undifferentiated (3). Serous and mucinous cystadenomas are the most common epithelial tumors and together account for about 30% of ovarian tumors (4). Within each histotype, tumors are further sub-classified as benign (cystic, cystic and solid or predominantly solid), borderline, or malignant(1).

Germ cell tumors (GCT) constitute approximately 20% of all ovarian neoplasms. Most of them are seen in children and young adults, and approximately 95% are benign cystic teratomas which is the single most common GCT; the younger the patient, the more likely the germ cell tumor will be malignant (1)(4).

According to WHO 2014 germ cell tumor includes Dysgerminoma, Teratoma (mature and immature), Yolk sac tumor, Embryonal carcinoma, Non-gestational Choriocarcinoma and mixed tumor(3).

Sex cord–stromal tumors are tumors that differentiate towards the sex cords and/or the specialized ovarian stroma and it accounts for 5% of all ovarian neoplasms. Sex cord tumors includes female-type cells (granulosa and theca cells), male-type cells (Sertoli and Leydig cells), and indifferent elements and stroma tumors includes fibroma, thecoma, fibrothecoma and others (1). The most common malignant sex cord–stromal tumor, the granulosa cell tumor, accounts for only about 1% of ovarian tumors. Other sex cord–stromal tumors are rare(4).

In ovarian tumor one of the most important clinical features is the age of the patient. Only around one out of eight ovarian tumors are malignant in patients younger than 45 years; by contrast, in older women, the proportion is about one in three. Some tumors like mature cystic teratoma and most sex cord –stromal tumors, are encountered at all ages. While other ovarian neoplasms, by contrast, are largely restricted to certain age groups examples include primitive germ cell tumors like yolk sac tumor (2). Germ cell tumors are by far the commonest (60%–70%)ovarian tumors in pediatrics and young adults accounts for (1). Finally, accurate diagnosis of ovarian tumors depends on knowledge of the wide range of microscopic patterns they may exhibit and the cell types they may contain (2).

Peritoneal cavity, lymph nodes, lungs, and liver are the most common site for metastasis of ovarian cancer. The risk of ovarian cancer increases with ovulation induction treatment, nulliparity (nulliparous women are two times at risk of having ovarian cancer compared to parous ones), women taking hormonal replacement therapy(HRT) and those with early menarche and late menopause are at a higher risk of ovarian cancer. First pregnancy at an early age, early menopause, tubal ligation, breast feeding and the use of OCP (oral contraceptives) have been associated with lower risks of ovarian cancer (5). Familial cases are responsible for 10% of cases; the estimated risk for women with BRCA1 or BRCA2 is 50% (6).

1.2 Statement of the problem

Complex anatomy and peculiar physiology with constant cyclical changes from puberty to menopause and the fact that it is composed of a number of cell types each of whom can give rise to tumors makes ovarian pathologies quite challenging for diagnosis (7).Ovarian masses occur depending on functional, congenital, inflammatory and neoplastic processes (8).The neoplastic ones can be primary or secondary and the primary tumors are further categorized as benign, borderline and malignant, out of which the most common being benign tumors (80%) (9). Some non-neoplastic lesions of ovary frequently form a pelvic mass and potentially confuse with an ovarian neoplasm (10). In addition ovarian neoplasms present themselves in various clinical forms and surprisingly many times as vague, non-gynecological complaints such as abdominal mass with pressure effect, abdominal pain or even without symptoms which might be the reason for late and advanced stage diagnosis added to the lack of proper identification of at risk population and screening techniques has contributed to its grim prognosis and high mortality rate(11). Although Ninety percent of adnexal masses are detected by pelvic ultrasound, histopathologic classification and definite diagnosis is not done by clinicoradiologic evaluation but rather by histopathology (12).

Ovarian cancer is one of the most common gynecologic cancers that rank third after cervical and endometrial cancer. In 2018 around 4.4% of cancer-related mortality among women was due to ovarian cancer (5). Ovarian cancer (OC) is epidemiological diverse malignancy with geographic and racial difference in prevalence. Although studies suggest that there are high incidence and prevalence rates of OC in countries with high development index (HDI); mortality-to-incidence ratio is high among African women, indicating their lack of access to suitable treatment(13). Furthermore Increasing life expectancy and a more westernized lifestyle has led to rising numbers cases with ovarian cancer in countries with a low development index (LDI)(14). Malignant ovarian tumors are one of the leading cause of death in Ghana(15). Nigerian study also shows high prevalence of ovarian cancer, accounting for 12% of all the malignancy in female genital tract(16). As stated in Kenyan study Ovarian cancer is the third commonest cause of cancer death from gynecologic tumors in Kenya(17).

In most studies overall benign neoplasms outnumber the malignant and borderlines are the least common one. Studies done in Asian countries India, Iraq and Nepalese the most common histopathologic types were Surface epithelial tumors, with most common malignant and benign neoplasm being cystadenocarcinoma and cystadenoma respectively, followed by germ cell tumors & then sex cord stromal cell tumor(10)(18)(19). Where as in another Asian countries Saudi Arabia and Turkey studies in the top three common histotype are surface epithelial tumor, sex-cord stromal and germ cell tumor (20)(8). But in one Nepalese study most common histopathologic type is dermoid cyst (21).

In west Africa both Ghanaian and Nigerian study showed germ cell tumors were the most common histotypes followed by surface epithelial and sex-cord stromal (22)(15).Where as in east Africa Sudanese study, surface epithelial tumors dominated followed by sex-cord stromal and germ cell tumor (6).

Even though there is lack of sufficient study on the extent of ovarian tumors in sub-Saharan Africa and particularly Ethiopia, the few available studies show, OC is the third most common diagnosed cancer among women, with an estimated number of 12,705 and 2,550 cases and deaths in 2012, respectively, and around 2000 deaths each year in Ethiopia alone (14). Estimate of cancer incidence in Ethiopia 2015 (23), GOLOBOCAN 2018(24), studies done in Tikur Anbesa Hospital (25) and Debre Tabor general Hospital ovarian cancer is the 3rd common malignancy in female and the second common gynecologic malignancy following cervical cancer (26).

According to a study done in Addis Ababa Saint Paul Hospital Millennium Medical College benign out number malignant and borderline tumors, out of which the most common histotype was Surface epithelial tumors, with the most common malignant and benign variants being cystadenocarcinoma and cystadenoma respectively, followed by germ cell tumors & then sex cord stromal cell tumor (10).

This study wasconducted with the aim of examining the different histopathologic types of ovarian tumors and analyze their age distribution in Jimma.

1.3 Significance of the study

Ovarian tumors are one of the most important causes of morbidity and mortality due to female genital tract cancers without discrimination of any age group. There is variation in prevalence of different histotypes of ovarian tumor in different parts of the world. Though ovarian tumors were thought to be highly prevalent in countries with HDI and low in LDI having ones, current global data shows the rise of incidence in countries with LDI and incidence to mortality ratio is said to be high in African countries. In spite of the burden the studies done in Africa in general and Ethiopia in particular are scarce.

This research enhances the knowhow about the age distribution, and different histopathologic types of ovarian tumor seen in JUMC, given that ovarian tumors are one of the common diagnosis of female genital tract pathology made in our facility. There by contributing in the alleviation of the study scarcity and help in providing information that can be compared to the country, continent and global level and direct the attention toward further continuous studies about ovarian tumors.

2. Literature review

2.1 Global perspective

Ovarian tumor is frequent cause of hospitalization among females of different age groups (18). It is the most fascinating and challenging tumor in terms of histogenesis and malignant potential (10). Though ovarian malignancy is not as common as its benign counterpart the nonspecific nature of symptoms added to the lack of identification of high risk population and screening techniques made it one of the most common cause of morbidity and mortality ranking only third from all gynecologic cancer (5).Therefore it has the worst prognosis and the highest mortality rate. This is due to its late detection, thereby earning itself the term “Silent Killer” (13). According to American Cancer Society ovarian cancer ranks fifth in cancer deaths among women, accounting for more deaths than any other cancer of the FGT. Lifetime risk of getting and dying from OC in A woman is about 1 in 78 and 1 in 108 respectively (27). Like many cancers, the incidence of ovarian cancer varies across the world. The epidemiological diversity of ovarian cancer in different regions can be attributed to the difference in risk factors that account for the occurrence of ovarian cancer. According to FIGO ovarian cancer is the eighth most common cause of death from cancer in women all over the world (13).

According to National Cancer Institute, Bethesda, Maryland USA; Surface epithelial-stromal tumors account for around 60% and 90 % of all ovarian tumors and malignant ovarian tumors respectively. Malignant and Borderline serous tumors make up one-third and 10-15% of all ovarian serous tumors respectively. And malignant ovarian serous tumor which accounts half of all malignant ovarian tumor, commonly occur in 6^{th} decade of life with mean age of 59.4, and two-third are bilateral. Benign mucinous tumors, that mostly occur 3^{rd} -5^{th} decade of life, account for up to one-fourth and 75–85% of all benign ovarian neoplasms and all mucinous ovarian tumors respectively and are rarely bilateral. Malignant mucinous tumors that on average are diagnosed in the 6^{th} decade of life; with mean age at diagnosis was 54.7 years, represent 5–10% of all malignant ovarian neoplasms and 6%-20% are bilateral. Malignant endometrioid tumors were the most common type endometrioid tumors (80%) and account 10-25% all ovarian carcinomas were the second most common malignant ovarian surface epithelial-stromal tumor type

with average age at diagnosis being sixth decade of life and bilaterality rate being 13–28%. Sex-cord stomal tumors account for around 8% and 7% of all ovarian tumors and of all malignant ovarian tumors respectively. GCTs make up approximately one- fourth of all ovarian tumors but only 3–7% of malignant ovarian tumors. And Mature cystic teratomas are the most common kind accounting for 10% of all ovarian tumors (28).

In an Italian large-scale case control study done in a network of hospitals in Milan on patients <75 years of age Data separated by histological subtypes cases were grouped into four categories by histological type: The most common histotype serous tumor (n = 680), followed by mucinous tumor (n = 52), endometrioid tumor (n = 41), and other histologies including clear-cell and undifferentiated epithelial tumors (n = 50). Controls were 2758 patients admitted to the same network of hospitals for a wide spectrum of acute, nongynecological, non-hormone-related, non-neoplastic conditions. In comparison with nulliparae, the risk of serous, endometrioid, and other histologies of ovarian cancer tended to be lower in parous women (29).

A five year experience in North-East India stated that out of total number of 242 cases were studied. Benign ovarian neoplasms which commonly occurred in between 3rd and 5th decade outnumber the malignant ones in all age groups ((78.1%) benign, (4.96%) borderline and (16.94%) malignant). Majority of cases were Surface epithelial tumors, out of which most common malignant and benign neoplasm being cystadenocarcinoma and cystadenoma respectively, followed by germ cell tumors & then sex cord stromal cell tumor(10). Another Indian Hospital Based Study; also shows high prevalence benign tumors 65.71% with malignant and borderline tumors being 31.43 and 2.86% respectively. In addition surface epithelial tumors accounted for majority (57.14%) out of 70 ovarian tumors, followed by germ cell tumor (34.29%), sex cord tumors (7.14%) and metastatic tumor (1.43%). Similarly serous cystadenocarcinoma is the most common malignant histotype but cystadenoma is the second most common benign histotype following benign cystic teratoma (30.00%). The mean age of the subjects was 35.2 years, ranging from 8 to 70 years. Abdominal mass was the most predominant clinical presentation (30).

In A study done in Iraq from January 2008 to December 2011, out of 161 cases of ovarian lesions were collected from pathology departments in Azadi General Hospital with most of the diagnosis made by histopathology without ancillary techniques; out of 161 cases neoplastic (64%) dominated the non-neoplastic 58 (36%) ones. From neoplastic lesions benign tumors 90 (55.9%) dominate the malignant tumors 9 (5.6), the least common ones being borderline tumors 4 (2.4%). There was a wide age range, most being in the third decade. The right ovaries were more common involved than the left (18).

According one Nepalese study, from patients aged 12 to 88 years, majority were 20-40 years. Size of the tumors ranged from 2- 30cm, with majority having the size range of 5–10 cm. Malignant tumors were seen at any age and size. There was no association with age at presentation and size of tumor with behavior of tumor. Only 1 (0.6%) was bilateral. Most common histopathological diagnosis overall was dermoid cyst in 43.7% cases(21). But in Another Nepalese 10 year study; out of 409 cases of ovarian tumors, majorities (205) were of surface epithelial origin including 172 benign, 07 borderline and 36 malignant cases. Serous cystadenoma was the most common (119 cases) among the surface epithelial tumors, followed by mucinous cyst adenoma (40 cases). There were 176 cases of tumors with germ cell origin which included 170 cases of teratoma (19).

According to Saudi Arabian study out of total of 301 ovarian specimens, 217 (72%) were neoplastic and 84 (28%) were non-neoplastic. In total, 135 (63%) of the neoplastic specimens were benign, 16 (7%) were borderline tumors, and 66 (30%) were malignant tumors. Moreover, 41 (62%) of the malignant tumors were surface epithelial carcinomas, 17 (26%) were sex cord stromal tumors, and 8 (12%) were germ cell tumors. The incidence of Adult Granulosa Cell Tumor was unusually high, which accounts for 26% (16/66) of all malignant ovarian neoplasms (20).

In A Hospital based study done in Batticaloa, Sri-Lanka out of 537 ovarian specimens benign neoplastic lesions constituted most lesions diagnosed (49%). Among neoplastic ovarian lesions 80.1% cases were benign, 3.7% cases were borderline and 16.2% cases were malignant. Among benign ovarian neoplasms, 43.3% were serous cystadenomas; 30.0% were benign cystic teratomas and 22.4% were mucinous cystadenomas. Majority

of malignant neoplasms were serous cystadenocarcinomas(58.5%) followed by mucinous cystadenocarcinoma, clear cell carcinoma, dysgerminoma and germ cell tumor (7).

