

Immunohistochemical Expression of CD24 and Its Correlation with Clinicopathological Features in Malignant Surface Epithelial Tumors of the Ovary

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ABSTRACT

Background: Surface epithelial ovarian cancer (EOC) is the deadliest gynecological malignancy, mainly due to late-stage diagnosis and therapeutic resistance. Intratumoral heterogeneity, driven by cancer stem cells (CSCs), contributes to metastasis, recurrence, and therapy resistance. Cluster of Differentiation 24 (CD24) has emerged as a promising biomarker linked to tumor progression, metastasis, and immune evasion, but further research is needed to understand its role in ovarian cancer progression and patient outcomes.

Aim: This study investigates the immunohistochemical expression of CD24 in malignant surface epithelial ovarian tumors and its correlation with clinicopathological parameters and patient outcomes.

Methods: We performed a retrospective cohort analysis involving 117 formalin-fixed, paraffin-embedded (FFPE) samples of malignant ovarian surface epithelial tumors, retrieved from the archives of the Surgical Pathology Laboratory at our University oncology center in the period between 2018 and 2021. Patients underwent surgical resection, with follow-up data collected until 2024. Immunohistochemical (IHC) staining for CD24 was performed, and expression levels were assessed based on staining percentage and intensity. The correlation between CD24 expression and clinicopathological factors, disease-free survival (DFS), and overall survival (OS) was analyzed using appropriate statistical methods, including Kaplan-Meier survival analysis and Cox regression.

Results: CD24 expression was observed in 61.5% of cases, with varying expression levels: low (17.9%), moderate (23.1%), and high (20.5%). High CD24 expression was predominantly observed in HGSC ($p=0.02$) and was significantly associated with advanced FIGO stage ($p=0.001$), high tumor grade ($p=0.001$), lymph node involvement ($p=0.001$) and positive peritoneal-omental cytology ($p=0.001$). Univariate analysis revealed that patients with high CD24 expression exhibited significantly shorter DFS ($p=0.001$) and OS ($p=0.001$), compared to those with lower or absent expression. Cox regression identified CD24 as a significant predictor of shorter disease-free survival ($p=0.001$), while its role in overall survival showed a non-significant trend ($p=0.499$), suggesting a prognostic value that requires further validation.

Conclusion: CD24 overexpression in surface epithelial ovarian cancer is associated with aggressive tumor behavior, advanced stage, and worse survival outcomes. These findings suggest that CD24 expression may contribute to prognostic assessment in ovarian cancer. Further studies are needed to confirm its role and explore the potential of CD24-targeted therapies.

Keywords: Ovarian cancer, Surface epithelial tumors, CD24, Intratumoral heterogeneity, Cancer stem cells (CSCs),

1. BACKGROUND

Ovarian cancer continues to be the deadliest type of gynecological cancer and is recognized as the fifth most common cause of cancer mortality among women globally [1]. Most patients are identified at later stages (FIGO stages III–IV) because the disease typically progresses without noticeable symptoms and lacks reliable early detection strategies [2]. Despite advances in cytoreductive surgery and platinum-based chemotherapy, high recurrence rates and chemoresistance represent significant clinical challenges, with most patients experiencing disease relapse within two years of first-line treatment [3, 4].

Among ovarian cancer subtypes, surface epithelial tumors constitute the most prevalent group, accounting for nearly 90% of all ovarian malignancies [4, 5]. These tumors exhibit intratumoral heterogeneity, which drives tumor progression, metastatic spread, and therapeutic resistance. High grade serous carcinoma (HGSC), in particular, represents the most aggressive and treatment-resistant epithelial ovarian tumor, often presenting with widespread peritoneal dissemination at the time of diagnosis [6].

The high mortality rate associated with ovarian cancer is primarily due to late-stage diagnosis, tumor heterogeneity, and resistance to chemotherapy. The lack of robust prognostic markers limits the ability to predict disease progression and identify high-risk patients who may benefit from targeted therapeutic strategies [3].

Recent research has identified Cluster of Differentiation 24 (CD24) as a potential tumor-specific biomarker for tumor aggressiveness and prognosis in ovarian cancer [7]. CD24 is a glycosylphosphatidylinositol (GPI)-anchored surface protein involved in multiple oncogenic processes, including; epithelial-mesenchymal transition (EMT) via the PI3K/Akt and MAPK signaling pathways [8], cancer stem cell (CSC) properties as chemo-resistance and self-renewal capacity which contribute to tumor progression and recurrence [9], and immune evasion that suppresses anti-tumor immunity [10].

