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# Impact of serial blood glucose monitoring and treatment in patients with corticosteroid-induced hyperglycemia in the inpatient setting

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## BACKGROUND

- Corticosteroid induced hyperglycemia (CIH) occurs in 86% of patients
- Corticosteroids increase post-prandial blood glucose (BG) levels (highest 1 - 2 hours after meal) and BG levels normalize at night, leading to a normal fasting BG in the morning
- Risk factors for CIH: high or very high doses of steroids, pre-existing DM, ethnicity, age 65 or older, eGFR < 40 mL/min/1.73 m2, BMI > 25 kg/m2, concomitant hyperglycemic medications
- The goal of managing CIH is to achieve BG <180 mg/dL by utilizing basal-bolus insulin regimens plus correction scale and monitoring every 4-6 hours

| | |
|---|---|
| Very high dose | • ≥ 100 mg prednisone equivalent per day |
| High dose | • ≥ 30 mg prednisone equivalent per day |
| Medium dose | • ≥ 7.5 mg prednisone equivalent per day |
| Low dose | • < 7.5 mg prednisone equivalent per day |

## OBJECTIVE

- To evaluate pharmacist impact on serial blood glucose testing and corresponding treatment in patients experiencing CIH in the acute inpatient setting

## METHODS

- Single center, IRB-approved, two-phased study
- Phase I: Retrospective chart review (July-September 2018)
- Phase II: Prospective interventional review (February-April 2019)
- Inclusion criteria: age ≥ 18, admitted to medical surgical floor, receiving high or very high dose of systemic corticosteroid for > 24 hours
- Exclusion criteria: Diabetic on insulin therapy with average daily blood glucose <180 mg/dL, chronic high or very high dose corticosteroid use with average daily BG of <180 mg/dL
- Primary outcomes: Percentage of serial BG monitoring, incidence of hyperglycemia, average point-of-care (POC) BG levels
- Secondary outcomes: Risk factors, # of pharmacy interventions accepted in phase II

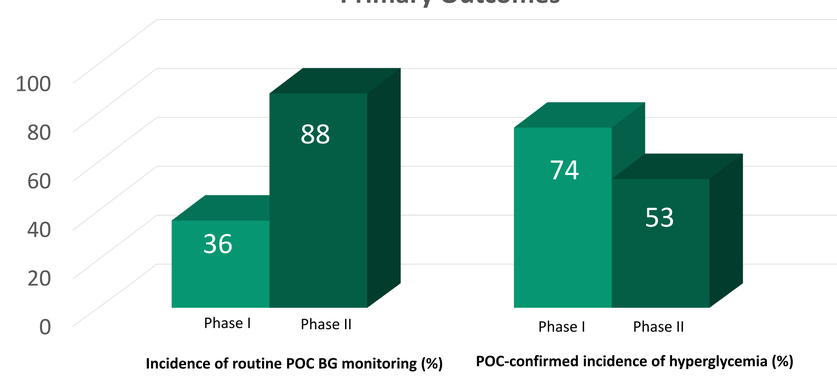
Daily screening for patients in medical surgical floors on high dose corticosteroids → Patient profiles reviewed for POC BG monitoring (If none, RPh recommended addition) → When two consecutive POC BG levels ≥ 180 mg/dL, pharmacist intervened to initiate or adjust insulin therapy

*Hyperglycemia = at least one POC BG ≥ 180 mg/dL within 24 hours*

## RESULTS

| Baseline Characteristics | Phase I (n=50) | Phase II (n=49) |
|---|---|---|
| Average age, years | 70 | 70 |
| Gender - female, n (%) | 26 (52) | 34 (69) |
| Diabetes mellitus (DM), n (%) | 17 (34) | 14 (29) |
| Average duration of corticosteroid therapy, days | 8 | 8 |
| Indication, n (%) | | |
| • Pulmonary | 34 (68) | 39 (80) |
| • Inflammatory | 6 (12) | 5 (10) |
| • Other | 7 (14) | 5 (10) |
| Risk Factors, n (%) | | |
| • Age > 65 years | 29 (58) | 33 (67) |
| • BMI >25 kg/m2 | 33 (66) | 26 (53) |
| • BMI > 30 kg/m2 | 15 (30) | 21 (43) |
| • Diabetes | 17 (34) | 14 (29) |
| • eGFR <40 mL/min/1.73m2 | 8 (16) | 7 (14) |
| • African American | 6 (12) | 10 (20) |

**Primary Outcomes**




Incidence of routine POC BG monitoring (%) — POC-confirmed incidence of hyperglycemia (%)

| Primary Outcomes | Phase I (n=50) | Phase II (n=49) | P value |
|---|---|---|---|
| **Incidence of routine POC BG monitoring, n (%)** | 18 (36) | 43 (88) | p <0.05 |
| DM, n (%) | 15/17 (88) | 14/14 (100) | -- |
| Non-DM, n (%) | 3/33 (9) | 29/35 (83) | -- |
| POC BG levels, average (range) | 206 (48-452) | 182 (31-463) | NS |
| **POC-confirmed incidence of hyperglycemia (%)** | 134/180 (74) | 150/282 (53) | p <0.05 |
| **Unable to assess glycemic status, days** | 208/388 (54) | 127/409 (31) | -- |

| Secondary Outcomes: Interventions | Phase II (n=49) |
|---|---|
| **# of pharmacy interventions** | 48 |
| Accepted by physician, n (%) | 38 (79%) |
| **Types of interventions, n (%)** | |
| Addition of POC BG monitoring | 29 (60%) |
| Initiate insulin therapy | 14 (30%) |
| Insulin adjustment | 5 (10%) |

| Additional Observations | Phase I (n=50) | Phase II (n=49) | P value |
|---|---|---|---|
| **Insulin regimens used, n (%)** | 18 (36) | 34 (69) | p <0.05 |
| Correction scale only | 4 (22) | 21 (62) | -- |
| Basal-bolus + correction scale | 7 (39) | 10 (29) | -- |
| Basal insulin + correction scale | 7 (39) | 3 (9) | -- |
| **Incidence of hypoglycemia (%)** | 10/878 (1.1) | 13/1475 (0.9) | NS |

NS= not significant

## DISCUSSION & CONCLUSION

- Pharmacist impact increased POC BG monitoring (36% vs. 88%)
  - Larger impact noted in non-DM patients where monitoring increased from 9% to 83%
- Pharmacist impact improved glycemic control
  - Hyperglycemia decreased from 74% to 53%
- Average POC blood glucose levels decreased from 206 to 182 mg/dL
- The most common risk factors identified were age greater than 65 years and BMI > 25 kg/m2
- A total of 48 pharmacy interventions were made, 38 of which were accepted for an overall acceptance rate of 79%
  - The most prevalent intervention was the addition of point-of-care blood glucose monitoring
- The incidence of hypoglycemia did not differ significantly between the two phases
- Future Directions: Propose collaborative agreement to allow automatic ordering of POC BG monitoring in patients meeting high dose steroid criteria

## LIMITATIONS

- Small sample size and lack of power
- The true incidence of hyperglycemia could not be determined due to significantly lower POC BG monitoring in phase I and missed opportunities in phase II
- Not all recommendations accepted by prescriber in phase II
- Prescriber hesitancy to accept basal-bolus regimen due to risk of hypoglycemia → preferred the use of insulin correction scale

## DISCLOSURES

- All authors of this presentation have nothing to disclose concerning possible financial or personal relationships with commercial entities that may have direct or indirect interest in the subject matter of this presentation

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