An Indian institutional study included 84 cases, out of which benign tumors were most common (75%), followed by (21.4%) malignant and (3.6%) borderline tumors. Of the histological subtypes surface epithelial tumors predominated (66.7%) the germ cell tumors (23.9%). The commonest benign tumor was Serous cystadenoma (36.9%) and mature cystic teratoma (17.9%) was the second common. Among the malignant tumors Serous cyst adenocarcinoma (10.7%) was the most common. Ovarian tumors were seen in a wide age range(10-78 years) and most cases were in the 4th to 6th decade. In Younger age groups benign tumors were more common whereas malignant tumors were more common in elderly individuals (31).

According to a retrospective Yemenis study of all cases of ovarian tumors collected during a period of 9 years from the Histopathology Department of Al-Gamhuria Teaching Hospital from 1993-1996 and IbnSina laboratory in Aden Governorate from 2009- 2013. Benign tumors (86.7%) outnumber the malignant (13.3%). And the majority (63.7%) are surface epithelial tumors with benign serous tumors accounting for most cases (44%) followed by mucinous tumors (9.6%). Furthermore the second most common benign tumor was benign cystic teratoma. In addition commonly seen malignant tumors were serous cystadenocarcinoma (2.8%), mucinous cystadenocarcinoma (1.8%), serous cystadenoma borderline (1.4%), and endometrioid adenocarcinoma (1.4%). Tumors derived from sex cord stromal tissue as benign fibroma and thecoma comprise 5%, while malignant tumors are granulosa cell tumor (1.4%)(32).

In a two years study done in BIRDEM General Hospital, Dhaka, Bangladish186 cases of ovarian tumors were found. And these ovarian tumor patients had Age range from 9 years to 70 years, with median age of 50 years. Among these most (158 cases (84.95%)) were benign, 3 cases (1.61%) were borderline and 25 cases (13.44%) were malignant. Based on histogenesis of ovarian tumor Surface epithelial tumor (61.83%) was the commonest followed by germ cell tumor. Among the benign tumorsbenign serous tumor was the most common type and seen in 60 (37.98%) cases, followed by mature cystic teratoma.

The most common malignant tumor (36%) was Serous cystadenocarcinoma followed by endometrioid carcinoma. Germ cell tumor accounted for all malignant cases that occurred below 20 years of age. Allage groups were affected by both benign and malignant ovarian tumors. Mean ages of occurrence of benign, borderline and malignant tumor were 44years, 20.5years and 47.5 years respectively. Overall, the most commonly affected age by ovarian tumor was 20- 50 years age group.Incidence of malignant ovarian tumor increased with age and the most frequently susceptible age for malignant ovarian tumor was age >50 years. Merely three cases of borderline tumor were found. Two cases occurred in 20- 50 years of age and one case occurred in 0-20 years of age. Most 145 case (77.96%) had cystic, 18 cases (9.68%) solid and solid and 23 cases (12.36%) mixed solid and cystic consistency. Most benign tumorswere cystic whereas malignant tumors were commonly solid and cystic. Bilaterality was seen in 10 cases (11.23%), and 42 (47.19%) cases involved the right side and 37(41.57%) cases involved the left side of ovary(33).

A Turkish retrospective study showed thatout of pathology reports of 93 patients, who had histopathological examination in the pathology clinic due to ovarian mass between January 2015 and July 2018.; 38.7% epithelial tumors, 8.6% sex-cord stromal tumors, 4.3% germ-cell tumors, other primary tumor group was 1.1%, and ovarian pathologies that were not neoplastic were 47.3%. Age distribution showed that the rates were 9.6% in the 10-20 age range; 12.9% in the 21-30 age range; 35.4% in the 31-40 age range; 30.1% in the 41-50 age range; and 11.8% in the 51+ age group (8).

2.2 Africa perspective

A Ghanaian study on Seven hundred and six ovarian tumors shows; Germ cell tumors were the most common (41.9%), with mean age of occurrence being 30.7 years they were dominated by mature teratomas (39.2%). Surface epithelial tumors were second, and commonly occurred in women aged 35–44years, 77 (26.8%). Sex cord stromal tumors followed with mean age of occurrence of 40.2 years. The most common malignant tumors were surface epithelial (52.1%) dominated by serous carcinomas with mean age 50.1 years. Most patients (47.7%) presented within 1 month of onset of symptoms, feeling a lower abdominal mass (38.5%) (15).

A 10 year retrospective study done in Nigeria Lagos University Teaching Hospitalindicatedthatout of 486 ovarian biopsies, 203 specimens were true ovarian neoplasms. Most (80.3%) of the true neoplasms were benign while 19.7 % were malignant ovarian tumors. Ovarian malignancy constituted about 7% of 203 gynecological malignant tumors in the 10 year period under review. Tumors of germ cell origin were the commonest, accounting for 52.7% of the true ovarian neoplasm seen. Surface epithelial tumors constituted 27.6%, while sex cord-stromal tumors contributed 15.8%. Mature teratoma was the commonest benign tumor, accounting for 60.1% cases of benign ovarian tumors with peak occurrence at 20-29 years. Serous cystadenocarcinoma (42.5%) was the commonest ovarian malignancy with mostly affected age 30-39 years (22).

In another study done in Zaria Nigeria the findings showedan increase in number of ovarian cancer cases in 10 years period, out of total of 78 patients aged 8-80 years, sixty-two (79.5%) patients were premenopausal while postmenopausal women accounted for only seven cases (9.0%). There were 17 cases (22.3%) of aggressive cancers in patients aged 20 years. Most of the patients, 65 (83.3%), were parous with only nine (11.5%) patients were nulliparous. Serous cyst adenocarcinoma accounted for 32 (41%) cases. Granulosa cell tumor was the second commonest with 18 cases (23.1%). The mean age of serous cyst adenocarcinoma patient was 31 years while that of epithelial ovarian cancers in general it was 33.5 years. Endometrioid adenocarcinoma was only one case. Factors like age, parity, and premenopausal status did not appear to be protective to the occurrence of malignant ovarian tumor in this group (34).

In another south Nigerian study a total of 156 ovarian samples were seen in the study which constitutes 9.7% of gynecological lesions during the study period. Malignant ovarian tumor constitutes 12% of all the malignancy in the female genital tract. Benign cystic teratoma was the commonest benign true ovarian tumor while serous cyst adenocarcinoma is the commonest malignant lesion (16).

A Sudanese study on ovarian cancer shows**;** out of 127 cases of ovarian cancers, Surface epithelial cancers were the most common 77.7% (n = 98), followed by sex cord-stromal cancers 11.23% (n = 14), Germ cell tumor 1.6% (n = 2). Metastasis were from colon

(6.3%) and breast (3.9 %) cancers. Few cases (14%) of ovarian cancers were reported before 40 years of age, after the age of 50 is a sharp increase in the incidence of a tumor. The mean age at presentation was 52.36 years; there is mean age of menarche 13.59 years. Very few patients used HRT (1.6%) or had been on ovulation induction treatment (8.7%)(6).

2.3 Ethiopia perspective

Ethiopia is the second most populous country in Africa, with an estimated 114.9 million population in 2020 and more than 56 million women (35). With approximately 79% of the population living in rural areas, Ethiopia is one of the least urbanized countries in the world. According to estimate of cancer incidence in Ethiopia 2015 ovarian cancer is the 3rd common malignancy in female and the second common gynecologic malignancy following cervical cancer (36). There are around 2550 cases and 2000 deaths each year (14). According to GLOBOCAN 2018 also shows similar finding, with 6.2% new cases among females of all age making it the 3rd most common cancer of females excluding the non-melanoma skin cancer (24).

According to a Retrospective cross-sectional study done by reviewing medicalrecords of cancer patients diagnosed from January 1, 2016 to December 30, 2018 in Debre Tabor general hospital stated that out of A total of 188 cancer patients with mean age at diagnosis of 45.5 ± 13.5years; ovarian cancer accounted for 10.1% of all cancer cases making it the third most common cancer and second most female genital tract malignancy. There was increasing patterns of cancer cases in three years duration. About 104 (55.3%) of patients were rural residents (26).

As stated in cross-sectional study done in Tikur Anbessa Hospital conducted on 919 patients with biopsy-confirmed cancers, from 2010 to 2014, ovarian cancer is the third most common malignancy with prevalence of 7.1% in females, following cervical (39.7%), breast (18.3%) cancers. The overall mean age was 44.6 ± 15.1 years among females (25).

In a retrospective record analysis done in University of Gonder hospital out of a total of 3231 specimens(1263 biopsies and 1968 FNAC) were evaluated in department of

pathology, From September 2014 to August 2015, Of these 540 (16.7%) were found to be cancers. The median age of patients at diagnosis was 46 years, with range of 1-86 years. Of 540 malignant tumors, 346 (64%) were females and 194 (36%) were males. Most malignancies (499 (92%)) occurred in adults age greater than 14 years and 41 (7.6%) occurred in children of pathology service results, biopsy and FNAC. Population: ovarian cancer is the 5th common cause of cancer in females accounting for 17(3.1%) (37).

In a Descriptive retrospective study done on Epidemiology of breast and gynecological cancers among patients attending Saint Paul's Hospital Millennium Medical College, reviewed characteristics of 2,002 female cancer patients who visited the Oncology unit of Saint Paul's Hospital Millennium Medical College from 2014–2018out of which ovarian cancers is the third most common cancer in female accounting for [n = 260 (13%)] of the cases. Epithelial, specifically serous tumor, was the predominant type of ovarian cancer in the study population accounting for 37.3%, most of which was high-grade serous carcinomas and are characterized by aggressive behavior, late-stage diagnosis, and low survival, contributing to the poor survival for ovarian cancer overall. The second and third common histotypes were Mucinous tumors which were seen in 11.1% of cases and teratoma accounting for 8.46%. Most of the tumors in the study (i.e. breast, ovarian and endometrial cancers) are most frequently diagnosed among younger women (38).

2.4 Conceptual frame work

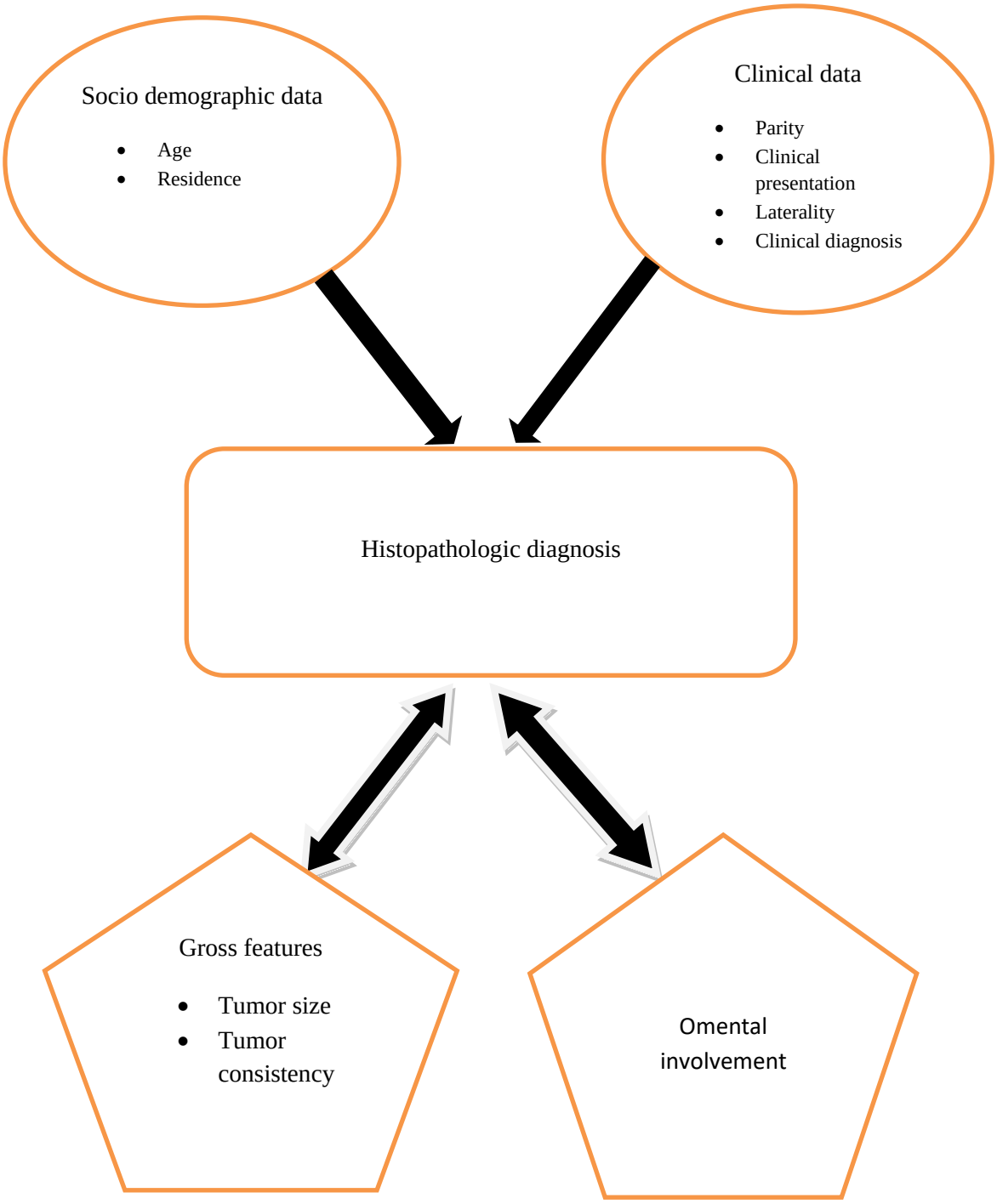

Figure 1: Conceptual frame work

3. Objective

3.1 General objective

- To assess the different Histopathologic spectrum and associated factors of primary ovarian tumors in Jimma University Medical center, from September 2015 to August 2019.

