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Corticosteroids as "God Drugs": Between Therapeutic Efficacy and Side Effects

Elsya Jaisi Oktorra[1], Dicka Trie Permana[1], Fitriyani[1], Revana Putri Amanda[1], Reva Sri Puspita[1*], Siti Nurcholisa[1], Rd Natasya Aurellia Putri[1], Heri Ridwan[1]

[1] Bachelor of Nursing Study Program, Universitas Pendidikan Indonesia, Sumedang City, West Java Province, Indonesia

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Corresponding author
Email: *revasripuspita@upi.edu*

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ABSTRACT

Corticosteroids are potent anti-inflammatory and immunosuppressive agents widely used in clinical practice due to their rapid therapeutic effects. Despite their proven efficacy, prolonged and inappropriate use is associated with a wide range of adverse effects affecting multiple organ systems. This systematic review aimed to evaluate the therapeutic benefits of corticosteroids and to summarize their reported side effects based on literature published between 2015 and 2025. A systematic search was conducted using Google Scholar, PubMed, and ScienceDirect with the keywords "corticosteroids," "benefits," and "side effects." Eligible studies were full-text, open-access articles published in English or Indonesian. Eight articles met the inclusion criteria and were analyzed descriptively. The findings indicate that corticosteroids are effective in managing inflammatory conditions such as asthma, autoimmune diseases, atopic dermatitis, nephrotic syndrome, and postoperative inflammation. However, long-term use is associated with metabolic and endocrine disturbances (hyperglycemia and Cushing's syndrome), musculoskeletal complications (osteoporosis and osteonecrosis), dermatological effects (skin atrophy and irritation), ocular disorders (increased intraocular pressure and glaucoma), and cardiovascular effects. Systemic corticosteroids pose the highest risk of adverse effects, while topical and ocular formulations predominantly cause local reactions but may still lead to serious complications with prolonged use. Children and older adults are particularly vulnerable. In conclusion, corticosteroids remain essential in clinical therapy, but their use must be rational, closely monitored, and supported by patient education to minimize long-term risks.

Keywords: Corticosteroids, Side Effects, Benefits.

ABSTRAK

Kortikosteroid merupakan obat antiinflamasi dan imunosupresan yang kuat dan banyak digunakan dalam praktik klinis karena efek terapinya yang cepat. Meskipun efektif, penggunaan jangka panjang dan tidak rasional dapat meningkatkan risiko efek samping pada berbagai sistem organ. Tinjauan sistematis ini bertujuan untuk mengevaluasi manfaat terapeutik kortikosteroid serta merangkum spektrum efek samping yang dilaporkan dalam literatur periode 2015–2025. Penelusuran literatur dilakukan melalui Google Scholar, PubMed, dan ScienceDirect menggunakan kata kunci "kortikosteroid," "manfaat," dan "efek samping." Artikel yang disertakan merupakan naskah teks lengkap, akses terbuka, berbahasa Indonesia atau Inggris. Sebanyak delapan artikel memenuhi kriteria inklusi dan dianalisis secara deskriptif. Hasil tinjauan menunjukkan bahwa kortikosteroid efektif dalam mengendalikan peradangan pada berbagai kondisi seperti asma, penyakit autoimun, dermatitis atopik, sindrom nefrotik, dan kondisi pascaoperasi. Namun, penggunaan jangka panjang berkaitan dengan gangguan metabolik dan endokrin (hiperglikemia dan sindrom Cushing), gangguan muskuloskeletal (osteoporosis dan osteonekrosis), efek dermatologis (atrofi dan iritasi kulit), gangguan okular (peningkatan tekanan intraokular dan glaukoma), serta gangguan kardiovaskular. Kortikosteroid sistemik memiliki risiko efek samping tertinggi, sementara sediaan topikal dan okular umumnya menimbulkan efek lokal tetapi tetap berpotensi menyebabkan komplikasi serius jika digunakan dalam jangka panjang. Anak-anak dan lanjut usia merupakan kelompok yang paling rentan. Oleh karena itu, meskipun kortikosteroid memiliki manfaat terapeutik yang signifikan, penggunaannya harus rasional, diawasi secara ketat, dan disertai edukasi pasien untuk meminimalkan risiko komplikasi jangka panjang.

