Assessment of Appropriateness in Glucocorticoid Prescribing in Medicine In-patients: A Prospective Observational Study

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ABSTRACT

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The purpose of this study was to assess the appropriateness in glucocorticoid prescribing with respect to selection, dose, duration and route of therapy to prevent therapeutic failure or occurrence of glucocorticoid associated adverse effects. A prospective observational study was conducted at tertiary care teaching hospital for the duration of 5 months. Patient's medical records were reviewed for patient demographics and pattern of glucocorticoid therapy prescribed. The data so obtained were analyzed to that of the recommended treatment guidelines. In our study, it was found that with respect to selection of glucocorticoid therapy, 80% were prescribed appropriately while 20% were inappropriately prescribed. As per doses, 43.75% of glucocorticoids were found appropriate while 53.13% and 3.13% were prescribed under dosage and in over dose respectively. According to duration 53.13% glucocorticoids prescribed inappropriately. All the glucocorticoids were prescribed appropriately according to the route of administration. To conclude, this study might be useful to alert health care professionals regarding the inappropriate prescribing of glucocorticoids and its consequences.

Keywords: Appropriate, Selection, Therapeutic deviation, Hyperglycemia.

INTRODUCTION

The actions of corticosteroids historically were described as glucocorticoid-carbohydrate metabolism-regulating and mineralocorticoid-electrolyte balance-regulating, reflecting their preferential activities. In humans, cortisol (hydrocortisone) is the main glucocorticoid and aldosterone is the main mineralocorticoid.[1]

In the structure of steroid skeleton, the presence of a hydroxyl group at position 11 seems to be essential for glucocorticoid activity, while a hydroxyl at position 21 is required for mineralocorticoid activity. Substitution at carbon 16 (as in betamethasone, dexamethasone, or triamcinolone) virtually eliminates mineralocorticoid activity.[2] (Steroid skeleton is represented in Figure 1).

Glucocorticoid indicated in wide variety of conditions. Wherever possible oral route is preferred but parenteral doses may be used if the disease is severe or an emergency arises. Intravenous therapy is generally used for intensive emergency treatment as the onset of action is relatively fast. Examples of conditions treated with systemic corticosteroids include:

- Some blood disorders, including auto-immune haemolytic anaemia and idiopathic thrombocytopenic purpura.

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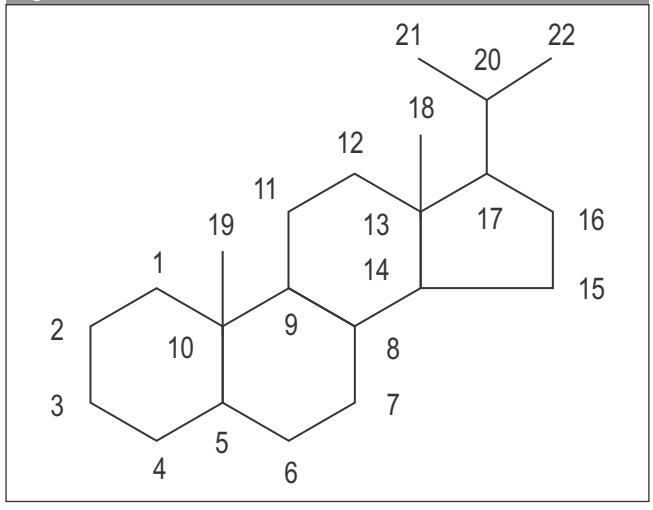
Fig. 1: Steroid skeleton[2]



- Inflammatory gastrointestinal disorders, such as Crohn's disease and ulcerative colitis, although local administration by the rectal route may be preferred in some circumstances.
- Some cases of rheumatoid arthritis, where recent evidence suggests there may be value in early treatment of active disease.
- Some respiratory disorders diffuse parenchymal lung disease, pulmonary sarcoid and neonatal respiratory distress syndrome.[2]

Besides this glucocorticoids are also used as life saving drugs in case of life threatening asthma (Symptoms – Patient too

dysphonic to speak and perspiring with PEF <25) and severe skin disorders such as pemphigus and pemphigoid.[3]

Glucocorticoid may induce Adverse Effects on various body systems based on its short term and long term therapy.

