ORIGINAL ARTICLE

Prognostic Factors of Chemotherapy Response and Survival in Non-Small Cell Lung Cancer: Data from Real-World Practice with Limited Access to Novel Therapy

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Background: Chemotherapy is a backbone treatment in advanced-stage non-small cell lung cancer (NSCLC) for non-targetable mutations and inaccessible to novel therapies. However, the data on the response rate, factors of chemotherapy response, and survival in Thailand are limited.

Objective: To find the chemotherapy response rate, factors that predict chemotherapy response and survival in advanced-stage NSCLC.

Materials and Methods: A retrospective cohort study was performed by including advanced-stage NSCLC patients older than 18 years old who received chemotherapy at the medical oncology unit, Sawanpracharak Hospital between July 2014 and January 2020. Demographic data, laboratory data, details of treatment, computed tomography (CT) of chest, and survival time were collected. Descriptive statistical analyses followed by univariable and multivariable were performed to determine factors associated with chemotherapy response. Kaplan-Meier survival curve was used to estimate overall survival (OS), and the log-rank test was performed to compare survival differences in each group. The univariable and multivariable Cox regression method was adopted for OS.

Results: Tree hundred four chemotherapy-treated advanced-stage NSCLC were included. The chemotherapy response rate was 45.5%, and ECOG 0-1 was a favorable prognosis for chemotherapy response (OR 3.03, 95% CI 1.480 to 7.370, p=0.004). Pericardial metastasis (HR 1.833, 95% CI 1.102 to 3.215, p=0.021), liver metastasis (HR 2.05, 95% CI 1.131 to 3.201, p=0.002), non-objective response rate (ORR) for chemotherapy (HR 1.429, 95% CI 1.099 to 1.859, p=0.008) were worse prognosis factors. Obtaining second-line and third-line systemic treatment were favorable prognoses of survival in advanced-stage NSCLC (HR 0.476, 95% CI 0.348 to 0.651, p<0.001 and HR 0.247, 95% CI 0.123 to 0.494, p<0.001, respectively).

Conclusion: The response rate in chemotherapy-treated advanced-stage NSCLC was 45.5%. ECOG 0-1 was an independent factor in chemotherapy response. Liver metastasis, pericardial metastasis, no subsequent treatment, and poor response to chemotherapy were worse prognosis outcomes in advanced-stage NSCLC.

Keywords: NSCLC; Advanced-stage; Factor of chemotherapy response; Factor of survival

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Lung cancer is a leading cause of death worldwide, with an estimated 2.2 million new cases and 1.2 million deaths of lung cancer in 2020[1]. Non-small cell lung cancer (NSCLC) comprises the majority of lung cancer and is diagnosed with advanced-stage cancer[2]. While recent discoveries and developments of molecular alterations and tailored medicines significantly improve the outcome of chemotherapy in advanced-stage NSCLC[3-8], these drugs may not be accessible in some countries or in cases without targetable mutation. Traditional chemotherapy remains the main treatment of most patients with advanced-stage NSCLC with an improvement in response and survival[9-11].

The previous study found that factors associated with response to platinum combined with old-generation chemotherapy in NSCLC were platelet at less than $440\times10^3/mm^3$, white blood count (WBC) at less than $1,000/mm^3$, absent adrenal gland and skin metastasis, and normal hemoglobin level[12]. The other studies including new-generation chemotherapy revealed that low baseline platelet-lymphocyte ratio (PLR)[13], baseline neutrophil-lymphocyte ratio (NLR), well to moderate differential carcinoma[14], smoking status, and Eastern Cooperative Oncology Group (ECOG)[15] are the predictive factors of chemotherapy response in advance stage NSCLC.

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Prognostic factors associated with survival such as ECOG, gender, smoking status, number of organ metastasis, epidermal growth factor receptor (EGFR) gene mutation, and tyrosine kinase inhibitor (TKI) treatment have been described for advanced-stage NSCLC[12,13,16,17]. However, the data on the response and survival rate of treatment advanced-stage NSCLC with limited access to novel therapy in Thailand remain underrepresented[18,19]. The aim of the present study is to identify chemotherapy response rate, factors that affect the chemotherapy response, and survival in advanced advanced-stage NSCLC in real practice with limited access to novel therapy.

