ORIGINAL

# Ability of the Glasgow Prognostic Score to predict the tolerability and efficacy of platinum-combination chemotherapy among elderly patients with advanced non-small cell lung cancer

Kazuhisa Nakashima, Kojiro Hata, Takamasa Hotta, Seiko Tanaka, Yuki Mitarai, Takae Okuno, Akari Tanino, Mika Nakao, Yoshihiro Amano, Megumi Hamaguchi, Tamio Okimoto, Shunichi Hamaguchi, Taishi Nagao, Noriaki Kurimoto, Takeshi Isobe, and Yukari Tsubata

*Department of Internal Medicine, Division of Medical Oncology & Respiratory Medicine, Shimane University Faculty of Medicine, Shimane, Japan*

**Abstract : *Background* : Although platinum-combination chemotherapy is widely used to treat advanced non-small cell lung cancer (NSCLC), not all elderly patients benefit from this regimen. In this retrospective study, we aimed to evaluate whether the Glasgow Prognostic Score (GPS), an indicator of systemic inflammation and malnutrition, could predict the tolerability and efficacy of platinum-combination chemotherapy among elderly patients with NSCLC. *Methods* : The eligibility criteria included patients aged ≥70 years with NSCLC treated with first-line platinum-combination chemotherapy at Shimane University Hospital between January 2015 and December 2018. *Results* : Thirty-two patients with NSCLC (median age, 74 years) were included. The GPS scores were 0–1 for 19 patients and 2 for 13 patients. Four chemotherapy cycles were completed by 57.9% and 30.8% of patients in the GPS 0–1 and GPS 2 groups, respectively. The GPS 0–1 group experienced better outcomes than the GPS 2 group (response rate : 26% vs. 15%, *P*=0.67 ; median progression-free survival : 4.1 vs. 2.1 months, P=0.0026 ; median overall survival : 22.8 vs. 9.6 months, *P*=0.0092). *Conclusions* : Platinum-combination chemotherapy demonstrated promising efficacy among elderly NSCLC patients with a GPS 0–1. Therefore, GPS may be crucial in determining whether treatments recommended for younger patients are suitable for older patients with NSCLC. J. Med. Invest. 68 : 260-264, August, 2021**

***Keywords*** **:** *non-small cell lung cancer, platinum-combination chemotherapy, Glasgow Prognostic Score, elderly patients*

## INTRODUCTION

Platinum-combination chemotherapy is a widely used standard treatment for advanced non-small cell lung cancer (NSCLC) (1). The recent development of reduced toxicity in platinum-combinations has broadened its scope by including elderly patients (2-5). However, elderly patients experience age-related changes along with the development of comorbidities, implying that not all elderly patients benefit from platinum-combination chemotherapy. For example, although a subset analysis of the CA031 study data demonstrated that carboplatin plus nanoparticle albumin-bound paclitaxel is safe and effective among elderly patients, a phase II study to assess the efficacy and safety of the treatment regimen was interrupted because of treatment-related mortality and serious adverse events among elderly patients with NSCLC (4, 6).

The Glasgow Prognostic Score (GPS) is an indicator of systemic inflammation and malnutrition (7, 8). Fujio *et al*. retrospectively demonstrated that among patients with advanced NSCLC and an Eastern Cooperative Oncology Group performance status (PS) of 2, a high GPS was associated with poorer outcomes than a low GPS (9). Thus, the GPS may be useful for identifying elderly patients with NSCLC who are likely to benefit from platinum-combination chemotherapy. The present study aimed to evaluate whether the GPS could predict the tolerability and efficacy of platinum-combination chemotherapy in elderly patients with NSCLC.

Received for publication January 18, 2021 ; accepted April 21, 2021.

Address correspondence and reprint requests to Yukari Tsubata, MD, PhD, Department of Internal Medicine, Division of Medical Oncology & Respiratory Medicine, Shimane University Faculty of Medicine, 89-1 Enya-cho, Izumo, Shimane, Japan and Fax : +81-853-20-2581.