Kata Kunci: Kortikosteroid, Efek Samping, Manfaat.

INTRODUCTION

Corticosteroids are one of the most widely used drug groups in clinical practice due to their anti-inflammatory and immunosuppressant properties (Samuel, Nguyen, & Choi, 2017; Williams, 2018). These drugs are used in a variety of conditions, from autoimmune diseases and asthma to dermatitis and nephrotic syndrome, to certain emergency situations. The rapid clinical response often leads to the perception among healthcare professionals and the public that corticosteroids are a panacea for all ailments, leading to their widespread recognition as "god cures."

The term "god cures," in this context, is not simply a pharmacological terminology, but also a representation of the clinical and social perception of corticosteroids, which are believed to provide rapid and significant relief. Despite their clear therapeutic benefits, these drugs have the potential to lead to excessive, long-term, and irrational use (Qamariat, 2021; Shipwright, & Murphy, 2025). This is a serious concern because corticosteroids are known to have a broad spectrum of side effects involving multiple organ systems.

Various previous studies have addressed the benefits and side effects of corticosteroids, both in clinical trials and literature reviews (Stone, Malanga, & Capella, 2021; Goodman, Johnson, & Balko, 2023; Pofi et al., 2023; Saleem et al., 2023). However, most of these studies focus on a single route of administration or a specific disease group, for example, the use of systemic corticosteroids in autoimmune diseases and topical corticosteroids in skin disorders. Furthermore, many reviews discuss side effects in general without comprehensively linking them to various routes of administration, duration of use, and patient population characteristics.

Based on this, it is important for researchers to delve deeper into integrative research by discussing the therapeutic and risk factors for corticosteroid side effects based on various routes of administration (systemic, topical, inhaled, and ocular) and linking them to rational use practices. The period 2015-2025 was chosen to provide evidence of the latest scientific findings over the past decade, including developments in corticosteroid use patterns and reports of long-term side effects.

The purpose of this article is to comprehensively review the effectiveness of corticosteroids as therapeutic agents while identifying the spectrum of side effects based on research findings from the past 10 years. It also emphasizes the importance of rational and monitored corticosteroid use.

RESEARCH METHODS

This study is a literature review using a systematic approach to the search and selection of articles. The research search was conducted in Google Scholar, PubMed, and ScienceDirect databases using a combination of the keywords "corticosteroids," "side effects," and "benefits," along with their Indonesian equivalents.

Inclusion criteria included full-text, open-access articles in Indonesian or English, published between 2015 and 2025, and discussing the therapeutic benefits and/or clinical side effects of corticosteroids. Exclusion criteria included articles without full-text access, as well as editorials or opinion pieces.

Article selection was conducted through title and abstract screening, followed by full-text review. This process resulted in eight relevant articles for analysis. The included articles had diverse research designs, including cohort, cross-sectional, retrospective studies, and case reports. Due to the heterogeneity of study designs, no quantitative meta-analysis was performed. Methodological quality was assessed descriptively, considering the design type and strength of each study's evidence.

