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A review on challenges & clinical management of adverse drug reactions associated with corticosteroids treatment by clinical pharmacist perspective

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Abstract
Corticosteroids are used extensively in clinical practice because of their strong anti-inflammatory and immunosuppressive actions, rendering them useful in the management of various conditions such as autoimmune diseases, allergic diseases, and chronic inflammatory conditions. Despite their beneficial use, the prolonged use of corticosteroids has been related to a vast number of adverse drug reactions (ADRs) that can strongly influence patient health and treatment outcomes. These ADRs are associated with metabolic abnormalities like hyperglycaemia, hypertension, osteoporosis and susceptibility to infections caused by profound immunosuppression. Corticosteroid use can also cause mood alterations, weight gain, Cushing's syndrome, and gastrointestinal adverse effects. Healthcare practitioners must use careful monitoring and efficient management due to the serious consequences of corticosteroid-induced adverse drug reactions. Reword this statement. This involves performing routine supervising to detect ADRs in a timely manner, employing the smallest required corticosteroid dose for the minimum duration, and using alternative therapy where possible. Reporting and monitoring of ADRs are important practices in enhancing patient safety and for making clinical recommendations. Patient-orientated strategies involving education about early detection of ADR symptoms and compliance with management strategies are critical in preventing risks. This review highlights the need for thorough risk assessment and tailored therapy to maximize therapeutic effectiveness and reduce corticosteroid-related adverse effects.

Keywords: Corticosteroids, drug adverse reactions (ADRs), immunosuppression, metabolic disturbances, clinical management, patient-focused care.

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Introduction

A group of steroid hormones called corticosteroids is employed in the management of numerous respiratory, inflammatory, allergy, and autoimmune conditions. Notwithstanding its therapeutic value, prolonged or high-dose corticosteroid therapy has been implicated with severe adverse drug reactions (ADRs), necessitating keen observation in the clinical environment. The review focuses on the common adverse drug reactions (ADRs) associated with corticosteroids, patterns of incidence, management issues, and the importance of pharmacovigilance [1].

I. Epidemiology and Trends in Adverse Drug Reactions

According to guidelines from the Uppsala Monitoring Centre (UMC) and the Pharmacovigilance Programme of India (PVPI), the increasing reports of corticosteroid-induced metabolic disturbances, osteoporosis, and neuropsychiatric effects from hospital-based pharmacovigilance programs highlight the urgent need for stricter monitoring protocols. These guidelines emphasize proactive risk assessment, timely detection, and effective management of ADRs to enhance patient safety and treatment outcomes. The incidence of adverse drug reactions (ADRs) associated with corticosteroid therapy is on the rise, particularly in long-term treatments. Epidemiological reports indicate that up to 50% of long-term corticosteroid users experience at least one serious ADR [3-5].

II. Challenges in Managing Adverse Drug Reactions from Corticosteroids

A. Recognition of Adverse Drug Reactions

It is difficult to differentiate corticosteroids-induced ADRs from signs of underlying diseases. ADRs such as mood alterations, osteoporosis, and hyperglycaemia are camouflaged as disease advancement signs. Some ADRs are impeded by delayed presentation, which makes early identification challenging [6].

B. Stratification and Risk Assessment

It is difficult to evaluate individual risk factors such as age, comorbidities, and polypharmacy. Erratic risk stratification procedures typically result in suboptimal management [7].

C. Observation and Prompt Identification

Long-term corticosteroid treatment necessitates regular monitoring of blood pressure, bone density, and blood glucose. Standardized procedures and specialized equipment are not always available [8].

D. Adherence and Patient Education

Patients generally have an incomplete understanding of corticosteroid ADRs and consequently, poor compliance. Proper education in terms of ADRs as well as tapering regimens needs to be ensured [9].

E. Collaboration among Interprofessionals

Poor unstructured communication between health professionals can be a barrier to ADR management. Pharmacists are usually underutilized in inter-professional care [10].

