Scientific Foundation SPIROSKI, Skopje, Republic of North Macedonia
South East European Journal of Immunology. 2025 Mar 27; 8(CITIM):078
https://doi.org/10.3889/seejim.2025.6141
eISSN: 1857-9388
Category: *CITIM - Cancer Immunotherapy & Immunomonitoring (CITIM2025)*
Section: *Posters*

Innovative Vanadium (V)-Based Drug: Preliminary In Vitro and In Vivo Antitumor Investigations

Mihaela Turtoi*, Maria Anghelache, Geanina Voicu, Florentina Safciuc, Mariana Deleanu, Manuela Călin

Medical and Pharmaceutical Bionanotechnologies Department, Institute of Cellular Biology and Pathology "Nicolae Simionescu" of the Romanian Academy, Bucharest, 050568, Romania.

Citation: Turtoi M, Anghelache M, Voicu G, Safciuc F, Deleanu M, Călin M. Innovative Vanadium (V)-Based Drug: Preliminary In Vitro and In Vivo Antitumor Investigations. SEE J Immunol. 2025 Mar 27;8(CITIM):078. https://doi.org/10.3889/seejim.2025.6141.
Keywords: metal-based compounds, antitumor activity, pyroptosis, macrocyclic tetranuclear oxovanadium (V) compound
***Correspondence:** Mihaela Turtoi. Medical and Pharmaceutical Bionanotechnologies Department, Institute of Cellular Biology and Pathology "Nicolae Simionescu" of the Romanian Academy, Bucharest, Romania.
E-mail: mihaela.turtoi@icbp.ro
Received: 01-March-2025
Accepted: 25-March-2025
Copyright: © 2025 Mihaela Turtoi, Maria Anghelache, Geanina Voicu, Florentina Safciuc, Mariana Deleanu, Manuela Călin. This is an open-access article distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (CC BY-NC 4.0)
Funding: This research did not receive any financial support
Competing Interests: The authors have declared that no competing interests exist

Abstract

Several metal-based compounds have been synthesized and tested for their antitumor properties, as current Pt-based cytostatic drugs have not achieved the expected pharmacological outcomes.
In this study, we evaluated the antitumor effects of our newly developed macrocyclic tetranuclear oxovanadium (V) compound, with the chemical formula $[(V^{V}O)(L)(CH_3O)]_4$ (abbreviated Van), where L represents the deprotonated form of the Schiff base 3-methoxysalicylidenvaline (Turtoi M et al., 2021). We investigated the effects of Van on inducing apoptosis and pyroptosis in the human hepatocarcinoma (HepG2) cell line, as well as its potential to reduce the tumor volume *in vivo*.
The synthesis and physicochemical characterization for Van, its stability in cell culture media, its cellular uptake, interaction with albumin, and effects on cell viability, oxidative status, DNA integrity, and cell cycle of HepG2 cells have been previously reported (Turtoi M et al., 2021). The mechanism by which Van exerts its antitumor activity was further investigated by determining the activity of caspase 3 and analyzing the protein expression levels of the anti-apoptotic protein Bcl-2, the pro-pyroptotic proteins NLRP3 and caspase 1, as well as Interleukin (IL)-1β, in comparison to cisplatin. Additionally, the ability of Van to reduce the size of solid tumors was initially evaluated through the subcutaneous injection of HepG2 cells in C57BL/6J mice. The antitumor treatment started 48 hours after tumor induction, involving three injections given either intravenously (i.v.) or intratumorally (i.t.), with each injection administered every three days. The doses were either 1 mg/kg BW Van or 1 mg/kg BW cisplatin. All animals were euthanized one-month post-anti-tumor therapy using an overdose of ketamine and xylazine. The tumors were then excised and histologically analyzed by Trichrome Masson's staining.
Our results demonstrated that Van can produce a pro-apoptotic effect by increasing caspase 3 activity and reducing the synthesis of the anti-apoptotic protein Bcl-2, similar to the effects of cisplatin. Furthermore, Van exhibited a greater ability to activate the pyroptotic signaling pathway compared to cisplatin by enhancing the expression of NLRP-1, caspase 1, and IL-1β protein expression in HepG2 cells. The preliminary *in vivo* results evidenced that Van effectively prevents the formation of subcutaneous solid tumors following i.v administration and reduces the tumor volume after i.t injection compared to control animals.
Our findings highlight the remarkable antitumor efficacy of $[(V^{V}O)(L)(CH_3O)]_4$, underscoring its potential as a powerful therapeutic agent.
Turtoi M et al., Antitumor Properties of a New Macrocyclic Tetranuclear Oxidovanadium(V) Complex with 3-Methoxysalicylidenvaline Ligand. *Biomedicines* **2022**, *10*, 1217.