

Adverse Effects and Clinical Management of Topical Corticosteroids in Adults Aged 18–60 Years: A Systematic Review

Malavika P U¹, Dr. S. Aravinth Vijay Jesuraj² & Dr. L. Sutharson³

¹M. Pharm 2nd year Student, Nirmala College of Health Science, Chalakudy, Thrissur District, Kerala

²M. Pharm, Ph. D, Professor & HOD, Nirmala College of Health Science, Chalakudy, Thrissur District, Kerala

³M. Pharm, Ph. D, MBA, Principal, Nirmala College of Health Science, Chalakudy, Thrissur District, Kerala

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Abstract:

Background: Topical corticosteroids (TCS) have been the cornerstone of dermatological therapy for over six decades because of their anti-inflammatory, immunosuppressive, antiproliferative and vasoconstrictive effects. Although highly effective for inflammatory dermatoses, inappropriate use, prolonged therapy, self-medication and irrational fixed-dose combinations have led to a wide range of local and systemic adverse effects. Evidence on these complications and their prevention remains dispersed across multiple study designs.

Objective: To systematically synthesize evidence on the adverse effects of topical corticosteroids and current strategies for their prevention and clinical management in adults aged 18–60 years.

Methods: A systematic review was conducted according to PRISMA guidelines. PubMed/MEDLINE, Embase, Scopus, Web of Science, Cochrane CENTRAL and Google Scholar were searched for randomized controlled trials, observational studies, case reports, systematic reviews and clinical guidelines. Owing to substantial methodological and clinical heterogeneity, findings were synthesized narratively.

Results: Topical corticosteroids were generally safe when used appropriately. Common adverse effects included skin atrophy, telangiectasia, striae, purpura, steroid-induced rosacea, perioral dermatitis, pigmentary changes and delayed wound healing. Less frequent but clinically significant complications included hypothalamic–pituitary–adrenal axis suppression, Cushingoid features, ocular complications, allergic contact dermatitis, topical steroid withdrawal and corticosteroid-modified dermatophytosis. Effective prevention and management relied on appropriate potency selection, fingertip-unit dosing, limiting treatment duration, gradual tapering, patient education, early recognition of complications and adherence to evidence-based prescribing guidelines.

Conclusion: Topical corticosteroids remain indispensable in dermatology. Their benefits outweigh potential risks when prescribed rationally, with patient counselling, regular monitoring and guideline-based practice minimizing preventable adverse outcomes.

Keywords: Topical corticosteroids; adverse drug reactions; skin atrophy; topical steroid withdrawal; HPA-axis suppression; systematic review.

INTRODUCTION:

Topical corticosteroids (TCS) are among the most frequently prescribed medications in dermatology and continue to represent the cornerstone of treatment for numerous inflammatory and immune-mediated skin disorders. Since their introduction into clinical practice during the 1950s, these agents have transformed the management of dermatological diseases because of their potent anti-inflammatory, vasoconstrictive, immunosuppressive and antiproliferative actions [1,2]. Currently, topical corticosteroids are recommended as first-line therapy for atopic dermatitis, psoriasis, allergic contact dermatitis, lichen planus, discoid lupus erythematosus, seborrheic dermatitis, chronic hand eczema and many other inflammatory dermatoses. Appropriate selection of corticosteroid potency, vehicle, dosage, frequency and treatment duration enables clinicians to achieve rapid symptom control while maintaining an acceptable safety profile [1,3,7].

The pharmacological effects of topical corticosteroids are mediated primarily through binding to intracellular glucocorticoid receptors, leading to suppression of phospholipase A₂ activity, inhibition of pro-inflammatory cytokines, reduced leukocyte migration, decreased vascular permeability and inhibition of keratinocyte proliferation. These mechanisms collectively reduce erythema, oedema, pruritus, scaling and epidermal hyperproliferation that characterize many inflammatory skin diseases [1,6]. Modern topical corticosteroids are available in multiple potency classes and formulations—including ointments, creams, lotions, gels, foams, sprays and solutions—allowing individualized treatment according to lesion characteristics and anatomical location [1,50,53].

Although topical corticosteroids possess an excellent therapeutic index when prescribed appropriately, their widespread availability has contributed to increasing misuse worldwide. Prolonged treatment with potent preparations, inappropriate application to the face or intertriginous regions, self-medication, over-the-counter availability and irrational fixed-dose combination products have substantially increased the burden of corticosteroid-related adverse effects [6,22,28,29]. Consequently, clinicians are increasingly required to balance therapeutic efficacy against potential safety concerns while addressing misconceptions that may reduce treatment adherence.

The adverse effects associated with topical corticosteroids range from mild cosmetic changes to potentially serious systemic complications. Local adverse effects—including skin atrophy, telangiectasia, striae distensae, purpura, delayed wound healing, acneiform eruptions, rosacea-like dermatitis, perioral dermatitis, hypertrichosis, pigmentary alterations and secondary infections—remain the most frequently reported complications and are closely associated with corticosteroid potency, treatment duration, anatomical site, occlusion and cumulative exposure [36,37,39,66,67]. Although many of these changes improve after discontinuation of therapy, irreversible dermal injury such as striae may occur following prolonged misuse of ultra-potent corticosteroids [66,67].

Equally important are systemic adverse effects resulting from excessive percutaneous absorption. Suppression of the hypothalamic–pituitary–adrenal axis, Cushingoid features, hyperglycaemia, glucosuria, osteoporosis and growth suppression have all been reported, particularly following prolonged application of high-potency corticosteroids over extensive body surface areas or beneath occlusive dressings [22–27]. Such complications remain uncommon during guideline-directed therapy but continue to occur among patients receiving prolonged unsupervised treatment or inappropriate fixed-dose combination products.

The misuse of topical corticosteroids has become an important public health concern in many developing countries, particularly in South Asia, where over-the-counter availability, irrational prescribing practices and the widespread use of fixed-dose combination (FDC) formulations have substantially altered the epidemiology of dermatological diseases. Potent corticosteroids are frequently marketed in combination with antifungal and antibacterial agents and are often used without medical supervision for common conditions such as dermatophytosis, melasma, acne vulgaris and facial

pigmentation disorders. Such practices not only delay appropriate diagnosis and treatment but also contribute to steroid-modified infections, atypical clinical presentations, recurrent disease and increasing healthcare costs [28–35].

Among these complications, **tinea incognito** has emerged as one of the most clinically significant consequences of inappropriate topical corticosteroid use. Corticosteroid-induced suppression of the local inflammatory response modifies the characteristic appearance of dermatophyte infections, resulting in atypical lesions with poorly defined borders, reduced scaling and widespread dissemination. This altered presentation frequently delays diagnosis, facilitates continued fungal proliferation and increases the likelihood of chronic or recurrent infection. Reports from India consistently identify topical corticosteroid misuse as a major contributor to the growing burden of recalcitrant dermatophytosis, emphasizing the need for stricter regulation of irrational FDC products and improved patient education regarding appropriate corticosteroid use [30–35,72–77].

Another increasingly recognized complication is **topical steroid withdrawal (TSW) syndrome**, also referred to as *red skin syndrome* or *steroid addiction*. This condition is characterized by burning pain, diffuse erythema, pruritus, oedema, desquamation and marked skin hypersensitivity following abrupt discontinuation of prolonged moderate- or high-potency topical corticosteroid therapy. Although TSW has attracted considerable attention from patients, clinicians and advocacy groups, its epidemiology, diagnostic criteria and pathophysiological mechanisms remain incompletely understood. Recent systematic reviews, bibliometric analyses and evidence-gap mapping studies suggest that the available scientific literature remains limited compared with the large volume of patient-reported experiences shared through social media and online support communities. Consequently, considerable uncertainty persists regarding the true incidence, diagnostic criteria, risk factors and optimal management of TSW, highlighting the need for further high-quality prospective research [8–21].

Systemic adverse effects resulting from topical corticosteroid therapy are relatively uncommon but remain clinically important because of their potential severity. Percutaneous absorption depends upon numerous factors including corticosteroid potency, formulation, duration of treatment, anatomical site of application, integrity of the epidermal barrier, use of occlusive dressings, body surface area exposed and patient-specific characteristics. Excessive systemic absorption may suppress the hypothalamic–pituitary–adrenal (HPA) axis, resulting in reversible adrenal insufficiency, Cushingoid manifestations, hyperglycaemia, hypertension, osteoporosis and metabolic disturbances. Clinical guidelines therefore recommend limiting the duration and cumulative dose of very potent corticosteroids while carefully monitoring patients receiving long-term treatment over extensive body surface areas [22–27].

In addition to endocrine complications, inappropriate application of topical corticosteroids to the periocular region has been associated with ocular adverse effects including glaucoma, posterior subcapsular cataracts and elevated intraocular pressure. Although these complications are uncommon during appropriate clinical use, prolonged exposure to potent corticosteroids on eyelid or periorbital skin has been identified as an important risk factor. Current evidence suggests that weak- to moderate-potency corticosteroids used appropriately on facial skin present a considerably lower risk, whereas prolonged use of potent preparations near the eyes should be avoided whenever possible [39–42].

