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Editorial Board Member of *World Journal of Clinical Cases*, Manish Ramesh Balwani, DNB, FASN, MBBS, MD, Professor, Department of Nephrology, Saraswati Kidney Care Center, Nagpur 442301, Maharashtra, India. balwani.manish@yahoo.com

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The *WJCC* is now abstracted and indexed in Science Citation Index Expanded (SCIE, also known as SciSearch®), Journal Citation Reports/Science Edition, Current Contents®/Clinical Medicine, PubMed, PubMed Central, Scopus, Reference Citation Analysis, China National Knowledge Infrastructure, China Science and Technology Journal Database, and Superstar Journals Database. The 2022 Edition of Journal Citation Reports® cites the 2021 impact factor (IF) for *WJCC* as 1.534; IF without journal self cites: 1.491; 5-year IF: 1.599; Journal Citation Indicator: 0.28; Ranking: 135 among 172 journals in medicine, general and internal; and Quartile category: Q4. The *WJCC*'s CiteScore for 2021 is 1.2 and Scopus CiteScore rank 2021: General Medicine is 443/826.

RESPONSIBLE EDITORS FOR THIS ISSUE

Production Editor: *Hua-Ge Yu*; Production Department Director: *Xu Guo*; Editorial Office Director: *Jin-Lei Wang*.

NAME OF JOURNAL

World Journal of Clinical Cases

ISSN

ISSN 2307-8960 (online)

LAUNCH DATE

April 16, 2013

FREQUENCY

Thrice Monthly

EDITORS-IN-CHIEF

Bao-Gan Peng, Jerzy Tadeusz Chudek, George Kontogeorgos, Maurizio Serati, Ja Hyeon Ku

EDITORIAL BOARD MEMBERS

<https://www.wjgnet.com/2307-8960/editorialboard.htm>

PUBLICATION DATE

January 16, 2023

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INSTRUCTIONS TO AUTHORS

<https://www.wjgnet.com/bpg/gerinfo/204>

GUIDELINES FOR ETHICS DOCUMENTS

<https://www.wjgnet.com/bpg/GerInfo/287>

GUIDELINES FOR NON-NATIVE SPEAKERS OF ENGLISH

<https://www.wjgnet.com/bpg/gerinfo/240>

PUBLICATION ETHICS

<https://www.wjgnet.com/bpg/GerInfo/288>

PUBLICATION MISCONDUCT

<https://www.wjgnet.com/bpg/gerinfo/208>

ARTICLE PROCESSING CHARGE

<https://www.wjgnet.com/bpg/gerinfo/242>

STEPS FOR SUBMITTING MANUSCRIPTS

<https://www.wjgnet.com/bpg/GerInfo/239>

ONLINE SUBMISSION

<https://www.f6publishing.com>

Gefitinib improves severe bronchorrhea and prolongs the survival of a patient with lung invasive mucinous adenocarcinoma: A case report

Guo-Chun Ou, Wen Luo, Wei-Shan Zhang, Shu-Hong Wang, Jie Zhao, Hong-Mei Zhao, Rong Qiu

Specialty type: Medicine, general and internal

Provenance and peer review:

Unsolicited article; Externally peer reviewed.

Peer-review model: Single blind

Peer-review report's scientific quality classification

Grade A (Excellent): 0

Grade B (Very good): 0

Grade C (Good): C

Grade D (Fair): 0

Grade E (Poor): 0

P-Reviewer: Sánchez JIA, Colombia

Received: October 9, 2022

Peer-review started: October 9, 2022

First decision: December 13, 2022

Revised: December 21, 2022

Accepted: January 3, 2023

Article in press: January 3, 2023

Published online: January 16, 2023



Guo-Chun Ou, Wen Luo, Shu-Hong Wang, Jie Zhao, Hong-Mei Zhao, Rong Qiu, Department of Respiratory and Critical Care Medicine, Suining Central Hospital, Suining 629000, Sichuan Province, China

Wei-Shan Zhang, Department of Pathology, Suining Central Hospital, Suining 629000, Sichuan Province, China

Corresponding author: Rong Qiu, PhD, Doctor, Department of Respiratory and Critical Care Medicine, Suining Central Hospital, No. 27 Dongping North Road, Hedong New District, Chuanshan District, Suining 629000, Sichuan Province, China. snszxyqr@126.com

Abstract

BACKGROUND

Lung invasive mucinous adenocarcinoma (LIMA), formerly referred to as mucinous bronchioloalveolar carcinoma, is a rare disease that usually presents as bilateral lung infiltration, is unsuitable for surgery and radiotherapy, and shows poor response to conventional chemotherapy.

