HYPOGLYCEMIA HARM REDUCTION: GLYCEMIC MANAGEMENT IN ACUTE CARE

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Objectives

• Define and describe the levels of hypoglycemia
• Determine true risk factors for hypoglycemia
• Implement safe guidelines for glycemic management in the acute care setting
What is the key barrier to acute care glycemic management?

- Fear of hypoglycemia
- Fear of failure to rescue
- Fear of the unknown
- Fear of causing harm
Why?

- Insulin is a high risk, high alert drug
- Prescribed throughout the care system
- Complicated therapies and regimens exist
- Highly variable individual patient responses
- Care providers are insufficiently prepared and have demonstrated lack of knowledge
- Safe and effective utilization of insulin is essential to clinical excellence
**What is hypoglycemia?**

- Technically, a plasma glucose level $< 70$ mg/dl is hypoglycemia.
- The signs and symptoms, both adrenergic and neuroglycopenic, are demonstrative of hypoglycemia.
- Relief of symptoms following the elevation of the plasma glucose level indicates a hypoglycemic event has occurred.
Classifications of Hypoglycemia

- Severe hypoglycemia; < 45 mg/dl
- Moderate hypoglycemia; 45-59 mg/dl
- Mild hypoglycemia; 60-70 mg/dl
Classifications of Hypoglycemia

- Severe hypoglycemia
- Documented symptomatic hypoglycemia
- Asymptomatic hypoglycemia
- Probable symptomatic hypoglycemia
- Relative hypoglycemia

Diabetes Care, Volume, 28, Number 5, May, 2005
American Diabetes Association Workgroup on Hypoglycemia
Defining and Reporting Hypoglycemia in Diabetes
ADA Workgroup Report
What is harm?

- A plasma glucose value $\leq 50$ mg/dl
- A plasma glucose value $\leq 40$ mg/dl?
- Associated neuroglycopenic symptoms
- Potential for injury, brain damage and even death
“A retrospective analysis of mortalities associated with medication errors reports that insulin is the fourth leading cause of death due to errors.”

What are the precipitating factors to hypoglycemic events?

- Predisposing conditions
- Triggers
- Pharmaceutical agents
- Systems failure(s)
- Human error
- Complexities of cases and systems
Predisposing Conditions

- Renal insufficiency
- Malnutrition
- Hepatic disease/failure
- Sepsis
- Shock
- Pregnancy
- Malignant lesion
- Hyperkalemia (GIK cocktail)
- TPN
- Alcoholism and/or illegal drug use
- Burns
- Gastroparesis or altered nutrient absorption
- Dementia
- CHF
- Stroke
- Altered ability to self-report
- Hypoglycemia
- Unawareness
- Aging
- Other metabolic disorders such as pituitary and adrenal insufficiency
Triggers

- Transportation off patient care unit
- NPO status, new/changed
- Interruption of IV dextrose therapy
- Interruption of TPN
- Interruption of enteral feedings
- Interruption of continuous venovenous hemodialysis
- Mental health/ECT
- Errors
- Schedules altered/timing
Pharmaceutical Agents Lower Plasma Glucose

- Androgens/anabolic steroids
- Aspirin
- Beta-adrenergic antagonists
- Caffeine
- Chloroquine
- Clofibrate
- Ethanol
- Fluoroquinolones
- Monoamine oxidase inhibitors
- Octreotide
- Rifampin
- Salicylates
- Tapering of glucocorticoids
Systems Failure(s)

• Failure mode and effects analysis (FEMA)
• Medication delivery system including ordering, dispensing, administration and monitoring
• Complex schedules, such as tray delivery times, medications, misinterpreted lab results, storage limitations, and IV pump programming errors contribute to harm
Medications Management

Core Processes

Evaluate ➔ Decide ➔ Order

Monitor ➔ Transcribe

Administer ➔ Distribute
Failure Modes: Evaluate

- Insufficient information about other drugs (including oral hypoglycemics) patient is on
- Insufficient information about past dose-response relationships
- Insufficient drug information
- Insufficient lab information
- Insufficient allergy or other patient information
Failure Modes: Evaluate