Intravenous corticosteroids injected into the blood can cause side effects including:

- Stomach irritation, such as indigestion
- Rapid heartbeat (tachycardia)
- Nausea
- Insomnia
- A metallic taste in the mouth

Side effects of oral corticosteroids that are used for short periods include:

- Increased appetite that often lead to weight gain
- Acne – a skin condition that affects most people at some point
- Mood changes, such as becoming very aggressive, irritable and short tempered with people
- Rapid mood swings, such as feeling very happy one minute and then very sad and weepy the next

Side effects of oral corticosteroids that are used for longer than three months include:

- Further weight gain
- Thinning skin which can bruise easily
- Muscle weakness
- A combination of fatty deposits that develop in the face (moon face), stretch marks across the body and acne – this is known as Cushing's syndrome
- Weakening of the bones (osteoporosis)
- The onset of diabetes, or worsening of existing diabetes
- High blood pressure
- Glaucoma – an eye condition where fluid gathers inside the eye
- Cataracts – an eye condition where cloudy patches develop at the front of the eye
- Delayed wound healing
- Reduced growth in children
- Increased risk of infection[4]

Parameters which should be continuously monitored during administration of glucocorticoids are blood pressure, blood glucose, serum electrolytes and body weight.[5] Selection of glucocorticoid therapy with respect to the predisposing factors such as body mass index (BMI) and age plays an important role in recovery of illness. Some of the recent studies conducted among the asthmatic patients receiving glucocorticoid therapy demonstrates low efficacy of glucocorticoids in obese and overweight asthmatic patients. Also a study conducted among the geriatric patients shows occurrence of glucocorticoid induced hypertension very often in elderly patients and is more common in patients with positive family history of essential hypertension.[6,7] Our previous study results also demonstrates occurrence of steroid induced hyperglycemia among the non-diabetic hospitalized patients.[8]

Selection of glucocorticoids along with its dose and duration are the important aspects which should be considered while prescribing to the critically ill hospitalized patients. A prospective observational study was therefore, undertaken at tertiary care teaching hospital to assess the appropriateness of glucocorticoid prescribing with respect to selection, dosage, duration and route of glucocorticoid administration.

MATERIAL AND METHOD

A prospective observational study was carried out for the duration of 5 months among the patients under inclusion criteria. All the Patients above 18 years of age of either sex and the patients admitted in the medicine ward with the condition that requires glucocorticoid therapy were included in the study.

For data collection and documentation Patient profile form was designed which includes information on demographics of patient (e.g. Patient's name, age, gender, height, weight, date of admission and date of discharge), presenting complaints, provisional/confirmed diagnosis, glucocorticoid therapy given (with name of glucocorticoid, dose, duration and route of therapy) and laboratory test reports.

During the study period, medical case records of patients were reviewed for the diagnosis, glucocorticoid therapy prescribed and pattern of glucocorticoid administration. Patients were also interviewed on daily basis for any fresh complaints regarding any adverse effects of drug. The data obtained was analyzed to assess the appropriateness of glucocorticoid therapy with respect to selection, dose, duration and route of administration to that of the recommended treatment guidelines.

RESULTS

A total of 759 patients were admitted in the medicine ward of the hospital during five month of study period. Out of the 759, 76 (10%) patients indicated for steroid therapy. Among 76 patients included in the study comprised of 31 male patients and 45 female patients.

Maximum numbers of patients were admitted with the diagnosis of Fever with thrombocytopenia (26.31%), Dengue fever (21%) and Bronchial asthma (17.10%). (Results are presented in Figure 2).

Amongst all 5 glucocorticoids, Deflazacort was prescribed in maximum number of cases (30%) as an oral glucocorticoid at a time of discharge. On admission Hydrocortisone and Dexamethasone were prescribed intravenously in 25% and 20% of cases respectively. (Results are presented in Figure 3).

According to the selection of glucocorticoid therapy with respect to disease condition, 80% of glucocorticoids were prescribed appropriately while 20% of glucocorticoids were prescribed inappropriately which are totally not recommended for the specific disease condition as per the recommended guidelines. In prescribing of Hydrocortisone (100 mg), 62.5% was prescribed appropriately and 37.5% was prescribed inappropriately in cases of Tuberculosis and COPD.Also 33.33% of Deflazacort was prescribed inappropriately in cases of TB, COPD and Bronchial asthma. (Results are presented in Table 1).

As per the dose of glucocorticoid therapy, 43.75% was given appropriately, 53.13% found under dosage and 3.13% was found over dose. In prescribing of dexamethasone (8 mg) intravenously, 83.33% was found under dosage and 16.67% found over dose. Similarly dexamethasone (4 mg) intravenously was prescribed in cases of fever with thrombocytopenia which was found to be under dosage. Methyl prednisolone was also found under dosage in cases of transverse myelitis and fever with thrombocytopenia. (Results are presented in Table 2).

