

The Correlation Between Tumor Gross Type and Pathological Response Rate of Neoadjuvant Immunochemotherapy in Locally Advanced Esophageal Squamous Cell Carcinoma

Xiao Yang

yangxiao625@tmmu.edu.cn

Army Medical University

Huixin Yu

Army Medical University

Kunkun Li

Army Medical University

He Xiao

Army Medical University

Xunjie Xun

Army Medical University

Mingfang Xu

Army Medical University

Mengxia Li

Army Medical University

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Abstract

Background

Neoadjuvant chemoimmunotherapy has emerged as a promising strategy for locally advanced esophageal squamous cell carcinoma (ESCC), yet the patients who will benefit from such treatment have not been fully defined. We aimed to systematically evaluate the association of clinicopathological features with efficacy of neoadjuvant chemoimmunotherapy.

Methods

This single-center study retrospectively enrolled 409 ESCC patients who underwent neoadjuvant chemoimmunotherapy followed by surgery (January 2020–July 2025). Pathological responses were assessed, and the associations with clinicopathological features were analyzed using univariate and multivariate logistic regression.

Results

The pathological complete response (pCR) rate was 22.2%, and the major pathological response (MPR) rate was 39.4%. Female patients were associated with higher pCR (34.3% vs. 19.9%, $p = 0.015$). Tumor location significantly influenced MPR, with proximal tumors achieving the highest rate (47.9%) and distal tumors the lowest (30.2%) ($p = 0.013$). The constrictive gross type showed markedly lower pCR (3.5% vs. 23.7%, $p = 0.022$) and MPR (20.7% vs. 40.8%, $p = 0.053$) compared with other types. Carboplatin was associated with significantly higher MPR (44.7%) compared to cisplatin (21.2%) or nedaplatin (25.7%) ($p < 0.001$). Multivariate analysis identified constrictive type and carboplatin as independent predictors of both pCR (OR = 0.101, $p = 0.027$; OR = 5.514, $p = 0.024$, respectively) and MPR (OR = 0.349, $p = 0.032$; OR = 2.971, $p = 0.018$, respectively). Distal tumor location independently predicted lower MPR (OR = 0.474, $p = 0.019$).

Conclusions

Tumor location, tumor gross type (particularly constrictive type), and platinum agents selection might independently influence the pathological response to neoadjuvant chemoimmunotherapy in locally advanced ESCC. These findings may inform patient stratification and treatment optimization in clinical practice.

Introduction

Esophageal cancer is one of the malignancies with high incidence and mortality globally, and esophageal squamous cell carcinoma (ESCC) accounts for approximately 90% of all cases in China [1].

The standard of care for locally advanced ESCC has evolved into a multidisciplinary approach [2], where neoadjuvant therapy plays a pivotal role in tumor downstaging, increasing R0 resection rates, and ultimately improving the long-term survival [3]. For decades, neoadjuvant chemotherapy or chemoradiotherapy has been the standard of treatment [4–6]. However, the recent integration of immune checkpoint inhibitors (ICIs) into this paradigm has marked a revolutionary shift. Multiple phase II and III clinical trials have demonstrated that neoadjuvant chemotherapy combined with ICIs could achieve improved pathological complete response (pCR) rates, offering a potential role for disease control and prognostic improvement [7–9].

Despite these encouraging advances, the benefit derived from neoadjuvant chemoimmunotherapy is not consistent across all patients. Although a proportion of patients achieve pCR, a substantial number of patients still exhibit residual disease, and may be exposed to the potential toxicities and financial costs of immunotherapy. Therefore, identifying the patient population that can benefit from this treatment has become a core issue urgently requiring resolution in precision medicine.

Current research have predominantly focused on exploring molecular biomarkers for efficacy prediction, while programmed death ligand-1 (PD-L1) combined positive score (CPS), tumor mutation burden (TMB), and tumor neoantigen burden (TNB) have been extensively evaluated [10–12]. However, the predictive value of these biomarkers remains inconsistent across different studies, attributed to the intratumoral heterogeneity and the lack of standardized cut-off values. Notably, classical clinical-pathological features such as gross tumor type, which was confirmed as important prognostic factors in the surgery-alone cohort [13], have been scarcely investigated in the neoadjuvant immunotherapy setting, due to the limited sample sizes.

Therefore, this study systematically evaluated the predictive value of clinical-pathological features in the efficacy of neoadjuvant chemoimmunotherapy. We conducted a retrospective analysis of clinical and pathological data from locally advanced ESCC patients with different tumor gross types (e.g. ulcerative, constrictive, medullary, and mushroom-umbrella types) who underwent surgical resection after neoadjuvant chemoimmunotherapy in our center. This study aims to elucidate the clinical-pathological characteristics influencing the pathological response rate, providing evidence for subsequent prospective studies and the development of individualized treatment strategies.

