Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/23ds9403

EVALUATION OF PRESCRIPTION PATTERN AND SAFETY OF DIFFERENT CORTICOSTEROIDS IN POST-GRADUATE DEPARTMENT OF MEDICINE, GSVM MEDICAL COLLEGE, KANPUR

Dr Brijesh Pathak[1], Dr Pooja Agrawal[1], Dr Virendra Kushwaha[1*], Dr B P Priyadarshi[1], Dr Amit Kumar[2], Dr Himanshu Sharma[1]

[1*]GSVM Medical College, Kanpur
[2]Rajkiya Medical College, Jalaun

***Corresponding Author:** Dr Virendra Kushwaha
*Department of Pharmacology, GSVM Medical College, Kanpur (UP),
Email: vkushwaha1970@gmail.com

Abstract:
Introduction: Corticosteroids are essential anti-inflammatory and immunosuppressive agents used across various medical conditions. Despite their therapeutic benefits, corticosteroids pose significant risks of adverse effects, making their rational prescription crucial. This study aims to evaluate the drug utilization and safety of corticosteroids in the Department of General Medicine at GSVM Medical College, Kanpur.
Objectives: To assess drug utilization pattern and safety of drugs in patients using different corticosteroids.
Material & Methods: An observational prospective study was conducted by the Department of Pharmacology in G.S.V.M Medical College, Kanpur from February 2023 to May 2024. Data were collected from patients attending the outpatient and inpatient clinics. Inclusion criteria encompassed patients prescribed corticosteroids, while exclusions involved those with incomplete medical records, critically ill, pregnant, and non-consenting patients.
Results: The study included 165 patients, with a mean age of 39.85 ± 11.15 years. The demographic analysis revealed a male predominance (61.21%). The most prescribed corticosteroids were methylprednisolone, hydrocortisone, and dexamethasone, primarily administered intravenously (65.83%). The average number of drugs per prescription was 8.95, with corticosteroids at 1.21 per prescription.
Conclusion: The study highlights the prevalent use of corticosteroids and the importance of monitoring their prescribing patterns to ensure safety. The findings emphasize the need for continuous education and adherence to guidelines to mitigate adverse effects and promote rational use.

Keywords: Drug utilization, Drug evaluation, Prescribing pattern, Corticosteroids

INTRODUCTION:

The World Health Organization (WHO) in 1997 defined drug utilization as the marketing, distribution, prescription, and use of drugs in a society, with special emphasis on the resulting medical, social, and economic consequences. Drug utilization research is an essential part of

pharmacoepidemiology and Pharmacoeconomics as it describes the extent, nature, and determinants of drug exposure. [1, 2]

Corticosteroids (CS) are potent anti-inflammatory and immunosuppressive drugs, widely used to treat variety of diseases, [3] like replacement therapy in adrenal insufficiency and of various dermatologic, ophthalmologic, rheumatologic, pulmonary, hematologic, and gastrointestinal conditions. They are also used to treat acute exacerbations of chronic obstructive pulmonary disease (COPD) and severe, uncontrolled asthma, as well as inflammatory parenchymal lung diseases such as hypersensitivity pneumonitis and immune-mediated vasculitis. [4]

Despite their efficacy, corticosteroids are linked to a wide range of adverse effects. As a greater number of patients are prescribed corticosteroids for long-term prophylaxis so there has been growing concern about their safety.[5] Long-term systemic (oral or parenteral) use of these agents is associated with well-known adverse events (AEs), such as osteoporosis and fractures, adrenal suppression, hyperglycemia and diabetes, cardiovascular disease (CVD) and dyslipidemia, dermatological and gastrointestinal (GI) events, psychiatric disturbances, and immunosuppression. Corticosteroids can cause serious side effects that mimic Cushing's disease due to their potent effect. Systemic corticosteroids are a common cause of adverse effects that may increase the treatment's cost.[6]

The usefulness of corticosteroids is limited by their severe adverse effects, despite their high potency. Corticosteroid side effects appear related to both their average dose and cumulative duration.[7] Although adverse effects are not restricted to greater doses and long-term usage, they are more prevalent at these levels. Ninety percent of patients who take these medications for more than sixty days develop side effects.[8]

With this background, present study was planned with aim to evaluate drug utilization, and safety of different corticosteroids used in patients by Department of General Medicine, G.S.V.M Medical College, Kanpur, Uttar Pradesh.

