

PEDIATRIC DIABETIC KETOACIDOSIS



October 2011

Quality Improvement Resources

Illinois Emergency Medical Services for Children



is a collaborative program between the
Illinois Department of Public Health

and

Loyola University Medical Center

www.luhs.org/emsc



**LOYOLA
UNIVERSITY
HEALTH SYSTEM**

Loyola University Chicago

**Illinois EMSC
Pediatric DKA
Data Dictionary
Confidential – for QI purposes only**

AIM Statement:

To provide safe and effective care for pediatric patients ($0 \leq 15$ years) presenting to the Emergency Department in DKA (known DM or new onset) as evidenced by:

- Appropriate Assessment
- Appropriate Management
- Appropriate Disposition

REVIEW THE PATIENT'S ENTIRE ED MEDICAL RECORD TO COLLECT THE NECESSARY DATA (i.e., BOTH MD AND RN NOTES)

Record Sampling:

Select up to 10 patient visits from all pediatric patients treated in your Emergency Department from January 1, 2008 – current. You can review the same patient more than once if he/she presented for multiple visits within the time frame.

Inclusion Criteria:

Each patient must meet the following inclusion criteria:

1. Age: 1 day through 15 years of age
2. Presenting Complaint – signs/symptoms of DKA **OR**
3. Discharge Diagnosis of DKA (either new onset or known DM patient)
 - Criteria: Blood glucose > 200 mg/dL *and* Venous pH < 7.30 *and* Moderate or large ketonuria or ketonemia (blood β -hydroxybutyrate > 3 mmol/L)
 - Suggested ICD9 Codes:
 - 250.1 – 250.13 (Diabetes with ketoacidosis)
 - 250.3 – 250.33 (Diabetes with other coma)
 - 250.9 – 250.93 (Diabetes with unspecified complication)
 - 790.6 (hyperglycemia NOS)
 - 790.29 (Other abnormal glucose)
 - Other suggested methods to find appropriate patients:
 - Patients who were transferred
 - Patients who had IV insulin orders
 - Patients with “abnormal lab values”
 - Patients with elevated blood glucose levels
 - Patients with presenting complaint of nausea and vomiting

Ask your Medical Record and/or Quality Departments for help in identifying appropriate patients

Answer the questions using the following acronyms (unless otherwise directed):

Y = Yes

N = No

N/D = Not Documented/Unknown

N/A = Not Applicable

Arrival:

1. What was the patient's mode of arrival?
 - Prehospital (P) = transported by EMS from the scene (**answer Q.1a**)
 - Transfer (T) = transported from one acute care facility to another acute care facility (**skip to Q.2**)
 - Walk-in (W) = brought in by family/caregiver; as a referral from an urgent care center, doctor's office, etc. (**skip to Q.2**)

Prehospital: *If a patient arrived via EMS from the scene answer Questions #1a – e.*

- a) What level of prehospital service was used? Choose N/A if patient was transferred or was a walk-in.
 - a. ALS/ILS (A) (**answer Q.1b-e**)
 - b. BLS (B) (**answer Q.1b and 1c only**)
- b) All levels: Was blood glucose level checked by prehospital provider?
- c) All levels: Was neurologic status assessed by prehospital provider (e.g., AVPU, GCS)?
- d) ALS/ILS: Was IV fluid bolus started or attempted by prehospital provider? (Note: Region 6 facilities defined this as 10-20 mL/Kg bolus of 0.9% NS over one hour.)
- e) ALS/ILS: Was cardiac monitor applied by prehospital provider?

Initial ED Assessment:

2. Age of patient (in months or years)
3. Was patient's weight documented in kilograms?
4. Was a full set of vital signs documented (must include: HR, RR, BP, Temp, Oxygen saturation)?
5. Was a point-of-care testing (POCT) blood glucose level obtained within 15 minutes of patient assessment in triage? Choose N/A if blood glucose level was already obtained by prehospital provider.
6. Was the respiratory status assessed appropriately (e.g., Kussmaul's respiration)?
7. Was the neurologic status assessed appropriately (e.g., AVPU, GCS)?

