

Hospital Diabetes: Why Quality of Care Matters to Both Patients and Hospitals

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Introduction

Hospital patients with diabetes and hyperglycemia, compared with patients without diabetes, have an increased risk of mortality, increased incidence of complications, increased length of stay, and increased costs per admission. Hospital patients benefit when their physicians have expertise in treating diabetes and hyperglycemia. Hospitals need to have management systems to ensure that hyperglycemic inpatients achieve and maintain target blood glucose levels.

Safety Systems

Multiple safety systems must be in place at hospitals where intravenous insulin is used to effectively treat hyperglycemia and to avoid hypoglycemia. Systems are needed for the following hospital personnel: (1) nursing staff, so that nurses will be proficient in checking blood glucose levels; (2) clinical laboratory staff, so that glucose monitors will be maintained as accurate and disinfected; (3) medical staff so that insulin doses will be ordered at appropriate levels; (4) diabetes educator staff, so that patients can receive proper education in self-management; and (5) hospital administrators, to establish and support attainment of quality assurance programs. Use of electronic medical records in the hospital environment will facilitate adoption of and compliance with all these types of safety systems.

Importance of Hospital Diabetes

Since 1980, the number of hospital discharges with diabetes as any listed diagnosis has more than doubled.¹ According to the American Diabetes Association, 22% of all hospital inpatient days in the United States are incurred by people with diabetes.² Management of hospitalized diabetes patients, compared with diabetes patients in their free-living state, is becoming a specialty apart from managing outpatients with diabetes. Hospital diabetes management, compared with outpatient diabetes management, requires different glycemic goals, insulin dosing regimens, technologies, and metrics for assessing performance with different metrics. Because of the emerging importance and potential benefits of specific management methods for hospitalized diabetes patients, Diabetes Technology Society launched the annual International Hospital Diabetes Meeting last year, October 8 and 9, 2010, in San Diego, CA). This year, the meeting will be held November 18 and 19, 2011, in Barcelona, Spain.

Better Clarity Is Needed

Four important areas pertaining to improving hospital diabetes care, where better clarity is needed, include (1) glycemic goals, (2) tactics for diabetes management,

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(3) technology for diabetes management, and (4) quality of care. Additional empiric data from randomized controlled trials and consensus recommendations in these four areas are currently needed to better treat the many situations that arise during a hospitalization for a patient with established diabetes or a patient without diabetes who has transient hyperglycemia during a hospitalization.

Glycemic Goals

Consensus glycemic goals for hospitalized patients with hyperglycemia have evolved since 2000. There is increasing realization that hyperglycemia is associated with worse outcomes. Specifically, hyperglycemia prior to a surgical admission³ and hyperglycemia during a hospitalization are both associated with an increased risk of mortality and complications in surgical,⁴ medical,⁵ and pediatric⁶ patients. The American Association of Clinical Endocrinologists and the American Diabetes Association have jointly published a set of consensus recommendations for treatment of hyperglycemia of inpatients that sets levels for initiating insulin therapy, target glucose levels, and preferred rates of insulin administration for critically ill and non-critically ill patients.^{7,8} Glycemic variability is also becoming recognized as a risk factor for hospital mortality;⁹ however, metrics for describing this phenomenon have not been universally agreed upon, and the field has not yet been extensively studied.

Tactics for Management

Three emerging tactics for improving diabetes management in the hospital include the use of computer-based technology for insulin dosing, rational insulin therapy when transitioning a patient from the fasting state to the fed state, and provision of sufficient nutritional support for patients who cannot eat. Computerized algorithms for determining insulin doses have been demonstrated to provide better safety and efficacy than paper-based systems for hospitalized patients.¹⁰ These systems can recommend an optimal frequency for monitoring and treating glycemia (which might not necessarily be every hour), and they can deliver alerts to caregivers if glucose patterns are not within a predicted range. Basal/bolus insulin dosing has replaced sliding scale insulin dosing because the latter tends to alternately overtreat (immediately after a dose of short-acting insulin) and undertreat (soon after the sliding scale dose wears off and there is no basal insulin on board). A combination of basal insulin and bolus insulin (for correcting premeal hyperglycemia, covering meals proactively, and treating

other instances of hyperglycemia) leads to the smoothest glucose levels.¹¹ Patients can easily be transitioned from continuous intravenous insulin to subcutaneous time-release insulin when glucose levels are stable and when they begin to eat following a period of *nil per os*. Their therapy can then be advanced to also consist of bolus dosing.¹² The two main goals of nutrition support for patients with diabetes are to provide adequate calories to promote recovery without malnutrition and provide a plan for self-management following discharge.¹³

