Tom Manning

An Examination of Prednisone

Prednisone is a synthetic corticosteroid (glucocorticoid). In this brief investigation of the molecule's lipid class, structure and function, and biological workings, an understanding of the drug and some of its side effects should arise. Prednisone is prescribed for conditions such as asthma, rheumatoid arthritis, COPD, and dermatological disorders, mainly due to its anti-inflammatory and immunosuppressant effects. Like all steroids, prednisone has a steroid nucleus which includes three cyclohexane rings and one cyclopentane ring fused together. The molecule is made unique by two hydroxyl groups attached to the cyclopentane ring, and various carbonyl groups spaced throughout the cyclohexane rings. As an aside, steroids such as prednisone are classified as lipids due to their organic nature and insolubility in water. Prednisone's unique functional group composition differentiates it from other steroids, but like other steroids it works similar to a hormone to upregulate anti-inflammatory responses inside of cells. More specifically, its lipophilic structure allows it to easily diffuse through a cell membrane and bind to glucocorticoid receptors which then signal immune responses. Since prednisone is a synthetic molecule, it mimics cortisol's natural biological mechanisms (reducing inflammation and regulating carbohydrate metabolism).

Prednisone use is linked to psychiatric conditions such as mania and depression, and some authors[1] have questioned if steroid-induced dementia is an overlooked diagnosis. While the psychiatric conditions that arise are usually mild and typically reverse once a course-of-treatment ends, they are very common and typically present themselves a few days after starting treatment. The cause for such psychiatric conditions is also of unknown etiology. At the very least, the pathophysiology for psychiatric side effects is unclear. Some hypotheses list interference with serotonergic and dopaminergic pathways while others cite an increased release of glutamate that induces neuronal toxicity due to an accumulation effect[2][3]. It is clear that most reports of psychiatric ailments are examined through patient case studies and not traditional scientific studies, however. To counter the psychiatric effects of glucocorticoids, some studies used prophylactic treatments of lithium. For patients sensitive to mood changes, lithium is thought to act as a mood stabilizer.

Prednisone use is banned by the World Anti-Doping Agency for athletic events. A popular belief that glucocorticoids may boost athletic performance was affirmed in small study on short distance cycling[4]. However, the well documented and common psychiatric mood effects of glucocorticoids (one comprehensive review of the literature listed a 26% incidence of mania

---

[1]Sacks O, Shulman M: Steroid dementia: an overlooked diagnosis? NCBI. 2005.

[2]Flores B, Kenna Gumina H: The Neuropsychiatric Sequelae of Steroid Treatment. 2003.

[3] Wolkowitz OM, Rubinow D, Doran AR, Breier A, Berrettini WH, Kling MA. Prednisone effects on neurochemistry and behavior. Preliminary findings. Arch Gen Psychiatry. 1990

[4] Le Panse B, et al.:Short-term glucocorticoid intake improves exercise endurance in healthy recreationally trained women

and 10% incidence of depression in patients who were initially free of psychiatric illness[5]) might be used counter the belief that glucocorticoids are beneficial to athletic performance in the long term.

Best Sources:

1. **Brown E, Chandler P: Mood and Cognitive Changes During Systemic Corticosteroid Therapy 2001.**

   A comprehensive review of psychiatric conditions linked to glucocorticoids

2. **Flores B, Kenna Gumina H: The Neuropsychiatric Sequelae of Steroid Treatment. 2003.**

   Also a comprehensive review of steroid literature

3. **Ciriaco M et al.: Corticosteroid-related central nervous system side effects. 2013.**

   Most recent

[5] **Brown E, Chandler P: Mood and Cognitive Changes During Systemic Corticosteroid Therapy 2001.**