CASE SUMMARY

We report a 56-year-old Chinese man with a history of smoking and epidermal growth factor receptor mutation-positivity who was initially misdiagnosed as severe pneumonia, but was ultimately diagnosed as a case of invasive mucinous adenocarcinoma of the lung by computed tomography -guided percutaneous lung biopsy. Bronchorrhea and dyspnea were improved within 24 h after initiation of gefitinib therapy and the radiographic signs of bilateral lung consolidation showed visible improvement within 30 d. After more than 11 months of treatment, there is no evidence of recurrence or severe adverse events.

CONCLUSION

Although the precise mechanism of the antitumor effects of gefitinib are not clear, our experience indicates an important role of the drug in LIMA and provides a reference for the diagnosis and treatment of this disease.

Key Words: Gefitinib; Epidermal growth factor receptor; Lung cancer; Bronchorrhea; Lung invasive mucinous adenocarcinoma; Case report

Core Tip: Gefitinib improves severe bronchorrhea and prolongs the survival of a patient with lung invasive mucinous adenocarcinoma.

Citation: Ou GC, Luo W, Zhang WS, Wang SH, Zhao J, Zhao HM, Qiu R. Gefitinib improves severe bronchorrhea and prolongs the survival of a patient with lung invasive mucinous adenocarcinoma: A case report. *World J Clin Cases* 2023; 11(2): 441-448

URL: <https://www.wjgnet.com/2307-8960/full/v11/i2/441.htm>

DOI: <https://dx.doi.org/10.12998/wjcc.v11.i2.441>

INTRODUCTION

Lung cancer is the second most common cancer worldwide and the leading cause of cancer-related deaths, accounting for almost one-quarter of all cancer-related deaths[1]. Non-small cell lung cancer (NSCLC) is the main pathological type of lung cancer, accounting for about 80%–85% of all cases of lung cancer[2,3]. In the 2015 World Health Organization classification of lung tumors, lung invasive mucinous adenocarcinoma (LIMA) is classified as a variant of invasive lung adenocarcinoma, which accounts for approximately 5%–10% of lung adenocarcinomas[4]. The diagnostic hallmark of invasive mucinous adenocarcinoma (IMA) is tall columnar cell morphology with abundant intracellular/extracellular mucus and invasive adenocarcinoma patterns (such as acinar, lepidic, papillary, and predominant patterns)[5]. The clinical presentation of LIMA is different from that of other subtypes of adenocarcinoma. LIMA typically shows diffuse lung involvement, which results in severe respiratory symptoms, such as bronchorrhea and dyspnea[6,7]. In addition, LIMA also tends to be resistant to conventional chemotherapy, and patients typically have a short survival time after detection of the cancer[8].

Recent years have witnessed important breakthroughs in the treatment of NSCLC, which has evolved from traditional surgery, chemotherapy, and radiotherapy to the era of molecular targeted therapy and immunotherapy. The development of epidermal growth factor receptor (EGFR) targeted tyrosine kinase inhibitors (TKIs) have helped facilitate the concept of personalized cancer therapy into a reality[9]. Several studies have demonstrated high antitumor activity of EGFR-TKIs against bronchioloalveolar carcinoma and the therapeutic response can be dramatic and long-lasting[10,11]. Gefitinib is a reversible EGFR targeted TKI that competes for Mg-ATP binding sites in the EGFR catalytic region, thereby blocking signaling, inhibiting cancer cell proliferation, and inhibiting mitogen-activated protein kinase activation, inducing cancer cell apoptosis[12].

Here, we report a patient with LIMA who was successfully treated with gefitinib. Bronchorrhea and dyspnea were improved within 24 h after treatment with gefitinib, and the radiographic signs of bilateral lung consolidation were visibly improved within 30 d. As of 11 mo after initiation of gefitinib, there are no signs of tumor progression.

CASE PRESENTATION

Chief complaints

On October 29, 2021, a 53-year-old man presented to the department of respiratory medicine at our hospital due to shortness of breath and excessive sputum production for 3 mo.

