

Corticosteroid Usage Trend And Their Focus Effects In Patients of Dermatology Using Machine Learning

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Abstract

Corticosteroids are hormone surrogates formed within the cortex of adrenal glands. They serve an important part in the treatment of numerous pathological states. Many of the clinical roles of steroids are associated with their potent anti-inflammatory and immune-modulating properties. The study conducted for a period of 6 months and encompasses 151 subjects using corticosteroids for their respective disease states. Standardized scales were used to assess the preponderance of adverse effects. The study aims to evaluate corticosteroid use pattern and proportion of adverse effects occurring using a machine learning algorithm. The results were found effectively after analyzing the patterns of patients.

Keywords: Corticosteroids, Anti-inflammatory, Immune-modulating, Disease states, Adverse effects, Machine Learning.

Results: The causality assessment using Naranjo scale score disclosed the preponderance of acne, tinea corporis, weight gain, facial-erythema, myopathy and facial puffiness were more significant. The severity assessment of ADRs was done using Hart wig's severity assessment scale revealed the scores of acnes and tinea corporis as moderate and weight gain as mild.

Introduction

Tinea corporis is a fungal skin infection superficial in which the hand and feet of the person, the scalp, the face and beard, groin, and nail may affect all parts of the person. It is also referred to as ringworm because it exhibits traditional ring-shaped lesions. In most areas of the world, Tinea Corporis can be found but particularly in hot humid climates. It is more often seen in younger children, although all age groups including newborns may be affected. Tinea corporis spreads from contaminated skin through the removal of fungal spores. A wet, humid atmosphere and fomites like bedding, clothing and towels are facilitated for transmission. Dermatophyte infection may also be spread to other areas of the skin, including tinea pedis. It takes 1–3 weeks to break down. The dermatophyte is intruded and propagated in the cornea of the stratum yet cannot reach deeper skin layers. Initially, Tinea Corporis presents as a solo circular red patch with a high scaly leading edge. A lesion extends from the middle forming a ring shape and a scaly red rim central hypo-pigmenting (ringworm). The edge can be either papular or pustular. Itch is a natural phenomenon. With the time, several lesions that may coalesce into a polycyclic pattern may form. In general, the lesions are asymmetrically distributed [12].

Related work

Corticosteroids are synthetic congeners of human hormones normally released by the adrenal cortex, which includes glucocorticoids and mineralocorticoids [1]. These are the most effective and commonly used medicines due to their antiviral and anti-inflammatory properties in dermatologic practice [2]. However, their unsuitable and long-term use is associated with many adverse effects [3]. ADRs rank among the top 10 leading causes of mortality in both hospitalized and ambulatory patients. Thus, there is a need to identify ADRs as early as possible to reduce harm to patients [4]. Systemic (Oral or Parenteral) Corticosteroids (eg: Prednisolone, Prednisone, Methyl Prednisolone, Dexamethasone) possess anti-inflammatory, immunomodulatory and anti-neoplastic properties used to treat numerous clinical conditions like auto-immune diseases, allergic reactions [5]. Well-known adverse effects (AEs) associated with Systemic Corticosteroid use include Osteoporosis, Cardiovascular disease, impaired immune response, alterations in glucose & lipid metabolism and psychiatric disturbances [6]. Potent Topical Corticosteroids (TCs) are easily available over the counter at a low price, misuse has been noticed among the general population, producing many adverse effects [7]. The recommended, dispensed and applied volume and ability of corticosteroids should be carefully considered because too little steroids can cause a poor reaction and too much can be at risk for adverse events [8]. Therefore, the effective and reliable use of these agents is very necessary to achieve the maximum possible benefit with the least adverse effects [9].

Machine Learning

In short, three stages were involved in the machine-learning workflow: data planning, model learning and external validation. Data preparation included multiple standardisation techniques, batch correction and age, sex and other patient demographic changes in some model. In the second model study process, machine learning tasks were performed in line with various algorithms after data preparation and for the feature selection, model training and sample classification, and their application was restricted to learning data sets in this period. Feature selection included the use of 4 separate algorithms to classify the unique patient segregation steroid combinations.

Several combinations of the above-mentioned processes for optimised data analysis have been explored, and the variants of four widely used models in medicine have been evaluated according to 9 machine-learned algorithms: random forests, supportive vectors (SVMs), linear discrimination, and logistic regression.

The dataset has been obtained from the Department of Dermatology, MGMH, Warangal, India. This study was conducted among individuals visiting dermatology department of MGMH, to assess the most common adverse effects resulting from Corticosteroids misuse. This prospective observational spontaneous reporting study with both Active (Pharmacist actively seeking suspected ADRs) and Passive (Stimulating clinicians to report suspected ADRs).