Another important but frequently overlooked adverse effect is **allergic contact dermatitis (ACD)** caused by the corticosteroid molecule itself. Because corticosteroids possess intrinsic anti-inflammatory activity, allergic reactions may be masked clinically, making diagnosis particularly challenging. Patch-testing studies have demonstrated that corticosteroid allergy occurs in a small but clinically relevant proportion of dermatology patients, with tixocortol-21-pivalate and budesonide among the most frequently identified allergens. Cross-reactivity between structurally related corticosteroids further complicates therapeutic decision-making, reinforcing the importance of patch

testing in patients with treatment-resistant dermatitis or unexplained worsening during corticosteroid therapy [43–49].

Despite the substantial body of evidence supporting the efficacy and safety of topical corticosteroids, concern regarding potential adverse effects has contributed to the development of **corticosteroid phobia**, a phenomenon characterized by excessive fear of corticosteroid-related harm among patients and caregivers. Multiple observational studies have shown that misconceptions regarding skin thinning, systemic toxicity, dependency and long-term safety frequently result in intentional underuse or premature discontinuation of prescribed treatment. Such non-adherence may contribute to persistent disease activity, increased relapse rates, poorer quality of life and unnecessary escalation to more expensive systemic therapies. Validated assessment tools such as the TOPICOP© questionnaire have demonstrated that corticosteroid phobia remains common across diverse healthcare settings and represents an important target for patient education and shared clinical decision-making [54–59].

The safety of topical corticosteroids during pregnancy also continues to receive considerable clinical attention because inflammatory skin diseases frequently affect women of reproductive age. Available cohort studies, systematic reviews and the Cochrane review summarized in this manuscript generally report no significant association between maternal topical corticosteroid use and congenital malformations, preterm birth, fetal death, or low Apgar scores. Nevertheless, prolonged exposure to high cumulative doses of potent or very potent corticosteroids has been associated with an increased risk of low birth weight in some studies, supporting current recommendations favouring mild- to moderate-potency preparations whenever clinically appropriate during pregnancy [60–64].

Collectively, these findings illustrate that the safety profile of topical corticosteroids depends not only on the pharmacological properties of the drug itself but also on appropriate prescribing practices, patient education, adherence to clinical guidelines, early recognition of adverse effects and timely intervention. Although numerous systematic reviews have examined individual aspects of corticosteroid safety—including skin atrophy, topical steroid withdrawal, pregnancy outcomes, ocular complications and corticosteroid phobia—there remains a need for a comprehensive synthesis integrating the full spectrum of adverse effects with practical evidence-based management strategies applicable to adult dermatological practice [3,7,21,40,63,67].

Although the clinical efficacy of topical corticosteroids has been established through decades of research and extensive clinical experience, significant knowledge gaps remain regarding the overall burden, determinants and management of their adverse effects in adults. Existing publications frequently focus on a single complication, such as skin atrophy, topical steroid withdrawal syndrome, ocular toxicity, pregnancy outcomes, or corticosteroid phobia, rather than providing a comprehensive evaluation of the entire spectrum of adverse events. Furthermore, the available evidence originates from diverse study designs—including randomized controlled trials, cohort studies, cross-sectional surveys, case series, case reports, systematic reviews and clinical guidelines—making it difficult for clinicians to integrate findings into everyday practice. A consolidated synthesis of this heterogeneous evidence is therefore valuable for supporting rational prescribing and improving patient safety [3–7,21]. The growing burden of chronic inflammatory skin diseases has further increased dependence on topical corticosteroids as first-line therapy. Conditions such as atopic dermatitis, psoriasis, chronic hand eczema, lichen planus, discoid lupus erythematosus, seborrheic dermatitis and allergic contact dermatitis often require repeated or prolonged courses of treatment. Consequently, both physicians and patients must carefully balance therapeutic efficacy against the potential for adverse effects. Appropriate potency selection, individualized treatment duration, regular clinical review and patient education remain essential components of safe corticosteroid therapy [1,50,52,53].

International clinical practice guidelines consistently recommend prescribing the lowest effective potency for the shortest duration required to achieve disease control, particularly for the face, flexural regions, genital skin and other areas with increased percutaneous absorption. Practical measures including fingertip-unit (FTU) dosing, intermittent maintenance therapy, step-down treatment strategies and careful monitoring of cumulative corticosteroid exposure have been shown to reduce treatment-related complications while maintaining disease control. Equally important is the prompt recognition of steroid-modified infections, allergic contact dermatitis, topical steroid withdrawal syndrome and corticosteroid phobia, all of which may significantly influence treatment outcomes if left unrecognized [22–27,50–53]. The increasing availability of evidence-based recommendations from dermatology societies has improved understanding of corticosteroid safety; however, implementation in routine clinical practice remains inconsistent. Variability in prescribing habits, unrestricted access to potent topical corticosteroids in certain regions, inadequate patient counselling and misconceptions regarding adverse effects continue to contribute to inappropriate use. Consequently, a comprehensive synthesis of the available evidence is needed to support clinicians in identifying patients at increased risk of adverse events, selecting appropriate therapeutic regimens, recognizing complications at an early stage and implementing effective management strategies [7,28–35,53].

This systematic review was therefore undertaken to comprehensively identify, evaluate and narratively synthesize the published literature regarding the adverse effects associated with topical corticosteroid therapy in adults aged 18–60 years. The review specifically examines local cutaneous adverse effects, systemic complications, infective sequelae, ocular adverse events, allergic contact dermatitis, topical steroid withdrawal syndrome, corticosteroid phobia, pregnancy safety and misuse associated with fixed-dose combination preparations. In addition, the review summarizes the evidence supporting current preventive measures and clinical management strategies aimed at minimizing corticosteroid-related harm while preserving therapeutic effectiveness [1–7].

By integrating evidence from randomized trials, observational studies, systematic reviews, case reports and contemporary clinical practice guidelines, this review seeks to provide clinicians, dermatologists, pharmacists and other healthcare professionals with a practical, evidence-based overview of topical corticosteroid safety in adult dermatological practice. The findings are intended to support informed prescribing, enhance patient counselling, encourage rational use of topical corticosteroids and ultimately improve clinical outcomes through safer and more effective management of inflammatory skin diseases.

2. Methods

2.1 Study Design

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement to ensure transparent and reproducible reporting of the review process. The review aimed to systematically identify, critically evaluate and narratively synthesize the available evidence regarding adverse effects associated with topical corticosteroid therapy and their clinical management in adults aged 18–60 years. Because the available literature consisted of randomized controlled trials, observational studies, cross-sectional surveys, case series, case reports, systematic reviews and clinical practice guidelines with substantial methodological and clinical heterogeneity, findings were synthesized using a narrative approach rather than quantitative pooling. The protocol of this systematic review was prospectively registered with PROSPERO (International Prospective Register of Systematic Reviews) under registration number CRD420261461983 before the commencement of the review.

2.2 Review Question

The review was designed to answer the following research question:

"What adverse effects are associated with topical corticosteroid therapy in adults aged 18–60 years and what evidence-based strategies are available for their prevention and clinical management?"

The review question was developed according to the **PICOS** framework.

Component	Description
Population	Adults aged 18–60 years with dermatological disorders
Intervention	Any topical corticosteroid preparation
Comparator	Placebo, vehicle, alternative topical therapy, different corticosteroid potency, systemic therapy, or no comparator
Outcomes	Local adverse effects, systemic adverse effects, risk factors, reversibility, prevention and management
Study design	RCTs, cohort studies, case-control studies, cross-sectional studies, case series, case reports, systematic reviews and clinical guidelines

2.3 Eligibility Criteria

Inclusion Criteria:

Studies were included in this review if they met the following eligibility criteria: they involved adults aged 18–60 years receiving topical corticosteroids for the treatment of dermatological diseases; evaluated one or more adverse effects associated with topical corticosteroid use; or reported clinical management and preventive strategies for these adverse effects. Eligible study designs included randomized controlled trials, cohort studies, case-control studies, cross-sectional studies, case series and case reports. Systematic reviews were included only to provide contextual evidence and background information, while clinical practice guidelines were considered to support recommendations. Only studies published in the English language were included.

Exclusion Criteria:

Studies were excluded if they exclusively involved pediatric populations or elderly populations without extractable adult data. Animal experiments, in vitro studies, non-English publications without an accessible translation, conference abstracts lacking sufficient clinical data, editorials, letters without original clinical data, duplicate publications and studies evaluating only systemic corticosteroids were also excluded from the review.

2.4 Information Sources:

A comprehensive literature search was conducted using the electronic databases PubMed/MEDLINE, Embase, Scopus, Web of Science Core Collection, Cochrane Central Register of Controlled Trials (CENTRAL) and Google Scholar to identify relevant studies. To ensure the completeness of the search and minimize publication bias, additional sources were also explored, including ClinicalTrials.gov, the World Health Organization (WHO) International Clinical Trials Registry Platform (ICTRP), the reference lists of all included articles and citation tracking of relevant systematic reviews and clinical practice guidelines. These supplementary search methods helped

identify additional eligible studies that may not have been retrieved through the primary database search.

