Proof In the (Sugar-Free) Pudding: Implementing Computerized Insulin Drip Management

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Background

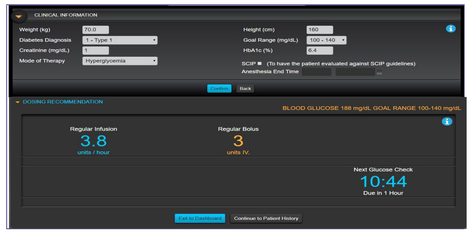
Learning Objectives:
- Explain the advantages of using a computerized system for insulin drip management.
- Describe basic outcome and process measures for patient care involving insulin drips.

This project focuses on the implementation of a computerized insulin drip management system in the ICU setting at a community hospital (Northwestern Medicine Lake Forest Hospital, "LFH") affiliated with an academic medical center (Northwestern Memorial Hospital).

This software uses a personalized, adaptive algorithm for insulin drip dosing, and also provides management prompts (such as the timing of the next blood glucose check), to facilitate safe and effective insulin drip management.

Over the past few years, computerized insulin drip management systems have proliferated across the healthcare system – automating a cumbersome manual workflow that has historically been reliant on paper nomograms and instructions. Multiple prospective and observational studies have demonstrated improved glycemic control via computerized systems versus traditional paper-based approaches.[1]

Figure #1: Software Initiation



Methods

For roughly one year prior to go-live, we convened a team of multidisciplinary stakeholders, which designed the workflow through a methodological approach.

We updated our insulin drip protocols, based on the most recent literature available on hyperglycemic crises. This would serve as the basis for the parameters that we programmed into the software – particularly the blood glucose goal ranges for diabetic ketoacidosis (DKA), hyperosmolar hyperglycemic state (HHS), and hyperglycemia.

We also developed a procedure for end-users of the software, via process mapping and FMEA (Failure Modes and Effects Analysis), to ensure that the workflow was engineered at the point of care.

Figure #2: High-Level Process Overview

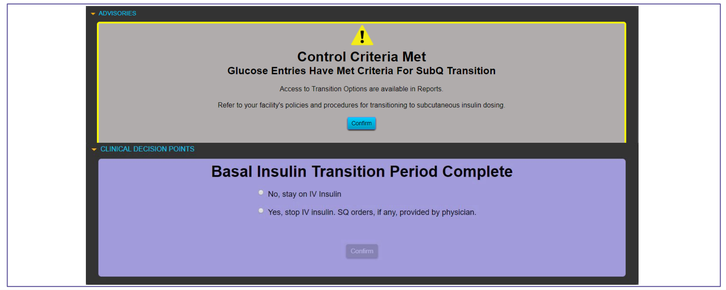
Role	Initial Management	Ongoing Management	Transitions
MD	Place orders from order set		Place order for SQ insulin

RN	• Enter initial clinical information into software
	• Check POC BG
	• Enter POC BG into software
	• Dose insulin drip as per software
		• Re-Check POC BG at recommended time
		• Enter POC BG into software
		• Follow software's updated treatment recommendations:
		  • Re-dose insulin drip
		  • Treat hypoglycemia/pre-hypoglycemia
			When prompted:
			• Initiate dextrose
			• Initiate SQ transition
			• Discontinue insulin drip

To operationalize the software-based protocol, we updated our order sets to include decision support regarding the parameters to be entered into the software (as the software is not fully integrated into our EHR). We also added customized orders for dextrose and other supplemental carbohydrates, to align with anticipated management prompts from the software.

To streamline the workflow, we designated the RN (rather than patient care technician-PCT) as the person responsible for checking the point-of-care blood glucose. This reduced duplicative work (as the RN must enter the room after each blood glucose check anyway, to engage the software), and eliminated an extra layer of communication between RN and PCT. We also increased the number of glucometers on the unit, to mitigate potential accessibility issues.

Figure #3: Examples of Management Prompts

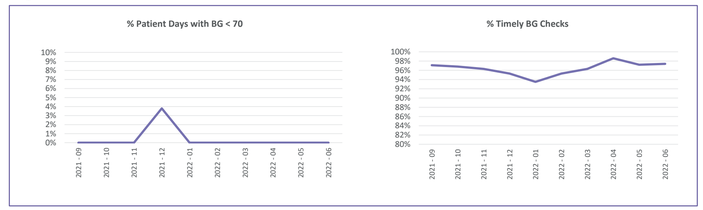


Results

Since implementing a computerized glucose management system in our ICU in late August 2021 (through June 2022), we have had 0.6% patient-days with blood glucose less than 70 mg/dL (359 patient-days), and 0 patient-days with severe hypoglycemia. We have also had a rate of 96.1% timely blood glucose checks (defined as being performed up to 30 minutes later than the expected recheck time).

We do not have pre-implementation data available for comparison, as it is difficult to create data logic that circumscribes this nuanced process without the aid of a computerized system that specifically focuses on this workflow. However, our post-implementation data on hypoglycemia is very encouraging and is consistent with our expectations based on literature review.

Figure #4: Outcome and Process Measures



The additional insight into the nursing workflow afforded by the analytics platform also facilitates sustainment of our processes.

For accountability, we report out our performance to hospital leadership monthly. We are also beginning to leverage the data from multiple sites within our hospital system, to potentially identify opportunities to improve and standardize practice.

Conclusions

- The implementation of a computerized insulin drip management system has led to a very low rate of hypoglycemia for patients on insulin drips at our hospital.
- The analytics platform provided by the computerized system allows for insight into glucose management outcomes and processes within this nuanced workflow, which otherwise would be difficult to obtain.
- Thoughtful workflow design (protocol/procedure) is integral to achieving optimal performance -- to ensure that the software is seamlessly integrated into the workflow, and to streamline the aspects of the workflow that are outside the scope of the software.

Reference

(1) Davis GM, Galindo RJ, Migdal AL, Umpierrez GE. Diabetes Technology in the Inpatient Setting for Management of Hyperglycemia. Endocrinol Metab Clin North Am. 2020 Mar;49(1):79-93. doi: 10.1016/j.ecl.2019.11.002. PMID: 31980123; PMCID: PMC7453786.
(2) Images (used with permission from Monarch Medical Technologies, Charlotte, NC. https://monarchmedtech.com)

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