High CD24 expression has been correlated with poor survival outcomes, therapy resistance, and increased metastatic potential in ovarian cancer patients [11]. However, the exact role of CD24 in ovarian cancer progression, metastasis, and patient outcomes remains incompletely understood. Investigating the correlation between CD24 expression and clinicopathological parameters in ovarian cancer may provide new insights into its potential as a diagnostic and prognostic biomarker. Furthermore, the identification of reliable prognostic biomarkers is crucial for enhancing early diagnosis, stratifying patient risk, and developing individualized treatment strategies for ovarian cancer.

The primary aim of this study was to investigate the immunohistochemical expression of CD24 in malignant surface epithelial tumors of the ovary and its correlation with clinicopathological features and patient outcomes.

2. MATERIALS AND METHODS

Study Design and Setting

This retrospective cohort study included 117 formalin-fixed, paraffin-embedded (FFPE) tissue specimens collected from cases diagnosed with malignant surface epithelial ovarian tumors at our university's oncology center over a four-year period from between January 2018 and December 2021. The patients underwent total abdominal hysterectomy with bilateral salpingo-oophorectomy, and the FFPE tissue blocks were retrieved from the electronic archives of the Surgical Pathology Laboratory at the same center.

This research received ethical approval from the Institutional Research Board (IRB) at our faculty (Code Number: MDP.21.07.71, 2021). The study complied with the latest revision of the Helsinki Declaration on ethical guidelines for medical research involving human subjects [12].

Inclusion & Exclusion Criteria

The study included cases with confirmed histopathological diagnosis of malignant surface epithelial ovarian tumors, comprehensive clinical and histopathological data, and paraffin blocks with adequate quality suitable for immunohistochemical analysis. Cases with incomplete or missing clinical data, insufficient or degraded quality, or lost follow-up were excluded from the study.

Clinicopathological Data Collection

The clinicopathological data for the 117 cases included age, histological type, tumor grade, tumor stage, lymph node involvement, cytology, peritoneal involvement, omental involvement, and any distant metastases present.

Histological subtyping was done according to the current fifth edition (2020) of the WHO Classification of Female Genital Tumors [5]. Tumor grading was done according to the two-tier grading system (High, Low) adopted by the MD Anderson

Cancer Center group [13]. Tumor staging was performed following the guidelines of the International Federation of Gynecology and Obstetrics (FIGO) classification system [14].

The follow-up information focused on the length of follow-up (in months), and whether patients experienced relapse (either locally or distant metastasis) as determined by radiological or histopathological investigations, disease-free survival (DFS) from primary surgery to documented relapse, overall survival (OS) from the date of initial surgery until death due to the disease or the last documented follow-up.

Immunohistochemistry

Immunostaining was carried out on 4µm-cut sections utilizing the Autostainer Link 48 (Dako) along with its recommended reagents and pharmDx kits, using the EnVision™ FLEX Visualization Systems (Link code K8000) and EnVision FLEX Hematoxylin (Link code K8008). The staining process followed the manufacturer's standardized procedure, pre-set in the autostainer's software. Immunostaining was carried out using CD24 (SN3), mouse monoclonal anti-human antibody (Quartett, Berlin, Germany, clone SN3, ready to use).

The immunohistochemical staining was interpreted semi quantitatively by two independent pathologists using an ordinary light microscope. CD24-positive staining was detected when a membranous and/or cytoplasmic staining was observed. Each section was evaluated for the percentage of stained tumor cells and the staining intensity. The percentage of stained tumor cells was categorized as follows: score 0 (no staining), score 1 (1–40%), score 2 (41–80%), and score 3 (>80%). The staining intensity was scored as 0 (negative), 1 (mild), 2 (moderate), and 3 (strong staining).

The final score was obtained by multiplication of staining percentage score by the staining intensity score. The final score was coded as Negative (0), Low (1–2), Moderate (3–4), or High (6–9) [15].

Statistical Analysis

Statistical analysis was conducted using SPSS software version 26 (SPSS Inc., PASW Statistics for Windows, version 26, Chicago: SPSS Inc.). Qualitative variables were presented as frequencies and percentages. Quantitative variables were summarized as mean ± standard deviation for data that followed a normal distribution, which was verified by applying the Kolmogorov-Smirnov test. Appropriate statistical tests, such as Chi-square, Fisher's exact, and Monte Carlo tests, were utilized to assess qualitative differences between groups. Kaplan-Meier analysis was applied to determine differences in disease-free survival (DFS) and overall survival (OS) among groups categorized by CD24 expression levels. Additionally, Cox regression analysis was conducted to control for possible confounding factors and to identify prognostic factors independently influencing patient outcomes. A p-value ≤ 0.05 was considered statistically significant, and results were classified as non-significant (p > 0.05), significant (p ≤ 0.05), or highly significant (p ≤ 0.001).