Technology

Engineered products are providing information to enhance management of hyperglycemic inpatients. In order to describe the patterns of glycemia that occur in hospitalized patients, it is necessary to develop a language and a set of agreed upon measures that describe the quality of glucose management during the admission. Glucometrics is a term that refers to the systematic analysis of blood glucose data.¹⁴ At this time, there are no consensus guidelines for describing inpatient glucose data. Descriptions of inpatient glucose data must include: (1) a definition of the patients' diagnoses; (2) the hospital treatment department or intensive care unit; (3) the time period during the admission; and (4) any restrictions on the relevant blood glucose measurements during any given time period. Examples of glucometric ratios can be calculated to include the ratio of glucose values within a specified range per total number of glucose values measured, the ratio of patients with particular glucose-related events per total number of patients studied, or the ratio of glucose-related events occurring in a patient or population per unit of time. Handheld blood glucose monitors or modified handheld glucose monitors for hospital use are frequently used in the hospital setting because they provide point of care results rapidly and inexpensively. There is concern that these devices, which were approved for outpatient use, might not be sufficiently accurate for determining insulin dosing as part of intensive insulin therapy.¹⁵ Blood analyzers provide point-of-care immediate information, and they are more accurate than handheld monitors, but they are much more difficult to work with and are rarely used in hospitals.¹⁶ New measurement technologies for hospital use, such as continuous intravenous glucose monitors, are currently under development. It is currently unknown how well currently available subcutaneous continuous glucose monitors can provide accurate information in hospitalized patients. Insulin pumps are widely used in the outpatient setting, and these devices are migrating

into the hospital setting also. These devices can provide better diabetes management in the hospital than subcutaneous multidose therapy with insulin; however, the nursing staff is often uncomfortable if patients are controlling any of their own therapy, especially when the therapy is insulin, a potentially dangerous drug. The best way for patients to benefit from insulin pump technology and for the hospital staff to be comfortable with safety of the technology is for the hospital to establish a formal written insulin pump policy for patients. Such a policy should consist of: (1) contraindications for continued insulin pump use; (2) rules to guide the medical staff about insulin pump management; and (3) a requirement that the patient sign an informed consent form that presents the criteria for continued use of their insulin pump continuous subcutaneous insulin infusion while hospitalized. In that case, insulin pump therapy can be safely continued in the hospital setting.¹⁷

Quality of Care

Quality of care for patients with diabetes and hyperglycemia is important to define and document, because this documentation determines how a hospital is assessed by patients and payers.¹⁸ Various measures go into the calculation of hospital ratings. These factors include lengths of stay, readmission rates, complications, and costs. Many hospitals are developing formal institution-wide diabetes treatment protocols to improve measures of quality of care for diabetes. These programs incorporate best practices that are translated into a set of procedures, orders, workflow designs, alerts, and consultations, which are compatible with the individual's hospital culture. Since October 1, 2008, Medicare has no longer been paying the incremental reimbursement associated with hospital-acquired conditions, such as poor glucose control, which includes ketoacidosis, hyperosmolarity, and hypoglycemic coma. It behooves hospitals now more than ever to establish programs to avoid such conditions. Furthermore, rapid readmissions may also not be covered. Therefore, careful discharge planning and discharge education are now even more important than ever to prevent misinformed actions or decisions by patients leading to readmissions.¹⁹ One vehicle for demonstrating quality of diabetes care is to become certified by the Joint Commission for Inpatient Diabetes. This process requires demonstration of performance measurements, implementation of care standards, documentation of performance, and evaluation of patient perception of care quality.²⁰

Conclusions

The treatment of diabetes and hyperglycemia in the hospital is coming under increasing scrutiny by clinicians who wish to improve the quality of care for clinical reasons and by regulators and payers who wish to evaluate the level of care for reimbursement reasons. The definition of quality of care for diabetes is currently under development, and it is not clear at this time exactly which activities comprise quality care and to what extent such defined quality care can actually prevent diabetes complications related to hyperglycemia and hypoglycemia in the hospital. New technology will help to provide data for glucometrics analyses and will also help to improve outcomes by providing more timely information to guide treatments.

Quality of care matters for both patients and hospitals. Hospital diabetes is a rapidly advancing field with important ramifications not only for patients in terms of improved clinical outcomes, but also for caregivers and hospitals in terms of improved reimbursements.