8. Did the patient have a history of Diabetes Mellitus?
- Yes (**go to Q.9**)
 - No (**skip to Q.11**)
9. If patient has a HISTORY of DM, was an appropriate history taken (e.g., insulin regimen, last meal eaten, hx of compliance, previous A1c, pump hx checked, injection site checked, all equipment checked, etc.)?
10. If currently using an insulin pump, was the patient's pump stopped or disconnected in the ED? Choose N/A if patient was not on a pump.
- Yes (**answer Q.10a**)
 - No (**skip to Q.12**)

10a. Was the pump stopped or disconnected *after the patient was switched to an alternate insulin source*?

11. If this was a NEW ONSET patient, was an appropriate history taken (e.g., hx polydypsia, polyuria, vomiting w/ polyuria, altered mental status, abdominal pain, recent infections, other chronic conditions, recent weight loss, family hx of DM, etc.)?

ED Management: (ADA Guideline recommendations are noted in the parentheses)

12. Did the patient receive an initial IV fluid bolus within the first hour of treatment (10 - 20 mL/Kg bolus of 0.9% NS over hour)?
13. Were standard/critical labs ordered (must include: blood glucose, urinalysis, venous blood gas, electrolytes/Chem-7)?
14. Were additional labs ordered per policy (e.g., A1c, CBC, Osmolality, BOH, etc.)?
15. Was cardiac monitor applied?
16. Was fluid input & output status documented (per policy)?
17. Were vital signs checked every hour (minimally include: HR, RR, BP, Oxygen saturation)?
18. Was POCT blood glucose level checked every one (1) hour?
19. Was neurologic status assessed every one (1) hour (e.g., AVPU, GCS)?
20. Were electrolyte levels checked every 2-4 hours? Choose N/A if patient was already discharged/transferred.
21. After initial IV fluid bolus, was IV insulin infusion/drip given (0.1unit/Kg/hour)? Choose N/A if patient was already discharged/transferred.

22. Was potassium replacement initiated (total concentration of 40 mmol/Liter IV fluid with some mixture of potassium salt)? Choose N/A if patient was already discharged/transferred.
23. Was IV dextrose given to prevent hypoglycemia (when blood glucose concentration reaches 250 mg/dL)? Choose N/A if patient was already discharged/transferred.
24. Was sodium bicarbonate given?
- Yes (**answer Q.24a**)
 - No (**skip to Q.25**)
- 24a. If sodium bicarbonate was given, was the patient severely acidotic (pH < 7.0) or did the patient have symptomatic hyperkalemia?

Disposition/Discharge:

25. Were vital signs reassessed before disposition (minimally include: HR, RR, BP, Oxygen saturation)?
26. Was neurologic status reassessed before disposition (e.g., AVPU, GCS)?
27. Was POCT blood glucose level reassessed before disposition?
28. What was the child's disposition from the ED?
- Transferred (T) = transferred to a higher level of care (**answer Q.28a**)
 - PICU Admission (P) = admitted to PICU/ICU (*in same hospital*)
 - Intermediate Care Admission (I) = admitted to an intermediate care bed (*in same hospital*)
 - General Admission (F) = admitted to a general care floor (*in same hospital*)
 - Observed (O) = admitted to an observation unit/general floor and/or observed in the ED for ≤ 23 hours (*in same hospital*)
 - Home (H) = discharged home after a brief period of observation (≤ 6 hours)
 - Expired (E) = expired in the ED
- 28a. If transferred, what level/type of patient transport service was used?
- Specialty/Transport Team (S)
 - ALS/ILS (A)
 - ALS/ILS (with nurse) (A/n)
 - BLS (B)
 - BLS (with nurse) (B/n)
 - Private vehicle (PV)
29. Was pediatric Diabetes/DKA patient education initiated in the ED (when appropriate)? Choose N/A if patient was admitted.
30. Was appropriate follow up referral with Diabetes Educator and/or Physician documented (when appropriate)? Choose N/A if patient was admitted.