F. Recording and Reporting ADRs

ADRs are consistently underreported to pharmacovigilance schemes. Safety assessment information was weakened by frequently incomplete records [11].

III.Monitoring Parameters before Starting Corticosteroids

- To reduce the likelihood of adverse drug reactions and enhance therapy, the following should be assessed before initiating corticosteroid treatment:
- Blood Pressure (BP): Water and sodium retention induced by corticosteroids can cause or worsen hypertension. Baseline blood pressure monitoring is important.
- Blood Glucose or HbA1c: Corticosteroids can cause hyperglycaemia or exacerbate existing diabetes. Fasting blood glucose, or HbA1c, must be monitored, especially in high-risk patients.
- Bone Mineral Density (BMD; identified through a DEXA scan): Osteoporosis and fractures are increased with prolonged corticosteroid use. During prolonged therapy, a DEXA scan is advised, especially for the elderly.
- Weight and Body Mass Index (BMI): Baseline weight is recorded to help assess fluid retention or adiposity; corticosteroids can cause weight increase.
- Electrolytes (Na+, K+): Hypokalemia and sodium retention may be induced by corticosteroids. In patients on diuretics or with cardiovascular disease, monitoring of electrolytes is important.
- Lipid Profile: Dyslipidemia induced by long-term corticosteroid therapy increases the risk of cardiovascular disease.
- Infection Screening: In the immunocompromised or high-risk groups, latent TB, hepatitis B/C, and HIV screening should be considered.
- Ocular Examination: Long-term use of corticosteroids can increase your risk of developing glaucoma and cataracts. In the case of long-term use, an eye exam is recommended.
- Psychiatric History: All of these may be exacerbated by corticosteroids. Any previous history of mental health should be documented.
- Gastrointestinal History: People who have a history of GI bleeding or peptic ulcer disease are at a higher risk for developing issues, especially if they are also on NSAIDs [12].

IV. Clinical Indications of Corticosteroids

1. Allergic and Hypersensitivity Conditions

Even though corticosteroids are supplements to epinephrine and not a substitute, they are often employed to manage severe allergic reactions such as anaphylaxis, where they help reduce delayed inflammatory reactions and airway edema [13].

Since they suppress mast cell activation and inflammatory mediator generation, they are also beneficial in the management of acute allergic rhinitis, contact dermatitis, angioedema, and drug hypersensitivity reactions [14].

2. Disorders of the Autoimmune and Connective Tissue.

Corticosteroids are employed in controlling acute exacerbations and reducing systemic inflammation in systemic lupus erythematosus (SLE), specifically in life-threatening manifestations like cerebritis or lupus nephritis. Corticosteroids may serve as bridging therapy in rheumatoid arthritis until disease-modifying antirheumatic drugs (DMARDs) take effect since they give rapid relief from joint inflammation. They are also employed in vasculitides like polyarteritis nodosa and giant cell arteritis, where inflammation of the blood vessels can lead to organ injury and tissue ischemia [11].

3. Conditions of the Respiratory System

Since they decrease airway inflammation, decrease mucus production, and increase bronchial responsiveness, corticosteroids play a vital role in the management of asthma, especially severe exacerbations. Systemic corticosteroids are employed to reduce inflammation and improve lung function in exacerbations of chronic obstructive pulmonary disease (COPD). In addition, they reduce granulomatous inflammation in interstitial lung diseases like sarcoidosis and hypersensitivity pneumonitis [13].

4. Skin Diseases

Corticosteroids are often employed in dermatology to help reduce immune-mediated blistering and inflammation of autoimmune and inflammatory skin diseases like pemphigus vulgaris, bullous pemphigoid, and serious psoriasis. They are employed to decrease inflammation and itching in eczema, urticaria, and contact dermatitis [12].

