

Glucose Management by Registered Nurses for Adult Patients Hospitalized in Medical Wards: Structured Guidelines (Protocol) and Working Process

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Hyperglycemia in hospitalized patients is a common severe condition.^{1,2} The estimated hyperglycemia incidence in hospitalized patients exceeds 38%.³ This can lead to poor clinical results, extended lengths of stay, disability, and elevated morbidity.¹⁻⁴ According to recommendations from the American Diabetes Association (ADA) and the American College of Endocrinology (ACE),^{5,6} guidelines and protocols need to be developed for the efficient treatment of hyperglycemia.¹

A substantial proportion of the existing literature on protocol development concerns hospital intensive care units (ICUs) and patients receiving intravenous insulin. Protocol-based insulin treatment is considered the safest and most effective method to treat hyperglycemia and control glucose levels of surgical patients and medical patients in ICUs.⁷⁻¹¹ Treatment based on such protocols has consistently shown an improvement in patient care quality, reduced variability in physicians' orders, and reduced morbidity, lengths of stay in ICUs, and treatment costs.¹² One of the main recommendations from these studies is to focus on the increasing need for standardization of care in such patients to control glucose levels and manage care according to guidelines.^{1,3,13,14}

Despite the significance of this issue and the prevalence of the condition in medical wards, few studies have addressed the management of patients who receive subcutaneous insulin according to structured protocols. A retrospective study¹⁵ conducted at the Mayo Clinic medical center in the United States

between 2001 and 2004 examined treatment of hyperglycemia in patients who were diagnosed with diabetes or hyperglycemia and hospitalized in non-ICU wards. Of the 2,916 patients in the study, 20% who had chronic hyperglycemia and 42% who had fluctuating blood glucose levels during the first 24 hours of hospitalization were also discharged with poorly controlled glucose levels. The study concluded that inpatient glucose management was deficient and that inpatient insulin treatment was suboptimal. The investigators recommended introducing a training program that would focus on the importance of managing the glucose levels of hospitalized patients and providing instructions for how and when to modify treatment.

Despite the significance and international awareness of this issue, the literature specifying structured treatment protocols for medical patients hospitalized in general hospitals is lacking.

In Israel, the role of the National Diabetes Council is, among other things, to improve the treatment and quality of life of patients with diabetes through research development, training for clinical teams that treat diabetes, and health care education. The council is also charged with maintaining contact with European and global forums of diabetes associations and representing its interests in all international forums. (Additional information can be found at the Israel Diabetes Association Web site: www.sukeret.co.il.)

Recently, the Israeli National Diabetes Council articulated the need for standardization of care

in managing the glucose levels of hospitalized patients.¹⁶ The council's recommendations included the following:

- Practice should be based on a structured treatment protocol.
- Hospitalization should be used as an opportunity to control glucose levels and educate hospitalized patients.
- Definition of target glucose levels should include accepted minimum and maximum ranges.
- Deviant glucose values should be defined.

The council further emphasized the need to extend the authority of registered nurses (RNs) to make management-related decisions regarding insulin dose adjustments, with the aim of improving inpatient glucose control for patients with diabetes.

The aim of the project described here was to develop a standardized protocol for patients hospitalized in medical wards based on the recommendations available in the literature, as well as recommendations of the Israeli National Diabetes Council. The assumption was that practice based on such protocols would improve inpatient glucose management for patients with diabetes or hyperglycemia.

The protocol developed in this project included extending the decision-making authority of RNs and revising the interface between physicians and RNs in terms of decision-making authority and patient-care responsibilities. The project also precisely defined the target population of patients who should be treated on the basis of the protocol and outlined glucose management instructions based on glucose values. The protocol was approved by the administration and diabetes specialists at the Hadassah Medical Center in Jerusalem, Israel.