**Illinois EMSC
Pediatric DKA Record Review Monitor Tool
Record Number: ____**

1. What was the patient's mode of arrival? <input type="checkbox"/> Prehospital <input type="checkbox"/> Transfer <input type="checkbox"/> Walk-in	1a What level of prehospital service was used? Choose N/A if patient was transferred or was a walk-in. <input type="checkbox"/> ALS/ILS <input type="checkbox"/> BLS
1b. All levels: Was blood glucose level checked by prehospital provider? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/D <input type="checkbox"/> N/A	1c. All levels: Was neurologic status assessed by prehospital provider? (e.g., AVPU, GCS) <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/D <input type="checkbox"/> N/A
1d. ALS/ILS: Was IV fluid bolus started or attempted by prehospital provider? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/D <input type="checkbox"/> N/A	1e. ALS/ILS: Was cardiac monitor applied by prehospital provider? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/D <input type="checkbox"/> N/A
2. Age (if < 1yr, enter months) Years: _____ Months: _____	3. Was patient's weight documented in kilograms? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/D <input type="checkbox"/> N/A
4. Was a full set of vital signs documented (must include: HR, RR, BP, Temp, Oxygen saturation)? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/D <input type="checkbox"/> N/A	5. Was a point-of-care testing (POCT) blood glucose level obtained within 15 minutes of patient assessment in triage? Choose N/A if blood glucose level was already obtained by prehospital provider. <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/D <input type="checkbox"/> N/A
6. Was the respiratory status assessed appropriately (e.g., Kussmaul's respiration)? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/D <input type="checkbox"/> N/A	7. Was the neurologic status assessed appropriately (e.g., AVPU, GCS)? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/D <input type="checkbox"/> N/A
8. Did the patient have a history of Diabetes Mellitus? <input type="checkbox"/> Yes <input type="checkbox"/> No	9. If patient has a HISTORY of DM, was an appropriate history taken (e.g., insulin regimen, last meal eaten, hx of compliance, previous A1c, pump hx checked, injection site checked, all equipment checked, etc.)? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/D <input type="checkbox"/> N/A
10. If currently using an insulin pump, was the patient's pump stopped or disconnected in the ED? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/D <input type="checkbox"/> N/A	10a. If yes, was the pump stopped or disconnected after the patient was switched to an alternate insulin source? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/D <input type="checkbox"/> N/A
	11. If this was a NEW ONSET patient, was an appropriate history taken (e.g., hx polydypsia, polyuria, vomiting w/ polyuria, altered mental status, abdominal pain, recent infections, other chronic conditions, recent weight loss, family hx of DM, etc.)? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/D <input type="checkbox"/> N/A
12. Did the patient receive an initial IV fluid bolus within the first hour of treatment (10 -20 mL/Kg bolus of 0.9% NS over hour)? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/D <input type="checkbox"/> N/A	13. Were standard/critical labs ordered (must include: blood glucose, urinalysis, venous blood gas, electrolytes/Chem-7)? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/D <input type="checkbox"/> N/A

Illinois EMSC Pediatric DKA Emergency Department (ED) Survey

Job Title of Survey Respondent(s) *Check all that apply*

- Pediatric Quality Coordinator/CQI Liaison
- ED Medical Director
- ED Nurse Manager
- ED Staff Nurse
- ED Physician
- ED Educator
- Diabetes Educator
- Pediatric Endocrinologist
- Chief/staff Department of Endocrinology
- Chief of Staff
- Nutritionist
- Other _____

Diabetic ketoacidosis (DKA)

Diagnostic Criteria:

- Blood glucose > 200 mg/dL **AND**
- Acidemia: venous pH < 7.30 or bicarbonate 15 mmol/L **AND**
- Moderate or large ketonuria or ketonemia (blood β -hydroxybutyrate > 3 mmol/L)

Source: ADA/ISPAD Consensus Guidelines

1. How does your emergency department define the pediatric population? *Check one answer only*

<input type="checkbox"/>	0 through 12 years old	<input type="checkbox"/>	0 through 18 years old
<input type="checkbox"/>	0 through 13 years old	<input type="checkbox"/>	0 through 19 years old
<input type="checkbox"/>	0 through 14 years old	<input type="checkbox"/>	0 through 20 years old
<input type="checkbox"/>	0 through 15 years old	<input type="checkbox"/>	0 through 21 years old
<input type="checkbox"/>	0 through 16 years old	<input type="checkbox"/>	Not defined specifically
<input type="checkbox"/>	0 through 17 years old	<input type="checkbox"/>	Other

2. What is the average volume of pediatric (defined as 0 through 15 years old) ED visits per year in your facility? *Check one answer only*

<input type="checkbox"/>	0 – 2,000/year	<input type="checkbox"/>	7,001 – 9,000/year
<input type="checkbox"/>	2,001 – 3,000/year	<input type="checkbox"/>	9,001 – 11,000/year
<input type="checkbox"/>	3,001 – 5,000/year	<input type="checkbox"/>	11,001 – 13,000/year
<input type="checkbox"/>	5,001 – 6,000/year	<input type="checkbox"/>	13,001 – 15,000/year
<input type="checkbox"/>	6,001 – 7,000/year	<input type="checkbox"/>	15,001+/year

