AACE Module on Patient Safety in Inpatient Diabetes Care

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Patient Safety is now widely accepted as one of the six aims of healthcare systems:

- Healthcare should be
  - Effective
  - Patient centered
  - Timely
  - Efficient
  - Equitable

  Institute of Medicine 2001

- But patient safety – freedom from harm during the process of receiving health care cannot be taken for granted in the present health care system.
Patient Safety Lapses in Hospitals are Increasing

- Patient safety lapses increased by 3% overall from 2003 to 2005
- 1.16 million preventable patient safety lapses occurred in 40.6 million hospitalizations from 2003 to 2005
- 247,662 deaths could have been prevented if hospitals had made fewer medical mistakes

Kaiser Family Foundation  February 27, 2010
Patient Safety Issues and Inpatient Glycemic Control

- Hospitals are extremely complex organizations in which errors in carrying out plans are common.
- Reductions in injurious errors are best achieved by a broader, systemic analysis of how best to safely and effectively institute better glycemic control.
• Medicine is a high error opportunity endeavor
• Decisions are made often with incomplete information, in urgent circumstances, with systems of care that do not work well together.
Deficit reduction efforts delay new FDA standards and cut reimbursement for glucose meters.

Glucose meters that are inaccurate due to industry choice of priorities.

Hospital cuts cost – delays use of modern infusion pumps and EMR project.

Physician giving insulin orders.

End of shift Poor nurse education.

Nurse giving insulin.

Wrong dose.

PATIENT INJURY.

illegible handwriting.

sliding scale orders.

Sharp End (Action Errors).

Blunt End (Latent Errors).

Systems Perspective for Medical Errors in Inpatient Glycemic Control.
Definition of Culture of Safety

- A system of care that establishes a collective point of view amongst members and results in them working together as a team to protect the patient from accidental injury due to a medical error.

- Common characteristics include
  - Timely communication of patient information
  - “back-up” checks in critical settings

- Error prone organizations, in contrast, discount the importance of training, education and supervised practice in their work force and instead rely upon being punitive.

Hellman, 2004 Endocrine Practice
“CULTURE OF SAFETY”

- Initial physician orders
- Defective culture No Barriers
- Unintended Injury
  - TIME
  - Scope of awareness
  - Intended therapeutic result
  - CorreCtion by physician
  - Nurse on team
  - Back-up check by peer
  - No injury
  - “Culture of safety”

Richard Hellman ©2005
“DEFECTIVE CULTURE OF SAFETY”
a system under stress

Initial physician orders

Defective culture
No Barriers

Unintended Injury

Intended therapeutic result

No injury

Nurse on team

Backup check by peer

CORRECTION BY PHYSICIAN

TIME

Scope of awareness

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The Evidence:

• In 2007, Centers for Medicare Services reported 14,929 episodes of manifestations of poor blood sugar control as examples of preventable conditions.

Conclusions:
The major problems noted by CMS were inadequate insulin therapy and hyperglycemia, not hypoglycemia. But both hyperglycemia and hypoglycemia may cause injury in vulnerable patients and should be avoided, if possible.
How could diabetic ketoacidosis develop in hospital setting so often?

Medical errors
- Physician diagnostic errors, typically among the most frequent cause of malpractice claims
- Willful neglect / fear of hypoglycemia
- Defective culture of safety

Lost or hidden information
- Illegible notes or orders
- Lab data or chart not accessible to ordering physician
- Defective transfer of care
- Defective medicine reconciliation
- No back-up checks

Defective or absent protocols for care
Misleading information from point-of-care glucose meters
Causes of Error Leading to Hospital Acquired Hyperosmolar Non-ketotic Hyperglycemic Coma

- **Diagnostic error**
  - Neurologic signs: stupor, coma, focal weakness, seizure activity all may be confused with a CVA
  - Distraction: sepsis, gram negative infections are common co-morbid conditions – attention may focus on these problems

- **Defective culture of safety** (similar to previous slide) missed information, no back-up checks, etc.

- **Linguistic or cultural barriers to communication**

- **Faulty or delayed data on glucose levels**
What are the common factors that are associated with hypoglycemic coma or severe hypoglycemia (≤40mg/dl) acquired in the hospital?

- Patient unable to warn staff that they are becoming hypoglycemic
  - Sedation, intubation or CNS manifestations of hypoglycemia are present
- Diagnostic error
  - Physician or nurses do not notice findings or consider the diagnosis
- Defective Culture of Safety
  - Missed meal after insulin is given (patient transported elsewhere)
  - Infrequent glucose monitoring
  - Defective point of care glucose monitoring
PATIENT INJURY

POTENTIAL ERRORS

Defenses (back-up checks)

Adapted from Dr James Reason
Actual Case Study
38 year-old married woman with Type 1 diabetes

- Patient LG presents to a hospital at 7:30am for a routine cardiac catheterization.
- Her initial glucose is 152 mg%.
- Her cardiac catheterization shows 60% narrowing of LAD and circumflex arteries.
- The patient returns to recovery at 1:20pm, and begins vomiting. She complains of abdominal pain, and undergoes a KUB and CT, which show dilation of her stomach.
- Blood pressure 140/92, Pulse 112, Temperature 98º
- Zofran 4 mg is given IV, without relief of vomiting. Additional laboratory tests are ordered.
- EKG shows ST segment depression in leads 2, 3, AVF, and across the precordium.
- At 2:50pm she has a cardiac arrest. Resuscitation was unsuccessful.

What happened?
What happened.

• Laboratory results were returned, showing:
  – NA 126 meq/l
  – K 5.8 meq/l
  – CL 86 meq/l
  – \( \text{CO}_2 \) 6 meq/l
  – Glucose 842 mg%
  – Serum was not tested for ketones

• The cardiologist realized that the insulin had been held in error, to avoid hypoglycemia.