A total of 151 participants with corticosteroids were approached and requested to participate in this study who met our inclusion criteria. Before starting the study, the subjects were chosen according to the inclusion and exclusion criteria: 1. Patients of all ages 2. With the usage of at least one corticosteroid. 3. history of steroid intake. Exclusion criteria include 1. Patients with concomitant usage of drugs that show similar adverse effects of corticosteroids. 2. Patients who were diagnosed with a clinical condition similar to adverse effects that occurs with the use of corticosteroids.

Data collection tools were standardized questionnaires. First, a demographic dataset was used to record the personal characteristics like height, weight, age, gender, occupation, region, duration of steroid use, social history, educational status and co-morbidities.

The ADRs were evaluated using the Naranjo algorithm. Cause evaluation. The Naranjo-algorithm is a survey invented by Naranjo et al to assess the probability of an ADR, rather than other variables, actually arising from the drug. Probability is assigned using a definite, likely, possible (or) uncertain score.

Scoring for Naranjo Algorithm:

- If the score is >9 =termed as definite ADR
- 5-8=Probable ADR
- 1-4=Possible ADR

The severity evaluation of ADRs was carried out using the severity evaluation scale of Hart Wig. ADR classified into 7 levels by Hartwig SC, Siegel J and Schneider PJ.

The severity assessment of ADRs levels:

- Level 1 and 2 falls under the mild category
- Level 3 and 4 under moderate
- Level 5, 6, 7 falls under the severe category

Experimental Setup

JMP Pro Statistical Software Version 14 was utilised for statistical analysis (SAS Institute). Significance was classified as $P < .05$ unless otherwise stated. Double-tailed statistical studies included the exact Fisher test and the Whitney-U-test. Trials included Nominal logistic modelling was applied for presence versus absence of sequence variants with criteria-based findings by sex, age and other as additional covariates for associations. Logistic regression used to produce characteristic steroid recipient curves with a profile selection dependent on both incremental regression and probability ratios in each group of individuals. In order to evaluate the efficiency of logistic regression models, the difference between areas under receiver operating feature curves and data from uncertainty matrices (AUROC) has been used.

Results

All the eligible persons participated in the study. The mean age of the people included was (39.86 ± 6.7) , the majority of patients were females (56%), and the most common age group being 35-44 years. Considering the region-wide distribution, the preponderance of subjects was rural (72%) and urban (28%). Regarding body mass index (BMI), the preponderance of subjects was pre-obese (89.7%) and the majority of patients were in between 41-50kgs weight band. Out of 151 patients, the various types of adverse effects observed include acne(19.51%), weight gain (19.51%), taenia corporis (19.51%), facial-erythema (7.31%), facial puffiness (7.31%), myopathy (7.31%), blurred vision (4.87%), profuse-sweating (4.87%), burning sensation over face(2.43%), cataract(2.43%), depression(2.43%), hyperpigmentation of face (2.43%). After being adjusted for Naranjo scale score a possible correlation for taenia corporis, the probable correlation for weight gain and a definite correlation for acne was observed. Among 151 patients, Hartwig's severity assessment scale revealed moderate severity of adverse effects (acne and taenia corporis) was observed and severity of weight gain was mild.

Causality assessment of ADRs by Naranjo scale:

Among 41 adverse drug reactions noticed, 12 ADRs (29.26%) were possible type, 18 ADRs(43.90%) were probable type, 11 ADRs (26.82%) were definite type reactions and is shown in the following figure 1.

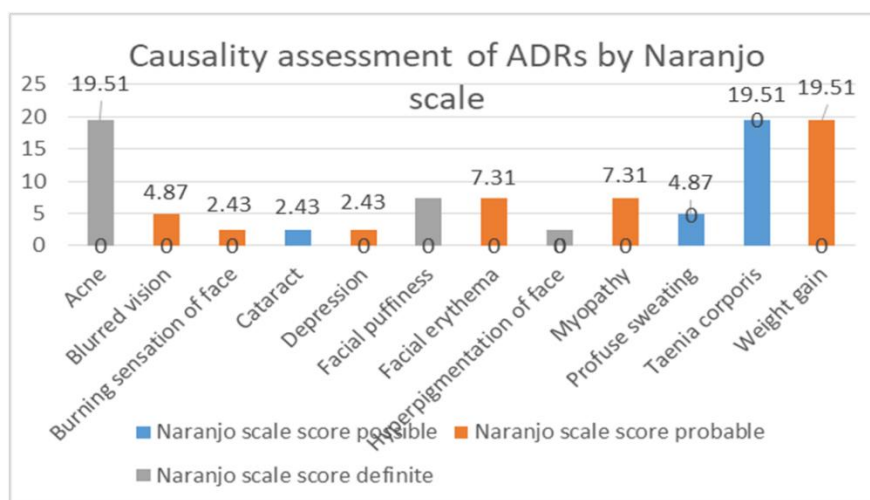


Figure1: Causality Assessment of ADRs by Naranjo Scale

Hartwig’s Severity Assessment Scale:

According to Hartwig severity assessment scale among 41 adverse drug reactions 18ADRs (43.90%) fits a mild category, 23ADRs (56.09%) fits moderate category shown in Table1.