3. What is the average volume of ALL patient (adult and pediatric) ED visits per year in your facility? *Check one answer only*

<input type="checkbox"/>	0 – 4,000/year	<input type="checkbox"/>	40,001 – 50,000/year
<input type="checkbox"/>	4,001 – 10,000/year	<input type="checkbox"/>	50,001 – 60,000/year
<input type="checkbox"/>	10,001 – 20, 000/year	<input type="checkbox"/>	60,001 – 70,000/year
<input type="checkbox"/>	20,001 – 30,000/year	<input type="checkbox"/>	70,001 – 80,000/year
<input type="checkbox"/>	30,001 – 40,000/year	<input type="checkbox"/>	80,001+/year

4. Does your ED have a documented DKA protocol/policy/guideline/clinical pathway?
- Yes (answer Q.4a - e)
 - No (skip to Q.5)

4a. Does your ED's DKA protocol/policy/guideline/clinical pathway specifically address pediatrics?

- Yes
- No

4b. What laboratory measures does your ED's DKA protocol/policy/guideline/clinical pathway require? *Check all that apply*

Laboratory Evaluation	
a. Venous Blood Gas	0
b. CBC with differential	0
c. Urinalysis	0
d. Blood Glucose	0
e. Plasma Osmolality	0
f. Hemoglobin A1c	0
g. Electrolytes (Ca, Mg, Phos)	0
h. BUN and Creatinine	0
i. Serum ketones [beta-hydroxybutyrate (BOH)]	0
j. Pancreatic antibodies (per policy)	0
k. Pregnancy test (age requirement per policy)	0
l. Electrocardiogram (EKG)	0
m. None	0
Other _____	0

4c. What documentation does your ED's DKA protocol/policy/guideline/clinical pathway require? *Check all that apply*

Documentation	
a. Respiratory status	0
b. Cardiovascular status	0
c. Hydration status	0
d. Neurologic status	0
e. History of polyuria	0
f. History of polydypsia	0
g. History of recent weight loss	0
h. History of abdominal pain	0
i. Signs of infection	0
j. Fluid I & O monitoring	0
k. History of known DM	0
l. History of non-compliance	0
m. Insulin pump problem	0
n. Insulin injection site checked	0
o. Family history of DM	0
p. None	0
Other _____	0

4d. Does your ED's DKA protocol/policy/guideline/clinical pathway specifically address monitoring for and treatment of Cerebral Edema?

- Yes
- No

4e. How recently has your ED's DKA protocol/policy/guideline/clinical pathway been updated/reviewed?

- In the past 6 months
- In the past 12 months
- It has not been updated/reviewed in the past year

5. For stable DKA patients, how frequently are the following monitored in your ED (per policy)?

	Continuously (i.e., more than once an hour)	Every Hour	Every 2 – 4 hours	Not defined in DKA policy	Per physician decision
Vital signs					
Cardiac monitoring					
Neurologic status					
Blood glucose level					
Electrolytes					

6. Typically, who makes up the insulin drips for your ED patients?

- Pharmacist who is physically available 24/7
- Pharmacist during day hours/ED staff during evening hours
- Pharmacist on call for consultation
- ED staff 24/7
- Other _____

7. What safety checks are routinely used when administering insulin? *Check all that apply*

- Designate insulin as a "High Alert" medication
- Follow a specific titration parameter to reach target blood glucose range
- Use a pump with a pump library
- Conduct an independent double check with another caregiver prior to administration
- Regulate the rate of glucose decline through the use of hourly point-of-care testing blood glucose levels
- Other _____

8. During electrolyte replacement, how often is sodium bicarbonate used?

- Every time
- Per physician decision
- Per pharmacist decision
- Only in specific circumstances
- Never
- I don't know

9. Do you use the "two-bag system" when administering variable IV fluid and dextrose to pediatric DKA patients?

- Yes (**answer Q.9a**)
- Occasionally (**answer Q.9a**)
- No (**skip to Q.10**)