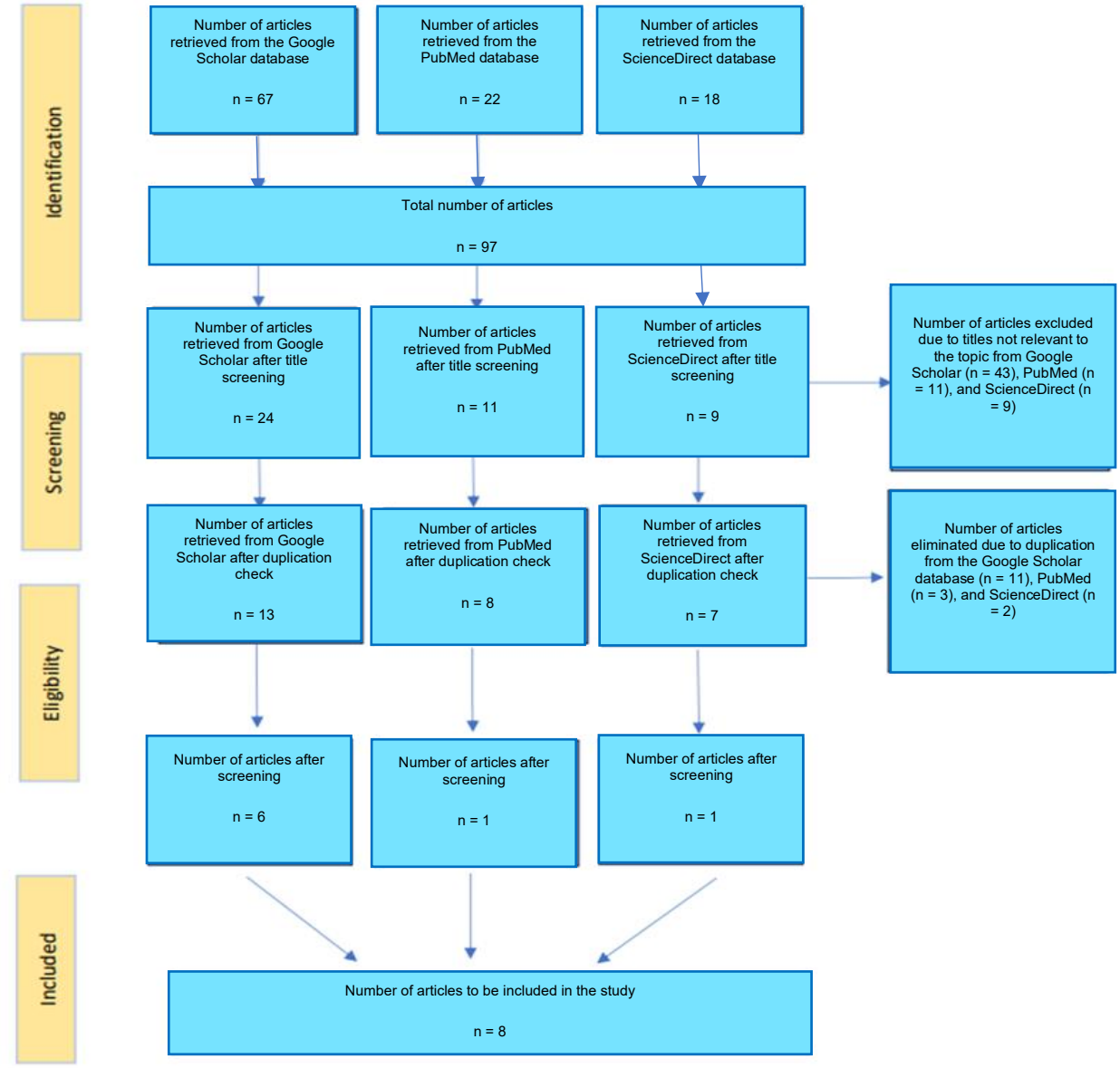

Figure 1. Prisma Flowchart

RESULTS

The literature search yielded eight articles that met the inclusion criteria. These studies reported the benefits of corticosteroids in controlling inflammation and improving clinical outcomes in various conditions, including asthma, nephrotic syndrome, atopic dermatitis, systemic lupus erythematosus, and post-ocular surgery.

Reported side effects were multisystemic and varied depending on the route of administration, duration of use, and patient characteristics. Systemic corticosteroids were most associated with metabolic and musculoskeletal effects, while topical and ocular corticosteroids caused more local side effects, although they still carried the risk of systemic effects with long-term use.