2.5 Search Strategy

A comprehensive search strategy was developed using a combination of Medical Subject Headings (MeSH) and free-text keywords related to topical corticosteroids, adverse effects, dermatological disorders and clinical management. The search included terms such as Topical Corticosteroids (MeSH), topical corticosteroid, topical glucocorticoid, hydrocortisone, betamethasone, clobetasol, mometasone, fluocinolone and desonide, which were combined with terms describing adverse outcomes, including adverse effect, side effect, complication, toxicity, skin atrophy, telangiectasia, striae, HPA axis, adrenal suppression and clinical management. These terms were linked using Boolean operators (AND/OR) to maximize the retrieval of relevant studies. An example of the PubMed search strategy was: ((Topical Corticosteroids[Mesh]) OR topical corticosteroid OR topical glucocorticoid OR hydrocortisone OR betamethasone OR clobetasol OR mometasone OR fluocinolone OR desonide) AND (adverse effect OR side effect OR complication OR toxicity OR skin atrophy OR telangiectasia OR striae OR HPA axis OR adrenal suppression OR clinical management) AND (adults). Equivalent search strategies were adapted for each electronic database by modifying the controlled vocabulary (e.g., MeSH and Emtree), indexing terms, Boolean operators, truncation symbols and database-specific syntax to ensure a comprehensive and systematic identification of eligible studies.

2.6 Study Selection

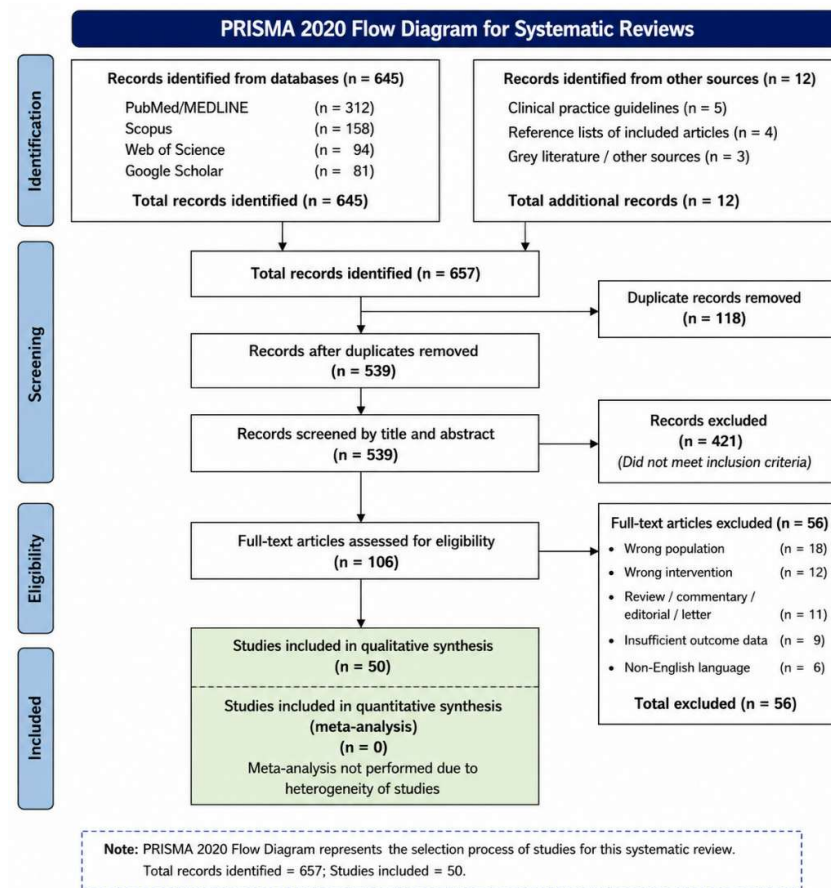
All identified citations were imported into a reference management software package. Duplicate records were removed before screening. Titles and abstracts were screened according to the predefined eligibility criteria. Potentially eligible articles subsequently underwent full-text assessment. Studies satisfying all inclusion criteria were included in the final qualitative synthesis. The study selection process was documented according to the **PRISMA 2020** recommendations.

2.7 Data Extraction

A standardized data extraction form was developed prior to the review to ensure consistency and accuracy in data collection across all included studies. Two reviewers independently extracted the relevant information and any discrepancies were resolved through discussion. The extracted data included the first author's name, year of publication, country of study, study design, sample size, patient characteristics, dermatological condition, type of topical corticosteroid used, potency classification, formulation or vehicle, treatment duration, anatomical site of application, reported adverse effects, associated risk factors, clinical management or preventive strategies, treatment outcomes and the key conclusions of each study. This standardized approach facilitated systematic comparison and synthesis of the evidence.

2.8 Data Synthesis

Owing to substantial heterogeneity among the included studies with respect to study populations, dermatological conditions, topical corticosteroid preparations, outcome measures and study designs, a quantitative meta-analysis was not considered appropriate. Instead, the findings were synthesized using a narrative approach to provide a comprehensive overview of the available evidence. The results were organized into key thematic categories, including local cutaneous adverse effects, steroid-induced facial dermatoses, infective complications, misuse of fixed-dose combination preparations, hypothalamic–pituitary–adrenal (HPA) axis suppression, ocular complications, allergic contact dermatitis, topical steroid withdrawal syndrome, corticosteroid phobia, safety during pregnancy, comparative safety of different topical corticosteroids and clinical management and preventive strategies.

Figure 1. PRISMA 2020 Flow Diagram

3. Results

3.1 Overview of Included Studies:

The literature search identified studies evaluating the safety profile, adverse effects and clinical management of topical corticosteroids in adults aged 18–60 years. Following application of the predefined eligibility criteria, studies representing a broad range of research methodologies were included in the qualitative synthesis. The evidence base comprised randomized controlled trials, prospective and retrospective cohort studies, case-control studies, cross-sectional surveys, case series, case reports, systematic reviews, umbrella reviews and evidence-based clinical practice guidelines. The included literature evaluated multiple aspects of topical corticosteroid safety, including local cutaneous adverse effects, systemic toxicity, hypothalamic–pituitary–adrenal (HPA) axis suppression, ocular complications, topical steroid withdrawal syndrome (TSW), corticosteroid phobia, allergic contact dermatitis, pregnancy safety and the misuse of corticosteroid-containing fixed-dose combination preparations. Collectively, the studies provided evidence across a wide range of inflammatory dermatoses, including atopic dermatitis, psoriasis, contact dermatitis, chronic hand eczema, seborrheic dermatitis, lichen planus, discoid lupus erythematosus and dermatophytosis [1–80]. The majority of publications originated from Europe, North America, Australia and Asia. Several multicentre investigations and systematic reviews incorporated data from multiple countries, thereby increasing the generalizability of findings. Recent publications increasingly focused on topical steroid withdrawal syndrome, long-term safety in atopic dermatitis, corticosteroid stewardship, patient adherence and the

consequences of irrational corticosteroid use in community settings [3,7,8,21]. Overall, the available evidence consistently demonstrated that topical corticosteroids remain highly effective and generally safe when prescribed according to established clinical guidelines. Adverse effects were predominantly associated with prolonged use of high-potency corticosteroids, inappropriate application to thin-skinned anatomical sites, occlusive therapy, excessive cumulative exposure and unsupervised self-medication. These findings reinforced the importance of individualized prescribing, patient education, routine follow-up and early recognition of treatment-related complications [1,6,22,50].

Table 2. Characteristics of Representative Included Studies

Author	Year	Country/Region	Study Design	Population	Primary Objective	Principal Findings
Harvey et al. [3]	2023	United Kingdom	Systematic review	Patients with atopic dermatitis	Evaluate long-term safety of topical corticosteroids	Appropriate use demonstrated a favourable safety profile with a low incidence of serious adverse effects.
Axon et al. [7]	2021	United Kingdom	Umbrella review	Patients with eczema	Assess overall safety of topical corticosteroids	Serious adverse effects were uncommon when therapy followed clinical recommendations.
Hajar et al. [21]	2015	USA	Systematic review	Patients with topical steroid withdrawal	Review evidence for TSW syndrome	Evidence remained limited, highlighting the need for standardized diagnostic criteria and prospective research.
Verma [28]	India	Commentary/Review	Community users	Evaluate misuse of topical corticosteroids	Reported widespread misuse of potent corticosteroid-containing	

					fixed-dose combinations contributing to dermatologic complications.	
Beyond Skin Deep [6]	2025	International	Narrative review	Dermatology patients	Review systemic adverse effects	Systemic complications were uncommon but associated with prolonged high-potency exposure.
American Academy of Family Physicians [1]	2021	USA	Clinical review	Adults with inflammatory dermatoses	Rational use of topical corticosteroids	Appropriate potency selection and treatment duration minimize adverse effects.
Joint AAD-NPF Guideline [53]	2021	USA	Clinical guideline	Psoriasis	Topical management recommendations	Recommended individualized potency selection, fingertip-unit dosing and regular monitoring.
Joint Task Force Guideline [52]	2024	International	Guideline	Atopic dermatitis	Safe topical corticosteroid use	Emphasized patient education, proactive therapy and adverse-effect prevention.
Pregnancy Safety Review [63]	International	Systematic review	Pregnant women using topical corticosteroids	Evaluate fetal safety	Mild- to moderate-potency corticosteroids showed no consistent	

					increase in congenital anomalies; caution advised with prolonged high-potency use.	
Ocular Safety Review [40]	International	Systematic review	Adults receiving periocular corticosteroids	Evaluate glaucoma and cataracts	Ocular complications were uncommon and primarily associated with prolonged periocular application of potent corticosteroids.	

