

Incidence and Disposition of Diabetic Emergencies by Paramedic Services in Halton, Ontario

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A B S T R A C T

OBJECTIVE

To review the incidence and type of disposition of diabetic emergencies treated in the community by paramedic services.

METHOD

All paramedic records over a 1 year period for a regionally operated emergency medical service (EMS) in Halton, Ontario, were reviewed for ambulance calls involving diabetic emergencies or capillary blood glucose (CBG) level <4.0 mmol/L.

RESULTS

There were 31 171 ambulance calls during the 1 year review period. 3.8% of ambulance calls (1169/31 171) met the inclusion criteria of being coded as a diabetic emergency or involving a CBG <4.0 mmol/L. Only 34.8% (407/1169) of ambulance calls coded as diabetic emergencies had a CBG recorded in the charts. Of those ambulance calls involving a patient with a CBG <4.0 mmol/L, 44.6% (165/370) were treated in the community and not transported to a hospital emergency department.

CONCLUSION

Paramedics treat a significant number of people with diabetic emergencies in the community and do not transport them to emergency departments. Analysis using only emergency

R É S U M É

OBJECTIF

Évaluer l'incidence et la prise en charge des urgences diabétiques dans la communauté par des travailleurs paramédicaux

MÉTHODE

À partir de tous les dossiers paramédicaux d'une année d'un service régional d'urgences médicales situé à Halton (Ontario), on a repéré les sorties d'ambulance faites pour des urgences diabétiques ou des glycémies capillaires (GC) < 4,0 mmol/L.

RÉSULTATS

Au cours de l'année évaluée, il y a eu 31 171 sorties d'ambulance; 3,8 % des sorties (1 169/31 171) répondaient aux critères d'urgence diabétique ou étaient attribuables à une GC < 4,0 mmol/L. La GC avait été notée dans seulement 34,8 % (407/1 169) des cas répondant aux critères d'urgence diabétique. Pour ce qui est des sorties d'ambulance pour une GC < 4,0 mmol/L, 44,6 % (165/370) des patients ont été traités en milieu extra-hospitalier plutôt que transportés au service des urgences d'un hôpital.

CONCLUSION

Les travailleurs paramédicaux traitent un nombre considérable de personnes en situation d'urgence diabétique en milieu extra-hospitalier et ne les transportent pas aux urgences. Les analyses effectuées à partir des données recueillies dans des services des urgences seulement pourraient beaucoup sous-estimer l'incidence de l'hypoglycémie

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department data may significantly underestimate the incidence of hypoglycemia in the community. We raise the point that there may be more hypoglycemic events in the community that require the assistance of a second party than is demonstrated by emergency room data alone. Further study of the incidence of hypoglycemia in the community is required.

KEYWORDS

Hypoglycemia, incidence of hypoglycemia, paramedic service

dans la communauté. Nous voulons attirer l'attention sur le fait qu'il pourrait y avoir davantage d'hypoglycémies qui exigent l'attention d'un deuxième intervenant que les données des urgences ne l'indiquent. Il faudra que d'autres études sur l'incidence de l'hypoglycémie soient menées

MOTS CLÉS

Hypoglycémie, incidence de l'hypoglycémie, travailleurs paramédicaux.

INTRODUCTION

The United Kingdom Prospective Diabetes Study demonstrated that each 1% reduction in A1C corresponds to an approximately 30% reduction in risk for diabetic complications (1). This finding has been reflected in the Canadian clinical practice guidelines published in 1998 and 2003 for type 1 and type 2 diabetes, both of which recommended lower target blood glucose (BG) levels to delay the onset and reduce the severity of diabetes-related complications (2,3). However, as patients and healthcare providers strive for these lower BG levels, the risk of hypoglycemia increases (1,4–7). Nevertheless, despite aggressive recommendations for lowering BG levels and the related potential increase in the risk of hypoglycemia, the Institute for Clinical Evaluative Sciences (ICES) reports that the number of cases of hypoglycemia treated in emergency departments in Ontario has significantly declined between 1995 and 1999 (8,9).

