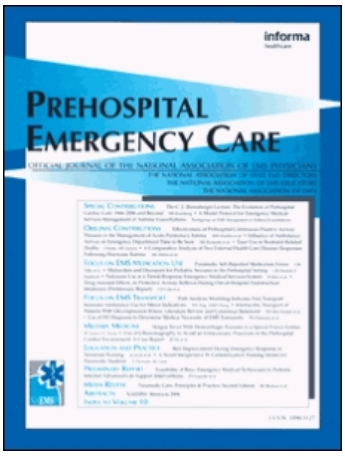

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PREHOSPITAL HYPOGLYCEMIA: THE SAFETY OF NOT TRANSPORTING TREATED PATIENTS

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EDUCATION AND PRACTICE

PREHOSPITAL HYPOGLYCEMIA:

THE SAFETY OF NOT TRANSPORTING TREATED PATIENTS

Ed Cain, MD, Stacy Ackroyd-Stolarz, MSc, Peggy Alexiadis, BA, BSc, RRT, Daphne Murray, BN

ABSTRACT

Objectives. Emergency medical services (EMS) personnel frequently encounter patients who refuse transport after being treated for a hypoglycemic episode. The outcomes of most of these patients are unknown. The purpose of this study was to determine the outcomes of patients treated and not transported for hypoglycemia and identify criteria that could be used to identify patients who did not require transport to hospital. **Methods.** This was a prospective, observational study involving all adult (>15 years) hypoglycemic patients (blood glucose less than 4 mmol/L by glucometer) attended to by the EMS system in the Halifax Metropolitan area in the province of Nova Scotia during a ten-month interval. **Results.** There were 220 calls for adult patients with hypoglycemia. Of the 75 calls that resulted in transport, there were 17 further hypoglycemic episodes requiring a repeat call for an ambulance (22.7%) and three recurrences (4%). Of the 145 calls that did not result in transport, 40 further episodes of hypoglycemia (27.6%) and three recurrences (2%) were reported. These differences were not statistically significant (p = 0.43 and 0.33, respectively). There was also no statistically significant difference in the intervals between hypoglycemic episodes for patients transported (51.1 days ± 65) compared with patients not transported for their previous hypogylcemic episode (40.7 days ± 53.5) (p = 0.6). Of the 47 calls entered in the study, there were seven repeat calls for hypoglycemia (15%) and one recurrence (2.1%). The majority of patients did not follow up with their physician. **Conclusions.** Repeat episodes of hypoglycemia are common; however, recurrences within 48 hours are not. Admission to hospital is rarely required. There appears to be no difference in the incidence of recurrences and repeat episodes of hypoglycemia between transported and nontransported insulin-dependent patients, regardless of age. Given the high incidence of repeat episodes, paramedics and physicians need to emphasize the importance of follow-up. **Key words:** prehospital; emergency; transport; hypoglycemia.

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Diabetes mellitus is the most common endocrine disorder and hypoglycemia the most common endocrine medical emergency.[1] As a result of several recent studies,[2–4] patients and their physicians are aiming for as tight control as possible of blood glucose levels. One adverse effect that may result more often is hypoglycemia.

The immediate treatment is the restoration of blood sugar levels by ingestion of oral glucose or an equivalent, glucagon injection or nasal spray, or an intravenous (IV) dextrose solution. Often this reverses the central nervous system (CNS) signs and symptoms promptly and the patient is then able to eat. With the exception of sulfonylurea-induced severe hypoglycemia, this may be the only treatment required.[5]

With the increased knowledge of patients and their families, the availability of clinic or family physician follow-up, and the increased workload on emergency departments, many patients, paramedics, and physicians are questioning the medical necessity of patient transport to hospital for an uncomplicated hypoglycemic episode. However, several studies have demonstrated that patients who refuse transport for further assessment by a physician or are refused transport by emergency medical services (EMS) have a significant

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incidence of admission to hospital for the same medical complaint for which they called the ambulance.[6–9]

There is also increased liability exposure. Ayres states that "the greatest single medical and legal risk in EMS systems today is the failure or refusal to treat or transport a patient who desires such treatment and transport." He also states that patients who are not transported are responsible for 50–90% of litigation involving patient care issues filed against EMS systems.[10] However, at least three retrospective studies and one prospective short-term outcome study have concluded that the practice of treating and releasing hypoglycemic patients in the out-of-hospital setting appears to be safe.[11–14]

The Emergency Health Services Nova Scotia online medical control (OLMC) physicians frequently receive calls from paramedics in the field informing them that they have a patient who is refusing transport after being treated for a hypoglycemic episode. The outcomes of most of these patients are unknown. The purpose of this study was to determine the outcomes of patients treated and not transported for hypoglycemia and identify criteria that could be used to identify patients who did not require transport to hospital.