Methods

Study design and patients selection

This study retrospectively collected baseline data from 803 patients with ESCC treated in our center between January 8, 2020, and July 2, 2025, and a total of 409 patients with locally advanced ESCC were ultimately included in the analysis. All enrolled patients were pathologically confirmed ESCC, and diagnosed as stage II to IVA (T2-4a/N0-3/M0) according to the American Joint Committee on Cancer (AJCC) eighth edition TNM staging system. All patients received neoadjuvant chemoimmunotherapy

followed by radical esophagectomy. The exclusion criteria were as follows: incomplete clinical data (n = 79), presence of other malignant tumors (n = 32), diagnosis of metastatic ESCC (n = 201), prior radiotherapy or target therapy (n = 24), prior only chemotherapy (n = 27), without surgery (n = 20), and intraluminal gross type (n = 11). The sample selection process is illustrated in Fig. 1. This study was approved by the Clinical Research Ethics Committee of our center (Approval No. : #2020–8401), and conducted in accordance with the Declaration of Helsinki. All data collection and analysis were performed under the premise of protecting patient privacy, and the written informed consent was waived.

Gross classification of ESCC

The tumor gross type classification of ESCC follows the domestic classification standards of China [14], confirmed by two experienced esophageal cancer experts through endoscopic and upper gastrointestinal barium examinations. Medullary type: characterized by thickening of the esophageal wall with a sloping marginal elevation. Mushroom-umbrella type: the tumor margin is elevated, with lip-like or mushroom-like eversion, and superficial ulcer may be present on the surface. Ulcerative type: a central ulcer is present, usually accompanied by marginal elevation. Constrictive type: the patients presented with pronounced dysphagia, characterized by significant narrowing of the lumen. Intraluminal type: rare but also observed in early/superficial cancers, the lesion appears a mushroom-like or large polypoid with a thin stalk. As the intraluminal type is relatively rare, it was excluded from this study.

Treatment options

The choice of neoadjuvant regimen was determined by the physician in charge. All patients received 2–4 cycles of neoadjuvant chemoimmunotherapy before surgery. Neoadjuvant immunotherapy included 4 PD-1 inhibitors: tislelizumab (200 mg, every 3 weeks), camrelizumab (200 mg, every 3 weeks), sintilimab (200 mg, every 3 weeks), and toripalimab (240 mg, every 3 weeks). The chemotherapy regimen consisted of taxane plus platinum agents, specifically: albumin-bound paclitaxel (80–100 mg/m², every 3 weeks) / paclitaxel (135–175 mg/m², every 3 weeks) / docetaxel (80 mg/m², every 3 weeks) + cisplatin (75–100 mg/m², every 3 weeks) / carboplatin (area under the curve, 5; every 3 weeks) / nedaplatin (75–100 mg/m², every 3 weeks). All patients in this study underwent thoracoscopic McKeown esophagectomy, as previously described [15]. The selection of surgical approach depended on each surgeon, ensuring at least a 2-field lymph node dissection.

Efficacy evaluation

After surgery, pathologic response was assessed by tumor regression grade (TRG) using the Ryan system: TRG 0 (no residual tumor), TRG 1 (residual single tumor cells or small groups of tumor cells), TRG2 (residual partial tumor), and TRG3 (no regression) [16]. The pathologic complete response (pCR)

was defined as the absence of any residual tumor cells in the resected tumor and lymph nodes, and MPR was defined as less than 10% residual tumor cells.

Statistical analysis

Statistical analyses were performed using R software (version 4.5.2, The R Foundation, Vienna, Austria). Differences in pCR or MPR rates between the different clinical groups were determined using the chi-squared test with continuity correction or Fisher's exact probability. Univariate and multivariate binary logistic regression analyses were used to evaluate the independent factors associated with pCR or MPR. The multivariate logistic regression included gender, age, anatomical location, tumor gross type, clinical TNM stage, ICIs, taxanes, platinum agents and cycle of neoadjuvant treatment, while T-stage and N-stage were excluded to avoid multicollinearity. Forest plot was used to visualize the results from the logistic regression. All *p* values were two-sided with confidential intervals at the 95% level. $p < 0.05$ was considered significant in all analyses. No statistical method was used to predetermine the sample size.