Table 1. Corticosteroids as “God Drugs”: Between Therapeutic Efficacy and Side Effects

No	Journal Title	Authors	Research Purposes	Methods	Result
1.	Prevalence of Three Prominent Corticosteroid Side Effects in a Large Asthma Population by Age, Sex and ICD-10 Asthma Severity with Recommendations for Screening	Yao et al., (2025)	To assess the prevalence of three major side effects of corticosteroid therapy in asthmatics osteoporosis, cataracts, osteonecrosis compared to the non-asthmatic population, based on age, sex, and asthma severity (ICD-10).	Colorado All-Payers Claims Database	Inhaled corticosteroids are effective for long-term asthma control with a relatively lower systemic risk, but at high doses (≥1000 µg/day) and long-term use, they are still associated with an approximately two-fold increase in the risk of cataracts (OR ±1.25 per 1000 µg increase), while the risk of osteoporosis and osteonecrosis is much more prominent in long-term systemic corticosteroid use, which is reported to increase the risk of cataracts up to threefold and osteonecrosis up to almost sevenfold compared to non-users.
2.	Long-Term Side Effects of Corticosteroids in Children with Nephrotic Syndrome	Halim et al., (2025)	To describe the side effects due to long-term corticosteroid consumption in children with nephrotic syndrome treated at Prof. Dr. R. D. Kandou Manado General Hospital.	Descriptive	As a first-line therapy for nephrotic syndrome, oral corticosteroids administered for a duration of ≥4 weeks have been shown to reduce mortality and induce remission in approximately 80% of patients. However, long-term use carries the risk of side effects, including moon face (76.67%), growth retardation (36.67%), underweight (50%), hypertension (13.33%), and obesity (3.33%).
3.	Study on Corticosteroid Use in Patients with Atopic Dermatitis at Toto Kabila Regional General	Ismail et al., 2023	To determine and analyze the use of corticosteroid drugs in atopic dermatitis patients at the outpatient installation of Toto Kabila Regional Hospital, Gorontalo Province in 2022.	This was a non-experimental study with a retrospective descriptive design; the	The use of corticosteroids in the treatment of atopic dermatitis is dominated by topical desoximetasone, which is the most widely used medication (41%). Corticosteroids are used because of their benefits

	Hospital, Gorontalo			sample consisted of all outpatients with atopic dermatitis in 2022; the sampling method used was general sampling; and data were taken from medical records.	in reducing inflammation, itching, and other skin complaints in atopic dermatitis patients. Although useful in suppressing inflammation, some types of corticosteroids used such as fluocinolone acetonide, clobetasol propionate, betamethasone, and hydrocortisone have the potential to cause side effects such as skin irritation, burning sensations, dryness, skin discoloration, and even skin atrophy if used excessively or long-term.
4.	Evaluation of the Side Effects of Corticosteroid Eye Drop Use in Postoperative Patients at the Pharmacy Department of Jakarta Eye Center Kedoya Eye Hospital	Husna et al., (2019)	to see the side effects of using corticosteroid eye drops and the duration of use in post-operative patients at the Pharmacy Installation of JEC Kedoya Eye Hospital.	Research shows that the use of descriptive survey drugs with cross-sectional methods, using universal sampling,	Research shows that the use of corticosteroid eye drops for a duration of >30 days is most common in post-operative patients, with the most common side effects being a burning sensation (23.08%), blurred vision (13.85%), and complaints of redness, dizziness, and a feeling of discomfort (3.08%). A total of 21.54% of patients experienced combined side effects, while 32.31% experienced no side effects. In addition, increased intraocular pressure occurred in 33.85% of patients, particularly those using prednisolone as a follow-up therapy.
5.	Overview of Long-Term Corticosteroid Side Effects in Patients with Systemic Lupus Erythematosus (SLE) at	Suwandi et al., (2022)	To find out the side effects of long-term corticosteroid use in SLE patients at Pasar Rebo Regional Hospital, Jakarta.	Desain cross-sectional, Analisis mengguna kan statistik deskriptif.	The use of corticosteroids in SLE patients with doses of ≥10 mg/day and a duration of ≥30 days is associated with an increased risk of side effects, the most common of which is gastritis (70%), followed