Material and Method

The present study was a retrospective cohort study conducted at the medical oncology unit at Sawanpracharak Hospital, Thailand. Patients eligible for inclusion were 18 years or older, had histological/cytological confirmation for new case or recurrence of stage IIIB-IV NSCLC who received first line chemotherapy treatment. Ethic approval was obtained from the Human Research Ethics Committee of Sawanpracharak Hospital, certificate approval no. 21/2565

Data collection and assessment

All data were collected from the electronic medical record. The information was evaluated baseline characteristics regarding age, gender, body weight, body mass index (BMI), smoking history, ECOG, histology, comorbid disease, concomitant medications, stage, organ metastasis, EGFR mutations, baseline laboratory testing, and details of treatment. The chemotherapy regimen was selected depending on the oncologist. Tumor response was assessed by the response evaluation criteria in solid tumor (RECIST), version 1.1. The response was categorized into complete response (CR), partial response (PR), stable disease (SD), and progressive disease (PD)[20]. The objective response rate (ORR) included patients with CR or PR following treatment. Response evaluation by computed tomography (CT) scan was done after four cycles of chemotherapy or clinical deterioration.

The overall survival (OS) was calculated from the date of diagnosis to the date of death or date of last known follow-up. Risk factors that affect the chemotherapy response and associated with survival in advanced stage NSCLC were determined statistically.

Statistical analyses

Based on response rate of chemotherapy treated NSCLC in the previous study[9]. The sample size was calculated using 80% power, 5% type I error with 5% precision margin, and an addition of 15% to prevent data loss or incompleteness, therefore, the sample size was 283.

Wilcoxon rank-sum tests and independent t-test were used to compare continuous data and data were reported as median (IQR) or mean ± standard deviation. Chi-square test or Fisher's exact test were used to compare categorical data. To identify the factors associated with chemotherapy response, univariable and multivariable logistic regression were performed. Statistically significant factors in univariable analysis were evaluated as potential covariates in multivariable logistic regression analysis. Time-to-event data were compared by log-rank test and median survival was estimated and represented as Kaplan-Meier survival curve. Univariable and multivariable Cox regression method were used to find independently associated variables with OS. Those variables found statistically significant in univariate analysis and clinically relevant were included in stepwise multiple Cox regression model with a probability of entry of 0.05 and probability of removal of 0.10. A p-value of less than 0.05 was considered statistically significant. All analyses were performed using IBM SPSS Statistics, version 26.0 (IBM Corp., Armonk, NY, USA).

Results

Three hundred four advanced-stage NSCLC patients diagnosed between July 2014 and January 2020 were retrospectively enrolled. Two hundred eighty-eight patients (94.73%) had evidence of treatment response. The median age was 65 years old with higher proportion of male (56.6%) than female (43.4%). The patient's characteristics and details of treatment are summarized in Table 1. Patients with ORR, SD, and PD (non-ORR) were 45.5%, 28.1%, and 26.4% respectively. Of the patients with NSCLC, 163 patients (56.6%) had a history of smoking and median smoking was 30 pack-year. Two hundred thirty-one patients (80.2%) had ECOG 0-1, 197 patients (68.4%) were diagnosed with adenocarcinoma, and 35 patients (12.1%) received EGFR testing. No difference in the site of organ metastasis in the ORR and non-ORR groups was observed. Almost all regimen chemotherapy was platinum-based with 98.9%. There was a significantly higher median cycle of chemotherapy in ORR than