• Incorrect diagnosis
• Incorrect or incomplete assessment regarding patient’s compliance ability
• Patient discharge summaries do not match home medication lists
• Home medication lists not reconciled
• Unclear information regarding alcohol or herbal remedies
Failure Modes: Decide

- Incorrect drug selected
- Incorrect dose selected
- Incorrect route selected
- Parameters incorrect
- Regimen too complex
- Managed-care dictated formulary or brand changes
- Incorrect selection of insulin over oral agent
Failure Modes: Order

- Illegible handwriting
- Order not transmitted to pharmacy
- Use of samples
- Overlapping sliding scales
- Failure to account for changing conditions of diet, TPN, steroids, NPO status
- Wrong route prescribed
Failure Modes: Order

- Use of the letter “u” or other unsafe designations (e.g. “L”)
- Untimely orders
  - (e.g. RN must call MD for orders but the time delay is prolonged)
- Doses not prescribed for high sugar contingencies
- Wrong dose prescribed
Failure Modes: Transcription

- Misreading of order
- Incorrect entry into pharmacy computer or CPOE system
  - Slip
  - Picking error
- Illegible transcription
Failure Modes: Dispense

- Incorrect drug selected
- Patient information unavailable
- Look-alike or sound-alike drugs
- Patient inability to pay (ambulatory)
- Use of multiple pharmacies (ambulatory)
- Label incorrect, ambiguous, or applied incorrectly
- Infusion prepared incorrectly
- Incorrect dose drawn into syringe
Failure Modes: Administer

- Incorrect or insufficient patient education
- Improper storage & lighting
- Look-alike labeling
- Incorrect syringe used
- Administered via incorrect route
- Failure to chart correctly or in a timely manner
- MAR misread
Failure Modes: Administer

- Dietary issues
  - Mistimed administration related to meals
    - Late meals due to being off the floor
    - Meal delivery delays
  - Insufficient bedtime snacks
  - Incorrect diet sent
Failure Modes: Administer

- IV Pump issues
  - Changing concentrations
  - Non-standard concentration
  - Pump programming error
  - Bag inserted into incorrect channel
  - Over-reliance on “smart” technology
  - Line swaps
  - Free flow pump
Failure Modes: Monitor

- Incomplete or insufficient monitoring; patient not observed for hypoglycemia
- Blood sugars not ordered
- Blood sugars ordered incorrectly
- Blood sugar results unavailable
- Blood sugar results communicated incorrectly
- Mislabeled specimens
- Fragmented care
Human Error

• Academic rotations
• Continuity of care delivery
• Fatigue
• Overtime
• Double check
• Knowledge
• Human factors
Human Factors Principles & Systems Design

- Avoid reliance on memory
- Simplify
- Standardize
- Use constraints and forcing functions
- Use protocols and checklists
Human Factors Principles & Systems Design

- Improve access to information
- Decrease reliance on vigilance
- Reduce hand-offs
- Increase feedback
- Decrease look-alikes
- Careful automation
Complexities of Cases and Systems

- Co-morbidities
- Polypharmacy
- Multiple team members, consultants, care providers
- Communication
- Size, distribution, services, populations
How do you create a culture of patient safety and clinical excellence?

How do you develop a culture of insulin harm reduction, clinical excellence in acute care glycemic management?
Medication Safety Action Group

- Institute for Clinical Systems Improvement
- Collaborative of metropolitan and state-wide health care systems
- Safest In America
- Insulin Harm Reduction Task Group
The goal of the collaborative is to eliminate harm caused by the improper use of insulin. In order to accomplish this, all sources of failure must be closed regardless of how often it happens currently. Work must be done in multiple realms simultaneously.
Design Principles for Safety

1. Design systems to prevent errors and harm.
2. Design procedures to make errors and harm visible.
3. Design procedures that can mitigate harm.