	Pasar Rebo Regional General Hospital, July 2017– July 2019				by pneumonia (26%) and hyperglycemia (13%). In addition, long-term use of corticosteroids has been reported to increase the risk of gastric perforation by up to 40%, so strict monitoring of the dose and duration of therapy is necessary.
6.	Coincidence of Insulinoma and Cushing's Syndrome: A Case Report	Nugraha & Gotera (2025)	Reporting the case of a 39-year-old woman with recurrent hypoglycemia due to insulinoma coincident with Cushing's syndrome.	Case report	Chronic long-term use of high-dose corticosteroids (±8 years) is known to be the most common cause of iatrogenic Cushing's syndrome, which in this case gives rise to typical clinical manifestations in the form of moon face, central obesity, striae, menstrual disorders, and metabolic changes, even though it was initially given as symptomatic therapy without a clear etiological diagnosis.
7.	Topical corticosteroid misuse : observational study to evaluate pattern of abuse and adverse drug reaction	Saini et al., (2019)	Analyze the magnitude of the problem of topical corticosteroid abuse and identify patterns of frequently misused drugs and the side effects they cause.	Retrospective observational study	Research shows that topical corticosteroid abuse is most common among adolescents (43.8%) and women (76%), with betamethasone valerate being the most commonly used (72.5%), primarily for acne (55%) and cosmetic purposes (21%). This inappropriate use causes various side effects, particularly burning and itching sensations (53%), worsening acne (44%), thinning of the skin (17%), and rosacea-like dermatitis (18%).
8.	Long-Term Risk of Steroid-Induced Ocular Hypertension/Glaucoma With Topical	Price et al., (2024)	To assess the long-term risk of steroid-induced ocular hypertension (intraocular pressure), as well as the need for glaucoma treatment,	Retrospective study	Long-term use of topical corticosteroid prednisolone 1% after DSEK procedure shows a high cumulative risk of ocular hypertension, which is 29% in 1 year, increasing to 41% in 5

Prednisolone Acetate 1% After Descemet Stripping Endothelial Keratoplasty	in patients using topical prednisolone acetate 1% without a previous history of glaucoma.	years, and 49% in 10 years of use, as well as the risk of causing the need for glaucoma therapy up to 25% in 10 years of use.

DISCUSSION

The literature review indicates that the perception of corticosteroids as a “panacea” arises not only from their strong pharmacological properties but also from clinical usage patterns that often result in rapid symptom relief across a wide range of diseases. This rapid therapeutic response reinforces both patient and clinician reliance on corticosteroids. However, analysis of the results table demonstrates that these benefits are highly contextual and depend substantially on the route of administration, dosage, and duration of therapy. These same factors simultaneously shape the risk profile and severity of adverse effects, indicating that the therapeutic efficacy of corticosteroids is inseparable from their potential harm.

In general, corticosteroids function as potent anti-inflammatory, immunosuppressive, and anti-allergic agents, making them highly effective in managing conditions such as respiratory tract inflammation, autoimmune disorders, and allergic reactions. Their mechanism of action involves modulation of immune responses and suppression of inflammatory mediators (William D.M, 2018). In clinical practice, corticosteroids are available in various dosage forms, including topical preparations used to suppress local inflammation in dermatitis, allergic contact reactions, and other inflammatory skin diseases (Ismail et al., 2023). Inhaled and intranasal corticosteroids act directly on the respiratory tract and are widely used for controlling chronic airway inflammation in asthma (Fadhilah et al., 2025). Systemic corticosteroids administered orally or via injection are commonly prescribed for severe inflammatory and autoimmune diseases, while ocular corticosteroids are effective for managing eye inflammation but require close monitoring due to risks such as increased intraocular pressure and cataract formation (Kate et al., 2023).

Topical corticosteroids demonstrate high effectiveness in controlling dermatological inflammation, as evidenced in studies on atopic dermatitis and topical steroid misuse (Johan, 2015). However, comparative analysis across studies reveals that dermatological side effects including skin atrophy, steroid-induced acne, and rosacea-like dermatitis are more frequently associated with high-potency formulations and prolonged or uncontrolled use. These findings indicate that adverse effects are not solely related to the pharmacological characteristics of the drug itself, but are strongly influenced by irrational use patterns, particularly when applied to sensitive areas such as the face. This underscores that many side effects arise from inadequate patient education and insufficient clinical supervision rather than from appropriate therapeutic use.