Table 1. Patients characteristics

Characteristic	Total (n=288)	ORR (n=131)	Non-ORR (n=157)	p-value
Age (years); median (IQR)	65 (58 to 70)	64 (57 to 69)	66 (59 to 72)	0.012
Female; n (%)	125 (43.4)	69 (52.7)	56 (35.7)	0.004
Smoking; n (%)	163 (56.6)	65 (49.6)	98 (62.4)	0.031
Pack-year; median (IQR)	30 (20 to 40)	30 (20 to 40)	30 (20 to 40)	0.083
Weight loss; n (%)	162 (56.3)	64 (48.9)	98 (62.4)	0.021
BMI; median (IQR)	20.15 (17.96 to 22.58)	20.76 (18.22 to 23.45)	19.16 (17.78 to 22.12)	0.015
ECOG; n (%)				<0.001
ECOG 0-1	231 (80.2)	120 (91.6)	111 (70.7)	
ECOG ≥2	57 (19.8)	11 (8.4)	46 (29.3)	
Comorbid disease; n (%)	185 (64.2)	78 (59.5)	107 (68.2)	0.129
Renal disease	67 (23.3)	23 (17.6)	44 (28.0)	0.036
Diabetic mellitus	27 (9.4)	16 (12.3)	11 (7.0)	0.126
Hypertension	93 (32.3)	43 (32.8)	50 (31.8)	0.860
COPD	24 (8.3)	11 (8.4)	13 (8.3)	0.972
Cardiovascular disease	15 (5.6)	4 (3.1)	12 (7.6)	0.090
Cerebrovascular disease	11 (3.8)	2 (1.5)	9 (5.7)	0.064
Concomitant herbal medicine; n (%)	7 (2.4)	4 (3.1)	3 (1.9)	0.531
Concomitant anticoagulant; n (%)	15 (5.2)	3 (2.3)	12 (7.7)	0.041
Diagnosis; n (%)				0.804
Newly diagnosis	283 (98.3)	129 (98.5)	154 (98.1)	
Recurrence Disease	5 (1.7)	2 (1.5)	3 (1.9)	
Histology; n (%)				0.005
Adenocarcinoma	197 (68.4)	99 (75.6)	98 (62.4)	
Squamous cell carcinoma	57 (19.8)	15 (11.5)	42 (26.8)	
Others	34 (11.8)	17 (12.9)	17 (10.8)	
Stage; n (%)				0.032
IIIB	27 (9.4)	7 (5.3)	20 (12.7)	
IV	261 (90.1)	124 (94.7)	137 (87.3)	
Site of metastasis; n (%)				
Brain	37 (12.8)	17 (13.0)	20 (12.7)	0.952
Lung	159 (55.2)	73 (55.7)	66 (42)	0.872
Pleural	130 (45.1)	65 (49.6)	66 (42)	0.163
Liver	29 (10.1)	9 (6.9)	20 (12.7)	0.099
Bone and soft tissue	46 (16)	22 (16.8)	24 (15.3)	0.728
Lymph node	44 (15.3)	19 (14.5)	25 (15.9)	0.739
Adrenal	30 (10.4)	15 (11.5)	15 (9.6)	0.600
Pericardial metastasis	18 (6.3)	9 (6.9)	9 (5.7)	0.691
EGFR; n (%)				0.896
EGFR mutation	16 (5.6)	8 (6.1)	8 (5.1)	
EGFR wild type	19 (6.6)	8 (6.1)	11 (7.0)	
No testing	253 (87.8)	115 (87.8)	138 (87.9)	
WBC (mm^3); median (IQR)	8,950 (7,182.50 to 11,350)	8,880 (7,250.00 to 11,200.00)	9,100 (6,980 to 11,600)	0.663
Neutrophil (mm^3); median (IQR)	5,943 (445.00 to 8096.50)	5,910 (5560.00 to 7567.00)	6,060 (4,430 to 8,502)	0.559
Lymphocyte (mm^3); median (IQR)	1,715 (1,230 to 2,380)	1,762 (1,282 to 2,280)	1,650 (1,220 to 2,270)	0.164
Hemoglobin (mm^3); mean±SD	11.68±1.71	11.84±1.59	11.55±1.80	0.166[a]

BMI=body mass index; ECOG=Eastern Cooperative Oncology Group; COPD=chronic obstructive pulmonary disease; EGFR=epidermal growth factor receptor; WBC=white blood count; PLR=platelet-to-lymphocyte ratio; NLR=neutrophil-lymphocyte ratio; GFR=growth factor receptor; CMT=chemotherapy; RT=radiotherapy; IQR=interquartile range; SD=standard deviation; ORR=objective response rate

[a] Independent t-test

Table 1. (continued)