- 9a. When using the “two-bag system,” are you required to label your IV tubing lines?
- Yes
 - No
10. What endocrinology services does your hospital provide? *Check all that apply*
- Pediatric Endocrinologist – at all times (24/7)
 - Pediatric Endocrinologist – limited coverage
 - Adult Endocrinologist with pediatric privileges – at all times (24/7)
 - Adult Endocrinologist with pediatric privileges – limited coverage
 - Adult Endocrinologist (provides no/minimal pediatric consultation services) – at all times (24/7)
 - Adult Endocrinologist (provides no/minimal pediatric consultation services) – limited coverage
 - None
 - Other _____
11. Approximately, what percentage of pediatric DKA cases has your ED transferred in the past 12 months?
- None (**skip to Q.12**)
 - 50% or less (**answer Q.11a & b**)
 - More than 50% (**answer Q.11a & b**)
 - All (**answer Q.11a & b**)
 - No cases of DKA presented in the past 12 months to transfer (**skip to Q.12**)
- 11a. If a patient is transferred, which level of service is typically used?
- Specialty/Transport Team (either ground or air)
 - ALS/ILS (with additional ED/ICU nurse)
 - ALS/ILS (no additional ED/ICU staff)
 - BLS (with additional ED/ICU nurse)
 - BLS (no additional ED/ICU staff)
 - Per referring physician’s decision
- 11b. Does your preferred EMS service require their personnel to take either a PALS or PEPP course?
- Yes
 - No
 - I don’t know
12. Does your hospital have a Diabetes Educator available to provide **PATIENT** education?
- Yes – for both adult and pediatric patients
 - Yes – for adults only
 - Yes – for pediatrics only
 - No
13. Does your hospital have a Diabetes Educator available to provide **STAFF** education?
- Yes
 - No

14. Does your hospital conduct chart reviews of patients with ***DKA*** for QI purposes?
- Yes (if yes, answer Q.14a & b)
 - No (go to **DKA Scenario Section**)

14a. What QI indicators are included in the ***DKA*** chart reviews? *Check all that apply*

QI Indicators	0
a. Documentation of laboratory evaluation	0
b. Appropriate initial IV fluid management	0
c. Vital signs	0
d. Blood glucose assesment	0
e. Neurologic status assessment	0
f. History of DM	0
g. History of non-compliance	0
h. Appropriate insulin management	0
i. Appropriate fluid replacement management	0
j. Appropriate electrolyte replacement management	0
k. Appropriate fluid/insulin calculation reconciliation (patient safety)	0
l. Neurologic status reassessment	0
m. Blood glucose reassessment	0
n. Endocrinology consultation	0
o. Transportation issues	0
p. Patient disposition	0
q. Patient/caregiver discharge instructions/education	0
Other _____	0

14b. Is this information reviewed at some type of formal QI committee/process within your organization?

- Yes
- No

THANK YOU FOR COMPLETING THE SURVEY!

If you have not already done so, please also complete the
Case Scenarios and Medical Record Reviews

**Illinois EMSC
Pediatric DKA
Case Scenario #1 – New Onset DM**

History:

A lethargic child is rushed into the emergency department by her frantic mother who states that she was unable to arouse the three-year-old from bed this morning. She reports that her child had appeared “totally fine” until last evening when her daughter complained of some “belly pain” and experienced several episodes of vomiting.

The mother denies a history of trauma and states that her child has no medical problems. The child is not taking any medications, has no medication allergies, and has had no recent contact with any communicable diseases.

What are the potential diagnoses based on this presentation? *Check all that apply*

- Abuse
- Alcohol ingestion
- Dehydration
- DKA
- Endocrine problem
- Epilepsy
- Infection
- Insulin issue
- Intussusception
- Overdose/opiates
- Poisoning
- Psychogenic
- Seizure
- Space occupying lesion
- Stroke
- Trauma
- Uremia

The triage nurse notes that the child is responsive to verbal and painful stimuli. Her airway is patent and she is breathing rapidly and deeply. Her breath has a fruity smell. Her skin is pale and extremities are cool, with a 3-second capillary refill.

The child is immediately admitted for evaluation and management.

Initial Assessment:

What would your initial assessment include? *Check all that apply*

- Height
- Weight
- Temperature
- Heart rate
- Respiratory rate

- Blood pressure
- Oxygen saturation
- Pediatric GCS or AVPU
- Degree of dehydration
- Pain level
- Point-of-care/fingerstick blood glucose concentration
- Urine dip for ketones

The child is placed on a non-rebreather mask at 15 L/minute, a continuous cardiac monitor and pulse oximeter.

