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Original Research Article

Evaluation of Corticosteroid Utilization Pattern in the Various Departments of a Tertiary Care Teaching Hospital, Khammam

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Abstract

Corticosteroids have proved to be extremely effective in the treatment of acute inflammation and chronic inflammatory diseases. Drug utilization review (DUR) is an on-going, systematic, criteria-based program of medicine evaluations that will help ensure appropriate medicine use. The present study aim was to evaluate the drug utilization of Corticosteroids in the various department of a tertiary care teaching hospital, Khammam. A prospective observational study was conducted to evaluate drug utilization pattern of corticosteroids. Total 249 corticosteroids were prescribed Prednisolone was prescribed in 39.5% prescription followed by hydrocortisone in 27%, budesonide in 19%, methylprednisolone in 15.5%, Dexamethasone in 9.5%, Deltazacort in 7.5%, Prednisone in 4.5% and Fluhydrocortisone in 2% respectively. 34 ADRs were detected in the study due to corticosteroid use, facial puffiness was detected in 12.50%, headache in 14.70%, Hypernatremia in 14.70%, Hyperglycemia in 17.64%, hypertension in 26.47% and osteoporosis in 14.70%. 72.6% of the drugs were prescribed from the NELM list. Clinical pharmacists interact directly with patients in several different ways. Hence, the clinical pharmacist can perform potential role in health care system in assisting physician in altering the number of medications taken, the number of doses taken, improving the patient medication adherence, detect the adverse drug reactions, drug interactions, in patient counselling, improve the health related quality of life and decreasing the health care cost of the patient.

Keywords: Corticosteroid, drug utilization, rational use, adverse drug reaction, drug interaction etc.

INTRODUCTION

First isolation of cortisol was done in 1950; corticosteroids have proved to be extremely effective in the treatment of acute inflammation and chronic inflammatory diseases. However, despite their clinical success, oral corticosteroids (OCS) are used sparingly due to a broad array of serious adverse events including bone fractures, osteoporosis, and susceptibility to infections, hyperglycemia, and obesity amongst others [1-3].

Glucocorticoids are widely used as potent anti-inflammatory and immunosuppressive drugs to treat a wide range of diseases. However, they are also associated with a number of side effects [3, 4]. Corticosteroids are generally called as “steroids”; they highly improve symptoms and provoke impressive results in different conditions [5]. Due to their powerful anti-inflammatory and immunosuppressive actions, these drugs are being prescribed widely by physicians [5, 6]. It is most frequently prescribed for patients with respiratory conditions such as asthma or chronic obstructive pulmonary disease (COPD)[7, 8].

There has been increasing concern regarding the safety of corticosteroids, as a large number of patients are prescribed these drugs for long-term prophylactic treatment [8,9]. There are different aspects of concern with regard to systemic side effects like glaucoma, changes in bone mineral density and cataracts, psychiatric effects [10-13].

The World Health Organization has defined Drug Utilization Research (DUR) as “the marketing, distribution, prescription and use of drugs in a society, with special emphasis on the resulting medical, social and economic consequences [14, 15]”. Drug utilization evaluation can be used for the description of pattern of drug use, irrational use of drug, to improve the drug quality; the basic objectives drug utilization study is to

facilitate the rational use of drugs in the community [16].

The goal of a DUE is to assist the optimal medication therapy and ensure that drug therapy meets current standards of treatment. Additional objectives may include:

- Creation of guidelines for appropriate drug utilization.
- Evaluation of the effectiveness of medication therapy.
- Enhancing responsibility in the medicine use process.
- Controlling medicine cost.
- Prevention of medication related problems, for example adverse drug reactions, treatment failures, over-use, under-use, incorrect doses and non-formulary medicine use.
- Identification of areas where further information and education may be needed by healthcare providers [17-19].

AIM AND OBJECTIVES

Aim

To evaluate the Corticosteroid Utilization Pattern in the Various Departments of A Tertiary Care Teaching Hospital, Khammam.

Objectives

1. To evaluate the most commonly used corticosteroids in various conditions.
2. To evaluate the dose and frequency of administration of corticosteroid used.
3. To evaluate the most common causes for prescribing corticosteroids.
4. To evaluate the gender distribution pattern of corticosteroids.
5. To evaluate the age distribution pattern of corticosteroids.
6. To study the drug interaction induced by corticosteroids.
7. To evaluate the adverse drug reactions induced by corticosteroids.