Characteristic	Total (n=288)	ORR (n=131)	Non-ORR (n=157)	p-value
Platelet (×10 mm^3); median (IQR)	337 (277.75 to 432.25)	327 (277 to 420)	343 (279 to 435)	0.578
PLR; median (IQR)	201.84 (141.48 to 283.63)	204.53 (132.94 to 283.69)	194.10 (151.82 to 283.62)	0.357
NLR; median (IQR)	3.50 (2.47 to 5.28)	3.27 (2.34 to 4.58)	3.83 (2.51 to 5.56)	0.092
Albumin (g/dL); median (IQR)	3.70 (3.2 to 4.0)	3.80 (3.40 to 4.17)	3.55 (3.00 to 3.90)	0.001
GFR (mL/min/1.73^2); median (IQR)	76 (56.75 to 91.97)	79.87 (60 to 91)	76 (54.34 to 91.79)	0.528
Regimen chemotherapy; n (%)				0.003
Single-agent platinum	41 (14.1)	9 (6.9)	32 (20.4)	
Platinum/gemcitabine	44 (15.3)	22 (16.8)	22 (14)	
Platinum/paclitaxel	200 (69.4)	100 (76.3)	100 (63.7)	
Others	3 (1.1)	3 (1.9)	-	
Cycle CMT; median (IQR)	4.5 (4 to 6)	6 (6 to 6)	4 (2 to 4)	<0.001
Palliative RT; n (%)				
Mediastinum/SVC	5 (1.7)	1 (0.8)	4 (2.5)	0.248
Lung	22 (7.6)	8 (6.1)	14 (8.9)	0.371
Brain	10 (3.5)	5 (3.8)	5 (3.2)	0.770
Bone and soft tissue	6 (2.0)	3 (2.3)	2 (1.3)	0.415
Total systemic treatment; n (%)				0.059
1st line	195 (67.7)	78 (59.8)	117 (74.5)	
2nd lines	78 (27.1)	45 (34.4)	33 (21)	
≥3rd lines	15 (5.2)	8 (6.1)	7 (4.4)	

BMI=body mass index; ECOG=Eastern Cooperative Oncology Group; COPD=chronic obstructive pulmonary disease; EGFR=epidermal growth factor receptor; WBC=white blood count; PLR=platelet-to-lymphocyte ratio; NLR=neutrophil-lymphocyte ratio; GFR=growth factor receptor; CMT=chemotherapy; RT=radiotherapy; IQR=interquartile range; SD=standard deviation; ORR=objective response rate

[a] Independent t-test

Table 2. Univariable and multivariable for ORR

Factors	Univariable for response to CMT			Multivariable for response to CMT		
	OR	95% CI	p-value	OR	95% CI	p-value
Age ≥70 years	0.509	0.298 to 0.872	0.013	0.905	0.449 to 1.826	0.781
Smoking	0.583	0.364 to 0.934	0.025	0.918	0.426 to 1.980	0.828
Female	2.007	1.250 to 3.223	0.004	1.784	0.831 to 3.830	0.138
Adenocarcinoma	1.863	1.115 to 3.111	0.017	1.488	0.809 to 2,737	0.201
ECOG 0-1	4.521	2.23 to 9.165	<0.001	3.280	1.469 to 7.321	0.004
Weight loss	0.575	0.359 to 0.921	0.021	0.841	0.472 to 1.499	0.558
Renal disease	0.547	0.310 to 0.966	0.038	0.921	0.265 to 3.198	0.896
GFR >60 mL/min/1.73^2	1.908	1.114 to 3.268	0.018	2.431	0.756 to 7.816	0.136
Concomitant anticoagulants	0.281	0.078 to 1.019	0.053			
Combination CMT	3.470	1.59 to 7.574	0.002	1.997	0.752 to 5.300	0.165
Severe thrombocytopenia during CMT	0.143	0.018 to 1.161	0.069			
PLR	0.988	0.997 to 1.00	0.033	0.999	0.997 to 1.001	0.306
Dose reduction	0.526	0.322 to 0.826	0.010	1.600	0.826 to 3.098	0.164
Dose interrupt	0.596	0.360 to 0.987	0.044	1.610	0.788 to 3.290	0.191

ECOG=Eastern Cooperative Oncology Group; GFR=growth factor receptor; PLR=platelet-to-lymphocyte ratio; CMT=chemotherapy; HR=hazard ratio; CI=confidence interval

non-ORR at six versus four cycles (p<0.01). Ninety-three patients (32.3%) received second- and third-line of systemic treatment.