METHODS

Design

This was a prospective, observational study.

Population

The study included all adult (>15 years) hypoglycemic patients (blood glucose less then 4 mmol/L by glucometer) attended to by the EMS system in the Halifax metropolitan area during study period (August 17, 2000, to June 20, 2001) and not transported to hospital.

Setting

The province of Nova Scotia is served by a single ambulance service. All calls to 911 are answered at one of five primary service answering points (PSAPs). All requests for ambulances are transferred to a single provincial ambulance dispatch center. Here, using computer-aided dispatch (CAD), they are assigned a unique identifying number or master incident number (MIN). The nearest ambulance is then dispatched using Advanced Medical Priority Dispatch.

Ambulances are designated as advance life support (ALS) or basic life support (BLS) according to the crew members' registration levels. Paramedics in Nova Scotia are registered as P1 (basic care, automated external defibrillator (AED) use, IV monitoring, and provision of "symptom relief" medications—subcutaneous epinephrine, glucagon, nitroglycerin, salbutamol, and acetylsalicylic acid); P2 (P1 skills plus initiation of IVs, endotracheal intubation, and specific medications, including IV D50 [dextrose solution]); or P3 (equivalent to nationally registered emergency medical technician–paramedic [NREMT-P] in the United States). In terms of the Paramedic Association of Canada National Occupational Profiles, a Nova Scotia P1 is equivalent to a primary care paramedic (PCP) and a P3 is equivalent to an advanced care paramedic (ACP). All ambulances are equipped the same and contain the same drugs (controlled drugs are contained in pouches carried only by P2s and P3s).

Each ambulance carries a Bayer Glucometer Elite (Bayer Inc., Toronto, Ontario, Canada) blood glucose meter. This machine has been found to accurately determine blood glucose levels.[15] The procedure for using the Glucometer Elite calls for the paramedic, using universal precautions, to wipe the patient's fingertip with an alcohol swab, allow it to dry, and then puncture the patient's finger with the lancing device. The test end of the test strip is touched and held to the drop of blood until the glucometer beeps. The test itself then takes 30 seconds. The Glucometer Elite is capable of displaying a numeric value between 1.1 mmol/L (20 mg/dL) and 33.3 mmol/L (600 mg/dL). Beyond this range the meter will read "Lo" or "Hi." All glucometers are checked daily for accuracy using a "check strip."

All paramedics in Nova Scotia follow a single set of provincial policies and protocols. The protocols for suspected hypoglycemia and altered level of consciousness NYD (not yet diagnosed) call for the paramedic to check the patient's blood glucose with the glucometer and, if the result is <4 mmol/L, to administer oral glucose or IV D50 depending on the clinical state of the patient. Glucagon is used if the paramedic is not able to give IV glucose (beyond scope of practice or inability to start IV). All patients who refuse care and/or transport are asked to sign a "Refusal Form." This documents that the paramedic has explained to the patient the possible diagnosis, has explained the possible consequences of refusal, has given advice to the patient or his or her significant others, and has made an assessment of the patient' competence. For all patients who refuse transport and have abnormal vital signs, chest pain, shortness of breath (SOB), head injuries, or diabetes-related emergencies, and for refusals by parents of patients under age 5 years, the paramedics are required to call the OLMC physician. The OLMC physician may, but is not required to, speak directly with the patient.

Paramedics complete a patient care report (PCR) for every call whether there is patient contact or not. Copies of all PCRs are forwarded to a Quality Control

Paramedic for the area. All ALS calls, all patient refusals, all calls involving patients under 16 years of age, and 10% of all remaining PCRs are audited for compliance with protocols, documentation, assessment, and scene time standards and procedures performed. This is entered into a provincial database from which reports are produced. The protocol compliance for hypoglycemia during the study interval was 97%.