Nolan, T. BMJ 2000
Assessment of Current Status

• Identify patient volumes to establish baseline data.
• Develop a survey tool that can be easily utilized.
• If you have information systems that can help you, use them!
• If you do not, take the time to do the tedious data collection!
Survey

- Patient/Unit
- Diagnosis
- Type 1, 2, Unrecognized, Stress-Induced
- Steroids
- Insulin IV/Subq/Inhaled
- Orals
- Incretins

The survey should be done for each patient care unit and the entire population on the floor. You must know the total number of patients on that given day to determine percentage of patients/unit being treated.
Assessment of Hypoglycemia

- Adverse Drug Events/Occurrence Reports
- Retrospective and Concurrent Chart Reviews
- Laboratory Quality Review
- Insulin Utilization
- IV Dextrose, Glucagon Utilization
- Knowledge Assessment of Staff
Key Issues Identified

- Continuous Subcutaneous Insulin Infusion
- Subcutaneous Insulin Management
- Transition of Intravenous Insulin to Subcutaneous, Basal-Bolus Management
- Continuous Intravenous Insulin Infusion
- Patient Self-Management
- Oral Hypoglycemic Agents
- Knowledge of Glycemic Management
Key Services/Populations

• 47% of the UMMC population has hyperglycemia/diabetes as a co-morbidity!
• Critical Care, Cardiothoracic and Cardiology Services, Bone Marrow Transplant, Solid Organ Transplant, Med-Surg, OB, Pediatrics, Neo-Natal, Oncology, Cystic Fibrosis Related Diabetes, Peri-operative Services, Ambulatory Surgery, Sports Medicine, Emergency Department, Mental Health, Rehabilitation……
How do you establish clinical excellence in diabetes?

- Develop a dynamic, collaborative interdisciplinary team
- Identify true champions in each discipline
- Administrative support
- Honest and thorough assessment of current practices
- Development of standardized order sets, policies, protocols, curriculum
- Glucometrics
Multidisciplinary Team/Acute Care Diabetes Advisory Committee

- Interdisciplinary is critical!
- Endocrinology, Physicians from other disciplines (internal medicine, family practice, surgery), Diabetes CNS/CDE, Dietitian, Pharmacist, Laboratory Point-of-Care, Social Services, Rehabilitation, Patient Learning Center, Outpatient diabetes, Staff Nurse, Consumer, Performance Improvement, Information Systems, Administrative liaison
- These individuals need to know they are the champions!
Team

• Identify the players as champions in their department!
• Outline expectations of shared workload, shared educational offerings, shared research……..
• Take time to develop the team members, get everyone on the same page with shared vision and goals!
• Meet monthly; if you don’t, you lose momentum and the focus of others.
• Communicate!!!!!
Knowledge

• Assessment of each discipline’s current knowledge base
• Assessment of the experts available to assist with education and competencies
• Medical Library
• Intranet/Internet Resources
Professional Education

- Establish annual competencies for all disciplines.
- Provide updated education to all disciplines through mandatory inservices, grand rounds, medical meetings, continuing education, lunch and learns, topics on Tuesdays.
- Web-based offerings.
- Journal Club/Journal Boxes.
- Rotating posters.
- Be creative!
- Evaluate learning!
Interventions-Education

• Knowledge Assessment-Completed with all nursing, pharmacy, and nutrition staff.

• Orientation-New nurses in employee orientation have a 90 minute lecture on Acute Care Diabetes Management and 60 minutes on Blood Glucose Monitoring and Point of Care. Medication Tests have been revised with 6 current insulin related questions.

• Competencies-Nursing, Pharmacy, Nutritional Services all have competencies in place for licensed staff.
Interventions-Education

- Hypoglycemia Awareness-Articles in newsletter, Nursing Links, posters, talks on teachable Tuesdays, inservices strictly on patient assessment for hypoglycemia and its treatment.

- School of Nursing-Education provided to nursing students. Co-authored “Glycemic Management” in Acute and Critical Care Nursing, due out fall’06

- Medical Staff Education-simulated learning lab for medical students, web-based modules, service rounds, grand rounds
Successful Tools and Venues

• Exercise In Critical Thinking
• Case Scenarios/Review with staff
• Interdisciplinary Team Rounds
• Unit Council Meetings
• Unit Clinical Mentoring
• Individual Nurse Assessment/Plan
• Diabetes Intranet Site; go live fall’06
• Web-based learning modules for all disciplines; go live fall’06
Identify Tools/Resources Currently in Use