History of present illness

As shown in **Figure 1**, the patient expectorated large amount of white and foamy sputum (approximately 700 mL/d), accompanied by chest tightness and shortness of breath. He was earlier treated with oral amoxicillin and expectorants, but the results were not satisfactory.

History of past illness

The patient had no prior chronic disease, but had recently lost 2 kg of his body weight.

Personal and family history

He was a chronic smoker (20 cigarettes per day for more than 10 years). The patient denied having a family history of lung cancer, hypertension, or coronary heart disease.



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Figure 1 Image shows 700 mL/d watery sputum produced by the patient.

Physical examination

Vital signs at admission were as follows: Body temperature, 37.8°C; heart rate, 114/min; respiratory rate, 30/min; blood pressure, 147/110 mmHg; oxygen saturation, 90% (under nasal cannula 5 L/min oxygen inhalation). Physical examination revealed coarse crackles in both lungs.

Laboratory examinations

Blood gas analysis showed respiratory failure with an oxygen partial pressure (PaO₂) of 54 mmHg and oxygenation index of 129 mmHg. Conventional inflammation markers [C-reactive protein: 1.37 mg/mL (reference range, 0–10), procalcitonin: 0.05 ng/mL (< 0.05), white blood cell count: 10.9 × 10⁹/L (4–10 × 10⁹), absolute neutrophil count: 6.35 × 10⁹/L (1.8–6.3 × 10⁹), and neutrophil percentage: 58.3% (40%–75%)] were measured on the day of clinical examination. No obvious abnormalities were found in coagulation, sputum smear microscopy, sputum culture, tuberculosis bacilli gamma interferon release test, rheumatoid factor, liver and kidney function, tumor markers (carcinoembryonic antigen, cytokeratin, neuron-specific enolase), connective tissue related antibodies, or anti-neutrophil cytoplasmic antibody.

Imaging examinations

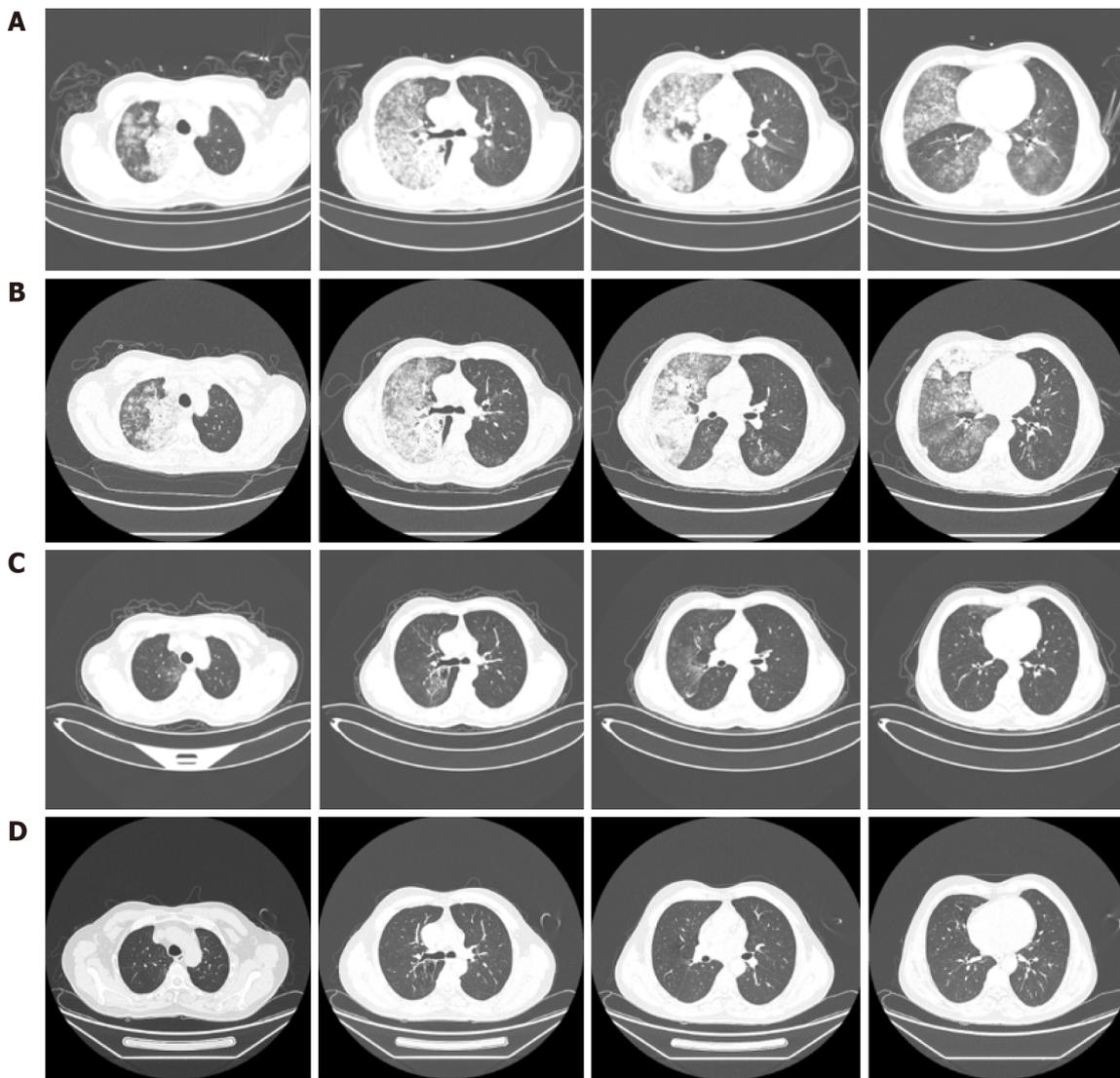
Chest high-resolution computed tomography scan showed large flaky hyperintense shadows in both lungs, especially in the right lung (Figure 2).