Using administrative data, Booth showed that hospitalizations for hypoglycemia dropped 76.9% between 1994 and 1999, and that emergency visits for diabetes-related complications fell 23.9% (8,9). Although this decline may be due in part to better implementation of guidelines, better patient understanding of diabetes through educational programs and improved patient adherence to treatment, we hypothesize that many potential cases of hypoglycemia never reach the emergency department (1,2). The actual incidence of hypoglycemia episodes in Ontario may be underestimated if based on emergency room data alone, partly due, for example, to improved management of hypoglycemia in the community because of improved training programs provided to paramedics.

In order to estimate the incidence and type of disposition of diabetic emergencies treated in the community by paramedic services, we conducted a retrospective review of the paramedic records over a 1 year period for 1 regionally operated emergency medical service (EMS) in Halton, Ontario.

METHOD

Paramedics in Ontario use a standardized data form to record the events of every ambulance call to which they are dispatched. These reports are collated by a staff member and entered into a computerized database. Paramedic reports for a 1 year period (September 1, 2003, to August 30, 2004),

collected from the Base Hospital Program for Halton Region, were examined.

Paramedics use "problem codes" to describe each ambulance call report. Problem codes are classified as *dispatch*, *primary*, *secondary* and *final primary*, depending on the time the code is assigned. The dispatch personnel and paramedics who attend the ambulance calls assign these codes. The dispatch code is assigned by the dispatcher and most appropriately applies to the information the dispatcher receives about the emergency call. The primary problem code reflects the working assessment of the main problem, while the secondary code refers to any treatable problems resulting from the main problem. The final primary code is assigned after the paramedic has attended the ambulance call and is the most likely cause of the presentation.

All records in which a problem code of "diabetic emergency" was recorded at any point during the ambulance call and all records with at least 1 capillary BG (CBG) reading of <4.0 mmol/L were included in the analysis. The Canadian Diabetes Association 2003 Clinical Practice Guidelines for the Prevention and Management of Diabetes in Canada define hypoglycemia as a low plasma glucose level and propose that 4.0 mmol/L be an operational clinical cutoff for patients treated with insulin or an insulin secretagogue (3). Although the guidelines include symptoms in the definition, few symptoms were recorded on data sheets, so the CBG reading was accepted as the basis for hypoglycemia in this audit.

Demographic data, age, sex, location of pickup, estimated weight, previous diagnoses and drugs being used prior to the episode were examined and collated to describe hypoglycemic events. Treatment data, including state of patient, initial BG values and administration of intravenous solutions and glucagon were analyzed to assess the process of care.

Analysis was conducted using SPSS statistical software (SPSS 11.0 for Macintosh, SPSS Inc., Chicago, Illinois, United States). Incidence rates were estimated using the total number of ambulance calls, population size for the EMS catchment area and estimated population of people with diabetes.

The ethics review board at the Joseph Brant Memorial Hospital in Burlington, Ontario, Canada, approved the study protocol.

RESULTS

There were 31 171 paramedic ambulance calls during the 1 year review period. The inclusion criteria (diabetic emergency code or a CBG of <4.0 mmol/L) were met by 3.8% of ambulance calls (1169/31 171). Of all patients classified by paramedic coding as having a diabetic emergency, 82.3% (962/1169) had had a previous diagnosis of diabetes and 37.5% (438/1169) were taking insulin. A comparison of the demographic characteristics of the ambulance calls that met the inclusion criteria, had at least 1 low CBG and were transported to a hospital are shown in Table 1.

Of the 1169 EMS calls that met the inclusion criteria, 34.8% (407/1169) had at least 1 CBG recorded. Figure 1 shows the number of CBG readings recorded during each ambulance call. Of the 407 ambulance calls that included testing for CBG, 37 involved BG levels >4.0 mmol/L. Although none of these patients had high BG levels, 75.7% of the episodes (28/37) were coded as a diabetic emergency in the final problem code. Of patients with a CBG <4.0 mmol/L, 2.7% (10/370) had a final problem code of "altered level of consciousness" and 6.8% (25/370) a code of "other medical trauma."

