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Original Research

Acute Management and Outcomes of Patients with Diabetes Mellitus Presenting to Canadian Emergency Departments with Hypoglycemia

Brian H. Rowe MD, MSc [a,b,*], Mira Singh MA [a], Cristina Villa-Roel MD, MSc [a,b], Lawrence A. Leiter MD [c], Irene Hramiak MD [d], Marcia L. Edmonds MD, MSc [e], Eddy Lang MD [f], Marco Sivilotti MD, MSc [g], Frank Scheuermeyer MD [h], Andrew Worster MD, MSc [i], Jennifer Riley MD [j], Marc Afilalo MD [k], Ian Stiell MD, MSc [l], Jean-Francois Yale MD [m], Vincent C. Woo MD [n], Samuel Campbell MD [o], for the Canadian Association of Emergency Physicians Research Consortium

[a] *Department of Emergency Medicine, University of Alberta, Edmonton, Alberta, Canada*
[b] *School of Public Health, University of Alberta, Edmonton, Alberta, Canada*
[c] *Keenan Research Centre, Li Ka Shing Knowledge Institute of St. Michael's Hospital and University of Toronto, Toronto, Ontario, Canada*
[d] *Division of Endocrinology and Metabolism, University of Western Ontario, London, Ontario, Canada*
[e] *Division of Emergency Medicine, University of Western Ontario, London, Ontario, Canada*
[f] *Alberta Health Services and University of Calgary, Calgary, Alberta, Canada*
[g] *Departments of Emergency Medicine and Pharmacology and Toxicology, Queen's University, Kingston, Ontario, Canada*
[h] *Department of Emergency Medicine, St. Paul's Hospital, Vancouver, British Columbia, Canada*
[i] *Division of Emergency Medicine, McMaster University, Hamilton, Ontario, Canada*
[j] *Department of Emergency Medicine, University of Toronto, Toronto, Ontario, Canada*
[k] *Emergency Multidisciplinary Research Unit, Jewish General Hospital, McGill University, Montréal, Quebec, Canada*
[l] *Department of Emergency Medicine, University of Ottawa, Ottawa, Ontario, Canada*
[m] *Division of Endocrinology and Metabolism, McGill University, Montreal, Quebec, Canada*
[n] *Division of Endocrinology and Metabolism, University of Manitoba, Winnipeg, Manitoba, Canada*
[o] *Departments of Emergency Medicine, Dalhousie University and Queen Elizabeth II Health Science Centre, Halifax, Nova Scotia, Canada*

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ABSTRACT

Objectives: This retrospective chart audit examined the demographics, investigations, management and outcomes of adult patients with diabetes mellitus presenting to Canadian emergency departments (EDs).
Methods: All sites conducted a search of their electronic medical records using International Classification of Diseases, Tenth Revision, codes to identify ED visits for hypoglycemia between 2008 and 2010. Patient characteristics, demographics, ED management, ED resources and outcome are reported.
Results: A total of 1039 patients over the age of 17 years were included in the study; 347 (33.4%) were classified as type 1 diabetes and 692 (66.6%) were classified as type 2 diabetes. Type 2 diabetes patients were significantly older (73 vs. 49 years; $p<0.0001$) and had more chronic conditions recorded on their chart (all $p<0.001$). Most subjects arrived by ambulance, and triage scores revealed severe presentations in 39% of cases. Treatments for hypoglycemia were common (75.7%) during prehospital transport; 38.5% received intravenous glucose and 40.1% received glucagon. Hypoglycemia treatments in the ED included oral (76.8%), intravenous (29.6%) and continuous infusion (27.7%) of glucose. Diagnostic testing (81.9%) commonly included electrocardiograms (51.9%), chest radiography (37.5%) and head computed tomography scans (14.5%). Most patients (73.5%) were discharged; however, more subjects with type 2 diabetes required admission (30.3 vs. 8.8%). Discharge instructions were documented in only 55.5% of patients, and referral to diabetes services occurred in fewer than 20% of cases. Considerable variation existed in the management of hypoglycemia across EDs.
Conclusions: Patients with diabetes presenting to an ED with hypoglycemia consume considerable healthcare resources, and practice variation exists. Emergency departments should develop protocols for the management of hypoglycemia, with attention to discharge planning to reduce recurrence.

* Address for correspondence: Brian H. Rowe, MD, MSc, Department of Emergency Medicine, University of Alberta, 1G1.42 Walter C. Mackenzie Centre, 8440-112 Street NW, Edmonton, Alberta T6G 2B7, Canada.
E-mail address: brian.rowe@ualberta.ca

