Inpatient Glycemic Management: What Are the Goals and How Do We Achieve Them?

Preface

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The publication of this *Diabetes Spectrum* From Research to Practice section on inpatient glycemic management coincides with my 10th anniversary as an inpatient diabetes nurse practitioner at New York-Presbyterian Hospital/Weill Cornell Medical Center in New York City. This decade has been a remarkable journey, marked by a slow but steady national shift from sliding-scale to basal-bolus insulin therapy in hospitals, with an accompanying culture change from one in which the majority doubted the dangers of inpatient hyperglycemia to a new reality in which more health care professionals (HCPs) realize that, for inpatients, "glycemic control *really* matters."

Hyperglycemia is common in hospitalized patients with and without diabetes.[1] Since 2004, various organizations have published inpatient guidelines,[1–4] but these have been based on limited evidence and a great deal of expert opinion and have not always been widely adopted. Because of the lack of evidence and continuing debate over best practices, the PRIDE (Planning Research in Inpatient Diabetes) research group formed and published a call to action[5] to promote clinical trials testing high-quality, cost-effective, and sustainable inpatient hyperglycemia management strategies.

There are many components to inpatient glycemic management, all of which require ongoing assessment and care coordination to achieve targets in the setting of acute illness. The first task is to recognize hyperglycemia and diabetes in hospitalized patients. High-risk individuals must be identified soon after admission and appropriately monitored to ensure adequate treatment.[1] Glycemic targets should be well known to all clinical staff, and these patients' daily glucose results should be reviewed during rounds and in shift reports so timely action can be taken to initiate and intensify therapy as needed.

Inpatient treatment of hyperglycemia mirrors the key strategies we rely on for outpatients: meal planning, pharmacological therapy, hypoglycemia prevention, and self-management education. The additional challenge in acute care is that patients often are quite ill from other conditions and may have limited ability to participate in self-care. Here, we provide an update on strategies to manage diabetes and hyperglycemia during hospitalization and to send patients home with a safe and effective discharge plan.

Whether at home or in the hospital, nutrition plays a key role in achieving glycemic targets. Over the past decade, hospital meals have been moving from a focus on calories to a more diabetes-friendly consistent-carbohydrate meal plan, as suggested by the Endocrine Society.[1] Thus, our discussion begins with an article by Donna B. Ryan, MPH, RN, CDE, and Carrie S. Swift, MS, RD, BC-ADM, CDE (p. 163), about one of our greatest challenges: how to better coordinate the timing of blood glucose monitoring, insulin administration, and meal delivery in the fast-paced inpatient arena. These authors include a list of quality improvement strategies that may resolve some of the barriers to improving coordination of these key tasks. They also identify potential roadblocks to adequate nutrition during hospitalizations and offer evidence-based solutions. Ryan and Swift stress the importance of interdisciplinary collaboration among prescribers, nurses, dietitians, and food service staff to promote the provision of opti-

mal meals and nutrition education to patients.

In our next article (p. 169), Charlotte Hodge, RN, NP, and Joyce Malaskovitz, PhD, RN CDE, clarify glycemic goals in critical care and noncritical care inpatient populations.[1,4,6] They discuss the uses of A1C testing in the hospital, including diagnosing diabetes, estimating insulin requirements, and providing more effective transitional care from hospital to home.[1,6] These authors remind us of the importance of patient education and discharge planning starting on the day of admission to give patients time to learn survival skills in a safe environment with assistance and encouragement. This strategy could help reduce emergency department visits and 30-day readmission rates.[7] Hodge and Malaskovitz also review hot topics such as health care–acquired conditions, recent changes in the SCIP (Surgical Care Improvement Project) measures for cardiac surgery patients, and Joint Commission Advanced Certification in Inpatient Diabetes requirements.[7,8]

Our next article (p. 174) provides an update on point-of-care (POC) blood glucose monitoring and whether the degree of accuracy of available devices negatively affects clinical outcomes. Author David C. Klonoff, MD, FACP, Fellow AIMBE, discusses the importance of hypo- and hyperglycemia prevention in acutely ill patients and advocates for more accurate devices that are verified and approved for use in critically ill patients. Klonoff, who is working with the U.S. Food and Drug Administration (FDA) in this endeavor, reviews the most recent International Organization for Standardization (ISO) standards for blood glucose meters (ISO 15197-2013) and compares them to the FDA's proposed new standards. He describes risk factors that can skew blood glucose readings in the acute care setting, as well as possible ways to reduce them.[9] Finally, he compares and contrasts analytical and clinical accuracy, looking at meter performance in terms of preanalytical, analytical, and postanalytical factors. Hospital-based HCPs rely on blood glucose monitoring results to initiate and modify insulin therapy, but how accurate do these results need to be given that insulin adjustments are generally made by ranges of values (e.g., 100–150 mg/dl)? Klonoff addresses this issue and stresses the importance of staff training to minimize factors that can contribute to inaccurate results.

The latest trends in pharmacological interventions to treat hyperglycemia and minimize hypoglycemia in acutely ill patients are reviewed next (p. 180). Carlos E. Mendez, MD, and Guillermo E. Umpierrez, MD, provide an overview of the dangers of short-term hyperglycemia during hospitalization and the benefits of insulin therapy as the best remedy for glycemic excursions. These authors assist readers in designing scheduled insulin protocols that address basal, prandial, and correction insulin requirements and replace the outdated sliding-scale insulin method.[1,6] They review clinical trials comparing the safety and efficacy of various insulin regimens and provide dosing algorithms to guide clinical practice. Although oral agents are not recommended during hospitalization,[1] their usefulness is still debated. Mendez and Umpierrez review commonly used oral agents and their limitations and potential hazards in the acute care setting. They also delineate the potential benefits of incretin therapy, highlighting the low risk for hypoglycemia and potential to impart cardiac benefits found in recent trials of GLP-1 receptor agonist infusion.[10,11] A table in their article lists the advantages and disadvantages of basal and bolus insulins and oral antidiabetic agents, making it a valuable teaching tool for hospital-based clinicians.

