Blood Glucose Levels in Diabetic Patients Following Corticosteroid Injections Into the Hand and Wrist

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Purpose To quantify diabetic patients' change in blood glucose levels after corticosteroid injection for common hand diseases and to assess which patient-level risk factors may predict an increase in blood glucose levels.

Methods Patients were recruited for this case-crossover study in the clinic of fellowship-trained hand surgeons at a tertiary care center. Patients with diabetes mellitus type 1 or 2, who received a corticosteroid injection, recorded the morning fasting blood glucose levels for 14 days after the injection. Fasting glucose levels on days 1 to 7 after injection qualified as case data; levels on days 10 to 14 provided control data. A mixed model with a priori contrasts was used to compare postinjection blood glucose levels with baseline levels. We used a linear regression model to determine patient predictors of a postinjection rise in blood glucose levels.

Results Of 67 patients recruited for the study returned, 40 (60%) completed blood glucose logs. There was a significant increase in fasting blood glucose levels after injection limited to postinjection days 1 and 2. Among patient risk factors in the linear regression model, type 1 diabetes and use of insulin each predicted a postinjection increase in blood glucose levels from baseline, whereas higher glycated hemoglobin levels did not predict increases.

Conclusions Corticosteroid injections in the hand transiently increase blood glucose levels in diabetic patients. Patients with type 1 diabetes and insulin-dependent diabetics are more likely to experience this transient rise in blood glucose levels. *(J Hand Surg Am. 2014;39(4):706–712.*

Type of study/level of evidence Therapeutic III.

Key words Blood glucose, corticosteroid, diabetes, methylprednisolone.

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Corticosteroid injections are commonly used to treat a variety of common hand and wrist conditions such as trigger finger, de Quervain tenosynovitis, and osteoarthritis. Local injection is often first-line therapy and is anticipated to provide temporary or lasting pain relief with the potential for a definitive cure, as in the case of trigger fingers.[1–3]

Diabetic patients are at increased risk for developing trigger fingers.[4] Previous studies have reported a 10% to 20% higher incidence of trigger finger in diabetic patients and a higher likelihood of multiple digit involvement than in a nondiabetic patient.[5–8] With prior data indicating only moderate long-term relief (36% to 60%) after corticosteroid injections for trigger finger in diabetic patients, the risks of injection must be weighed against potential benefits.[1,9,10]

Corticosteroid injections in the knee, shoulder, and spine produce a short-term rise in blood glucose levels with no effect on long-term measures of blood glucose control (fructosamine or HbA_1c).[11–13] Two studies have reported transient increases in blood glucose after corticosteroid injection in the hand or wrist.[10,14] Patient characteristics that distinguish an individual's reaction to injection were not assessed. Some clinicians may be hesitant to administer corticosteroids owing to the perceived risk of hyperglycemia after an injection, coupled with potentially limited efficacy of injection in diabetic patients.

The purposes of this study were to quantify diabetic patients' change in blood glucose levels after corticosteroid injection for common hand diseases and to assess which patient-level risk factors could predict an increase in blood glucose levels. We hypothesized that diabetic patients would show a significant but transient rise in blood glucose levels postinjection, with greater increases in poorly controlled diabetics, as measured by HbA1c.

MATERIALS AND METHODS

This prospective case-crossover study evaluated the effect of corticosteroid injection in the hand on blood glucose levels in patients with diabetes. Diabetic patients treated with corticosteroid injections of methylprednisolone acetate completed a daily blood glucose log to determine changes in blood glucose levels after injection. Our institutional review board approved this study.

Patients at least 18 years of age, who were undergoing clinically indicated corticosteroid injection for de Quervain disease, trigger finger, osteoarthritis, or carpal tunnel syndrome in the clinic of fellowship-trained hand surgeons at a tertiary care institution, were considered for the study. Patients were included if they had a diagnosis of type 1 or 2 diabetes mellitus and checked blood glucose values daily. Patients were excluded if they were unable to provide consent, had received a corticosteroid injection in the previous 3 months, had been administered oral corticosteroid in the past 6 months, or had any contraindications to the administration of corticosteroids.

Patients provided consent after electing to proceed with a corticosteroid injection after discussing treatment options and risks and benefits with their surgeon. After the injection, we recorded the location (ie, tendon sheath, joint) and amount of methylprednisolone acetate administered (range, 20–120 mg), patient demographics, diabetes type, most recent HbA1c result, and diabetes control regimen (diet, oral medication, and/or insulin).

Participants were provided a daily log to record morning fasting blood glucose levels for 14 days after injection. All participants used personal glucose meters to record their readings. Upon completion of the 14-day postinjection period, patients returned the logs via a self-addressed stamped envelope provided at the time of the corticosteroid injection.

Data analysis

In this case-crossover design, participants' first 7 days of blood glucose readings provided case outcome data. Days 8 and 9 represented the washout period, whereas the average of days 10 to 14 were used to determine baseline blood glucose levels. This design was based on prior literature of corticosteroid injections in diabetic patients' knees, shoulders, spine, and hands that showed no statistically significant elevation in blood glucose levels after 5 days following injection.[10,11,13,15,16] To ensure a proper washout period, we doubled this time and did not consider participant blood glucose values to be at baseline until 10 days after injection. Recording blood glucose levels prospectively before a corticosteroid injection would have required withholding pharmacologic therapy for a painful condition and a second visit to the clinic for treatment, which would increase participant burden.

Our sample size analysis determined that 40 patients were needed to detect a difference of 20 mg/dL in blood glucose level with a power of 0.90 using a paired data design with a 2-tailed alpha of 0.05. To analyze our data, we used a mixed model and a priori contrasts of paired *t* tests to compare the calculated baseline fasting blood glucose levels with the blood glucose levels attained on each day of the first week postinjection. This model took into account each patient's repeated contribution to the data. All 95% confidence intervals underwent a Bonferroni adjustment to account for multiple comparisons.

To determine which risk factors were associated with a rise in blood glucose levels, we used a Fisher exact test. For this univariate analysis, we compared patients with a greater than 50-mg/dL rise in fasting postinjection day 1 blood glucose levels with different patient risk factors (diabetes type, diabetes control regimen, sex, and location of injection). A rise in greater than 50 mg/dL was chosen because it would represent an 80% change relative to the normal standard deviation of fasting glucose levels.[17] For each risk factor, we reported Mantel-Haenszel adjusted odds ratios to account for differences in the amount of methylprednisolone acetate received. The Spearman rho was used to determine whether overall