3. RESULTS

Table (1) provides an overview of the demographic and pathological characteristics of the studied cases. The average age of patients is 57.56 years, with 53% being under 60 years old. The majority of cases are high-grade serous carcinoma (77.8%), and advanced stages (III and IV) account for more than half of the studied cases (53%). Lymph node involvement (29.9%) and positive cytology (59.8%) indicate a significant burden of disease. Additionally, the presence of peritoneal and omental involvement in 53.8% of cases highlights the aggressive nature of the tumors. Distant metastasis was identified in 41% of the cases, indicating a substantial proportion of patients presenting with widespread disease.

Table (1): Clinicopathological Characteristics of The Studied Cases

	N=117	%
Age / years		
Mean ±SD	57.56±8.55	
Median (range)	58(35-83)	
<60	62	53.0
≥60	55	47.0
Type		
HGSC	91	77.8
LGSC	9	7.7
Mucinous	7	6.0

Endometroid	8	6.8
Clear Cell	2	1.7
Grade		
Low	17	14.5
High	100	85.5
Stage		
I	41	35.0
II	14	12.0
III	54	46.2
IV	8	6.8
LN involvement		
Negative	82	70.1
Positive	35	29.9
Cytology		
Negative	47	40.2
Positive	70	59.8
Peritoneal involvement		
Negative	54	46.2
Positive	63	53.8
Omentum involvement		
Negative	54	46.2
Positive	63	53.8
Distant metastasis		
Negative	69	59.0
Positive	48	41.0
Relapse		
No	93	79.5
Yes	24	20.5
Type of relapse		
	N=24	
Local Relapse	2	8.3
Distant Mets	22	91.7
Death		
	6	5.1

The results of IHC expression of CD24 staining are shown in table (2). CD24 expression analysis revealed a heterogeneous pattern: 38.5% of cases showed no staining (Figure 1), while 35.9% exhibited low percentage of expression (1–40%). Moderate (40–80%) and high (>80%) percentages of expression were observed in 13.7% and 12% of cases, respectively. Intensity analysis indicated that strong staining was most common (34.2%), followed by moderate (17.1%) and weak (10.3%) staining intensity. This variation in expression intensity may reflect differences in tumor biology and potential outcomes. The final CD24 expression combined score was low in 17.9% of cases (Figure 2), moderate in 23.1% (Figure 3), and high in 20.5% of cases (Figure 4).

Table (2): Immunohistochemical Staining Results of CD24 Among Studied Cases

	N=117	%
CD24 Expression Positivity		
Negative	45	38.5
Positive	72	61.5
CD24 Staining Percentage		
none	45	38.5
1–40%	42	35.9
40–80%	16	13.7
>80%	14	12.0
CD24 Staining Intensity		
no staining	45	38.5
weak	12	10.3
moderate	20	17.1
Strong	40	34.2
CD24 Expression Levels		
Negative	45	38.5
Low	21	17.9
Moderate	27	23.1
High	24	20.5

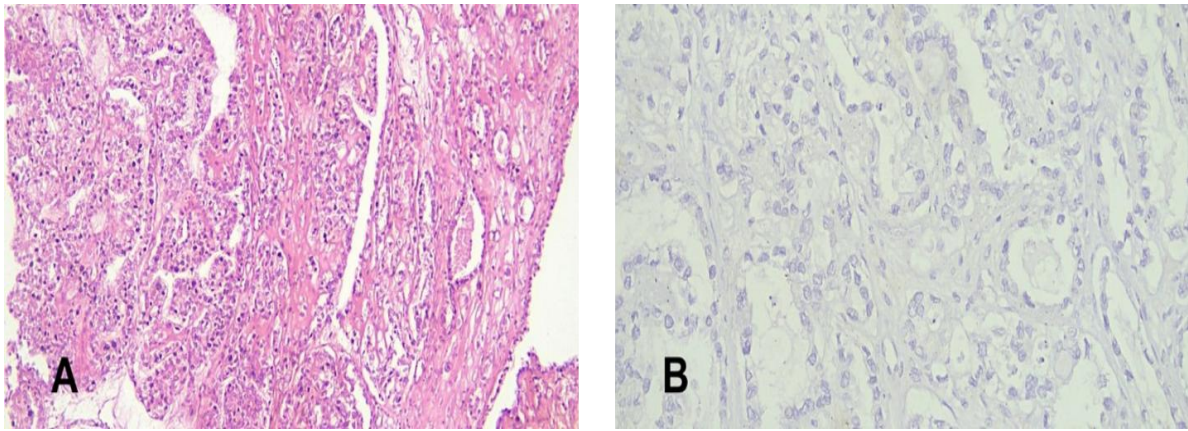


Figure 1. (A) Case of clear cell carcinoma of the ovary (H&E; x100). (B) CD24 negative tumor cells in the same case with no membranous or cytoplasmic staining in any of the tumor cells (Negative CD24 expression, Score = Zero; x200).

