Pilot Trial of STAR in Medical ICU


INTRODUCTION

Background: Accurate glycemic control (AGC) has proven difficult without excessive hypoglycemia risk. Stochastic TARGeted (STAR) glycemic control forecasts changes in insulin sensitivity to calculate a range of glycemic outcomes for an insulin intervention using the ICING model pictured below, creating a risk framework to increase safety and performance.

Objective: Evaluate the performance, safety and clinical applicability of STAR, as observed during pilot trials in Christchurch Hospital Medical ICU.

METHODS

N=13 hyperglycemic patients (blood glucose >145mg/dL) were consented from Christchurch Hospital Medical ICU to participate in the pilot trial. Tablet PCs loaded with the STAR algorithm were placed at each bed, and were consulted by nursing staff after each blood glucose (BG) glucometer reading was taken. Measurement frequency was nurse-managed within a range of 1-3 hours, with 2 and 3 hour measures only offered if excessive risk of either hyper- or hypoglycemia was not foreseen.

Enteral nutrition between 30-100% ACCP goal, and held constant when called for by dieters. IV insulin boluses were delivered each hour, with doses ranging from 0-6 U and maximum increase between interventions limited to +2U to prevent over-responding to changes in BG. Insulin infusions (1-3 U/hr) were used in addition for patients with consistently high insulin requirements (> 5U/hr for 5 hours).

BG target choices were clinically made, with 80-145mg/dL for the majority and a raised target chosen for poorly controlled diabetics and other exceptional cases.

RESULTS

Median BG was 109 mg/dL for N=10 80-145 mg/dL target patients and 145 mg/dL for N=3 108-162 mg/dL target patients.

In total, 85.6% of time was in the specified target band, with 1.18% of BG>72mg/dL and 2.41% BG>80mg/dL. BG measurement frequency was 13.3 measures/day, with a slight increase to 13.6 measures/day for the raised target. Per-patient median carbohydrate intake was 5.4g/hr [IQR: 2.5-8.1g/hr] and median insulin usage was 2.5U/hr [IQR: 1.0-4.5 U/hr].

These results were achieved across a range of patient types from a medical ICU. Observed response to insulin (quantified as median insulin sensitivity) varied by a factor of 26x between patients. This wide variance indicates accurate control was maintained over a range of metabolic conditions, implying STAR was able to adapt safely. During periods on STAR dramatic changes in condition were observed (Figure 2), patients were given high-dose steroids known to inhibit insulin action (Figure 3), as well as the long-acting insulin analogue Glargine.

CONCLUSIONS

STAR was able to provide AGC in a clinical setting, with tight and accurate control extended to patients with a range of metabolic requirements. The risk-management approach proved capable of balancing clinical workload and risks presented by patient variability.