Fig. 2: Prevalence diseases conditions among admitted patients

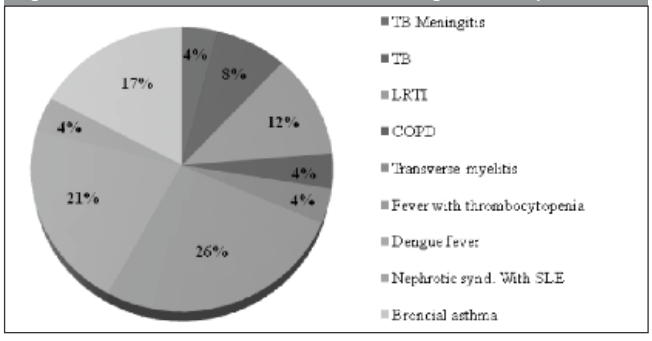
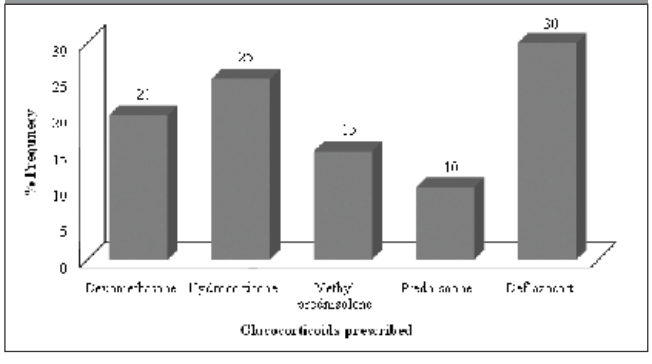


Fig. 3: Frequency of Glucocorticoid prescribing



According to the duration of therapy, 53.13% of glucocorticoids were prescribed inappropriately with respect to the duration mentioned in the recommended treatment guidelines.

In 80% prescriptions of Hydrocortisone 100 mg intravenously the duration of therapy was found unknown. Similarly, the duration of Deflazacort therapy in cases of fever with thrombocytopenia and nephrotic syndrome was also found unknown. (As the standard duration of Hydrocortisone and Deflazacort was not mentioned in recommended treatment guidelines for a particular disease condition for which the drugs were prescribed). (Results are presented in Table 3).

According to the recommended guidelines, all the glucocorticoids were prescribed (or given) appropriately with respect to the route of administration. (Results are presented in Table 4).

Among these 76 patients, 3 (4%) patients were known case of hypertension and 4 (5%) patients had their blood sugar level in impaired diabetic range. Also 5 (5%) patients were found overweight according to the ideal Body Mass Index.

DISCUSSION

After the innovative discovery of Cortisol by Hench and Kendall, synthetic corticosteroids (i.e. Glucocorticoids) were discovered and were proved to be lifesaving drugs in multiple disease conditions.[1,9] Long-term glucocorticoid usage worldwide is estimated at between 1% and 3% of adults. In the UK, a third of patients on glucocorticoids for more than 2 years took more than 7.5mg of prednisone daily. While most patients receive short courses of glucocorticoids, as many as 20% take oral glucocorticoids for more than 6months and almost 5% of patients are on daily glucocorticoid therapy for over 5 years.[10]

Besides the use of glucocorticoids in wide variety of disease conditions they may also cause serious side effects on different body systems. Occurrence of these side effects depends on the duration and dose of glucocorticoid usage. So, it is necessary to prescribe glucocorticoids as per the recommended treatment guidelines according to the disease conditions.

In our study we found inappropriate prescribing (37.5%) of Hydrocortisone and (33.33%) of Deflazacort in cases of Tuberculosis and COPD. But according to the GOLD (Global

Table 1: Assessment of selection of Glucocorticoid therapy according to disease condition

	Dose	No. of prescription	Appropriate	Not appropriate (Not recommended)
Dexamethasone	8mg	18	18	0
	4mg	6	6	0
Hydrocortisone	50mg	3	3	0
	100mg	24	15	9
	200mg	3	3	0
Prednisolone	30mg	6	6	0
	40mg	6	3	3
Methyl Prednisolone	6mg	3	3	0
	16mg	3	3	0
	32mg	3	3	0
	40mg	3	3	0
	80mg	6	6	0
Deflazacort	6mg	36	24	12
Frequency prescribed		**120**	**96**	**24**
% Assessment			**80%**	**20%**

