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Progress on ABI3BP in Malignant Tumors

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Abstract: ABI3BP is a newly discovered tumor-associated protein.Studies have shown that ABI3BP plays an important role in cell proliferation, migration, invasion, and tumor microenvironment regulation. ABI3BP is increasingly recognized as a potential biomarker and therapeutic target, but current studies still face limitations such as insufficient sample size and inadequate mechanistic research. This article aims to review the current research status of ABI3BP in cancer, explore its role in tumorigenesis and development, and discuss future research directions, with the hope of providing a theoretical basis and reference for clinical applications.

1. Introduction

Malignant tumor is one of the leading causes of death in the world. Its complex biological mechanism and diverse clinical manifestations make it an important subject in the medical field. In recent years, with advancements in science and technology, research on malignant tumors has deepened, but challenges such as difficulties in early diagnosis, poor treatment outcomes, and drug resistance remain. The extracellular matrix, as one of the main components of the tumor microenvironment (TME), plays a crucial role in tumor proliferation and invasion by providing mechanical support, cell adhesion, growth factors, and intercellular communication[1]. Therefore, a comprehensive understanding of the dysregulation of the extracellular matrix in the TME will help identify promising cancer therapeutic targets. ABI family member 3 binding protein (ABI3BP) is a newly discovered extracellular matrix protein expressed in various cell types. Studies have shown that ABI3BP may influence cell proliferation, migration, and senescence, and is involved in various physiological and pathological processes, including cancer development[2]. In lung cancer, esophageal cancer, and gallbladder cancer, ABI3BP expression has been linked to tumor progression and prognosis, suggesting its potential as a tumor biomarker and therapeutic target[3-5]. The abnormal expression of ABI3BP not only affects the proliferation and migration of cancer cells but may also influence the immune evasion mechanisms of tumors by regulating immune cell infiltration in the tumor microenvironment[6]. Therefore, studying the role of ABI3BP in cancer has important clinical significance. In conclusion, as an emerging biomarker, the role and mechanisms of ABI3BP in cancer warrant in-depth exploration, which will not only help in understanding the biological characteristics of tumors but may also provide new targets and strategies for personalized cancer treatment.

2. Expression Patterns of ABI3BP in Different Types of Cancer

2.1. Molecular Structural Characteristics of ABI3BP

ABI3BP was first screened and reported by Matsuda in 2001 using yeast two-hybrid technology, initially naming the newly discovered gene Tarsh[7], but the biological function of ABI3BP remains unclear. ABI3BP is a member of the ArgBP/E3B1/Avi2/NESH family of proteins, which mainly participate in the negative regulation of cell movement and metastasis and have been proven to be SRC homology (SH3) adaptor molecules. The structural features of ABI3BP include multiple proline-rich regions that play key roles in cell adhesion and signal transduction[8-9]. The function of ABI3BP is closely related to its structure. Studies have shown that ABI3BP participates in the regulation of cell signaling pathways through interactions with other proteins. Additionally, ABI3BP is downregulated in various cancers, and there is evidence that ABI3BP is involved in the regulation of cellular senescence and plays a regulatory role in cell adhesion[4,8,10,11]. These results suggest that ABI3BP may be an important tumor suppressor.

2.2. Expression and Clinical Relevance of ABI3BP in Lung Cancer

As an extracellular matrix-binding protein, ABI3BP has been found to have significantly different expression levels in different subtypes of lung cancer. Studies have shown that ABI3BP is downregulated in lung adenocarcinoma (LUAD) and lung squamous cell carcinoma (LUSC) [6]. In addition, the expression of ABI3BP is closely related to the immune characteristics of tumors, and abnormal expression may affect the infiltration of immune cells in the tumor microenvironment, thus affecting the prognosis of lung cancer patients[12]. In gene co-expression network analyses of LUSC and LUAD, ABI3BP has been identified as an important core gene, and its high expression significantly associated with shorter patient survival time[13]. The expression of ABI3BP is closely related to not only the subtype of lung cancer, but also the stage of the tumor. Studies have found that downregulation of ABI3BP is closely related to the progression and stage of lung cancer, especially in advanced patients, where the expression level of ABI3BP is significantly lower than that of early patients [6]. Based on the analysis of the TCGA database, ABI3BP has been confirmed as an independent prognostic factor for lung cancer patients, and its expression level is negatively correlated with tumor stage, which means that the low expression of ABI3BP may predict the malignancy of tumors and the poor prognosis of patients [14]. Therefore, the expression of ABI3BP can not only serve as a biomarker for lung cancer, but also may provide new ideas for tumor staging and prognosis assessment, helping clinicians to formulate individualized treatment plans.