Results

Baseline clinical characteristics

This study enrolled a total of 409 patients with ESCC who underwent neoadjuvant chemoimmunotherapy combined with surgery in our center between January 8, 2020, and July 2, 2025. Baseline clinical characteristics are shown in Table 1. The median age was 65 years (range: 37–86), with males accounting for 83.6%. Tumors were located in the proximal third of the esophagus in 73 patients (17.8%), the middle third in 187 patients (45.7%), and the distal third in 149 patients (36.4%). According to the AJCC 8th edition TNM staging system, 80 patients (19.5%) had stage II, 272 patients (66.5%) had stage III, and the remaining patients (13.9%) had stage IVA. The predominant gross type of ESCC was medullary (230/409, 56.2%), followed by ulcerative type (79/409, 19.3%), mushroom-umbrella type (71/409, 17.3%), and constrictive type (29/409, 7.0%). Most patients (279/409, 68.2%) received 2 cycles of neoadjuvant therapy, whereas 130 patients (31.8%) underwent more than 2 cycles of neoadjuvant therapy for the following reasons: 32 patients (24.6%) showed no significant reduction in tumor or lymph nodes by preoperative imaging evaluation, and 52 patients (40.0%) required a delay owing to poor physical condition and 46 patients (35.4%) for their own reasons. Patients were administered camrelizumab (45.5%), toripalimab (4.1%), tislelizumab (46.9%), sintilimab (3.5%) for immunotherapy, albumin-bound paclitaxel (79.4%), paclitaxel (10.3%), docetaxel (10.3%), carboplatin (73.8%), cisplatin (8.1%), or nedaplatin (18.1%) for chemotherapy.

Table 1
Baseline clinical characteristics of patients
who underwent neoadjuvant
chemoimmunotherapy combined with
surgery

Characteristics	n = 409 (%)
Gender	
Man	342 (83.6%)
Woman	67 (16.4%)
Age (Year)	
Median [Range]	65 [37–86]
Location	
Proximal	73 (17.8%)
Middle	187 (45.7%)
Distal	149 (36.4%)
Clinical disease stage	
II	80 (19.5%)
III	272 (66.5%)
IVA	57 (13.9%)
Tumor gross type	
Medullary	230 (56.2%)
Ulcerative	79 (19.3%)
Mushroom-umbrella	71 (17.3%)
Constrictive	29 (7.0%)
Neoadjuvant therapy cycle	
2	279 (68.2%)
> 2	130 (31.8%)
PD-1 inhibitors	
Camrelizumab	186 (45.5%)
Toripalimab	17 (4.1%)
Tislelizumab	192 (46.9%)

Characteristics	n = 409 (%)
Sintilimab	14 (3.5%)
Taxane	
Albumin-bound paclitaxel	325 (79.4%)
Paclitaxel	42 (10.3%)
Docetaxel	42 (10.3%)
Platinum	
Carboplatin	302(73.8%)
Cisplatin	33(8.1%)
Nedaplatin	74(18.1%)

Relationship between clinicopathological features and pathological response rate

All patients underwent complete resection (R0 = 100%), and the median number of lymph nodes removed during surgery was 32 (range, 11–85). The pathologic findings are presented in Table 2. After surgery, the postoperative pathologic results showed that, in the primary tumor, 104 patients (25.4%) achieved complete pathologic regression, of whom 91 (22.2%) had no residual tumor in either the primary lesion or lymph nodes (pCR). A total of 161 patients (39.4%) achieved MPR.

Table 2
Pathologic characteristics

Characteristics	n = 409(%)
ypTNM stage	
I	186(45.4%)
II	47(11.4%)
IIIA	71(17.3%)
IIIB	87(21.2%)
IVA	18(4.4%)
Tumour regression grade	
Grade 0	104(25.4%)
Grade 1	57(13.9%)
Grade 2	117(28.6%)
Grade 3	131(32.0%)
Pathological response rate	
pCR	91(22.2%)
MPR	161(39.4%)
Vascular invasion	86(21.0%)
Perineural invasion	100(24.4%)
Abbreviations: pCR, pathological complete response; MPR, major pathological response.	

As shown in Table 3, female patients exhibited a significantly higher pCR rate (34.3%) compared to male patients (19.9%, $\chi^2=5.95$, $p = 0.015$). Tumor location was significantly associated with MPR, but not with pCR: the proximal third of the esophagus had the highest MPR rate (47.9%), followed by the middle (43.3%) and distal (30.2%) thirds ($\chi^2=8.72$, $p = 0.013$); while the pCR rate was highest in the proximal third (30.1%), then middle (23.5%), and lowest in the distal third (16.8%, $\chi^2=5.38$, $p = 0.068$). These findings are consistent with the conclusions of our previous retrospective study [9]. Regarding tumor gross type, although no overall statistical significance was observed ($\chi^2=6.86$, $p = 0.077$), the constrictive type showed a significantly lower pCR rate (3.5%) compared to all other types combined (23.7%, $\chi^2=5.26$, $p = 0.022$). For MPR, the constrictive type also showed the lowest rate (20.7%), with a borderline significance when compared to other types (40.8%, $\chi^2=3.76$, $p = 0.053$). Among platinum agents, carboplatin was associated with the highest MPR rate (44.7%), significantly higher than cisplatin (21.2%) or nedaplatin (25.7%, $\chi^2=13.97$, $p < 0.001$). No significant correlations were observed between pCR or MPR and age, T stage, N stage, clinical TNM stage, immunotherapy agents, chemotherapy agents, or neoadjuvant

therapeutic cycles (all $p > 0.05$). These findings highlight that gender, tumor location, tumor gross type (particularly constrictive type), and the choice of platinum agents may influence pathological response in ESCC patients.