METHODOLOGY

Study Design

A prospective observational study was conducted to evaluate drug utilization pattern of corticosteroids. Patients prescribed with corticosteroids in various departments, were randomly collected. The drug, dose, dosage, frequency of drugs were noted from the patient's record who prescribed with corticosteroids along with patient's demographics.

Study Site

The study was carried out in various departments of Mamata General Hospital, Khammam.

STUDY CRITERIA

Inclusion criteria

- Inpatients prescribed with corticosteroids.
- Patients of both genders.
- Patients above 18 years of age.

Exclusion criteria

- Patients below 18 years of age.
- Lactating and nursing mothers.
- Pregnant women.
- Patients treated on outpatient basis.
- Patients under critical condition and requiring critical care stay.

Sources of Data

- Inpatient profile form.
- Laboratory data record.
- By conducting patient history interview.

Collection of data

The data was collected using suitably designed data collection form.

Sample size

200 patients.

STATISTICAL ANALYSIS

Statistical analysis was conducted descriptively by using SPSS 21 software.

Duration of study

The study was conducted for a period of 6 month after obtaining IEC clearance.

RESULTS

All subjects satisfy the inclusion and exclusion criteria were included as the study population. Total 200 inpatient subjects prescribed with corticosteroids were included in the study.

Gender categorization

Subjects were categorized according to gender and out of 200 subjects 94 (47%) were male and 106 (53%) were female as shown in table 5.1 and figure 5.1.

Table-1: Gender distribution of the subjects

Gender	No. of subjects	Percentage (%)
Male	94	47
Female	106	53
Total	200	100

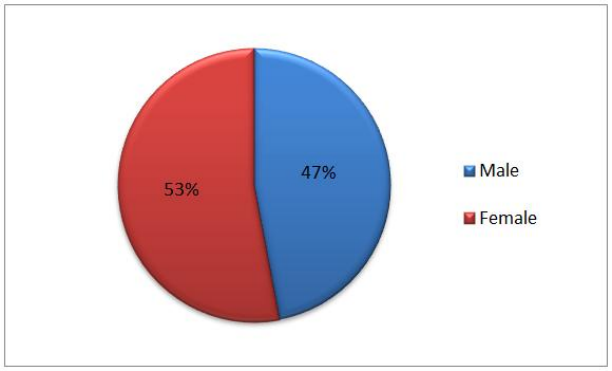

Fig-1: Representing the gender distribution of the subjects

Age group categorization

Out of 200 subjects 34(17%) subjects were in age group of 18-30 years, 42(21%) subjects were in age group of 31-40 years, 52(26%) subjects were in age group of 41-50, 43(21.5%) subjects were in age group of 51-60, 29(14.5%) subjects were in age group above 60 years shown in table 5.2 and figure 5.5, the mean age of population was 46.66±15.23 (Mean±SD) and the range of ages was between 18->60 years old as shown in table 2 A, 2 B and figure 2.

Table-2 A: Age classification in different categories

Age	No. of subjects	Percentage (%)
18-30	34	17
31-40	42	21
41-50	52	26
51-60	43	21.5
>60	29	14.5
Total	200	100

Table-2: B: Mean age of the population

Age ranges	Mean age ± Standard Deviation
18->60	46.66±15.23

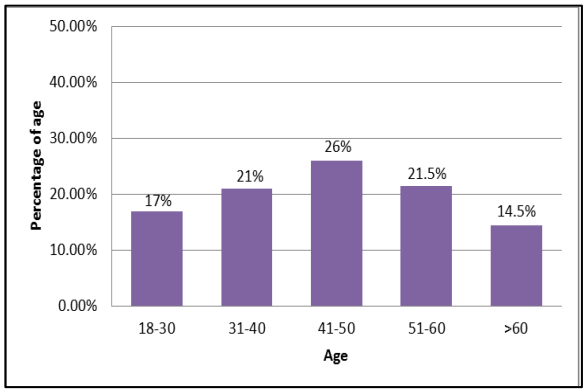

Fig-2: Representing the age group classification

Marital status of subjects

Out of 200 subjects 172 (86%) were married and 28 (14%) were unmarried as shown in table 3 and figure 3.