Rationale for Protocol Development

The number of hospital admissions of patients with diabetes at Hadassah Medical Center has increased by > 390% in the past 25 years, from 6,111 admissions between 1980 and 1985 to 24,242 admissions between 2000 and 2005. The continuous rise in the number of inpatients with

diabetes and the necessity for more effective blood glucose management created the need to develop treatment protocols to maintain and improve the quality of care of these patients. Until now, no standardized protocol for treatment of diabetes and hyperglycemia has been applied in the internal medicine wards, despite the fact that there are significant differences in approaches, methods of treatment, and follow-up of patients, both between wards and within the same ward among different physicians.

Before the protocol was implemented, patients in medical wards were treated with subcutaneous insulin on a sliding-scale regimen, with physicians using a broad and heterogeneous target range. The primary physician had exclusive responsibility for controlling glucose levels and determining types and doses of insulin. Nurses were responsible for blood glucose monitoring, diet control, patient education, and administration of insulin injections.

The ability of RNs to make independent decisions about how best to control patients' glucose levels was extremely limited. In general, physicians ordered insulin doses based on patients' blood glucose test results before each meal. This process required nurses to obtain physicians' orders to correct patients' glucose levels after every glucose test. Problems arose whenever physicians were not readily available, causing delays in insulin administration to correct out-of-range glucose levels and resulting in excessive glucose fluctuations among patients.

Given these issues and the recommendations of the Israeli National Diabetes Council, there was an urgent need to develop an accepted, uniform protocol for managing and treating diabetic inpatients in internal medicine wards.

The Protocol

The protocol was developed to achieve standardization of care for patients with hyperglycemia who are admitted to medical wards. Based on the joint work of physicians and nurses, it confers authority for glucose management decisions on RNs and defines appropriate interac-

tion among nurses, physicians, and other health care team members. Specifically, the protocol aimed to:

- Increase the quality of care of patients with diabetes hospitalized in medical wards
- Establish uniformity of treatment for patients with diabetes hospitalized in medical wards
- Achieve improved glucose control through regimens that are individualized to meet the specific needs of each patient and accepted by all involved clinicians
- Build a mutual basis of knowledge for nursing and medical staff members concerning diabetes management, treatment, and education
- Establish the responsibility and instill the commitment of nurses for managing patients' glucose levels

Toward that end, the protocol includes the project's background and aims; definition of terms; delineation of the authority and responsibilities of RNs and primary physicians; definition of the target population and exclusion criteria for use of the protocol; description of the treatment procedure and regimen; and guidelines for nurse training, reporting, and patient discharge. The following sections provide details on the principles contained in the protocol.

Glucose control regimen

1. The initial order must be given by patients' primary physician at the time of admission.
2. The method of treatment is based on a basal-bolus insulin regimen, taking into consideration the different types of insulin available.
3. The ordered regimen must include determination of a glucose target range (either 110–180 mg/dl or as defined otherwise by the physician).
4. The ordered regimen must include a scale for insulin correction doses that defines necessary changes to insulin doses to address glucose levels that deviate from the target range.
5. The physicians' orders must be renewed daily to address the forthcoming 24-hour period.

Nurses' self-sufficient decision-making

RNs are authorized to manage glucose levels by adjusting insulin doses based on their knowledge and the protocol guidelines. Informed by the results of capillary blood glucose measurements, RNs will decide whether to apply the correction scale in addition to the initial insulin dose ordered for a patient by a physician. The RNs also continue to have responsibility for monitoring patients' glucose levels and diet and for ensuring appropriate documentation.

Patient education

RNs have primary responsibility for educating patients about appropriate lifestyle behaviors. At the time of discharge, patients should understand the required treatment to follow at home, the need for self-care, the steps they should take to avoid complications, and the importance of compliance. Referrals to relevant community-based clinicians should be made as needed.

Team training

Training of diabetes care team members is key to ensuring that the protocol is adopted as a safe and effective tool for treating hospitalized patients with diabetes or hyperglycemia. Training for young physicians and nursing staff members includes imparting comprehensive knowledge about diabetes, its treatment options (including pharmaceutical therapies), patient education, and discharge procedures for patients with diabetes. Physicians and nurses also undergo joint training on the protocol-based treatment and its elements, including treatment simulations for the entire staff.