FINAL DIAGNOSIS

The clinical picture was suggestive of infectious pneumonia and he was administered routine anti-infection, expectorant, and antispasmodic treatment. However, the patient showed no symptomatic improvement after 3 d of treatment. Bronchoscopy was performed to further clarify the cause, which showed a lot of white secretions in the trachea (Figure 3). The right lower lobe was lavaged and sent for next-generation sequencing (NGS). However, NGS results showed no pathogens. Repeat chest computed tomography (CT) performed on the 7th day of treatment showed an increase in the lung solid lesions compared with those on admission, while there was no significant change in inflammatory marker levels. Subsequently, the patient underwent CT-guided percutaneous lung biopsy, which confirmed the diagnosis of LIMA (Figure 4). In addition, the tissue specimen was subjected to *EGFR* analysis. Systematic investigations revealed no metastases other than the lungs, and based on clinical and histological findings, the patient was diagnosed with stage IV disease. Fortunately, genetic testing revealed positive *EGFR-21* mutation (c.2573T>G:p.L858R).

TREATMENT

Other medications were discontinued, and treatment with an *EGFR*-tyrosine kinase inhibitor, gefitinib (250 mg/d) was commenced.



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Figure 2 Chest computed tomography findings. A: At the beginning of treatment; B: Anti-infection treatment lasted for 1 wk; C: Gefitinib was treated for 1 mo; D: Gefitinib was treated for 11 mo. Chest high-resolution computed tomography scan shows large flaky hyperintense shadows in both lungs, especially in the right lung. A-D show the chest computed tomography images at the first diagnosis, after anti-infection treatment for 1 wk, after treatment with gefitinib for 1 mo, and after treatment with gefitinib for 11 mo, respectively.

OUTCOME AND FOLLOW-UP

Twenty-four hours after initiation of treatment, the patient showed remarkable improvement in symptoms with alleviation of dyspnea and bronchorrhea. Arterial blood gas analysis showed a PaO₂ of 81 mmHg and oxygenation index of 279 mmHg upon nasal inhalation of 2 L/min O₂. The volume of sputum discharged decreased from 700 to 300 mL/d, and 3 d later it was further reduced to 100 mL/d. Chest CT scan showed remarkable improvement of infiltration 30 d (Figure 2) after treatment. After more than 11 mo of treatment (Figure 2), there was no evidence of recurrence or severe adverse events.