For the purposes of this study, paramedics in the Halifax Regional Municipality (population of 340,000, area of 5,550 square kilometres, 17,400 calls per annum) were asked to manage and document any hypoglycemic patient in the usual manner. If the patient refused transport, the Refusal form would be completed and the OLMC physician contacted. As per study protocol, before leaving, the paramedics informed the patient that another paramedic would be checking him or her within 24 hours. The paramedics then called the area supervisor and informed him or her of a potential patient for the study. The supervisor visited the patient, explained the study, and invited the patient to participate. If the patient agreed, he or she was asked to sign a consent form. The signed consent and a copy of the PCR then were dropped off to the study coordinator for data abstraction and follow-up. This was attempted within one week. The follow-up inquiry included a determination of compliance with instructions given by the paramedics, recurrence of symptoms, and, if symptoms had occurred, whether the patient had required treatment, had been transported to hospital, and had been admitted.

For the first five months of the study, case abstraction was carried out by a respiratory technician. For the second five months, case abstraction was performed by a registered nurse due to personnel changes. Both were trained to do case abstraction and had experience performing this work in previous studies. Any questions regarding data that were ambiguous, conflicting, or unknown were resolved by review of the PCR with and discussion between the coordinator and lead investigator. There was monitoring of the case abstractors by one of the investigators.

Case abstraction included age, gender, date, diabetic medication, pre- and posttreatment glucometer readings, vital signs, mental status, presenting symptoms, treatment administered, identifiable cause, transport, documentation of follow-up advice, and comorbid conditions, including renal dialysis, chest pain, dyspnea, alcohol intoxication, arrhythmias, and vomiting and/or diarrhea.

We looked at two groups. The first was all hypoglycemic patients identified by PCR review. For this group a recurrence was defined as signs and symptoms compatible with low blood sugar occurring within 48 hours of the initial event and requiring a call for an ambulance. The second group consisted of the patients from whom consent was obtained to enter into the study. A recurrence of hypoglycemia for this group was defined as signs and symptoms compatible with low blood sugar occurring within 48 hours of the initial event and requiring a repeat call for an ambulance, visit to a medical practitioner, or visit to a health care facility. This is in keeping with the definition of Socransky et al.[16] For both groups a repeat episode was defined as signs and symptoms compatible with low blood sugar requiring a call for an ambulance occurring at any time during the ten- month study period.

Ethics Review

This study was approved by the Health Sciences Human Research Ethics Board at Dalhousie University as well as the Ethics Review Committees of participating institutions.

Data Analysis

Descriptive epidemiological data analysis was performed using Stata statistical software version 6 (Stata Corporation, College Station, TX). Demographic and clinical data were tabulated to determine the frequency of relapse, outcomes, and compliance with paramedics' instructions. The differences between those who were transported and those who were not transported were determined using a chi-square test for categorical data (e.g., number of recurrences) and a Mann-Whitney U test for continuous data that were not normally distributed (e.g., interval between hypoglycaemic episodes).

RESULTS

From review of computer-aided dispatch (CAD) data, there were 17,416 emergency (lights and siren response) and urgent (non–lights and siren) calls for an ambulance in the Halifax Regional Municipality during the study months. Four hundred ninety-nine (2.9%) were for diabetic problems. From review of the PCR audit data, there were 220 calls for hypoglycemic adults. This accounted for 1.3% of all emergent and urgent calls for an ambulance.

Seventy-five (34%) of these 220 calls resulted in a patient being transported to hospital (66 individual patients). Of these calls, there were 163 initial calls and 57 repeat calls (calls for patients previously seen for hypoglycemia during the study period). Twenty-four patients were seen more than once during the ten-month period and accounted for 82 calls (24 initial calls and the 57 repeat calls). Two patients were seen eight times in the ten-month period. Of the 75 calls that resulted in transport, there were 17 further hypoglyemic episodes requiring a repeat call for an