2.3. Expression and Clinical Relevance of ABI3BP in Gallbladder Cancer

Gallbladder cancer is a relatively rare malignant tumor with poor prognosis, and its early symptoms are not obvious. Studies have shown that the expression level of ABI3BP in gallbladder cancer is significantly lower than that in normal tissues, and the decrease of this expression may be closely related to the occurrence and development of tumors[5]. Specifically, the downregulation of ABI3BP can inhibit the growth and migration of cancer cells, and restoring ABI3BP expression can significantly reduce the proliferation capacity of gallbladder cancer cells. In terms of the molecular mechanism, the expression of ABI3BP is regulated by multiple factors, including long non-coding RNA (lncRNA), suggesting that ABI3BP inhibits the occurrence and development of gallbladder cancer[5]. Additionally, studies have found that low expression of ABI3BP is significantly correlated with shortened survival periods for patients, suggesting that ABI3BP may serve as a prognostic marker for gallbladder cancer[3]. The aforementioned regulatory mechanisms suggest possible

pathways of ABI3BP's action in gallbladder cancer. Therefore, further research on the specific role and regulatory mechanisms of ABI3BP in gallbladder cancer will help develop new therapeutic strategies to improve the prognosis of gallbladder cancer patients.

In summary, as the expression level of ABI3BP in gallbladder cancer tissues is closely related to clinical features, its potential as a biomarker has gradually emerged. This indicates that the expression level of ABI3BP may be an important indicator for the early diagnosis and prognosis assessment of gallbladder cancer, with the expectation of providing new diagnostic tools for clinical practice.

2.4. Research Progress of ABI3BP in Other Cancer Types

In thyroid cancer cell lines, the expression level of ABI3BP is reduced, and restoring ABI3BP in thyroid cells can trigger cellular senescence via the p21 pathway, inducing reduced transformation activity, cell growth, viability, migration, invasion, and tumor growth in nude mice[4]. Studies have shown that ABI3BP is significantly downregulated in KYSE-150 and Eca-109 esophageal cancer cells, and miR-183 has been confirmed to mediate the proliferation, migration, invasion, and development of esophageal cancer cells by regulating ABI3BP expression levels[3]. These studies suggest that ABI3BP may be a potential effective target and biomarker for tumor diagnosis. In other tumors such as pancreatic cancer and clear cell renal carcinoma, abnormal expression of ABI3BP is also associated with patient prognosis. Studies have shown that down-regulation of ABI3BP is significantly associated with immune characteristics, tumor mutation load (TMB), microsatellite instability (MSI) and other immune-related indicators in the tumor microenvironment, further emphasizing the importance of ABI3BP in the cancer immune microenvironment [14]. These studies indicate that ABI3BP is not only an important biomarker but may also play a key role in the immune therapy and prognosis assessment of various cancers.

3. Mechanisms of ABI3BP in Cancer Cell Biology

3.1. Role of ABI3BP in Tumor Cell Proliferation

Tumor cell proliferation is a key process in cancer biology, involving the interaction of multiple internal and external factors. The regulation of cell cycle, abnormal activation of signal transduction pathway and changes of tumor microenvironment all affect the proliferation ability of tumor cells. ABI3BP exhibits inhibitory effects on cell proliferation in various tumor cells. Studies have shown that the oncogene miR-183 promotes tumor cell proliferation and metastasis by inhibiting ABI3BP expression [3]. Therefore, restoring ABI3BP expression may be a new strategy for treating esophageal cancer and provide potential biomarkers for early diagnosis and treatment of esophageal cancer. Additionally, in gallbladder cancer (GBC), the expression level of ABI3BP is also significantly reduced, and overexpressing ABI3BP can inhibit tumor cell growth, suggesting its important regulatory role in gallbladder cancer cell proliferation[5]. The existing research results suggest that ABI3BP may promote tumor progression by regulating the cell cycle and the abnormal activation of signal transduction pathways, which provides a new perspective for us to understand tumor biology.

3.2. Role of ABI3BP in Tumor Cell Migration and Invasion

Cell migration is an important physiological process in organisms, involving various functions such as development, immune response, and wound healing. Cytoskeletal remodeling plays a crucial role in cell migration, regulating morphological changes and motility of cells.