## PATIENTS AND METHODS

### *Patients*

We retrospectively reviewed elderly patients with NSCLC who received platinum-combination chemotherapy as first-line treatment at the Shimane University Hospital between January 2015 and December 2018. The study's retrospective protocol was approved by our Institutional Review Board (approval number : 4654, approval date : June 4, 2020), which also waived the requirement for informed consent. Based on several previous studies, "elderly" patients were defined as being aged ≥70 years (2, 4, 6). Patients were excluded from this study if they had epidermal growth factor receptor gene mutations or anaplastic lymphoma kinase fusion genes.

### *Assessments*

Blood tests were conducted for all patients to determine their pretreatment serum concentrations of serum albumin (Alb) and C-reactive protein (CRP). Those findings were used to determine the GPS scores (7, 8) : a GPS of 0 was defined as patients with CRP concentration of <1.0 mg/dL and Alb concentration of ≥3.5 mg/dL ; a GPS of 1 was defined as patients with CRP concentration of ≥1.0 mg/dL or Alb concentration of <3.5 mg/dL ; and a GPS of 2 as patients with CRP concentration of ≥1.0 mg/dL and

Alb concentration of < 3.5 mg/dL. In a retrospective study for advanced patients with NSCLC with a PS of 2, Fujio *et al*. compared the outcomes to a GPS 0–1 group or a GPS 2 group (9). Similarly, in our study, the patients were assigned to a GPS 0–1 group or a GPS 2 group for the analyses to compare the tolerability and efficacy of platinum-combination chemotherapy. Treatment responses were retrospectively assessed using version 1.1 of the Response Evaluation Criteria in Solid Tumors. Adverse events were evaluated using version 5.0 of the Common Terminology Criteria for Adverse Events.

*Statistical methods*

Progression-free survival (PFS) and overall survival (OS) outcomes were evaluated using the Kaplan-Meier method and log-rank test. All other analyses were performed using Fisher's exact test. Differences were considered statistically significant at P-values of < 0.05. The analyses were performed using JMP software (version 10.0 ; SAS Institute, Cary, NC, USA).

## RESULTS

*Patient characteristics*

The study included 32 patients (29 men and 3 women) with a median age of 74 years, and their characteristics are listed in Table 1. The GPS 0–1 group included 19 patients (GPS 0 included 14 patients and GPS 1 included 5 patients), and the GPS 2 group included 13 patients. The GPS 0–1 group included 6 patients with a PS of 0, 11 with a PS of 1, and 2 with a PS of 2. All 13 patients in the GPS 2 group had a PS of 1. Chronic obstructive pulmonary disease, diabetes mellitus, and heart disease were common comorbidities. Most patients received carboplatin as the platinum agent. Although there were no significant differences in the baseline characteristics of the two groups, the GPS 0–1 group had higher proportions of female patients, presence of other cancers, and interstitial lung disease.

Table 1. Patient characteristics

| | | GPS 0–1 (n = 19) | GPS 2 (n = 13) |
|---|---|---|---|
| Age, years | Median (range) | 74 (70–84) | 74 (70–82) |
| Sex, n (%) | Female | 3 (15.8%) | 0 (0%) |
| Histology, n (%) | Non-SCC | 11 (57.9%) | 6 (46.2%) |
| | SCC | 8 (42.1%) | 7 (53.8%) |
| Stage, n (%) | III | 4 (21.0%) | 2 (15.4%) |
| | IV | 15 (78.9%) | 11 (84.6%) |
| PS, n (%) | 0 | 6 (31.6%) | 0 (0%) |
| | 1 | 11 (57.9%) | 13 (100%) |
| | 2 | 2 (10.5%) | 0 (0%) |
| Comorbidities, n (%) | COPD | 8 (42.1%) | 5 (38.5%) |
| | DM | 6 (31.6%) | 6 (46.2%) |
| | Heart disease | 6 (31.6%) | 4 (30.8%) |
| | Other cancer | 7 (36.8%) | 1 (7.7%) |
| | ILD | 6 (31.6%) | 1 (7.7%) |
| | Cerebrovascular disease | 4 (21.0%) | 2 (15.4%) |
| | Hepatic disease | 3 (15.8%) | 2 (15.4%) |
| Platinum agent, n (%) | CBDCA | 16 (84.2%) | 12 (92.3%) |
| | CDDP | 3 (15.8%) | 1 (7.7%) |
| Additional drugs, n (%) | PEM | 5 (26.3%) | 5 (38.5%) |
| | Nab-PTX | 3 (15.8%) | 4 (30.8%) |
| | TS-1 | 4 (21.0%) | 3 (23.1%) |
| | PEM + Bev | 4 (21.0%) | 0 (0%) |
| | PTX | 2 (10.5%) | 0 (0%) |
| | GEM | 1 (5.3%) | 1 (7.7%) |