MATERIAL AND METHODS:

An observational prospective study was conducted by the Department of Pharmacology in collaboration with the Department of Medicine, G.S.V.M Medical College, Kanpur from February 2023 to May 2024. All patients of either Sex and 18-60 years of age, who attended the outpatient and inpatient clinic of the General Medicine department, GSVM Medical College, Kanpur, and prescribed different corticosteroids drugs were included after taking written informed consent. However, patients with incomplete medical records, critically ill, pregnant and lactating females were excluded from the study.

Sample size was calculated using Cochran's Formula, $n=Z^2 PQ/d^2$ considering non-responsive rate of 10% and at 5% level of significance, minimum sample size was 150.

On considering inclusion and exclusion criteria, total 165 study subjects were selected randomly after obtaining written consent for the present study. Prescription of each study subject were collected and further studied for prescription of corticosteroids.

All basic details of patient and prescribed corticosteroids were collected and recorded using a structured data collection sheet prepared for study having following sections;

Section A includes Patients name, age, gender, education, occupation, income, etc. and filled.

Section B includes details of various prescribed corticosteroids and medical reason for which corticosteroid was prescribed. Details of drug utilization pattern indicators were filled.

Section C includes drugs utilization pattern assessed by using quality indicators of drug use, recommended by WHO. [9]

Section D, is for drug safety and includes the 10-questions to assess the Adverse drug reactions in subjects by using Naranjo Adverse Drug Reaction Probability Scale.

The data of present study has been recorded and after its proper validation checked for error, coding and data compilation, and segregation were done in MS excel. Statistical Package for the Social

Sciences (SPSS) software version 23.0 (SPSS1 Inc., Chicago, IL, USA) was used for statistical analysis.

RESULTS

The observations and results among study patients with their basic details and prescribed corticosteroids are as follows;

The study included 165 patients, most of them were in the late age group of 50 and above years (50/165,30.3%) followed by young age upto 24 years (48/165, 29.1%). There were 35 (21.2%) patients with age between 25-40 years and 32(19.4%) with age between 40-50 years. The mean age± S.D. was 39.85 ± 11.15. The demographic analysis revealed a male predominance (61.21%). [Table 1, Figure 1]

Table 1: Distribution of Age and Gender of study patients

Variables	Age Interval (Years)	Frequency (n = 165)	Percent (%)
Age	Up to 24 Years	48	29.09
	25-40 Years	35	21.21
	41-50 Years	32	19.39
	Above 50 Years	50	30.30
Gender	Male	101	61.21
	Female	64	38.79

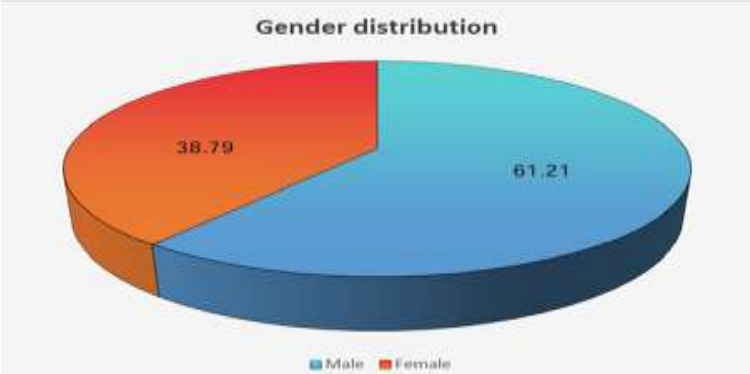

Figure 2: Distribution of Gender of study patients

On considering prescribed corticosteroids by generic classes, most commonly prescribed corticosteroids were inj. Methylprednisolone 61 (30.65%) followed by inj. Hydrocortisone 39 (19.6%) and inj. Dexamethasone 31(15.58%), primarily administered intravenously (65.83%). Other prescribed corticosteroids were oral Prednisolone 35 (17.59%) and inhalational Budesonide 33 (16.58%). [Table 2, Figure 2]

Table 2: Distribution of prescribed corticosteroids in study subjects

Types of Corticosteroids	Frequency	Percentage
Inj. Methylprednisolone	61	30.65%
Inj. Hydrocortisone	39	19.60%
Inj. Dexamethasone	31	15.58%
Tab. Prednisolone	35	17.59%
Inhalation Budesonide	33	16.58%

