

Hypoglycemia and the Rapid Response Team

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Recognition of the Problem 2001

- A review of condition calls by the hospital safety committee revealed the occurrence of several episodes of severe hypoglycemia in the hospital that were associated with a poor patients outcomes.
- The Endocrine Division was approached to create recommendations for treatment and prevention of hypoglycemic events in the hospital.
- Initial review of computerized database revealed hypoglycemia as a frequent, dangerous event for which there was no reporting mechanism and no standard treatment approach.

Hypoglycemia in the hospital *What we learned*

- Unrecognized and inappropriately treated hypoglycemia can be associated with severe morbidity and mortality
- There is an under appreciation of the contribution of sulfonylureas as a risk for severe and prolonged hypoglycemia
- There was no published data on the frequency of hypoglycemia in the inpatient setting
- Concern for hypoglycemia represented a major barrier to glycemc control in the hospital

Patient Case

82 year old woman with type 2 diabetes treated with glyburide and metformin admitted with BG 26 mg/dl

Diabetes Consult called for persistent hypoglycemia despite IV D50 and IV Dextrose infusions over a period of 6 hours.

Treated with Octreotide 50 mcg SQ

Hyperglycemia developed 24 hrs following Octreotide prompting start of scheduled insulin therapy

The beginning of the Diabetes Inpatient Safety Committee

A multidisciplinary committee was formed with representation from

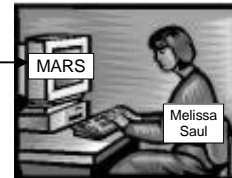
- Endocrinology
- Nursing
- Pharmacy
- Critical Care Medicine
- General Medicine



Initial tasks for the committee:

- Define the frequency of hypoglycemia
- Create a treatment algorithm for hypoglycemia that will be used by nurses and physicians.

What was the frequency of hypoglycemia at UPMC?



Frequency of hypoglycemic events
Hypoglycemia Treatment Protocol 2001

Frequency and severity of hypoglycemia during the month of May 2001 conducted using MARS database

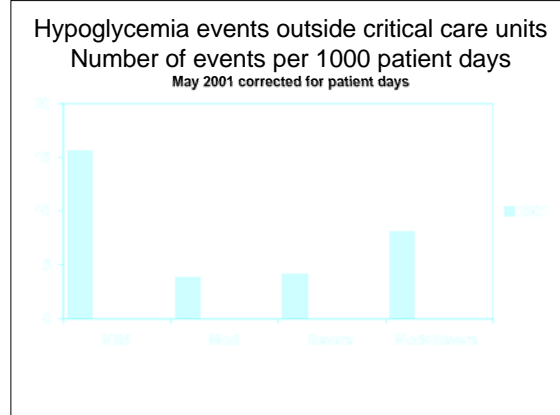
Mild	50-69 mg/dl
Moderate	40-49 mg/dl
Severe	<40 mg/dl

Database screened for all bedside blood glucose values (GLUP/GLUT) < 70

Events defined by intervals of 4 hours

Nadir BG during 4 hr period defines severity of event

Data for patients identified as being in a critical care unit at time of event subtracted from total data set



Nurse Initiated Hypoglycemia Treatment Protocol Introduced 2001

For mild (50-69 mg/dl) hypoglycemia, give one of the following:

- 4 oz Orange/Apple Juice
- 3 Graham Crackers
- 1 tube Glucose Gel

If NPO or unable to swallow:
20 ml D50 IV & start IV D5W @100 mL/h

Hypoglycemia Treatment Protocol

For moderate (40-49 mg/dl) hypoglycemia, give one of the following:

- 8 oz milk (or juice) & 3 graham crackers
- 2 tubes Glucose Gel (*if able to swallow only thickened liquids*)

If NPO or unable to swallow:
50 ml D50 IV (1 amp) and start IV D5W @100 mL/h

For severe hypoglycemia (< 40 mg/dl), give 50 ml D50 IV (1 amp) and start IV D5W @100 mL/h

