Efficacy and Acquired Resistance of EGFR-TKI Combined with Chemotherapy as First-Line Treatment for Chinese Patients with Advanced Non-Small Cell Lung Cancer in a Real-world Setting

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Abstract

Background To compare the benefits and explore the cause of acquired resistance of epidermal growth factor receptor tyrosine kinase inhibitor (EGFR-TKI) and its combination with chemotherapy in advanced non-small-cell lung cancer (NSCLC) patients harboring EGFR mutation in a real-life setting.

Methods This retrospective analysis included 117 advanced NSCLC patients with EGFR mutation who underwent next-generation sequencing (NGS) prior to treatment. The combination group included 50 patients who received the regimen of EGFR-TKI combined with chemotherapy, while the EGFR-TKI monotherapy group included 67 patients treated with TKI only. The primary endpoint of this study was progression-free survival (PFS); the secondary endpoints were overall survival (OS), response rate, and toxicity.

Results The median PFS was significantly longer in the combination group than in the EGFR-TKI monotherapy group (19.00 months [95% CI, 14.674-23.326] vs. 11.70 months [95% CI, 10.807-12.593], $p = 0.000$). Subgroup analysis showed a similar trend of results. The median OS was not reached in the combination group and was 38.50 (95% CI, 35.300-41.700) months in the EGFR-TKI monotherapy group ($p = 0.586$). Patients in the combination group were more likely to experience adverse events, most of which showed the severity of grade 1 or 2. T790M mutation remains the main reason for acquired resistance, and the frequency of T790M mutation was similar between the two groups ($p = 0.898$).

Conclusions Compared with EGFR-TKI monotherapy, EGFR-TKI combined with chemotherapy significantly improved PFS in advanced NSCLC patients with EGFR mutation, with acceptable toxicity.

Background

GLOBOCAN 2018 shows that lung cancer remains the commonest cancer and a leading cause of cancer death worldwide [1]. Non-small cell lung cancer (NSCLC) occurs in approximately 85% of all cases [2]. In the past two decades, new technologies, like molecular and histological testing and next-generation sequencing (NGS), have greatly reformed the treatment of NSCLC. A consensus has been made that the epidermal growth factor receptor (EGFR) is implicated in the pathogenesis of NSCLC. An increasing number of studies reported that for EGFR-mutant patients, EGFR- tyrosine kinase inhibitors (TKIs) brings a higher objective response rate (ORR) and longer progression-free survival (PFS) compared to traditional chemotherapy [3–8]. These studies have led to the era of personalized therapy. For NSCLC patients harboring EGFR mutation, EGFR-TKIs have been standardized into the first-line treatment.

Although targeted therapies have achieved much for NSCLC patients, challenges remain [9]. The most noteworthy is drug resistance, including initial resistance and acquired resistance. Different mechanisms of acquired resistance to EGFR-TKIs have been reported. The acquired resistance to first-generation TKIs is primarily caused by the second point mutation, with a threonine-to-methionine acid change at position 790 (T790M) of exon 20[10]. Other mechanisms include amplification in HER2, MET, EGFR, or mutations in MET, BRAF, PIK3CA, and SCLC transformation epithelial-to-mesenchymal transition [9, 11]. The results

of AURA3 have proved the efficacy of osimertinib, a third-generation EGFR-TKI that is selective for original sensitizing and T790M mutations in NSCLC patients [12]. However, first-generation TKI is still recommended by NCCN and CSCO clinical practice guidelines in oncology. And because of its long history of use and lower price, it is still widely used in clinical practice. Extending the survival time of patients and overcoming or delaying acquired drug resistance has become a new problem. EGFR-TKI combined with chemotherapy, immunotherapy, anti-angiogenesis, radiotherapy, and other treatments may solve this problem.

As we all know, pemetrexed is a multitargeted antifolate that inhibits multiple enzymes involved in folate metabolism, including thymidylate synthase (TS) [13]. In addition, studies in vitro and vivo suggested that first-generation TKI could also down-regulate TS at mRNA and protein levels [14–16]. The synergistic effect of TKI and pemetrexed provides a molecular foundation for the use of TKI plus chemotherapy. Herein, we retrospectively assessed the efficacy of EGFR-TKI alone or in combination with chemotherapy as first-line therapy for treatment-naïve advanced NSCLC patients.