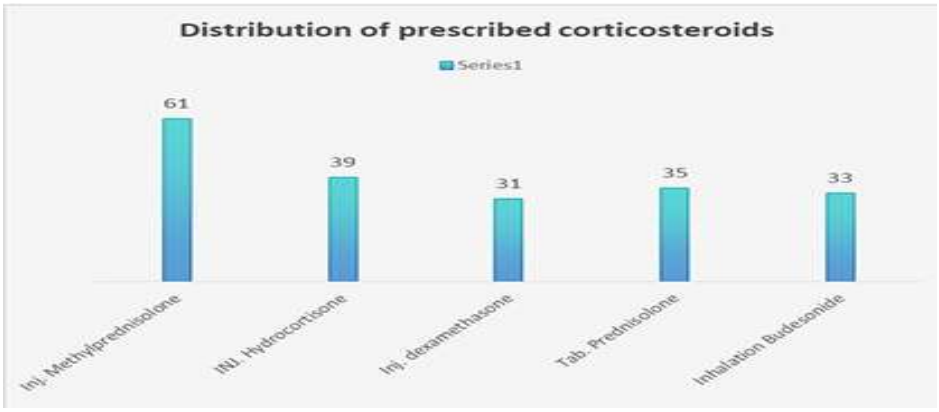

Figure 2: Distribution of prescribed corticosteroids in study subjects

On considering various routes of administration of prescribed corticosteroids drug, the most common route for administration was intravenous route in 131 (65.83%) and oral route of administration in 35 (17.59%) of prescribed corticosteroids. 33(16.58%) corticosteroids were respiratory/inhalational route. [Table 3, Figure 3]

Table 3: Distribution of prescribed corticosteroids by Route

Route	Frequency	Percentage
Intravenous	131	65.83%
Oral	35	17.59%
Inhalational	33	16.58%

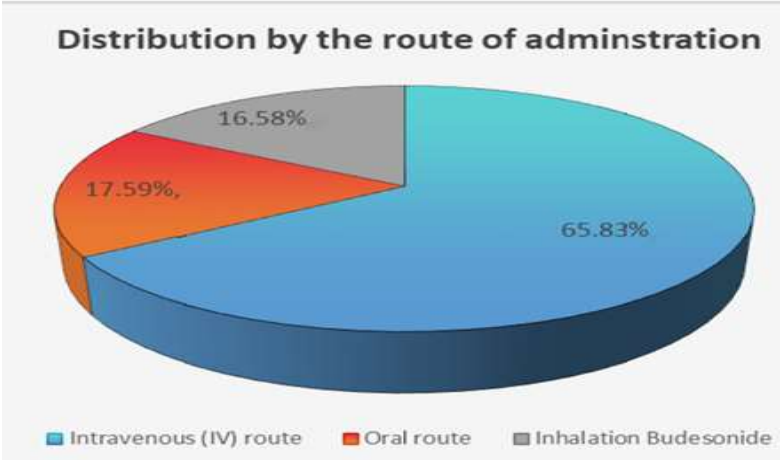

Figure 3: Distribution of prescribed corticosteroids by Route

In this study we observed the corticosteroids prescription pattern as per WHO prescribing indicators. Amongst the prescribing indicators, an average number of corticosteroids per prescription was found 1.21 and average number of corticosteroids encounters with an injection was 0.79. Generic prescription are (59.79%) and the prescription of the corticosteroids enlisted in the essential drugs list are determined as 85.10%. [Table 4]

The safety of prescribed corticosteroids among study patients was assessed by using Naranjo Adverse Drug Reaction Probability scale in this study. Among 165 study patients, ADRs due to prescribed corticosteroids was seen in 34 (22.6%) cases. ADRs were detected in the study due to prescribed corticosteroids were nausea/vomiting in 4 (11.76%), Headache in 9 (26.5%), Hyperglycemia in 10 (29.4%), and gastric upset in 11(32.3%) patients during follow up in this study. Most common ADR was seen as gastric upset 11(32.3%). For causality assessment of ADRs according to Naranjo scale,

out of these 34 reported ADRs, 14 (41%) ADRs were probable and 20 (59%) were possible according to Naranjo causality assessment scale as shown in table 5 and figure 5.

