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Evaluation of glycemic control with EndoTool Glucose Management System® for insulin infusion therapy

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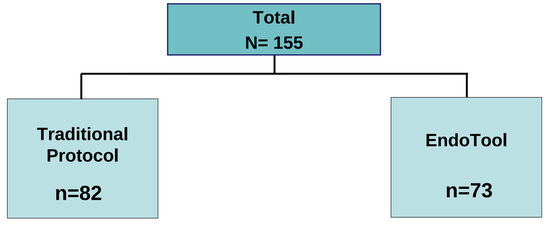
INTRODUCTION

- Traditional intravenous (IV) continuous insulin infusion protocols utilize linear, point-to-point formulas that do not account for differences in patient baseline characteristics such as diabetic status, weight, renal function, historic response to insulin, and receipt of therapies known to impact glycemic control.[1]
- EndoTool Glucose Management System® is a blood glucose (BG) management software produced by Monarch Medical Technologies that provides patient-specific, real-time insulin dose titrations and BG monitoring recommendations to allow for improved glycemic control.[2]
- Most guidelines recommend targeting BG between 140-180 mg/dL or <180 mg/dL in critically-ill patients in order to achieve adequate glycemic control while minimizing the potential for hypoglycemia.[3,4]
- Recent data suggest that lower target BG may be associated with survival in critically-ill patients.[5] Therefore, the goal BG range of 100-150 mg/dL was selected for our institution-specific algorithm.
  - After reviewing data on file with the EndoTool developers, this goal was thought to be achievable without increasing risk for hypoglycemia.
- The purpose of this study is to assess whether time to glycemic control is improved in critically-ill patients administered IV insulin with EndoTool compared with a traditional insulin infusion protocol.

METHODS

- Retrospective review of 155 patients ordered insulin infusion protocol from June-September 2014 (Traditional Protocol) and June-September 2015 (EndoTool).
- IRB approval was granted with a waiver of informed consent.
- Patients were identified through the medication administration database.
- **Inclusion criteria:** Patients ordered insulin infusion protocol and who received treatment for ≥12 hours.
- **Exclusion criteria:** Subjects <18 years of age, pregnant subjects, prisoners, and recipients of cardiothoracic surgery procedures within 24h of insulin order.
- **Primary outcome**
  - Time to glycemic control between groups; first recorded BG<150 mg/dL
- **Secondary outcomes**
  - Percent time in target range (BG 100-150 mg/dL) once target achieved, incidence of hypoglycemia (BG <70 mg/dL), severe hypoglycemia (BG <50 mg/dL), treatment of hypoglycemic events, frequency of BG monitoring, intensive care unit (ICU) and hospital length of stay (LOS)
- **Statistical analysis**
  - Descriptive statistics
  - Chi-square and Wilcoxon rank-sum tests were used as appropriate; p-value = 0.05

Figure 1: Subject stratification



Disclosure
Authors of this presentation have nothing to disclose concerning possible financial or personal relationship with commercial entities that may have a direct or indirect interest in the subject matter of this presentation.

RESULTS

Table 1: Demographics

Baseline characteristics	Traditional n=82	EndoTool n=73
Age (mean, years ± SD)	66 ± 15.1	63.4 ± 13.8
Gender, (% male)	38 (46.3)	40 (48.8)
Past medical history		
Type 1 DM	29 (35.4)	26 (35.6)
Type 2 DM	46 (56.1)	44 (60.3)
Renal Disease	43 (52.4)	17 (23.3)
HTN	65 (79.3)	57 (78.1)
Dyslipidemia	69 (84.2)	54 (74.0)
Metabolic Syndrome	18 (22.0)	4 (5.5)
CAD	43 (52.4)	38 (52.1)
PAD	35 (42.7)	12 (16.4)
Previous Stroke	18 (22.0)	16 (21.9)
Clinical indication for insulin therapy		
DKA	10 (12.2)	15 (20.5)
Standard	71 (86.6)	58 (79.5)
HHS	1 (1.2)	0
Endocrinology Consult	37 (36.6)	30 (50.7)
Time to endocrinology consult, (HH:MM)	11:18	08:20