Table1: Hartwig’s Severity Assessment Scale:

Type of ADR	Hartwig’s severity assessment scale		
	Mild (%)	Moderate (%)	Severe (%)
Acne	0	19.51	0
Blurred vision	4.807	0	0
Burning sensation of face	0	2.43	0
Cataract	0	2.43	0
Depression	0	2.43	0
Facial erythema	7.31	0	0
Facial Puffiness	0	7.31	0
Hyperpigmentation of face	0	2.43	0
Myopathy	7.31	0	0
Profuse sweating	4.87	0	0
Taenia corporis	0	19.51	0
Weight gain	19.51	0	0

A chosen 8 steroid panel was less powerful than an ARR out of the differences in AUROCs. And AUROC variations, 0.053; 95% CI, 0.006 to 0.099; P = 0.03 and is shown in the following figure2.

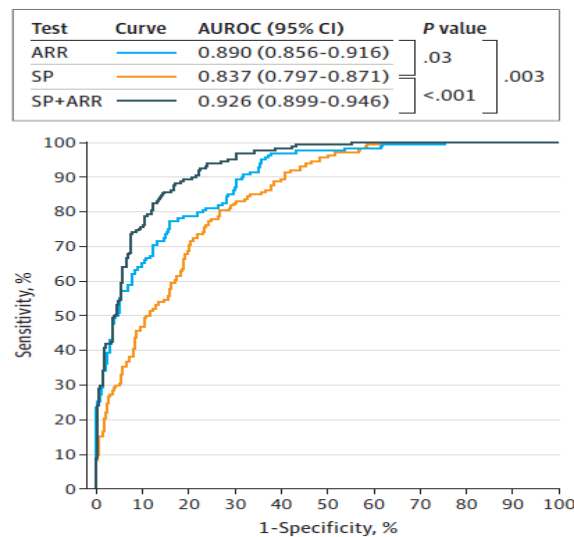


Figure2: Performance of AUROCs diagnosis

Discussion

Corticosteroids are among the most widely used drug groups for both short term and long term prescription treatment in dermatological practice. However, their unsuitable use is related to many significant adverse events. However, responsible use of corticosteroids can mitigate both systemic and skin side effects. The physician is solely responsible for recommending the dermatologist with the strongest clinical advantages and the least probable harmful effects.

The dermatology department in a tertiary care hospital included a total of 151 patients. Of these, 56% of women registered ADRs in comparison to men, 44% of whom reported similar findings to the study conducted by Shakya et al.[10]. The majority of patients in this study are aged between 35-44 years and were averagely aged about 39.85 years. Among patients using topical corticosteroids most frequently reported ADRs to include Facial Erythema, Acne, Hyperpigmentation of face, burning sensation of face found similar to the study conducted by Abhijeet et al [11].

Among 151 patients, 26% are of urban population and 72% are of the rural population using corticosteroids in our study. In this study, the majority of patients were within weight bands 41-50kgs with a mean weight of 45.5kgs.

In our study, most of the adverse effects observed were due to the usage of oral Prednisolone [Weight Gain (19.51%), Taenia corporis (19.51%)]. Accordingly, the doses were tapered. It also reveals the adverse effects associated with the use of Corticosteroids in various dermatological conditions. The various types of Adverse drug reactions (ADRs) observed include Weight Gain (19.51%), Taenia corporis (19.51%), Acne (19.51%), Facial Erythema (7.31%), Facial puffiness (7.31%) were most common ADRs found similar to the study of Abhijeet et al [11]. Causality assessment of all ADRs was done by using Naranjo's causality assessment scale, 12 ADRs (29.26%) were "Possible" type while 18 ADRs (43.90%) were "Probable" type and 11 ADRs (26.82%) were "definite" type reactions. On examining Severity assessment of ADRs by using modified Hartwig and Seigel scale, 18 ADRs (43.90%) belong to the "mild" category, 23 ADRs (56.09%) belong to "moderate" category.

Conclusion

In our view, this study was the first to show the use of Multidimensional Pattern Recognition and Machine Learning in PA Diagnosis. This approach makes a more effective and accurate diagnostic stratification of different studies with individual measures of certain cut-off values compared to the traditional series. Corticosteroid is of great clinical importance, particularly in dermatology. Despite their efficacy, the patients experience many moderate to extreme adverse effects due to their improper and lengthy use in various dermatological conditions. Precise treatment regimens and effective patient monitoring can mitigate and control the harmful effects of heavy use and abrupt removal of corticosteroids.

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