With regard to inhaled corticosteroids (ICS), studies in asthma patients show a more favorable balance between benefits and risks compared to systemic administration. ICS are effective for long-term inflammatory control with relatively lower systemic exposure; however, quantitative analyses indicate that high doses (≥1000 µg/day) and prolonged use are still associated with increased risks of cataracts and bone disorders (Fadiyah et al., 2022). These findings challenge the assumption that inhaled corticosteroids are completely safe, particularly in patients with severe asthma who require dose escalation. Moreover, review studies in COPD patients who frequently receive long-term ICS therapy similar to those with severe asthma have shown associations with local adverse effects such as oral candidiasis and dysphonia, as well as increased risks of pneumonia and mycobacterial infections depending on dose and duration. Meta-analytic evidence emphasizes the need for individualized risk assessment when prescribing long-term ICS therapy (Miravitlles et al., 2021).

Systemic corticosteroids show the most consistent and extensive association with multisystem adverse effects. Studies involving patients with systemic lupus erythematosus (SLE) and children with nephrotic syndrome demonstrate that doses ≥10 mg/day or prolonged duration of therapy are correlated with increased incidences of hyperglycemia, hypertension, growth

disturbances, and cushingoid features (Suwandi et al., 2022). Comparative findings suggest that musculoskeletal complications such as osteoporosis and osteonecrosis primarily occur with chronic exposure, supporting biological mechanisms involving suppression of osteoblast activity and increased bone resorption. From a clinical pharmacology perspective, long-term systemic corticosteroid use is closely linked to hypothalamic pituitary adrenal (HPA) axis suppression, which may result in secondary adrenal insufficiency, particularly if therapy is discontinued abruptly. Broersen et al. (2015) emphasized that this risk increases with cumulative dose and duration, making gradual dose tapering a critical component of safe clinical practice. Additionally, retrospective observational studies indicate that systemic corticosteroid exposure significantly increases the risk of new-onset type 2 diabetes mellitus compared to non-exposed populations (12.5 vs 6.7 per 1000 persons/year) (Ambery et al., 2023).

Ocular corticosteroids also present clinically relevant risks. Husna I et al. (2019) reported that prednisolone accounted for the highest proportion of ocular side effects (38.5%), followed by dexamethasone (27.7%), while fluorometholone was more frequently associated with local symptoms such as burning, stinging, and blurred vision. These variations suggest that both potency and type of corticosteroid influence the manifestation of side effects, rather than frequency of use alone. Although initial symptoms are often transient and resolve after discontinuation, prolonged use significantly increases the risk of elevated intraocular pressure and glaucoma, which may develop after more than two weeks of use and persist with chronic exposure. This risk is particularly pronounced in individuals aged 45–64 years, highlighting age and duration of therapy as major contributing factors. Consequently, ocular corticosteroid therapy requires strict duration limits and regular intraocular pressure monitoring, especially in middle-aged and elderly patients.

When examined by organ system, corticosteroid-related adverse effects encompass nearly all physiological systems, particularly with long-term or high-dose exposure. Endocrine and metabolic disturbances are among the most consistent findings, including hyperglycemia in 13% of SLE patients (Suwandi et al., 2022), iatrogenic Cushing's syndrome characterized by central obesity (Nugraha & Gotera, 2025), and a high prevalence of moon face in children with nephrotic syndrome (76.67%) accompanied by growth impairment and nutritional disturbances (Halim et al., 2025). These findings indicate that age represents an important biological vulnerability factor and reinforce the need for intensive metabolic monitoring in patients receiving prolonged systemic corticosteroid therapy.

Musculoskeletal complications are also prominent in long-term systemic corticosteroid users. Glucocorticoids suppress osteoblast differentiation, increase osteocyte apoptosis, and prolong osteoclast lifespan, resulting in rapid bone loss that may occur within the first six months of therapy (Compston, 2018). A large cohort study by Yao et al. (2025) demonstrated significantly higher incidences of osteoporosis and osteonecrosis among corticosteroid-treated asthma patients compared to non-asthmatic individuals, with risk increasing in parallel with asthma severity. These findings are biologically plausible and provide strong evidence linking chronic corticosteroid exposure to skeletal complications, even though not all reviewed studies explicitly assessed musculoskeletal outcomes.