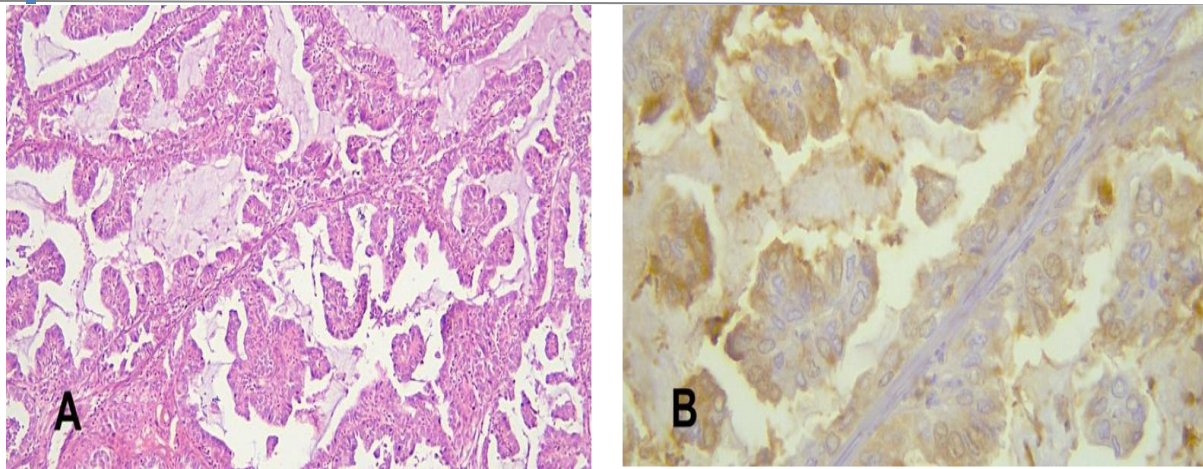


Figure 2. (A) Case of high-grade endometrioid carcinoma of the ovary (H&E; x100). (B) CD24 positive tumor cells in the same case with moderate membranous and cytoplasmic staining in (1-40%) of the tumor cells (Low level of CD24 expression, Score $2 \times 1 = 2$; x400).

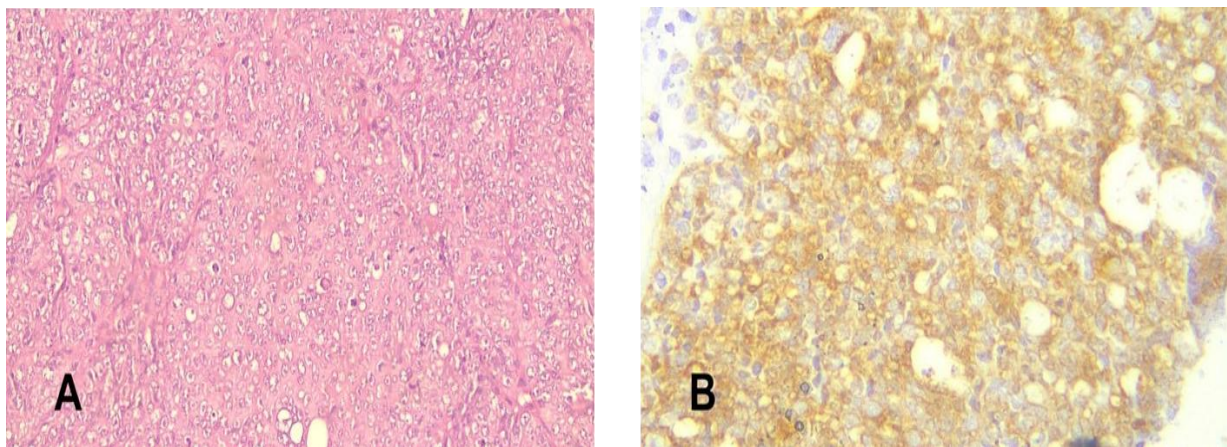


Figure 3. (A) Case of high-grade serous carcinoma of the ovary (H&E; x200). (B) CD24 positive tumor cells in the same case with moderate membranous and cytoplasmic staining intensity in (40-80%) of tumor cells (Moderate level of CD24 expression, Score $2 \times 2 = 4$; x200).