TABLE 1. Repeat Episodes for All Hypoglycemic Patient Calls

	All	Transported	Not Transported	p
No. (%)	220	75 (34%)	145 (66%)	
Repeat	57 (25.9%)	17 (22.7%)	40 (27.6%)	0.43
Recurrences	6 (2.7%)	3 (4%)	3 (2%)	0.33
Mean interval for repeat episodes	48.8 days	57.1 days	40.7 days	0.60

ambulance (22.7%). Of the 145 calls that did not result in transport, 40 further episodes of hypoglycemia were reported (27.6%). These differences were not statistically significant (p = 0.43). The mean interval between hypoglycemic episodes for patients transported to hospital was 51.1 days (±65). For patients not transported, the mean interval was 40.7 days (±53.5) This difference was not statistically significant (p = 0.6) (Table 1).

Sixty-one calls were for patients older than 65 years. They made up 28% of all adult hypoglycemic calls. The incidence of repeat hypoglycemic episodes for this age group was 13% (16% for transported and 8% for nontransported patients) (Table 2).

In 54 calls (37% of 145 eligible), it was documented that the patient was invited to participate in the study. Two patients refused. Of the remaining 52 calls, a total of five did not meet inclusion criteria (in two calls, the patients were found to have pretreatment glucometer readings of greater than 4 mmol/L (72 mg/dL). In another three calls, the last recorded blood sugar was less than 4 mmol/L. This left a total of 47 calls eligible for inclusion in the study (41 individual patients). One patient was enrolled in the study four times over the ten-month period. Three other patients were each enrolled twice over the study period (Table 3).

In 13 (27.7%) of the study calls, the patients were unresponsive on paramedic arrival. In eight calls (17%), comorbid conditions were identified (Table 4). In 19 cases, no identifiable cause could be found (Table 5).

In 26 calls (55.3%), there was documentation that the patient was advised to follow up with his or her family physician. In 14 calls (29.8% of 47), patients reported following up with their family physician. In 27 calls (57%), patients indicated that they did nothing because they considered the episode to be an isolated event.

There were seven calls (15% of 47) for an ambulance at least one more time during the ten months (repeat episodes). There was only one (2.1%) recurrence (defined as signs and symptoms compatible with low blood sugar occurring within 48 hours of the initial event and requiring a repeat call for an ambulance, visit to a medical practitioner, or visit to a health care facility). This patient was an 18-year-old insulin-dependent diabetic male with decreased level of consciousness, a glucometer reading of 1.4 mmol/L (25 mg/dL) on the first call. His symptoms were completely reversed with D50. He had been out late the previous night and had had little to eat before the ambulance was called at 16:57. He had a recurrence just less than 48 hours later. He was again treated, but then transported by ambulance to the hospital where he was assessed and released from the emergency department. He did not have a family physician.

Only one study patient (of the 41) was admitted to hospital during the study period. This was an 81-year-old man who was taking oral hypoglycemics, presented with confusion, and had no charted comorbidities or an identifiable cause. He had an initial glucometer reading of 2.9 mmol/L (52 mg/dL). He was treated with oral sugar, had a posttreatment reading of 4.6 mmol/L (83 mg/dL), and appeared normal when paramedics left him at home with his son. Five days later, he was admitted to a general medicine ward for uncontrolled diabetes after another hypoglycemic episode.

One patient died one week after being enrolled in the study. The death was related to cancer and was an expected death.

DISCUSSION

Traditionally the role of paramedics has been to examine, treat, and then transport patients to an emergency department for further assessment and management. This includes the investigation for a cause of the hypoglycemic episode, evaluation of the overall health and functioning of the patient, including the patient's ability to monitor and control his or her blood sugars, and suggestions or arrangements for ongoing management and follow-up. As such, a standard of

TABLE 2. Repeat Episodes by Patient Age

	>65 Years			<65 Years		
No. (%)	61 (28%)			159 (72%)		
Repeat	8 (13%)			49 (31%)		
Recurrence	2 (3.8%)			4 (2.5%)		
	Transported	*Not Transported*	*p*	*Transported*	*Not Transported*	*p*
No. (%)	37 (61%)	24 (39%)		38 (24%)	121 (76%)	
Repeat	6 (16%)	2 (8%)	0.32	11 (29%)	38 (31%)	0.47
Recurrence	2 (5.4%)	0	0.36	1 (2.6%)	3 (2.5%)	0.67

