

Striking lung cancer response to self-administration of cannabidiol: A case report and literature review

SAGE Open Medical Case Reports
Volume 7: 1–4
© The Author(s) 2019
Article reuse guidelines:
sagepub.com/journals-permissions
DOI: 10.1177/2050313X19832160
journals.sagepub.com/home/sco



Josep Sulé-Suso^{1,2}, Nick A Watson³, Daniel G van Pittius⁴ and Apurna Jegannathen¹

Abstract

In spite of new drugs, lung cancer is associated with a very poor prognosis. While targeted therapies are improving outcomes, it is not uncommon for many patients to have only a partial response, and relapse during follow-up. Thus, new drugs or re-evaluation of existing therapies used to treat other non-malignant diseases (drug repurposing) are still needed. While this research both *in vitro* and *in vivo* is being carried out, it is important to be attentive to patients where the disease responds to treatments not considered standard in clinical practice. We report here a patient with adenocarcinoma of the lung who, after declining chemotherapy and radiotherapy, presented with tumour response following self-administration of cannabidiol, a non-psychoactive compound present in *Cannabis sativa*. Prior work has shown that cannabidiol may have anti-neoplastic properties and enhance the immune response to cancer. The data presented here indicate that cannabidiol might have led to a striking response in a patient with lung cancer.

Keywords

Lung cancer, cannabinoid, cannabidiol

Date received: 23 August 2018; accepted: 29 January 2019

Introduction

The quest to improve the prognosis of lung cancer has led to the development and evaluation of new drugs with mechanisms of action that differ from those of conventional chemotherapy drugs used for many years worldwide. Great effort is now being placed in developing and assessing the potential of targeted therapies and immunotherapy in lung cancer which are leading to improved clinical outcomes.¹ Thus, targeted therapy is replacing conventional chemotherapy as standard treatment for patients with targetable oncogenic drivers.² However, it has to be acknowledged that responses to these agents are still partial with tumours recurring during follow-up. In fact, due to tumours' genetic heterogeneity, a complete response in lung cancer patients is very difficult to achieve.²

The challenge to improve the outcome of patients with lung cancer is leading to the evaluation of alternative drugs which, alone or in combination, may lead to improved response and survival in patients with lung cancer. Therefore, further development of new drugs or even established therapies previously used to treat non-malignant diseases (drug

repurposing) which could have shown an effect on lung cancer *in vitro* and/or *in vivo* are worth pursuing.

One possible example is cannabidiol (CBD), a non-psychoactive compound from *Cannabis sativa*. CBD, which has been used in the management of several non-oncological pathologies,³ could be a potential drug in the treatment of cancer. CBD has been shown to have anti-neoplastic effects *in vitro* and/or *in vivo* in lung cancer^{4–9} and other types of cancer.^{10,11} However, although work is needed to better

¹Cancer Centre, Royal Stoke University Hospital, University Hospitals of North Midlands (UHNM), Stoke on Trent, UK

²Institute for Science and Technology in Medicine, Guy Hilton Research Centre, Keele University, Stoke on Trent, UK

³Imaging Department, Royal Stoke University Hospital, University Hospitals of North Midlands (UHNM), Stoke on Trent, UK

⁴Histopathology Department, Royal Stoke University Hospital, University Hospitals of North Midlands (UHNM), Stoke on Trent, UK

Corresponding Author:

Josep Sulé-Suso, Institute for Science and Technology in Medicine, Guy Hilton Research Centre, Keele University, Thornburrow Drive, Stoke on Trent ST4 7QB, UK.

Email: josep.sulesuso@uhnm.nhs.uk



Creative Commons Non Commercial CC BY-NC: This article is distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0 License (<http://www.creativecommons.org/licenses/by-nc/4.0/>) which permits non-commercial use, reproduction and distribution of the work without further permission provided the original work is attributed as specified on the SAGE and Open Access pages (<https://us.sagepub.com/en-us/nam/open-access-at-sage>).