GPS, Glasgow Prognostic Score ; SCC, squamous cell carcinoma ; PS, performance status ; COPD, chronic obstructive pulmonary disease ; DM, diabetes mellitus ; ILD, interstitial lung disease ; CBDCA, carboplatin ; CDDP, cisplatin ; PEM, pemetrexed ; nab-PTX, nanoparticle albumin-bound paclitaxel ; TS-1, tegafur/gimeracil/oteracil ; BEV, bevacizumab ; PTX, paclitaxel ; GEM, gemcitabine.

*Treatment parameters*

The treatment parameters are shown in Table 2. The median number of chemotherapy cycles was 4 cycles (range : 1–11 cycles) in the GPS 0–1 group and 2 (range : 1–4 cycles) in the GPS 2 group. Four chemotherapy cycles were completed by 57.9% of patients in the GPS 0–1 group and 30.8% in the GPS 2 group. The main cause of treatment discontinuation was disease progression, which was relatively common in the GPS 2 group (7 patients, 53.4%).

Table 2. Treatment parameters

| | GPS 0–1 (n = 19) | GPS 2 (n = 13) |
|---|---|---|
| Median chemotherapy cycles (range) | 4 (1–11) | 2 (1–4) |
| Patients who completed 4 cycles, n (%) | 11 (57.9%) | 4 (30.8%) |
| Causes of discontinuation | | |
| Disease progression, n (%) | 4 (21.0%) | 7 (53.4%) |
| Toxicity, n (%) | 2 (10.5%) | 2 (15.4%) |
| PS worsening, n (%) | 2 (10.5%) | 0 (0%) |

GPS, Glasgow Prognostic Score ; PS, performance status.

*Efficacy*

Table 3 shows the tumor responses. The overall response rates (ORRs) were 26.3% in the GPS 0–1 group and 15.4% in the GPS 2 group ; however, the difference was not significant ($P = 0.67$). The disease control rates were 68.4% in the GPS 0–1 group and 23.1% in the GPS 2 group, and most patients in the GPS 2 group developed progressive disease (10 patients, 76.9%). The survival curves are shown in Figures 1 and 2. Patients in the GPS 0–1 group had significantly longer median values for PFS (4.1 months [95% confidence interval : 2.2-7.4 months] vs. 2.1 months [95% confidence interval : 0.8-2.7 months], $P = 0.0026$) and OS (22.8 months [95% confidence interval : 8.2-NA months] vs. 9.6 months [95% confidence interval : 2.6-14.8 months], $P = 0.0092$). In a subgroup analysis including patients aged ≥75 years (n = 15), the median PFS in the GPS 0–1 group and the GPS 2 group was 3.2 and 2.1 months ($P = 0.11$), respectively, and

Table 3. Tumor responses

| | GPS 0–1 (n = 19) | GPS 2 (n = 13) | P |
|---|---|---|---|
| CR, n (%) | 0 (0%) | 0 (0%) | |
| PR, n (%) | 5 (26.3%) | 2 (15.4%) | |
| SD, n (%) | 8 (42.1%) | 1 (7.7%) | |
| PD, n (%) | 6 (31.6%) | 10 (76.9%) | |
| ORR | 26.3% | 15.4% | 0.67 |
| DCR | 68.4% | 23.1% | 0.29 |

CR, complete response ; PR, partial response ; SD, stable disease ; PD, progressive disease ; ORR, overall response rate ; DCR, disease control rate.