3.2 Specific objectives

- To identify histopathologic patterns of ovarian tumor
- To determine age distribution of ovarian tumor and other associated factors
- To assess magnitude of peritoneal involvement

4. Methods and materials

4.1 Study area and period

This research was conducted in JUMC, which is found in Jimma town located in south west part of the Ethiopia 352km far from the capital city, is one of the oldest hospitals in the country with estimated catchment population of 15 million. Currently it is the biggest teaching and referral hospital in south west part of the country providing services for approximately 15000 in patient, 160000 outpatient, 11000 emergency cases and 4500 deliveries in a year (39).

The pathology department, with its 4 pathologists, 15 residents, 2 histopathology technicians and 7 technical assistants, is one of the largest diagnostic departments in the hospital with a broad scope. The services given by the department includes: histopathology (biopsy), cytopathology (FNAC), Hematopathology, fluid cytology and teaching undergraduate preclinical medicine and dental medicine students, other health students and post graduate students.

Data was collected from June1-30 2020 from result histopathologic report done from September 2015- August 2019, (five years duration).

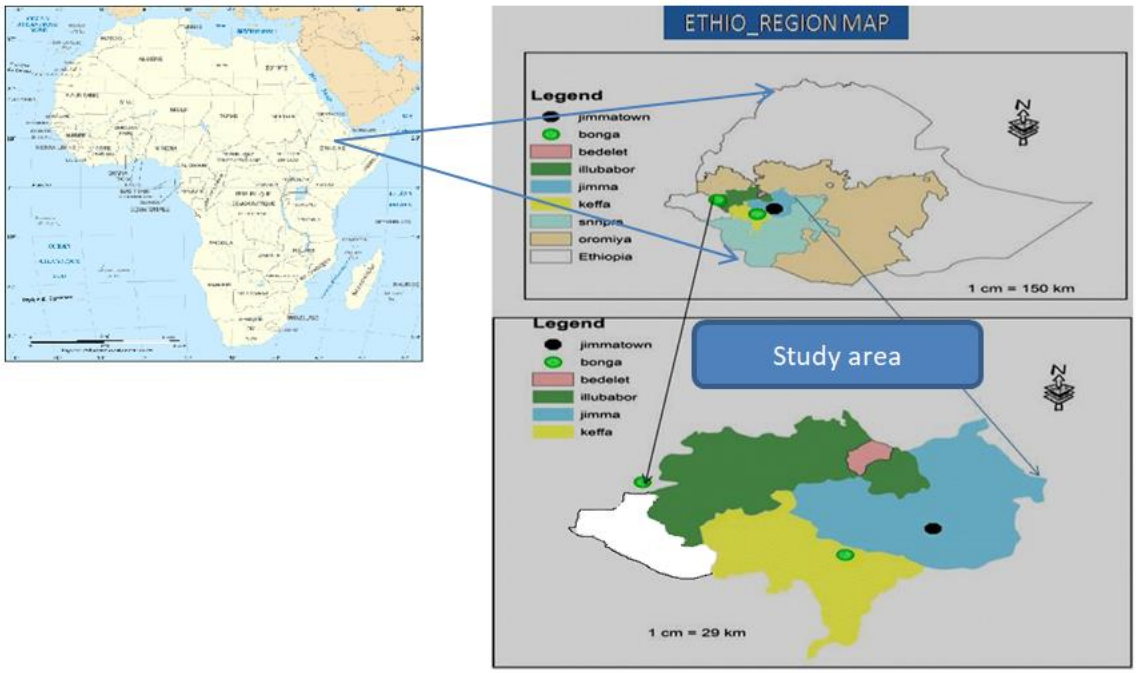

Figure 2: Figure showing study area map (40)(41)

4.2 Study design

Facility based retrospective cross sectional study design was conducted.

4.3 Population

4.3.1 Target population

All female patients in the catchment of JUMC

4.3.2 Source population

All female patients whose ovarian biopsy sample was submitted to JUMC

4.3.3 Study population

All female patients whose ovarian sample was submitted to JUMC from September 2015 to August 2019

4.3.3.1 Inclusion criteria

All ovarian samples with a recorded age from September 2015 to August 2019

4.3.3.1 Exclusion criteria

- poorly registered medical record with-out histopathologic diagnosis
- secondary metastasis to the ovary
- non neoplastic ovarian lesions

4.4 Sample size

All patients whose ovarian samples submitted to JUMC pathology department during the study period who met the inclusion and exclusion criteria were part of the study, thus non-probability convenient sampling was used. Therefore 345 cases which had diagnoses of ovarian tumor in years 2015-2019were included all of whom fulfilled the inclusion and exclusion criteria.

4.5 Data collection technique and procedures

Using checklist prepared after proper evaluation of literatures and suited to the study objectives, data was reviewed and collected from a secondary data which are patient biopsy request and result forms that are archived in pathology department manually by pathology residents and well trained histopathology technical staff, and any missed information of some variables was filled from patients' charts. All the data collection was done with proper precautions to avoid a risk of COVID19 (Corona virus disease 2019)infection of the data collectors. Thus proper PPE (personal protective equipment)

such as surgical mask, examination glove and hand sanitizer was provided and physical distancing was applied.

4.6 Data processing and analysis

After completion of data collection data was coded, edited and entered using Epidata version 3.1, and analyzed by SPSS version 26, Descriptive analysis was done for frequency and distribution of the disease. Cross tabulation, chi square test and logistic regression was done to see the association between the variables. Those variables with a *P*-value <0.25 in binary logistic regression were identified and used for multiple logistic regressions. Then, a *p*-value<0.05 was used as a cut-off point for identifying predictors for histopathologic patterns. Finally it was presented using narration, tables and graphs.

4.7 Study variables

Study variables Include Patients'

- Socio-demographic data such as; Age, Residency
- Clinical information like; parity, laterality, clinical presentation, clinical diagnosis
- Gross and microscopic features including; tumor size, tumor consistency, histopathologic diagnosis, Omental involvement

4.7.1 Independent Variable

- Age
- Residency
- Parity
- Laterality
- Tumor size
- Consistency
- Clinical presentation
- Clinical diagnosis

4.7.2 Dependent variable

- Histopathologic diagnosis
- Omental involvement

4.8 Operational definition

- Reproductive age group: female from 14- 55 years
- Rural: outside Jimma town
- Urban: Jimma town
- Nulliparous: women who have not gave birth
- Primiparous: women who gave birth once
- Multiparous: women who gave birth more than once but less than five times
- Grand multiparous: women who gave birth five up to six times
- Great grand multiparous: women who gave birth more than seven times
- Non-neoplastic lesion: ovarian specimens which has diagnosed as inflammatory conditions, functional cyst or congenital cyst

4.9 Data quality control

Ovarian tissue specimens brought to histopathology laboratory were immediately fixed with 10% buffered formalin and the processing and staining by the routine H&E stain (Hematoxylin and Eosin) was done by histopathologic technicians. The final diagnosis of the slides was signed out by 4 qualified pathologists.

First checklist was pretested on 10% of sample size on biopsies which were not included in the study. Moreover data collection was started after the collectors got proper orientation and training on what and how to locate, retrieve, categorize and record the data. After data collection checklist was checked for completeness and entered into epidata on password protected computer. The principal investigator supervised the data collection daily for completeness of data.

4.10 Ethical consideration

The study was conducted after getting approval from the ethical review board of Jimma University, institute of health. The nature of the study makes it difficult to take informed consent of the patients but institutional consent was obtained from Jimma University, pathology department for permission to use the patient record from its archive and patients' chart. In order to maintain confidentiality, only the relevant parameters, excluding the name of the patients, were collected.

4.11 Dissemination of findings

The result was presented and submitted to the pathology department and copies will be kept in the university library. In addition the result will be communicated to other relevant stake holders. Finally Publication in scientific journals will be considered.

4.12 limitation of the study

The diagnosis of each patient was done solely by morphologic evaluation of slides. No ancillary techniques such as immunohistochemistry or molecular studies were done because of their inaccessibility in the facility.

5. Result

5.1 Sociodemographic data analysis result

5.1.1 The distribution of ovarian tumor in year

There were 7925 biopsies done in the last five years and 345 histopathologic report of ovarian tumor were found and included in this study.

Out of the 345 case analyzed in this study, largest number of cases were done in the year 2018/19 (84, 24.3%), followed by 2017/18 (81, 23.5%), 2016/17 (77, 22.3%), 2015/16 (55, 15.9%) and the least cases were reported in the year 2014/15 (48, 13.9%). During these five years the average ovarian biopsy done was 69 biopsies per year. The trend of malignant ovarian tumor was increasing with its peak seen in the year 2011/2019 (figure 3).

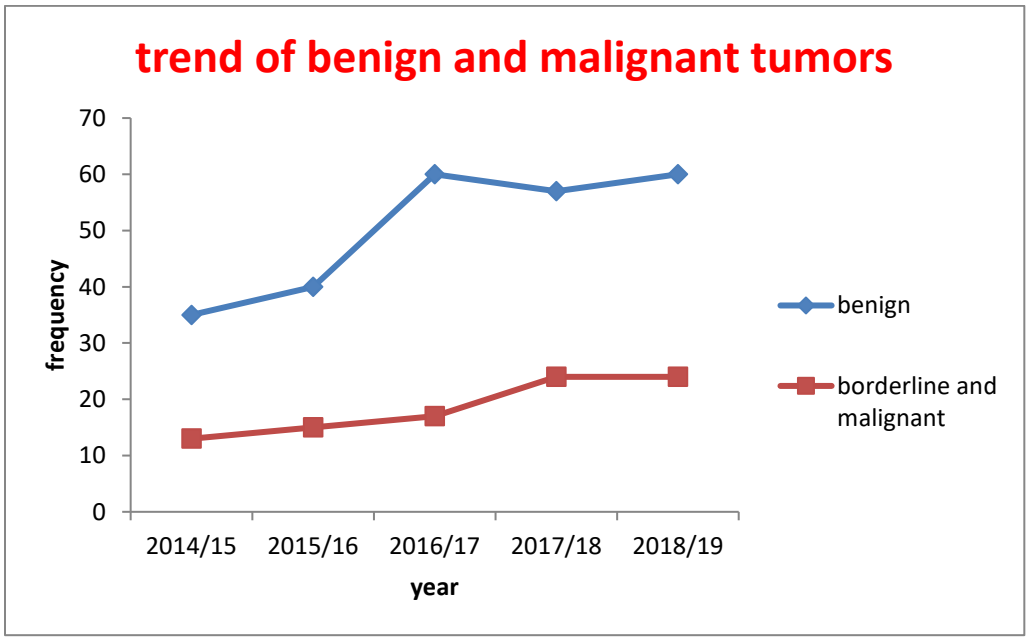

Figure 3: Trend of benign and malignant/borderline ovarian tumor in JUMC in years 2014/15-2018/19 N=345

5.1.2 The distribution of ovarian tumor with regard to age

The minimum age of the patient with ovarian tumor was 1 year and the maximum age was 80 years. The mean age was 34.75± 13.436 years. The most commonly affected age range was the third decade of life accounting for 105 cases (30.4%). The mean ages of benign, borderline and malignant tumors were 33.24±12.731 years, 44±12.936 years and 37.08±14.668

yearsrespectively. Fifth decade of life was the most common (31%) age affected by malignant tumors, whereas benign tumors frequently occurred (36.9%)in the third decade (figure 4).Out of the malignant and borderline tumors majority (53.8%) were seen in women ≥40 years and most (71.8%) of benign tumors occurred in women <40 years. Therefore there is association between age and malignant potential(x^2= 19.533, df= 1, *p*<**0.001**)

Compared to patients who were<20 years of age,thosein the sixth decade of life had increased risk of malignancy but it was not statistically significant(*p=0.471*,COR=1.423, CI 0.545-3.717)(table 6)

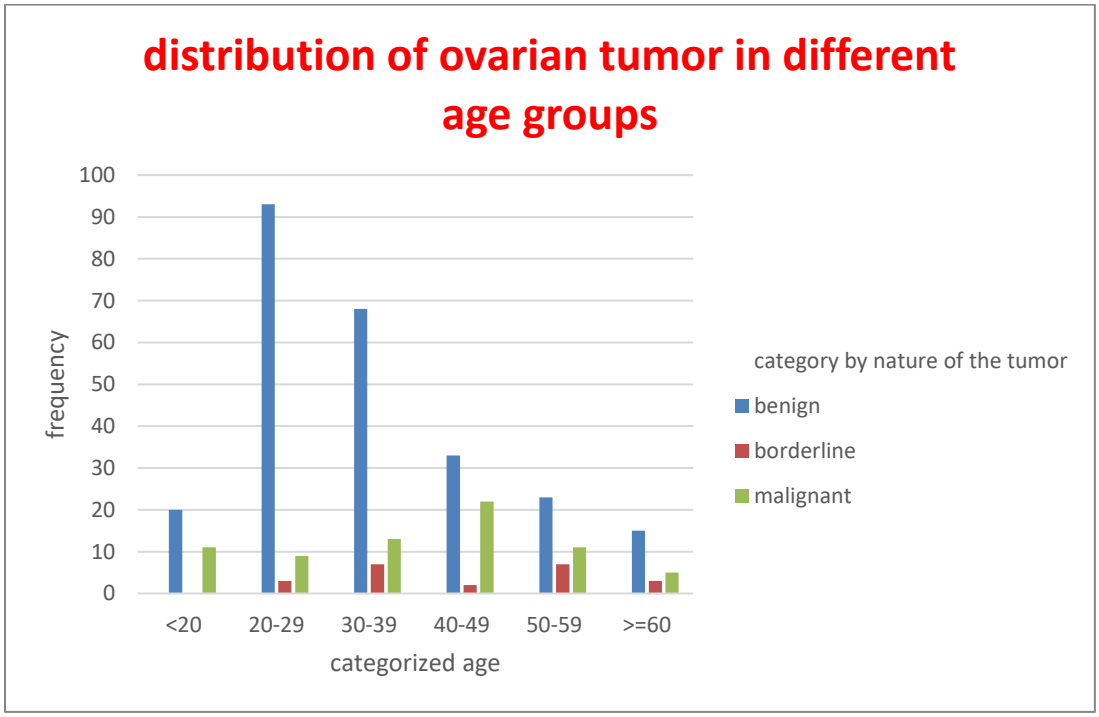

Figure 4: Distribution of ovarian tumor in different age groups in yearin JUMC (2014/15-2018/19) N=345

5.1.3 The distribution of ovarian tumor with regard to residency

Out of the 345 cases, 320 had a recorded residence among which majority were rural dwellers accounting for 282 (88.13%) and the rest 38(11.88%) live in urban setting (figure 5). Most of both malignant/borderline (92.7%) and benign tumors (86.6%) were from rural setting. Thus residency had no significant association with malignant nature of ovarian tumor (x^2= 2.149, df=1, *p= 0.139*).