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RÉSUMÉ

Objectifs : Cette vérification rétrospective des dossiers a permis d'examiner les données démographiques, les examens, la prise en charge et les résultats des patients adultes souffrant de diabète sucré qui se sont présentés aux services des urgences (SU) au Canada.
Méthodes : Tous les sites ont mené une recherche dans leurs dossiers médicaux électroniques à l'aide des codes de la Classification internationale des maladies, dixième révision, pour relever les visites aux SU entre 2008 et 2010 qui étaient liées à l'hypoglycémie. Les caractéristiques des patients, les données démographiques, la prise en charge aux SU, les ressources des SU et les résultats sont rapportés.
Résultats : Un total de 1039 patients de plus de 17 ans ont été inclus dans l'étude; 347 (33,4 %) ont été classifiés comme étant des cas de diabète de type 1 et 692 (66,6 %) ont été classifiés comme étant des cas de diabète de type 2. Les patients souffrant du diabète de type 2 étaient beaucoup plus âgés (73 ans *vs* 49 ans; $p<0,0001$) et avaient plus d'affections chroniques inscrites à leur dossier (tous $p<0,001$). La plupart des sujets arrivaient par ambulance, et 39 % des cas montraient des scores de triage qui révélaient des tableaux cliniques graves. Les traitements contre l'hypoglycémie étaient fréquents (75,7 %) durant le transport préhospitalier; 38,5 % recevaient du glucose et 40,1 % recevaient du glucagon par voie intraveineuse. Les traitements administrés dans les SU contre l'hypoglycémie comprenaient le glucose par voie orale (76,8 %), le glucose par voie intraveineuse (29,6 %) et en perfusion continue (27,7 %). Les examens diagnostiques (81,9 %) comprenaient fréquemment les électrocardiogrammes (51,9 %), la radiographie thoracique (37,5 %) et la tomodensitométrie crânienne (14,5 %). La plupart des patients (73,5 %) recevaient leur congé. Cependant, plus de sujets souffrant du diabète de type 2 nécessitaient une admission (30,3 *vs* 8,8 %). Les instructions de congé étaient étayées chez seulement 55,5 % des patients, et l'orientation vers des services de diabète se rencontrait chez moins de 20 % des cas. Une variation considérable dans la prise en charge de l'hypoglycémie existait entre les SU.
Conclusions : Les patients souffrant de diabète qui se présentaient à un SU en raison d'une hypoglycémie consomment considérablement de ressources en soins de santé, puis une variation est observée dans la pratique. Les SU devraient élaborer des protocoles de prise en charge de l'hypoglycémie en portant une attention à la planification du congé pour réduire la récurrence.

Introduction

Hypoglycemia associated with diabetes mellitus is a state characterized by abnormally low levels of blood glucose and is defined by 1) the development of autonomic or neuroglycopenic symptoms; 2) low plasma glucose levels (<4.0 mmol/L for patients treated with insulin or an insulin secretagogue) and 3) symptoms responding to the administration of carbohydrate (1). Many people without diabetes can have glucose levels in the hypoglycemia range without symptoms or disease; however, for people with diabetes, the severity of hypoglycemia is based on the clinical manifestations of their episodes. The Endocrine Society recommends a diagnosis of hypoglycemia be based on the combination of a low glucose level and evidence of adverse effects (2).

Hypoglycemia can produce a variety of symptoms and effects; most important is the impairment of function due to inadequate supply of glucose to the brain, resulting in cognitive impairment that may be mild, transient and reversed with nothing more than minor oral supplementation. Conversely, it may lead to potentially significant complications (e.g. seizures, permanent neurological sequelae and coma) (3). Moderate and severe hypoglycemia occurs as a complication of treatment of diabetes with insulin or insulin secretagogues. Hypoglycemia has been associated with an increased risk of cardiovascular events; its role as a mediator or a marker for severity is still unresolved (4). Numerous hypoglycemia events over a person's life span can negatively affect quality of life and represent significant indirect and direct economic costs to the healthcare system (5,6).

Hypoglycemia often results in presentation to the emergency department (ED), where acute treatment approaches vary and the relapse rate can be high, particularly when the event is related to non-insulin antihyperglycemic agents. Little research describing these presentations and variation in clinical practice has been conducted in the ED setting, and none in Canada. MEDLINE searches in late 2012 identified 1 Canadian study (7) and several American studies, including a multicentre chart review (8). The Canadian study was restricted to patients with type 1 diabetes, and in the American study, the investigators completed a 1-year chart review on consecutive hypoglycemia cases identified using the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes, not specific to diabetes. Limitations of this study are that presentations may be related to the United States (US) healthcare system of public and private health, and only 3 centres in 1 city were used.

The purpose of this study was to examine characteristics, resources and current protocols for hypoglycemia presentations across Canadian EDs, where care is transferable and universal for patients, and to describe the sociodemographic profile, investigations, management and outcomes of patients with diabetes presenting to EDs across Canada with hypoglycemia.

Methods

Study design

This medical record review study involved 11 adult community and teaching medical centres across 5 provinces in Canada between January 1, 2008, and December 31, 2010.

Study setting

The study involved 11 ED sites in British Columbia (1 site), Alberta (2 sites), Ontario (6 sites), Quebec (1 site) and Nova Scotia (1 site). All sites were members of the Canadian Association of Emergency Physicians (CAEP) Research Consortium (RC) network, and represented both English and French language sites. One site gathered data from a pediatric ED, which was not included in this analysis; 2 sites from the same city were merged to represent 1 site. Research teams conducting the chart reviews at each site were composed of nurses, medical students and physicians. On average, these sites saw more than 60 000 patients a year.