Methods

Patients

We conducted retrospective research of NSCLC patients who were treated at the First Affiliated Hospital of Nanjing Medical University between November 2014 and August 2019. All of the NSCLC patients were histopathologically confirmed, and advanced NSCLC was defined as stage IIIb/c and IV according to the AJCC (American Joint Committee on Cancer) Cancer Staging Manual (8th edition). Inclusion criteria: (1) pathologically diagnosed NSCLC; (2) underwent NGS prior to treatment, and genome sequencing confirmed EGFR mutation (primarily exon 21 L858R point mutation or exon 19 deletion); (3) first-line treatment was first-generation TKI or TKI in combination with chemotherapy; (4) age ≥ 18 ; (5) Eastern Cooperative Oncology Group (ECOG) performance status was ≤ 2 ; (6) a life expectancy of longer than 3 months; and (7) without other malignant tumor histories. The study was conducted according to the Declaration of Helsinki and approved by the First Affiliated Hospital of Nanjing Medical University Ethics Committee, and written informed consents was obtained from all participants included in the study.

Treatment

Patients assigned to the monotherapy group received EGFR-TKI therapy (gefitinib 250 mg po qd, icotinib 125 mg po tid or elortinib 150 mg po qd). Patients assigned to the combination group received EGFR-TKI therapy combined with chemotherapy (cisplatin or carboplatin plus pemetrexed, or pemetrexed alone). After 6 cycles of chemotherapy, EGFR-TKI was combined with pemetrexed as maintenance therapy. Treatment continued until progressive disease (PD), unacceptable toxicity, or withdrawal of consent.

Assessment Of Efficacy And Adverse Events

The primary endpoint of this study was progression-free survival (PFS); secondary endpoints included overall survival (OS), response rate, and toxicity. PFS was defined as the period from the start of treatment to disease progression, death or the last follow-up, and OS was defined as the time from the start of treatment to death or the deadline of follow-up. The tumor response rate was expressed with objective response rate (ORR) and disease control rate (DCR). RECIST 1.1 was used to evaluate the tumor response. Tumor status was assessed every two cycles during chemotherapy for patients in the combination group, and for patients received EGFR-TKI monotherapy was assessed every two months or at overt signs of progression. Adverse events (AEs) were assessed according to Common Terminology Criteria for Adverse Events of the National Cancer Institute (CTCAE 4.0) and were rated from grades 1 to 5.

Statistical analysis

The chi-squared test was used for comparisons of ORR and DCR intergroup at a significance level of 5% ($\alpha = 0.05$, two-sided). PFS and OS were analyzed by the Kaplan-Meier method. The log-rank test was utilized to compare the significance between groups, while the Cox proportional hazards model was used for the multivariate survival analysis. p -values of < 0.05 ($p < 0.05$) were considered statistically significant. SPSS software (version 20.0; SPSS Inc.), RStudio (Version 1.2.1335; RStudio, Inc.) and Adobe Illustrator 2020 were used for all statistical analysis and create the graphics.

Results

Patients and clinical characteristics

A total of 117 patients were retrospectively analyzed in this retrospective study. Patients received first-generation EGFR-TKI or plus chemotherapy. Among them, 50 patients in combination group (T+C) received chemotherapy plus first-generation EGFR-TKI, while the other 67 patients in the monotherapy group (T) received EGFR-TKI alone. The patients' clinical characteristics were summarized in Table 1, including age, sex, histology, ECOG PS, smoking history, EGFR mutation, brain metastasis, and stage. There was no significant difference in clinical characteristics between the two groups.

Tumor response

After two cycles / two months of treatment, the response rate was evaluated. Of the 50 patients in the combination group, 1 achieved complete response (CR), 38 achieved partial response (PR), 10 achieved stable disease (SD), 1 achieved PD, resulting in an ORR of 78.00% and DCR of 98.00%. Of the 67 patients in the EGFR-TKI monotherapy group, 43 achieved PR, 22 achieved SD, 2 achieved PD, and no one achieved CR, resulting in an ORR of 64.18% and DCR of 97.01% (Table S1). As shown in Table S1, the ORR was slightly higher in the combination group than in the EGFR-TKI monotherapy group, but there was no statistically significant difference ($p = 0.108$).

Survival analysis

As of March 2020, 79 patients (67.52%) had reached the endpoint of disease progression or death, and the median follow-up time was 26.27 months. The median PFS (mPFS) was 19.00 months (95% CI, 14.674-23.326) in the combination group and 11.70 months (95% CI, 10.807-12.593) in the EGFR-TKI monotherapy group, and the difference was statistically significant ($p = 0.000$) (Fig 1a).