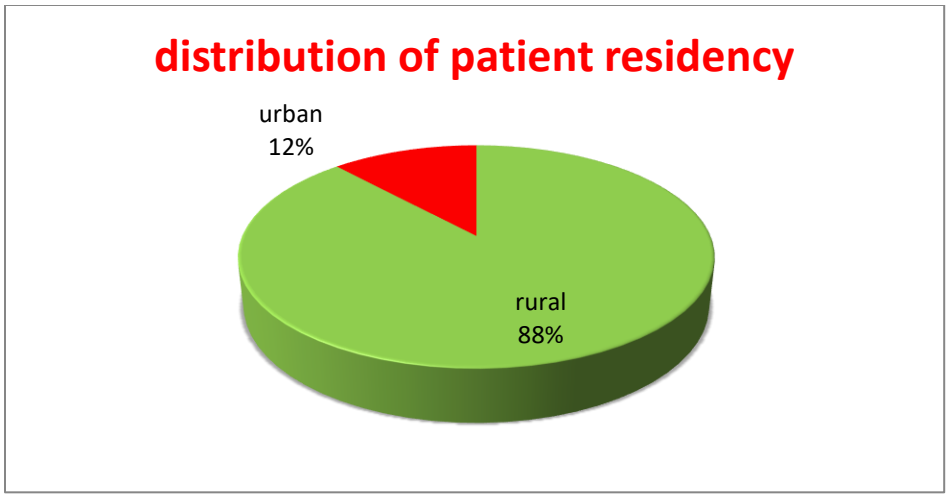

Figure 5: Distribution of patients' residence in JUMC (2014/15-2018/19) N=320

5.1.4 The distribution of ovarian tumor with regard to parity

Out of those whose parity was recorded most were parous 105 (69.54%). And among the parous women most were multiparous 34 (22.51%) and great grand multiparous 27 (17.88%), grand multiparous 24(15.89%),primiparous 20 (13.24%) and nulliparous accounting for 46 (30.46%). Nearly sixty percent (59.5%) of the malignant and borderline tumors were seen in parous women and 40.5% of the malignant tumors were seen in nulliparous women. Parous women accounted for majority (73.4%) of benign and (59.5%) of malignant/borderline cases. Out of the nulliparous patients around two third (63%) had benign ovarian tumor and solely few (37%) had malignant and borderline ovarian tumor. Similarly three quarter of parous women had benign tumor and only one quarter had malignant and borderline tumor. So There is no significant association between parity and malignancy (x^2=2.754, df= 1, *p*= 0.97).

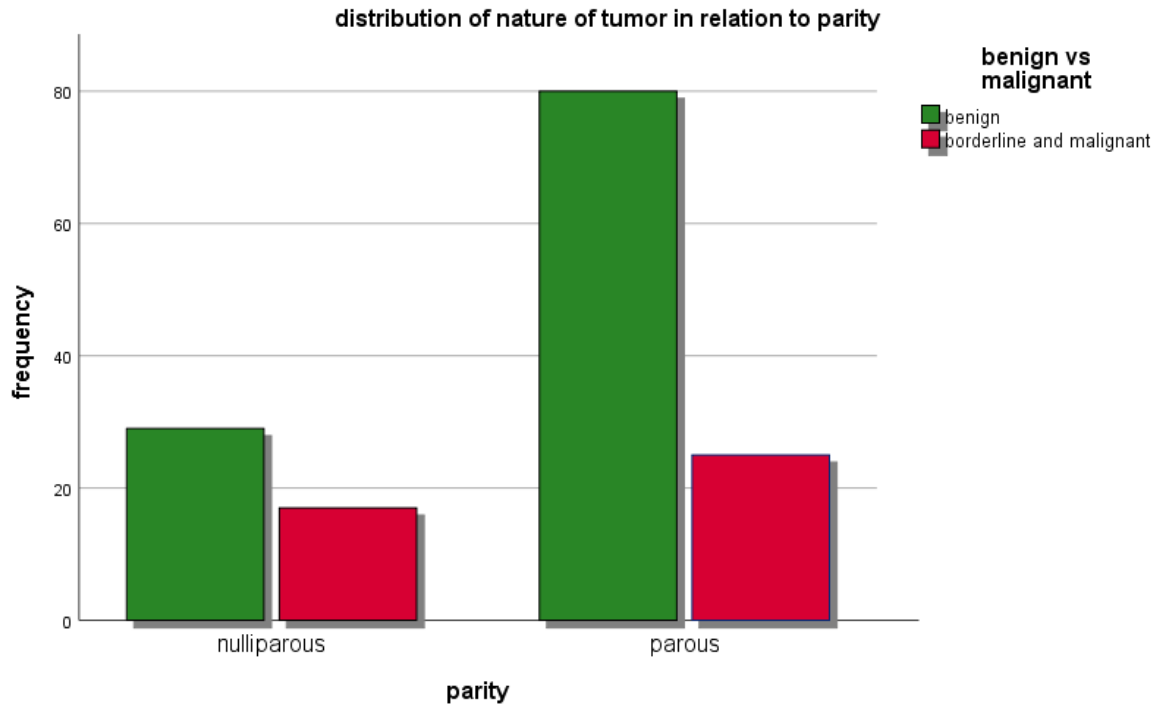

Figure 6: Distribution of the nature of tumor in relation to parity in JUMC in years (2014/15-2018/19) N= 151

5.2 Distribution of Clinical data of the patient with ovarian tumor

Two hundred and seventy three cases had recorded clinical presentation most of which were mixed symptoms(like abdominal swelling with pressure symptoms, abdominal pain or vaginal bleeding accounting) accounted for 145 (42%) cases followed by abdominal swelling (24.6%) and the least common presentations were vaginal bleeding and asymptomatic (0.6%) each (figure 7). And the most common isolated clinical presentation was abdominal swelling accounting for 85 (24.6%). Among cases with recorded clinical diagnosis the most common clinical diagnosis was ovarian tumor accounting for 160 (46.4%) cases followed by ovarian cyst accounting for 51 (14.8%) cases.

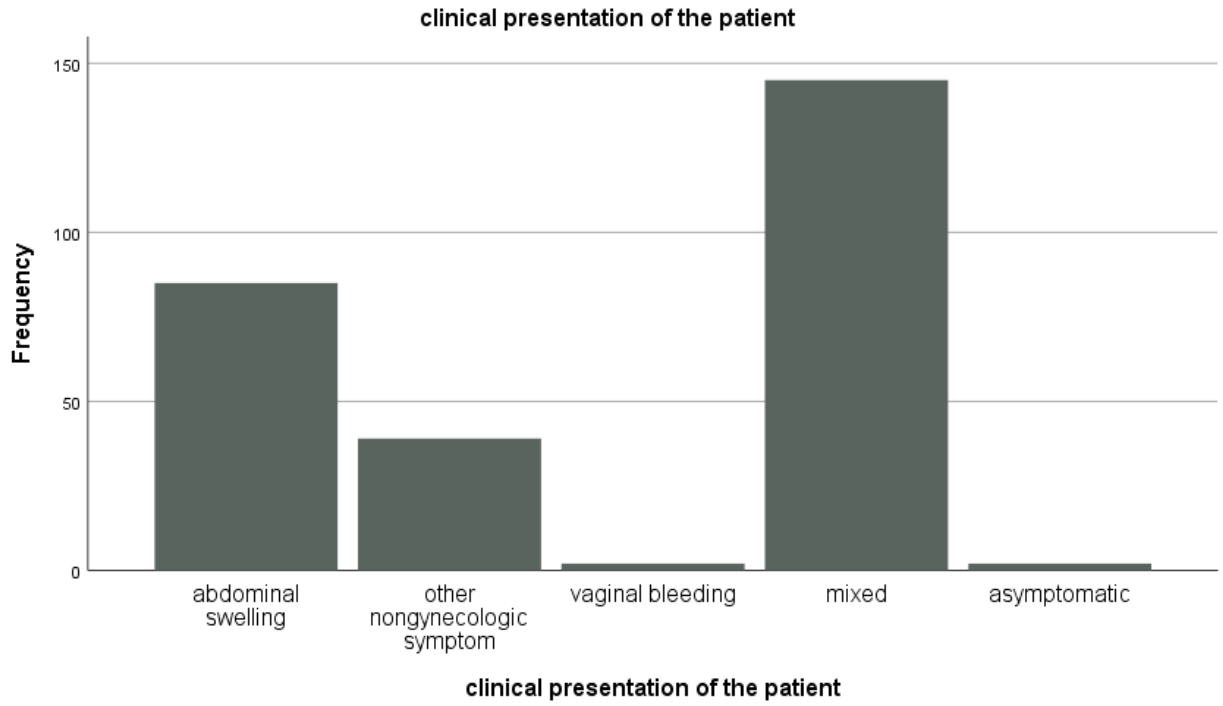

Figure 7: Clinical presentation of ovarian tumor patients in JUMC in years (2014/15-2018/19) N=273

5.3 Distribution of gross findings distribution of ovarian tumor

5.3.1 Distribution of laterality in ovarian tumor

Laterality was recorded in 219 cases and most were unilateral 194 (88.58%) out of which the right side is most commonly affected accounting for 114 (58.76%) of unilateral cases, and only 25 (11.42%) were bilateral. Out of the bilateral tumors 56%, 36% and 8% were benign, malignant and borderline respectively. Most of both benign(91.5%) and malignant/borderline(79.6%) tumors were unilateral and bilateral tumors accounted 20.4% of malignant tumors and only 8.5% of benign tumors (figure 8). There is strong association between bilaterality and malignant potential (x^2= 5.684, df= 1, *p*= **0.017**, OR=2.759, CI=1.168-6.516) (table 6).

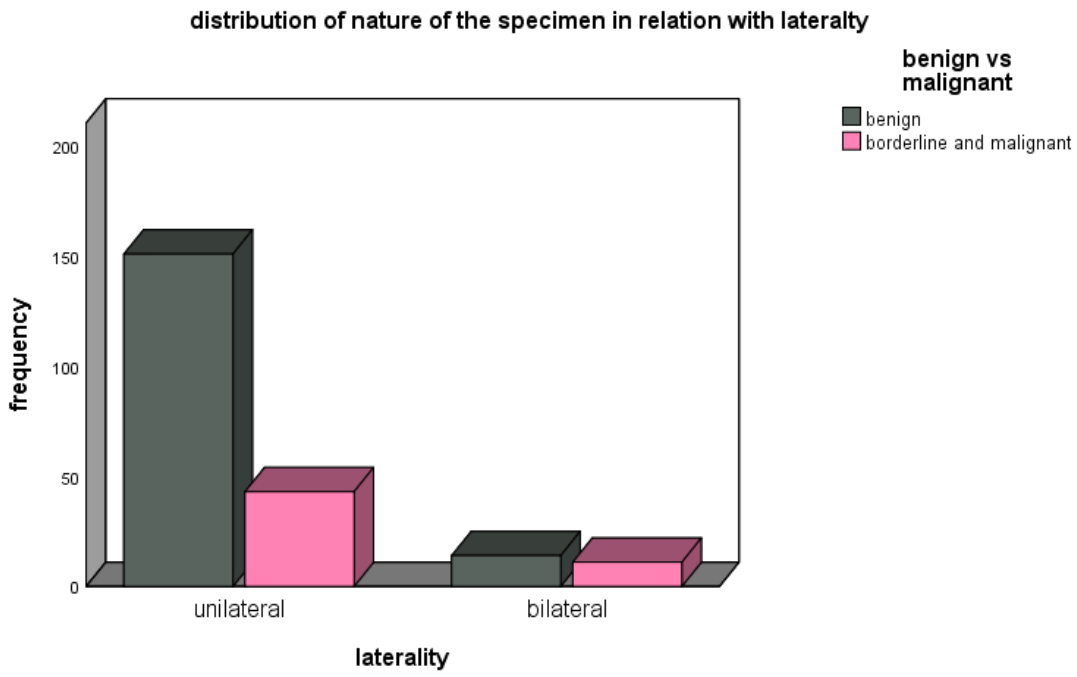

Figure 8:Distributionof nature of specimen in relation with laterality in JUMC in years (2014/15-2018/19) N=219

5.3.2 Distribution of size with ovarian tumor

More than one fourth (29.9%) of tumors had size in of 10-14cm followed by 102(29.6%) cases with in size range of 15-20cm.The remaining 86(24.9%) had size of 5-9cm, 32(9.2%) cases had size of >20cm, andfew22(6.4%) cases were<5cm. Most (62.4%) malignant/borderline tumor were≥15cm and majority of (69.8%) of benign tumor were <15cm (figure 9). There is significant association between size and malignant potential of ovarian tumor (x^2=29.663, df=1, p<**0.001**) (table 6). There is also significant association between size and malignant potential of surface epithelial ovarian tumor (x^2=9.337, df=1, p=**0.002**).