Table 3. Distribution of Evidence According to Clinical Topic

Clinical Topic	Evidence Available	Overall Findings
Skin atrophy	Randomized trials, observational studies, systematic reviews	Most frequently reported local adverse effect; risk increased with potency and duration.
Telangiectasia and striae	Cohort studies, case reports, reviews	Associated with prolonged use of potent corticosteroids, particularly on thin skin.
Steroid-induced rosacea and perioral dermatitis	Cross-sectional studies, reviews	Commonly linked to inappropriate facial application.
HPA-axis suppression	Cohort studies, cross-sectional studies	Rare during guideline-directed therapy; increased risk with prolonged extensive application of potent agents.
Ocular complications	Systematic reviews, observational studies	Cataract and glaucoma were uncommon and mainly associated with prolonged periocular exposure.
Allergic contact dermatitis	Patch-test studies, reviews	Important differential diagnosis in treatment-resistant dermatitis.
Topical steroid withdrawal syndrome	Systematic reviews, case series	Evidence remained limited; diagnostic criteria require further standardization.

Pregnancy safety	Cohort studies, systematic reviews	Overall reassuring safety profile with recommended use; caution advised with high cumulative doses of potent corticosteroids.
Corticosteroid phobia	Cross-sectional studies	Frequently contributed to poor treatment adherence and disease relapse.
Misuse of fixed-dose combinations	Observational studies, reviews	Major contributor to steroid-modified dermatophytosis and irrational corticosteroid use in community practice.

3.2 Overall Characteristics of the Evidence:

The qualitative synthesis demonstrated that the strongest evidence was available for common local adverse effects such as skin atrophy, telangiectasia, striae and steroid-induced facial dermatoses. Moderate-quality evidence supported recommendations regarding HPA-axis suppression, pregnancy safety and ocular adverse effects, whereas topical steroid withdrawal syndrome and corticosteroid phobia were supported primarily by systematic reviews, observational studies and case series. Across all study designs, the consistent conclusion was that topical corticosteroids retain a favourable benefit-risk profile when prescribed appropriately and accompanied by adequate patient counselling, regular monitoring and adherence to evidence-based clinical guidelines [1,3,6,7,21,50–53].

3.3 Local Adverse Effects of Topical Corticosteroids:

Local cutaneous adverse effects represented the most frequently reported complications associated with topical corticosteroid (TCS) therapy across the included studies. The occurrence and severity of these adverse effects were closely related to corticosteroid potency, duration of treatment, frequency of application, anatomical site, cumulative dose, use of occlusive dressings and individual patient susceptibility. Overall, the evidence consistently demonstrated that most local adverse effects were preventable when topical corticosteroids were prescribed according to evidence-based clinical guidelines and accompanied by appropriate patient education and regular follow-up [1,3,6,7].

3.3.1 Skin Atrophy:

Skin atrophy was the most commonly documented adverse effect associated with prolonged topical corticosteroid therapy. Histologically, corticosteroids reduce fibroblast proliferation and inhibit the synthesis of collagen, elastin and glycosaminoglycans, resulting in thinning of both the epidermis and dermis. Clinically, affected skin becomes thin, translucent, fragile and susceptible to trauma. Patients frequently present with increased skin transparency, easy bruising, wrinkling and visible underlying vasculature. The risk of skin atrophy increases substantially with prolonged application of potent or very potent corticosteroids, particularly when used on thin-skinned anatomical regions such as the face, eyelids, axillae, groin, genital skin and flexural surfaces. Occlusive dressings, damaged skin barriers and excessive treatment duration further increase percutaneous absorption and the likelihood of atrophic changes. Most studies included in this review reported that mild atrophy may improve following discontinuation of therapy, whereas severe dermal damage may be only partially reversible [1,3,36,37].

3.3.2 Telangiectasia:

Telangiectasia is another well-recognized complication of chronic topical corticosteroid exposure. Persistent vasodilation, reduced dermal connective tissue support and thinning of the

overlying epidermis contribute to the appearance of prominent superficial blood vessels. Telangiectasia occurs most frequently on facial skin because of its relatively thin epidermis and increased vascularity.

Several observational studies reported that facial application of high-potency corticosteroids for prolonged periods markedly increased the likelihood of persistent telangiectasia. Early recognition and discontinuation of inappropriate corticosteroid therapy generally prevent progression, although cosmetic improvement may be gradual and occasionally incomplete [1,6,39].

3.3.3 Striae Distensae:

Striae distensae represent one of the most cosmetically significant adverse effects of topical corticosteroid misuse. Corticosteroid-induced inhibition of collagen synthesis weakens dermal connective tissue, leading to linear atrophic bands that commonly develop over flexural areas, thighs, groin, buttocks, abdomen, breasts and axillae. Evidence synthesized in this review demonstrated that striae are predominantly associated with prolonged use of potent or ultra-potent corticosteroids, especially under occlusion or on areas subjected to repeated stretching. Unlike mild skin atrophy, corticosteroid-induced striae frequently persist despite discontinuation of treatment, emphasizing the importance of prevention through appropriate prescribing practices [36,37,66].

3.3.4 Steroid-Induced Rosacea and Perioral Dermatitis:

Several studies identified prolonged facial application of topical corticosteroids as an important cause of steroid-induced rosacea and perioral dermatitis. Patients typically develop persistent facial erythema, burning sensation, papules, pustules, telangiectasia and rebound inflammation following withdrawal of corticosteroid therapy. These conditions frequently occur after self-medication with potent corticosteroids used for acne, facial pigmentation disorders, or cosmetic purposes. Management generally consists of gradual withdrawal of corticosteroids, avoidance of irritants, supportive skin care and appropriate anti-inflammatory therapy under dermatological supervision [38,39].

3.3.5 Acneiform Eruptions:

Acneiform eruptions constitute another recognized adverse effect of topical corticosteroid therapy. Corticosteroids promote follicular occlusion and alter local immune responses, resulting in monomorphic papules and pustules that differ clinically from acne vulgaris. Most reports described acneiform eruptions following repeated application of potent corticosteroids to the face, chest, or back. Lesions generally improve after withdrawal of corticosteroid therapy combined with standard acne management [39].

3.3.6 Pigmentary Changes:

Both hypopigmentation and hyperpigmentation have been reported following topical corticosteroid use. Hypopigmentation results primarily from suppression of melanocyte activity rather than melanocyte destruction and therefore often improves after treatment cessation. Pigmentary alterations were reported more frequently among individuals with darker skin phototypes, where even minor pigmentary disturbances may have considerable cosmetic and psychological impact. Appropriate potency selection and avoidance of unnecessary prolonged treatment reduce the incidence of these complications [39].

3.3.7 Hypertrichosis:

Localized hypertrichosis has occasionally been observed during prolonged topical corticosteroid therapy. Although the precise mechanism remains uncertain, corticosteroids may prolong the anagen phase of the hair cycle, resulting in excessive localized hair growth at treated sites. Hypertrichosis is generally reversible after discontinuation of therapy and rarely requires additional intervention [39].

3.3.8 Delayed Wound Healing:

Experimental and clinical studies consistently demonstrated that corticosteroids suppress fibroblast proliferation, collagen synthesis, angiogenesis and inflammatory cell recruitment, all of which are essential for normal wound repair. Consequently, prolonged application over ulcerated or injured skin may delay epithelialization and impair wound healing. Clinicians should therefore avoid unnecessary prolonged corticosteroid use over chronic wounds unless specifically indicated and carefully balance anti-inflammatory benefits against delayed tissue repair [6,39].

3.3.9 Secondary Cutaneous Infections:

By suppressing local immune responses, topical corticosteroids increase susceptibility to bacterial, fungal and viral infections. One of the most important clinical consequences identified in this review was steroid-modified dermatophytosis (tinea incognito) resulting from inappropriate use of corticosteroid-containing fixed-dose combination preparations. Suppression of cutaneous inflammation alters the characteristic morphology of dermatophyte infections, frequently delaying diagnosis and facilitating chronic or recurrent disease. Similar masking effects have also been reported for bacterial pyoderma, viral infections and scabies. Multiple studies from India emphasized that irrational over-the-counter availability of potent corticosteroid combinations has significantly contributed to the increasing burden of chronic dermatophytosis [28–35,72–77].