References:

1. Department of Health and Human Services, Centers for Disease Control and Prevention. Number (in thousands) of hospital discharges with diabetes as any-listed diagnosis, United States, 1980–2006. <http://www.cdc.gov/diabetes/statistics/dmany/fig1.htm>. Accessed December 2, 2010.
2. American Diabetes Association. Economic costs of diabetes in the U.S. in 2007. *Diabetes Care*. 2008;31(3):596–615.
3. Hatzakorzian R, Bui H, Carvalho G, Pi Shan WL, Sidhu S, Schrickler T. Fasting blood glucose levels in patients presenting for elective surgery. *Nutrition*. 2010. Epub ahead of print.
4. Feringa HH, Vidakovic R, Karagiannis SE, Dunkelgrun M, Elhendy A, Boersma E, van Sambeek MR, Noordzij PG, Bax JJ, Poldermans D. Impaired glucose regulation, elevated glycated haemoglobin and cardiac ischaemic events in vascular surgery patients. *Diabet Med*. 2008;25(3):314–9.

5. Umpierrez GE, Isaacs SD, Bazargan N, You X, Thaler LM, Kitabchi AE. Hyperglycemia: an independent marker of in-hospital mortality in patients with undiagnosed diabetes. *J Clin Endocrinol Metab.* 2002;87(3):978–82.
6. Palacio A, Smiley D, Ceron M, Klein R, Cho IS, Mejia R, Umpierrez GE. Prevalence and clinical outcome of inpatient hyperglycemia in a community pediatric hospital. *J Hosp Med.* 2008;3(3):212–7.
7. Moghissi ES, Korytkowski MT, DiNardo M, Einhorn D, Hellman R, Hirsch IB, Inzucchi SE, Ismail-Beigi F, Kirkman MS, Umpierrez GE, American Association of Clinical Endocrinologists, American Diabetes Association. American Association of Clinical Endocrinologists and American Diabetes Association consensus statement on inpatient glycemic control. *Endocr Pract.* 2009;15(4):353–69.
8. Moghissi ES, Korytkowski MT, DiNardo M, Einhorn D, Hellman R, Hirsch IB, Inzucchi SE, Ismail-Beigi F, Kirkman MS, Umpierrez GE, American Association of Clinical Endocrinologists, American Diabetes Association. American Association of Clinical Endocrinologists and American Diabetes Association consensus statement on inpatient glycemic control. *Diabetes Care.* 2009;32(6):1119–31.
9. Kronsley JS. Glycemic variability and mortality in critically ill patients: the impact of diabetes. *J Diabetes Sci Technol.* 2009;3(6):1292–301.
10. Davidson PC, Steed RD, Bode BW, Hebblewhite HR, Prevosti L, Cheekati V. Use of a computerized intravenous insulin algorithm within a nurse-directed protocol for patients undergoing cardiovascular surgery. *J Diabetes Sci Technol.* 2008;2(3):369–75.
11. Juneja R, Foster SA, Whiteman D, Fahrback JL. The nuts and bolts of subcutaneous insulin therapy in non-critical care hospital settings. *Postgrad Med.* 2010;122(1):153–62.
12. Braithwaite SS. Inpatient insulin therapy. *Curr Opin Endocrinol Diabetes Obes.* 2008;15(2):159–66.
13. Boucher JL, Swift CS, Franz MJ, Kulkarni K, Schafer RG, Pritchett E, Clark NG. Inpatient management of diabetes and hyperglycemia: implications for nutrition practice and the food and nutrition professional. *J Am Diet Assoc.* 2007;107(1):105–11.
14. Thomas P, E Inzucchi S. An internet service supporting quality assessment of inpatient glycemic control. *J Diabetes Sci Technol.* 2008;2(3):402–8.
15. Klonoff DC. The Food and Drug Administration is now preparing to establish tighter performance requirements for blood glucose monitors. *J Diabetes Sci Technol.* 2010;4(3):499–504.
16. Fahy BG, Sheehy AM, Coursin DB. Glucose control in the intensive care unit. *Crit Care Med.* 2009;37(5):1769–76.
17. Nassar AA, Partlow BJ, Boyle ME, Castro JC, Bourgeois PB, Cook CB. Outpatient-to-inpatient transition of insulin pump therapy: successes and continuing challenges. *J Diabetes Sci Technol.* 2010;4(4):863–72.
18. Braithwaite SS, Magee M, Sharretts JM, Schnipper JL, Amin A, Maynard G, Society of Hospital Medicine Glycemic Control Task Force. The case for supporting inpatient glycemic control programs now: the evidence and beyond. *J Hosp Med.* 2008;3(5 Suppl):6–16.
19. Kim H, Ross JS, Melkus GD, Zhao Z, Boockvar K. Scheduled and unscheduled hospital readmissions among patients with diabetes. *Am J Manag Care.* 2010;16(10):760–7.
20. Morrison K. The road to JCAHO disease-specific care certification: a step-by-step process log. *Dimens Crit Care Nurs.* 2005;24(5):221–7.