Table 3
Association of clinicopathological features with pCR or MPR

		pCR, n = 409(%)		<i>p</i>	MPR, n = 409(%)		<i>p</i>
		No	Yes		No	Yes	
Age	> 65	157 (38.4)	43 (10.5)	0.812	118 (28.9)	82 (20.0)	0.575
	≤ 65	161 (39.4)	48 (11.7)		130 (31.8)	79 (19.3)	
Gender	Female	44 (10.8)	23 (5.6)	0.015	37 (9.0)	30 (7.3)	0.393
	Male	274 (67.0)	68 (16.6)		211 (51.6)	131 (32.0)	
Location	Distal	124 (30.3)	25 (6.1)	0.068	104 (25.4)	45 (11.0)	0.013
	Middle	143 (35.0)	44 (10.8)		106 (25.9)	81 (19.8)	
	Proximal	51 (12.5)	22 (5.4)		38 (9.3)	35 (8.6)	
Clinical stage	II	58 (14.2)	22 (5.4)	0.423	43 (10.5)	37 (9.0)	0.338
	III	216 (52.8)	56 (13.7)		168 (41.1)	104 (25.4)	
	IVA	44 (10.8)	13 (3.2)		37 (9.0)	20 (4.9)	
Tumor gross type	Medullary	177 (43.3)	53 (13.0)	0.077	139 (34.0)	91 (22.2)	0.125
	Ulcerative	61 (14.9)	18 (4.4)		48 (11.7)	31 (7.6)	
	Mushroom-umbrella	52 (12.7)	19 (4.6)		38 (9.3)	33 (8.1)	
	Constrictive	28 (6.8)	1 (0.2)		23 (5.6)	6 (1.5)	
Tumor gross type	Constrictive	28 (6.8)	1 (0.2)	0.022	23 (5.6)	6 (1.5)	0.053
	Others	290 (70.9)	90 (22.0)		225 (55.0)	155 (37.9)	

Abbreviations: pCR, pathological complete response; MPR, major pathological response; ICIs: immune checkpoint inhibitors.

Neoadjuvant treatment Cycles	2	217 (53.1)	62 (15.2)	0.999	168 (41.1)	111 (27.1)	0.884
	> 2	101 (24.7)	29 (7.1)		80 (19.6)	50 (12.2)	
ICIs agents	Camrelizumab	146 (35.7)	40 (9.8)	0.874	116 (28.4)	70 (17.1)	0.529
	Sintilimab	10 (2.4)	4 (1.0)		7 (1.7)	7 (1.7)	
	Tislelizumab	148 (36.2)	44 (10.8)		117 (28.6)	75 (18.3)	
	Toripalimab	14 (3.4)	3 (0.7)		8 (2.0)	9 (2.2)	
Taxane	Docetaxel	37 (9.0)	5 (1.2)	0.235	32 (7.8)	10 (2.4)	0.091
	Albumin-bound paclitaxel	249 (60.9)	76 (18.6)		192 (46.9)	133 (32.5)	
	Paclitaxel	32 (7.8)	10 (2.4)		24 (5.9)	18 (4.4)	
Platinum	Carboplatin	226 (55.3)	76 (18.6)	0.024	167 (40.8)	135 (33.0)	< 0.001
	Cisplatin	31 (7.6)	2 (0.5)		26 (6.4)	7 (1.7)	
	Nedaplatin	61 (14.9)	13 (3.2)		55 (13.4)	19 (4.6)	
Abbreviations: pCR, pathological complete response; MPR, major pathological response; ICIs: immune checkpoint inhibitors.							

Logistic regression analysis between clinicopathological features and pathological response rate

Univariate logistic regression analysis (Fig. 2) revealed that both tumor location, tumor gross type and platinum agents were the significant predictors for both pCR (distal vs proximal, odds ratio (OR) = 0.467; 95% confidence interval (CI), 0.242–0.904, $p = 0.024$; constrictive type vs others, OR = 0.115; 95% CI, 0.015–0.857, $p = 0.035$; carboplatin vs cisplatin, OR = 5.212; 95% CI, 1.219–22.295, $p = 0.026$), and MPR (distal vs proximal, OR = 0.470; 95% CI, 0.264–0.837, $p = 0.010$; constrictive type vs others, OR = 0.379; 95% CI, 0.151–0.952, $p = 0.039$; carboplatin vs cisplatin, OR = 3.003; 95% CI, 1.264–7.130, $p = 0.013$), suggesting that tumor location, tumor gross type and platinum agents may universally influence the pathological response rate of neoadjuvant immunochemotherapy in ESCC. In addition, gender was only significantly associated with pCR (male vs female, OR = 0.547; 95% CI, 0.313–0.956; $p = 0.034$). Other

variables such as age, T stage, N stage, immunotherapy agents, and taxane agents did not show significant effects.