Table-3: Marital status of subjects

Marital status	No. of subjects	Percentage (%)
Married	172	86
Unmarried	28	14
Total	200	100

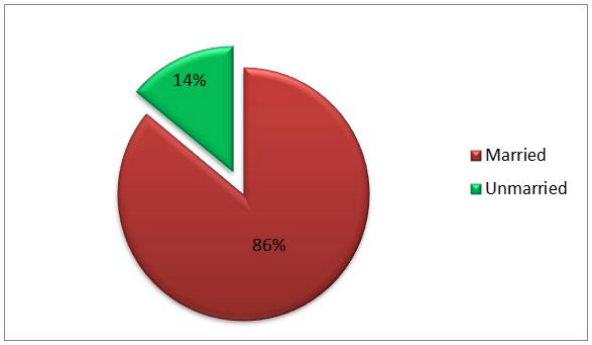

Fig-3: Representing the marital status of subjects.

Occupational status

When distributed according to employment status, out of 200 subjects most of them were in Unorganised sector 94 (47%), Unemployed 67 (35.5%), in Organised sector 39 (16.67%) as shown in table 4 and figure 4.

Table-4: Occupational status of subjects

Occupation	Frequency	Percentage %
Organised	39	19.5
Unorganised	94	47
Unemployed	67	35.5
Total	200	100

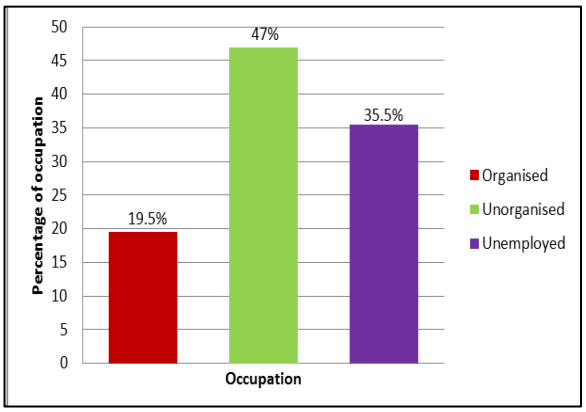

Fig-4: Representing the occupational status of subjects

Frequency of administration

Out of 249 corticosteroids 107 (42.97%) corticosteroids were prescribed in OD, 95 (38.15%) prescribed in BD, 33 (13.25%) prescribed in TDS, 14 (5.62%) prescribed in QID as shown in table 5 and figure 5.

Table 5: Frequency of administration of corticosteroids

Frequency of Administration	No. of prescriptions	Percentage (%)
OD	107	42.97
BD	95	38.15
TDS	33	13.25
QID	14	5.62
Total	249	100

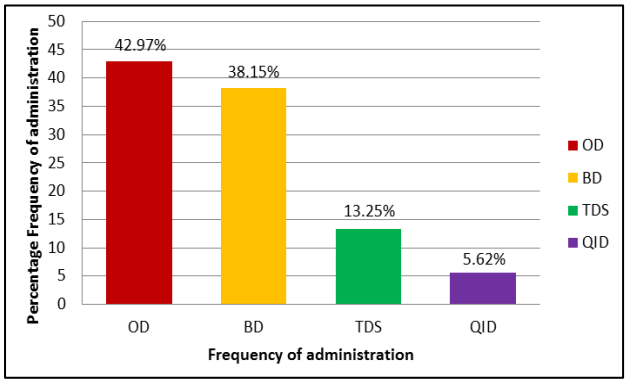

Fig-5: Representing the frequency of corticosteroid administration

Dosage form used in study

The most preferred route of administration of corticosteroid was oral (37.75%), Topical (28.92%), IV (27.31%) and inhaler (6.02%) respectively as shown in table 6 and figure 6.

Table-6: Route of Administration of corticosteroids

Route of Administration	No. of drug	Percentage (%)
Oral	94	37.75
IV	68	27.31
Inhaler	15	6.02
Topical	72	28.92
Total	249	100

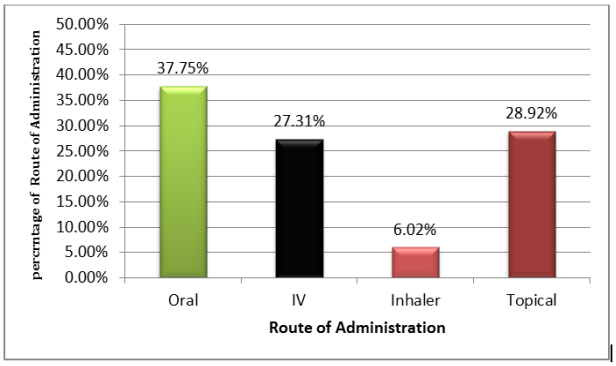

Fig-6: Representing the Route of Administration of corticosteroids

Prescribing pattern of corticosteroids

Prednisolone was prescribed in 79 (39.5%) prescription followed by hydrocortisone in 54 (27%), budesonide in 38 (19%), methylprednisolone in 31 (15.5%), Dexamethasone in 19 (9.5%), Deltazacort in 15 (7.5%), Prednisone in 9 (4.5%) and Fluhydrocortisone in 4 (2%) respectively as shown in table 7 and figure 7.