Table 4. Summary of Local Adverse Effects Associated with Topical Corticosteroids

Adverse Effect	Mechanism	Major Risk Factors	Clinical Significance	Reversibility
Skin atrophy	Reduced collagen synthesis	High potency, prolonged duration, occlusion	Most common complication	Usually reversible if detected early
Telangiectasia	Dermal thinning and vascular dilation	Facial application, prolonged use	Cosmetic concern	Partial improvement
Striae distensae	Dermal collagen disruption	Potent steroids, flexures, prolonged therapy	Often permanent	Poor
Rosacea/perioral dermatitis	Rebound inflammation	Facial misuse	Frequent relapse	Good with appropriate management
Acneiform eruption	Follicular occlusion	Potent corticosteroids	Cosmetic	Good
Pigmentary changes	Altered melanocyte function	Long-term therapy	Cosmetic	Usually reversible
Hypertrichosis	Altered hair cycle	Chronic use	Mild	Reversible
Delayed wound healing	Suppressed tissue repair	Chronic application over wounds	Delayed recovery	Improves after withdrawal

Secondary infections	Local immunosuppression	Misuse, prolonged treatment	May delay diagnosis	Good with appropriate antimicrobial therapy
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3.4 Systemic Adverse Effects of Topical Corticosteroids

Although topical corticosteroids (TCS) are primarily intended to exert localized therapeutic effects, systemic absorption may occur under certain clinical circumstances. The extent of percutaneous absorption depends on multiple factors, including corticosteroid potency, formulation, duration of therapy, frequency of application, integrity of the epidermal barrier, anatomical site, body surface area treated, patient age and the use of occlusive dressings. Most evidence included in this systematic review indicated that systemic adverse effects are uncommon when topical corticosteroids are prescribed appropriately and according to evidence-based clinical guidelines. However, prolonged use of high-potency or very potent corticosteroids over extensive body surface areas significantly increases the likelihood of systemic toxicity [1,6,22,50].

3.4.1 Percutaneous Absorption and Systemic Exposure:

Topical corticosteroids penetrate the stratum corneum before reaching the viable epidermis and dermis. A proportion of the absorbed drug subsequently enters the systemic circulation through dermal capillaries. Percutaneous absorption varies considerably according to anatomical location, with the eyelids, face, genital region and flexural surfaces demonstrating substantially greater absorption than the palms and soles because of their thinner epidermis. Several studies included in this review reported that occlusive dressings, inflamed skin, impaired epidermal barrier function and prolonged continuous application markedly increase systemic exposure. Consequently, current dermatology guidelines recommend using the lowest effective potency for the shortest possible duration and avoiding prolonged treatment of large body surface areas with potent corticosteroids [1,22,50].

3.4.2 Hypothalamic–Pituitary–Adrenal (HPA) Axis Suppression:

Hypothalamic–pituitary–adrenal (HPA) axis suppression represents the most extensively investigated systemic complication of topical corticosteroid therapy. Excessive systemic absorption suppresses endogenous cortisol production through negative feedback on hypothalamic corticotropin-releasing hormone (CRH) and pituitary adrenocorticotrophic hormone (ACTH) secretion. The reviewed evidence consistently demonstrated that clinically significant HPA-axis suppression is uncommon during guideline-directed therapy but may occur following prolonged application of high-potency corticosteroids, particularly under occlusion or over extensive body surface areas. Patients with inflammatory dermatoses requiring repeated long-term treatment appear to be at relatively greater risk because impaired skin barrier function enhances corticosteroid absorption. Most reported cases involved reversible biochemical suppression rather than clinically significant adrenal insufficiency. Serum cortisol concentrations generally normalized following gradual reduction or discontinuation of corticosteroid therapy. Nevertheless, clinicians should maintain a high index of suspicion in patients receiving prolonged high-potency topical corticosteroid treatment who develop unexplained fatigue, weakness, hypotension, nausea, or dizziness [22–27].

3.4.3 Adrenal Insufficiency:

Adrenal insufficiency secondary to topical corticosteroid therapy remains a rare but potentially serious complication. Persistent suppression of endogenous cortisol production may reduce the body's physiological response to stress, increasing the risk of adrenal crisis during severe illness or major surgical procedures. Evidence synthesized in this review suggests that clinically significant adrenal insufficiency occurs predominantly in patients exposed to prolonged treatment with very potent corticosteroids applied over large body surface areas. Most reported cases improved following gradual

withdrawal of corticosteroid therapy and appropriate endocrinological management. Abrupt discontinuation of prolonged corticosteroid therapy should therefore be avoided, particularly in patients demonstrating biochemical evidence of HPA-axis suppression [22–27].

3.4.4 Cushing Syndrome and Cushingoid Features:

Systemic corticosteroid exposure resulting from excessive topical absorption may occasionally produce Cushingoid manifestations. Reported clinical features include facial rounding (moon facies), truncal obesity, dorsocervical fat accumulation, hypertension, proximal muscle weakness, purple striae, hyperglycaemia and impaired glucose tolerance. The included literature indicated that topical corticosteroid-induced Cushing syndrome is extremely uncommon in adults and almost exclusively associated with prolonged misuse of potent or ultra-potent corticosteroids under occlusive conditions or over extensive areas of diseased skin. Appropriate prescribing practices, regular follow-up and avoidance of unnecessary long-term therapy substantially reduce this risk [6,22,23].

3.4.5 Hyperglycaemia and Metabolic Disturbances:

Glucocorticoids influence carbohydrate, protein and lipid metabolism through multiple physiological mechanisms. Although systemic metabolic complications are rarely observed following appropriate topical therapy, isolated reports have described transient hyperglycaemia and impaired glucose tolerance following prolonged application of potent corticosteroids over large body surface areas. Patients with pre-existing diabetes mellitus may experience deterioration in glycaemic control during prolonged treatment with highly potent corticosteroids. Consequently, periodic clinical assessment and appropriate metabolic monitoring may be considered for patients receiving long-term therapy under high-risk conditions [6,22].

3.4.6 Hypertension:

Hypertension has occasionally been reported in association with systemic corticosteroid exposure resulting from excessive topical absorption. Proposed mechanisms include increased sodium retention, expansion of extracellular fluid volume and enhanced vascular responsiveness to circulating catecholamines. However, the available evidence reviewed in this study indicates that clinically significant hypertension attributable solely to topical corticosteroid therapy is uncommon and generally associated with prolonged misuse rather than appropriate therapeutic application [6].

3.4.7 Osteoporosis and Bone Health:

Chronic systemic glucocorticoid therapy is a well-established cause of osteoporosis; however, evidence linking topical corticosteroids to clinically important reductions in bone mineral density remains limited. The reviewed studies suggest that topical corticosteroids used according to current prescribing recommendations are unlikely to produce clinically significant skeletal complications. Nevertheless, excessive cumulative systemic absorption resulting from prolonged application of potent corticosteroids may theoretically contribute to reduced bone formation through inhibition of osteoblast activity. Additional prospective studies are required to clarify this potential association [6].

3.4.8 Factors Increasing the Risk of Systemic Toxicity:

The risk of systemic adverse effects depends primarily on the extent of corticosteroid absorption rather than simply the duration of treatment. Across the included studies, the principal factors associated with increased systemic exposure included:

- Use of potent or ultra-potent corticosteroids.
- Prolonged continuous therapy.
- Application over extensive body surface areas.

- Occlusive dressings.
- Inflamed or damaged skin.
- Facial, genital and flexural application.
- Repeated treatment courses without clinical review.
- Inappropriate self-medication.
- Irrational corticosteroid-containing fixed-dose combination preparations.

Recognition of these risk factors enables clinicians to individualize therapy and minimize systemic complications through careful potency selection, limitation of treatment duration, patient counselling and regular monitoring [1,22,50].

Table 5. Systemic Adverse Effects Associated with Topical Corticosteroids

Systemic adverse effect	Proposed mechanism	Major risk factors	Clinical outcome
HPA-axis suppression	Negative feedback inhibition of cortisol production	High-potency corticosteroids, prolonged use, occlusion	Usually reversible after treatment modification
Adrenal insufficiency	Persistent cortisol suppression	Extensive body surface area, prolonged therapy	Rare but clinically important
Cushing syndrome	Excess systemic corticosteroid exposure	Potent corticosteroids under occlusion	Very uncommon in adults
Hyperglycaemia	Increased hepatic gluconeogenesis and insulin resistance	Long-term high-potency therapy	Usually transient
Hypertension	Sodium retention and vascular effects	Excess systemic absorption	Rare
Osteoporosis	Reduced osteoblast activity	Chronic excessive systemic exposure	Limited evidence

3.5 Ocular Adverse Effects Associated with Topical Corticosteroids:

Although topical corticosteroids are intended for localized treatment of inflammatory skin diseases, prolonged application around the periocular region may result in ophthalmic complications due to transcutaneous absorption. The included studies consistently indicated that ocular adverse effects are uncommon and occur primarily following prolonged use of potent or very potent corticosteroids on the eyelids or surrounding facial skin. Current evidence suggests that appropriate short-term use of low- to moderate-potency topical corticosteroids on facial skin carries a low risk of clinically significant ocular toxicity [1,40–42].