Multivariate logistic regression analysis (Fig. 3) revealed that both constrictive type and platinum agents were independently associated with pCR (constrictive type vs others, OR = 0.101; 95% CI, 0.013–0.771, $p = 0.027$; carboplatin vs cisplatin, OR = 5.514; 95% CI, 1.251–24.299, $p = 0.024$) and MPR (constrictive type vs others, OR = 0.349; 95% CI, 0.133–0.916, $p = 0.032$; carboplatin vs cisplatin, OR = 2.971; 95% CI, 1.201–7.351, $p = 0.018$). In addition, tumor location showed a significant positive correlation with MPR (distal vs proximal, OR = 0.474; 95% CI, 0.253–0.887). Other variables, including gender, age, TNM stage, and other treatment groups, did not demonstrate significant independent predictive value of either pCR or MPR.

Given the limited sample size in the constrictive type ($n = 29$), which may affect the stability of OR estimates, we performed a bootstrap internal validation with 2,000 resampling iterations to assess the robustness of the OR estimates for the constrictive type. The bootstrap-derived 95% confidence intervals for constrictive type remained consistent with our primary analysis (**Table S1**).

Discussion

In this retrospective cohort study of 409 ESCC patients receiving neoadjuvant immunochemotherapy followed by surgery, we observed a pCR rate of 22.2% and an MPR rate of 39.4%. Our analysis identified several clinicopathological factors associated with pathological response, among which tumor gross type (specifically the constrictive type), and the choice of platinum agent (carboplatin) were confirmed as independent predictors of both pCR and MPR. Additionally, tumor location (distal vs. proximal) were independently associated with MPR. These response rates are comparable to previously reported outcomes in neoadjuvant immunochemotherapy for ESCC [7, 8].

In our center, the medullary type was the most common gross type of ESCC, accounting for 56.2%, followed by the ulcerative type and mushroom-umbrella type, representing 19.3% and 17.4% respectively. The constrictive type was the rarest, accounting for 7.1%, which is consistent with previous research findings [17]. The study found that the pathological response rates varied across different gross types, and the constrictive type exhibited a significantly lower pCR (3.5%) and MPR (20.7%) compared to other gross types, warranting particular attention. The constrictive type is characterized by infiltrative growth, extensive desmoplastic reaction, and peritumoral fibrosis, which may impede drug penetration and immune cell infiltration, contributing to chemoresistance and immunotherapeutic tolerance [18]. To our knowledge, few studies have specifically investigated the constrictive type as an independent predictor of poor response in neoadjuvant chemoimmunotherapy. A previous study showed that ESCC with different gross types exhibited significant differences in biological characteristics [19]. Another study found that, for patients with pT1b to pT4aN0M0 ESCC who underwent radical surgery, those with the constrictive type might carry a higher risk of postoperative recurrence [13]. Ji et al. also found that patients with constrictive type ESCC had the highest positive rate of lymph node metastasis [20]. Our

multivariate analysis confirmed that the constrictive type retained independent predictive value of both pCR (OR = 0.101, $p = 0.027$) and MPR (OR = 0.349, $p = 0.032$). These findings collectively suggested that the constrictive type of ESCC might serve as a potential negative predictive marker in future risk stratification models, which underscored the necessity of incorporating tumor gross type assessment into pretreatment evaluation.

Tumor location also significantly influenced the pathological response, with proximal tumors showing the highest response rate and distal tumors the lowest. A possible explanation involved the regional differences in tumor biology, immune microenvironment, or etiology [21]. The differences in lymphatic drainage and local immune cell composition along the esophageal axis might influence the efficacy of combined immunotherapy [22, 23]. Current studies have not clearly demonstrated the differences in pathological response rates across different tumor locations, needing further research to elucidate the underlying mechanisms.