DISCUSSION

Adenocarcinoma is the most commonly diagnosed pathological subtype of NSCLC. LIMA was recognized as a distinct subtype of lung adenocarcinoma with unique biological properties, as well as a different prognosis compared with other lung adenocarcinoma subtypes[13]. Previous studies have shown that LIMA may originate from type II alveolar epithelial or Clara cell metaplastic lesions, and further develop atypical hyperplasia and carcinogenesis[14,15]. Tumor cells in IMAs are highly discrete, and show poor adhesion; These easily diffuse widely through alveolar pores and small airways, which is an important reason for their diffuse distribution[16,17]. In a study by Cha *et al*[18], 13.9% of IMAs were initially identified as pneumonia, which is much higher than the rate of initial misdiagnosis of

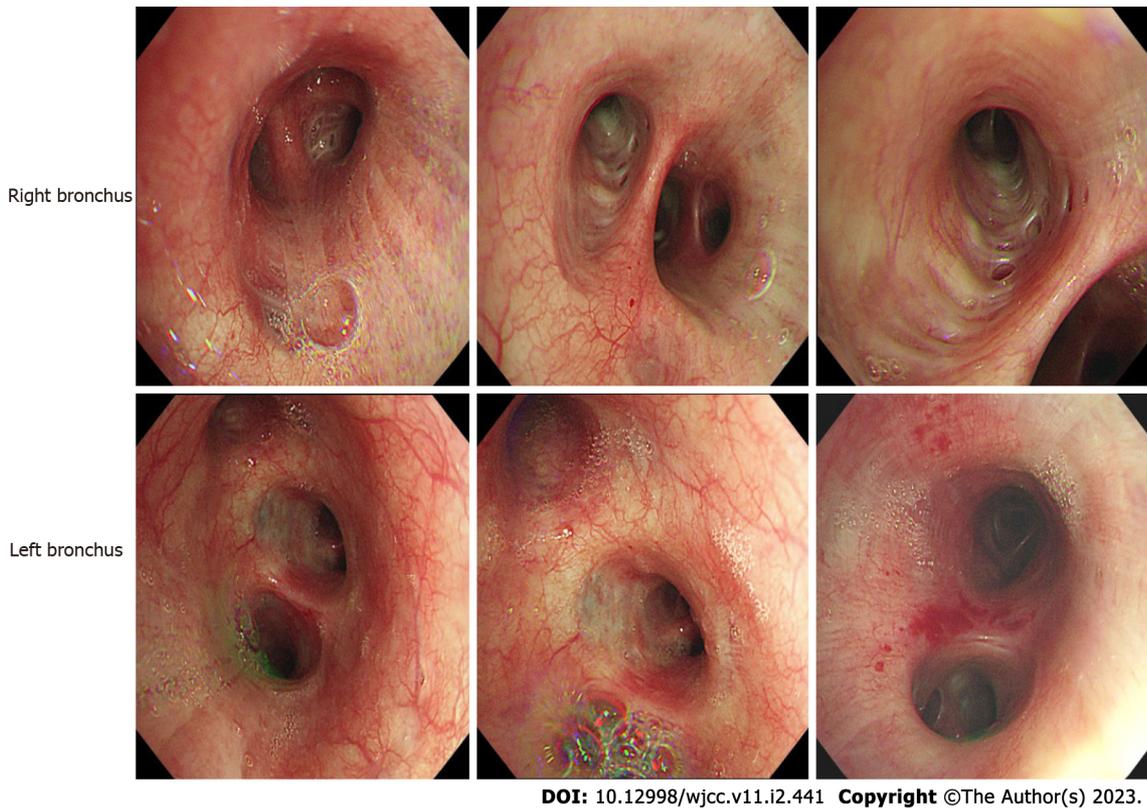


Figure 3 Bronchoscopy findings of the case. There are a lot of white secretions in the trachea.

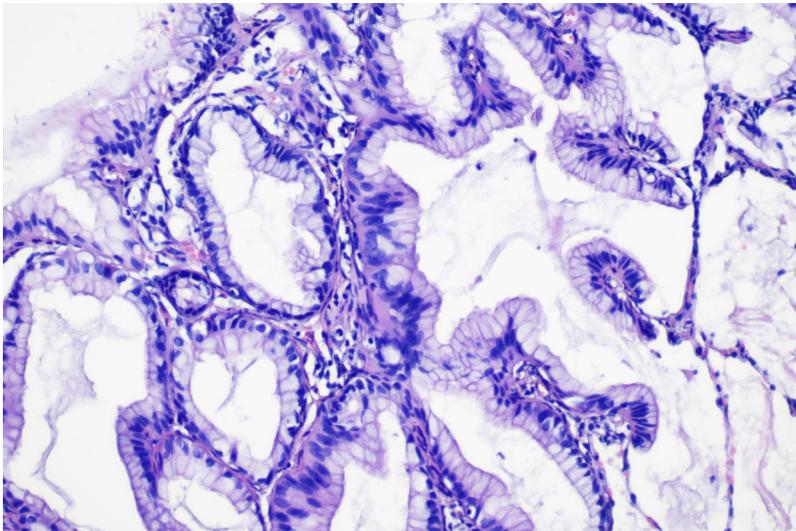


Figure 4 Histopathological section of computed tomography -guided percutaneous lung biopsy specimen showing lung invasive mucinous adenocarcinoma (H&E stain, 200×).

