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Review Article www.enlivenarchive.org Enliven: Pharmacovigilance and Drug Safety

ISSN: 2378-5411

Evaluating the Pharmaceutical Properties and Drug Likeness of Anticancer Drugs

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Received Date: 16th September 2018

Accepted Date: 22nd November 2018

Published Date: 23rd November 2018

Citation: Paul A (2018) Evaluating the Pharmaceutical Properties and Drug Likeness of Anticancer Drugs. Enliven: Pharmacovigilance and Drug Safety 5(1): 003.

The researchers performed an assessment of the molecular structure and numerical evaluation of molecular properties to examine the interrelationships that are prevalent in anticancer pharmacotherapies relied on to medically treat the lung cancer [1]. In these cases, the researcher examined almost sixteen cancer medications focusing on their bioactivity scores, molecular properties, as well as their structures [2]. The drugs molecular structures were analyzed and they established that they showed a considerable multiplicity of scaffolding [3]. After the analysis, molecular volume, electron donators/acceptors, molecular weight, polar surface area, and Log P were established to be the most significant molecular properties of the drugs [4]. Furthermore, bioactivity scores for medication similarity were explained by categorizing them into six namely the enzyme inhibitor, protease inhibitor, nuclear receptor ligand, kinase inhibitor, on channel modulator, as well as the GPCR ligand as shown below [5].

Additionally, the univariate statistical technique as well as K-means cluster assessment was used to assess the molecular properties [6]. The K-means cluster exploration relied was done on the molecular properties to positively distinguish the drugs with the greatest similarity [7]. There are several diseases which make up cancer, they usually cancer cells usually start from the normal cells before being changes in a manner that the cells grow and continually split in irrepressible way [8]. Such types of cancer as urinary bladder, colon, and lung cancers are commonly diagnosed among men while uterus, lung, breast, and colon cancer are popularly diagnosed in women [9]. The effect of the anticancer drugs largely relies on diverse factors, for instance, the growth faction (rate of actual separating cell in a tumor) as well as the time it takes to double the mass of the tumor [10]. The growth function is mostly inversely proportional. The mass doubling time is inversely proportional to the growth fraction proving that the anticancer drugs are extremely responsive to smaller mass doubling [11]. The average size of the tumor is regarded as a factor that can reduce the effectiveness of chemotherapy. Huge tumors fail are relatively hard to be treated with chemotherapy owing partly to the challenges which are usually experienced, for instance, adequate amount of the drug usually fails to permeate into the tumor to neutralize the cancerous cells [12]. Additionally, inside the tumor, the cancer cell might not multiply which means after chemotherapy, the cells can re-create the tumors. The patient's immuno-competence inclusive of the recovery from the drugs' cytotoxic effects as well as his or her general status, for instance, the capacity of the patient to endure the drug cytotoxic effects greatly impact the outcome of the chemotherapy [13].

There are several types of anticancer agents, for instance, the endocrine targeting, chromatin inhibitors, noncovalent DNA binding, covalent DNA binding drugs, as well as the antimetabolites [14]. The ability of the patient to tolerate the antineoplastic drugs is assessed mostly by considering the patient's capacity to create blood cells despite being under stressful situation as well as the kidney and liver metabolic capacity [15]. The study examined the pharmaceutical properties of the drugs being used to treat lung cancer. Furthermore, the researchers compared the structures in addition to the definite molecular properties commonly regarded as suggestive drug-similarity to be analyzed and contrasted [16]. Moreover, the researchers used K-means and hierarchical cluster analyses as the main pattern recognition method to establish the fundamental networks of such anticancer agents (on the basis of their molecular properties) [17].

By understanding how the group of anticancer agents are similar or dissimilar might enable scientists to understand their mode of action and give a framework for predicting the lead pharmaceutical entities [18]. In this case, the researchers have opted to compare the bioactivity scores, molecular properties, as well as molecular properties of sixteen anticancer agents that are regarded as critical to treat NSCLC and SCLC [19]. The findings prove that the comparative molecular scaffolding showed considerable multiplicity in substituent, non-aromatic and aromatic rings, in addition to functional group. Such significant range in structure was accompanied by determining and analyzing molecular properties [20]. The researchers established satisfactory drug similarity (for oral administration) in nine out of the sixteen agents under the Rule of Five criteria [21].