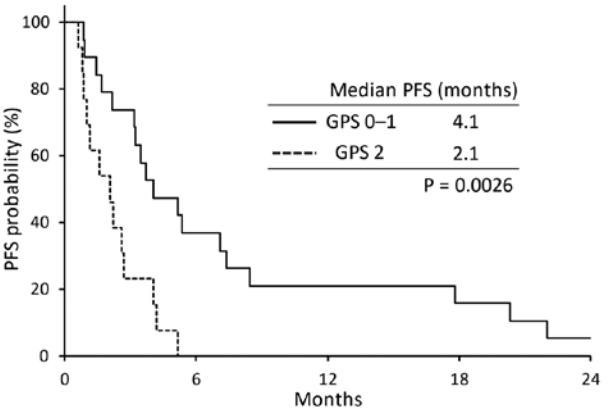


Figure 1. Kaplan-Meier curves for progression-free survival (PFS) according to the Glasgow prognostic score (GPS).

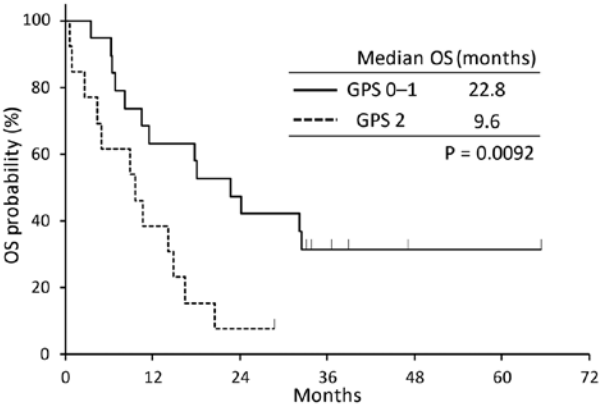


Figure 2. Kaplan-Meier curves for overall survival (OS) according to the Glasgow prognostic score (GPS).

the median OS in the GPS 0–1 group and the GPS 2 group was 32.5 and 9.8 months (p = 0.11), respectively.

Additional chemotherapy regimens were administered to 14 patients (73.7%) in the GPS 0–1 group and 8 (61.5%) in the GPS 2 group. Immune checkpoint inhibitors (ICIs) were administered to 9 patients (47.4%) (programmed death-ligand 1 tumor proportion score was 0% in 3 patients, 1-49% in 2 patients, ≥50% in 1 patient, and unknown in 3 patients) in the GPS 0–1 group and 6 patients (46.2%) (programmed death-ligand 1 tumor proportion score was 0% in 2 patients, 1-49% in 2 patients, and unknown in 2 patients) in the GPS 2 group. In the GPS 0–1 group, ORR of ICIs was 22% and 3 patients experienced PFS for more than 1 year by ICIs. In the GPS 2 group, ORR of ICIs was 0% and 1 patient experienced PFS for more than 1 year by ICIs.

*Toxicity*

The most common adverse events are shown in Table 4. No significant inter-group differences were observed for all grades of adverse events. However, both groups had relatively high rates of hematological adverse events, except febrile neutropenia, with incidences of 15–40% for grade 3–4 hematological adverse events. One patient in the GPS 0–1 group experienced febrile neutropenia. Although anorexia, constipation, and fatigue were common events, few cases involved grade 3 events. No grade 4 non-hematological adverse events were observed in either of the two groups. However, 1 treatment-related death caused by grade 5 acute kidney injury occurred in the GPS 2 group.

Table 4. Toxicities

| | GPS 0–1 (n = 19) | | GPS 2 (n = 13) | |
|---|---|---|---|---|
| Hematological | All grades n (%) | Grade ≥ 3 n (%) | All grades n (%) | Grade ≥ 3 n (%) |
| Anemia | 19 (100%) | 3 (15.8%) | 13 (100%) | 5 (38.5%) |
| Thrombocytopenia | 12 (63.2%) | 4 (21.0%) | 10 (76.9%) | 3 (23.1%) |
| Neutropenia | 12 (63.2%) | 6 (31.6%) | 9 (69.2%) | 2 (15.4%) |
| Leukopenia | 11 (57.9%) | 3 (15.8%) | 9 (69.2%) | 3 (23.1%) |
| Non-hematological | All grades n (%) | Grade ≥ 3 n (%) | All grades n (%) | Grade ≥ 3 n (%) |
| Anorexia | 14 (73.7%) | 0 (0%) | 8 (61.5%) | 1 (7.7%) |
| Constipation | 12 (63.2%) | 0 (0%) | 9 (69.2%) | 0 (0%) |
| Fatigue | 11 (57.9%) | 0 (0%) | 10 (76.9%) | 0 (0%) |
| Nausea | 6 (31.6%) | 0 (0%) | 4 (30.8%) | 1 (7.7%) |
| AST | 5 (26.3%) | 0 (0%) | 5 (38.5%) | 0 (0%) |
| ALT | 4 (21.0%) | 0 (0%) | 3 (23.1%) | 0 (0%) |
| Creatinine | 2 (10.5%) | 0 (0%) | 3 (23.1%) | 1 (7.7%) |
| Rash | 2 (10.5%) | 0 (0%) | 2 (15.4%) | 1 (7.7%) |

GPS, Glasgow prognostic score ; AST, aspartate transaminase ; ALT, alanine transaminase.