The univariable analysis found that age, gender, smoking, adenocarcinoma subtype, ECOG performance status, weight loss, renal disease,

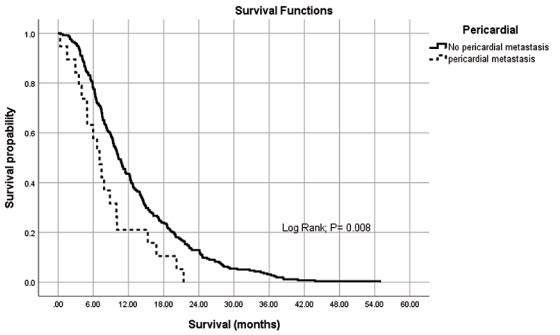

Figure 1. Overall survival, stratified by pericardial metastasis.

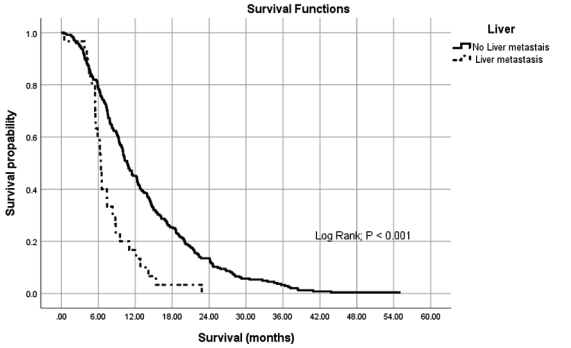

Figure 2. Overall survival, stratified by liver metastasis.

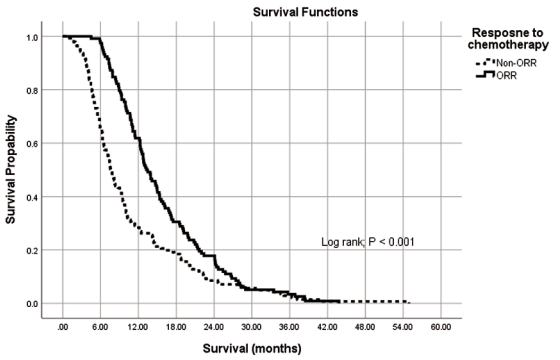

Figure 3. Overall survival, stratified by chemotherapy response.

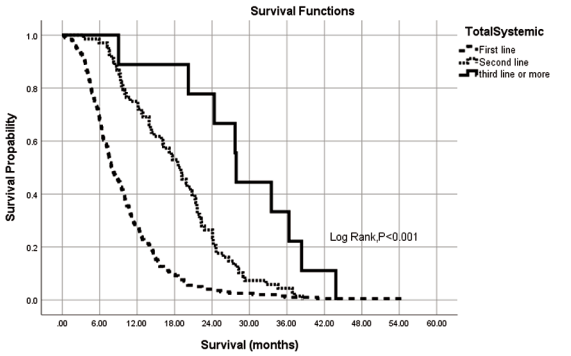

Figure 4. Overall survival, stratified by amount of systemic treatment.

baseline PLR, combination chemotherapy, dose reduction, and dose interrupt chemotherapy were associated with chemotherapy response. The multivariable analysis found that ECOG 0-1 (OR 3.03, 95% CI 1.480 to 7.370, p=0.004) was a predictive factor response of chemotherapy (Table 2).

The data cutoff was June 30, 2021. There were 274 patients or 90.13% that passed away and median OS were 10.03 months from 0.33 to 54.93 months. There was a significant reduction in survival in pericardial metastasis, liver metastasis, non-ORR chemotherapy, and limited access to systemic treatment (Figure 1-4). Univariable analysis revealed that gender, ECOG, amount of organs metastasis, bone or soft tissue, pericardial and liver metastasis, amount of systemic treatment, exposed TKI, and response to chemotherapy were associated with survival. The multivariable analysis found that pericardial metastasis (HR 1.833, 95% CI 1.102 to 3.215, p=0.021), liver metastasis (HR 2.05, 95% CI 1.131 to 3.201, p=0.002), and non-ORR chemotherapy (HR 1.429, 95% CI 1.099 to 1.859, p=0.008) were worse prognosis of survival. Patients who received second-line and third-line systemic treatment had favorable prognoses of survival in advanced-stage NSCLC (HR 0.476, 95% CI 0.348 to 0.651, p<0.001 and HR 0.247, 95% CI 0.123 to 0.494, p<0.001, respectively) (Table 3).