Despite an extensive diversity in Log P, molecular volume, and molecular weight, the study revealed a high correlation between the nine properties of all the drugs. By adopting the discriminant, K-means cluster, and hierarchical cluster analyses to perform pattern recognition assessment, the researchers were able to clearly prove which drug with high degree of similarity ostensible supposedly to show the likely comparable medical activities [22]. The molecular weight of the drugs, the number of hydrogen donors, Log P, rotatable bonds, nitrogen atoms, and oxygen atoms also increased proportionally [23]. Additionally, the researchers were able to develop an algorithm that enabled prediction of new drugs of similar characteristics to treat cancer by relying on multiple regression analysis [24]. It is critical to discovery and development of new anticancer drugs which target the cancerous lumps in the pulmonary parts [25]. The analysis of the present effective pharmacotherapies will improve the development of new anticancer drugs.

References

1. Bartzatt Ronald (2016) Pharmaceutical Properties and Drug Likeness of Anticancer Drugs Administered for The Clinical Treatment of Lung Cancer. International Journal of Cancer Research and Prevention 9: 279.
2. Pratt William B, William D. Ensminger, Raymond W. Ruddon. The Anticancer Drugs, Oxford University Press, USA, 1994.
3. Richard BS, Holladay MW (2014) The Organic Chemistry of Drug Design and Drug Action. Academic Press.
4. Swathi M (2017) Clustering Enhancement Using Similarity Indexing to Reduce Entropy. Enliven: Bioinform 4: 001.
5. Temel JS, Greer JA, Muzikansky A, Gallagher ER, Admane S , et al. (2010) Early Palliative Care for Patients with Metastatic Non–Small-Cell Lung Cancer. N Eng J Med 363: 733-742.
6. Kelley AS, Meier DE (2010) Palliative Care-A Shifting Paradigm. N Engl J Med 363:781-2.
7. Roggli VL, Vollmer RT, Greenberg SD, McGavran MH, Spjut HJ (1985) Lung Cancer Heterogeneity: A Blinded and Randomized Study of 100 Consecutive Cases. Hum Pathol 16: 569-579.
8. Swathi M (2017) Drug Prediction of Cancer Genes Using SVM. Enliven: Pharmacovigilance and Drug Safety 4: 001.
9. Zhou Y, Xu Y, Zhao J, Zhong W, Wang M (2015) Combined Chemotherapy with Vinorelbine and Ifosfamide as Third-line Treatment and Beyond of Advanced Non-Small Cell Lung Cancer. Zhongguo Fei Ai Za Zhi 18: 351-357.
10. Isokangas OP, Knuuttila A, Halme M, Mantyla M, Lindström I (1999) Phase II Study of Vinorelbine and Gemcitabine for Inoperable Stage IIIB-IV Non-Small-Cell Lung Cancer. Ann Oncol 10: 1059-1063.
11. Martoni A, Marino A, Sperandi F, Giaquinta S, Di Fabio F, et al. (2005) Multicentre Randomised Phase III Study Comparing the Same Dose and Schedule of Cisplatin Plus the Same Schedule of Vinorelbine or Gemcitabine in Advanced Non-Small Cell Lung Cancer. Eur J Cancer 41: 81-92.
12. Zhai XJ, Cheng HR, Long HL, Mao WK, Cao L, et al. (2015) Effects of Docetaxel Plus Three-Dimensional Conformal Radiation Therapy On Microvessel Density and Apoptosis Expression in Local Advanced Squamous Non-Small-Cell Lung Cancer. Genet Mol Res 14: 5399-5406.