Ratifying the Protocol

The need to develop this protocol originated from the RNs working on medical wards. After obtaining administrative approval in principle, the protocol was developed by a multidisciplinary team that included internal medicine ward physicians and nurses, the director of the Diabetes Unit, diabetes specialists, a diabetes nurse coordinator, and a head nurse on an internal medicine

ward. The project was developed through the institution's nursing administration, which included the director of the Internal Medicine Division of Nursing, the academic coordinator of the Internal Medicine Division, the coordinator of nursing procedures and professional guidelines, and the deputy director of the research and development wing of nursing.

The protocol was ratified as follows within the hospital:

1. At the department level, by directors and head nurses of medical wards
2. At the professional level, by the Diabetes Unit
3. At the wing level, by the director of nursing
4. At the administration level, by the chief executive officer and other administrative team members

Protocol Training Program

Successful implementation of the protocol will depend on a training program that is customized to a multidisciplinary team and on the full assimilation of the protocol in hospital wards.

The nursing and medical staff who treat patients with diabetes or hyperglycemia will be trained on the goals of the protocol and its administration based on a basal-bolus insulin regimen, the use of an insulin dose correction scale as outlined in the protocol, and instruction in determining insulin doses. They also will receive general knowledge education on diabetes and its treatment, the principles of controlling and monitoring pharmaceutical diabetes therapies, patient education, and related topics. The training program was developed in conjunction with the In-Service Nursing Education Department and is based on requisite standards that apply to the clinical performance of physicians and nurses.

Learning will be reinforced with discussions on the various topics, accompanied by case studies, presentations of possible scenarios and simulations, and an exam at the end of the program. Nurses who prove that they have attained the required level of knowledge on completion of training will then be supervised by the hospital diabetes coordina-

tor and head nurse on their ward as they administer the protocol to five patients. If their performance is acceptable at that point, the nurses will be certified to treat patients independently under the protocol.

The Assimilation Process

After the training program, the protocol will be introduced into the medical wards, where all patients hospitalized with diabetes or hyperglycemia who are being treated with basal-bolus insulin will be uniformly treated with subcutaneous insulin according to the protocol.

Because successful assimilation depends on staff commitment and cooperation, head nurses and ward staff were enrolled in the protocol development process even before the protocol was drafted. When the protocol was completed, a draft was disseminated among physicians and diabetes specialists in the hospital for their comments and suggestions about modifications or improvements. Kick-start meetings with the Diabetes Unit team and directors of the Internal Medicine Wing were held to generate broad support for the definitions, procedures, and other elements in the program.

After the program was approved by the hospital administration, the head nurses developed an assimilation program, which included, among other elements:

1. Presentation of the topic in staff meetings
2. Definition of a schedule and selection of the most suitable candidates for the nurses' training program
3. A pilot program involving several patients before introducing the protocol for general use
4. Implementation on all hospitalized patients in medical wards

Summary and Conclusions

Hyperglycemia in hospitalized patients is a common severe condition leading to poor clinical results, extended lengths of stay, disability, and elevated morbidity. According to ADA and ACE recommendations, guidelines and protocols for efficient treatment of hyperglycemia should be developed. Recently, the Israeli National Diabetes Council acted

on the need for standardization of care by calling for inpatient management of glucose levels according to uniform professional guidelines. The council also emphasized the need to extend the authority of RNs to make management decisions about insulin doses, with the aim of improving glucose control in hospitalized patients.

Nurses are the professional authority who care for patients on hospital wards 24 hours a day and are the personnel who are closest and most accessible to patients. Therefore, the protocol described in this article expands the authority of nurses in controlling blood glucose levels in patients with diabetes.

The aim of this project was to develop a protocol for inpatients in medical wards, based on recommendations available in the literature and outlined by the National Diabetes Council of Israel. The protocol, based on the joint work of physicians and nurses, confers on RNs the authority to manage patients' glucose levels and defines the division of authority between nurses and physicians.

The implementation of the protocol includes a training program that is customized to a multidisciplinary team and assimilation of the protocol in all medical wards. Protocol effectiveness will be assessed in a study examining blood glucose control in hospitalized patients before and after its implementation.

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