Table-7: Corticosteroids used in study

Corticosteroids	Frequency	Percentage (%)
Prednisolone	79	39.5
Hydrocortisone	54	27
Budesonide	38	19
Methylprednisolone	31	15.5
Dexamethasone	19	9.5
Deltazacort	15	7.5
Prednisone	9	4.5
Fluhydrocortisone	4	2

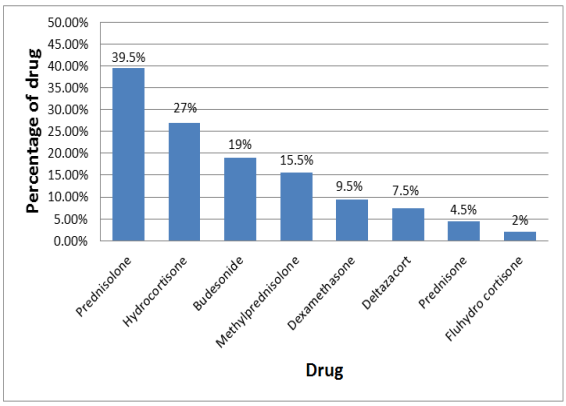

Fig-7: Representing the prescribing pattern of corticosteroids

Distribution of drugs according to generic and branded

73.09% (182) drugs were prescribed by branded name and 26.91% (67) drugs were prescribed in generic name as shown in table 8 and figure 8.

Table-8: Distribution according to branded and generic name

Drug Type	No. of drugs	Percentage (%)
Branded	182	73.09
Generic	67	26.91
Total	249	100

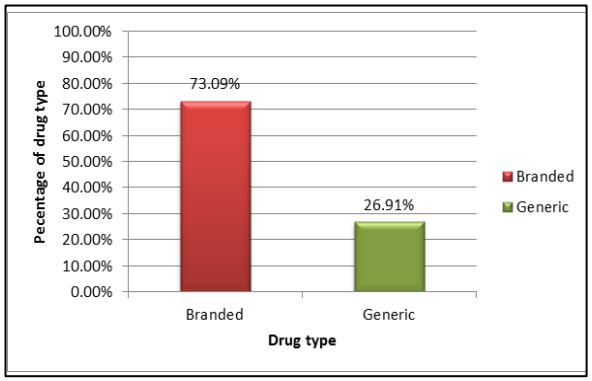

Fig-8: Representing percentage of branded and generic drug

Distribution of diseases treating with corticosteroids

Corticosteroids were used in COPD (11.5%), Bronchial asthma (8.5%), RA (10%), CKD (10%), Ecezema (5%), Conjectvitis (2.5%), Psoriasis (6.5%), Cataract (4.5%), GI (6.5%), Cellulitis (4.5%), Glucoma (5.5%), Occular Sarcodiasis (2%), Pnemonia (4.5%), SLE(5.5%), Occular Oxoplasmois(4%), Diarrhoea (1.5%) and other conditions (14.5%) respectively as shown in table 9 and figure 9.

Table-9: Distribution of diseases treated with corticosteroids

Diseases	Frequency	Percentage (%)
COPD	23	11.5
Bronchial asthma	17	8.5
RA	20	10
CKD	6	3
Ecezema	10	5
Conjectvitis	5	2.5
Psoriasis	13	6.5
Cataract	9	4.5
GI	13	6.5
Cellulitis	9	4.5
Glucoma	11	5.5
Occular Sarcodiasis	4	2
Pnemonia	9	4.5
SLE	11	5.5
Occular Oxoplasmois	8	4
Diarrhoea	3	1.5
Others	29	14.5

