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IMMUNOMODULATORY EFFECT OF HUMAN CHORIONIC GONADOTROPIN

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Human Chorionic Gonadotropin (hCG) is a vital pregnancy hormone secreted by placenta. It is detectable in maternal blood shortly after implantation and plays essential roles in maintaining pregnancy, it supports progesterone secretion by corpus luteum and contributes to uterine relaxation and immune tolerance. hCG is a glycoprotein with two subunits: the alpha subunit is shared with other gonadotropins, while the beta subunit provide specificity. Its structure and glycosylation vary with pregnancy stages and production sources. The α subunit is identical to pituitary hormones, (LH, FSH, TSH), contains two N-glycosylation and is coded by only one gene (CCA). But, almost differently, β subunits are specific for each hormone and encoded by cluster of genes and these have two sites of N-glycosylation same as α subunit but furthermore contains four sites for O-glycosylation. hCG is mostly produced by syncytiotrophoblast during early trimester from 10 weeks. And it has one important form called, hyper-glycosylated form (hCG-H) by invasive trophoblast cells. (J Mol Appl Genet 1981)

Immunomodulatory effect mean ability to maintain or modify the immune response. It may be stimulated or suppress the immune system. Normally, most fetus do not get autoimmune diseases while pregnancy like rheumatoid arthritis, crohn's disease and multiple sclerosis. But anyway, after delivery baby may get this disease, it evidences that effect. In most research, hCG give hope to unique immune tolerant state during pregnancy. Scientists found small fragments called β -loop of hCG that immunologically active and a lot in pregnancy. Among these fragments, a linear tetra peptide called EA 230, derived from hCG, (Ala, Glu, Gly, Val) reduce mortality in mice population when they give. (J Leukoc Biol 2008).

Some research says as negative effect, hCG reduce the effects of antigen presenting function, reduce dendritic cell proliferation by the mechanism of indole-amine dioxygenase. To natural killer (NK) cells, it reduces activation of peripheral blood cytotoxic NK cells. In endothelial lining, it inhibits leucocyte adhesion by the effect of reduced E-selection mediated leukocyte binding. And also, same research says, because of same receptor as LH hormone it competes with reduce T cell activation and antibody production. And moreover, after some IVF pregnancy with positive hCG test, scientists can see suppressed T cell activity. (Mol. Cell. Endocrinol, 1995).

In some diabetic research, scientists found for type 1 diabetes, normally autoimmune cells destroy pancreatic beta cells. So, they found hCG treatment prevent autoimmune diabetes. This is how, by reduced Th1 cytokines and macrophage proinflammatory cytokines. And by increased Th2 cytokines and TGF- β (anti-inflammatory). And then, decreased CD4⁺ and CD8⁺ cells while increasing the proportion of CD4⁺ CD25⁺ regulatory T cells. (J Biol Chem 1992)

Overall, human chorionic gonadotropin (hCG), a critical glycoprotein hormone, plays a dual role in pregnancy by maintaining reproductive processes and modulating the immune system. Biochemical evidence highlights its capacity to suppress pro-inflammatory Th1 cytokines, promote anti-inflammatory cytokines, enhance Treg cell activity, and modulate dendritic and natural killer cell function. These immunomodulatory effects not only ensure maternal-fetal tolerance but also present therapeutic potential in addressing autoimmune disorders and inflammatory conditions. Further exploration of hCG's molecular pathways could pave the way for innovative approaches in immune modulation and cell-based therapies.