3.5.1 Glaucoma:

Glaucoma is the most frequently discussed ocular complication associated with topical corticosteroid therapy. Elevated intraocular pressure (IOP) develops when corticosteroids reduce aqueous humor outflow through structural and functional changes within the trabecular meshwork.

Persistent elevation of intraocular pressure may damage the optic nerve, resulting in progressive visual field loss if not recognized and treated promptly. The evidence synthesized in this review demonstrated that glaucoma associated with topical corticosteroids is uncommon and is predominantly reported in patients receiving prolonged treatment with potent corticosteroids on the eyelids or periocular skin. Individuals with a family history of glaucoma or pre-existing ocular hypertension may have greater susceptibility. Routine ophthalmological evaluation should therefore be considered in patients requiring repeated or prolonged periocular corticosteroid therapy [40–42].

3.5.2 Cataract Formation:

Posterior subcapsular cataract represents another recognized but infrequent complication of excessive corticosteroid exposure. The exact pathophysiological mechanism remains incompletely understood but is believed to involve corticosteroid-induced alterations in lens epithelial cell metabolism and oxidative stress. Available systematic reviews included in this study found insufficient evidence to suggest that appropriately prescribed topical corticosteroids significantly increase cataract risk. Reported cases generally involved prolonged periocular application of potent corticosteroids or concurrent exposure to systemic corticosteroid therapy. Consequently, the overall risk appears low when topical corticosteroids are used according to clinical guidelines [40–42].

3.5.3 Elevated Intraocular Pressure:

Several observational studies have described transient elevation of intraocular pressure following prolonged application of potent topical corticosteroids around the eyes. Increased IOP is usually asymptomatic during the early stages, emphasizing the importance of periodic ophthalmic assessment in patients receiving long-term periocular treatment. Where clinically indicated, early detection through tonometry enables timely intervention and reduces the likelihood of permanent optic nerve damage [40].

3.5.4 Periocular Skin Changes:

Apart from intraocular complications, prolonged corticosteroid application to eyelid skin may produce marked local adverse effects, including epidermal thinning, telangiectasia, pigmentary changes and increased skin fragility. Because the eyelid possesses the thinnest epidermis of the body, even moderate-potency corticosteroids should be prescribed cautiously and for limited treatment durations. Most studies recommended that only low-potency corticosteroids should be used for periocular inflammatory dermatoses and only under appropriate clinical supervision [1,39].

3.6 Prevention and Clinical Management of Adverse Effects:

The prevention of corticosteroid-related adverse effects represents the cornerstone of safe topical corticosteroid therapy. Across the included studies, the most consistent recommendation was the selection of the lowest effective corticosteroid potency capable of achieving adequate disease control. Potency should be individualized according to disease severity, anatomical site, patient age and expected duration of therapy [1,50–53].

3.6.1 Appropriate Potency Selection:

Clinical practice guidelines uniformly recommend:

- Mild-potency corticosteroids for the face, eyelids, genital skin and flexural regions.
- Moderate-potency corticosteroids for the trunk and extremities.
- Potent or very potent corticosteroids only for thick plaques, palms, soles, or severe hyperkeratotic dermatoses and for limited treatment durations.

Individualized potency selection substantially reduces both local and systemic adverse effects [50–53].

3.6.2 Limiting Treatment Duration:

Continuous long-term corticosteroid therapy was identified as one of the strongest predictors of adverse effects. Most guidelines recommend:

- Limiting potent corticosteroids to approximately **2–4 weeks** of continuous therapy.
- Transitioning to lower-potency preparations during maintenance treatment.
- Employing intermittent ("weekend") therapy for chronic relapsing dermatoses.

These strategies effectively reduce cumulative corticosteroid exposure while maintaining satisfactory disease control [50–53].

3.6.3 Fingertip Unit (FTU) Method:

Several studies emphasized the importance of the fingertip unit (FTU) method to improve dosing accuracy. One FTU represents the quantity of ointment expressed from a standard tube extending from the distal skin crease to the fingertip of the adult index finger and is generally sufficient to treat approximately two adult palm-sized areas. Routine use of FTU guidance minimizes both under-treatment and excessive corticosteroid exposure [1,50].

3.6.4 Patient Education:

Patient education emerged as one of the most effective interventions for preventing corticosteroid misuse. Appropriate counselling should include:

- Correct application technique.
- Recommended treatment duration.
- Expected therapeutic response.
- Recognition of adverse effects.
- Avoidance of unsupervised prolonged use.
- Avoidance of sharing prescription medications.
- Dangers associated with irrational fixed-dose combination products.

Educational interventions have also been shown to reduce corticosteroid phobia and improve treatment adherence [54–59].

3.6.5 Regular Clinical Monitoring:

Patients requiring repeated courses of potent corticosteroids should undergo periodic review to evaluate:

- Clinical response.
- Treatment adherence.
- Local adverse effects.
- Systemic symptoms.
- Need for potency reduction.

- Requirement for alternative non-steroidal therapies.

Early identification of complications substantially improves clinical outcomes and prevents irreversible tissue damage [1,7].

Table 6. Evidence-Based Strategies for Prevention of Topical Corticosteroid Adverse Effects

Preventive strategy	Clinical benefit
Select the lowest effective potency	Reduces local and systemic toxicity
Limit treatment duration	Prevents cumulative corticosteroid exposure
Use fingertip-unit dosing	Improves dosing accuracy
Avoid prolonged facial application	Reduces atrophy and ocular complications
Avoid unnecessary occlusion	Reduces systemic absorption
Educate patients	Improves adherence and reduces misuse
Regular follow-up	Enables early recognition of adverse effects
Consider steroid-sparing therapies when appropriate	Minimizes long-term corticosteroid exposure

3.7 Topical Steroid Withdrawal Syndrome (TSW):

Topical steroid withdrawal syndrome (TSW), also referred to as red skin syndrome, topical steroid addiction, or topical corticosteroid withdrawal, has emerged as an increasingly recognized complication of prolonged topical corticosteroid therapy. The syndrome develops predominantly in patients who have used moderate- or high-potency topical corticosteroids continuously for extended periods, particularly on the face or flexural regions. Although awareness of TSW has increased considerably during the past decade, the available scientific evidence remains limited and many aspects of its epidemiology, pathophysiology, diagnosis and optimal management require further investigation.

The systematic reviews included in this review consistently indicated that TSW is characterized by a constellation of symptoms that appear following reduction or discontinuation of prolonged corticosteroid therapy. Patients commonly present with intense erythema, burning pain, severe pruritus, oedema, skin hypersensitivity, scaling, desquamation and recurrent inflammatory eruptions. In many individuals, symptoms extend beyond the original site of corticosteroid application, resulting in considerable physical discomfort and psychological distress [8,21]. The precise pathophysiological mechanism underlying TSW remains uncertain. Proposed mechanisms include persistent vasodilation following corticosteroid withdrawal, rebound inflammatory cytokine release, impaired epidermal barrier function, alterations in glucocorticoid receptor sensitivity and neurovascular dysregulation. However, the evidence supporting these mechanisms remains largely theoretical and further translational research is required to establish definitive biological pathways [8–21].

Several risk factors were consistently identified across the included studies. These include prolonged continuous use of topical corticosteroids, application of potent or very potent preparations, facial involvement, repeated treatment courses without adequate clinical supervision, frequent self-medication and abrupt discontinuation following long-term therapy. Patients with chronic inflammatory dermatoses such as atopic dermatitis appear to represent the population most frequently described in

the available literature. Diagnosis of TSW remains primarily clinical because no universally accepted diagnostic criteria currently exist. Clinicians must carefully distinguish TSW from relapse of the underlying dermatological disease, allergic contact dermatitis, bacterial infection, fungal infection, rosacea, seborrhoeic dermatitis and other inflammatory dermatoses. Comprehensive clinical assessment, medication history and careful evaluation of corticosteroid exposure are therefore essential before establishing the diagnosis [8,21].

Management of TSW remains largely supportive owing to the limited availability of high-quality interventional studies. Current evidence emphasizes individualized treatment strategies that include gradual reduction of topical corticosteroids when clinically appropriate, restoration of the skin barrier using regular emollient therapy, management of secondary infections, psychological support and close dermatological follow-up. In selected patients, topical calcineurin inhibitors, phosphodiesterase-4 inhibitors, phototherapy, or systemic immunomodulatory therapies may be considered as steroid-sparing alternatives according to disease severity and underlying diagnosis. However, robust comparative studies evaluating these approaches remain limited. Although public awareness of TSW has increased substantially through patient advocacy groups and social media platforms, the systematic reviews consistently concluded that the available scientific evidence remains insufficient to accurately determine the true prevalence of the syndrome. Consequently, future prospective cohort studies employing standardized diagnostic criteria are required to clarify disease burden, identify predictors of susceptibility and evaluate effective therapeutic interventions [8–21].