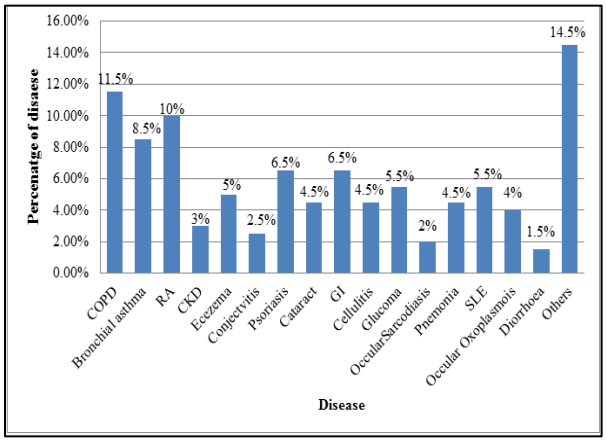

Fig-9: Representing the percentage diseases treated with corticosteroids

ADRs due to corticosteroids

34 (17 %) ADRs were detected in the study due to corticosteroid use, facial puffiness was detected in 2 (12.50%), headache in 5 (14.70%), Hypernatremia in 5 (14.70%), Hyperglycemia in 6 (17.64%), hypertension in 9 (26.47%) and osteoporosis in 5 (14.70%) as shown in table 10 and figure 10.

Table-10: ADRs due to corticosteroid use

ADRs	Frequency	Percentage (%)
Facial Puffiness	4	11.76
Headache	5	14.70
Hypernatremia	5	14.70
Hyperglycemia	6	17.64
Hypertension	9	26.47
Osteoporosis	5	14.70

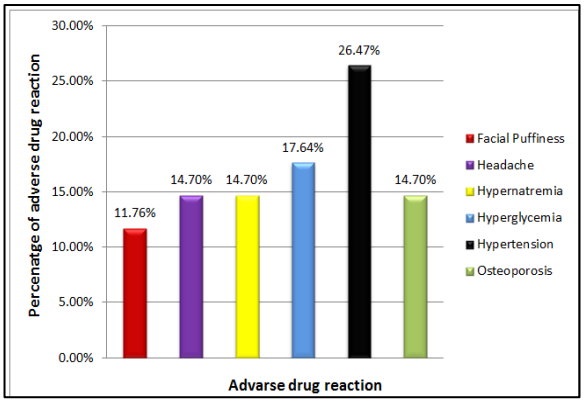

Fig-10: Representing the ADRs due to corticosteroid use.

Causality assessment of ADRs according to Naranjo scale

Out of 34 ADRs 14 (41%) were probable and 20 (59%) were possible according to Naranjo causality assessment scale as shown in table 11 and figure 11.

Table-11: Causality assessment of ADRs by Naranjo scale

Causality Assessment by Naranjo scale	No. of ADRs	Percentage %
Probable	14	41
Possible	20	59

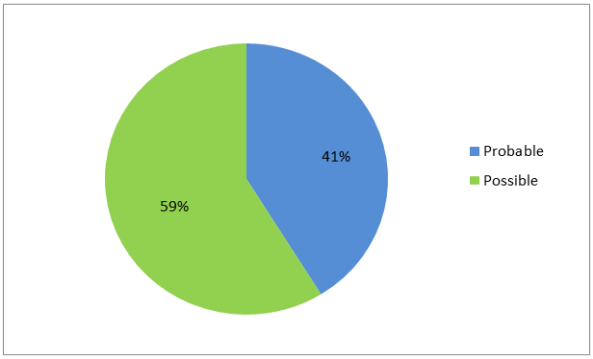

Fig-11: Representing causality assessment of ADRs by Naranjo scale.

Drug interactions with corticosteroids

Total 27 drug interactions were found in 200 prescription, the majority of interactions were moderate 15 (55.56%) followed by minor 7 (25.93%) and major 5 (18.52%) respectively as shown in table 12 and figure 12.

Table-12: Drug interactions with corticosteroids

Interaction	Frequency	Percentage %
Minor	7	25.93
Moderate	15	55.56
Major	5	18.52

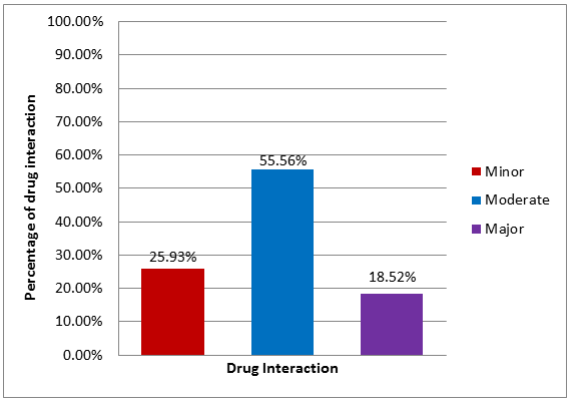

Fig-12: Representing drug interactions with corticosteroids.