Dermatological adverse effects, particularly associated with topical corticosteroids, are clinically apparent but often underestimated during early treatment phases. Saini et al. (2019) reported that misuse of high-potency topical corticosteroids especially betamethasone valerate led to acne exacerbation in 44% of patients and skin atrophy in 17%. Similar patterns were observed among atopic dermatitis patients in Gorontalo due to excessive use of desoximetasone and other steroids (Halim et al., 2023). Facial skin was identified as the most vulnerable site, with prolonged use increasing the risk of topical steroid withdrawal syndrome (Hajar et al., 2015). These findings emphasize that while topical corticosteroids are effective anti-inflammatory agents, their benefits are maximized only through controlled use and close clinical supervision, particularly in primary care settings.

In the ocular system, corticosteroid-related complications can progress to severe outcomes if inadequately monitored. Increased intraocular pressure was reported in 33.85% of postoperative patients using corticosteroid eye drops (Husna et al., 2019), with prednisolone associated with the highest risk. Long-term follow-up studies further demonstrated cumulative

risks of ocular hypertension and glaucoma reaching 49% after ten years of topical prednisolone acetate use (Price et al., 2024). Additionally, Yao et al. (2025) identified an increased incidence of cataracts among patients exposed to systemic and inhaled corticosteroids, particularly those with severe asthma. These findings highlight deficiencies in long-term drug monitoring systems and underscore the influence of individual susceptibility factors such as age, genetics, and cumulative steroid dose (Takano et al., 2025).

Cardiovascular effects of corticosteroids are primarily mediated through sodium retention, fluid overload, and activation of the renin–angiotensin system, leading to elevated blood pressure. The occurrence of hypertension in 13.33% of children with nephrotic syndrome receiving long-term corticosteroid therapy (Halim et al., 2025) suggests heightened hemodynamic vulnerability in pediatric populations. Although cardiovascular outcomes related to inhaled corticosteroids were not directly evaluated in the reviewed studies, evidence from comparative COPD literature suggests indirect cardiovascular contributions through systemic effects. Overall, the evidence is sufficient to establish long-term systemic corticosteroid exposure as a significant cardiovascular risk factor, necessitating routine blood pressure monitoring.

Patient education and continuous monitoring play pivotal roles in preventing corticosteroid-related adverse effects. Budiawan et al. (2023) demonstrated that comprehensive counseling significantly reduces irrational corticosteroid use, consistent with findings that low health literacy is a major contributor to misuse (Nagesh, & Akhiles A., 2016). The implementation of structured monitoring protocols including regular assessments of blood pressure, blood glucose, bone density, and adrenal function has been shown to reduce serious complications associated with systemic corticosteroid therapy (Curtis et al., 2017). These strategies reinforce the central role of healthcare professionals in ensuring patient safety.

In conclusion, although corticosteroids provide substantial therapeutic benefits in managing various clinical conditions, uncontrolled use and misuse can lead to serious complications affecting dermatological, metabolic, musculoskeletal, ocular, and cardiovascular systems. This highlights the urgent need for continuous education programs, strengthened pharmaceutical regulations, and optimization of healthcare professional involvement to ensure the safe, rational, and effective use of corticosteroids.

CONCLUSION

The findings of this literature review demonstrate that, although corticosteroids are highly effective in suppressing inflammation and play a crucial role in the management of various diseases, their use is associated with a substantial risk of adverse effects affecting multiple organ systems. This review confirms that corticosteroid-related side effects are strongly influenced by dosage, duration of therapy, potency, route of administration, and individual patient susceptibility. Systemic corticosteroids are most frequently associated with metabolic disturbances, including hyperglycemia and iatrogenic Cushing's syndrome, as well as dermatological manifestations such as skin atrophy and irritation. In addition, ocular corticosteroid use may lead to increased intraocular pressure and the development of glaucoma. Overall, these findings indicate that while corticosteroids remain indispensable in clinical practice, their use must be accompanied by careful dose adjustment, appropriate duration of therapy, and close clinical monitoring to minimize long-term risks and ensure patient safety.

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