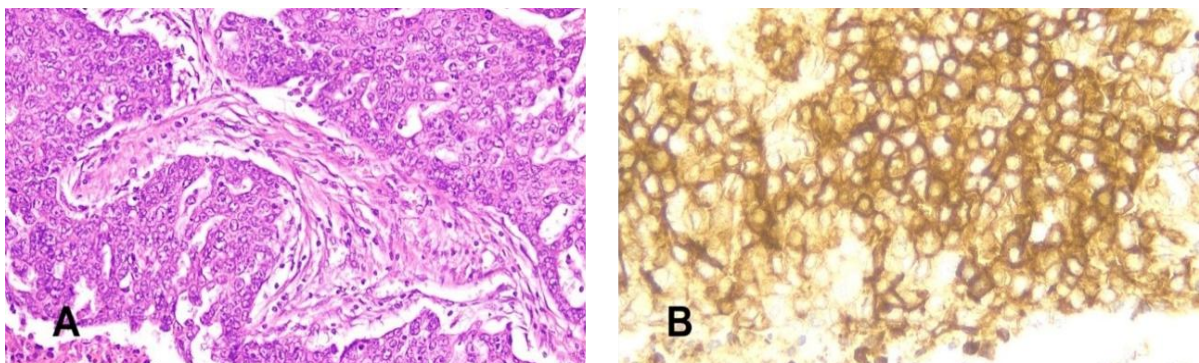


Figure 4. (A) Case of high-grade serous carcinoma of the ovary (H&E; x200). (B) CD24 positive tumor cells in the same case with strong membranous and cytoplasmic staining intensity in more than 80% of tumor cells (High level of CD24 expression, Score $3 \times 3 = 9$; x400).

Table (3) demonstrates the relationship between CD24 expression categories (Negative, Low, Moderate, High) and various clinic-pathological characteristics, highlighting significant associations with tumor aggressiveness, metastasis, and patient outcomes. High CD24 expression was strongly linked to older age, with 79.2% of patients aged ≥ 60 showing high expression ($p=0.001$). Additionally, high CD24 expression was most prevalent in high-grade serous carcinoma (HGSC), with 95.8% of HGSC cases exhibiting high expression ($p=0.02$), and no cases of high expression were found in mucinous or clear cell carcinomas.

All tumors with high CD24 expression were high-grade, with the majority being stage III (70.8%) or stage IV (16.7%) ($p=0.001$). Furthermore, high CD24 expression was significantly associated with lymph node involvement (54.2%) and peritoneal spread (91.7%), with both showing a p-value of 0.001.

These findings suggest that high CD24 expression is closely linked to advanced disease features and poor prognosis. There was a clear association between CD24 expression levels and adverse clinical outcomes. As CD24 expression increased, the relapse rate progressively increased, reaching 75% in the high-expression group ($p=0.001$), indicating a strong link between elevated CD24 levels and higher relapse risk. Additionally, patients with high CD24 expression experienced a significantly higher mortality rate ($p=0.001$), with 25% of them dying during the study period.

Table (3): Relation Between CD24 Expression Levels and Clinicopathological Features of Studied Cases

	CD 24 Expression				Test of Significance
	Negative	Low	Moderate	High	
	N=45	N=21	N=27	N=24	
Age / years					
<60	36(80)	9(42.9)	12(44.4)	5(20.8)	$\chi^2=24.79$
≥60	9(20)	12(57.1)	15(55.6)	19(79.2)	P=0.001*
Type					
HGSC	26(57.8)	17(81)	25(92.6)	23(95.8)	$\chi^{2MC}=24.02$
LGSC	6(13.3)	2(9.5)	1(3.7)	0	P=0.02*
Mucinous	7(15.6)	0	0	0	
Endometroid	4(8.9)	2(9.5)	1(3.7)	1(4.2)	
Clear Cell	2(4.4)	0	0	0	
Grade					
Low	14(31.1)	2(9.5)	1(3.7)	0	$\chi^{2MC}=17.01$
High	31(68.9)	19(90.5)	26(96.3)	24(100)	P=0.001*
Stage					
I	27(60)	6(28.6)	7(25.9)	1(4.2)	$\chi^2=30.38$
II	5(11.1)	3(14.3)	4(14.8)	2(8.3)	P=0.001*
III	12(26.7)	12(57.1)	13(48.1)	17(70.8)	
IV	1(2.2)	0	3(11.1)	4(16.7)	
LN involvement					
Negative	40(88.9)	15(71.4)	16(59.3)	11(45.8)	$\chi^2=15.85$
Positive	5(11.1)	6(28.6)	11(40.7)	13(54.2)	P=0.001*
Cytology					
Negative	28(62.2)	8(38.1)	10(37.0)	1(4.2)	$\chi^2=22.19$
Positive	17(37.8)	13(61.9)	17(63.0)	23(95.8)	P=0.001*
Peritoneal involvement					