Categorization of drugs according to NELM list

72.6% of the drugs were prescribed from the NELM list and 27.4% drugs are not prescribed from NELM list as shown in table 13 and figure 13.

Table-13: Categorization of drug according to NELM list

Drugs	Percentage (%)
NELM list	72.6
Non NELM list	27.4

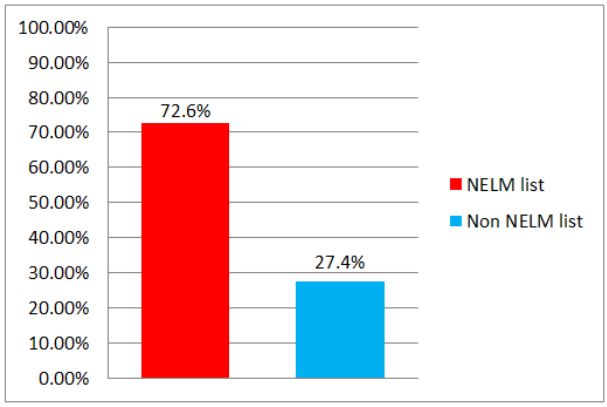

Fig-13: Representing categorization of drug according to NELM list.

Categorization of drugs according to WHO ELM

79% of the drugs were prescribed from the WHO ELM and 21% drugs are not prescribed from WHO ELM as shown in table 14 and figure 14.

Table-14: Categorization of drug according to WHO ELM

Drugs	Percentage %
WHO ELM	78
Non WHO ELM	22

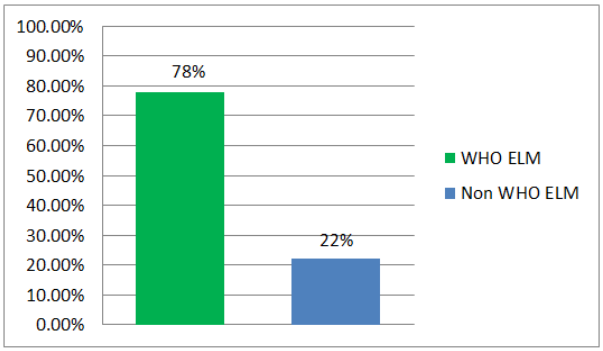

Fig-14: Representing categorization of drug according to WHO ELM

DISCUSSION

In the present study 200 subjects were included who were prescribed with corticosteroids and admitted to the various inpatient departments of a tertiary care hospital. Demographics details, corticosteroid used, route of administration, dose, dose frequency, dosage form of corticosteroids, condition for use, drug interactions and ADRs subsequent to use of corticosteroids were studied. This study included 200 subjects out of which 106 (53%) were female and 94 (47%) were male. The number of married subjects 172 (86%) were more than unmarried subjects 28 (14%). There were 66.5% employed subjects and 33.5% unemployed subjects in the study. Curtis R Jeffery *et al.* [19].

Who found that mean age of subjects was 53±14 years? The percentage of female (71%) was more than male subjects. Percentage of married and employed subjects was 67% and 56% respectively. In another study by Laugesen Kristina *et al.*,[20].

In which the annual prevalence of systemic GC prescription users was higher among women than among men with a prevalence ratio of 1.11 (95% CI 1.11 to 1.11) and prevalence ranging from 3.3% to 3.7% in women and 2.7% to 3.1% in men.

In the present study age wise distribution, 34 (17%) subjects prescribed with corticosteroid in age group 18-30 years, 42 (21%) subjects in 31-40 years, 52 (26%) in 41-50 years, 43 (21.5%) in 51-60 years and 29 (14.5%) in above 60 years. The mean age of subjects was 46.66±15.23. In this the prescribing of corticosteroids were increasing as the age group increased and then decreasing when age crosses 50 years. These factors were comparable with the studies of Overman A. Robert *et al*. [21] who found that mean age of subjects was 56.5 (54.4-58.7) years. Women (53.3%; 95% CI 47.2–59.4) represented a larger proportion of oral glucocorticoid users than men. When stratified by sex, oral glucocorticoid use was reported by 1.3% (95% CI 1.0 –1.5) of women and 1.2% (95% CI 1.0 –1.4) of men. When stratified by sex and age, the prevalence rates were between 0.5% and 3.5%. Greatest

use by sex and age was reported in men ages ≥80 years (3.5%; 95% CI 2.3–4.7) and women ages 70–79 years (2.7%; 95% CI 1.7–3.7).