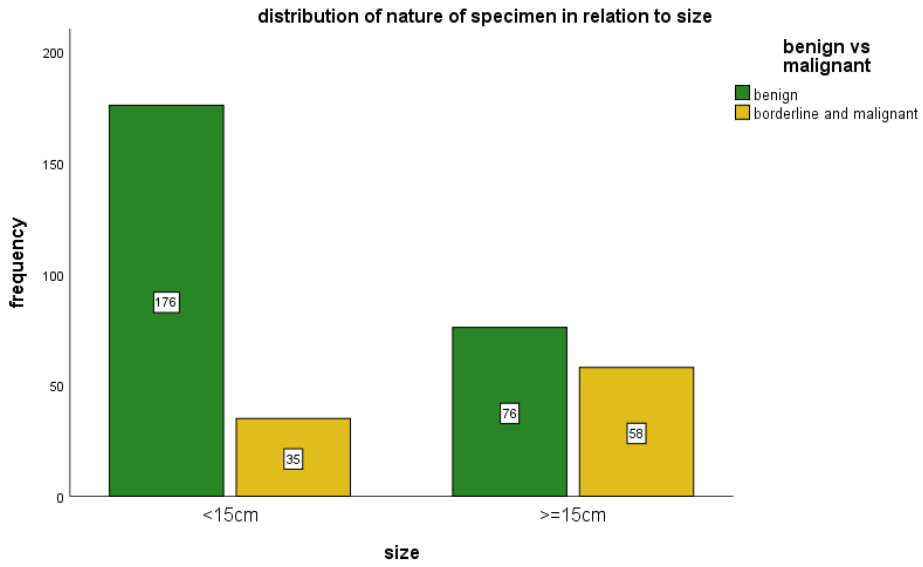

Figure 9:Distribution of nature of specimen in relation to sizein JUMC in years (2014/15-2018/19) N=345

5.3.3 Gross nature of the specimen (consistency) ovarian tumor

Most of the tumors (63.77%) were grossly cystic followed by mixed solid and cystic and solid accounting for 28.12%, and 7.83% respectively. Most of the cystic tumors were benign accounting for 76.9% of benign tumors and majority (59.2%) of malignant tumors had mixed solid and cystic consistency. Majority of the malignant/borderline tumor had solid component (71%) and most (76.9%) benign tumors were cyst only. And most of cyst only tumors (87.7%) were benign and majority of tumors with solid component (53.2%) were malignant (figure 10). Thus there is strong association between gross nature of specimen and malignant potential (x^2= 67.425, df= 1, *p*<**0.001**) (table 6). And out of malignant surface epithelial tumors 61.7% were solid and out of benign surface epithelial tumors 81.5% were cyst. There is strong relation between gross nature of surface epithelial tumor and malignant potential (x^2=39.053, df=1, *p*<**0.001**).

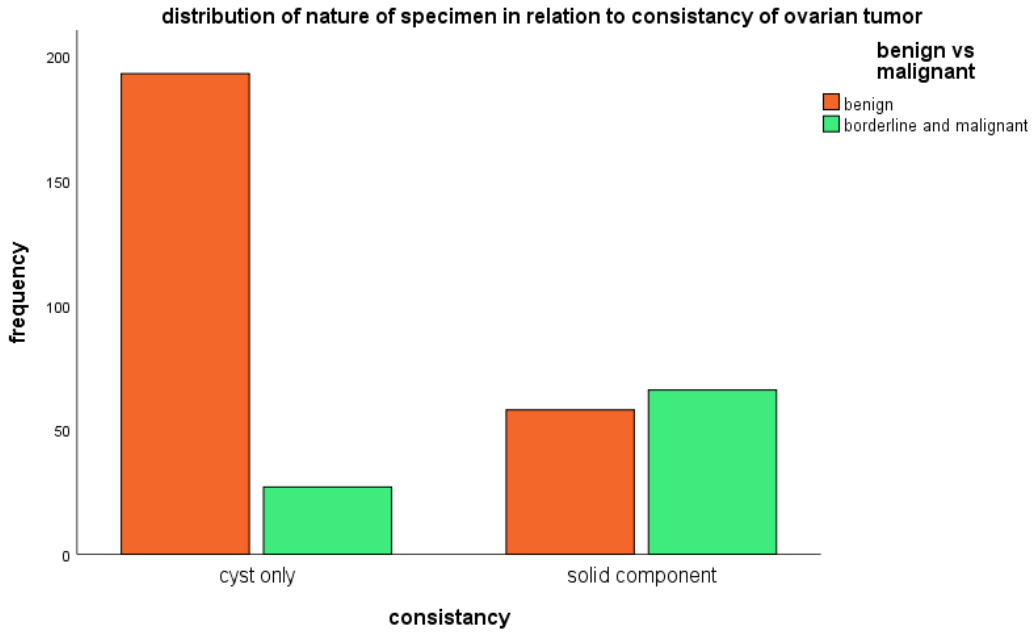

Figure 10:Distribution of nature of specimen in relation to consistancy of ovarian tumorin JUMC in (2014/15-2018/19) N=344

5.3.4 Distribution of Presence of papillary excrescence with ovarian tumor

In 73 cases,presence or absence of papillary excrescence was documented. Out of cases with the record, majority (83.3%) of malignant tumors had papillary excrescence and most of (85.4%) the benign tumors didn't show papillary excrescence (figure 11). In Majority of the malignant/borderline surface epithelial tumor (83.9%) papillary excrescencewere present and in most (84.2%) benign surface epithelial tumors papillary excrescence was absent.Presence of papillary excrescence is strongly associated with malignant potential of ovarian tumor in general and surface epithelial tumors in particular (x^2= 32.395, df=1, p<**0.001**) (table 6).

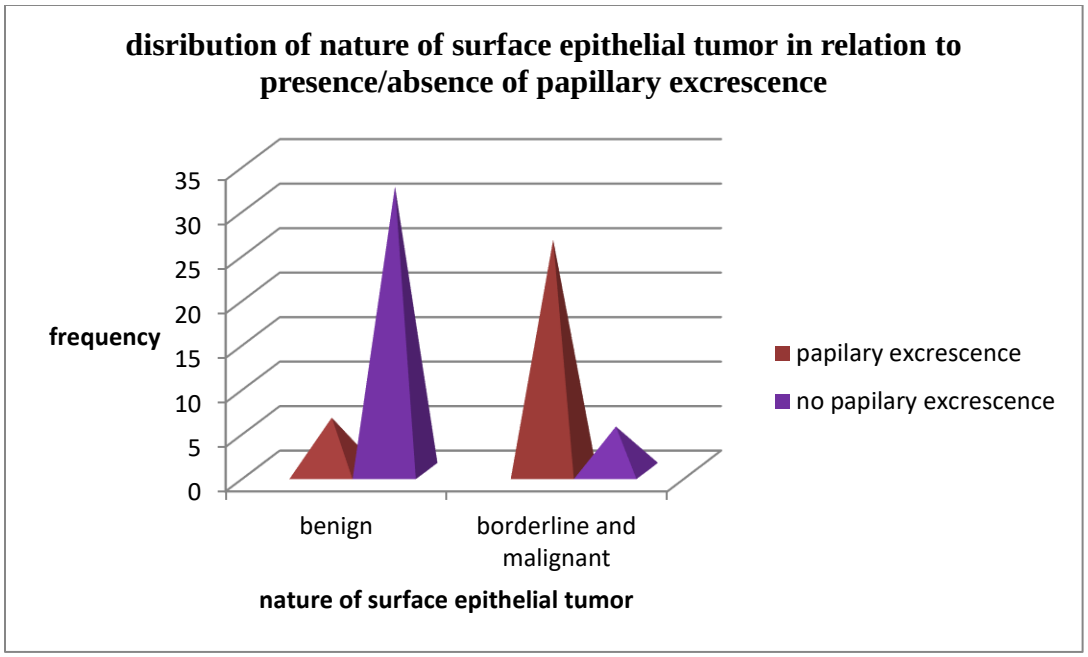

Figure 11:Distribution nature of surface epithelial tumor in relation to presence/absence of papillary excrescence in JUMC in years (2014/15-2018/19) N=73

5.4 Distribution of histopathologic features

In this study most cases were benign accounting for 73.04% followed by malignant 20.58% and only 6.38% were borderline (figure 12).

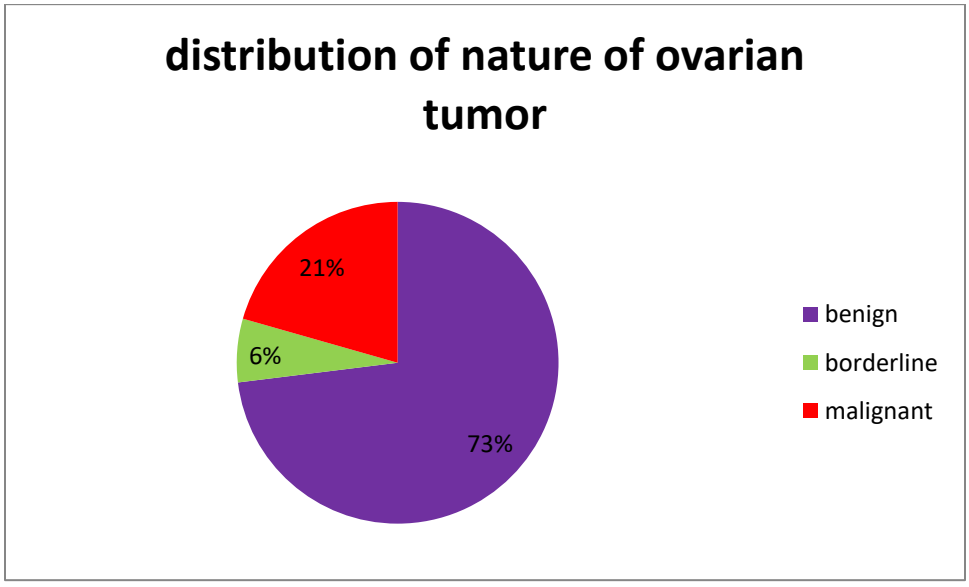

Figure 12:Distribution of nature of ovarian tumor in JUMC (2014/15-2018/19) N=345

Surface epithelial tumors were the commonest type of ovarian tumor based on site of origin (64.64%)(Figure 13). Out of Surface epithelial tumor majority (72.6%) benign, followed by

(17.5%) malignant and few (9.9%) were borderline (table 1).Of malignant tumors majority (54.9%) were surface epithelial. In addition most cases had a size of 15-20cm (31.8%) (figure 14) and occur at age range of 20-29(33.2%) with the mean age of 35.66±13.125 years.

Out of the surface epithelial tumors the most common type was serous (185 (53.6%)) followed by mucinous (31(9%)) the third common type were Brenner (4(1.2%)) and the least common type is endometrioid (3(0.9%))(table 5). Surface epithelial tumors occurred at mean age of 35.66 years (SD 13.125). Majority (78.4%) of serous tumors were benign followed malignant (15.1%) and borderline (6.5%). Among all benign, malignant and borderline tumors majority were serous accounting for 89.5%, 71.8% and 54.5% respectively, Around 13.1% of serous tumors were bilateral. More than one third (36.2%) of serous tumors occur in the third decade of life with mean age of 35.69±13.254.Around 31.9% serous tumors had a size of 10-14cm. Majority (73%) of serous tumors were pure cystic. Out of the 9 cases with Omental involvement majority (7(77.8%)) were serous. Nearly half(46.7%) of serous tumor had papillary excrescence. Most mucinous tumors (45.2%) were benign followed by (29%) borderline and (25.8%) malignant (figure 15).The most common age group affected by mucinous tumors was 30-39 years accounting for (32.3%) with mean age of 33.94±11.781 years. Around 22.2% of mucinous tumors were bilateral, when compared to serous tumors(accounted for 80% of the bilateral case), mucinous tumors are less bilateral(20%of bilateral cases). Nearly three fourth (74.3%) of mucinous tumors had a size of >15cm which is higher in comparison to serous tumors (35.7%). Majority (64.8%) of mucinous tumors were purely cystic in consistency.

The most common specific histopathologic diagnosis was serous cystadenoma accounting for 145 (42%) of cases followed by mature cystic teratoma 72 (20.9%) and serous cystadenocarcinoma 28 (8.1%). Mucinous cystadenoma, fibroma and granulosa cell tumor ranked fourth, fifth and sixth with 14(4.1%), 12(3.5%) and 11(3.2%) respectively (table 5).

Out of benign tumors the most common diagnosis was serous cystadenoma(57.5%) followed by mature cystic teratoma (28.6%) with the third and fourth being mucinous cystadenoma and fibroma (table 3).

The most common malignant ovarian tumor was serous cystadenocarcinoma (39.4%) followed by granulosa cell tumor (15.5%), and dysgerminoma (12.7%), mucinous

cystadenocarcinoma(11.3%) ranked third, fourth and fifth respectively. The least common diagnosis (2.8%) was yolk sac tumor (table 4).

Most serous cystadenoma occurred at age group 20-29(44.8%) years with mean age of 32.96±12.373 years, and (66.9 %) had size <15cm and only (33.1%) were ≥ 15cm, 31% had a size range of 10-14cm, 90.7% were unilateral and only (9.3%) were bilateral. Majority(83.4%) were cystic and the remaining 16.6% were mixed cyst and solid (table 3).

Most borderline serous cystadenoma were seen in age group 30-39years(41.7%) with mean age of 45.83±13.953years,66.7% had size<15cm and only (33.3%) were ≥15cm,with most common(50%) size range of 10-14cm and 14.3% were bilateral. And two third (66.7%)were cystic while one third(33.3%) were mixed solid and cystic.

Most serous cystadenocarcinoma were observed within age range of 40-49 years (39.3%) with mean age of 45.46±10.793years. Half (50%) had size ≥15cm, most common size were seen within size range of 15-20cm.One third (33.3%) of serous cyst adenocarcinoma were bilateral. Most (71.4%) had mixed solid and cystic consistency.Most were highgrade 18 (85.7%) and 3 (14.3%) were lowgrade. (table 4)

Half (50%) of mucinous cystadenoma occurred in age group 30-39years with mean age of 27.07±8.01 years. Most (64.3%) had a size of ≥15cm and (35.7%) had a size of <15cm and 42.9% were seen in a size range of 15-20cm. All were unilateral. Majorities (85.7%) of mucinous cystadenomas were cystic and few (14.3%) were mixed solid and cystic (table 3).

