Strategies to Improve Outcomes of Pediatric Diabetic Ketoacidosis Patients

Susan Wible MSN, MBA, RN
Tara Work MSN, RN, CPN
Ashley Fisk RN, BSN
May 1st, 2013

Disclosures

- All research studies discussed are appropriately cited.
- All pictures are either public domain or permissions have been obtained and are on file.
- There are no conflicts of interest to disclose.

Objectives

- Review the definition and clinical manifestations of Diabetic Ketoacidosis (DKA).
- Discuss treatment modalities utilized for management of DKA at Children’s Hospital of Pittsburgh of UPMC.
- Define iSTAT® and its use in the management of DKA.
- Review the nurse led initiative of applying iSTAT® at the bedside for pediatric DKA patients.
Diabetic Ketoacidosis (DKA)

- Life threatening acute complication of Type 1 Diabetes
  - Severe insulin deficiency
  - Hyperglycemia
  - Acidosis
  - Ketosis

Diabetic Ketoacidosis (DKA)

- American Diabetes Association (ADA) defines DKA in children as:
  - Hyperglycemia - glucose greater than 250 mg/dl
  - Venous pH <7.3 and/or bicarbonate of < 15 mmol/L
  - Elevated ketones in urine or blood

(Rewers, 2012)

Diabetic Ketoacidosis (DKA)

- The prevalence of DKA at diagnosis of Type 1 diabetes remains high.

- Reportedly in the United States, 29% of patients 20 years and younger present with DKA at diagnosis.

(Rewers, 2012)
DKA at Children's Hospital of Pittsburgh of UPMC

**ED Order Set**
- Peripheral IV insertion
- Urinalysis
- Bedside Glucose Q1 hour
- iSTAT Q1 hour
- BMP, Glucose, Acetone, Osmolality, Venous Blood Gas Q3 hour
- Hgb A1C once
- CBC once
- Insulin Level and C-Peptide (prior to insulin)

**All newly diagnosed diabetics are admitted to the Adolescent/Endocrine Med Unit.**

**Guidelines for DKA patients- Acute care vs. PICU**

**Floor Management**
- Q1 Hour labs
- Glucometer
- MIVF (ex: D5 0.45% Sodium Chloride + 40mEq/L KCl, D5 0.2% Sodium Chloride)
- Regular Insulin Infusion
- NPO
- Neuro checks/VS
DKA at Children’s Hospital of Pittsburgh of UPMC

- 3 days of inpatient teaching for the patient and family
- Collaboration with Diabetes Educators and Dieticians
- Support and education of families

Management of DKA patients is a highly acute process

Obstacles in Practice

- STAT Labs
  - 30-40 minute turnaround
- MD orders based on labs from sometimes 1 hour prior
- IVF from pharmacy
  - 20-30 minutes turn around
- Next hourly lab sent prior to any intervention being initiated
Nurses Ask….

Is there a tool that could be used to improve efficiency and caregiver satisfaction when managing DKA patients?

Answer

iSTAT ®

The iSTAT is a point of care (POC) device
- Hand held
- Cartridge-driven
- Electrolyte and Blood Gas testing
- Requires < 0.1 mL of blood
- Test cycle 120 seconds
- Uploads directly into eRecord
Insert iStat demonstration video
approximately 3 mins
awaiting approval from
UPMC Corporate
Communications

Literature review
Papadea, C., Foster, J., Grant, S., Ballard, S.A.,
Cate, J.C., Southgate, M., Purohit, D.M.
(2002). Evaluation of the i-STAT Portable
Clinical Analyzer for Point-of-Care Testing in
the Intensive Care Units of a University
Children’s Hospital, Annals of Clinical &
Laboratory Science 32, 231-243.

Literature Review
Vos, G., Engel, M., Ramsay, G., van
analyzer during interhospital transport of
clinically ill children. European Journal of
Emergency Medicine, 13, 304-307.
Literature Review

Introducing iSTAT at Children’s Hospital of Pittsburgh of UPMC

- **Pilot Study**
  - How do you manage pediatric DKA patients?
  - Various responses
  - iStat® was a common factor

Financial Perception of the i-Stat®

- Emphasis placed on improvement of patient care
- Operational efficiency
- Rapid turnaround time and data availability
- Clinician response time can be improved
Pilot Study
- Establish validity of the iStat®
  - 3 month time frame (March 2010-June 2010)
  - BMP/Mag/Phos/VBG sent to lab and iStat® ran at bedside on same blood sample
  - Lab confirmed samples were comparable

Financial Perception of the i-Stat®
- Minimize blood draws and volume
- Therapists can utilize their time more efficiently for patient care
- Regulatory compliance simplified
- Potentially reduce patient stays
- Reduction of pre-analytical errors
  - Insufficient volume, clotting, incorrect labeling, sample transport issues

Introducing iSTAT
- Purchase of iSTAT devices for acute care unit was approved.
- Implementation began in early 2010.
Implementation

- 2 i-Stats® for the 24 bed unit
- Process developed with lab to maintain supply of cartridges

Implementation

- MD approval and protocol changed
- iSTAT performed hourly, Q3 labs sent to clinical laboratory.

Education

- Training began in February 2010
- Preformed by nurse educator and lab personnel
- Only RN’s trained
- One on one in-services
- Annual competency
Planning

- Work with pharmacy leadership to obtain fluids in a timely manner

- Stock IV on par for emergent situations
  - D5 0.45% Sodium Chloride + 40mEq/L KCl
  - D5 0.2% Sodium Chloride

Impact on Patient Care

- Post implementation-
  - What is the impact on patient outcomes?
  - Has patient length of stay been impacted?
  - Has the insulin infusion time decreased?

Quality Improvement Project

- July 2012- Submitted application for QI Project Approval from the UPMC QI Review Board.

- Approval granted to pursue chart audits.
Data Collection

- Submission of request to Data Warehouse committee
- Requested
  - Initial blood gases
  - Insulin start time
  - Insulin stop time

Data Analysis

- Collaboration with Advanced Clinical Education Specialist to perform data analysis.
- Classified DKA patients into three groups (mild, moderate, severe)
Discussion

- **Faster results**
  - 120 seconds for iSTAT results vs. 30-40 minutes for clinical lab
- **Automatic Upload into electronic record**
- **IVF Adjustments**
  - Based on iSTAT results, maker for quicker clinical judgment
- **Increased Nurse Satisfaction**
Limitations
 Length of stay- driven by education
 Time of presentation to the ED
  – Often in the evening
  – Rarely transition before breakfast

Conclusion
 iSTAT remains part of the CHP treatment protocol for DKA.

References


