Background

- The anatomical site for subcutaneous injection is known to affect insulin kinetics and blood glucose levels.
- The abdomen is commonly accepted as the most rapid and consistent site for insulin injection.
- Despite the abdomen being the most ideal anatomical region for insulin administration, some patients may prefer injecting in other sites.
- Long-term glycemic goals achieved regardless of injection site by means of dose titration.
- Short-term glycemic goals.

Objectives

- The primary objective of this exploratory study was to determine if changing the site of subcutaneous insulin injection from the abdomen to another approved site would affect short-term glycemic control in patients with type 2 diabetes mellitus.
- The secondary objective was to assess patient preferences between injection sites, including ease of administration, convenience, and pain.

Methods

All patients were thoroughly informed regarding the purpose and procedures of the study before consent to participate was obtained. The protocol was approved by the St. Luke's University Health Network IRB. Enrollment occurred between the months of February and April 2012.

DESIGN: Exploratory crossover trial with 14-day study periods.

SETTING: Single-center outpatient medical center in Bethlehem, PA.

PATIENTS: Individuals who met the inclusion/exclusion criteria [Table 1] were invited to participate in the study.

INTERVENTIONS

- Patients were injected into two subcutaneous sites:
  - Abdomen
  - Upper arm or thigh

SELF-MONITORING OF BLOOD GLUCOSE (SMBG):

- Patients were required to self-test blood glucose at least once daily and at the same frequency that they had been testing prior to enrollment.
- Standardized log sheet provided by the investigators.
- Adherence of at least 80% required.
- Patients continued to use their own glucometers.
- All glucometers compared with a standard, calibrated glucometer.
- +/− 20% of the standard to be considered acceptable.

FOLLOW-UP

- All patients were seen in clinic for follow-up after 14 days of using the first study injection site and after completion of the 28-day study.
- Patients completed a questionnaire on injection site preference at the last visit.

OUTCOME MEASURES

- The primary outcome measure was a change in mean blood glucose between subcutaneous injection sites (i.e., abdomen, thigh, and upper arm).
- Clinically relevant difference in mean blood glucose defined as ≥ 15 mg/dL.
- Based on extrapolation to a change in A1C of 0.5%.
- The secondary outcome was a measure of patients’ self-reported preference between injection sites, an assessment of ease of administration and pain.

STATISTICAL METHODS

- Statistical analyses were not performed for this study because there are no known population values from which to base the calculation of a sample size.

Results

- Nine patients successfully completed the research protocol.
- The absolute mean difference ± SD in average daily blood glucose:
  - Abdomen vs. other injection site: 23 ± 19.8 mg/dL (n=3); range: 51.0 to 46.9 mg/dL.
  - Abdomen vs. thigh: 15.6 ± 18.7 mg/dL (n=6)

Results, cont.

- No patients experienced any severe adverse event, required acute medical care, or experienced any other non-hypoglycemic adverse events while enrolled.
- Injection site preference: 78% considered the abdomen to be the most convenient and easy to use insulin injection site.
- No consensus with regard to which injection site was most painful.

Discussion

- Wide distribution of mean blood glucose between patients:
  - Changes in mean blood glucose were not unidirectional.
  - At the extremes, 51 mg/dL lower or 46.9 mg/dL higher from one injection site to the next in the same person.
  - Explanation likely multifactorial, including body mass index, amount of subcutaneous fat at the injection site, injection technique, and use of biphasic vs. basal-bolus insulin regimens.

- Recommendations:
  - Continue to recommend consistent use of same insulin injection site.
  - Close monitoring for those wishing to change sites.
  - Physicians should ask where a patient injects insulin while obtaining a medication history.

- Results of this research justify continuing the investigation in a larger, multicenter study employing our methods.

Conclusions

Unpredictable changes in mean blood glucose were observed when changing the subcutaneous injection of insulin from the abdomen to the other upper arm or thigh in patients with type 2 diabetes. Based on these findings, we cannot definitively conclude how blood glucose will change when altering insulin administration sites. Clinicians should be conscious of these inconsistent results and take site administration into account when evaluating insulin’s efficacy.

Disclosure

The authors of this presentation have no conflicts of interest to disclose.

References