

# 基于肿瘤微环境探讨中药干预结直肠癌转移的研究进展<sup>Δ</sup>

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**摘要** 结直肠癌起病隐匿, 部分患者在确诊时已经发生局部浸润或转移, 影响治疗策略的选择及生存预后。肿瘤微环境不仅是肿瘤细胞生存的基础条件, 更是驱动其发生局部浸润与远处转移的核心调控因素。本文综述了中药调控肿瘤微环境抑制结直肠癌转移的机制, 发现黄芪多糖、益母草碱、山柰酚等中药活性成分, 以及健脾解毒方等中药复方可通过调控免疫抑制、炎症反应、肠道微生态紊乱、异常血管生成及细胞外基质稳态失衡等肿瘤微环境关键环节抑制结直肠癌转移。但目前相关研究仍以细胞和动物实验为主, 临床循证证据有限, 且机制研究多集中于单一通路, 未来研究需结合多组学技术与系统生物学方法, 系统解析中医药调控结直肠癌肿瘤微环境以抑制转移的关键靶点及作用网络。

**关键词** 结直肠癌; 肿瘤转移; 肿瘤微环境; 中药活性成分; 中药复方

## Research progress on traditional Chinese medicine interventions in colorectal cancer metastasis based on tumor microenvironment

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**ABSTRACT** Colorectal cancer has an insidious onset, and some patients have already developed local invasion or metastasis at the time of diagnosis, which affects treatment strategy selection and survival prognosis. The tumor microenvironment is not only the basic condition for tumor cell survival but also the core regulatory factor driving their local invasion and distant metastasis. This article reviewed the mechanisms by which traditional Chinese medicine regulates the tumor microenvironment to inhibit colorectal cancer metastasis. It was found that traditional Chinese medicine active ingredients such as astragalus polysaccharides, leonurine, kaempferol, etc., as well as traditional Chinese medicine formulas such as Jianpi jiedu formula, can inhibit colorectal cancer metastasis by regulating key links of the tumor microenvironment, including immunosuppression, inflammatory response, intestinal microecological disorder, abnormal angiogenesis, and extracellular matrix homeostasis imbalance. However, current related research was still mainly based on cell and animal experiments, with limited clinical evidence-based data, and mechanistic studies mostly focused on single signaling pathways. Future research should integrate multi-omics technologies and systems biology methods to systematically elucidate the key targets and action networks through which traditional Chinese medicine regulates the colorectal cancer tumor microenvironment to combat metastasis.

**KEYWORDS** colorectal cancer; tumor metastasis; tumor microenvironment; traditional Chinese medicine active ingredients; traditional Chinese medicine formulas

结直肠癌是我国常见的恶性肿瘤之一, 发病率和死亡率均位居前列, 严重威胁公众健康<sup>[1]</sup>。肿瘤转移是导致结直肠癌患者死亡的主要原因, 也是影响患者长期生存率和预后的关键因素<sup>[2]</sup>。已有研究表明, 结直肠癌转移与肿瘤微环境(tumor microenvironment, TME)密切相

关。TME是由肿瘤细胞与其周围多种非恶性基质成分共同构成的复杂动态网络, 主要包括免疫细胞、癌症相关成纤维细胞(cancer-associated fibroblasts, CAFs)、异常血管系统、重塑的细胞外基质(extracellular matrix, ECM)以及多种可溶性因子和代谢产物<sup>[3]</sup>。近年来, TME在结直肠癌转移中的作用越来越受到重视, 调控TME已成为抑制结直肠癌转移的重要策略之一<sup>[4]</sup>。中医学强调整体观念, 认为结直肠癌的发生发展及转移多与正气亏虚、邪毒内伏、痰湿瘀热互结有关, 治疗应以扶正培本为核心, 兼顾活血化瘀、清热解毒、散结消积等以恢复机体内环境平衡并抑制转移。上述认识与现代医

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