3.8 Allergic Contact Dermatitis:

Allergic contact dermatitis (ACD) resulting from topical corticosteroids represents an uncommon but clinically important adverse effect that may complicate the management of inflammatory skin diseases. Unlike irritant dermatitis, corticosteroid allergy is an immunologically mediated delayed hypersensitivity reaction that may paradoxically present as persistent or worsening dermatitis despite ongoing corticosteroid therapy. Because topical corticosteroids possess potent anti-inflammatory properties, recognition of corticosteroid allergy may be delayed, resulting in prolonged symptoms and inappropriate escalation of treatment [43–49].

Patch-testing studies included in this review demonstrated that corticosteroid allergy occurs in a relatively small proportion of dermatology patients but should be considered whenever inflammatory skin disease fails to respond to appropriately prescribed corticosteroid therapy. Patients with chronic eczema, venous leg ulcers, occupational dermatitis, or repeated corticosteroid exposure appear to be at greater risk of developing sensitization [43–49]. Several corticosteroid molecules have been identified as important contact allergens. Tixocortol pivalate and budesonide are the screening allergens most frequently recommended in patch-testing panels because they detect a substantial proportion of corticosteroid allergies. Cross-reactivity among structurally related corticosteroids may further complicate clinical management, making classification according to corticosteroid molecular structure particularly valuable when selecting alternative therapeutic agents [43–49]. Clinical manifestations vary considerably and frequently resemble the patient's underlying dermatological disorder. Common features include persistent erythema, pruritus, eczematous plaques, worsening inflammation, treatment failure and recurrent dermatitis following repeated corticosteroid application. Because these manifestations are non-specific, clinicians should maintain a high index of suspicion in patients demonstrating inadequate clinical response despite apparently appropriate corticosteroid therapy [43–49].

Patch testing remains the diagnostic gold standard for confirming corticosteroid allergy. Identification of the responsible allergen permits selection of alternative corticosteroids from different structural classes or substitution with non-steroidal anti-inflammatory therapies such as topical calcineurin inhibitors where appropriate. Early diagnosis not only improves disease control but also prevents unnecessary exposure to ineffective medications and repeated treatment failure [43–49].

Management consists primarily of discontinuation of the offending corticosteroid, treatment of active dermatitis, avoidance of cross-reactive preparations, patient education regarding future corticosteroid exposure and documentation of confirmed allergy within the patient's medical records. Most studies reported favourable outcomes following appropriate allergen identification and individualized therapeutic modification [43–49].

Table 7. Summary of Topical Steroid Withdrawal Syndrome and Allergic Contact Dermatitis

Condition	Major Risk Factors	Common Clinical Features	Diagnosis	Recommended Management
Topical Steroid Withdrawal Syndrome	Prolonged use, high-potency corticosteroids, facial application, abrupt withdrawal	Burning, diffuse erythema, oedema, scaling, rebound dermatitis	Clinical assessment after exclusion of alternative diagnoses	Gradual withdrawal where appropriate, emollients, infection control, steroid-sparing therapy, regular follow-up
Allergic Contact Dermatitis	Repeated corticosteroid exposure, chronic eczema, occupational dermatitis	Persistent dermatitis, treatment failure, pruritus, erythema	Patch testing	Discontinue offending corticosteroid, avoid cross-reactive agents, alternative therapy, patient education

3.9 Pregnancy Safety of Topical Corticosteroids:

The use of topical corticosteroids during pregnancy remains an important clinical consideration because inflammatory skin diseases such as atopic dermatitis, psoriasis, contact dermatitis and eczema frequently affect women of reproductive age. The principal objective of treatment during pregnancy is to achieve adequate disease control while minimizing fetal exposure to medications. The studies included in this systematic review consistently demonstrated that topical corticosteroids, when prescribed appropriately, possess a favourable maternal and fetal safety profile. Most available evidence originated from population-based cohort studies, systematic reviews and the Cochrane review evaluating pregnancy outcomes following maternal exposure to topical corticosteroids. The reviewed studies found no consistent association between maternal topical corticosteroid use and congenital malformations, spontaneous abortion, stillbirth, fetal death, preterm delivery, or low Apgar scores. Mild- and moderate-potency topical corticosteroids demonstrated reassuring safety across multiple observational investigations and remain the preferred therapeutic options for most inflammatory dermatoses requiring treatment during pregnancy [60–64].

Although overall pregnancy outcomes were favourable, several studies suggested that prolonged exposure to high cumulative doses of potent or very potent topical corticosteroids may be associated with an increased risk of low birth weight. However, this association was inconsistent across studies and the overall certainty of evidence remained moderate because of differences in study design, exposure assessment and confounding factors. Consequently, current clinical guidelines recommend restricting prolonged use of potent corticosteroids during pregnancy whenever clinically feasible and prescribing the lowest effective potency for the shortest duration necessary to control disease activity.

Appropriate patient counselling remains essential during pregnancy because poorly controlled inflammatory skin disease may itself adversely affect maternal quality of life and pregnancy outcomes. Dermatologists should therefore balance the potential risks of medication exposure against the consequences of untreated disease, emphasizing that appropriately prescribed topical corticosteroids are generally considered safer than prolonged uncontrolled inflammation requiring systemic immunosuppressive therapy [60–64].

3.10 Corticosteroid Phobia:

Corticosteroid phobia (also referred to as topical corticosteroid concern or steroid fear) has emerged as an important barrier to successful dermatological treatment. It describes excessive fear or anxiety regarding the adverse effects of topical corticosteroids that results in poor adherence, intentional under-application, premature discontinuation of therapy, or complete avoidance of prescribed treatment. Multiple cross-sectional studies included in this review demonstrated that corticosteroid phobia affects both patients and caregivers and may substantially compromise treatment outcomes in chronic inflammatory skin diseases [54–59].

The principal concerns expressed by patients included fear of skin thinning, permanent skin damage, systemic toxicity, hormonal disturbances, dependency, growth suppression, infertility and topical steroid withdrawal syndrome. Misinformation obtained from social media, non-medical sources, family members and previous negative experiences frequently contributed to these concerns. Several validated assessment instruments have been developed to quantify corticosteroid-related anxiety, with the **TOPICOP© (Topical Corticosteroid Phobia Questionnaire)** being the most widely used. Studies employing this instrument consistently reported moderate-to-high levels of corticosteroid concern among patients with atopic dermatitis and their caregivers. Increased corticosteroid phobia was associated with reduced adherence, delayed clinical improvement, increased disease relapse and poorer health-related quality of life [54–59].

The included studies demonstrated that corticosteroid phobia may lead patients to:

- Apply smaller quantities than prescribed.
- Reduce treatment frequency.
- Stop treatment prematurely after partial improvement.
- Substitute evidence-based therapy with ineffective alternative remedies.
- Refuse corticosteroid treatment despite clear clinical indications.

Such behaviours contribute to persistent inflammation, recurrent disease flares, increased healthcare utilization and unnecessary escalation to systemic therapies. Educational interventions consistently emerged as the most effective strategy for reducing corticosteroid phobia. Successful approaches included individualized patient counselling, written educational materials, demonstration of fingertip-unit dosing, discussion of expected adverse effects, reassurance regarding evidence-based safety and shared decision-making between clinicians and patients. Studies reported that improved patient understanding significantly enhanced treatment adherence and overall clinical outcomes [54–59].

3.11 Overall Clinical Interpretation of the Evidence:

The findings synthesized in this systematic review demonstrate that topical corticosteroids remain among the safest and most effective anti-inflammatory medications available for dermatological practice when prescribed appropriately. Across randomized controlled trials, cohort studies, systematic reviews, observational investigations and evidence-based clinical guidelines, the overwhelming majority of adverse effects were associated not with appropriate therapeutic use but with prolonged

application of potent corticosteroids, irrational prescribing, unsupervised self-medication, inappropriate facial use, occlusive therapy and excessive cumulative exposure [1–7].

Local cutaneous adverse effects—including skin atrophy, telangiectasia, striae distensae, pigmentary alterations, steroid-induced rosacea, acneiform eruptions and secondary infections—represented the most frequently reported complications. Systemic adverse effects such as HPA-axis suppression, adrenal insufficiency, metabolic disturbances and Cushingoid manifestations occurred considerably less frequently and were primarily associated with prolonged high-potency corticosteroid exposure over extensive body surface areas [22–27].

The review further demonstrated that topical steroid withdrawal syndrome and corticosteroid allergy remain clinically important but comparatively uncommon complications requiring careful clinical evaluation. Similarly, pregnancy safety data provided reassuring evidence supporting the use of low- and moderate-potency topical corticosteroids when clinically indicated, whereas corticosteroid phobia emerged as a significant behavioural barrier affecting treatment adherence despite the favourable overall safety profile demonstrated across the available literature [21,43–64].