## DISCUSSION

This retrospective study evaluated whether the GPS could efficiently predict the tolerability and efficacy of platinum-combination chemotherapy among elderly Japanese patients with NSCLC. The results revealed that the GPS 0–1 group had an ORR of 26.3%, a median PFS of 4.1 months, and a median OS of 22.8 months. These results were comparable to the reported efficacy of platinum-combination chemotherapy among all patients with NSCLC, including young patients (3, 10-12). The present study revealed that the GPS 2 group had a higher disease progression rate and shorter PFS and OS intervals than the GPS 0–1 group. Similarly, in a subgroup analysis of patients aged ≥75 years, the median PFS and OS of the GPS 0–1 group tended to be longer than those of the GPS 2 group (3.2 vs 2.1 months and 32.5 vs 9.8 months, respectively). There were no significant differences observed with regard to adverse events between the two groups, and only a few patients experienced febrile neutropenia or grade 3 non-hematological adverse events. Moreover, in the GPS 2 group, the main cause of treatment discontinuation was disease progression, as opposed to toxicity. Thus, platinum-combination chemotherapy might be less effective, but not intolerable, for elderly patients with NSCLC and a GPS of 2.

Although in our study, all patients in the GPS 2 group possessed a good PS (PS = 1), they experienced poor response to treatment and had a poor prognosis. Therefore, for elderly patients, assessment using the PS alone may be insufficient, and the GPS could be a valuable marker for predicting the tolerability, efficacy, and prognosis after various treatments for NSCLC (7, 8, 13-16). Furthermore, Fujio *et al*. reported that among patients with advanced NSCLC and a PS of 2, a GPS of 2 was associated with poorer outcomes than a GPS of 0–1 (9). Based on the results of our study and that conducted by Fujio *et al*., it appears that patients with NSCLC with a GPS of 0–1 might benefit from standard treatment that is recommended for younger patients or patients with a good PS, even if the patient is in a high-risk group (older aged or poorer PS). Thus, the GPS might be a helpful tool to guide treatment selection for NSCLC among patients with higher risk factors. Additionally, the combination of platinum-based chemotherapy and ICIs has recently become

standard therapy for advanced NSCLC (17-19). Therefore, we further intend to verify whether the GPS can predict the tolerability and efficacy of platinum-based chemotherapy plus ICIs among elderly patients with NSCLC.

The present study has several limitations. First, the retrospective design and small sample size are potential sources of bias. Second, the patients were treated using various chemotherapy regimens, and the small sample size precluded treatment-specific sub-analyses. Third, CRP and Alb concentrations are non-specific markers, and comorbidities can also influence the GPS. Therefore, the GPS may not always accurately reflect the condition of elderly patients with NSCLC. Fourth, additional therapy with ICIs might affect the result for OS. The efficacy of ICIs was better in the GPS 0–1 group than in the GPS 2 group.

In conclusion, platinum-combination chemotherapy provided promising efficacy for elderly patients with NSCLC and a GPS of 0–1. Thus, elderly patients with NSCLC and a GPS of 0–1 may benefit from standard treatment regimens that are generally recommended for younger patients.

## FUNDING

This research did not receive any specific grants from funding agencies in the public, commercial, or not-for-profit sectors.

## CONFLICTS OF INTEREST

Takeshi Isobe has received personal fees from AstraZeneca, Pfizer, and Boehringer Ingelheim outside of the submitted work. Yukari Tsubata has previously received personal fees from AstraZeneca, Chugai Pharmaceutical, and Daiichi-Sankyo outside of the submitted work. The other authors have no conflicts of interest to declare.