The median OS (mOS) was not reached in the combination group and no difference in OS was identified at the time of this analysis (NA vs. 38.50 months, $p = 0.586$, Fig 1b). 1-year OS rate was 94.87% (37/39) in the combination group and 96.82% (61/63) in the TKI monotherapy group ($p = 0.562$). 2-year OS rate was 92.86% (13/14) in the combination group and 81.25% (39/48) in the TKI monotherapy group ($p = 0.303$) (Fig S1). As the overall survival data was not sufficient enough, further analysis was not performed.

EGFR mutation site analysis

In all patients, approximately 57.26% ($n=67$) had an exon 19 deletion (19 del), while 37.61% ($n=44$) had an exon 21 L858R mutation (21 L858R) in the EGFR gene. For the patients with EGFR exon 19 deletion, the mPFS was 20.93 months (95% CI, 7.927-33.933) in the combination group and 11.87 months (95% CI, 10.424-13.316) in the EGFR-TKI monotherapy group ($p = 0.004$) (Fig 2a). The mPFS for patients harboring L858R point mutation was 18.07 months (95% CI, 13.212-22.928) in the combination group and 11.17 months (95% CI, 9.992-12.3482) in the EGFR-TKI monotherapy group ($p = 0.021$) (Fig 2b).

EGFR mutation abundance analysis

In this study, abundance data was available in 51 patients, including 23 were in the combination group and 28 were in the EGFR-TKI monotherapy group. We explored the relationship between the EGFR mutation abundance and the efficacy of EGFR TKI combination with or without chemotherapy. The cutoff value of mutation abundance was set as 4.9% for exon 19 deletion and 9.5% for exon 21 L858R [17]. The cutoff value of ctDNA abundance from plasma was set as 2% for exon 19 deletion and 5% for exon 21 L858R [17]. Of all 51 patients, 39 patients harbored high abundance EGFR mutation and 12 had low abundance mutation. Among patients with high EGFR mutation abundance, the mPFS was 19.00 (95% CI, 15.3442-22.656) months in the combination group and 10.93 (95% CI, 9.687-12.179) months in the EGFR-TKI monotherapy group ($p = 0.008$) (Fig 2c). However, among patients with low EGFR mutation abundance, mPFS was 11.83 months (95% CI, 9.013-14.647) vs. 10.57 months (95% CI, 5.181-15.959), and the difference was not significant ($p = 0.541$)(Fig 2d).

Subgroup analysis

Subgroup analysis was conducted to screen out the intended population. The Cox regression model was used to calculate hazard ratios. Fig 3 showed that the results of the subgroup analysis were basically consistent with the above-mentioned result. Most patients may obtain clinical benefits from the regimen of TKI combined with chemotherapy. But for patients with brain metastasis, T+C did not show a significant advantage and the risk of progression was 1.2 times higher in the combination group than

that in the TKI monotherapy group ($p = 0.686$; HR = 1.2; 95% CI, 0.3-1.8). Significant difference was also not observed in subgroups of none or single EGFR co-mutation and multiple (≥ 2) co-mutation ($p = 0.276$, HR = 0.39, 95% CI (0.07-2.1) in none or single co-mutation subgroup and $p = 0.154$, HR = 0.49, 95% CI, (0.18-1.3) in multiple co-mutation subgroup).

Post-progression detected by NGS

Considering the impact of drug resistance on treatment, re-biopsy, and NGS-based testing were made. T790M was detected in 59.09% (26/44) of patients in the TKI monotherapy group and 57.14% (8/14) in the combination group, and the results suggested that there was no statistical difference in the frequency of T790M mutation ($p = 0.898$, Fig 4c). Acquired resistance also involved Her2 amplification, Met amplification, ALK fusion, and Myc amplification (Fig 4a,b). Of the 117 patients, 34 patients obtained T790M mutation after progression, and 27 patients received third-generation EGFR-TKIs, of which 7 were in the combination group, and 20 were in the EGFR-TKI monotherapy group.

AEs

The details about the AEs were shown in Table 2. Skin rash was the most common (64.00% in the combination group and 70.15% in the EGFR-TKI monotherapy group) ($p = 0.804$), followed by elevated liver enzymes (62.00% in the combination group and 50.74% in the EGFR-TKI monotherapy group, $p = 0.228$). The other AEs observed in the TKI monotherapy group included diarrhea (35.82%), mucositis (13.43%), constipation (10.45%), and nausea/vomiting (10.45%). Meanwhile, hematologic toxicities were more common in the combination group, such as leukopenia/neutropenia (44.00% vs. 7.46%, $p = 0.000$), anemia (38.00% vs. 8.96%, $p = 0.000$), thrombocytopenia (34.00% vs. 8.96%, $p = 0.001$). The patients in the combination group were more likely to develop AEs, most of which showed the severity of grade 1 or 2. No drug-related interstitial lung disease or deaths were observed.