Table 4: Prescription pattern as per WHO Prescribing Indicators

WHO INDICATORS	FREQUENCY	INFERENCE (per prescription encounter)
Average number of drugs prescribed per prescription	1476	8.95
Average number corticosteroids encounters of prescribed	199	1.21
Average number of encounters as injectable corticosteroids	131	0.79
Average number of oral corticosteroids per encounter	35	0.21
Percentage of corticosteroids prescribed by generic name	119	59.79%
Percentage of corticosteroids prescribed from the essential drugs list	170	85.10%

Table 5: Causality assessment of ADRs by Naranjo scale

Scale	No. of ADRs	Percent (%)
Probable	14	41%
Possible	20	59%

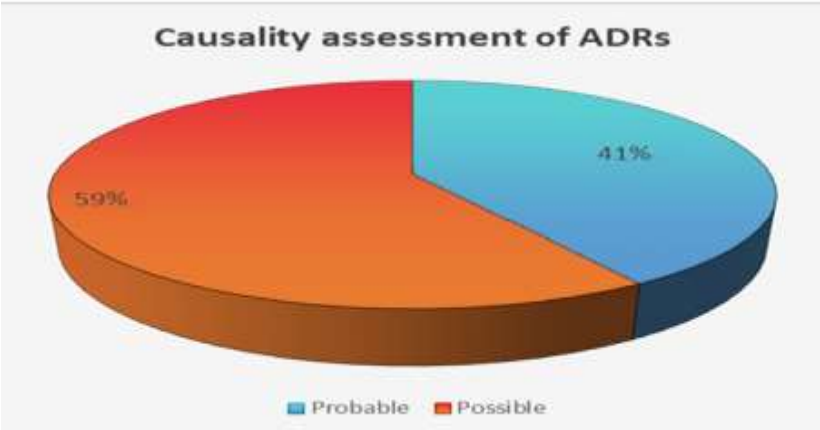

Table 5: Causality assessment of ADRs by Naranjo scale

DISCUSSION

This study has included 165 patients who attended the outpatient and inpatient clinic of the General Medicine department, GSVM Medical College, Kanpur, and prescribed different corticosteroids drugs. In our study, most of the study patients were in late age group of 50 and above years (30.3%) and Similarly, In study by Curtis R Jeffery et al. [10] the study population with older age mean age of 53±14 year and 56.5 (54.4-58.7) years. There were males' predominance over female (61.21% Vs 38.79%) in our study. Nerukar et al. [11] and Saravanakumar et al. [12] showed a higher male preponderance. Reason for this finding may be either due to variation in demographic situation and common diseases in local area or study sample increases the chance of male patients to be recruited more.

In present study, the average number of drugs per prescription was found 8.95 and average number of corticosteroids was found 1.21. These findings were higher than the WHO recommendations (optimal value 1.6-1.8) and suggested a trend towards polypharmacy. [13] It is preferable to keep the number of drugs per prescription as low as possible to avoid an increased risk of adverse effects and drug interactions, thereby minimizing the cost of drug therapy. Our study findings were similar to studies conducted by Bhuvana et al. [14] and Padma et al. [15] In contrast, Purushotham et al. [16] in his study stated that the average number of drugs per prescription was 2.09. while In Gambre R et al. [17] study a prescription of GC per prescription was 1.11.
In our study It was found that most of physician prescribed corticosteroids by their generic name and out of total 199 prescribed corticosteroids, (59.79%) were prescribed as generic name which is low.
In contrast to our study, Kumar et al. [18] and Ankit P et al. [19] where 100% brand names usage was reported. All the drugs were prescribed by brand name and none of the drugs were prescribed by generic name. In our study most commonly, prescribed corticosteroids were injectables and these were inj. Methylprednisolone (30.65%) followed by inj. Hydrocortisone (19.6%) and inj. Dexamethasone (15.58%).

Oral Prednisolone (17.50%) and inhalational Budesonide (16.58%) were other prescribed corticosteroids. However, according to Biswas NR et al. [20] rational uses of drugs can help to reduce the incidence of adverse effects. In Adhikari K et al.[21] study, the usage of Dexamethasone and Fluocinolone was higher than other prescribing corticosteroids. In Shende M et al. [22] study in the general medicine ward, dexamethasone was given to 63.8% of patients, followed by hydrocortisone (32.8% of patients) and prednisolone (3.4% of patients). In dermatology department, out of 51 drugs, betamethasone was given to 1.9% of patients. Dexamethasone was prescribed most frequently, while hydrocortisone was used as a short acting and prednisolone as an intermediately acting corticosteroid.