## ACKNOWLEDGEMENT

We would like to thank Editage (www.editage.com) for English language editing.

## REFERENCES

1. NCCN Clinical Practice Guideline in Oncology : Non-Small Cell Lung Cancer. Version 2.2018. http://www.nccn.org.
2. Quoix E, Zalcman G, Oster JP, Westeel V, Pichon E, Lavolé A, Dauba J, Debieuvre D, Souquet PJ, Bigay-Game L, Dansin E, Poudenx M, Molinier O, Vaylet F, Moro-Sibilot D, Herman D, Bennouna J, Tredaniel J, Ducoloné A, Lebitasy MP, Baudrin L, Laporte S, Milleron B ; Intergroupe Francophone de Cancérologie Thoracique : Carboplatin and weekly paclitaxel doublet chemotherapy compared with monotherapy in elderly patients with advanced non-small-cell lung cancer : IFCT-0501 randomised, phase 3 trial. Lancet 378 : 1079-1088, 2011
3. Socinski MA, Bondarenko I, Karaseva NA, Makhson AM, Vynnychenko I, Okamoto I, Hon JK, Hirsh V, Bhar P, Zhang H, Iglesias JL, Renschler MF : Weekly nab-paclitaxel in combination with carboplatin versus solvent-based paclitaxel plus carboplatin as first-line therapy in patients with advanced non-small-cell lung cancer : final results of a phase III trial. J Clin Oncol 30 : 2055-2062, 2012
4. Socinski MA, Langer CJ, Okamoto I, Hon JK, Hirsh V, Dakhil SR, Page RD, Orsini J, Zhang H, Renschler MF : Safety and efficacy of weekly nab-paclitaxel in combination with carboplatin as first-line therapy in elderly patients with advanced non-small-cell lung cancer. Ann Oncol 24 : 314-321, 2013
5. Okamoto I, Nokihara H, Nomura S, Niho S, Sugawara S, Horinouchi H, Azuma K, Yoneshima Y, Murakami H, Hosomi Y, Atagi S, Ozaki T, Horiike A, Fujita Y, Okamoto H, Ando M, Yamamoto N, Ohe Y, Nakagawa K : Comparison of carboplatin plus pemetrexed followed by maintenance pemetrexed with docetaxel monotherapy in elderly patients with advanced nonsquamous non-small cell lung cancer : a phase 3 randomized clinical trial. JAMA Oncol 6 : e196828, 2020
6. Okuma Y, Hosomi Y, Takahashi S, Nakahara Y, Watanabe K, Nagamata M, Takagi Y, Mikura S : A phase II study of nanoparticle albumin-bound paclitaxel plus carboplatin as the first-line therapy in elderly patients with previously untreated advanced non-small cell lung cancer. Cancer Chemotherapy Pharmacol 78 : 383-388, 2016
7. Forrest LM, McMillan DC, McArdle CS, Angerson WJ, Dunlop DJ : Evaluation of cumulative prognostic scores based on the systemic inflammatory response in patients with inoperable non-small-cell lung cancer. Br J Cancer 89 : 1028-1030, 2003
8. Forrest LM, McMillan DC, McArdle CS, Angerson WJ, Dunlop DJ : Comparison of an inflammation-based prognostic score (GPS) with performance status (ECOG) in patients receiving platinum-based chemotherapy for inoperable non-small-cell lung cancer. Br J Cancer 90 : 1704-1706, 2004
9. Fujio T, Nakashima K, Naito T, Kobayashi H, Omori S, Wakuda K, Ono A, Kenmotsu H, Murakami H, Takahashi T : Platinum combination chemotherapy is poorly tolerated in malnourished advanced lung cancer patients with poor performance status. Nutr Cancer 71 : 767-777, 2019
10. Scagliotti GV, Parikh P, von Pawel J, Biesma B, Vansteenkiste J, Manegold C, Serwatowski P, Gatzemeier U, Digumarti R, Zukin M, Lee JS, Mellemgaard A, Park K, Patil S, Rolski J, Goksel T, de Marinis F, Simms L, Sugarman KP, Gandara D : Phase III study comparing cisplatin plus gemcitabine with cisplatin plus pemetrexed in chemotherapy-naive patients with advanced-stage non-small-cell lung cancer. J Clin Oncol 26 : 3543-3551, 2007
11. Ohe Y, Ohashi Y, Kubota K, Tamura T, Nakagawa K, Negoro S, Nishiwaki Y, Saijo N, Ariyoshi Y, Fukuoka M : Randomized phase III study of cisplatin plus irinotecan versus carboplatin plus paclitaxel, cisplatin plus gemcitabine, and cisplatin plus vinorelbine for advanced non-small-cell lung cancer : Four-Arm Cooperative Study in Japan. Ann Oncol 18 : 317-323, 2007
12. Okamoto I, Yoshioka H, Morita S, Ando M, Takeda K, Seto T, Yamamoto N, Saka H, Asami K, Hirashima T, Kudoh S, Satouchi M, Ikeda N, Iwamoto Y, Sawa T, Miyazaki M, Tamura K, Kurata T, Fukuoka M, Nakagawa K : Phase III trial comparing oral S-1 plus carboplatin with paclitaxel plus carboplatin in chemotherapy-naïve patients with advanced non-small-cell lung cancer : results of a west Japan oncology group study. J Clin Oncol 28 : 5240-5246, 2010
13. Gioulbasanis I, Pallis A, Vlachostergios PJ, Xyrafas A, Giannousi Z, Perdikouri IE, Makridou M, Kakalou D, Georgoulias V : The Glasgow Prognostic Score (GPS) predicts toxicity and efficacy in platinum-based treated patients with metastatic lung cancer. Lung Cancer 77 : 383-388, 2012
14. Jiang AG, Lu HY : The Glasgow prognostic score as a prognostic factor in patients with advanced non-small cell lung