Discussion

The present study comprehensively analyzed the treatment response to chemotherapy and survival outcomes in advanced-stage NSCLC. In context of ORR, it is a valuable marker of therapeutic response over a limited period of time. A systematic review of 44 randomized controlled trials (RCTs) found that ORR could potentially be useful surrogate to OS, although they are not strong enough to replace it as primary endpoint[21]. In the present study, ORR was 45.5%. The response rate was higher in Asian population than Caucasians, which is consistent with the prior studies[22,23]. Female, younger than 70 years old, no history of smoking, no weight loss, adenocarcinoma (ADC) histology, good ECOG, no renal disease, combination of chemotherapy, no dose chemotherapy reduction, and no chemotherapy interruption were associated with ORR. The multivariable analysis found that

Table 3. Univariable and multivariable of poor survival

Factors	Subgroup	n	mOS (month)	Univariate for survival			Multivariate for survival		
				HR	95% CI	p-value	HR	95% CI	p-value
Sex	Female	119	12.16	1		0.006	1		0.171
	Male	155	8.93	1.402	1.101 to 1.787		1.199	0.925 to 1.553	
ECOG	0-1	209	11.03	1		<0001	1		0.129
	≥2	65	6.93	1.848	1.394 to 2.451		0.778	0.563 to 1.076	
Metastasis	≤2 organs	201	10.70	1		0.021	1		0.243
	≥3 organs	73	8.83	1.376	1.049 to 1.830		1.246	0.861 to 1.802	
Adrenal gland metastasis	No	240	10.10	1		0.053			
	Yes	33	7.90	1.435	0.995 to 2.071				
Bone/soft tissue metastasis	No	222	10.20	1		0.047	1		0.597
	Yes	52	8.20	1.363	1.005 to 1.848		1.107	0.761 to 1.610	
Pericardial metastasis/MPE	No	255	10.26	1		0.009	1		0.021
	Yes	19	7.06	1.872	1.169 to 2.996		1.883	1.102 to 3.215	
Liver metastasis	No	244	10.70	1		<0.001	1		0.002
	Yes	30	6.40	2.351	1.591 to 3.474		2.050	1.131 to 3.201	
Total systemic treatment	1st lines	197	7.90	1			1		
	2nd lines	68	18.60	0.400	0.300 to 0.532	<0.001	0.476	0.348 to 0.56	<0.001
	≥3rd line	9	27.86	0.207	0.105 to 0.410	<0.001	0.247	0.123 to 0.494	<0.001
TKI	Yes	12	20.20	1		0.036	1		0.134
	No	262	9.93	1.863	1.042 to 3.330		1.659	0.855 to 3.218	
Reponses to CMT	ORR	118	13.267	1		<0.001	1		0.008
	Non-ORR	141	7.600	1.627	1.271 to 2.082		1.429	1.099 to 1.859	

ECOG=Eastern Cooperative Oncology Group; MPE=malignant pericardial effusion; TKI=tyrosine kinase inhibitor; CMT=chemotherapy; mOS=median overall survival; HR=hazard ratio; CI=confidence interval

ECOG performance status was a predictive factor of chemotherapy response. ECOG is a reliable measure of functional independence, and an important factor in treatment decisions. Patients with good ECOG will be able to tolerate the side effects and receive complete course chemotherapy. These may be the reason for ECOG to be a prognostic determinant of response and survival, with other studies supporting this finding[15,24-26]. EGFR mutation status was not a prognosis factor of chemotherapy response unlike the other studies[27,28] due to less EGFR mutation testing. The present study found that chemotherapy dose reduction and interruption were not predictors of the chemotherapy response and survival. Response to chemotherapy must also consider relative dose intensity (RDI). In general, RDI more than 85% does not affect the effectiveness of chemotherapy in killing cancer cells[29,30]. Previous studies have shown that combination chemotherapy led to a higher response rate than single agent chemotherapy[31,32], which is different to the finding from this research. There are factors that influence chemotherapy response such as tumor and treatment factors. The previous study focused on expression or activities of drug metabolism enzymes, drug transporters, and drug target enzymes that modulate intracellular drug accumulation are relevant to platinum response such as expression of excision repair cross-complementation group 1 (ERCC1) proven to be correlated with cisplatin resistance in NSCLC[33,34]. Despite recent advances in molecular causes of chemo-drug resistance, no biomarkers have been identified for predicting treatment sensitivity in practice[35]. To understand the mechanism of chemotherapy sensitivity and resistance as well as the effects of lung cancer chemotherapy, more research is necessary beyond genetic aberration, tumor environment, and race.