In present study ADRs due to prescribed corticosteroids was seen in (22.6%) cases. Most common ADR was seen as gastric upset (32.3%) and other ADRs Nausea/vomiting (11.76%), Headache (26.5%), Hyperglycemia (29.4%), and gastric upset (32.3%) patients during follow up in this study. In Makbul Hussain Chowdhury et al. [23] study suggest that, 34 ADRs were found in this study due to corticosteroids use. Facial Puffiness (11.76%), headache (14.70%), Hypernatremia (14.70%), Hyperglycemia (17.64%), hypertension (26.47%) and osteoporosis (14.70%). By using Naranjo causality assessment scale 14 ADRs were probable and 20 ADRs were possible. Similarly, our study was consistent with the study of Treadwell. B. et al. [24] and Kumar S et al. [25] who found that corticosteroid causes hypertension, facial mooning, osteoporosis in the subjects who were on corticosteroid therapy.

According to findings of Unissa SM et al. [26] ten ADRs were found in this study due to corticosteroids use. Facial mooning was detected in 2, headache in 3, hyperglycemia in 1, hypertension in 3 (25%) and osteoporosis in 1 (12.50%). The study of Treadwell.B, et al [24] who found that corticosteroid causes hypertension, facial mooning, osteoporosis in the subjects who were on corticosteroid therapy, Also Clore J, et al. [27] in his study found that Glucocorticoid-induced hyperglycemia is common in patients with and without diabetes. Several studies have reported that transient increases in serum glucose are associated with acute inflammatory processes and endothelial dysfunction in both diabetic and non-diabetic patients. [28]

The key strength of this study is its novel approach taken by the Pharmacology department to study drug utilization, prescribing pattern, and safety of different corticosteroids in Post- Graduate Department of Medicine of our institute. Although our study has limitations as this was a single hospital based observational study. The findings cannot be generalized as this was not a population-based study. The sample size and the target population selected for the study was limited. We suggest

further studies on a broader based and a more representative sample size using sophisticated methodology in order to generalize the results.

RECOMMENDATIONS

The results and conclusions of this study suggests the following recommendations:

- Based on the study findings, corticosteroids were prescribed carefully considering age and social aspect of patients.
- Most commonly steroids are given by systemic route so the safe injection practices and proper bio-waste disposal management should be followed at institutional level.
- In study findings, Prednisolone was found cost effective and cheaper prescribed drug in comparison of other prescribed corticosteroids but the side effects due to over prescription and adverse effects due to prolonged use would be taken under consideration and make evidence-based recommendations for improving corticosteroid prescribing practices.
- Our findings indicate Polypharmacy so it is recommended that always keep the number of drugs per prescription as low as possible to avoid an increased risk of adverse effects and drug interactions, thereby minimizing the cost of drug therapy.
- As the generic prescription was low in our study it is recommended that develop educational programs for healthcare providers on rational prescription and the appropriate use of corticosteroids by treating physician.
- For continuously monitoring corticosteroid prescribing patterns and adverse effects there is need to develop and implement monitoring systems or tools at institutional level.
- This study will use as baseline for comparing the prescribed corticosteroids in tertiary care hospitals and to plan longitudinal studies to assess long-term safety and effectiveness of corticosteroid use. Explore intervention studies to test strategies for improving prescribing practices and patient outcomes.

Although ADRs seen in our study was not serious and most common reported ADRs are gastric upset, Hyperglycaemia, Headache, nausea/vomiting. It is recommended that use of corticosteroids with PPIs and all patients who are started on steroid treatment should have
a baseline glucose, as well as education on daily self-monitoring of glucose.

