二烯丙基三硫醚對肝細胞癌的凋亡與術後細胞再生

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摘要

肝細胞癌（Hepatocellular carcinoma；HCC）是一個重大的治療挑戰，特別是因為和肝硬化密切相關，與沒有肝硬化的個體相比，肝硬化的風險增加了十倍。傳統的治療方法常常會產生嚴重的副作用。在這種背景下，二烯丙基三硫化物（Diallyl trisulfide；DAT）已成為減少發炎反應、增強細胞合成和硫化氫（Hydrogen sulfide；H_2S）釋放的天然化合物。這種機制可抑制肝星狀細胞（Hepatic stellate cells；HSC）過度激活而促使肝纖維化，這是肝硬化和肝癌進展的關鍵因素。本研究探討 DAT 抑制癌細胞增生、促進細胞凋亡的作用及機制。首先對大鼠肝星狀細胞 (HSC-T6)、人類肝癌細胞 (HepG2) 和 Wistar 白化雄性大鼠進行實驗分析。結果表明，DAT 藉由調節 B 細胞淋巴瘤細胞 (B-cell lymphoma 2；Bcl-2)、细胞淋巴瘤 2 蛋白 (Bcl-2-associated X protein；Bax)、腺苷酸活化蛋白激酶 (AMP-activated protein kinase；AMPK) 和去乙醯化酶 (Sirtuin 1；SIRT1) 等生長因子，有效抑制 HSC-T6 和 HepG2 癌細胞的生長，同時促進細胞凋亡過程。在涉及切除 70%肝臟切除手術 (70% partial hepatectomy；PHx) 的動物實驗中，H_2S 顯著增強了正常肝細胞的再生。然而，它也會導致肝臟脂肪堆積，突顯了對於代謝的影響。綜合上述，DAT 不僅可以延緩肝癌細胞的增殖，還可以促進手術後正常肝細胞的再生。儘管如此，觀察到的脂肪累積需要仔細考慮 DAT 的臨床應用。

The Effect of Diallyl Trisulfide on Apoptosis in Hepatocellular Carcinoma and Postoperative Cellular Regeneration

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Abstract

Hepatocellular carcinoma (HCC) represents a major therapeutic challenge, particularly because of its close association with cirrhosis, which increases the risk tenfold compared with individuals without cirrhosis. Traditional treatments often have serious side effects. In this context, diallyl trisulfide (DAT) has emerged as a natural compound that reduces inflammatory responses and enhances cellular synthesis and hydrogen sulfide (H_2S) release. This mechanism inhibits excessive activation of hepatic stellate cells (HSCs) and promotes liver fibrosis, which is a key factor in the progression of cirrhosis and liver cancer. This study explores the role and mechanism of DAT in inhibiting cancer cell proliferation and promoting cell apoptosis. Experimental analyses were performed on rat hepatic stellate cell line (HSC-T6), human hepatoma cell line (HepG2), and Wistar albino male rats. The results show that DAT is effective in regulating growth factors such as B-cell lymphoma 2 (Bcl-2), Bcl-2-associated X protein (Bax), AMP-activated protein kinase (AMPK) and Sirtuin 1 (SIRT1), inhibits the growth of HSC-T6 and HepG2 cells while promoting the apoptosis process. In animal experiments involving 70% partial hepatectomy (PHx), H_2S significantly enhanced normal liver cell regeneration. However, it can also lead to fat accumulation in the liver, highlighting the metabolic consequences. Based on the above, DAT can not only delay the proliferation of liver cancer cells but also promote the regeneration of normal liver cells after surgery. Nonetheless, the observed fat accumulation requires careful consideration of the clinical application of DAT.

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