Dexamethasone: Uses, Dosage, Mechanism of action and Side effects

Dexamethasone is a synthetic corticosteroid medication widely used in the treatment of a range of conditions. It is a derivative of cortisol (hydrocortisone) and is chemically known as 1-dehydro-9?-fluoro-16?-methylhydrocortisone. Compared to other corticosteroids, dexamethasone possesses powerful anti-inflammatory properties but lacks significant mineralocorticoid activity. It was approved by the Food and Drug Administration (FDA) for use in October 1958 and is marketed under various brand names including Decadron, Deronil, Hexadrol, and Spersadex.

Dexamethasone falls under Pregnancy Category C, indicating that it should only be used during pregnancy when the potential benefits justify the potential risks to the fetus.

In recent years, the UK RECOVERY Trial highlighted dexamethasone's significant role in reducing mortality among patients with severe COVID-19 complications. This is discussed in detail at the end of the article.

What is a Corticosteroid? Corticosteroids are naturally occurring hormones synthesized by the adrenal (suprarenal) glands located above each kidney. These hormones regulate a variety of physiological responses, notably immune suppression and inflammation control. The most important naturally occurring corticosteroid is cortisol.

Indications of Dexamethasone Dexamethasone is typically reserved for specific conditions:

- **Cushing's Syndrome Diagnostic Tool** : Utilized in dexamethasone suppression tests to differentiate between types of hypercortisolism. It doesn't cross-react with endogenous cortisol in immunoassays.
- **Cerebral Edema** : Alleviates intracranial pressure in brain tumors.
- **Preterm Labor** : Administered to pregnant women at risk of preterm birth to promote fetal lung maturation.
- **Chemotherapy-induced Nausea and Vomiting (CINV)** : Enhances the efficacy of 5-HT3 receptor antagonists such as ondansetron.
- **Chronic Arthritis** : Provides anti-inflammatory relief in chronic adjuvant-induced arthritis.
- **Autoimmune and Inflammatory Diseases** : Effective in conditions such as rheumatoid arthritis, bronchospasm, and idiopathic thrombocytopenic purpura (ITP).
- **Croup in Children** : Preferred treatment due to its potent anti-inflammatory effect.
- **Plantar Fasciitis** : Administered with triamcinolone acetonide into the inflamed heel.
- **Congenital Adrenal Hyperplasia (CAH)** : Used prenatally to manage symptoms, especially in female fetuses.
- **High-Altitude Illnesses** : Treats high-altitude pulmonary edema (HAPE) and cerebral edema (HACE).
- **Postoperative Nausea and Vomiting** : Effective when pain is managed with long-acting spinal opioids.
- **Hematological Malignancies** : Used in multiple myeloma, leukemias, and lymphomas, either alone or with other chemotherapeutics.
- **Sore Throat** : A single dose may accelerate symptom relief.

- **Glucocorticoid Resistance** : One of the rare indications.
- **Nephrotic Syndrome** : Induces diuresis or remission in idiopathic and lupus-induced forms.
- **Gastrointestinal Diseases** : Offers palliative relief in ulcerative colitis and regional enteritis exacerbations.

Mechanism of Action Dexamethasone is a potent glucocorticoid devoid of mineralocorticoid properties. It acts primarily by:

- Suppressing migration of polymorphonuclear leukocytes (PMNs)
- Reducing capillary permeability
- Stabilizing cell and lysosomal membranes
- Increasing fetal lung surfactant production
- Inhibiting pro-inflammatory cytokines and prostaglandins
- Suppressing lymphocyte proliferation through cytolysis and inhibition of mitosis

It binds to intracellular glucocorticoid receptors, altering gene transcription to inhibit:

- Neutrophil and monocyte accumulation
- Phagocytic and bactericidal activity
- Antigen responses by macrophages and T-helper cells
- Synthesis of cytokines, interleukins, and prostaglandins

Pharmacodynamics

- **Anti-inflammatory potency** : 25–30
- **Metabolic potency** : 1
- **Sodium-retaining potency** : 0.05
- **Duration of action** : 39–54 hours (long-acting)

Adverse Drug Reactions (ADRs) Common side effects include:

- Acne, weight gain, increased appetite
- Insomnia, depression, euphoria
- Vertigo, confusion, amnesia, headache
- Hypertension, dyspepsia, nausea, vomiting
- Impaired skin healing, increased infection risk
- Raised intraocular pressure, malaise, irritability

Contraindications Use of dexamethasone is contraindicated in:

- Patients with uncontrolled infections
- Individuals with known corticosteroid hypersensitivity
- Cases of cerebral malaria
- Systemic fungal infections
- Concurrent administration with live virus vaccines

Drug-Drug Interactions **Severe Interactions** (Not Recommended):

- Artemether
- Praziquantel
- Desmopressin
- Rotavirus Vaccine, Live
- Rilpivirine

Moderate to Mild Interactions : Includes interactions with a wide range of NSAIDs, antivirals, antiretrovirals, chemotherapeutics, opioids, and hormonal agents such as:

- Aceclofenac, Celecoxib, Diclofenac, Ibuprofen
- Amiodarone, Clarithromycin, Efavirenz, Itraconazole
- Carbamazepine, Doxorubicin, Ketoconazole
- Ethinyl Estradiol, Levonorgestrel, Mestranol, Drospirenone