CONCLUSIONS:

- Based on the study findings, corticosteroids were prescribed carefully considering age and social aspect of patients.
- Most commonly steroids are given by systemic route so the safe injection practices and proper bio-waste disposal management should be followed at institutional level.
- In study findings, Prednisolone was found cost effective and cheaper prescribed drug in comparison of other prescribed corticosteroids but the side effects due to over prescription and adverse effects due to prolonged use would be taken under consideration and make evidence-based recommendations for improving corticosteroid prescribing practices.
- Our findings indicate Polypharmacy so it is recommended that always keep the number of drugs per prescription as low as possible to avoid an increased risk of adverse effects and drug interactions, thereby minimizing the cost of drug therapy.
- As the generic prescription was low in our study it is recommended that develop educational programs for healthcare providers on rational prescription and the appropriate use of corticosteroids by treating physician.
- For continuously monitoring corticosteroid prescribing patterns and adverse effects there is need to develop and implement monitoring systems or tools at institutional level.
- This study will use as baseline for comparing the prescribed corticosteroids in tertiary care hospitals and to plan longitudinal studies to assess long-term safety and effectiveness of corticosteroid use.

- Explore intervention studies to test strategies for improving prescribing practices and patient outcomes. Although ADRs seen in our study was not serious and most common reported ADRs are gastric upset, Hyperglycaemia, Headache, nausea/vomiting.
- It is recommended that use of corticosteroids with PPIs and all patients who are started on steroid treatment should have a baseline glucose, as well as education on daily self-monitoring of glucose.

Limitations:

Here are the limitations of the study from the provided thesis document, summarized in simple and pointwise manner:

1. Single-hospital-based study: The study was conducted at one hospital, limiting the generalizability of the findings to other hospitals or regions.

2. Limited sample size: With only 165 patients, the sample size is small, potentially limiting the reliability of conclusions across broader populations.

3. Lack of population-based data: The study is not population-based, meaning it does not represent the wider community or patient demographics outside the hospital setting.

4. Short study period: The study was conducted over a limited timeframe, possibly missing long-term patterns in corticosteroid use and adverse reactions.

5. Potential polypharmacy issue: With an average of 8.95 drugs per prescription, polypharmacy may have influenced the results, but the interactions between corticosteroids and other drugs were not fully explored.

Financial support and Sponsorship

Nil

Conflicts of Interest

There are no conflicts of interest

REFERENCES:

1. WHO publication. What is drug utilization research and why is it needed? Introduction to drug utilization research 2003; 8.
2. Chandra S, Bhosle D, Ubale A. Prescription pattern at outpatient department in a tertiary care hospital at central Maharashtra, India. Int J Comprehensive Adv Pharmacol 2019;4(2):56-8.
3. Liu X, Zhu X, Miao Q, Ye H, Zhang Z, Li Y. Hyperglycemia Induced by Glucocorticoids in Nondiabetic Patients: A meta-analysis. Annals of Nutrition and Metabolism. 2014; 65 (4):324-32
4. Manson S, Brown R, Cerulli A, Vidaurre C. The cumulative burden of oral corticosteroid side effects and the economic implications of steroid use. Respiratory Medicine. 2009; 103 (7):975-94.
5. Kirby B. A review of the rational use of corticosteroids. Journal of international medical research. 1989; 17(6):493-505.
6. Sarnes E, Crofford L, Watson M, Dennis G, Kan H, Bass D. Incidence and US costs of corticosteroid-associated adverse events: a systematic literature review. Clinical therapeutics. 2011; 33(10):1413-32.
7. AE, Chapman KE. The anti-inflammatory and immunosuppressive effects of glucocorticoids, recent developments and mechanistic insights. Mol Cell Endocrinol. 2011 Mar 15; 335(1):2-13.
8. Oray M., Abu Samra K., Ebrahimiadib N., Meese H., Foster C.S. Long term effects Saf. 2016;15:457–465
9. **D**rugs utilization pattern- Quality indicators of drug use, recommended by WHO. (assessed on 22Sep2023)