Discussion

Many clinical trials have confirmed EGFR-TKIs as the standard first-line therapy for advanced NSCLC patients with EGFR sensitive mutations. Apart from their significant benefits, TKIs inevitably trigger acquired drug resistance [18]. Blakely CM et.al pointed out that tumor genomic complexity increased with the prolongation of EGFR-TKIs treatment, a change that, sometimes along with the co-mutation of other genes, can promote tumor development or limits EGFR inhibitor response [19]. In addition, the presence of intratumor heterogeneity and resistant subclones may also discount the efficacy of TKI [20]. Meanwhile, a retrospective cohort study verified that genetic co-alterations negatively affect the response and survival of patients with EGFR mutation [21]. All these findings have laid a theoretical foundation for the use of combination therapy. Clinical studies had been carried out to explore the feasibility of TKI combined with other treatments, such as chemotherapy and vascular endothelial growth factor (VEGF) inhibitors [22, 23]. Some of them have yielded encouraging results. Here, we show the results of a real-world study of EGFR-TKI in combination with chemotherapy.

Previous clinical studies have found that TKI combined with chemotherapy is superior to EGFR-TKI monotherapy in PFS. JMIT, the first randomized study to examine pemetrexed plus EGFR-TKI therapy as first-line treatment for advanced NSCLC patients with activating EGFR mutations, showed that the combination therapy improved PFS compared with TKI monotherapy [24]. Similarly, phase III randomized trials in Japanese and Indian population (NEJ009) also proved that a combination (pemetrexed + carboplatin + gefitinib), compared to single gefitinib, significantly prolonged PFS and OS in NSCLC patients with EGFR mutations [25, 26]. However, many clinical studies failed to find significant improvement, which may be explained by the inappropriate inclusion criteria [27]. In this study, the median PFS of patients reached 19.00 months in the combination group, but only 11.70 months in the TKI monotherapy group, thus confirming the superiority of the combination therapy mentioned before. Furthermore, the median PFS in both groups are close to those previously reported [27–29].

Biology varies with the EGFR mutation subtype in patients treated with EGFR-TKI therapy [30]. Therefore, we explored the efficacy of treatment regimens administered according to EGFR mutation subtypes. The results showed that the mPFS was longer in the combination group than in the TKI monotherapy group, regardless of whether the patient harbored EGFR exon 19 deletion or exon 21 L858R point mutation. And the results were consistent with previous studies [24].

We also explored the relationship between the abundance of EGFR mutations and the efficacy of EGFR-TKI with or without chemotherapy. Previous studies had reported that the abundance of EGFR mutation was significantly associated with the objective response to EGFR TKIs, and the mPFS in the high abundance group was significantly longer than that in the low abundance group [17, 31, 32]. The difference in EGFR mutation abundance may be caused by intratumoral heterogeneity [17]. For example, in patients with a low abundance of EGFR mutations, tumor clones without EGFR mutations may dominate in the primary tumors [17]. The result of this study also suggests that patients with a high EGFR mutation abundance may benefit more from the combination of TKI with chemotherapy. The superiority of combination therapy may be due to the synergy between TKI and pemetrexed, and studies in vitro and vivo have proved [14–16]. Besides, we believe that combination therapy can also prolong the PFS of patients with low-abundance EGFR mutations, but the difference is not significant due to the small sample size in this study. Moreover, previous studies have confirmed that EGFR-TKI plus chemotherapy could significantly improve PFS and OS in patients with low-abundance mutations as first-line treatment [33]. But in our study, this improvement was not significant, which may be due to the small sample size.

This study also showed no significant difference in the ORR and DCR between the two groups, which is basically consistent with previous findings [24, 33]. However, many studies have still shown the treatment regimen of TKI combined with chemotherapy was associated with a higher response rate [25, 26]. There was even a study reporting that a greater depth of response was associated with longer PFS and OS [34]. Deeper research is also needed to validate these findings. The results of the TKI monotherapy group initially indicated that OS reached 38.50 months, which was similar with previous studies [26]. Unfortunately, we had not yet been able to obtain OS data for the combined treatment group.