All data presented as n (%) unless otherwise specified; SD: standard deviation; HH:MM: hours, minutes

Figure 2: Median time to glycemic control

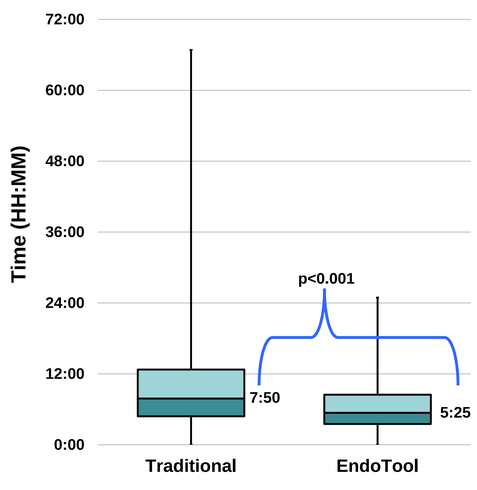
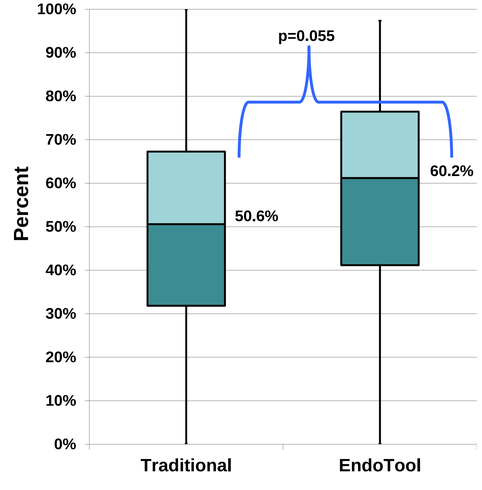


Figure 3: Percent time in range once at goal



RESULTS *(continued)*

Table 2: Length of Stay (LOS)

Outcome	Traditional n=82	EndoTool n=73	p-value
ICU LOS, median (IQR)	6 (2-14)	4 (1-14)	0.307
Hospital LOS, median (IQR)	12 (5-19)	8 (4-24)	0.384

All data presented in days; IQR (interquartile range)

Table 3: Hypoglycemia

Outcome	Traditional n=82	EndoTool n=73	p-value
Subjects experiencing any BG <70 mg/dL during infusion	34 (41.4)	9 (12.3)	p<0.001
Occurrences BG 50-69 mg/dL	68	21	
Occurrences BG <50 mg/dL	22	3	
Total	90	24	

All data presented as n (%) unless otherwise specified

CONCLUSIONS/RECOMMENDATIONS

- Our study demonstrates a statistically significant decrease in the time taken to reach glycemic control (BG <150 mg/dL) with EndoTool as compared to Traditional Protocol, 5h 25m vs. 7h 50m, respectively.
  - Future investigations should be conducted to assess the effect of reduced time to glycemic control on LOS and clinical outcomes.
- Patients managed on EndoTool were more likely to remain within the target BG range than patients on the Traditional Protocol, but statistical significance was not met.
  - BG variability has been associated with increased mortality in critically-ill patients.[6]
- EndoTool significantly reduced the probability of a subject experiencing a hypoglycemic event (BG <70 mg/dL) while ordered continuous infusion insulin.
  - Hypoglycemia increases the risk of mortality in critically-ill patients.[3,4]
- Reduced ICU and hospital LOS seen in the EndoTool group is clinically significant, despite the lack of statistical significance.
  - Reduced LOS is associated with fewer hospital acquired conditions and overall costs.[7,8]
- This study confirms EndoTool should be the standard of care for the management of patients receiving continuous infusion insulin at our institution.

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