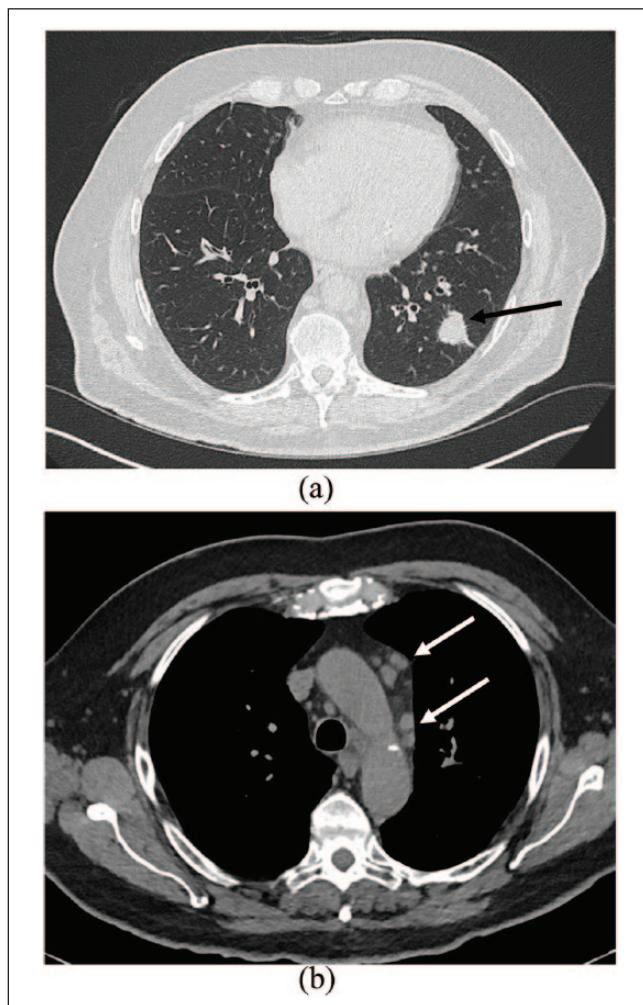


Figure 1. CT scan image at diagnosis: (a) irregular rounded tumour seen in the periphery of left lower lobe, and (b) prominent multiple scattered mediastinal lymph nodes.

understand the mechanism/s of action of CBD both *in vitro* and *in vivo*, it is worth identifying any possible cases of patients with lung cancer whose disease responds to this drug. On this basis, we present here the case of a lung cancer patient whose tumour markedly responded to CBD.

Case

In October 2016, an 81-year-old man with chronic obstructive pulmonary disease (COPD) presented to his general practitioner with a 3-week history of increasing breathlessness but no cough. A chest radiograph identified a shadow in the lower zone in the left lung, and subsequent CT scan confirmed the presence of a 2.5×2.5 cm mass in the lower left lung and multiple mediastinal lymph nodes (Figure 1(a) and (b)). The patient underwent an endobronchial ultrasound guided biopsy of the paratracheal lymph nodes which revealed lung adenocarcinoma (T1c N3 M0). Tumour cells were strongly positive for CK7, thyroid transcription

factor-1 (TTF-1) and with moderate focal expression of estrogen receptor (ER). They were negative for CK20, S100, PSA, CD56, synaptophysin and chromogranin. The tumour was negative for epidermal growth factor receptor (EGFR) and anaplastic lymphoma kinase (ALK) mutations.

His previous medical history was COPD, diet controlled diabetes, and cancer of the prostate treated with radical prostatectomy in 2004 and in remission. He was not on regular medication and had no history of drug allergies. He was a retired salesman. There was no previous history of asbestos exposure. He was an ex-smoker (around 18 cigarettes daily for around 15 years) having stopped smoking 45 years ago. His ECOG performance status was 1. Physical examination was unremarkable.

The patient was offered chemotherapy and radiotherapy, but he declined as he was in his 80s and did not want any treatment that could adversely affect his quality of life. The decision was made to follow the patient up but without active treatment.

A CT scan in December 2016 showed that the lung mass had increased in size to 2.7×2.8 cm though the mediastinal and left hilar lymph nodes had not changed in size. The patient was offered treatment but again declined. A chest X-ray in July 2017 showed progressive changes in the left lower zone but no significant collapse or effusion evident. The patient had a further CT scan in November 2017 which revealed near total resolution of the left lower lobe mass with only a small area of residual spiculated soft tissue remaining (1.3×0.6 cm) and a significant reduction in size and number of mediastinal lymph nodes (Figure 2(a) and (b)). The patient underwent another CT scan in January 2018 which showed stable appearances of the small residual opacity in the left lower lobe and mediastinal lymph nodes.

On further questioning, the patient stated that he had started taking CBD ("MyCBD") oil 2% (200 mg CBD in 10 mL) from the beginning of September 2017. He took two drops (0.06 mL, 1.32 mg CBD) twice daily for a week and then nine drops (0.3 mL, 6 mg CBD) twice daily until the end of September. Following the November 2017 CT scan, the patient started taking nine drops twice daily but had to stop around a week later. The reason behind this was that the patient did not like the taste and caused him slight nausea. He was never physically sick. There were no other changes in the patient's diet, medication or lifestyle from September 2017. Informed written consent was obtained from the patient.