TABLE 3. Patient Characteristics for 47 Calls in the Study

Male/female (%)	15/32 (3%/68%)
Age range	18–85 (mean 42 ± 17.4) years
Insulin dependent	45
Oral hypoglycemia	2
Pretreatment glucometer readings	0.7–3.8 mmol/L (mean 2.0 ± 0.7)
Posttreatment glucometer readings	4.5–20.0 mmol/L (mean 10.5 n ± 3.3)
Treated with D50	39 (83%)
Treated with glucagon	0.4 (8.5%)
Treated with oral glucose	4 (8.5%)
Repeat episodes	7 (15%)
Recurrences	1 (2.1%)

care has been set. Any alternative management should provide the same level of care and safety to patients. It is, therefore, incumbent upon any prehospital system actively or passively condoning the practice of prehospital "treat and release" to validate this in terms of patient safety, comfort, outcome, and satisfaction.

There are several concerns to consider when discussing the prehospital management of patients with hypoglycemia. They break down into two broad categories: medical (treatment and follow-up) and medical–legal (decision-making capacity and satisfaction of the patient).

The signs and symptoms of hypoglycemia can be divided into two symptom complexes. The first group—and usually the earliest—is the result of the sympathetic system as it attempts to raise the blood sugar. This includes sweating, tremor, and anxiety. The second group is the result of "neuroglycopenia"[1] and includes headache, lightheadedness, an inability to concentrate, altered level of consciousness, focal neurological signs, and seizures. The definition of low blood sugar is not clear-cut because it is known that the appearance of signs and symptoms is correlated with the rapidity and amount of drop in blood sugar.[17] Sympathetic symptoms tend to be most prominent with rapid drop in blood sugar.[17] In addition, the time it takes for signs and symptoms to reverse is dependent on the duration and severity of the hypoglycemia.[5]

The incidence of hypoglycemia is difficult to quantitate as studies may define it differently and many

TABLE 4. Comorbidities

	No.	Comment
Renal dialysis	4	Same patient
Chest pain	0	
Dyspnea	0	
Seizures	0	
Alcohol intoxication	0	
Arrhythmias	0	
Vomiting	1	
Diarrhea	1	
Pregnancy	2	Same patient

TABLE 5. Causes

	No.
Increased medication dose	2
Skipped a meal	11
Increased activity	3
No identifiable cause	19
Not documented	12
TOTAL	47

patients are able to recognize the earliest symptoms and take measures to abort the attack. Classically the diagnosis requires three criteria: symptoms and signs compatible with central nervous system (CNS) glucose deprivation, "laboratory" evidence of low blood sugar, and resolution of signs and symptoms after correction of the blood sugar.[17] The incidence also varies with what the patient is using to control his or her blood sugar. Miller et al., looking at patients attending a specialty diabetes clinic, found a prevalence of 12% in patients treated with diet alone, 16% for those using oral agents and 30% for those using any insulin.[18]

The Diabetes Control and Complications Trial[19] defined severe hypoglycemia as a set of symptoms and signs such as stupor, unconsciousness, and/or seizure resulting from low blood sugar that precludes self-treatment. Mulhauser et al.[20] found that 10% of insulin-dependent diabetes mellitus patients experienced at least one episode of severe hypoglycemia per year. Potter et al.[21] reported a similar incidence of 9% per year. Daniels et al.[22] noted 1.6 episodes of severe hypoglycemia requiring an ambulance per diabetic patient per year.

In 2001, 19% of all calls for an ambulance in Nova Scotia resulted in no transport, including 6.1% of patient-initiated refusals. The 66% incidence of hypoglycemic patients refusing transport that occurred in the ten-month study period is in keeping with other studies' findings of 34–69%.[11,13]

Besides the reversal of the acute signs and symptoms of hypoglycemia, a search for an underlying cause must be undertaken to avoid recurrences. This is highlighted by the findings of Kovatchev et al.,[23] who noted that 18% of severe hypoglycemic episodes are followed by another severe episode within 48 hours. Repeated episodes of hypoglycemia result in unawareness and loss of the warning symptoms of low blood sugar resulting in more episodes of severe hypoglycemia.[24] Advice regarding follow-up and management must be supplied and, ideally, notification of the patient's physician should be performed to ensure continuity of care.