• Departments/Personnel
• Orders, protocols, policies-check for continuity, inconsistencies, etc.
• Curriculum for Survival Skill Education
• Measures already being collected! Be sure to include insulin errors and events, poor outcomes, glycemic levels if available from lab download.
• What does your admission database offer?
• Division of work; responsibilities/duties
Development of Tools

- Protocols/algorithms/policies must be established.
- IV infusion, subcutaneous insulin, ambulatory pump in acute care, hypoglycemia, DKA, HHNS are the bare minimum! Then go on to Pramlintide, Metformin, Chromium, Flourquinolones, etc.
- Pilot first so that you can demonstrate safety and efficacy.
- Implement with high volume, high risk service lines/populations, and evolve.
- Be sure the tools are accessible!
- Evaluate monthly/quarterly.
- Review annually and revise as needed.
Interventions
Order Sets, Protocols, Policies

1. Multiple interdisciplinary work groups with Acute Care Diabetes Advisory and the Medical Directors for Adult and Pediatric Endocrinology having formal accountability and sign-off on all diabetes related order sets.

2. Protocols are guides such as dosing guidelines for insulin, oral agents, incretins, renal dosing.

3. Policies are related to pharmacy, nursing, nutrition, and laboratory.
Interventions

Nutrition

• Consistent Carbohydrate Meal Plan; very low, low, moderate, and high; is the diabetes meal plan offered. Menus identify CHO units per serving.
• Cafeteria has added CHO units and fat grams to selections.
• Revised Enteral/TPN order sheets, policy, etc. Maltose and galactose alerts reviewed with point of care monitoring systems
• Consult and order clarification/correction
Interventions
Pharmacy

• Formulary streamlined to reduce choice of insulins available
• Standardized order sets developed and implemented
• Deliver IV insulin on syringe pump only
• Device delivery of subcutaneous insulin
• Screening/assessment of CSII
• Order clarification
• Pharm-O-Gram for the Fluroquinolones
Interventions Laboratory

• Interface Point-of-Care Results with laboratory documentation system for recording on medical record in real time
• Analysis of quality of testing with current meters
• Review of accuracy in hypoglycemic range with anemic patients
• Review of accuracy with TPN substrates, medications such as IVIG
Patient Education

• Standardize survival skill curriculum!
• Determine who is responsible for ensuring safe discharges and documentation of teaching!
• Evaluate patient’s response and knowledge.
• Utilize adult learning principles and think outside of the box.
• Know your resources across the healthcare continuum as this is only the start of the education process!
Survival Skill Education

- What is diabetes? Principles of treatment and prevention of complications.
- Norms for blood glucose and target glucose levels for the individual.
- Recognition, treatment, and prevention of hyperglycemia and hypoglycemia.
- Medical nutrition therapy (instructed by a registered dietitian, who, preferably, is a CDE).
- Medication.
- Self-monitoring of blood glucose.
- Insulin administration (if going home on insulin.)
- Sick-day management.
- Community resources.
- Universal precautions for caregivers.
Evaluation and Measures

- Documentation of data
- Challenged by multiple documentation systems
- Two campuses co-existing with paper and electronic documentation in various areas
- PI support and data analysis support sparse
- Proper coding of co-morbid conditions
Glucometrics for Evaluation

- Define safety
- Define efficacy
- Glucose harm $> 180 \text{ mg/dl and } < 50 \text{ mg/dl (40)}$
- Time to target
- Values outside of range
- Reasons
- Report by unit/service/population/MD
SIA Measures

- Rate of blood glucose values < 50 mg/dl determined by # of episodes per total patient days (X 1000)
- Rate of blood glucose values > 180 mg/dl determined by # of episodes per total patient days (X 1000)
BS < 50mg/dl/1000 patient days

Insulin-related Hypoglycemia Rate

Baseline

87% reduction from baseline
Other data:

- Average glucose by patient care area: 88-216
- Mean glucose is now at 187 mg/dl
- Incidence of hypoglycemia 1.7%
- Insulin Error Rate at 1.2%
- Compliance in ICU, CVTS 100%
- Time to target
Glycemic Management

• Be persistent!
• Be patient!
• Be judicious in where you start with one service or population at a time!
• Be conservative initially!
• Be wise!
• Be passionate!