Table 2: Assessment of Glucocorticoid according to dose prescribed

	Dose	No. of prescription	Appropriate	Not appropriate	
				Under Dose	Over Dose
Dexamethasone	8mg	18		15	3(16.67%)
	4mg	6		6	
Hydrocortisone	50mg	3		3	
	100 mg	15	12	3	
	200 mg	3		3	
Prednisolone	30mg	6	6		
	40mg	3		3	
Methyl Prednisolone	6mg	3		3	
	16mg	3		3	
	32mg	3		3	
	40mg	3		3	
	80mg	6		6	
Deflazacort	6mg	24	24		
Frequency prescribed		**96**	**42**	**51**	**3**
% Assessment			**43.75%**	**53.13%**	**3.13%**

Initiative for Chronic Obstructive Lung Disease) and WHO treatment guidelines for management and treatment of COPD and Tuberculosis respectively, Hydrocortisone and oral Deflazacort are not recommended for these disease conditions.[11,12]

Majority of Dexamethasone prescribing was found under dosage (8 mg thrice a day) in cases of fever with thrombocytopenia. According to the recommended doses by American society of Hematology. Dexamethasone should be given 40 mg daily for four days every 2-4 week for 1-4 cycles, which was not appropriately followed at our hospital.[13]

In some cases of thrombocytopenia, Dexamethasone was given in doses of 4 mg thrice a day which was found ineffective in achieving high rise of platelet count in dengue infection as per the study conducted by Kularatne SA M et al.[14]

Same as Dexamethasone, Methyl prednisolone was also found under dosage in cases of fever with thrombocytopenia. As per the American society of Hematology, Methyl prednisolone should be given in doses of 30 mg/kg/d for 7 days which was not followed here.

In majority of the cases, appropriateness in duration of glucocorticoid prescribing was found unknown as the

Table 3: Assessment of Glucocorticoid according to duration of therapy

	Dose	No. of prescription	Appropriate	Not appropriate	Unknown
Dexamethasone	8mg	18		18	
	4mg	6		6	
Hydrocortisone	50mg	3	3		
	100mg	15		3	12 (80%)
	200mg	3		3	
Prednisolone	30mg	6		6	
	40mg	3		3	
Methyl Prednisolone	6 mg	3		3	
	16mg	3	3		
	32mg	3	3		
	40mg	3		3	
	80mg	6		6	
Deflazacort	6mg	24			24 (100%)
Frequency prescribed		**96**	**9**	**51**	**36**
% Assessment			**9.38%**	**53.13%**	**37.5%**

Table 4: Assessment of Glucocorticoid according to route

	Dose	No. of prescription	Appropriate	Not appropriate
Dexamethasone	8 mg	18	18	Nil
	4 mg	6	6	Nil
Hydrocortisone	50 mg	3	3	Nil
	100 mg	15	15	Nil
	200 mg	3	3	Nil
Prednisolone	30 mg	6	6	Nil
	40 mg	3	3	Nil
Methyl Prednisolone	6 mg	3	3	Nil
	16 mg	3	3	Nil
	32 mg	3	3	Nil
	40 mg	3	3	Nil
	80 mg	6	6	Nil
Deflazacort	6 mg	24	24	Nil
Frequency prescribed		**96**	**96**	Nil
% Assessment			**100%**	Nil

standard treatment guidelines did not mention duration of glucocorticoid therapy. But in cases of Dexamethasone and Methyl prednisolone prescribing it was found inappropriate as per American society of Hematology recommendations on treatment of thrombocytopenia.[15]

Some of the patients were found known cases of pre-diabetic which is a major risk factor for the occurrence of glucocorticoid associated adverse effects. A specific study conducted on non- diabetic and pre diabetic patients on short term steroid therapy showed steroid induced hyperglycemia which was evident in 62.5% patients.[8]

No therapeutic deviation or outcome was observed during the course of therapy in patients with hypertension and obesity (overweight), which are major risk factors for steroid induced adverse effects. This may be evident to the fact that the course of steroids was of short term and under dosing was predominant.

So, if the glucocorticoids are not prescribed appropriately with respect to selection, dose and duration of therapy among pre-diabetic and overweight patient it may cause glucocorticoid induced diabetes.

By this study we would like to draw attention towards the inappropriate prescribing of glucocorticoids which may leads to therapeutic ineffectiveness or it may cause serious adverse effects. So, this study might be helpful for the physicians to be conscious regarding the importance of appropriate prescribing of glucocorticoids as per recommended treatment guidelines.

CONCLUSION

Standard treatment guidelines should be developed at all multispecialty hospitals for the prescribing of steroids taking into consideration the patient specific parameters which will improve therapeutic outcomes.

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