Several studies have looked at the safety of not transporting treated hypoglycemic patients. Mechem et al.[11] prospectively examined short-term outcomes for hypoglycemic patients after out-of-hospital treatment. The study nurses contacted patients three days

after their hypoglycemic episodes. Of the 103 (of 132) patients they were able to contact, 91% had no recurrence of symptoms. They concluded that the release of most hypoglycemic, insulin-dependent diabetic patients who return to normal mental status after D50 administration appeared, in general, to be safe. Socransky et al.[16] retrospectively reviewed the call records of patients treated for hypoglycemia in the out-of-hospital setting. For the 571 calls reviewed, 72% of the patients were not transported. The rate of relapse for nontransported patients was 6.1%, while it was 4.4% for patients transported and discharged. Socransky et al. concluded that the out-of-hospital treatment of hypoglycemic diabetic patients appears effective and efficient. Carter et al.[12] conducted telephone follow-up two weeks after EMS contact of hypoglycemic patients. They were able to contact 100 of 157 patients (64%) and found no difference in terms of repeat access to the health care system or patient satisfaction between the patients transported and the patients who refused transport.

Prehospital studies have highlighted the relatively high rate of recurrence for patients who refuse or are refused transport. In their evaluation of outcomes for all patients who refused transport to hospital, Burstein et al.[8] contacted 199 of 321 eligible patients by phone. Of these, 48% sought further medical care within one week for the same complaint and 6.5% were admitted. The investigators did not identify the proportion of hypoglycemic patients. Sucov et al.[6] noted that 6% of patients refusing transport, who could be reached, were hospitalised for the medical problem for which they had contacted EMS within five days. Zachariah et al.[7] showed a 16% admission rate within 24 hours for all patients who refused. Cone et al.[25] reported a 13% admission rate.

Thompson and Wolford[14] attempted to identify criteria for allowing paramedics to safely treat and release patients with hypoglycemia. They retrospectively applied a history of insulin or non–insulin-dependent diabetes, pretreatment blood glucose <80 mg%, posttreatment blood glucose > 80 mg%, return to normal mental status within 10 minutes of treatment, and absence of complicating factors (renal dialysis, chest pain, arrhythmias, dyspnea, seizures, alcohol intoxication, and focal neurological signs) to 27 transported patients. These criteria identified 19 of the 23 patients discharged (83% sensitivity) and did not select for release the four patients requiring admission or an additional major intervention. They recommended that a much larger, prospective study be undertaken before prehospital criteria could be recommended.

Our study found an overall repeat incidence of hypoglycemic for ten months of 26% (22.6% for transported and 27.5% for nontransported patients). This is very close to the 30% annual incidence found by Miller for insulin-dependent patients.

The recurrence rate was 4% in patients transported and 2% in patients not transported for the previous hypoglycemic episode for an overall incidence of 2.7% for the 220 calls. In the study population the recurrence rate was 2.1%. These numbers are lower than those found by Mechem and the reverse of the findings of Socransky. This may reflect a different population and protocol. Our rate of refusal by treated hypoglycemic patients (66%) lies between Carter's 56% and Socransky's 72%.

The difference in the intervals between calls for hypoglycemia for patients transported on their previous call versus those not transported on the previous call was not statistically significant.

In an outcome study[12] of 431 patients who refused transport, 34 were hypoglycemic patients who received dextrose. Of all patients who refused, 17% were over the age of 65 years. Seven of ten patients who refused and contacted paramedics within 48 hours of refusing transport were in this age group. The authors concluded that elder patients were more likely to contact paramedics after the initial episode and they recommended that this population should be strongly encouraged to seek emergency medical treatment. We found neither a higher incidence of repeat hypoglycemic episodes nor an increased recurrence of hypoglycemia in our over-65 population. Of the 220 calls, there were 61 calls for patients aged over 65 years; 37 of these patients (60.6%) were transported. This is much higher than the percentage of the total population who were transported (34%). This may reflect the paramedics' heightened concern for this group, or this age group may rarely refuse transport. Of the 37 patients transported, 16% had another episode of hypoglycemia during the study period. Of the 24 patients not transported, 8% had another episode.