Of the ambulance calls that met the inclusion criteria, 55.7% (651/1169) were transported to hospital. Of those with a CBG <4.0 mmol/L, 55.4% (205/370) were transported to hospital, while the remaining 44.6% (165/370) were treated and remained in the community. Table 2 outlines on-site treatment with glucagon or dextrose.

The population of the Regional Municipality of Halton was approximately 400 000 (the mean between the 2001 census and the 2006 estimate). Using the ICES rate for diabetes in Halton, there are 18 000 people with diabetes, and the rate of ambulance calls for patients with CBG <4.0 mmol/L is 370/18 000 or 2055/100 000.

DISCUSSION

The 1169 ambulance calls with a problem code of "diabetic emergency" or with CBG readings of <4.0 mmol/L represented 3.8% of all the paramedic ambulance calls during that year, an average of 3.2 ambulance calls per day. Nearly half (44.6%) of the patients with CBG <4.0 mmol/L were not transported to an emergency department. It is reasonable to assume that had these patients not been dealt with by the paramedics, many would have gone to the emergency department for treatment.

While a diabetic emergency code can represent any diabetic emergency (not just hypoglycemia), the assigning of problem codes is at the discretion of the paramedics and we did not validate the use of the term. However, to limit our analysis to hypoglycemia episodes, we considered only those ambulance calls in which a CBG was recorded as <4.0 mmol/L; as a result, the actual number of hypoglycemic events may have been underestimated.

There are limited paramedic data from previous years to determine whether our data represent a change in the number of hypoglycemic events managed in the community. In 1996, the paramedic program was enhanced to improve the treatment of diabetic emergencies by administering glucagon to relieve symptoms of hypoglycemia in patients who had a CBG <4.0 mmol/L. Since December 1997, advanced care paramedics have been practising in Halton, and they have the ability to administer glucagon and dextrose. These factors may be significant in the decline in emergency visits for hypoglycemia.

Booth estimated a 24% decline in emergency visits for diabetic emergencies between 1995 and 1999 (8), but she was obliged to pool the hyperglycemia and hypoglycemia data, as the administrative coding used in her analysis did not allow for separation of diagnoses.

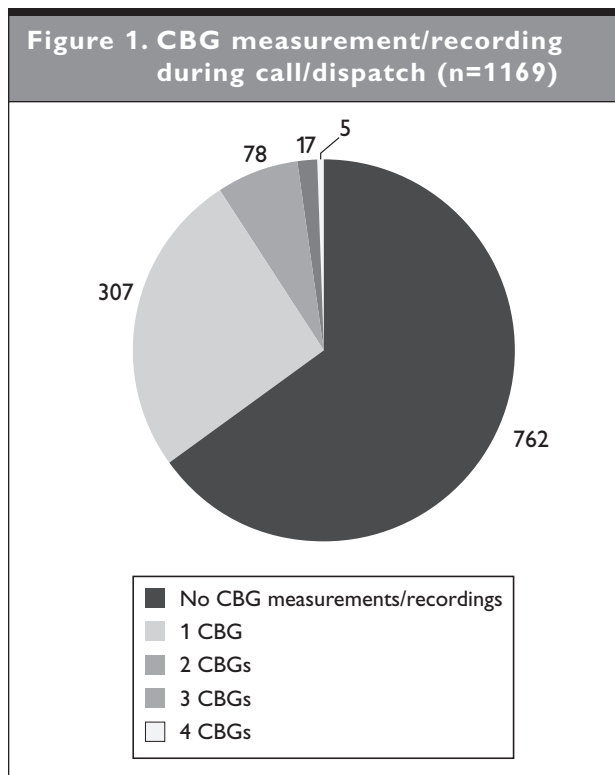
Table 1. Demographic factors associated with diabetic emergencies