Regarding chemotherapy agents, carboplatin was associated with a significantly higher pCR and MPR rate compared to cisplatin or nedaplatin, and this association persisted in multivariate analysis for both pCR (OR = 5.514, $p = 0.024$) and MPR (OR = 2.971, $p = 0.018$). This is somewhat unexpected, as cisplatin has traditionally been considered more potent in esophageal cancer [24]. However, carboplatin might offer better tolerability, allowing more patients to complete planned cycles and maintain dose intensity when combined with immunotherapy. Previous studies comparing carboplatin and cisplatin in neoadjuvant regimens have yielded mixed results: some reported comparable pathological response rates [25], while others emphasized the favorable toxicity profile of carboplatin-paclitaxel combinations [26, 27]. We also compared the baseline characteristics across different platinum agents (**Table S2**), and found that the efficacy advantage in the carboplatin group was likely confounded by earlier clinical stage and albumin-bound paclitaxel combination regimens. However, the interaction term of platinum agents and clinical stage or taxane agents in logistic regression were not significant (**Figure S1**), indicated that the superior responses with carboplatin could be sustained across different clinical stage or taxanes agents. Nevertheless, the possibility of selection bias cannot be entirely excluded, and our findings should be interpreted cautiously until they were validated by randomized controlled trials.

Limitations of this study should be acknowledged. First, this was a single-center retrospective study with a limited sample size, particularly a small number of cases in the constrictive type, which may lead to inherent selection bias and unmeasured confounders. Although bootstrap internal validation supported the robustness of our findings, the limited sample size warrants caution in interpretation, and the findings require external validation in independent, larger-scale cohorts before clinical translation. Second, the treatment regimens were not fully standardized, with variations in immunotherapy (camrelizumab, tislelizumab, etc.) and chemotherapy combinations, although no significant differences were observed among immunotherapy agents. Third, the follow-up duration is insufficient to correlate pathological response with long-term survival outcomes such as disease-free survival or overall survival. Additionally, we lack direct molecular or immunohistochemical analysis of the tumor microenvironment (e.g., CD8 + T cell infiltration, PD-L1 expression, TMB, and tertiary lymphoid structures), so the

interpretation of observed phenomena remains at the hypothesis level, which need further research to provide mechanistic insights beyond morphological features.

Conclusion

Our study demonstrated that tumor gross type, particularly the constrictive type, the choice of platinum agents, and tumor location are independently associated with pathological response to neoadjuvant immunochemotherapy in ESCC. These findings may contribute to pretreatment risk stratification and inform personalized therapeutic strategies, but their potential value for clinical practice still requires further validation through larger-scale prospective trials.

Abbreviations

AJCC
American Joint Committee On Cancer
CI
Confidence Interval
CPS
Combined Positive Score
ICIs
Immune Checkpoint Inhibitors
MPR
Major Pathological Response
OR
Odds Ratio
pCR
Pathological Complete Response
PD-L1
Programmed Death Ligand-1
TMB
Tumor Mutation Burden
TNB
Tumor Neoantigen Burden
TRG
Tumor Regression Grade

Declarations

Ethics approval and consent to participate

This study was approved by the Clinical Research Ethics Committee of Army Medical Center of PLA (Approval No.: #2020–8401), and conducted in accordance with the Declaration of Helsinki. All data collection and analysis were performed under the premise of protecting patient privacy, and the written informed consent was waived.

Consent for publication

Not applicable

Competing interests

The authors declare no competing of interest.

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Author Contribution

XY: Conceptualization, Formal analysis; Project administration, Writing – original draft, Writing – review and editing. HXY: Data curation, Investigation, Writing – review and editing. HX: Formal analysis, Visualization. XJK: Methodology. KKL: Data curation. MFX: Funding acquisition, Supervision. MXL: Resources, Funding acquisition, Supervision, Writing – review and editing. All authors gave their final approval and agree to be accountable for all aspects of the work.

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Availability of data and materials

The datasets used and analysed during the current study are available from the corresponding author on reasonable request.