5. Haematology and Oncology Uses

First-line therapy for immune thrombocytopenia (ITP) and autoimmune haemolytic anaemia includes corticosteroids, which reduce splenic sequestration of blood cells and antibody production. Corticosteroids are used to treat acute lymphoblastic leukaemia, multiple myeloma, and lymphomas in oncology, often as part of combination chemotherapy regimens.

6. Signs and Symptoms of Neurology

During exacerbations of multiple sclerosis, corticosteroids are given in high doses to reduce central nervous system inflammation and shorten the duration of relapses.

Due to the ability to decrease intracranial pressure and control the blood-brain barrier, they are also employed to manage cerebral edema induced by brain tumours or abscesses [15]. Other uses include Bell's palsy and myasthenia gravis crises, in which their immunosuppressive and anti-inflammatory activities facilitate improved outcomes.

7. Adrenal and Endocrine Insufficiency

If the adrenal glands are incapable of making adequate amounts of cortisol, a primary adrenal insufficiency (Addison's disease) results, in which case corticosteroids form the core of the therapy. Moreover, they are utilized to treat deficient cortisol in congenital adrenal hyperplasia and secondary adrenal insufficiency caused by pituitary or hypothalamic disease [14].

8. Liver and Gastrointestinal Diseases

Through inhibition of pro-inflammatory cytokines and mucosal immune responses, corticosteroids help to induce remission in inflammatory bowel diseases such as Crohn's disease and ulcerative colitis in acute exacerbations.

To curb immune-mediated liver inflammation and prevent cirrhosis development, they are also used in autoimmune hepatitis [11].

9. Receiving a transplant

Since they suppress T-cell-mediated immunological reactions, corticosteroids play a vital role in organ transplant to prevent acute rejection.

They are often administered along with other drugs, like calcineurin inhibitors, for maintenance immunosuppression as well as for induction therapy.[15]

V. Clinical Pharmacist's Role in Managing Corticosteroid-Associated ADRs

A. Medication Therapy Management (MTM)

When they review prescription regimens, clinical pharmacists look for drug interactions and potential adverse drug reactions (ADRs) [16].

B. Stratification and Risk Assessment

They evaluate each patient's unique profile and customize corticosteroid therapy according to risk factors [7].

C. Early Detection and ADR Monitoring

To identify ADRs early and react promptly, surveillance programs are instituted by pharmacists [9].

D. Patient Counselling and Education

One of the significant responsibilities is to provide total counselling regarding the usage of corticosteroids and side effects [10].

E. Collaboration Among Interprofessionals

To provide the best results, pharmacists work with health care teams to coordinate care [8].

F. ADR Mitigation and Management

There is a need to prescribe dose adjustments, adjunctive therapy, or other drugs [9].

G. ADR Reporting and Documentation

It is advisable to report and document suitably to pharmacovigilance programs [11].

H. Formulation of Policies and Implementation of Procedures

Pharmacists play a role in formulating the practice guidelines and ADR treatment modalities, according to Curtis et al. (2018) [7].

F. Strategies for Improving ADR Management in Corticosteroid Therapy

- Standardizing procedures for ADR management.
- augmenting provider and patient education.
- utilizing technology for monitoring and reporting.
- promoting collaboration between experts.

VI. Mechanisms of ADRs

By binding to intracellular glucocorticoid receptors, altering gene expression, and altering inflammatory pathways, corticosteroids exert their desired actions. With chronic exposure, however, immunological, musculoskeletal, and metabolic disease ensues. Among the causes of major ADRs are: [17]

- Metabolic Effects: Hyper gluconeogenesis leading to increased blood sugar levels.
- Cardiovascular Effects: Fluid and sodium retention increases blood pressure.
- The impact of cortisol dysregulation on cognition and mood is neuropsychiatric.
- Infectious Risk: Suppression of immune function renders individuals susceptible to infection [18].