	All calls/ dispatches (n=1169)	Patients transported (n=651)	Patients not transported (n=518)	Patients with CBG <4.0 mmol/L (n=370)
Mean age, years (range, SD)	56.2 (11–100; 20.6)	59.9 (11–100; 21.3)	51.5 (14–86; 18.7)	56.7 (11–100; 20.2)
Gender female, n (%)	479 (41.0)	316 (48.5)	163 (31.5)	145 (39.2)
Previous diabetes, n (%)	962 (82.3)	479 (73.6)	483 (93.2)	313 (84.6)
Oral hypoglycemia, n (%)	185 (15.8)	123 (18.9)	62 (12.0)	49 (13.2)
On insulin, n (%)	438 (37.5)	206 (31.6)	232 (44.8)	140 (37.8)
CBG recorded, n (%)	407 (34.8)	228 (35.0)	179 (34.5)	NA
Transported to ER, n (%)	651 (55.7)	NA	NA	205 (55.4)

CBG = capillary blood glucose

ER = emergency room

NA = not applicable



CBG = capillary blood glucose

Glucagon was given to only 92 patients who met the study inclusion criteria: 87 patients with a CBG <4.0 mmol/L and 5 with a CBG >4.0 mmol/L. We were not able to ascertain why the other patients with CBG <4.0 mmol/L did not receive glucagon or dextrose. A prospective review of these practices might clarify issues of treatment. Further, there were 762 ambulance calls coded as diabetic emergencies in which a CBG was not recorded. This is surprising, as CBG is a good tool for measuring the severity of a diabetic emergency. A review of CBG practices needs to be completed.

Socransky reported that 5.2% of paramedic calls were for hypoglycemia, defined as all adult patients with a field assessment of hypoglycemic signs/symptoms and a finger-stick glucose <80 mg/dL (10). The current study did not consider signs and symptoms of hypoglycemia, as the information pertaining to these symptoms was sparsely recorded. Using only the 370 patients who had a CBG <4.0 mmol/L, the rate of ambulance calls for hypoglycemia compared to all ambulance calls during that year was 370/31 171 (1.2%). This is a very low rate of hypoglycemic emergencies compared to other studies (1,10-12).

There are several limitations to our analysis. The data were based on a retrospective chart audit and, as such, were subject to deficiencies in data recording. Data recording is limited by the urgency of the care given versus the documentation of the care given; some CBG tests may have been conducted but not recorded. The data were also limited to a 1 year time frame and 1 emergency medical region, further

Table 2. Patients treated with glucagon or dextrose

	Total diabetic emergencies (n=1169)	CBG recorded (n=407)	CBG <4.0 mmol/L (n=370)
Glucagon, n (%)	92 (7.9)	87 (21.4)	86 (23.2)
Dextrose, n (%)	213 (18.2)	205 (50.4)	205 (55.4)

CBG = capillary blood glucose

limiting the generalizability of any conclusions. The criteria to select ambulance calls for our review based on paramedic codes for a diabetic emergency recorded at any time during the call were very inclusive and encompassing of all diabetic emergencies (not just hypoglycemia). The choice of codes used on the data forms was at the discretion of the paramedics, and the use of these terms was not validated.

CONCLUSION

Paramedics frequently treat hypoglycemia and diabetic emergencies in the community, and as many as 44.6% of all ambulance calls treated by paramedics are not transported to emergency rooms. The incidence of hypoglycemia as measured by emergency room visits alone may significantly underestimate the problem. Further studies of diabetic emergency care provided by paramedics and the incidence of hypoglycemia in the community are warranted.

ACKNOWLEDGEMENTS

We wish to acknowledge the contributions of the paramedics who work out of the Halton Region Base emergency medical services (EMS) unit for all their work documenting the runs they perform; Terri MacAleese, who entered the data and helped us understand the database; and Carrie Parkinson, who first raised the issue of diabetic emergencies treated by EMS. Funding was provided by the Team for Individualizing Pharmacotherapy in Primary Care for Seniors (TIPPS) program.

AUTHOR DISCLOSURES

No duality of interest declared.

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