The overall survival in the present study was 10.03 months, which is similar to the survival time before EGFR-TKI era[9-11]. In general, female report better outcome compared to male[36]. An ECOG study revealed that the median survival for female was 9.2 months compared to 7.3 months in male[37]. The present study also found longer survival in female compared to male. The authors hypothesized that low smoking prevalence (female 17.6% versus male 86.5%, p<0.001) and higher ORR (female 55.2% versus male 38%, p=004) may be the reason for this

finding. Unlike other studies[11,38], histology subtype (ADC versus non-ADC), EGFR status, and TKI treatment had no effect on survival. This may be attributed to the limited access to EGFR mutation testing (n=37, 12.2%) and TKI treatment (n=16, 5.3%) caused by the lack of reimbursement for testing and medication from universal health coverage in Thailand at that time. The study found that good response to first-line chemotherapy and access to subsequent treatment were predictive indicators of survival. Patients who respond well to first-line treatment can receive systemic treatment on a second and third regimens more frequently than patients who do not respond as well. In addition, it was found that oligometastatic showed longer survival than multiple organs metastasis. The multivariable analysis revealed that liver and pericardial metastasis were worse prognosis for survival. Incidence of liver metastasis was 13% to 15%[39,40], consistent with the present study. Prior to the use of targeted and immunotherapy therapy, liver metastasis had poor outcomes in NSCLC patients who received cytotoxic chemotherapy[41] and median overall survival was 4.4 months[42]. The recent studies found that liver metastasis did not significantly affect survival in immunotherapy treatment[42-44]. Therefore, NSCLC with liver metastasis should obtain more options for treatment than chemotherapy. Retrospective study reported that incidence of pericardial metastasis or malignant pericardial effusion (MPE) was 3% in lung cancer[45] and median survival was less than three months[46]. Although NSCLC with pericardial effusion is associated with poor prognosis, chemotherapy is shown to improve survival in NSCLC with MPE. ADC histology had a better prognosis of survival than SCCA[47]. Current reports on efficacy of immunotherapy or chemoimmunotherapy for MPE are scarce. Reports have implicated immunotherapy as a cause of cardiac tamponade. Immune checkpoint inhibitors activate T-cell, therefore, their adverse effects are mostly immune-mediated rection such as pericarditis, which may progress to pericardial effusion and tamponade[48]. Both pericardial and liver metastasis may indicate that the disease burden was high and worse prognosis for survival in advance-stage NSCLC.

The present study had limitations. Firstly, the present study was a retrospective study, which only permitted the evaluation of data found in medical records. Secondly, the present study was conducted in Thailand with a universal health coverage that limited the use of medication that may influence patient survival.

In conclusion, the present study found that chemotherapy response rate in Thai patients with advanced-stage NSCLC were 45.5%. ECOG 0-1 was a favorable prognosis to chemotherapy response. Liver metastasis, pericardial metastasis, no subsequence systemic treatment, and poor response to chemotherapy were worse prognostic factors in advanced-stage NSCLC.

What is already known on this topic?

Chemotherapy response rate in lung cancer varied between 20% to 50%. No biomarker or predictive model is used to predict the chemotherapy response in real practice. ECOG performance status is a predictive factor of survival in lung cancer.

What this study adds?

Chemotherapy response rate in advanced-stage NSCLC in the lower north of Thailand was 45.5%. ECOG 0-1 is an independent factor of chemotherapy response. Liver metastasis, pericardial metastasis, no subsequent treatment, and poor response to chemotherapy were the worse prognostic outcome in advanced-stage NSCLC.

Authors' contribution

SN performed design study, data collection, statistics analysis, and manuscript writing.

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Conflicts of interest

The author has no conflict of intertest to declare.

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