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Metabolic Strategies of Treg Cells in the Tumor Microenvironment: Implications for Immune Metabolism-Based Precision Medicine

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INTRODUCTION & AIM

Regulatory T cells (Tregs) play a crucial role in maintaining immune homeostasis and preventing autoimmunity. The tumor microenvironment (TME) is a complex milieu where cancer cells interact with various immune cells, including regulatory T cells (Tregs). Tregs play a crucial role in suppressing immune responses and maintaining immune homeostasis, but their function within the TME is still not fully understood. Recent research has highlighted the importance of metabolic reprogramming in regulating Treg function and phenotype in the context of cancer. In recent years, understanding the intricate relationship between immune cells and the tumor microenvironment has emerged as a crucial aspect of cancer research. In this review, we aim to explore the metabolic strategies employed by Tregs within the TME and discuss their implications for immune metabolism-based precision medicine. Understanding the metabolic pathways that govern Treg function in the TME could lead to novel therapeutic strategies targeting immune metabolism for cancer treatment.

METHOD

This review examines the metabolic alterations undergone by Tregs upon infiltration into the tumor, contrasting their metabolic profile with that of effector T cells. The study delves into the utilization of glycolysis, oxidative phosphorylation, and fatty acid metabolism by Tregs to sustain their survival and immunosuppressive functions. Additionally, it explores how Treg metabolic plasticity responds to environmental cues and immune checkpoint inhibitors.

RESULTS & DISCUSSION

Tregs exhibit distinct metabolic profiles in the TME compared to conventional effector T cells. Tregs in the TME exhibit distinct metabolic profiles compared to Tregs in peripheral tissues. Tumor-infiltrating Tregs display enhanced glycolytic activity and increased expression of nutrient transporters, allowing them to efficiently utilize glucose and other nutrients present in the TME. Moreover, Tregs in the TME exhibit heightened lipid metabolism, which supports their suppressive function and survival in the nutrient-deprived TME. Targeting key metabolic pathways such as glycolysis, fatty acid oxidation, and amino acid metabolism can modulate Treg function and improve anti-tumor immune responses.

CONCLUSION

Understanding the metabolic intricacies of Treg cells in the tumor microenvironment holds immense promise for advancing personalized and effective cancer immunotherapy. The insights garnered from these investigations pave the way for innovative therapeutic interventions that may shift the balance in favor of the body's immune system, heralding a new era in the fight against cancer.

FUTURE WORK / REFERENCES

Future research should focus on elucidating the specific metabolic pathways driving Treg function in different tumor types and stages. Additionally, exploring the efficacy of targeting Treg metabolism as a therapeutic strategy warrants further investigation. Such endeavors hold promise for advancing immune metabolism-based precision medicine in cancer treatment.