Hypoglycemia Treatment Protocol

- Repeat BG & treatment every 15 minutes until BG ≥ 70
- If hypoglycemia persists following third treatment, call Diabetes Consult Service
- Notify physician after treatment started and patient stabilized
- Allowance for Glucagon injection in patients who are NPO and/or without IV access
- Diabetes Consult suggested for patients receiving sulfonylureas

2006 Consultation with Inpatient Diabetes Service recommended for any inpatient with ≥ 2 BG < 40 mg/dl in a 24 hour period

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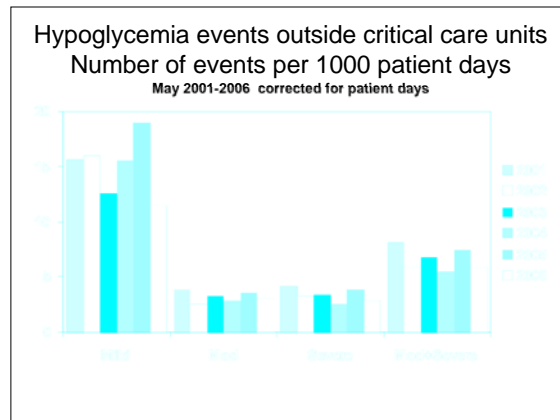
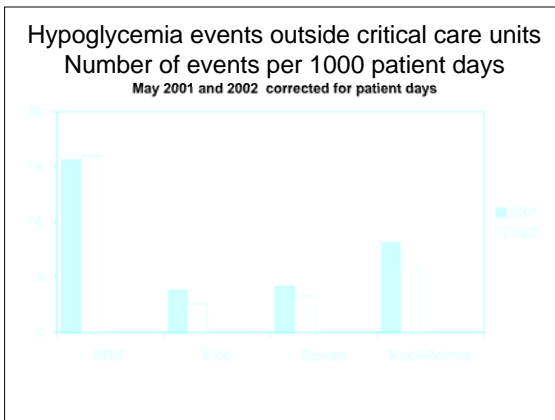
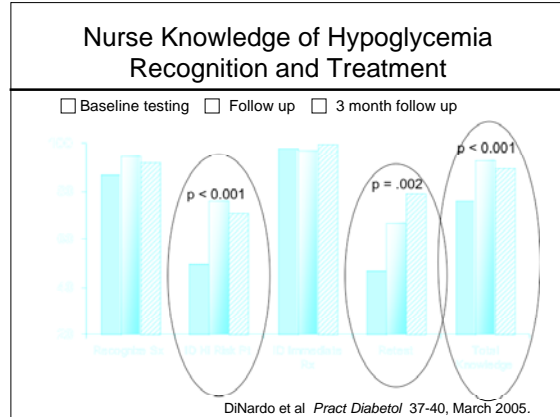
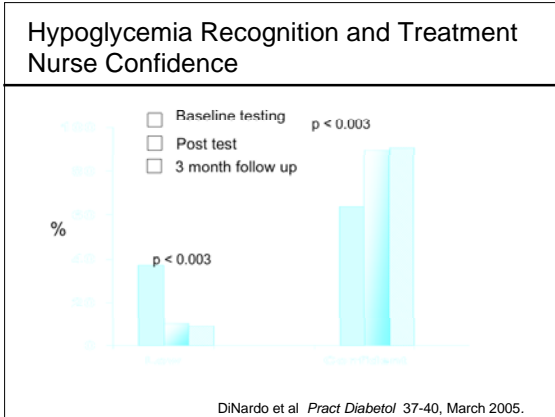
Hypoglycemia Unawareness in the Hospital

Case control retrospective study
60 patients age > 65
Hospitalized on an acute medical or geriatrics ward
Hypoglycemia defined as BG < 50 mg/dl
Mean nadir BG 39 ± 7 mg/dl

Only 23/60 (38%) hypoglycemic episodes noted at time of occurrence

Mortality in group experiencing hypoglycemia 48%

Shilo et al J Am Geriatrics Soc 46:978 1998



Targeted Review of Inpatients Experiencing Severe Hypoglycemia

Causes of hypoglycemia

- Sliding scale insulin 7(33%)
- Change in nutrition without insulin adjustment 4(19%)
- Infrequent BG monitoring 2 (10%)
- Patient refusal 1 (5%)
- Other illness 5 (24%)
- Unable to determine cause 2 (10%)