Negative	31(68.9)	9(42.9)	12(44.4)	2(8.3)	$\chi^2=23.29$
Positive	14(31.1)	12(57.1)	15(55.6)	22(91.7)	P=0.001*
Omental involvement					
Negative	31(68.9)	9(42.9)	12(44.4)	2(8.3)	$\chi^2=23.29$
Positive	14(31.1)	12(57.1)	15(55.6)	22(91.7)	P=0.001*
Distant metastasis					
Negative	31(68.9)	11(52.4)	19(70.4)	8(33.3)	$\chi^2=10.18$
Positive	14(31.1)	10(47.6)	8(29.6)	16(66.7)	P=0.017*
Relapse					
No	44(97.8)	18(85.7)	25(92.6)	6(25)	$\chi^{2MC}=56.28$
Yes	1(2.2)	3(14.3)	2(7.4)	18(75)	P=0.001*
Type of relapse					
Local Relapse	0	0	0	2(11.1)	$\chi^{2MC}=0.727$
Distant Mets	1(100)	3(100)	2(100)	16(88.9)	P=0.867
Death					
	0	0	0	6(25)	$\chi^{2MC}=24.51$
					P=0.001*

χ^2 =Chi-Square test, MC: Monte Carlo test, *statistically significant

Data are expressed as number (%)

The cohort had a median disease-free survival (DFS) duration of 74.68 months (95% CI:69.85–79.52). The DFS rate was 90.6% at 1 year, 87.2% at 2 years, and 80.3% at 3 years. The survival curve shows a gradual decline over time, with most patients remaining disease-free during the follow-up period.

Disease-free survival (DFS) was closely linked to CD24 expression levels, with high CD24 expression associated with a marked reduction in DFS (**31.50 months**), characterized by a sharp early decline in survival probability. In contrast, patients with negative CD24 expression displayed the most favorable DFS (**86.31 months**), maintaining stable survival over the follow-up period (Figure 5).

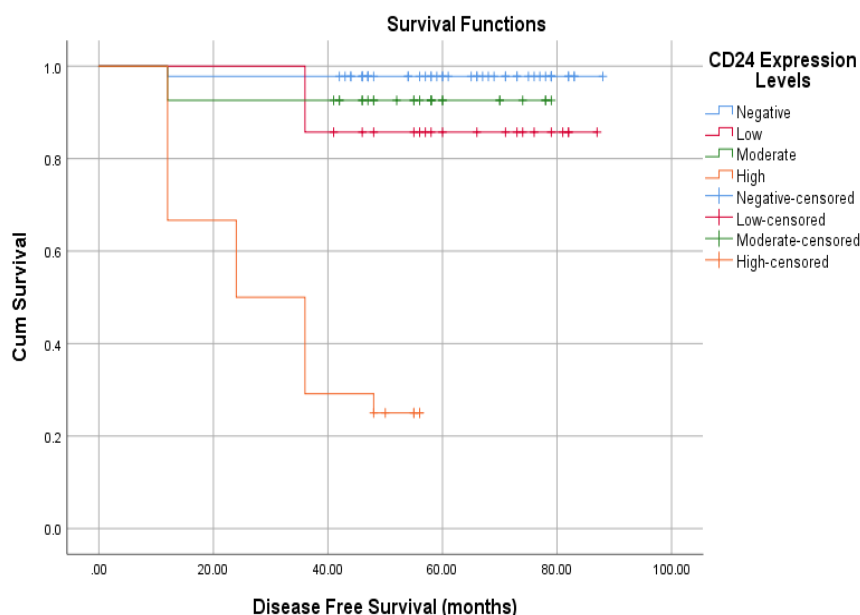


Figure (5): Kaplan-Meier Curve of Disease-Free Survival by CD24 Expression Levels

The Cox regression analysis identifying several predictors of disease-free survival (DFS) including age, stage, lymph node involvement, positive cytology, peritoneal-omental involvement, distant metastasis at time of diagnosis and CD 24 expression. High CD24 expression was associated with an HR of 48.06 (95% CI 6.38-300.56, $p=0.001$), **while low and moderate CD24 expression did not reach statistical significance** (Table 4).