Around 33.3% mucinous borderline tumors were seen in age range 50-59years with mean age of 40.89±12.293years. Most (88.9%) of borderline mucinous tumor had a size of 15-20cm and the remaining 11.1 had a size of 10-14cm. Most (75%) of borderline mucinous cystadenoma were unilateral and minority (25%) were bilateral. Most (66.7%) of mucinous borderline tumor were mixed cystic and solid and minority (33.3%) were cystic.

Majority of mucinous cystadenocarcinomas were seen in age range of 40-49years with mean age of 38.13±11.243years.Threequarter(75%) had size of ≥15cm. Nearly two third were cystic (62.5%) and minority (37.5%) were mixed solid and cystic (table 4).

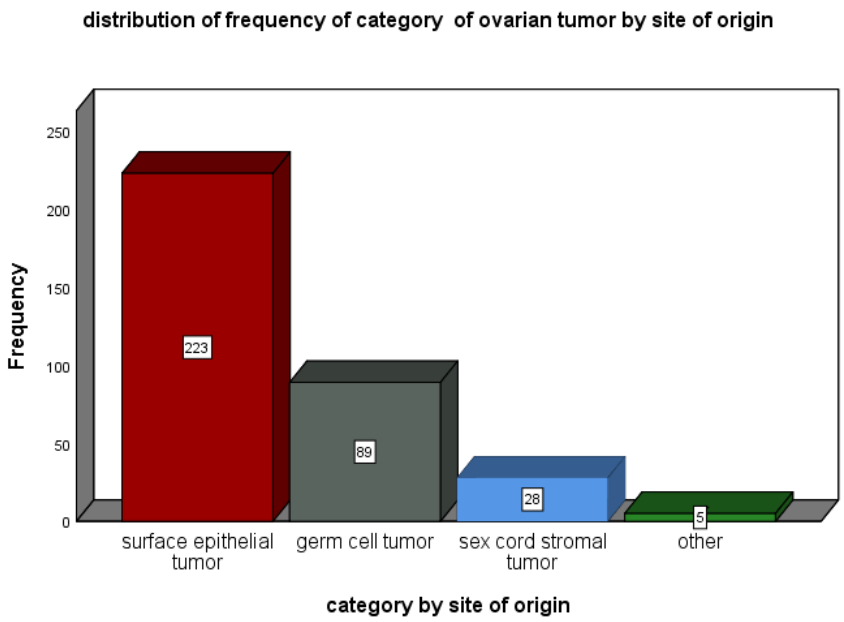

Figure 13: Distribution of ovarian tumor based on site of origin in JUMC (2014/15-2018/19) N= 345

Table 1:Cross tabulation of category by site of origin with category by nature of tumor in JUMC (2014/15-2018/19)

category by site of origin		category by nature of the tumor			Total
		Benign	Borderline	Malignant	
surface epithelial tumor	Count	162	22	39	223
	%	72.60%	9.90%	17.50%	100.00%
germ cell tumor	Count	72	0	17	89
	%	80.90%	0.00%	19.10%	100.00%
sex cord stromal tumor	Count	17	0	11	28
	%	60.70%	0.00%	39.30%	100.00%
Other	Count	1	0	4	5
	%	20.00%	0.00%	80.00%	100.00%
Total	Count	252	22	71	345
	%	73.00%	6.40%	20.60%	100.00%

Table 2:Cross tabulation of category by site of origin with categorized age in JUMC (2014/15-2018/19)

		category by site of origin				
categorized age		surface epithelial tumor	germ cell tumor	sex cord stromal tumor	Other	Total
<20	Count	11	18	2	0	31
	%	4.9%	20.2%	7.1%	0.0%	9.0%
20-29	Count	74	24	6	1	105
	%	33.2%	27.0%	21.4%	20.0%	30.4%
30-39	Count	55	24	8	1	88
	%	24.7%	27.0%	28.6%	20.0%	25.5%
40-49	Count	36	14	6	1	57
	%	16.1%	15.7%	21.4%	20.0%	16.5%
50-59	Count	28	7	4	2	41
	%	12.6%	7.9%	14.3%	40.0%	11.9%
>=60	Count	19	2	2	0	23
	%	8.5%	2.2%	7.1%	0.0%	6.7%
Total	Count	223	89	28	5	345
	%	100.0%	100.0%	100.0%	100.0%	100.0%

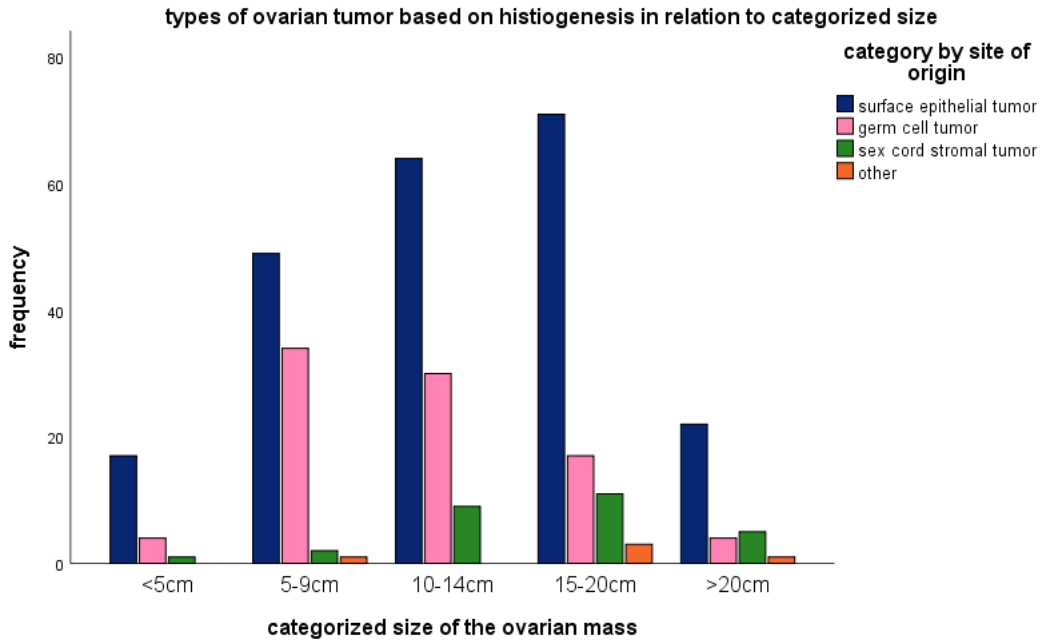

Figure 14:Distribution of types of ovarian tumor based on histogenesis in relation to categorized size in JUMC (2014/15-2018/19) N=345

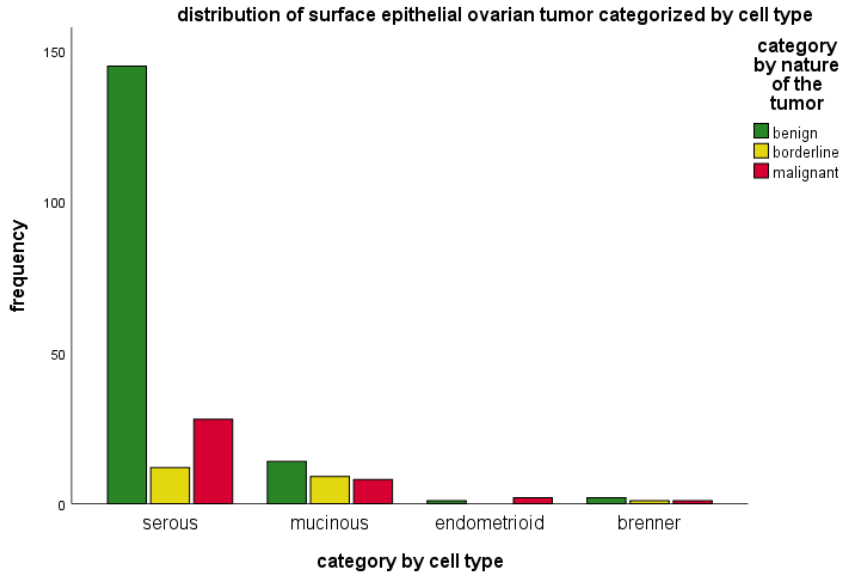

Figure 15: Distribution of surface ovarian tumor categorized by cell type in JUMC (2014/15-2018/19)

Around a quarter (25.80%) of ovarian tumors were Germ cell tumors (table 5). Out of germ cell tumor most (80.9%) were benign and only the remaining 19.1% were malignant (table 1). Around three quarter (74.2%) of germ cell tumor were seen at age less than 40 years with mean age of 31.07±13.885. More than one third of the cases (38.2%) had a size of 5-9cm (figure 14). Most teratoma were mature accounting for 72 case (94.7%) and few were immature teratoma 4 (5.3%) of cases and one casewas mature teratoma mixed with other germ cell tumor.More than half (58.4%) of mature teratomas occurred in age range of 20-39 years with mean age of 33.21±13.438 years.Most (80.6%) of mature teratoma were cystic and minority (19.4%) were mixed solid and cystic (table 3).

Two cases (50%) of immature teratoma occurred in age category of <20years and both were unilateral. Majority (75%)were cystic and minority (25%) were mixed solid and cystic.

The most common malignant germ cell tumor was dysgerminoma (9 cases (2.6%). Nearly two third (66.6%) of the cases occured at age <30years and had mean age of 24.78± 10.269. Most (66.7%) of it had a size of ≥15cm and the majority (44.4%) of the cases had a size range of 15-20cm. All dysgerminomas had solid component and were unilateral (table 4).

About 8.12% of ovarian tumors were sex cord stromal tumor (table 5). Out of sex cord stromal most (60.7%) were benign and (39.3%) were malignant (table 1). Most (39.3%) of it had a size

of 15-20cm (figure 14). Nearly one third (28.6%) of the cases occur in the fourth decade of life with a mean age of 37.75± 13.066 years (table 2).Fibromawas the most common (42.86%) type of sex cord stromatumor.Half (50%) of fibroma occurred in age group of 20-39years, with mean age 37.92±13.668 years. Most (58.3%) of the fibroma had a size <15cm and minority (41.7%) of ≥15cm. All of fibromas were unilateral and had solid component (table 3).

Granulosa cell tumor was the most common (11 cases) malignant sexcord stromal tumor (table 5). Around 36.4% occurred in age range of 40-49years, with mean age of 38.82±12.852 years. Majority (72.8%) had a size of >15cm and all were unilateral. Nearly 90.9% had solid component (table 4).

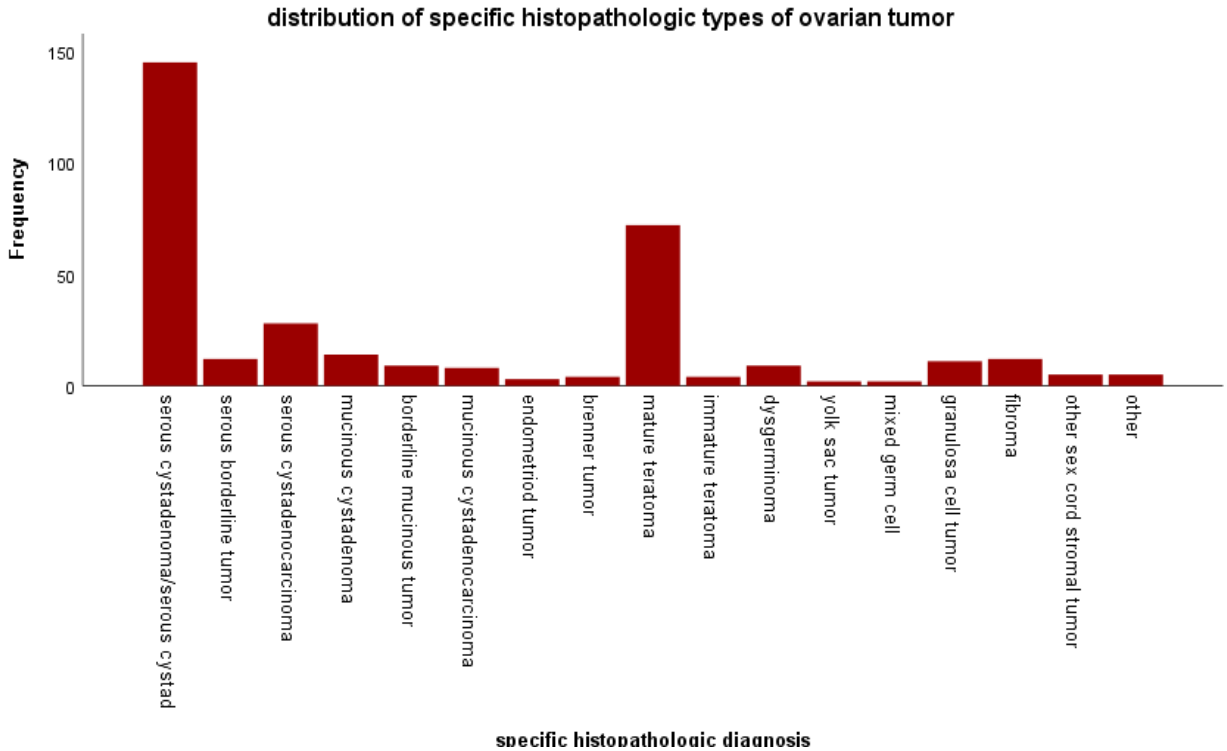

Figure 16: Distribution of specific histopathologic diagnosis of ovarian tumor in JUMC (2014/15-2018/19)

Of all malignant ovarian tumor with submitted omental tissue, in 71% of cases omentum was not involvedand the rest (29%) had omentalinvolvement.From the malignant tumors with omental metastasis most (88.9%) were surface epithelial and the remaining were germ cell tumors.Specific ovarian tumor with the highest rate of Omental tissue involvement was serous

cystadenocarcinoma(77.8% of involved cases) followed by Brenner tumor,which accounted for 11.1% .Most (66.6%) of the cases with omentalmetastesis had size≥15cm.