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Figures

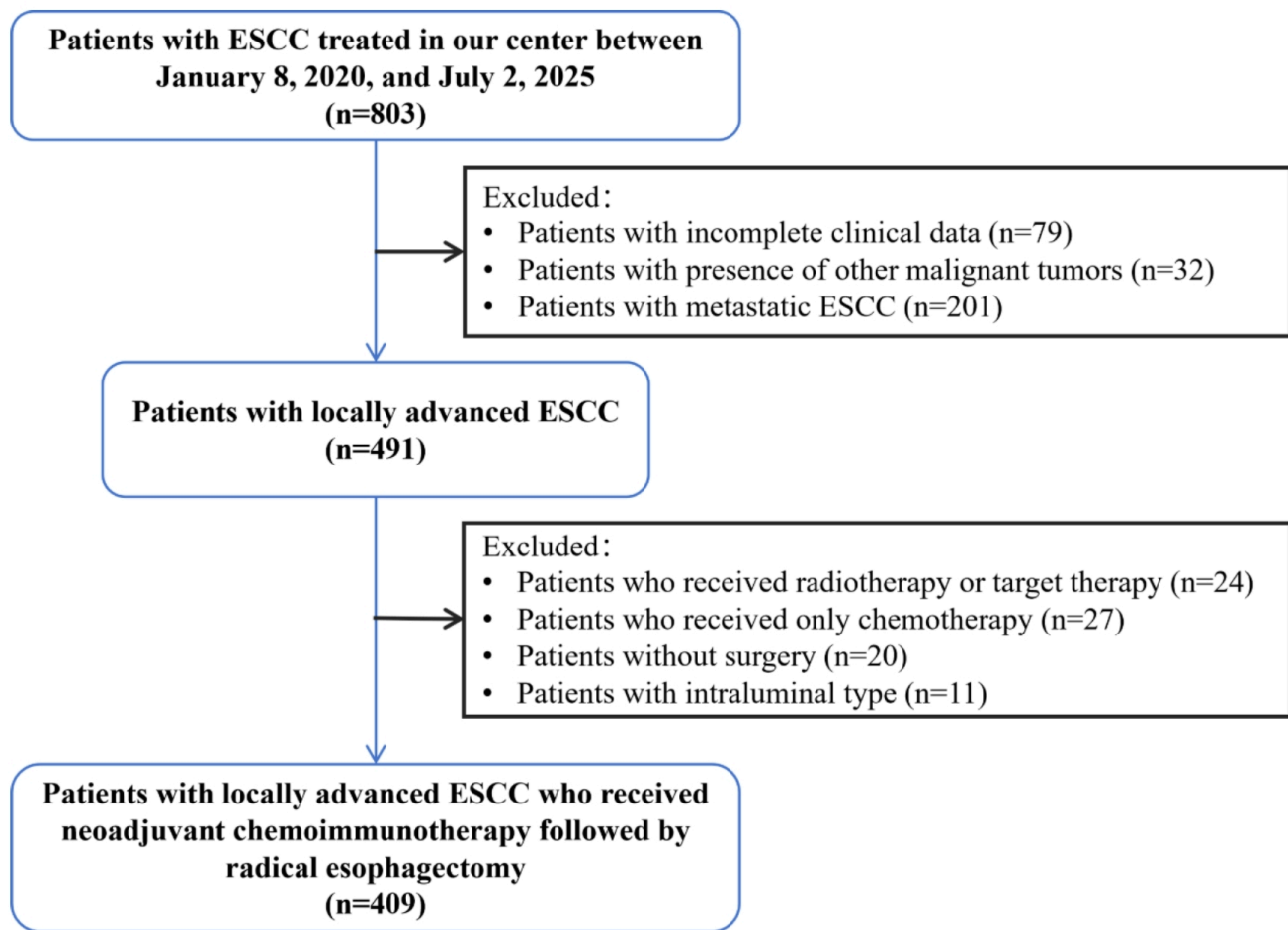


Figure 1

The screening flowchart.