10. Curtis, J.R., Westfall, A.O., Allison, J., Bijlsma, J.W., Freeman, A., George, V. (2006). Population-based assessment of adverse events associated with long-term glucocorticoid use. Arthritis Care & Research, 55 (3):420-6.
11. Nerukar G, Mohanta GP, Manna PK, Moorthi C, et al. Study of prescribing pattern of topical corticosteroids in multispeciality tertiary care teaching hospital in India. Int J Res Pharm Sci. 2012;3:685-7.
12. Saravankumar RT, Prasad GS, Ragul G, Mohanta GP, Manna PK, Moorthi C, et al. Study of prescribing pattern of topical corticosteroids in the department of dermatology of a multispeciality tertiary care teaching hospital in South India. Int J Res Pharm Sci. 2012;3:685-7.
13. World Health Organization. Using Indicators to Measure Country Pharmaceutical Situations. Available at: http://www.who.int/ 62 medicines/publicati ons/WHOTCM2006.2A.pdf. Accessed on 12 February 2022.
14. Bylappa BK, Patil RT, Pillai RT. Drug prescribing pattern of topical corticosteroids in dermatology unit of a tertiary-care hospital. Int J Med Sci Public Health. 2015;4:1702-7. .
15. Padma L, Komala R, Madan Mohan MNT, Manasa CR, Ramanujam R. Prescription trends of topical corticosteroids in dermatological conditions in Dr. B. R. Ambedkar Medical College. Int J Biol Med Res. 2013;4:2898-901.
16. Purushotham K, Eesha B R. Prescription Trend of Topical Corticosteroids in Outpatient of Dermatology in a Tertiary Care Hospital in Tumakuru, Karnataka. Int J Pharmacol and Clin Sci. 2016;5(3)77-72. DOI: 10.5530/ijpcs.5.3.3 [Crossref]
17. Gambre R, Khobragade A, Jalikar K, Patel S, Gaidhane S. Analysis of Prescribing Pattern of Drugs Among Patients Attending Dermatology Outpatient Department of a Tertiary Care Hospital. EJPMR. 2018;5(3)259-273. Kumar AM, Noushad PP, Shailaja K, Jayasutha J, Ramasamy C. A study on drug prescribing pattern and use of corticosteroids in dermatological conditions at a tertiary care teaching hospital. Int J Pharm Sci Rev Res. 2011;9(2):132-5.
18. Ankit P, Bharat G. Study of drug utilization pattern of glucocorticosteroid drugs with special emphasis on their immediate 63 adverse effects in a tertiary care teaching rural hospital. Indian J Pharm Pract. 2010;3(4):18-23.
19. Biswas NR, Jindal S, Siddiquei MM, Siddiquei MM, Maini R. Patterns of prescription and drug use in ophthalmology in a tertiary hospital in Delhi. Br J Clin Pharmacol. 2001;51(3)267-9. DOI: 10.1046/j.1365 2125.2001.00350.x [Crossref].
20. Adhikari K, Bezbaruah BK. Evaluation of prescription pattern of steroid in dermatology adverse effects with steroids use. Int J Current Res. 2017;9(3)48419-48422. [Crossref]
21. Mulchand Shende1, Bhupesh Ghutke1, Dhanshree Panekar; Assessment of drug utilization pattern of steroids in a district general hospital in Amravati region Research Results in Pharmacology 5(2): 57–64 UDC: 616.085 DOI 10.3897/rrpharmacology.5.32584
22. Makbul Hussain Chowdhury, K. Shravya1, Dr. M. Prasad et al; Evaluation of Corticosteroid Utilization Pattern in the Various Departments of a Tertiary Care Teaching Hospital, Khammam Saudi J Med Pharm Sci, Dec., 2019; 5(12): 1094-1101
23. Treadwell, B.L., Sever, E.D., Savage, O., Copeman, W.S.(1964). Side effects of long-term treatment with corticosteroids and corticotrophin. The Lancet, 283(7343):1121-3.
24. Kumar, S., Thakur, P.K., Shah, S.K.(2017). A prospective assessment of polypharmacy induced drug interactions with corticosteroids. Journal of Chitwan Medical College, 6(1):24-9.
25. Syeda Masarrath Unissa, Sana Kareem, Sumaiya Faheem Ahmed ET AL. A Prospective Observational Studies on Drug Utilization Evaluation and Rational Use of Corticosteroids in Tertiary Care Hospital; Journal of Drug Delivery & Therapeutics. 2020; 10(5-s):119-126 \
26. Clore JN, Thurby-Hay L. Glucocorticoid-induced hyperglycemia. Endocr Pract 2009; 15: 469-474 [PMID: 19454391 DOI: 10.4158/ ep08331.rar]
27. Coutinho AE, Chapman KE: The anti-inflammatory and immunosuppressive effects of glucocorticoids, recent developments and mechanistic insights. Mol Cell Endocrinol 2011, 335:2–13.