Discussion

The data presented here may indicate that CBD led to a partial tumour response in a patient with histologically proven adenocarcinoma of the lung. Various possible mechanisms of action leading to this objective response might be postulated.

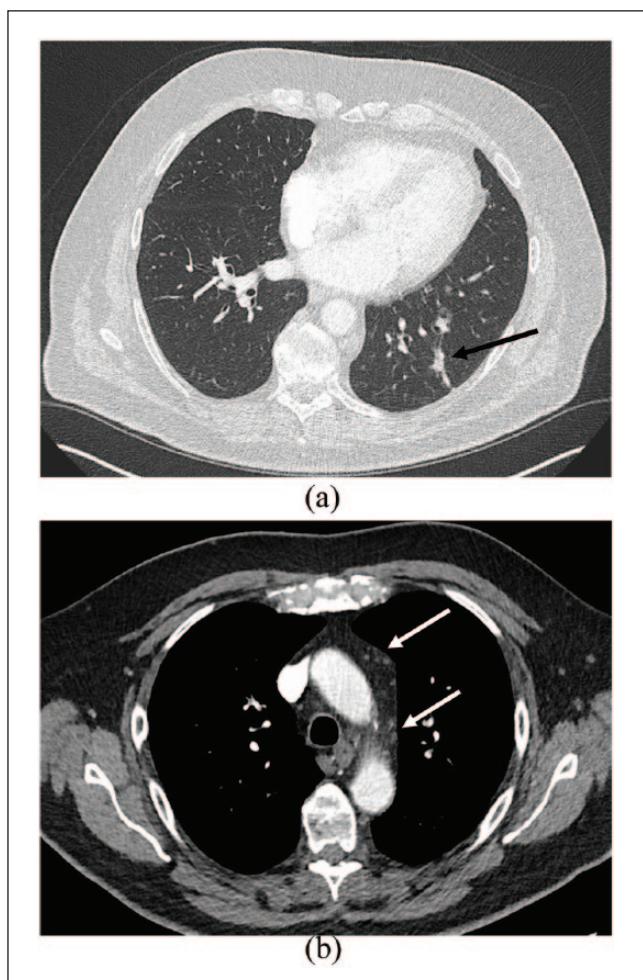


Figure 2. CT Scan image following the patient taking CBD: (a) marked regression of the left lower lobe mass leaving a small irregular residual linear band, and (b) striking regression of the mediastinal lymph nodes.

It has been described that CBD can act on tumour cells, directly or indirectly, through different pathways and that these effects might vary in different tumour cells. CBD acts as an inverse agonist for CB₂ receptor and an antagonist for CB₁ receptor.¹² However, CBD has low affinity to either CB₁ or CB₂ receptors.⁹ In addition, CBD has anti-cancer effects acting as an agonist for the transient receptor potential vanilloid (TRPV) 1 and 2 leading to changes in intracellular Ca²⁺ levels.^{5,13}

It is also reported that CBD can induce apoptosis in cancer cells via the production of reactive oxygen species (ROS), caspase activation^{4,13,14} and activation of p53 dependent apoptotic pathways in cancer cells^{14,15} and down-regulation of mammalian target of rapamycin (mTOR) and cyclin D1.¹⁶ CBD can also upregulate TNF/TNFR1 and TRAIL/TRAIL-R2 signalling by modulation of both ligand and receptor levels followed by apoptosis.¹⁴ Furthermore, CBD inhibits human umbilical vein endothelial cells (HUVEC)

endothelial cells migration, invasion and sprouting in vitro, and angiogenesis in vivo through down-modulation of several angiogenesis-related molecules.¹⁷

From the immunological point of view, CBD significantly inhibits the recruitment of tumour-associated macrophages (TAM) in primary tumour stroma and secondary lung metastases.¹² CBD enhanced the susceptibility of cancer cells to adhere to and subsequently be lysed by Lymphokine-Activated Killer (LAK) cells, with both effects being reversed by a neutralizing ICAM-1 antibody.⁹

Based on these data, it is clear that several factors may have been involved in this patient's response to CBD. However, although significantly lower potency in non-malignant cells has been described,¹⁸ the effects of CBD on non-malignant cells has yet to be fully assessed.

