# PIM-1 kinase

PIM-1 kinase (Proviral Integration site for Moloney murine leukemia virus 1) is a serine/threonine kinase that plays a significant role in various cellular processes, particularly in regulating cell survival, cell proliferation, and cell differentiation. It is a member of the PIM kinase family, which includes PIM-2 and PIM-3, and is involved in a range of biological functions, including:

1. **Cell Survival and Apoptosis**: PIM-1 kinase promotes cell survival by inhibiting apoptotic pathways. It can phosphorylate various proteins involved in regulating apoptosis, such as BAD (Bcl-2-associated death promoter) and other members of the Bcl-2 family, leading to their inactivation and the prevention of cell death.

2. **Cell Cycle Regulation**: PIM-1 regulates the cell cycle by phosphorylating and stabilizing key cell cycle regulators like p21, which is involved in cell cycle progression, and cyclin-dependent kinase inhibitors. PIM-1 also interacts with components of the cell cycle machinery to drive progression through the G1 and G2 phases, contributing to cellular proliferation.

3. **Oncogenic Potential**: Due to its role in promoting cell survival and proliferation, PIM-1 has been implicated in cancer development. It is often overexpressed in various types of cancers, such as prostate cancer, leukemia, and lymphoma, making it a potential target for cancer therapy.

4. **Response to Stress**: PIM-1 has a role in cellular stress responses, including those induced by DNA damage, hypoxia, or other types of environmental stress. This kinase helps cells cope with such stresses by promoting survival mechanisms and maintaining cellular integrity.

PIM-1 is often a target of interest for research in cancer therapy, as its inhibition could potentially reduce tumor growth and enhance the effectiveness of other treatments. Additionally, its role in the regulation of various cellular processes makes it an attractive candidate for exploring in other diseases related to cell survival and proliferation.

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A study aimed to explore the correlation of PIM-1 with the clinicopathological features and prognosis of patients.

Method: The MTERF3 mRNA and protein expression levels in tissues were detected by western blot and immunohistochemistry. The expression and survival of PIM-1 in patients with glioma were analyzed using the Gene Expression Profiling Interactive Analysis database, the Gene Expression Database of Normal and Tumor Tissues 2, and the Chinese Glioma Genome Atlas database. The relationship between PIM-1 expression and immune cells and chemokines was analyzed using the Tumor Immune Estimation Resource Version 2.0 tool and the Tumor and Immune System Interactions Database. A Kaplan-Meier plot was used to estimate the correlation between PIM-1 expression and the survival of patients with glioma.

Results: The expression of PIM-1 was upregulated in glioma and was positively correlated with tumor grade. The expression of PIM-1 was significantly inhibited on the second day after transfection ($p<0.05$), and the inhibition was most obvious on the sixth day ($p<0.01$). The results of the co-expression pattern of PIM-1 showed that the expression of 5,012 genes was positively correlated with PIM-1, while the expression of 3,651 genes was negatively correlated with PIM-1. Macrophages ($p<0.001$), myeloid dendritic cells ($p<0.001$), NK cells ($p<0.001$), CD4 T cells ($p<0.001$), cancer-

associated fibroblasts ($p<0.001$), and neutrophils ($p<0.001$) were positively correlated with the expression of PIM-1 in low-grade glioma.

This study provides compelling evidence that PIM-1 kinase is overexpressed in gliomas and that its expression correlates with poorer patient survival, particularly in GBM. The relationship between PIM-1 and the immune microenvironment further highlights its potential as a biomarker and therapeutic target. [1)].

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The study would benefit from additional functional validation, larger sample sizes, and further discussion on clinical applications. Future research focusing on the mechanistic role of PIM-1 in glioma progression and exploring therapeutic strategies targeting PIM-1 could be highly beneficial for advancing glioma treatment options.

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Li Z, Wang H, Wang G, Zhang A, Wang C, Mo L, Jia Z, Tong X. Expression and prognostic value of PIM-1 kinase in gliomas. Histol Histopathol. 2024 Nov 6:18845. doi: 10.14670/HH-18-845. Epub ahead of print. PMID: 39569612.