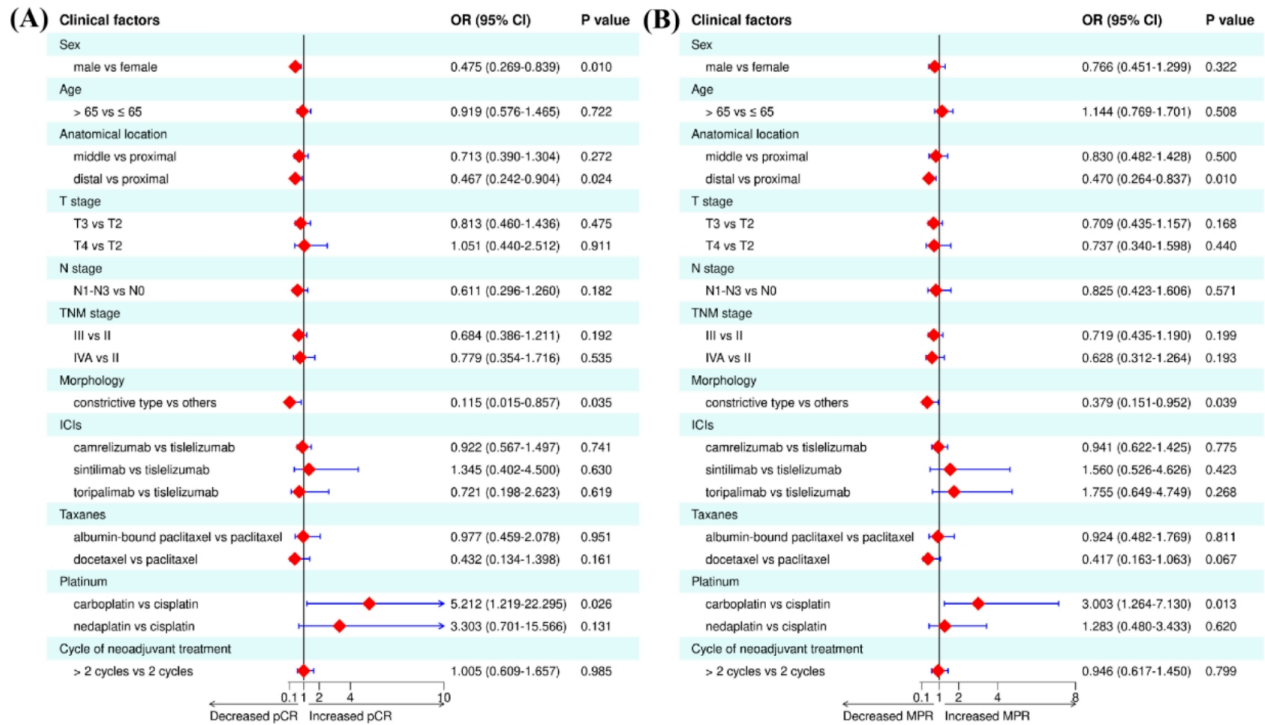


Figure 2

Univariate logistic regression analysis between clinicopathological features and pCR (A), MPR (B).

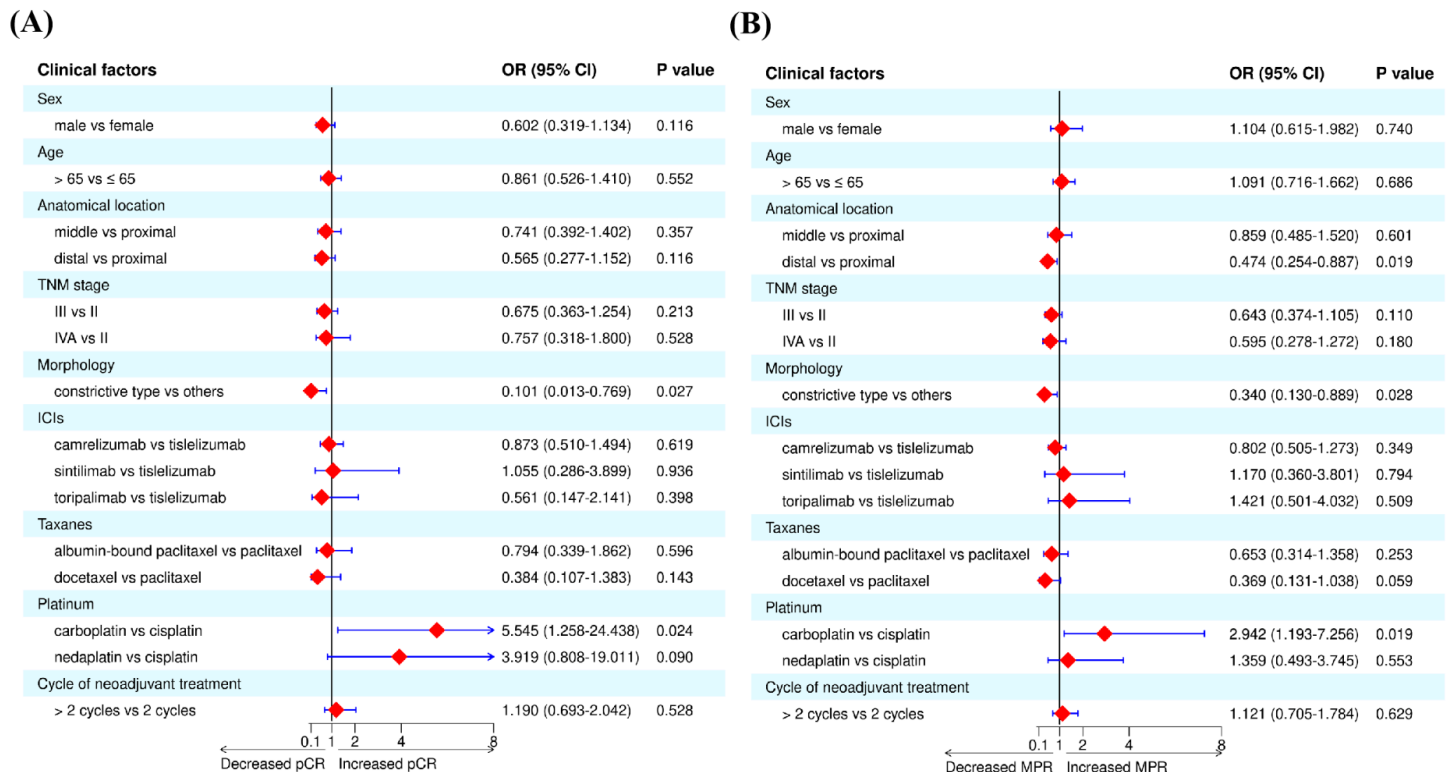


Figure 3

Multivariate logistic regression analysis between clinicopathological features and pCR (A), MPR (B).

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