Patient-Specific Risk Factors

Certain individuals are more susceptible to drug reaction adversities precipitated by corticosteroids, including:[4]

- Older individuals are likely to develop osteoporosis and cardiovascular issues.
- Children are vulnerable to adrenal insufficiency and growth suppression.
- Comorbidities: Patients with osteoporosis, diabetes, or hypertension are at increased risk of deterioration.

- Genetic Variation: Reactions to the individual could be determined by genetic differences in glucocorticoid receptor sensitivity [19].

VII.Adverse Drug Reactions of Corticosteroids Common to All

1.Endocrine and Metabolic Effects:

- Diabetes mellitus and increased blood glucose levels
- Weight gain and fluid retention
- Cushing's disease and adrenal suppression
- Effect on Musculoskeletal Systems:
- Osteoporotic fractures
- Muscle weakness and myopathy
- Avascular necrosis

2.Effect on the Heart

- High blood pressure
- Dyslipidemia
- A greater likelihood of cardiovascular events

3.Effect on the Gastrointestines

- Peptic ulcers and intestinal haemorrhage
- Pancreatitis
- Hepatic dysfunction

4.Effect on Neuropsychiatry

- Mood swings, despair, and anxiety
- Insomnia
- Cognitive impairment and psychosis

5.Risk of Infection

- Increased susceptibility to bacterial, viral, and fungal infections
- Wound healing delay [20].

Monitoring and Reporting of ADRs in Clinical Practice

Safety of the patient during corticosteroid treatment is dependent on proper ADR monitoring. Pharmacovigilance programs used by hospitals are:

- Frequent Patient Monitoring: Clinical tests and laboratory tests.
- Adverse Event Reporting Systems: Hospital-based reporting systems along with national reporting systems are utilized in order to determine high-risk conditions.
- Patient education and counselling: Patient education to identify early warning signs of drug reactions.
- Dose adjustments and alternative therapies: Minimizing risks with customized treatment plans.
- Safer Use of Corticosteroids through New Strategies
- Healthcare professionals employ several strategies to minimize corticosteroid-related adverse drug reactions (ADRs), including:
- The Use of the Lowest Effective Dose: Modifying the dose to achieve an optimal balance of safety and efficacy.
- Intermittent dosing or pulse therapy: reduction of exposure without compromise in therapeutic effect.
- Prevention of osteoporosis is achieved through adjunctive therapy by prescribing vitamin D, calcium, and bisphosphonates.
- Frequent Monitoring: Regular imaging and blood work to detect problems early.
- Changes in Patient Lifestyle: Promoting stress reduction, exercise, and food control.
- Corticosteroid-Sparing Therapies: Immunomodulators and biologics are used as alternatives in inflammatory conditions.
- Clinical Examples and Case Studies
  Some actual case studies demonstrate the importance of corticosteroid adverse drug reactions:
- A child patient with asthma on high-dose inhaled corticosteroids with mood swings and insomnia; a 65-year-old rheumatoid arthritis patient who develops osteoporosis and fractures following long-term corticosteroid therapy.
- A transplant recipient who is experiencing severe [21].

Discussion

The clinical utility of corticosteroids is evidenced by their widespread use in a number of acute and chronic diseases. However, owing to their myriad adverse drug reactions (ADRs), proper risk-benefit analysis is the need of the hour, particularly from the perspective of a clinical pharmacist. The ensuing discussion accentuates the increasing role of clinical pharmacists in modern treatments and explores key insights into the challenges and management strategies pertaining to corticosteroid-induced adverse drug reactions [22].

1. The Complexity of ADRs Induced by Corticosteroids

Since corticosteroids affect nearly every organ system, their adverse drug reactions (ADRs) are system-wide and complex, such as the immunological, musculoskeletal, cardiovascular, endocrine, metabolic, and psychiatric systems. ADRs like steroid-induced diabetes, osteoporosis, and adrenal suppression can develop quietly and remain unrecognized until issues arise. Clinical pharmacists can play a significant role by acting promptly to forestall this silent development, which requires early identification and active treatment [22-23].