ABI3BP plays an important role in cell migration, especially in the reorganization of the cytoskeleton. ABI3BP affects the morphology and movement of cells by regulating the structure of

intracellular F-actin, and the absence of ABI3BP will lead to the recombination of intracellular F-actin, thus affecting the migration ability of cells [15]. In cancer cells, the downregulation of ABI3BP is associated with enhanced proliferation, migration, and invasion capabilities, indicating that ABI3BP may inhibit the metastatic ability of tumor cells by regulating the dynamic balance of the cytoskeleton.

3.3. Role of ABI3BP in Immune Regulation

Immune regulation plays an important role in the occurrence and development of tumors, and the relationship between the immune system and tumors is intricate and nuanced. Tumor cells can not only evade the host's immune surveillance, but also regulate the immune system through various mechanisms, thus promoting their own growth and metastasis, and tumor microenvironment (TME) plays a crucial role in this process [16]. A deeper understanding of the interactions between the immune system and tumors will help formulate new tumor immunotherapy strategies.

ABI3BP is involved in immunomodulatory responses in the tumor microenvironment. Studies have shown that the expression of ABI3BP is closely related to the infiltration levels of various immune cells, especially in malignant tumors such as lung cancer, where low expression of ABI3BP is associated with reduced infiltration of immune cells such as T cells and dendritic cells. The expression level of ABI3BP can affect the function of tumor-associated immune cells, thereby influencing the immune response of tumors [6]. Additionally, the expression of ABI3BP may be related to the infiltration of B cells, CD4+ T cells, CD8+ T cells, macrophages, and neutrophils in tumor cells. By regulating the expression of ABI3BP, it may help improve the effectiveness of tumor immunotherapy, making ABI3BP a potential new target for future tumor immunotherapy[14].

3.4. Research Progress of ABI3BP as a Prognostic Biomarker

The expression level of ABI3BP is closely related to prognosis in various cancers. Studies have shown that ABI3BP is generally downregulated in multiple tumor types, and the downregulation of ABI3BP is associated with enhanced cell proliferation, migration, and invasion capabilities[3], suggesting its potential as a prognostic biomarker. Furthermore, the expression level of ABI3BP is also related to the immune characteristics of tumors, and its abnormal expression may affect patient survival and treatment response. Through analysis of the TCGA and GTEx databases, researchers have found that ABI3BP shows a downregulation trend in various cancers, and ABI3BP expression is closely related to patient prognosis[14]. Therefore, ABI3BP can serve not only as a biomarker for early cancer diagnosis but may also be used clinically to assess patient prognosis. [17]

3.5. Clinical Trials and Future Research Directions

Currently, clinical trials targeting ABI3BP are still in the early stages, but existing research results lay the foundation for future clinical applications. Utilizing ABI3BP as a biomarker to select suitable patients for specific targeted therapies or immunotherapies may improve treatment efficacy and safety. Future studies should focus on the specific mechanism of action of ABI3BP in different cancer types and its combined application with other biomarkers. In addition, conducting large-scale clinical trials to validate the effectiveness of ABI3BP as a prognostic biomarker and its potential applications in personalized treatment will be important directions for future research. As research on ABI3BP deepens, its potential as a biomarker and therapeutic target will be further explored, providing new treatment options for cancer patients. Targeted therapeutic strategies for ABI3BP may be a new strategy for cancer treatment research. Studies have found that the expression of ABI3BP is regulated by various microRNAs, especially miR-183, which is considered an oncogene in esophageal cancer.

By inhibiting the expression of miR-183, the level of ABI3BP can be restored, thereby inhibiting the proliferation and migration of tumor cells, This may be a potential therapeutic target[3].In addition, ABI3BP is closely related to immune cell infiltration in the tumor microenvironment, and studies have shown that its expression level can predict the therapeutic effect of immune checkpoint inhibitors, which provides a theoretical basis for the development of new immunotherapy strategies [6].

4. Conclusion

The research findings of ABI3BP in the field of cancer research have provided a new perspective for clinical treatment and indicated that ABI3BP is of great significance in tumorigenesis, tumor progression and prognosis evaluation. However, research on its specific mechanisms and functions is still insufficient. Future studies should focus on the mechanisms of ABI3BP in different cancer types, particularly its roles in tumor cell proliferation, migration, and drug resistance. Additionally, exploring the combined application of ABI3BP with other molecular biomarkers may further enhance its clinical application value. At the same time, conducting large-scale clinical trials to validate the effectiveness of ABI3BP as a biomarker and therapeutic target is also an important direction for future research.

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