cancer treated with cisplatin-based first line chemotherapy. J Chemother 27 : 35-39, 2015
15. Kasahara N, Sunaga N, Tsukagoshi Y, Miura Y, Sakurai R, Kitahara S, Yokobori T, Kaira K, Mogi A, Maeno T, Asao T, Hisada T : Post-treatment Glasgow prognostic score predicts efficacy in advanced non-small-cell lung cancer treated with anti-PD1. Anticancer Res 39 : 1455-1461, 2019
16. Kasahara N, Imai H, Naruse I, Tsukagoshi Y, Kotake M, Sunaga N, Kaira K, Maeno T, Asao T, Hisada T : Glasgow prognostic score predicts efficacy and prognosis in patients with advanced non-small cell lung cancer receiving EGFR-TKI treatment. Thorac Cancer 11 : 2188-2195, 2020
17. Gandhi L, Rodríguez-Abreu D, Gadgeel S, Esteban E, Felip E, De Angelis F, Domine M, Clingan P, Hochmair MJ, Powell SF, Cheng SY, Bischoff HG, Peled N, Grossi F, Jennens RR, Reck M, Hui R, Garon EB, Boyer M, Rubio-Viqueira B, Novello S, Kurata T, Gray JE, Vida J, Wei Z, Yang J, Raftopoulos H, Pietanza MC, Garassino MC ; KEYNOTE-189 Investigators : Pembrolizumab plus chemotherapy in metastatic non-small-cell lung cancer. N Engl J Med 378 : 2078-2092, 2018
18. Paz-Ares L, Luft A, Vicente D, Tafreshi A, Gümüş M, Mazières J, Hermes B, Çay Şenler F, Csőszi T, Fülöp A, Rodríguez-Cid J, Wilson J, Sugawara S, Kato T, Lee KH, Cheng Y, Novello S, Halmos B, Li X, Lubiniecki GM, Piperdi B, Kowalski DM ; KEYNOTE-407 Investigators : Pembrolizumab plus chemotherapy for squamous non-small-cell lung cancer. N Engl J Med 379 : 2040-2051, 2018
19. Socinski MA, Jotte RM, Cappuzzo F, Orlandi F, Stroyakovskiy D, Nogami N, Rodríguez-Abreu D, Moro-Sibilot D, Thomas CA, Barlesi F, Finley G, Kelsch C, Lee A, Coleman S, Deng Y, Shen Y, Kowanetz M, Lopez-Chavez A, Sandler A, Reck M ; IMpower150 Study Group : Atezolizumab for first-line treatment of metastatic nonsquamous NSCLC. N Engl J Med 378 : 2288-2301, 2018