Teaching HCPs to manage and educate patients with diabetes and hyperglycemia is no easy task. Some hospitals have created an advanced role for select unit-based nurses to serve as diabetes "champions" or resource nurses for their peers. This model is particularly important given the number of inpatients who need to learn skills such as insulin administration, blood glucose monitoring, carbohydrate counting, and hypoglycemia prevention and treatment.[6] Donna L. Jornsay, BSN, CPNP, CDE, and E. Dessa Garnett, MSN, FNP, CDE, developed a diabetes nurse champion program, which was recently expanded to include other disciplines. Their article (p. 188) serves as a guide for readers who want to start or expand similar programs. They describe the topics covered, program structure, and interactive teaching strategies incorporated to train participants in the best methods of providing self-management education to patients. The fact that there are now 154 diabetes champions in a 600-bed site within their health care system is impressive. More hospitals should consider empowering nurses to take on this role as a strategy to promote safe discharge planning and prevent readmissions—with increased nurse satisfaction as a bonus. If nurses feel comfortable in their ability to teach survival skills, patients will have daily opportunities to practice these skills and will return home with a greater degree of self-efficacy.

Transitional care from inpatient to outpatient settings has become a topic of increasing interest since the Centers for Medicare & Medicaid Services introduced its Readmission Reductions Program.[12] The Agency for Healthcare Research and Quality recommends interventions such as medication reconciliation at the time of discharge and formal communication with patients and their next providers regarding changes in medication, the need for follow-up tests and procedures, scheduling of next appointments, and provision of self-management education.[6,13] The Transitional Care Model (TCM) has been successfully used with older patients with diabetes. In an article on p. 192, Karen B. Hirschman, PhD, MSW, and M. Brian Bixby, MSN, CRNP, describe the TCM and provide a case study to showcase its components. In this model, advanced practice nurses provide comprehensive care management that begins within 24 hours of admission and lasts up to ~ 2 months after discharge. The authors provide a table listing key features of the TCM, as well as a website readers can visit for more information. This article demonstrates how the TCM has led to improvements in patients' physical functioning and quality of life and reduced both time to next hospitalization and overall readmission rates. I hope readers will be inspired to test these and other strategies to promote patients' safe and long-lasting journey home from the hospital.

In addition to the research section, several articles published elsewhere in this issue of *Diabetes Spectrum* further our examination of inpatient glycemic management. In the Pharmacy and Therapeutics department (p. 218), Janet L. Kelly, PharmD, BC-ADM, provides a detailed account

of continuous insulin infusion both in and outside of the intensive care setting. Insulin infusions are the ultimate method of achieving glycemic control in the hospital because of the ability they afford to get to goal faster than with subcutaneous insulin. Kelly reviews the key components of an insulin infusion protocol and offers recommendations for monitoring its safety and efficacy. She stresses the importance of multidisciplinary participation and staff education throughout the planning, implementation, and ongoing evaluation of such a protocol. Her discussion also covers computerized infusion protocols, hypoglycemia prevention, POC blood glucose monitoring, use of glucose sensors, outcome measures, and when and how to transition patients from intravenous to subcutaneous insulin.

As HCPs implement new glycemic management strategies, it is important to closely track rates of hypo- and hyperglycemia to ensure that their efforts are paying off. Toward that end, Greg Maynard, MD, MSc, SFHM, and his colleagues review the value of glucometrics in the Care Innovations department (p. 212). "Glucometrics" is a fairly new term coined in 2006, when Goldberg et al.[14] used it to describe a method of analyzing inpatient blood glucose data. Maynard et al. describe a web-based data management program developed by Society of Hospital Medicine (SHM) experts to assess initial rates of hypo- and hyperglycemia, recurrent hypoglycemia, and treatment time for hypoglycemia. Users can track their progress and benchmark it against performance in other units within their hospital and in other hospitals. Customized reports can aid in evaluating quality improvement projects. External benchmarking can be a powerful tool to inform progress toward goals or to validate a need for change.

Finally, a feature article by Annabelle Rodriguez, MD, et al. (p. 197) shares the results of a 2012 SHM survey of hospitals believed to be leaders in inpatient glycemic control to assess the roles of nonphysician providers within their inpatient glycemic management teams. I was fortunate to serve on the multidisciplinary SHM Glycemic Advisory Panel that developed and administered the survey and analyzed the data. Rodriguez et al. describe survey respondents' successful strategies, as well as barriers they are facing, including patients' access to diabetes supplies at discharge and limited implementation of best practices across settings within their institutions.

I hope our focus on inpatient care, both in this research section and throughout the issue, will expand readers' knowledge of both the science and the art of inpatient glycemic management. I would like to thank the editorial team of *Diabetes Spectrum* for offering me the opportunity to serve as guest editor and coaching me through the process. I believe readers will find this issue to be a valuable primer on the latest strategies for improving inpatient glycemic control, and I challenge you to conduct clinical research to test these interventions. Determining best practices in this endeavor truly takes a village.

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