The results of the subgroup analysis indicated that the combined therapy regimen was superior to EGFR TKI monotherapy for most patients. And the combined therapy regimen exerted a better efficacy on the young, females, never-smokers, and those without brain metastasis and high EGFR mutation abundance. This finding was consistent with the precedents advocating the superiority of TKI plus therapy over gefitinib in any subgroup [24–26]. Interestingly, the intended population happens to be those who respond well to TKI, which may also be explained by the EGFR mutation rate and mutation abundance.

T790M mutation, a second EGFR mutation, provokes acquired resistance in about half cases taking first-generation TKIs [35]. FLAURA trial demonstrated that the third-generation TKI osimertinib had better efficacy in patients with the T790M mutation. The proportions of patients with T790M at post-progression patients in this study were consistent with those in previous studies, and no significant difference was observed between treatment groups. Our results revealed that chemotherapy plus TKI does not reduce the frequency of EGFR T790M mutations, which means that the third-generation EGFR TKI osimertinib can still be used after progression. The result hinted that conservative chemotherapy plus TKI might delay the emergence of TKI resistance, and previous studies had also proved that the combination of gefitinib and pemetrexed prevented TKI resistance mediated by T790M mutation or epithelial-to-mesenchymal transition (EMT) in EGFR-mutant NSCLC cell lines and xenograft models [36]. On the other hand, the superiority of combination therapy may result from the synergistic effect of TKI and pemetrexed in down-regulating TS and arresting the cell cycle [14, 16]. TKI combined with anti-angiogenesis therapy was also an alternative to overcome drug resistance. RELAY, a randomized phase 3 trial, reported that ramucirumab plus erlotinib demonstrated superiority in prolonging PFS over placebo plus erlotinib (19.4 months vs. 12.4 months, $p < 0.0001$) [23]. The PFS achieved by TKI combined with chemotherapy in our study was similar to that by TKI combined with ramucirumab in RELAY, and the OS could not be compared due to the immature data. A recent study suggested that the frequency of EGFR T790M mutations seems reduced in patients treated with EGFR-TKI plus bevacizumab than EGFR-TKI monotherapy [22]. The effect of anti-angiogenesis therapy on the frequency of T790M is not conclusive, so more data are needed to define the population suitable to each regimen.

A limitation in this study is that less than half of the patients had mutation abundance data, making it difficult to analyze the relationship between EGFR abundance and the efficacy of treatment regimens. Another limitation is the insufficiency of OS data. In addition, this retrospective study was conducted using data from real-world settings, so it cannot be monitored rigorously like a randomized controlled trial.

Conclusions

In conclusion, TKI combined with chemotherapy is superior over EGFR-TKI monotherapy in prolonging mPFS, for the most subgroup of advanced NSCLC patients harboring the EGFR mutation. PFS of patients with high EGFR mutation abundance in the combination group was significantly longer than that in the EGFR-TKI monotherapy group, but there was no significant difference in PFS among patients with low

mutation abundance. TKI combination with chemotherapy can benefit patients more and delay acquired resistance against first-generation EGFR-TKI.

Abbreviations

EGFR: epidermal growth factor receptor; TKI: tyrosine kinase inhibitors; NSCLC: non-small cell lung cancer; NGS: next-generation sequencing; PFS: progression-free survival; OS: overall survival; ORR: objective response rate; TS: thymidylate synthase; AJCC: American Joint Committee on Cancer; ECOG: Eastern Cooperative Oncology Group; PD: progressive disease; DCR: disease control rate; AE: Adverse events; CTCAE: Criteria for Adverse Events of the National Cancer Institute; CR: complete response; PR: partial response; SD: stable disease; VEGF: vascular endothelial growth factor

Declarations

Ethics approval and consent to participate

The study was approved by the First Affiliated Hospital of Nanjing Medical University Ethics Committee and complied with the ethical standards of the Declaration of Helsinki. All participants gave their written informed consent at registry inclusion.

Consent for publication

Not applicable.

Availability of data and material

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

Competing interests

The authors declare that they have no conflict of interest.

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Authors' contributions

Study concept and design: R.G., L.C., Z.Z. Acquisition, analysis or interpretation of data: F.G., T.Q., C.Z. Drafting of the paper: Q.W., W.G. Critical revision of the paper for important intellectual content: S.J., F.L. All authors have read and approved the manuscript.