13. Clegg A, Scott DA, Sidhu M, Hewitson P, Waugh N (2001) A Rapid and Systematic Review of the Clinical Effectiveness and Cost-Effectiveness of Paclitaxel, Docetaxel, Gemcitabine and Vinorelbine in Non-Small-Cell Lung Cancer. Health Technol Assess 5: 1-195.
14. Swathi M (2018) Enhancement of K-Mean Clustering for Genomics of Drugs. Enliven: J Genet Mol Cell Biol 5: 001.
15. Clegg A, Scott DA, Hewitson P, Sidhu M, Waugh N (2002) Clinical and Cost Effectiveness of Paclitaxel, Docetaxel, Gemcitabine, and Vinorelbine in Non-Small Cell Lung Cancer: A Systematic Review. Thorax 57: 20-28.
16. Enomoto Y, Kenmotsu H, Watanabe N, Baba T, Murakami H (2015) Efficacy and Safety of Combined Carboplatin, Paclitaxel, And Bevacizumab for Patients with Advanced Non-Squamous Non-Small Cell Lung Cancer with Pre-Existing Interstitial Lung Disease: A Retrospective Multi-Institutional Study. Anticancer res 35: 4259-4263.
17. Brown T, Pilkington G, Bagust A, Boland A, Oyee J, et al. (2013) Clinical Effectiveness and Cost-Effectiveness of First-Line Chemotherapy for Adult Patients with Locally Advanced or Metastatic Non-Small Cell Lung Cancer: A Systematic Review and Economic Evaluation. Health Technol Assess 17:1-278.
18. Brown T, Pilkington G, Bagust A, Boland A, Oyee J, et al. (2015) Corrigendum: Clinical Effectiveness and Cost-Effectiveness of First-Line Chemotherapy for Adult Patients with Locally Advanced or Metastatic Non-Small Cell Lung Cancer: A Systematic Review and Economic Evaluation. Health Technol Assess 17: 281-282.
19. Hande KR (1998) Etoposide: Four Decades of Development of a Topoisomerase II Inhibitor. Eur J cancer 34: 1514-1521.
20. Shaw AT, Kim DW, Nakagawa K, Seto T, Crino L, et al. (2013) Crizotinib Versus Chemotherapy in Advanced ALK-Positive Lung Cancer. N Engl J Med 368: 2385-2394.
21. Liu R, Zheng H, Li W, Guo Q, He S, et al. (2015) Anti-Tumor Enhancement of Fei-Liu-Ping Ointment in Combination with Celecoxib Via Cyclooxygenase-2-Mediated Lung Metastatic Inflammatory Microenvironment in Lewis Lung Carcinoma Xenograft Mouse Model. J Transl Med 13: 366.
22. Susan Newton, Margie Hickey, Jeannine Brant (2016) Lung Cancers. Mosby's Oncology Nursing Advisor E-Book: A Comprehensive Guide to Clinical Practice 2: 116.
23. Gao G, Jiang J, Liang X, Zhou X, Huang R (2009) A Meta-Analysis of Platinum Plus Gemcitabine or Vinorelbine in The Treatment of Advanced Non-Small-Cell Lung Cancer. Lung Cancer 65: 339-344.
24. Schiller JH, Harrington D, Belani CP, Langer C, Sandler A (2002) Comparison of Four Chemotherapy Regimens for Advanced Non–Small-Cell Lung Cancer. N Engl J Med 346: 92-98.
25. de Castria TB, da Silva EM, Gois AF, Riera R (2011) Cisplatin Versus Carboplatin in Association with Third-Generation Drugs for Advanced Non-Small Cell Lung Cancer. Cochrane Database Syst Rev 16.
26. Feins RH (2002) Multi-Modality Treatment of Non-Small Cell Lung Cancer. Surg Clin North Am 82: 611-620.
27. Li J, Chen R, Ji M, Zou SL, Zhu LN (2015) Cisplatin-Based Chronotherapy for Advanced Non-Small Cell Lung Cancer Patients: A Randomized Controlled Study and Its Pharmacokinetics Analysis. Cancer Chemother Pharmacol 76: 651-655.
28. Greenhalgh J, McLeod C, Bagust A, Boland A, Fleeman N, et al. (2010) Pemetrexed for The Maintenance Treatment of Locally Advanced or Metastatic Non-Small Cell Lung Cancer. Health Technol Assess 14: 33-39.