Background

Sustained hyperglycemia is a known risk factor for adverse outcomes in the critically ill patient, whether or not the patient has a history of diabetes mellitus [1-3]. There are many factors that affect glycemic control; metabolic derangement and counter-regulation, increased stress, decrease insulin (resistance or underproduction), increased glucose administration just to name a few [4,5]. Although short term glycemic increases related to stress are not associated with rise in mortality in all populations [1,6,7].

Intensive insulin therapy is emerging as a treatment modality. At the time of our study, other than cardiovascular surgery patients [1,8,9], it was uncertain what specific patient populations benefit from intensive insulin therapy. Other populations are beginning to emerge in the literature [7]; trauma patients [10,11], intraoperative [12], and medical patients [13,14].

Despite some uncertainties, the management of hyperglycemia utilizing insulin protocols is fast becoming a new standard in critical care practice [1,13-23]. Nurse initiated protocols generally have been found to improve patient care [13,17,22], limit the prescribing variability [15,16,18,20,24] and contribute to financial cost savings [17]. However it is unknown if a nurse initiated IIP is effective and safe across different ICU populations. Also, it appears similar protocols in different populations' yields different clinical outcomes [9,14]. It is unclear if the protocol or operation of the protocol leads in part to these differences.

In this study we sought to determine if the IIP was effective and safe in bringing blood glucose values within the target range of 100–150 mg/dL among the three different ICUs (surgical, medical and coronary care). We were also interested in glycemic control across different ICU populations in the first 48 hours after the IIP was discontinued, when the patients transition out of the ICU.

Methods

Design

We conducted a descriptive retrospective review of 366 patients having 28,192 blood glucose values in the analysis of outcomes after Mayo Foundation Institutional Review Board (IRB) approval was granted. Patients had been cared for in one of three ICUs in a quaternary care hospital at Mayo Clinic Rochester, MN where an intensive insulin protocol was utilized. The ICUs included a 24-bed Surgical Trauma Intensive Care Unit (STICU), a 24-bed Medical ICU (MICU), and a 16-bed Coronary Care Unit (CCU).

Patients

Inclusion criteria included adult patients, 15 years of age and older, admitted to STICU, MICU or CCU who had a blood glucose level greater than 150 mg/dL while on the unit and were placed on an IIP during the identified data collection time frame October 2003-June 2004. 366 out of 386 eligible patients were used for data analysis. Eighteen patients were excluded since they did not grant approval for use of their data for research purposes. One patient was not started on insulin drip and one was on a modified insulin drip prior to ICU admission. There were not any other exclusion criteria. Patients readmitted to the ICU during the same or subsequent hospitalization were

Table 1: Patient characteristics

	STICU (n = 162)	MICU (n = 110)	CCU (n = 94)	*p* Value
Age, mean (SD)	59.9 (19.5)	61.4 (17.6)	67.8 (12.7)	0.01
Gender, Female, n (%)	79 (49)	57 (52)	35 (37)	0.09
Weight, kg, mean (SD)	90.5 (32.9)	84.7 (25.8)	87.4 (23.0)	0.70
Height, cm, mean (SD)	169.0 (9.6)	167.4 (19.4)	170.5 (10.2)	0.44
Diabetes, n (%)	48 (30)	47 (43)	57 (61)	< 0.0001
Medications				
IV/Oral Corticosteroids, n (%)	34 (21)	51 (46)	9 (10)	< 0.0001
Epinephrine/ Norepinephrine, n (%)	13 (8)	16 (15)	14 (15)	0.14
Beta blockers, n (%)	57 (35)	25 (23)	52 (55)	< 0.0001
APACHE III score, mean (SD)	n = 158 52.7 (21.9)	n = 109 67.3 (30.1)	n/a	< 0.0001
ICU LOS, days, median (IQR)	6.4 (3.3–13.2)	2.9 (1.3–8.7)	2.4 (1.3–4.2)	< 0.001
ICU mortality, n (%)	8 (5)	16 (15)	15 (16)	0.004
Hospital mortality, n (%)	12 (7)	21 (19)	25 (27)	< 0.001

ICU, Intensive Care Unit; STICU, Surgical Trauma ICU; MICU, Medical ICU; CCU, Coronary Care Unit; APACHE, Acute Physiological and Chronic Health Evaluation; n/a, not available; LOS, length of stay; IQR, interquartile range