invasive non-mucinous adenocarcinomas as pneumonia. Nie *et al*[19] analyzed the data of 40 patients with mucinous adenocarcinoma who underwent surgical resection; they found that 25% patients showed either pneumonia-like consolidation or multifocal patchy consolidation on chest CT. Invasive mucinous adenocarcinoma and pneumonia are not easy to distinguish due to the large overlap of clinical features, including cough and sputum symptoms[20].

This was also an important reason why this case was initially misdiagnosed as pneumonia. For middle-aged and elderly patients, those with pulmonary infiltrates that are not absorbed by anti-infection treatment, and who continue to experience cough with expectoration of large amount of white sputum, the possibility of pneumonia-type lung cancer should be considered and a pathological

diagnosis obtained. Pathology is still the gold-standard for the diagnosis of the disease, and the accurate diagnosis of LIMA is a key imperative to initiate appropriate treatment and improve the prognosis.

Advances in the field of molecular profiling and targeted therapies have brought about a paradigm shift in the treatment landscape for NSCLC[21]. Lung adenocarcinoma patients with genetic mutations can achieve prolonged survival with corresponding targeted therapy. According to previous studies reporting gene mutation analysis in the context of LIMA, KRAs are the most common mutation type accounting for approximately 35%–75%, while the incidence of Tp53 mutation is approximately 46%; the incidence of *EGFR* mutation, *ALK* rearrangement, and *BRAF* mutation is very low[22–24]. However, several studies have demonstrated high antitumor activity of *EGFR*-TKIs against LIMA, and the therapeutic response can be dramatic and long-lasting. In 2013, López-González *et al*[25] described a 66-year-old woman diagnosed with right lung IMA who tested positive for *EGFR* mutation; treatment with gefitinib led to significant shrinkage of lesions, and the patient showed a long progression-free survival. Moreover, Pastorino *et al*[26] claimed that long-term gefitinib therapy may be effective in the management of atypical adenomatous hyperplasia and multifocal IMA presenting as diffuse ground glass opacities, when fluorescence in situ hybridization or molecular testing are indicative of sensitivity.

Our patient was *EGFR* mutation-positive for which the recommended treatment is gefitinib. This treatment resulted in a rapid reduction of bronchorrhea, associated with a dramatic improvement in dyspnea, hypoxia, and radiographic abnormalities. Gefitinib is an orally-active, selective *EGFR*-TKI that blocks signal transduction pathways implicated in the proliferation and survival of cancer cells[27]. Of note, some studies have reported contradictory findings about LIMA without *EGFR* mutation treated with gefitinib[28,29].

CONCLUSION

At present, the exact mechanism of action of targeted drugs for tumors is not fully understood. Owing to the low number of patients treated with these drugs, further research and follow-up studies are required to obtain more definitive evidence.

FOOTNOTES

Author contributions: All authors have read and approved the manuscript, and significantly contributed to this paper. Ou GC, Luo W, Zhang WS, Wang SH, Zhao J, Zhao HM, and Qiu R contributed to conception and design, literature review, manuscript writing and correction, final approval of manuscript; Ou GC and Luo W contributed equally to this work; All authors read and approved the final manuscript.

Supported by the Science and Technology Research Project of Sichuan Provincial Administration of Traditional Chinese Medicine, No. 2021MS164; Scientific research project of Sichuan Medical Association, No. S21012.

Informed consent statement: Written informed consent to publish this information was obtained from the patient.

Conflict-of-interest statement: All the authors declare that they have no competing interests.

CARE Checklist (2016) statement: The authors have read the CARE Checklist (2016), and the manuscript was prepared and revised according to the CARE Checklist (2016).

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Country/Territory of origin: China

ORCID number: Guo-Chun Ou 0000-0002-6001-6691; Rong Qiu 0000-0001-6524-6392.

S-Editor: Liu JH

L-Editor: A

P-Editor: Liu JH

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