Our finding that prednisolone was the most frequent corticosteroid prescribed (39.5%) followed by hydrocortisone (27%), budesonide (19%), Methylprednisolone (15.5%), Dexamethasone (9.5%), deflazacort (7.5%), prednisone (4.5%) and Fluhydrocortisone (2%). Out of them 73.09% (182) drugs were prescribed by branded name and 26.91% (67) drugs were prescribed in generic name was consistent with the finding of Laugesen K *et al.* [20], who reported that 50% of the total corticosteroid prescription were for prednisolone and Overman R. *et al.* [21] who reported that prednisolone was the oral corticosteroid most commonly prescribed. In this study it was found that most of the Corticosteroids were prescribed with along with antacid and antibiotics.

In our study out of 249 prescriptions, 42.97% prescriptions with corticosteroid were prescribed in OD, 38.15% prescriptions with BD, 13.25% prescriptions with TDS, 5.62% prescriptions with QID. Among the total no. of prescription Oral route (37.75%) is the most preferred route of administration followed by topical (28.9%), IV (27.31%) and inhaler (6.02%) and which is not consistent to the study of Thakur P.K. *et al.* [22] in which inhalation (46.9%) was the most preferred route of administration followed by injection (37.2%), oral (13.4%), infusion (0.9%), topical (0.9%), syrup (0.4%). This can be due to the difference in the inclusion criteria of the study.

In our study corticosteroids were used in COPD (11.5%), Bronchial asthma (8.5), RA (10%), CKD (3%), Ecezema (2.5%), Psoriasis (6.5%), Cataract (4.5%), GI (6.5%), Cellulitis (4.5%), Glucoma (5.5%), Occular Sarcodiasis (2%), Pnemonia (4.5%), SLE (5.5%), Occular Oxoplasmois (4%), Diarrhoea (1.5%) and other conditions (14.5%) which was consistent to the study by Thakur P.K, *et al.*[22] in which the major clinical complaints were related to respiratory tract i.e. COPD (20.9%), LRTI (11.1%), TB (9.3%) and pneumonia (7.9%). COPD was the diagnosis for which most of the corticosteroid was prescribed.

In this study 34 ADRs were found in this study due to corticosteroids use. Facial Puffiness was detected in 4 (11.76%), headache in 5 (14.70%), Hypernatremia in 5 (14.70%), Hyperglycemia in 6 (17.64%), hypertension in 9 (26.47%) and osteoporosis in 5 (14.70%). By using Naranjo causality assessment scale 14 ADRs were possible and 20 ADRs were probable. Our study was consistent with the study of Treadwell. B. *et al.* [23] who found that corticosteroid causes hypertension, facial mooning, osteoporosis in the subjects who were on corticosteroid therapy.

In this study out of 200 prescriptions total 27 interactions were found out of which 7 (25.93%) were minor, 15 were (62.56%) moderate and 5 (18.52%) were major. Mostly moderate interactions were found in the study which was consistent with the study of Kumar S, *et al.* [24]. who found that 80% of the interactions were moderate, 13% were major and 55.8% were contraindicated interactions subsequent the use of corticosteroids in his study.

CONCLUSIONS

Prescription pattern of corticosteroids in this study was not found to be rational (e.g., inadequate dose or polypharmacy) as it may lead to failure of therapy or drug interactions/adverse reactions and increase the cost of therapy /mortality. There was a lack of appropriate guidelines for use of corticosteroids and drug interaction reporting, which could be considered an emerging scope of pharmacy. To ensure safety, efficacy and well balanced therapeutic management with corticosteroids, both patients and prescribers should be more aware of the appropriate dose, dosage regimen, and drug-drug interactions. Periodic monitoring of the drug utilization pattern is one of the methods to analyze the rationality of the drug and has been an effective tool to constitute guidelines for improving the utilization pattern. The clinical pharmacist can perform potential role in health care system in assisting physician in altering the number of medications taken, the number of doses taken, improving the patient medication adherence, preventing the adverse drug reactions, drug-drug interactions, in patient counselling, improves the health related quality of life and decreases the health care cost of the patient.