Table (4): Cox Regression for Predictors of Disease-Free Survival (DFS) by CD24 Expression Levels among studied cases

	β	p value	Hazard Ratio (95%CI)
CD24 Expression Positivity			
Negative (R)	R		R
Positive	2.77	0.007*	15.89(2.15-100.58)
CD24 Staining Percentage			
none	R		R
1–40%	1.15	0.318	3.17(0.330-30.47)
40–80%	3.62	0.001*	37.17(4.69-294.67)
>80%	3.83	0.0001*	46.13(5.94-350.4)
CD24 Staining Intensity			
no staining	R		R
weak	2.01	0.101	7.45(0.676-82.17)
moderate	2.87	0.007*	17.59(2.17-143.09)
Strong	2.88	0.005*	17.96(2.36-136.69)
CD24 Expression Levels			
Negative	R		R
Low	1.847	0.110	6.34(0.660-60.95)
Moderate	1.240	0.311	3.46(0.313-38.11)
High	3.872	0.001*	48.06(6.38-300.56)

R: reference group

* Statistically significant

The median overall survival (OS) for the studied cohort was 85.04 months (95% CI: 82.72–96.80). The 2-year survival rate was 97.4%, while the 3-year survival rate was 95.7%. The survival curve shows a high overall survival rate for the studied population, with a gradual decline over time.

High CD24 expression was associated with a significantly poorer OS on Kaplan-Meier analysis ($p=0.001$), though Cox regression results showed a non-significant trend ($p=0.499$), possibly due to limited events. The survival analysis for patients with high-grade CD24 expression revealed a progressive decline in survival over time. The 2-year survival rate was 87.5%, which dropped to 79.2% at 3 years and further decreased to 73.9% at 4 years (Figure 6).

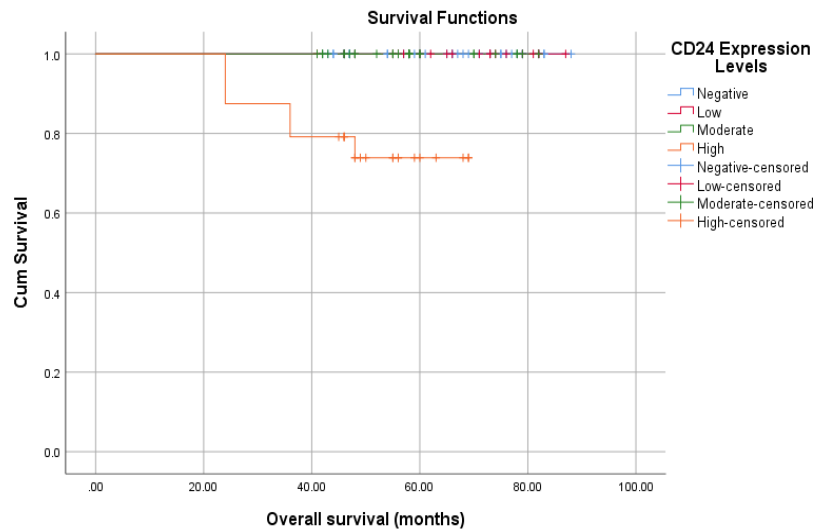


Figure (6): Kaplan-Meier Curve of Overall Survival by CD24 Expression Levels

Cox regression analysis identified Lymph Node Involvement as an independent predictor of overall survival (**HR=12.46, p=0.021**). OS analysis showed a non-significant trend toward worse survival in high CD24 expression cases (p=0.499), suggesting a need for further validation in larger cohorts.

4. DISCUSSION

This study investigated the immune-histochemical expression of CD24 in malignant surface epithelial ovarian tumors and its correlation with clinic-pathological parameters and patient outcomes. The findings indicated a significant link between elevated CD24 expression and advanced tumor stage, high-grade tumors, increased lymph node involvement, peritoneal and omental metastasis, and poor survival outcomes. Patients showing elevated CD24 levels had notably reduced disease-free survival (DFS) and overall survival (OS) compared to patients with low or negative expression. Specifically, High CD24 expression was significantly associated with poor DFS in multivariate analysis, while OS analysis showed a trend without statistical significance. These findings suggest that CD24 expression may contribute to prognostic assessment in ovarian cancer, pending further validation.

The associations observed in this study support the hypothesis that CD24 may be linked to aggressive tumor behavior; however, further functional validation is required to establish causality. These findings align with the broader understanding that CD24 functions as an oncogenic driver in various malignancies, playing a crucial role in tumor aggressiveness by promoting epithelial-mesenchymal transition (EMT), immune evasion, and metastatic potential [11, 16].

