

Dexamethasone Induced Hyperglycemia: A Case Report

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Abstract

Dexamethasone is the class of drugs that have been used extensively in a wide range of disease conditions and widely prescribed for their anti-inflammatory and immunosuppressive properties. Glucocorticoids have several side effects, being hyperglycemia one of the most common and representative. Hypertension and diabetes are common side effects of glucocorticoid treatment. Dexamethasone can cause elevation of patient blood sugar level. Steroids stimulate glucose production by the liver and inhibit peripheral glucose uptake, resulting in insulin resistance. Dexamethasone even after single dose administration has been shown to increase blood glucose. In the present case study a 56-year-old woman was hospitalized with the case of acute exacerbation of asthma with calcinosis cutis. Treatment regimen was planned accordingly including dexamethasone and clarithromycin. It was observed there are an elevation in blood glucose level upon administration Dexamethasone, it is known factor that dexamethasone capable to increase the blood sugar level and concurrent use of clarithromycin may exaggerate the factor. Upon withdrawal of these two drugs the sugar level becomes normal. Hence, it is advised that the judicious use of dexamethasone and its concurrent intractable drugs may be required to avoid the possible side effects of steroids.

Key words: Dexamethasone; Clarithromycin; Hyperglycemia.

Introduction

Glucocorticoids are commonly accustomed treat a good type of both acute and chronic illnesses which acts as anti-inflammatory and immunosuppressive processes, making them the cornerstone in treatment of various inflammatory diseases ⁽¹⁾. Despite their efficacy, their use is restricted by the large choice of side effects, which might be divided into three categories: immediate, gradual and idiosyncratic. Immediate effects include fluid retention, blurred vision, mood changes, insomnia, weight gain, and modulation of the reaction. The more gradual effects are those associated with endocrine metabolism, especially hyperglycemia, osteopenia with subsequent osteoporosis, dyslipidemia, central obesity, and adrenal suppression. Additionally, acne, skin thinning, and dyspepsia are considered of gradual onset. A number of the idiosyncratic effects are avascular necrosis, cataracts, chronic glaucoma and psychosis ⁽¹⁾.

Glucocorticoid has pro-found effects on carbohydrate metabolism: stimulating liver to form glucose from amino acids and glycerol. Steroids stimulate glucose production by the liver and inhibit peripheral glucose uptake resulting in insulin resistance. An adverse effect associated with use of steroids includes hyperglycemia and can worsen pre-existing diabetes or precipitate new “steroid-induced” diabetes, gastritis, glaucoma and hypertension. Glucocorticoid (GCs) induced hyperglycemia has long been noted in humans. Steroids elevate blood glucose levels by increasing hepatic glucose production and inhibiting glucose uptake into muscles. They also have a complex effect on beta cell functioning⁽²⁾. Dexamethasone even after single dose administration has been shown to increase blood glucose. Blood glucose concentrations increased significantly over time and peaked at 120 min after 10 mg dexamethasone⁽⁶⁾. The effect of glucocorticoids on glucose metabolism is likely the result of impairment of multiple pathways including beta cell dysfunction. On the other hand, they cause persistent hyperglycemia when administered in divided doses. Dexamethasone fits in the long-acting GCs, with a steroid hyperglycemia that lasts for more than 24 h, with a slight decline during an overnight fast. The effect of steroids is usually transient and reversible⁽⁵⁾. Dexamethasone co-administration with clarithromycin (inhibitors of CYP4503A4) may also have a chance of increase in plasma concentration and pharmacological effect of corticosteroids ^(3,4). Clarithromycin may increase the blood levels of dexamethasone. You may be more likely to experience side effects such as swelling, weight gain, high blood pressure, high blood glucose, muscle weakness, depression, acne, thinning skin, stretch marks, easy bruising, bone density loss, cataracts, menstrual

irregularities, excessive growth of facial or body hair, and abnormal distribution of body fat, especially in the face, neck, back, and waist. Other side effects that may occur include decreased ability to fight infections, increased risk of developing infections, and inadequate response to stress such as infection, surgery, trauma, or a severe asthma attack. Children may experience a reduced growth rate due to excessive effects of dexamethasone. Coadministration with inhibitors of CYP450 3A4 may increase the plasma concentrations and pharmacologic effects of corticosteroids, which are primarily metabolized by the isoenzyme.

Case Report

A 56-year-old woman was admitted to a female surgery ward with c/o breathlessness and cough with expectoration and swelling over left gluteal region. The Patient was diagnosed with acute exacerbation of asthma with Calcinosis cutis who had a history of asthma in the past 5 years, not a k/c/o HTN and DM. On examination the patient was conscious and coherent and other systemic examinations were performed. Inj. Dexona (Dexamethasone) IV; BD of 2cc and nebulizer Budecort (Budesonide) and Duolin(Ipratropium bromide & salbutamol) and tab Claribid(clarithromycin) was prescribed.

