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THYROPROTECTIVE PROPERTIES OF CONDITIONED MEDIUM FROM MESENCHYMAL STEM CELLS IN EXPERIMENTAL AUTOIMMUNE THYROIDITIS

Background. Thyroid disorders (TD) are among the most prevalent endocrine diseases, affecting over 10% of the adult population globally [1]. These conditions significantly impact individuals' health, contributing to a wide array of complications, including metabolic disturbances, cardiovascular issues, and infertility. Autoimmune thyroid diseases (AITD), particularly Graves' disease and Hashimoto's thyroiditis, are among the most common forms of thyroid dysfunction. These disorders are characterized by an aberrant immune response targeting the thyroid gland, leading to either excessive or insufficient thyroid hormone production. Standard therapeutic interventions for hypothyroidism involve the supplementation of thyroid hormones to restore their levels to physiological concentrations [2]. Although this approach remains effective, increasing interest has been directed toward alternative therapies, particularly biotechnological drugs that do not rely on cell-based products subjected to cryopreservation during production or prolonged storage. This shift in focus stems from the potential advantages of biotechnology-driven treatments, which may provide more targeted and sustainable therapeutic options for thyroid diseases.

Objective. The aim of this study was to evaluate the effects of conditioned medium derived from mesenchymal stem cells (MSC-CM) on the synthesis of thyroid hormones in an experimental model of autoimmune thyroiditis (AIT). This research sought to determine whether MSC-CM could modulate thyroid hormone production in the context of autoimmune thyroid dysfunction, thereby exploring its potential as a novel therapeutic approach for patients with thyroid diseases.

Materials and Methods. Autoimmune thyroiditis was induced in rats through the administration of a thyroid antigenic mixture composed of Freund's complete

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adjuvant and an antigen solution derived from the homogenate of allogeneic thyroid tissue in a 1:1 ratio [3, 4]. This method reliably mimics the pathophysiological features of autoimmune thyroiditis, providing a robust model for studying thyroid dysfunction. A total of 42 male rats, each weighing between 200–220 g, were randomly assigned to six experimental groups. The effect of MSC-CM on thyroid hormone levels was assessed by collecting blood samples on day 28 of the experiment. Hormonal analysis was conducted using enzyme-linked immunosorbent assay (ELISA) kits, which allowed for precise and sensitive quantification of triiodothyronine (T3) and thyroxine (T4) levels. This analytical approach enabled detailed evaluation of the impact of MSC-CM treatment on thyroid hormone regulation in the experimental autoimmune thyroiditis model.

Results. The results of the study demonstrated significant alterations in the levels of T3 and T4 hormones in the serum of rats with induced autoimmune thyroiditis following MSC-CM treatment. In the untreated AIT group, there was a marked and statistically significant increase in total T3 levels by 72.0% compared to the healthy control rats ($p < 0.001$), consistent with the pathophysiological manifestation of autoimmune thyroiditis, where immune-mediated thyroid gland dysfunction leads to elevated hormone production. Upon administration of MSC-CM, a significant reduction in the levels of both T3 and T4 was observed, indicating a corrective effect on thyroid hormone synthesis. Specifically, total T3 levels showed substantial improvement, reflecting a favorable response to MSC-CM treatment. These findings suggest that MSC-CM may play a pivotal role in restoring normal thyroid function by modulating immune responses or promoting tissue repair within the thyroid gland.

Conclusion. The induction of autoimmune thyroiditis in rats resulted in significant dysregulation of thyroid hormone metabolism, including elevated levels of both total and free T3 and T4. The study demonstrated that MSC-CM treatment effectively normalized these hormonal imbalances, particularly by reducing total T3 levels in a manner that was more pronounced than the effects observed with traditional interventions such as L-thyroxine. These results indicate that MSC-CM holds significant promise as a novel therapeutic modality for autoimmune thyroid diseases, potentially offering an alternative or complementary approach to conventional therapies. Further investigation is warranted to elucidate the underlying mechanisms by which MSC-CM exerts its therapeutic effects and to assess its long-term efficacy and safety in clinical settings. The findings of this study pave the way for the development of MSC-based therapies that could transform the management of thyroid dysfunctions, particularly in the context of autoimmune thyroiditis.

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