• The patient died from a catastrophic medical error, in diabetic ketoacidosis.
Analysis of Medical Errors in Care of Clinical Example 1

- Errors at “sharp” end of care (active errors)
  - Physician did not recognize N&V and abdominal pain as symptoms of DKA
  - Physician forgot patient had an absolute requirement for insulin at all times
  - Other staff did not notice the onset of symptoms of insulin deficiency

- Errors at “blunt” end of care (latent errors)
  - Defective culture of safety
    - Poor communication between providers
      - Patient’s absolute requirement for insulin was not communicated across transfers between units
  - No one felt empowered to challenge withholding of insulin during procedure
  - Glucose levels noted in paper chart / information not easily found – hospital had deferred purchase of EHR
  - Point of care glucose meters used read falsely low during emergency because of hypotension and hyperglycemia which causes a falsely low glucose on many POC glucose meters
Provider Error is an Important Cause of Poor Outcomes in Diabetes Care

1) In the cohort (comparison group), 20% of 283 patients had a major error in their care that caused at least one of these conditions:
   - excessive morbidity
   - complications
   - disability
   - death

1) 4.24% of patients had a major error that was an immediate cause of death

2) One third of patients with an error as an immediate cause of death had an error that was related to insulin administration

Complex Systems and Errors

• In complex systems such as hospitals, a catastrophic error has complex roots involving multiple individuals.
• The design of the system all too often has latent flaws that make human error likely, even predictable.
Relationship Between Quality, Errors and Safety

Quality of Care Issues

Latent Medical Errors – System Issues

Medical Errors

Patient Safety

Injurious Medical Errors

Non-preventable injuries

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Patient Safety in Hospital Settings is a Team Effort

• After a physician orders a medication, between 14 and 40 steps take place before the patient receives the medication. Many of these are not under the control of a physician, but may be a source of error.

• But, safety issues may be difficult to resolve without support and leadership of physicians on the medical staff.

• In complex systems, including hospitals, relatively subtle issues early in the sequence of events may have a profound effect.
Why should health care adopt non-punitive reporting systems of errors?

• Because “Blame and Shame” does not match with reality of human fallibility
• Health care is a high error opportunity system with small margin of safety
• Uncertainty and incomplete knowledge occur in many medical settings
• Hindsight bias is unscientific and simply wrong
Requirements for Achieving Optimal Glucose Levels in Inpatient Care

• Use insulin-glucose infusions in critical care and in other inpatient areas where systems are in place to allow for safe and appropriate care:
  – Needed systems for patient safety
  – Insulin infusions protocols validated for safety and efficacy
  – Training for users of insulin infusions
  – Availability of accurate and precise point-of-care testing
  – Continuous prospective monitoring of glucose metrics and outcomes
POC Glucose Meter Use in Hospitals

- Education of staff
  - Often, the POC meter is being used by the most poorly trained staff even though proper technique is essential for optimal results.
  - Many hospitals fail to have a comprehensive QC program for POC meters.
  - The key characteristics of their POC meters: accuracy, precision, and sensitivity to interfering substances is often not known by the staff.
Trainees and Patient Safety

- Part of the problem with errors in inpatient insulin therapy may lie in inadequate training and education of the health care delivery team.
- This is part of a general problem. In a study of 10,843 caregivers from 203 hospitals in 3 countries (including USA), only 58% of care providers reported that their trainees were adequately supervised.

Pronovost P., Ann Int Med 2004
Data from Sexton JB
Common Errors Leading to Hypoglycemia

- Infrequent glucose monitoring
- No algorithm to treat hypoglycemia
- Use of long-acting insulin in elderly or those with liver or kidney insufficiency
- Failure to adjust dosage to changing clinical situation
- Sliding scale insulin as monotherapy
- Reduction in or cessation of caloric or carbohydrate intake
- Errors in order writing
- Inaccurate glucose meters
Transitions of Care: Inpatient

• Medicine reconciliation should be done at the time of transition for all care transitions
  – Home to hospital
  – Perioperative
  – ICU to regular floor
  – Hospital to home, long-term care facilities

• Rationale:
  – 60% of inpatient medication errors occur during time of transition, upon admission, transfer or discharge of patient.

Rozick, JD
Journal of Clinical Outcomes Management, 2001
• The reconciled medication list needs to be understandable to the patient or family.
• They must be able to demonstrate understanding of the orders.
• Assess their cognitive, physical and psychological ability to carry out the orders.
• Rationale:
  – One study of discharged patients found that
    • 41% were able to state their diagnosis
    • 37% were able to state the purpose of their medicine
    • 14% knew the common side effects of their medicines

Maniaci MJ, Mayo Clinic Procedures 2008
Requirements for Achieving Optimal Glucose Levels in Inpatient Care

• A multi-disciplinary team to coordinate care between nursing service, dietary, and transportation etc.
• Medicine reconciliation during all transfers
• Appropriate rules for transition from insulin infusion to subcutaneous insulin therapy (either inpatient or to outpatient)
• Validation of accuracy and precision of glucose meters used at bedside
• Point-of-care glucose monitoring appropriate for the clinical setting
• Appropriate validated insulin therapy for the needs of the patient and the changing clinical condition
• Avoidance of hypoglycemia. Correction strategies for hypoglycemia and follow-up
• Administrative support for a hospital-wide glycemic control program
• Continuous, prospective monitoring and improvement of program performance
Conclusion

- Inpatient glycemic control is best achieved by applying validated, evidence based strategies for achieving glycemic control.
- Injurious errors can be minimized by applying systematic approaches to patient safety to achieve glycemic control that is not only effective but safer.
- Systemic approach to patient safety is essential in all health care systems.