REFERENCES

1. Manson, S. C., Brown, R. E., Cerulli, A., & Vidaurre, C. F. (2009). The cumulative burden of oral corticosteroid side effects and the economic implications of steroid use. *Respiratory medicine*, *103*(7), 975-994.
2. Liu, X. X., Zhu, X. M., Miao, Q., Ye, H. Y., Zhang, Z. Y., & Li, Y. M. (2014). Hyperglycemia induced by glucocorticoids in nondiabetic patients: a meta-analysis. *Annals of nutrition and metabolism*, *65*(4), 324-332.
3. Shalini, S., Ravichandran, V., Mohanty, B. K., Dhanaraj, S. K., & Saraswathi, R. (2010). Drug utilization studies-An overview. *Inter J Pharmaceut Sci Nanotechnol*, *31*, 803-10.
4. Bhalla, V., Fong, C. W., Chew, S. K., & Satku, K. (2006). Changes in the levels of major cardiovascular risk factors in the multi-ethnic population in Singapore after 12 years of a national non-communicable disease intervention programme. *Singapore medical journal*, *47*(10), 841.
5. Ankit, P., & Bharat, G. (2010). Study of drug utilization pattern of glucocorticosteroid drugs with

special emphasis on their immediate adverse effects in a tertiary care teaching rural hospital. *Indian Journal of Pharmacy Practice*, *3*(4).
6. Schäcke, H., Döcke, W. D., & Asadullah, K. (2002). Mechanisms involved in the side effects of glucocorticoids. *Pharmacology & therapeutics*, *96*(1), 23-43.
7. Shaikh, S., Verma, H., Yadav, N., Jauhari, M., & Bullangowda, J. (2012). Applications of steroid in clinical practice: a review. *ISRN Anesthesiology*, *2012*.
8. Gupta, P., Bhatia, V. (2008). Corticosteroid physiology and principles of therapy. The Indian Journal of Pediatrics, *75*(10):1039-44
9. Holloway, k., Green, T.(2003). Introduction. Drugs and Therapeutic Committees. A Practical Guide. WHO, 1-5.
10. Uboweja, A., Malhotra, S., Pandhi, P. (2006). Effect of inhaled corticosteroids on risk of development of cataract: a meta-analysis. Fundamental and Clinical Pharmacology, *20* (3):305-9
11. Sarnes, E., Crofford, L., Watson, M., Dennis, G., Kan, H., Bass, D. (2011). Incidence and US costs of corticosteroid-associated adverse events: a systematic literature review. Clinical therapeutics, *33*(10):1413-32
12. Van Staa, T.P., Leufkens, H.G., Abenhaim, L., Begaud, B., Zhang, B., Cooper, C. (2000). Use of oral corticosteroids in the United Kingdom. Quaterly Journal of Medicine, *93*(2):105-11.
13. Uijen, J.H., Van der Wouden, J.C., Schellevis, F.G., Willemsen, S.P., van Suijlekom-Smit L.W., Bindels, P.J.(2011). Asthma prescription patterns for children: can GPs do better?. The European journal of general practice, *17*(2):109-15.
14. Kirby, B. (1989). A review of the rational use of corticosteroids. Journal of international medical research, *17*(6):493-505
15. World Health Organization.(2003). Introduction to drug utilization research. Oslo: World Health Organization.
16. Management Sciences for Health and World Health Organization. (2007). Drug and Therapeutics Committee Training Course. Submitted to the U.S. Agency for International Development by the Rational Pharmaceutical Management Plus Program. Arlington, VA: Management Sciences for Health,1-3.
17. World Health Organization. (1985). The Rational Use of Drugs. Report of the Conference of Experts. Geneva. World Health Organization.
18. Pradhan, S.C., Shewade, D.G., Shashindran, C.H., Bapna, J.S. (1988). Drug utilization studies. National Med J India, *1*(4):185-9.
19. 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.
20. Laugesen, K., Jørgensen, J.O., Sørensen, H.T., Petersen, I. (2017). Systemic glucocorticoid use in Denmark: a population-based prevalence study. British Medical Journal, *7*(5): 1-5.
21. Overman, R.A., Yeh, J.Y., Deal, C.L. (2013). Prevalence of oral glucocorticoid usage in the United States: a general population perspective. Arthritis care & research, *65*(2):294-8.
22. Thakur, P.K., Majid, A., Shramik, M., Kumar, S. (2015). Prospective Study on Drug Utilization Evaluation of Corticosteroids among Out-Patients of Teaching Hospital. InternationalJournal of Pharmacy Teaching & Practices, *6*(4):2630-4.
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.