Importantly, nearly all included clinical practice guidelines emphasized similar principles for minimizing treatment-related harm:

- Appropriate potency selection.
- Individualized treatment duration.
- Fingertip-unit dosing.
- Regular clinical review.
- Avoidance of prolonged facial application.
- Judicious use of potent corticosteroids.
- Early recognition of adverse effects.
- Comprehensive patient education.

Collectively, these measures substantially improve the benefit-risk balance of topical corticosteroid therapy and reduce the incidence of preventable adverse outcomes [1,7,50–53].

Table 8. Summary of Evidence Across Major Clinical Outcomes

Clinical Outcome	Overall Evidence	Clinical Interpretation
Pregnancy safety	Strong observational evidence	Mild- and moderate-potency corticosteroids are generally safe when appropriately prescribed.
Corticosteroid phobia	Multiple cross-sectional studies	Major contributor to poor adherence and disease relapse.
Local adverse effects	Strong evidence	Most common complications; largely preventable.
Systemic adverse effects	Moderate evidence	Rare during guideline-directed therapy.
Topical steroid withdrawal	Limited-to-moderate evidence	Diagnostic uncertainty remains; further prospective studies required.

Allergic contact dermatitis	Moderate evidence	Important differential diagnosis in treatment-resistant dermatitis.
Ocular complications	Moderate evidence	Uncommon; associated mainly with prolonged periocular use of potent corticosteroids.
Prevention strategies	Strong guideline support	Rational prescribing and patient education substantially reduce adverse effects.

4.6 Overall Quality of Evidence:

The overall certainty of evidence synthesized in this systematic review was considered moderate to high for the safety of topical corticosteroids when used according to evidence-based clinical guidelines. Strong evidence supported the occurrence of common local adverse effects such as skin atrophy, telangiectasia and striae, whereas evidence regarding rare complications—including topical steroid withdrawal syndrome, allergic contact dermatitis, adrenal suppression and ocular toxicity—was derived predominantly from observational studies, case series and case reports. The findings consistently indicated that the therapeutic benefits of topical corticosteroids substantially outweigh their potential risks when treatment is individualized, evidence-based prescribing principles are followed and patients receive appropriate counselling and clinical monitoring. Remaining uncertainties primarily relate to uncommon adverse events and long-term outcomes, emphasizing the need for well-designed prospective multicentre studies with standardized diagnostic criteria and longer follow-up periods.

5. Discussion

5.1 Principal Findings:

This systematic review comprehensively evaluated the published evidence regarding the adverse effects associated with topical corticosteroid (TCS) therapy and the current strategies available for their prevention and clinical management in adults aged 18–60 years. Overall, the findings indicate that topical corticosteroids remain among the most effective and safest anti-inflammatory agents in dermatology when prescribed according to evidence-based clinical guidelines. The therapeutic benefits consistently outweighed the potential risks across randomized controlled trials, observational studies, systematic reviews and international clinical practice guidelines included in this review [1–7].

The review demonstrated that **local cutaneous adverse effects** were considerably more common than systemic complications. Skin atrophy, telangiectasia, striae distensae, steroid-induced rosacea, perioral dermatitis, acneiform eruptions, pigmentary alterations, delayed wound healing and secondary infections represented the most frequently reported adverse events. These complications were consistently associated with prolonged use of potent corticosteroids, inappropriate facial application, excessive treatment duration, occlusive therapy and unsupervised self-medication rather than appropriate guideline-directed treatment [1,3,6,36,37].

Systemic adverse effects—including hypothalamic–pituitary–adrenal (HPA) axis suppression, adrenal insufficiency, Cushingoid manifestations, metabolic disturbances and hypertension—were reported much less frequently. Across the included studies, clinically significant systemic toxicity occurred predominantly in patients receiving prolonged treatment with potent or very potent corticosteroids over extensive body surface areas or under occlusive conditions. Importantly, most reported cases demonstrated reversible biochemical abnormalities following dose reduction or discontinuation of therapy, reinforcing the favourable safety profile of topical corticosteroids when appropriately prescribed [22–27].

Another important finding of this review was the increasing recognition of **topical steroid withdrawal syndrome (TSW)**. Although patient awareness has increased substantially over recent years, particularly through online support communities, the available scientific evidence remains comparatively limited. The included systematic reviews consistently emphasized the absence of standardized diagnostic criteria and the need for prospective multicentre studies to better define the epidemiology, pathophysiology and optimal management of this condition [8–21].

The review also highlighted the growing clinical importance of topical corticosteroid misuse, particularly in regions where potent corticosteroid-containing fixed-dose combination (FDC) products are readily available without adequate medical supervision. Multiple studies reported increasing rates of steroid-modified dermatophytosis (tinea incognito), delayed diagnosis of fungal infections, recurrent disease and inappropriate long-term corticosteroid exposure resulting from irrational prescribing practices and over-the-counter availability [28–35].

Another noteworthy finding was the high prevalence of **corticosteroid phobia**, which emerged as an important determinant of poor treatment adherence. Fear of adverse effects frequently resulted in intentional underuse, premature discontinuation of therapy and disease relapse despite the strong evidence supporting the safety of guideline-directed corticosteroid treatment. Educational interventions, shared decision-making and individualized patient counselling consistently improved adherence and therapeutic outcomes across the included studies [54–59]. Pregnancy safety data synthesized in this review were generally reassuring. Most cohort studies and systematic reviews reported no significant increase in congenital anomalies, spontaneous abortion, fetal death, or preterm birth associated with maternal topical corticosteroid use. However, prolonged exposure to high cumulative doses of potent corticosteroids may warrant additional clinical caution, supporting current recommendations favouring mild- to moderate-potency preparations whenever possible during pregnancy [60–64].

5.2 Comparison with Previous Literature:

The findings of the present systematic review are consistent with previous systematic reviews evaluating topical corticosteroid safety. Harvey et al. reported that long-term topical corticosteroid therapy demonstrated an acceptable safety profile in patients with atopic dermatitis when prescribed according to current clinical recommendations [3]. Similarly, the umbrella review by Axon et al. concluded that evidence supporting serious corticosteroid-related adverse effects during appropriate clinical use remains limited, although higher-quality long-term studies continue to be needed [7]. The present review extends these earlier publications by integrating evidence across multiple clinical domains rather than focusing exclusively on a single disease or adverse effect. In addition to local and systemic complications, this review synthesizes evidence regarding topical steroid withdrawal syndrome, corticosteroid allergy, pregnancy safety, ocular toxicity, corticosteroid phobia and misuse associated with fixed-dose combination preparations. This broader perspective provides clinicians with a more comprehensive understanding of topical corticosteroid safety across routine dermatological practice.

The findings also align with international clinical practice guidelines issued by the American Academy of Dermatology (AAD), the National Psoriasis Foundation (NPF), the Joint Task Force on Practice Parameters and the American Academy of Family Physicians (AAFP), all of which emphasize individualized potency selection, limitation of treatment duration, fingertip-unit dosing and regular clinical review to minimize adverse effects while maintaining therapeutic efficacy [1,50–53].

5.3 Clinical Implications

The results of this systematic review have several important implications for dermatologists, primary care physicians, pharmacists, nurses and other healthcare professionals involved in the management of inflammatory skin diseases.

- First, topical corticosteroids should continue to be regarded as first-line therapy for many inflammatory dermatoses because the available evidence consistently demonstrates a favourable benefit-risk profile when treatment is individualized and evidence-based prescribing principles are followed.
- Second, clinicians should carefully consider corticosteroid potency, anatomical site, treatment duration and cumulative exposure before initiating therapy. Particular caution is warranted when prescribing potent corticosteroids for the face, eyelids, genital skin, or flexural areas because these regions demonstrate increased percutaneous absorption and greater susceptibility to adverse effects.
- Third, patient education should become an integral component of corticosteroid prescribing. Counselling regarding fingertip-unit dosing, appropriate duration of therapy, expected treatment response, recognition of adverse effects and the importance of adherence may substantially reduce both corticosteroid misuse and corticosteroid phobia.
- Fourth, pharmacists have an important role in preventing irrational corticosteroid use by reinforcing prescribing instructions, discouraging self-medication, identifying inappropriate fixed-dose combination products and promoting early referral when treatment failure or adverse effects are suspected.
- Finally, healthcare systems should strengthen regulatory measures governing over-the-counter availability of potent topical corticosteroids and irrational corticosteroid-containing combination products to reduce preventable adverse outcomes, particularly in countries where corticosteroid misuse has become a significant public health concern [28–35].

CONCLUSION:

Topical corticosteroids remain indispensable therapeutic agents in dermatology, offering substantial clinical benefits when used appropriately and according to evidence-based guidelines. This systematic review demonstrates that most adverse effects are preventable and are primarily associated with prolonged use of potent corticosteroids, inappropriate application sites, excessive cumulative exposure and unsupervised self-medication. Local cutaneous complications represent the most frequently reported adverse events, whereas systemic, ocular and endocrine complications are uncommon but clinically important. Emerging concerns such as topical steroid withdrawal syndrome, corticosteroid phobia, allergic contact dermatitis and misuse of fixed-dose combinations highlight the need for improved awareness and monitoring.

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