Conclusion

In summary, the data presented here indicate that CBD may have had a role in the striking response in a patient with histologically proven adenocarcinoma of the lung as a result of self-administration of CBD oil for a month and in the absence of any other identifiable lifestyle, drug or dietary changes. Further work is needed both *in vitro* and *in vivo* to better evaluate the various mechanisms of action of CBD on malignant cells, and its potential application in the treatment of not only lung cancer but also other malignancies.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical approval

Our institution does not require ethical approval for reporting individual cases or case series.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Informed consent

The patient described herein had given consent to the use of de-identified patient data for use in research and education. Written informed consent was obtained from the patient for his anonymized information to be published in this article.

ORCID iD

Josep Sulé-Suso  <https://orcid.org/0000-0003-0598-737X>

References

1. Rotow J and Bivona TG. Understanding and targeting resistance mechanisms in NSCLC. *Nat Rev Cancer* 2017; 17(11): 637–658.

2. Mayekar MK and Bivona TG. Current landscape of targeted therapy in lung cancer. *Clin Pharmacol Ther* 2017; 102(5): 757–764.
3. Rong C, Lee Y, Carmona NE, et al. Cannabidiol in medical marijuana: research vistas and potential opportunities. *Pharmacol Res* 2017; 121: 213–218.
4. Choi WH, Park HD, Baek SH, et al. Cannabidiol induces cytotoxicity and cell death via apoptotic pathway in cancer cell lines. *Biomol Ther* 2008; 16: 87–94.
5. Ramer R, Rohde A, Merkord J, et al. Decrease of plasminogen activator inhibitor-1 may contribute to the anti-invasive action of cannabidiol on human lung cancer cells. *Pharm Res* 2010; 27(10): 2162–2174.
6. Ramer R, Merkord J, Rohde H, et al. Cannabidiol inhibits cancer cell invasion via upregulation of tissue inhibitor of matrix metalloproteinases. *Biochem Pharmacol* 2010; 79(7): 955–966.
7. Preet A, Qamri Z, Nasser MW, et al. Cannabinoid receptors, cb1 and cb2, as novel targets for inhibition of non-small cell lung cancer growth and metastasis. *Cancer Prev Res (Phila)* 2011; 4(1): 65–75.
8. Ramer R, Bublitz K, Freimuth N, et al. Cannabidiol inhibits lung cancer cell invasion and metastasis via intercellular adhesion molecule-1. *FASEB J* 2012; 26(4): 1535–1548.
9. Haustein M, Ramer R, Linnebacher M, et al. Cannabinoids increase lung cancer cell lysis by lymphokine-activated killer cells via upregulation of ICAM-1. *Biochem Pharmacol* 2014; 92(2): 312–325.
10. Sayeda Y-K, Moreau M, Mueller R, et al. Enhancing the therapeutic efficacy of cancer treatment with cannabinoids. *Front Oncol* 2018; 8(114): 1–8.
11. Dumitru CA, Sandalcioglu IE and Karsak M. Cannabinoids in glioblastoma therapy: new applications for old drugs. *Front Mol Neurosci* 2018; 11: 159–157.
12. Elbaz M, Nasser MW, Ravi J, et al. Modulation of the tumor microenvironment and inhibition of EGF/EGFR pathway: novel anti-tumor mechanisms of cannabidiol in breast cancer. *Mol Oncol* 2015; 9(4): 906–919.
13. Ligresti A, Moriello AS, Starowicz K, et al. Antitumor activity of plant cannabinoids with emphasis on the effect of cannabidiol on human breast carcinoma. *J Pharmacol Exp Ther* 2006; 318(3): 1375–1387.
14. Ivanov VN, Wu J and Hei TK. Regulation of human glioblastoma cell death by combined treatment of cannabidiol, γ -radiation and small molecule inhibitors of cell signaling pathways. *Oncotarget* 2017; 8(43): 74068–74095.
15. De Petrocellis L, Ligresti A, Moriello AS, et al. Non-THC cannabinoids inhibit prostate carcinoma growth *in vitro* and *in vivo*: pro-apoptotic effects and underlying mechanisms. *Br J Pharmacol* 2013; 168(1): 79–102.
16. Sultan AS, Marie MA and Sheweita SA. Novel mechanism of cannabidiol-induced apoptosis in breast cancer cell lines. *Breast* 2018; 41: 34–41.
17. Ramer R, Fischer S, Haustein M, et al. Cannabinoids inhibit angiogenic capacities of endothelial cells via release of tissue inhibitor of matrix metalloproteinases-1 from lung cancer cells. *Biochem Pharmacol* 2014; 91(2): 202–216.
18. Nabissi M, Morelli MB, Santoni M, et al. Triggering of the TRPV2 channel by cannabidiol sensitizes glioblastoma cells to cytotoxic chemotherapeutic agent. *Carcinogenesis* 2013; 34(1): 48–57.