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Tables

Table 1 Characteristics of all patients

Characteristic	T+C (n=50)	T (n=67)	<i>p</i>
Age (years)			0.294
Median (range)	59(36-81)	61(40-84)	
Sex			0.506
Male	24(48.00%)	28(38.27%)	
Female	26(52.00%)	39(61.73%)	
Histology			1.000
Adenocarcinoma	50(100.00%)	67(100.00%)	
ECOG PS			0.835
0-1	49(98.00%)	66(98.77%)	
2	1(2.00%)	1(1.23%)	
Smoking history			0.986
Nerve	35(70.00%)	47(72.84%)	
Former	15(30.00%)	20(27.16%)	
EGFR mutation			0.321
Exon 19 deletion	26(52.00%)	41(55.56%)	
L858R	21(42.00%)	23(38.27%)	
Others	3(8.00%)	3(6.17%)	
Brain metastasis			0.345
Yes	9(18.00%)	17(23.46%)	
No	41(82.00%)	50(76.54%)	
Stage			0.713
IIIb/IIIc	3(6.00%)	3(3.70%)	
IV	47(94.00%)	64(96.30%)	

Table 2 Adverse events

Toxicity	T+C (n=50)		T (n=67)	
	Any	≥3	Any	≥3
Skin rash	32(64.00%)	2(4.00%)	47(70.15%)	2(2.99%)
Elevated AST / ALT	31(62.00%)	6(12.00%)	34(50.74%)	7(10.45%)
Diarrhoea	19(38.00%)	1(2.00%)	24(35.82%)	1(1.49%)
Leukopenia / Neutropenia	22(44.00%)	7(14.00%)	5(7.46%)	0(0.00%)
Anaemia	19(38.00%)	5(10.00%)	6(8.96%)	0(0.00%)
Thrombocytopenia	17(34.00%)	6(12.00%)	6(8.96%)	0(0.00%)
Nausea / Vomiting	14(28.00%)	2(4.00%)	7(10.45%)	0(0.00%)
Fatigue	16(32.00%)	2(4.00%)	5(7.46%)	0(0.00%)
Anorexia	15(30.00%)	2(4.00%)	7(10.45%)	1(1.49%)
Mucositis	12(24.00%)	1(1.23%)	9(13.43%)	1(1.49%)
Constipation	10(20.00%)	0(0.00%)	7(10.45%)	0(0.00%)

Figures

Figure 1

Progression-free survival (a) and overall survival (a) in two groups. T+C, EGFR-TKI combined with chemotherapy; T, EGFR-TKI monotherapy; PFS, progression-free survival; OS, overall survival

Figure 1

Progression-free survival (a) and overall survival (a) in two groups. T+C, EGFR-TKI combined with chemotherapy; T, EGFR-TKI monotherapy; PFS, progression-free survival; OS, overall survival

Figure 2

Progression-free survival in different subgroups (a) EGFR exon 19 deletion subgroup; (b) EGFR exon 21L858R subgroup; (c) EGFR high abundance subgroup; (d) EGFR low abundance subgroup. T+C, EGFR-TKI combined with chemotherapy; T, EGFR-TKI monotherapy; PFS, progression-free survival; OS, overall survival

Figure 2

Progression-free survival in different subgroups (a) EGFR exon 19 deletion subgroup; (b) EGFR exon 21L858R subgroup; (c) EGFR high abundance subgroup; (d) EGFR low abundance subgroup. T+C, EGFR-TKI combined with chemotherapy; T, EGFR-TKI monotherapy; PFS, progression-free survival; OS, overall survival

Figure 3

Subgroup analysis of progression-free survival HR: Hazard ratios; Del 19 del, exon 19 deletion; 21 L858R, exon 21 point mutation;T+C, EGFR-TKI combined with chemotherapy; T, EGFR-TKI monotherapy

Figure 3

Subgroup analysis of progression-free survival HR: Hazard ratios; Del 19 del, exon 19 deletion; 21 L858R, exon 21 point mutation;T+C, EGFR-TKI combined with chemotherapy; T, EGFR-TKI monotherapy

Figure 4

The resistance mechanism clarified by the patient and the frequency of T790M in two groups (a) EGFR-TKI combined with chemotherapy; (b) EGFR-TKI monotherapy; (c) the frequency of T790M in two groups

Figure 4

The resistance mechanism clarified by the patient and the frequency of T790M in two groups (a) EGFR-TKI combined with chemotherapy; (b) EGFR-TKI monotherapy; (c) the frequency of T790M in two groups

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