On continuous adherence to the treatment plan, sudden developed of increased blood glucose levels in the laboratory findings was observed which was suspected to be the adverse effect of steroid induced diabetes mellitus and there may also have a chance of increase in plasma concentration of dexamethasone due to co-administration of clarithromycin. Post discussion with the concerned physician soon after identification of this incident, it is advised and practiced to discontinued both dexamethasone and clarithromycin on and it is seen on next day of discontinuation, there is a change in the blood glucose level to normal and rest of the medications were continued as per the treatment regimen plan.

Discussion

The incidence of glucocorticoid-induced hyperglycemia has been reported to be 12%. Other studies of the prevalence of GIDM associated with different diseases have reported varying Results. However, the exact prevalence of hyperglycemia secondary to glucocorticoid therapy is not known. The prevalence of abnormal Glucose metabolism in patients with an organ transplant who undergo glucocorticoid therapy has been reported to be 17% to 32% ⁽⁷⁾.

SIDM (steroid induced diabetes mellitus) is defined as an abnormal increase in blood glucose associated with the use of glucocorticoids in a patient with or without a prior history of diabetes mellitus. Steroids are drugs that have been used extensively in a variety of diseased conditions. Although widely prescribed for their anti-inflammatory and immune-suppressive properties, glucocorticoids have several side effects, being hyperglycemia one of the most common and representative⁽²⁾. Dexamethasone is a corticosteroid with high anti-inflammatory activity and more potent. Dexamethasone mainly works by inhibiting the release of arachidonic acid, which is a precursor to the most important mediators of inflammation, prostaglandins and leukotrienes. Dexamethasone induces the synthesis of a protein, lipomodulin, which inhibits the action of the enzyme responsible for the release of arachidonic acid phospholipase A2. Corticosteroids are believed to act by modulating vascular endothelial adhesion molecules, cyclooxygenase 1 or 2 (COX-1 or COX-2), and cytokine expression which results in a reduction in the expression of proinflammatory mediators and the suppression of circulating leukocytes.

In this case as the patient was diagnosed with acute exacerbation of asthma with calcinosis cutis that was been prescribed with dexamethasone and clarithromycin. The patient was seen to be hyperglycemic after the administration of prescribed medication i.e., dexamethasone which has the tendency to cause adverse effect by leading to increase in the level of blood glucose in the patient. Increased plasma concentration of dexamethasone was also identified due to the drug interaction between dexamethasone and clarithromycin which was been confirmed after the identification and reported to concerned physician, where the discontinuation of both the drugs were advised in the course of treatment^(3,4).

Complete blood count

Test name	Results	Normal range
Hb	11.4	12 – 15 g/dL
Tc	8.14	4 – 10 $10^3\mu\text{L}$
PCV	33.9%	40 – 50 %
RBC	3.76	4.5 – 5.5 mcm
Platelet count	274	150 – 410 $10^3\mu\text{L}$
ESR	21	0 – 20 mm/hr

Liver function tests

Test name	Results	Normal range
SGPT	14	17 – 59 U/L
SGOT	23	21 – 72 U/L
Serum Albumin	4.0	3.5 – 5.5 g/dL
ALP	47	38 – 126 U/L

Renal function tests

Test name	Results	Normal range
Blood urea	22	19 – 43 mg/dl
Serum creatinine	0.5	0.4 – 1.1 mg/dl
Uric acid	3.4	3 – 5.5 mg/dl

Urine routine

Test name	Results	Normal range
Albumin	Absent	-
U. Sugar	Absent	-
U. Pus cells	2-3	0-5 cells/hpf
Epithelial cells	3-5	1-2 cells/hpf

Blood glucose level

Tests	20/4	21/4	22/4	24/4	25/4
FBS(70 – 100 mg/dL)	161	152	150	80	81
PPBS(70 – 140 mg/dL)	325	300	290	174	170
GRBS(70 – 140 mg/dL)	240	246	258	135	138
HBA1C	5.5%				

Conclusion

Diabetes is a known complication in most of the therapeutic plans with steroids prescribed alone or in combination with other drugs. The diabetogenic effect of glucocorticoids is said to be determined by dose, duration and type of steroid. Hence physician must adjust the dose

based upon patient's pharmacokinetic parameters. GCs are the drugs that have been widely used in a variety of medical conditions. Despite their medical efficacy, steroid induced hyperglycemia remains as a common potentially harmful problem that must be considered when using any type of the GC. Despite its frequency, little is known about the impact of hyperglycemia associated with steroid use on clinical comorbidity and mortality. A proper understanding of the mechanisms involved in steroid hyperglycemia is needed, since this will allow early detection and effective treatment in these patients. Hyperglycemia, hypertension should be monitored during these medications. Appropriate guidelines that establish the recommendations for the diagnosis and treatment of steroid diabetes are needed in order to prevent all the complications associated with the hyperglycemic state. Collective measures, monitoring and coordination are needed among the health care providers in order to rationalized use of steroids for the betterment of patient.

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