Table 3: Proportion of cases with diagnosis of the four most common benign ovarian tumors by common age range, size and consistency in JUMC (2014/15-2018/19)

Diagnosis	Frequency	Percent%	common age range (year)	Common size range(cm)	Common consistency
Serous cystadenoma	145	57.2	20-29 (44.8%)	10-14 (31%)	Cystic (83.4%)
Mature teratoma	72	28.6	20-39 (58.4%)	5-9 (43.1%)	Cystic (80.6%)
Mucinous cystadenoma	14	5.6	30-39 (50%)	15-20 (42.9%)	Cystic (85.7%)
Fibroma	12	4.8	20-39 (50%)	10-14 (58.3%)	Solid (91.7%)

Table 4:Proportion of cases with diagnosis of the four most common malignant ovarian tumors by common age range, size and consistencyin JUMC (2014/15-2018/19)

Diagnosis	Frequency	Percent%	Common age range (year)	Common size (cm)	Common consistency
Serous cystadenocarcinoma	28	39.4%	40-49 (39.3%)	15-20 (32.1%)	Mixed solid &cystic (78.6%)
Granulosa cell tumor	11	15.5%	40-49 (36.4%)	15-20 and >20 (72.8%)	Solid (90.9%)
Dysgerminoma	9	12.7%	<30 (66.6%)	15-20 (44.4%)	Mixed solid &cystic (100%)
Mucinous cystadenocarcinoma	8	11.3%	40-49 (50%)	15-20 (37.5%)	Cystic (62.5%)

Table 5: Summary of frequency distribution of variables and histopathologic patterns in JUMC in years 2014/15-2018/19

Types of surface tumors			Frequency	%
surface epithelial 223 (64.6%)	Serous 185 (83%)	serous cystadenoma	145	42
		serous borderline tumor	12	3.5
		serous cystadenocarcinoma	28	8.1
	Mucinous 31 (13.9%)	mucinous cystadenoma	14	4.1
		borderline mucinous tumor	9	2.6
		mucinous cystadenocarcinoma	8	2.3
	Endometrioid 3 (1.3%)	endometriod tumor	3	0.9
	Brenner 4 (1.8%)	Brenner tumor	4	1.2
germ cell tumors 89 (25.8%)		mature teratoma	72	20.9
		immature teratoma	4	1.2
		Dysgerminoma	9	2.6
		yolk sac tumor	2	0.6
		mixed germ cell	2	0.6
Sexcord stroma 28 (8.1%)		granulosa cell tumor	11	3.2
		Fibroma	12	3.5
		other sex cord stromal tumor	5	1.4
Other 5 (1.4%)			5	1.4
Total			345	100

		Frequency	Percent %
Omental involvement	Absent	22	71
	Present	9	29
	Total	31	100

		Frequency	%
Age of patients	<20	31	9
	20-29	105	30.4
	30-39	88	25.5
	40-49	57	16.5
	50-59	41	11.9
	>=60	23	6.7
	Total	345	100
Parity	Nulliparous	46	30.5
	Parous	105	69.5
Total		151	100
Size of tumor	<5cm	22	6.4
	5-9cm	86	24.9
	10-14cm	103	29.9
	15-20cm	102	29.6
	>20cm	32	9.3
	Total	345	100
Consistency	Cystic	220	64
	Solid	27	7.8
	Mixed	97	28.2
Total		344	100
Laterality	Unilateral	194	88.6
	Bilateral	25	11.4
	Total	219	100
Papillary excrescence	Present	32	43.8
	Absent	41	56.2
	Total	73	100

Table 6: Binary logistic regression of important variables associated with malignant behavior of ovarian tumor in JUMC in years 2014/15-2018/19

Variable		*p*-value	COR	95% C.I	
				Lower	Upper
Age					
	<20	0.000	1		
	20-29	0.003	0.235	0.091	0.607
	30-39	0.167	0.535	0.220	1.301
	40-49	0.545	1.322	0.535	3.266
	50-59	0.471	1.423	0.545	3.717
	>60	0.957	0.970	0.313	3.003
Laterality					
	Unilateral	**0.000**	1		
	Bilateral	**0.021**	2.759	1.168	6.516
Size					
	<5	0.000	1		
	5-9	0.418	0.592	0.167	2.105
	10-14	0.814	1.152	0.352	3.768
	15-20	0.070	2.903	0.916	9.206
	>20	**0.008**	5.786	1.594	20.998
Consistency					
	Cystic	**0.000**	1		
	Solid component	**0.000**	8.134	4.762	13.894
Papillary excrescence					
	Absent	**0.000**	1		
	Present	**0.000**	25.278	7.314	87.364

Of the variables which were associated with ovarian tumor and had $p<0.25$(age,residency,lateralty,size, consistency and pappillary excrescence),papillary excrescence was the most powerful independent predictor variable. (table 7)

Table 7: Multivariate binary logistic regression of selected variables associated with malignant behavior of ovarian tumor in JUMC in years 2014/15-2018/19

			95% C.I	
	p-value	AOR	Lower	Upper
Presence of papillary excrescence	**0.013**	11.911	1.703	83.324
Size	0.239	2.732	0.513	14.559
Consistency	0.244	2.695	0.508	14.301
Laterality	0.414	2.635	0.257	26.971
Age	0.925	1.100	0.152	7.971
Patients residence	0.767	0.583	0.016	20.780

6. Discussion

Ovarian neoplasm has great significance due to its different histopathologic spectrums, clinical behavior and increased mortality rate.Our study also intended to explore different histopathologic spectrums and associated factors of ovariantumors to give its general picture in the study area. A total of 345 cases were studied in the present study out of which benign tumors outnumbered the malignant and borderline. Similar finding was also seen inmost studies, including studies done in;Assam Indian, Sri Lanka, Saudi Arabia andsouth Nigeria (table8)(31)(7)(20)(16).

Table 8: Comparison of percentage incidence of benign, borderline and malignant tumors in different studies and present study

	Phukanet al(31)	Thirkumaret al(7)	Yousifet al(20)	Ayodeleet al(16)	Present study
Benign	75%	80.1%	63%	72%	73.04%
Borderline	3.6%	3.7%	7%	28%	6.38%
Malignant	21.4%	16.2%	30%		20.58%

According to American National Cancer Institute surface epithelial tumors are the most common (60%) ovarian tumor (28). Similarly Asianstudies done in; north eastern India, Nepal, Bangladish and Iraq majority of cases were Surface epithelial tumors, followed by germ cell tumors & sex cord stromal cell tumor(10)(19)(33)(18). And a Turkish study also showed predominance of surface epithelial tumor but sex cord tumor were more common than germ cell tumor (8). But In another Nepalese study and in studies done in west Africa (Lagos university, Nigeria, and Ghana) tumors of germ cell origin were the commonest, followed by Surface epithelial tumors and sex cord-stromal tumors(21)(22)(15). Present study found that surface epithelial tumors were the commonest (64.64%) followed by germ cell (25.8%) and sex cord stromal (8.12%) tumors respectively. Thus the findings of this study were quite similar withmost studies except studies done in Nepal,Nigeria and Ghana.

Table 9: Comparison of percentage incidence of surface epithelial, germ cell and sex cord stromal tumors in different studies and present study

	Saha M et al.	Ghosh *et al.*	M. Ahmedet al.	Suleiman *et al.*	Karlı P et al.	Igwebuike V et al	Akakpo *et al*	Present study
Surface epithelial	70.25%	52.57%	61.83%	38.5%	38.7%	27.6%	40.7%	64.64%
Germ cell tumor	26.03%	43.03%	30.64%	22.9%	4.3%	52.7%	41.9%	25.8%
Sex cord stromal	2.48%	1.96%	6.43%	1.86%	8.6%,	15.8%	15.2%	8.12%

In the present study out of Surface epithelial tumor, majority (72.6%) were benign, followed by (17.5%) malignant and few (9.9%) were borderline. This was consistent witha study done in Iraq which also showed dominance of benign tumors (82.27%)followed by malignant (11.29%) and borderline (6.45%)(18).Unlike aGhanian study which reported the mostcommonly (26.8%)affected age by surface epithelial tumor as35–44years,the current studyshowed increased susceptibility (33.2%) of a younger age range (20-29 years)(15).The present study showed larger size of surface epithelial tumors with most cases (31.8%) having a size of (15-20cm) which wasin line with a Nepalese study which also reported higher number of cases (45.37%) with tumor size more than 10 cm(19).

As seen in study done in Assam,this study also showed among the cell type category of surface epithelial tumors the most common type was serous (53.6%), followed by mucinous (9%), Brenner (1.2%) and endometrioid (0.9%)(31).Studies done in Yemen and Bangladish also showed prevalence of serous followed by mucinous(32)(33).In the present study when compared to serous tumors mucinous tumors accounted for only 20% of bilateral ovarian tumors and more than half of (54.8%) of mucinous tumors had a size of 15-20cm which is higher in comparison to serous tumors (27%). This is comparable to a Ghanian study which reported serous tumor as more bilateral than mucinous and mucinous tumor as larger than serous tumors (15).

In the current study out of serous tumors most were (78.4%) benign, followed by (15.1%) malignant and (6.5%) borderline tumors and of mucinous tumors benign were (45.2%) followed by borderline (29%) and malignant (25.8%) A Nepalese study showed similarity with the findings about serous (benign tumor (80%) followed by malignant tumors (16.8%) and 3.2%

borderline tumors) andout of mucinous benign outnumbered followed by malignant (benign 40, borderline 4 and malignant 11 tumors) even though it showed similarity with predominance of benign tumors out of mucinous, it showed lesser number of borderline mucinous tumors which was not consistent with our finding (19).

Like the study done in Assam, Indian, present study also reported serous cystadenoma accounting for 145 (42%), mature cystic teratoma 72 (20.9%) and serous cystadenocarcinoma 28 (8.1%) as the three commonest tumors(31). Similarly studies done in Srilanka and Bangladish reported serous cystadenoma and mature teratoma as the top two commonest histopathologic types of ovarian tumor(7)(33). But this findings were not in line with studies done in Lagos university Nigeria, south Nigeria and Ghana all of which reported mature teratoma as the most common diagnosis(22)(16)(15).

According to the current study top four commonest benign tumors were (serous cystadenoma (57.2%), mature teratoma (28.6%), mucinous cystadenoma (5.6%) and fibroma (4.8%)). This was consistent with studies done inBangladish (serous cystadenoma (37.97%), mature teratoma (33.54%), mucinous cystadenoma (15.82%), fibroma (6.32%)) and Assam India (serous cystadenoma (36.8%), mature teratoma (17.9%), mucinous cystadenoma (10.7%), fibroma (3.5%))(33)(31).And Sri Lankan study also reported similar finding(7). But in contrary to our study, studies donein an Iraq showeddominance of mature cystic teratoma 37 cases(22.9%), followed by serous cystadenoma 32cases (19.8%), mucinous cystadenoma(14 cases) and fibroma(2 cases)(18).Similarly west African studies done in Lagos university Nigeria, south Nigeria and Ghana reported mature teratoma as the most common benign tumor that accounted60.1%, 40.7%, 39.2% respectively all of which didn't coincidewith the present study(22)(16)(15).

Table 10: Comparison of percentage incidence of the four most common benign ovarian tumors in different studies and present study

	Serous cyst adenoma	Mature teratoma	Mucinous cyst adenoma	Fibroma
M Ahmed *et al.*	37.97	33.54%	15.82%	6.32%
Phukan *et al.*	36.8%	17.9%	10.7%	3.5%
Thirukumar *et al.*	34.8%	24.0%	18.1%	3.4%
Suleiman *et al.*	19.87%	22.98%	8.69%	1.24%
Present study	57.2%	28.6%	5.6%	4.8%

In this study the top four malignant tumors were (serous cystadenocarcinoma (39.4%), granulosa cell tumor (15.5%), dysgerminoma(12.7%), mucinous cystadenocarcinoma(11.3%)). This was in line with studies done in Saudi Arabia, Zaria Nigeria and Ghana all of which reported serous cystadenocarcinoma as the commonestfollowed by granulosa cell tumor (20)(34)(15). Even though a study done inBangladish shows similarity in the prevalence ofSerous cystadenocarcinoma (36.0%), it differs from the present study in prevalence of endometrioid carcinoma (28.0%) which was the second common type followed by immature teratoma (16%) and mucinous cystadenocarcinoma (12%)(33).In studies done in Iraq, India, Sudan and Saint Paul's Hospital Millenium Medical College Ethiopia serous cystadenocarcinoma was the commonest followed by mucinous cystadenocarcinoma which is similar to our study on the prevalence of serous cystadenocarcinoma but differ from it on the prevalence of mucinous cystadenocarcinoma(18)(30)(6)(38).A south Nigerian study (serous cystadenocarcinoma (28.1%) followed by choriocarcinoma (19%)),similarly put serous cystadenocarcinoma as the commonest which was concordant with the current study but had different result with regard to choriocarcinoma which was reported as the second commonest(16).But a study done in north India showed different finding in which mucinous cystadenocarcinoma was the commonest followed by serous cystadenocarcinoma(10).