Furthermore, the strong correlation between CD24 expression and increased metastatic spread suggests that CD24 is not merely a passive marker but actively contributes to tumor dissemination. Given that CD24 enhances tumor cell adhesion, migration, and immune evasion, its high expression in advanced-stage tumors may drive disease progression and chemoresistance as stated by Jang et al., 2024 [17] and Wang et al., 2023 [18].

The results of this study align with prior research identifying CD24 as a marker of poor prognosis in ovarian cancer and other malignancies [11] [17]. Previous studies have demonstrated that CD24 expression is linked to EMT, tumor invasion, and chemoresistance, which are consistent with our results [16]. A study by Nakamura et al., 2017 [7] found that CD24 expression was significantly associated with high-grade serous ovarian carcinoma (HGSC), advanced-stage disease, and reduced survival outcomes, paralleling our findings. However, our study extends these observations by providing detailed statistical evidence linking CD24 positivity to DFS and OS, further validating its prognostic significance.

Additionally, CD24 has been widely studied in breast and pancreatic cancers, where it has been implicated in metastatic dissemination and resistance to apoptosis [19]. In ovarian cancer, CD24 expression correlates with chemotherapy resistance, which underscores its potential as a therapeutic target [20].

These findings reinforce the potential of CD24 as a prognostic biomarker. Given its strong association with adverse survival outcomes, CD24 assessment could be integrated into histopathological evaluations to improve patient risk stratification. Moreover, CD24-targeted therapies, such as monoclonal antibodies and immune checkpoint inhibitors, are currently under investigation and could offer new therapeutic strategies for ovarian cancer [18].

This study's strengths lie in its robust methodology and clinical relevance, utilizing a well-defined cohort of 117 ovarian

cancer cases, ensuring a statistically meaningful analysis. The standardized immunohistochemical protocols and validated scoring criteria minimized interobserver variability, while Kaplan-Meier survival curves and Cox regression models provided a comprehensive evaluation of CD24's prognostic significance.

This study has several limitations. First, the retrospective nature and single-center setting may introduce selection bias and limit the generalizability of findings. Second, the relatively small sample size, especially for subgroup analyses, may affect the statistical power; due to the limited number of death events, especially in early follow-up years, OS analysis may be influenced by censoring and small event counts. Third, variability in treatment modalities was not accounted for, which could confound survival analyses. Confounding factors such as genetic variations and treatment responses were not accounted for in the statistical models, which could influence the observed associations. This study did not include benign or normal ovarian tissue controls, limiting our ability to define CD24 overexpression relative to baseline expression. Additionally, IHC alone can only show association, not cause-effect relationships or biological mechanisms. Thus, the lack of functional assays prevents a mechanistic understanding of CD24 role in ovarian cancer progression. Future studies should incorporate comprehensive genomic profiling and prospective validation cohorts to strengthen the clinical relevance of these findings.

5. CONCLUSION

In summary, this study highlights the association between CD24 expression and poor clinical outcomes in ovarian cancer. High CD24 expression correlates with advanced tumor stage, high-grade tumors, increased metastasis, and reduced survival rates, suggesting its potential as a prognostic biomarker. These results raise the possibility that CD24 expression could assist in stratifying patient risk, but its integration into clinical decision-making would require prospective validation. Future studies should aim to confirm these results in larger patient groups and investigate potential therapeutic approaches directed at CD24 to improve ovarian cancer management and patient survival outcomes.

6. LIST OF ABBREVIATIONS:

1. CD24 - Cluster of Differentiation 24
2. CSC - Cancer Stem Cells
3. EMT - Epithelial-Mesenchymal Transition
4. FFPE - Formalin-Fixed, Paraffin-Embedded
5. IHC - Immunohistochemistry
6. HGSC - High-Grade Serous Carcinoma
7. LGSC - Low-Grade Serous Carcinoma
8. FIGO - International Federation of Gynecology and Obstetrics
9. DFS - Disease-Free Survival
10. OS - Overall Survival
11. 3YS - 3-Year Survival
12. HR - Hazard Ratio
13. CI - Confidence Interval
14. LN - Lymph Node
15. MC - Monte Carlo
16. R - Reference group

7. DECLARATIONS

Ethics Approval and Consent to participate

This research received ethical approval from the Institutional Research Board (IRB) of the University Faculty of Medicine (Code Number: MDP.21.07.71, 2021). Confidentiality was maintained by using pathology identification numbers instead of patient names. The study complied with the latest revision of the Helsinki Declaration on ethical guidelines for medical research involving human subjects (The World Medical Association, 2013). After completion, all paraffin tissue blocks were returned to the archives to allow potential future use for clinical or research purposes.

Consent For Publication

The authors unanimously agree to publish the data and information in the manuscript.

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