The second broad category of concerns regarding prehospital management of patients with hypoglycemia is medical–legal. The problem of refusal of treated hypoglycemic patients is compounded by the capacity of such a patient to make an informed decision as well as the ability of paramedics to assess the patient's capacity. One difficulty with assessment of the patient's decision–making ability is that capacity is not a nice "straight line" that can be clearly defined for every case. Rather, capacity varies with the magnitude and frequency of the potential outcome(s) and can be thought of as a sliding scale.[26] Take the example of two equally intoxicated 19-year-olds. One cuts the tip of his finger; the other falls down a flight of stairs sustaining a loss of consciousness for several minutes. Both are equally alert on arrival of EMS. The first patient would have the capacity to refuse transport but the second would not—given the potential outcome.

Hypoglycemia accounted for 8% of 324 cases of transport refusal in a study by Schmidt and colleagues.[27] Of all the patients who refused transport, 59% subsequently contacted a health care provider and 6% were admitted. Despite the policy of providing verbal and written instructions, only 55% recalled receiving written and 22% verbal instructions. Twenty-six percent believed they did not fully understand their conditions. The authors concluded that many patients do not recall receiving written or verbal instructions, raising doubts about their ability to make informed decisions at the time of increased vulnerability.

Our study showed a low compliance with documentation of instructions given to the patient to follow-up with his or her family physician (55%), with giving these instructions, or both. Sixty-six percent of the patients admitted to not following up with their doctor becaue they believed the occurrence to be an isolated event.

The other concern that falls under medical–legal is patient satisfaction—or dissatisfaction. There are patient refusals and there are "patient refusals." For many reasons paramedics may discourage fully recovered hypoglycemic patients from being transported. These may include a belief that nothing further will be done for them at hospital; that patients who were "successfully" treated in the prehospital setting may sit for several hours either awaiting a bed or occupying a bed awaiting assessment by a physician; that the patient is a "frequent flyer" and will not follow advice; or that further care is not worth the cost of the transport. Ayres noted that nontransport of patients accounts for 50–90% of litigation directed toward EMS.[10] Cone et al. found that 20% of patients who were refused care were "very dissatisfied" with the EMS system.[25]

LIMITATIONS

There are several limitations to this study. One of the comorbid conditions we did not look at was alcoholism. Paramedics did document evidence of acute intoxication and this was included in the data abstraction form. The concern is the precipitation of Wernicke's encephalopathy by giving a bolus of glucose or increasing a patient's serum glucose level in the absence of adequate B vitamins, in particular, thiamine.

Due to low numbers, we were unable to identify whether comorbidities, type of diabetic medication, or type of hypoglycemic treatment provided influenced which patients had a recurrence among those not transported to hospital. It is recommended that patients who experience hypoglycemia and are taking oral agents (sulfonylureas) be admitted to hospital because of the long duration of action as well as the possibility of polypharmacy, hepatic insufficiency, and/or impaired renal function.[28]

We did not measure patient satisfaction.

From our low enrollment rate it appears there are several issues of communication and feedback with and to the paramedics.

CONCLUSION

Repeat episodes of hypoglycemia are common; however, recurrences within 48 hours are not. Admission to hospital is rarely required. This would appear to hold true for both patients transported to hospital and those not transported, regardless of age.

We were unable to achieve one of our objectives, which was to derive a list of criteria that identified which patients did not need to be transported to hospital. However, two variables are not often factored into the care of patients by paramedics—the latter's ability to perform critical thinking based on knowledge and experience and their access to physician advice for final decision making. The formulation of a management plan by health providers is often not solely the result of whether specific medical criteria are present. Rather, the plan is arrived at after assessing many variables.

If a patient wishes to be transported to hospital, then he or she should be transported. It would appear that it is safe not to transport an insulin-dependent patient whose hypoglycemic symptoms are completely resolved. The patient should be able to eat, not have an ongoing condition that would predispose him or her to another episode, and have someone who will remain with him or her. Written instructions should be given directing that follow-up with the patient's personal physician or diabetic specialist be done as soon as possible.

Given the high rate of repeat episodes of hypoglycemia, paramedics and physicians need to emphasize the importance of follow-up.

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