Table 11: Comparison of percentage incidence of four most common malignant ovarian tumors in different studies and present study

	serous cystadenocarcinoma	granulosa cell tumor	dysgerminoma	mucinous cystadenocarcinoma
Yousif *et al.*	32%	10.2%	1.97%	7.87%
Zayyan*et al.*	41%	23.1%	2.6%	10.3%
Akakpo *et al.*	10.05%	7.648	1.13%	1.27%
M. Ahmed *et al.*	36.0%	-	-	12%
Suleiman *et al.*	44.44%	33.33%	-	11.11%
Saha M *et al.*	26.8%	2.44%	7.32%	34.15%
Kheiri *et al.*	44.1%	12.6%	-	9.4%
Hailu *et al.*	37.3%	-	-	11.1%
Present study	39.4%	15.5%	12.7%	11.3%

A study done in Bangladish showed majority (61.67%) of serous cystadenomas were seen within the age range of 20-50 years (33). Similarly In the current study most of the cases occurred at age group 20-29(44.8%)years.To the contrary, inNepalese studymost cases were seen

in women in their fortiesand fifties which is not concordant to our study(19).In the present study majority (66.9 %) of serous cystadenomas had size less than 15cm.Similarly in a Nepalese study most (68%)of the cases had size less than 10 cm (19).

In the current study serous cyst adenocarcinoma accounts for around forty percent of (39.4%) all ovarian malignancy which is a bit lower than the figure in western countries(American National Cancer Institute (more than half) (28).In the current study serous cystadenocarcinoma was commonly seen in fifth decade (39.3%) with mean age of 45.46±10.793years. Where as American National Cancer Institute reported 6^{th} decade of life as the commonly affected age with mean age of 59.4, which is older than the current study. Ghanian study showed mean age for serous carcinoma was 50.1 years SD10(15) which only showed a small increment from the current study.Whereas a Zaria, Nigerian study reported mean age of occurrence of serous cyst adenocarcinoma was 33.5±0.5years which was lower than the current study(34). In the current study one third (33.3%) of the serous cystadenocarcinomas were bilateral which is quite similar with a study done in Nepal which reported 36.4% bilaterality rate (19). But an American National Cancer Institute reported higher rate of bilaterality (two-third)(28).In this study out of 28 cases diagnosed as serous cystadenocarcinoma most were high grade 18 (64.28%) and 3 (10.71%) were low grade. Similar finding was reported in a study done in Saint Paul's Hospital Millennium Medical College (38).

American National Cancer Institute report showed benign mucinous tumor, mostly occur 3^{rd} -5^{th} decade of life which is coherent with the current study (Half (50%)occurred in age group 30-39years) (28). In the current study all were unilateral which is in line with western report (28).

Inthe current study mucinous cystadenocarcinoma accounted for 11.3% of ovarian malignancy which shows concordance with American National Cancer Institute (5–10% of all malignant ovarian neoplasms)(28). In Ghanian study mean age for mucinous cystadenocarcinoma was 47.3 years (SD 7.1) and more than half (55.6%) of the cases had in sizes 11–20 cm(15).In our study comparable findings were reported with most cases seen within age range of 40-49years andmean age of 38.13years which is less than the Ghanian study but concordantly in this study majority of cases(75%) had large size (>10cm).

In studies done inSouth Nigerian, Assam India and Bangladesh out of the germ cell tumors the benign ones outnumbered the malignant (16)(31). In line with that this study also showed most germ cell tumor most (80.9%) were benign and followed by malignant (19.1%). In the current study around three quarter of germ cell tumor were seen at age less than 40 years which was consistent with a study done in south Nigeria, Nepal and Ghana(16)(19)(15). Concordant to a study done in Ghana (mean age 30.7 years SD 12.7) in this study mean age ofoccurrence of germ cell tumor was 31.07±13.885(15). Unlike a study done in Nepal which reported majority of germ cell tumors had a size greater than 10cm in our study the most common size was5-9cm. As seen in studies done in Nepal and Ghana this study showed predominance of mature teratoma over immature teratoma(19)(15).In the present study more than half (58.4%) of mature teratomas occurred in age range of 20-39 years which is consistent with a study done in south Nigeria which reported similar finding ((20-39 years (59.3%)) (16).In this study the most common malignant germ cell tumor was dysgerminoma (9 cases (2.6%) which was concordant with Ghanian and Assam, India studies(15)(31).

Congruent to American National Cancer Institute the current study reported around 8.12% of ovarian tumors assex cord stromal tumors which is also compatible with a Bangladesh study (6.54%)(28)(33). But in a Ghanian study sex cord stromal tumors accounted 15.2% of the cases which was relatively larger than our study(15). Out of sex cord stromal, most (60.7%) were benign and 39.3% were malignant which showed concordance with an Assam, Indian study but different from Ghanian study which showed predominance of malignant tumors (31)(15). Similar to a study done in Assam, India,in this study Fibroma was the most common type of sex cord stroma tumor (31). But a Ghanian study reported adult granulosa cell tumors as the most common sex cord stromal tumor (43%)(15).In this study the mean age of sex cord stromal tumor was 37.75 years (SD 13.066) which is comparable to a Ghanian study which showed a mean of 40.2 years (SD 17.9)(15).

Like a study done in Assam, India and Ghana, our study also showed that the most common malignant sex cord stromal tumor was Granulosa cell tumor (31)(15). Around 36.4% occurred in age range of 40-49years, with mean age of 38.82±12.852 years. Both studies done in Ghana and Saudi reported relatively older mean age (46.5 years(SD15.9) and 44.5 years respectively)(15)(20).

Ovarian tumor occurs in all age groups, in the current study age of patients ranged from 1 year to 80 years with mean of 34.72±13.436 years. A north eastern Indian study had comparative result with the mean age of the subjects 35.2 years, ranging from 8 to 70 years(10).A Ghanian study also showed mean age of 30.7years (SD12.7)(15). The most common age range affected by ovarian tumor was the third decade (30.4%) which was also the case in Turkish and Iraqy studies (8)(18).Similar to studies done in Assam Indian, Bangladish, Sri Lanka, Nepal and Ghana, the current study reported younger age group are commonly affected by benign tumors whereas malignant tumors were mainly found in the age >40 years(31)(33)(7)(15).In studies done in Bangladish, Sudan and Ghanamean ageformalignant ovarian tumor were 47.5, 52.36, 49 years respectively (33)(6)(19)(15).Whereas in this study the mean age of malignant ovarian tumors 37.08 years SD 14.668 which is relatively younger. As seen In Nepalese study this study showed association of age with malignancy (*p*<**0001)**(19).

According to studies done in west(zaria, Nigeria) and east (Sudan) Africa most, (83.3%) and (82.7%) respectively,most of the patients were parous with majority having high parity (grand multiparous)(34)(6). Concordantly the present study also found predominanceof parous (69.54%) over nulliparous (30.46%). Moreover parous women accounted for majority of cases in both benign(73.4%) and malignant/borderline (59.5%). So there was no significant association between parity and malignant potential of ovarian tumor (x^2=2.754, df= 1, *p*= 0.97) which is consistent with the two African studies(34)(6).However in an Italian study,in comparison nulliparity was associated with malignant behavior of surface epithelial tumor(29). This may be explained by the geographic difference.

As seen in an Assam, Indian study,in the present study, majority (42%) of the patients presented with mixed symptoms of abdominal pain, abdomen mass and menstrual irregularities(31). And the most common isolated clinical presentation was abdominal swelling accounting for 85 (24.6%), Which is concordant with an Indian hospital based and Ghanian studies(30)(15). But two Indian studies reported menstrual complains and abdominal painas the most common clinical presentations which is not consistent with our findings (12)(31).

In the present study most ovarian tumors were unilateral (88.58%)tumors were predominant with slight dominance (52.05%) of right side.Similarlypredominance of the right side was seen in studies done in Bangladish and Iraq(33)(18).But in an Nepalese study left ovary was affected

more than the right ovary (19). In concordance with a Bangladish study which showed bilateral involvement in 11.23 % of the cases, the current study also showed 11.42% bilateral ovarian tumors(33). But the incidence of bilaterality are said to less in studies done in Iraq and Assam, India which reported 5.5% and 7.2% bilaterality respectively(18)(31). In this study most (80%) of bilateral ovarian tumor were surface epithelial tumor. This was comparable with the finding seen in Assam Indian which showed around 83.4% bilateral tumors were surface epithelial tumors(31).

In a Nepalese study the most common size were 5-10cm(21). However in the present study most samples had a size range of 10-14cm.In this study most malignant tumors had size of greater than or equal to 15cm accounting for 64.8% of cases and most benign tumor had size of 14 cm or less accounting for 69.8% of cases.But in a Nepalese study Majority of both benign and malignant tumors were in the size range of 5 – 10 cm which is not in line with our study (21).

As seen in a studies done in Bangladish and Nepal both ofwhich reported predominance ofcystic(77.96%) and (88%) respectively,the present study also reported similar finding most with majority being cystic 63.77% followed by mixed solid and cystic 28.12% and 7.83% solid (33)(21). In studies done inAssamIndian,Bangladish and Nepal majority of the benign lesions were cystic and majority of malignant lesions had solid component which is quite similar to this study which reported most cyst only tumors (87.7%) as benign and majority of tumors with solid component (53.2%) as malignant (31)(33)(21).

In the present study papillary excrescence was seen in 11.88% cases where as in a study done in Nepal relatively smaller (2.5%) number of cases had a report of papillary excrescence(21). The present study reported high association between the presence of papillary excrescence and malignant nature of ovarian tumor (83.3%were malignant) similarly a Nepalese study reported that all cases with papillary excrescence as malignant which is in line with our study(21).

In the current study age, size, laterality, consistency and presence of papillary excrescence were associated with malignant nature of ovarian tumor. Similar finding was seen in one Nepalese study tumor types was reported to be significantlyassociated with age and size distribution ($p = 0.0001$, $p=0.0001$)(19). Similar to the current study a Zaria, Nigerian study reported absence of significant association between patients' parity and malignant nature of ovarian tumor(34).In

another Nepalese study age at presentation and size of the tumor was not associated with malignant nature of ovarian tumor which is not concordant with the present study (21).

7. Conclusion

In this study, benign tumors outnumbered malignant and borderline tumors.Most of the ovarian tumors were surface epithelial, of which serous predominated followed by germ cell tumor. The top two commonesthistopathologic type of benign ovarian neoplasm was serous cystadenoma followed by mature teratomawhileserous cystadenocarcinoma and granulosa cell tumorwere the two commonest malignant tumors. Among the malignant cases 29% had omental involvement. And serous cystadenocarcinoma was found to be the most common tumor (77.8%) with omental metastasis. Most patients with both benign and malignant tumor were parous thus parity had no effect on malignant ovarian tumor. Most malignant tumors occurred in older age, had larger size, were more solid as well as bilateral and had more papillary excrescence than benign. Thereforeage, size, consistency, laterality and presence of papillary excrescence were variables that affected the malignant nature of ovarian tumor, andout of which the most powerful independent predictor of malignant nature of ovarian tumors was the presence of papillary excrescence.

8. Recommendation

In order to include more variables,define risk factors in the community and identify specific etiologies, we also recommend further large scale studies thatincorporate immunohistochemical and molecular tests to investigate different specific histopathologic types of ovarian tumor in the area. Since there is no screening technique for malignant ovarian tumor,proper health education inorder to improve the health seeking behavior of the community and relatively early detection of malignant ovarian tumor is recommended.

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10. Annexes

Institutional consent form

To Jimma University Medical Center, department of pathology

Hello my name is Hana Mamo I am final year pathology resident and I am going to do research on different histopathologic spectrums of ovarian tumor in Jimma University Medical Center for partial fulfillment of specialty diploma in anatomic pathology. The research will identify histopathologic patterns of ovarian tumor, determine age distribution of ovarian tumor and other associated factors and assess magnitude of peritoneal involvement. Thus to conduct this research I need to collect patients' information from histopathologic request and report forms done in 2007-2011(Ethiopian calendar) from the department's archives and I will not use patients' name in order to respect their confidentiality. So I would like to kindly request the department to give me permission to use the data for my research.

Sincerely

Hana Mamo (MD)

Date _____

Signature_____

Checklist

Table 12:Data collection tool to study the histopathologic patterns of ovarian tumor

No.	Variable		
Socio-demographic data			
1	Biopsy No		
2	Year	1. 2007/2015 2. 2008/2016 3. 2009/2017 4. 2010/2018 5. 2011/2019	
3	Age	1. <20 2. 20-29 3. 30-39 4. 40-49 5. 50-59 6. >/=60	
4	Residency	1. Rural 2. Urban 9. Not mentioned	
Clinical information			
1	Parity	1. Nulliparous 2. Primiparous 3. Multiparous 4. Grand multiparous 5. Great grand multiparous 9. not mentioned	
2	Clinical presentation	1. Non gynecologic symptoms 1.1 abdominal swelling 1.2 abdominal bloating 1.3 early satiety 1.4 change in bowel habit 1.5 other 2. Gynecologic symptoms 2.1 menstrual irregularity 2.2 precocious puberty 3. Both 4. Asymptomatic	

		9. not mentioned	
3	Laterality	1. Unilateral 1.1 right 1.2 left 2. Bilateral 9. not mentioned	
4	Clinical diagnosis		
Gross and microscopic features			
1	Size	1. <5cm 2. 5-9cm 3. 10-14cm 4. 15-20cm 5. >20cm	
2	Consistency	1. Cystic 2. Solid 3. Both	
3	Papillary excrescence	1. Present 2. Absent	
4	Histopathologic Diagnosis	1. Epithelial 1.1 Serous • Benign • Borderline • Malignant o Low grade o High grade 1.2 Mucinous • Benign • Borderline • malignant 1.3 Endometrioid 1.4 Clear cell 1.5 Brenner 1.6 Undifferentiated 2. Germ cell 2.1 Dysgerminoma 2.2 Teratoma • Mature o Cystic	

		○ Solid • Immature ○ Cystic ○ Solid 2.3 Yolk sac tumor 2.4 Embryonal 2.5 Non-gestational choriocarcinoma 2.6 Mixed tumor 3. Sex-cord 3.1 Leydig cell tumor 3.2 Sertoli tumor 3.3 Sertoli-Leydig tumor 4. Stromal 4.1 Granulosa cell tumor • Adult • Juvenile 4.2 Fibroma 4.3 Thecoma 4.4 Fibro-thecoma	
5	Omental involvement	1. Present 2. Absent 3. Unknown	