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Evolution of the DPSC

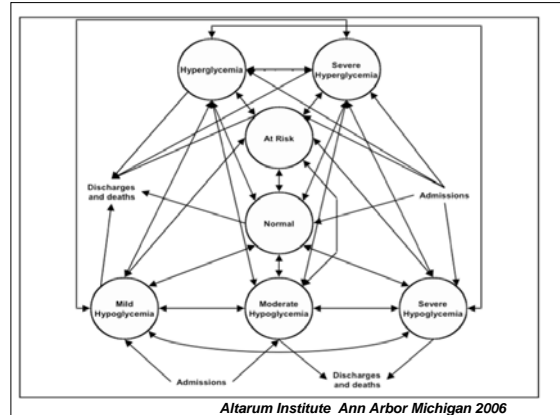
Summary and conclusions

- The Hypoglycemia Treatment Protocol (HTP) was an important first step in addressing uncontrolled blood glucose in the hospital
- An investigation of the causes of hypoglycemia helped to direct the activities of this committee in addressing hyperglycemia

Targeted Review of Inpatients with Hyperglycemia



Home diabetes medications not continued in the hospital	21 (22%)
Inadequate insulin dose adjustments based on obtained BGs or change in clinical status	18 (19%)
Initiation of corticosteroid therapy	13 (14%)
Sliding scale monotherapy for >48 hours	10 (10%)
No prandial insulin ordered in patients who were eating	9 (9%)
Medication error	7 (7%)
Poor glycemic control prior to admission	6 (6%)



Reduction of Time Spent in Hypoglycemia Following Implementation of the HTP

Age group	Year	Hypoglycemic States	Normal or At-risk	Hyperglycemic States
<30	2001	9.0%	57.8%	33.3%
	2006	4.3%	59.6%	36.1%
30-65	2001	5.9%	60.7%	33.4%
	2006	4.4%	62.7%	32.9%
>65	2001	25.4%	44.1%	30.5%
	2006	4.1%	66.9%	29.0%

Altarum Group 2006

Summary

- The HTP was associated with a reduced frequency and severity of hypoglycemia in each age group
- There was an increase in the amount of time spent with BG 80-180 mg/dl.
- The use of the HTP in adult inpatient reduces costs

While other factors may have contributed to these changes, this type of analysis may be useful in allowing hospitals to monitor the safety of glycemic interventions over time.

UPMC DPSC and the Diabetes Institute
Altarum Group 2006

The HTP and the Rapid Response Team

- Prior to implementation of the HTP, there was no standardized treatment for the management of patients with a bedside BG < 70 mg/dl.
- Delays in treatment of hypoglycemia resulted in progression to severe hypoglycemia with a change in level of consciousness prompting an alert to the RRT
- The HTP resulted in a decrease in the frequency of alerts to the RRT
- In those instances of hypoglycemia requiring the RRT, treatment by the nurse is initiated once there is confirmation that a low blood glucose is the cause of the change in clinical status.

UPMC DPSC

Print on Demand Order Sets at UPMC Diabetes Management

Diabetes Management Order Sets
Hypoglycemia Treatment Protocol

Diabetes Admission Order Set
Insulin Order Set
Insulin Pump Order Set and Guideline
IV Insulin Order Set
Regular Insulin Sliding Scale Order Set
Perioperative glycemic management

Diabetic Ketoacidosis

UPMC Diabetes Patient Safety Committee	
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UPMC Diabetes Inpatient Safety Committee
UPMC Diabetes InPatient Safety Committee Summary and conclusions Recommendations for success <ul style="list-style-type: none"> • Involve personnel directly involved in the daily use of the Hypoglycemia Treatment Protocol in plans for implementation and dissemination • Educate physicians and nurses on all inpatient services where protocol will be used • Reinforce education regarding the recognition and treatment of hypoglycemia • Train all incoming personnel

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