For example, steroid-induced hyperglycaemia in nondiabetic patients will mimic poorly controlled diabetes or escape detection. Patients are at risk of infections or diabetic ketoacidosis unless appropriate glucose screening and education are provided. In the same vein, except through a drug review, psychiatric side effects associated with corticosteroids, for example, mood disorders or psychosis, would be misread as primary psychiatric conditions [24-25].

2. Clinical Practice Gaps

There are a number of loopholes in ADR recording, reporting, and monitoring even with explicit direction on corticosteroid use. Patients are often initiated on corticosteroids without tapering plans and baseline measurements, including lipid profiles, fasting glucose levels, or bone density scans. Omissions of these kinds, which are often due to a shortage of time, lack of familiarity with rules, or splintered care among doctors, may lead to long-term damage [26].

By recognizing those high-risk patients, streamlining corticosteroid protocols, and ensuring the appropriate monitoring and follow-up is established, clinical pharmacists may help bridge such gaps. As corticosteroids often become part of the polypharmacy regimen of older or chronically ill patients, their proficiency in drug-drug interactions becomes a necessity [27].

3. Optimal ADR Management Barriers

Various systemic and patient-related reasons hinder optimal ADR management:

Low Patient Knowledge: Many patients are unaware of the long-term risks of corticosteroids. They face the risk of adrenal crisis or relapse if they abruptly discontinue using the drug or misuse it without appropriate therapy.

Problems with the Healthcare mechanism: In most locations, especially those with limited resources, there is no centralized system for monitoring adverse events or monitoring by pharmacists.

Underreporting of ADR: Pharmacovigilance systems are not maximally utilized. Although well-placed to detect adverse drug reactions, clinical pharmacists often fail to report due to administrative burden or lack of training.[28]

Promoting ADR reporting, involving pharmacists in clinical rounds, and training can all significantly enhance patient safety and quality of care.

4. Role of Clinical Pharmacist

Preventive and Proactive Clinical pharmacists are not just limited to dispensing activities and are now vital members of patient care teams. Among their roles in corticosteroid therapy are:

Prospective monitoring refers to the real-time monitoring of drug interactions, indicators of toxicity, and laboratory tests.

Proper dosage of steroids during transitions in care, like discharge from the hospital, is termed medication reconciliation.

Patient education is to help patients understand the importance of slow tapering, compliance, and warning signs.

Applying Guidelines: Facilitating compliance with national and international guidelines for corticosteroid management.

When long-term steroids are not indicated, team decision-making is to recommend alternatives such as biologics or non-steroidal treatments [29].

By modifying DMARDs or biologics, pharmacists and rheumatologists can minimize steroid dependency in chronic diseases such as lupus or rheumatoid arthritis [30].

5. Establishing a Safer Corticosteroid Culture

- Improving corticosteroid safety needs to be an orderly, interprofessional process:
- Institutional corticosteroid stewardship programs led by pharmacists.
- Regular checks to establish whether corticosteroid prescribing is justified.
- Development of ADR risk assessment tools tailored to the individual circumstances of each patient.
- Implementation of technology to alert against prolonged or high-dose corticosteroid therapy.
- Patient and healthcare professional education programs conducted by pharmacists.

Clinical pharmacists shall be well placed to predict patient-specific corticosteroid adverse drug reaction (ADR) risks and tailor therapies based on those results as personalized medicine and pharmacogenomics evolve [31].

Conclusion

Despite the fact that corticosteroids remain vital to the management of a broad spectrum of diseases, regular use leads to severe adverse drug reactions. Treatment outcomes and safety can be improved by a systematic approach with cautious monitoring, early reporting, and patient education. It is possible to optimize the use of corticosteroids with reduced risks by tackling challenges in ADR control with practical approaches and continuous studies.

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