Initial vital signs and laboratory results:

- Height is 92 cm
- Weight is estimated at 14 kg from a length-based resuscitation tape
- Oral Temperature: 36.7° C
- Heart rate: 168 beats per minute, regular with strong central pulses, weaker peripheral pulses
- Respiratory rate: 38 breaths/minute, deep with clear bilateral breath sounds
- Blood pressure: 90/60 mm Hg
- Oxygen saturation: 100%
- Pediatric Glasgow Coma Scale score: 10 (eye opening = 3, best motor response = 4, best verbal response = 3)
- Pupils are bilaterally equal, but slightly responsive to light
- Bedside glucose measures “high” (> 600 mg/dl)
- Presence of large urine ketones

The child is presumed to be in diabetic ketoacidosis (DKA).

Management:

A peripheral venous catheter is inserted.

What would your ED staff do in the first hour? *Choose most appropriate answer*

- Give IV fluid of 0.9% NS at maintenance
- Give an IV fluid bolus of 10-20 mL/kg 0.9% NS over the first hour
- Give IV fluid bolus 15-20 mL/kg 0.45% NaCl over the first hour
- Administer insulin drip of 0.1 units/kg/hour
- Wait for more laboratory results before giving any fluids or insulin

What diagnostic studies would be ordered at this time? *Check all that apply*

- Venous blood gas
- CBC with differential
- Urinalysis
- Blood glucose
- Plasma osmolality
- Hemoglobin A1c
- Electrolytes (Na, K, Cl, HCO₃)

- BUN and Creatinine
- Ca, Mg, Phos
- Serum ketones [beta-hydroxybutyrate (BOH)]
- Pancreatic antibodies
- Urine culture
- Urine toxicology screen
- Blood culture
- Serum to hold for further studies
- Chest radiograph
- Head CT
- Electrocardiogram (EKG)
- None

Initial lab results:

- Venous blood gas pH = 6.92
- HCO₃ = 6 mEq/L
- WBC count = 21.5 K/mm
- Hemoglobin = 12 mg/dL
- Hematocrit = 37%

Chemistry panel results:

- Blood glucose = 744 mg/dL
- Sodium = 130 mEq/L
- Potassium = 3.2 mEq/L
- Chloride = 102 mEq/L
- CO₂ = 7 mEq/L
- BUN = 30 mg/dL
- Creatinine = 0.9 mg/dL

A second intravenous line is inserted for frequent blood draws.
The venous blood gas results confirm the diagnosis of DKA.

What would your ED staff do next? *Check all that apply*

- Continue IV fluids only; would not start insulin in the ED
- Administer an insulin bolus of 0.1 units/kg
- Administer an insulin drip of 0.1 units/kg/hour
- Give starting dose of subcutaneous insulin of 0.25 - 0.5 units/kg/day
- Administer broad spectrum antibiotics
- Call pediatric endocrinology service for treatment suggestions
- Begin transfer process to your hospital's PICU/Pediatric unit
- Begin transfer process to a receiving hospital with a higher level of care

Where would your ED admit or transfer this child? *Choose most appropriate answer*

- PICU
- Pediatric Intermediate Care (step-down) Unit
- General Pediatric Unit
- General Medical Unit
- Observation Unit within the ED

She is released from the hospital 7 days after admission, neurologically intact, on subcutaneous insulin injections, and with follow-up referrals arranged with an endocrinologist and diabetic educator.

Adapted Case Study from:
Rebecca A. Steinmann, RN, APN, CEN, CPEN, CCRN, CCNS
Clinical Educator, Emergency Department
Edward Hospital

Illinois EMSC
Pediatric DKA
Case Scenario #2 – Known DM

History:

A 14-year-old male is brought to the Emergency Department via ambulance with a report of the patient being found unresponsive. Paramedics report that the patient's mother came home to find her son lying on the sofa unresponsive. They also report that the child is a diabetic and gives himself his own insulin. His mother told the paramedics she was unsure when her son last took his medication. The patient himself offers no history whatsoever.

Initial Assessment:

What would your initial assessment include? *Check all that apply*

- Height
- Weight
- Temperature
- Heart rate
- Respiratory rate
- Blood pressure
- Oxygen saturation
- Pediatric GCS or AVPU
- Degree of dehydration
- Pain level
- Point-of-care/fingerstick blood glucose concentration
- Urine dip for ketones
- History of medication/nutrition compliance
- History of previous/recent DKA episodes
- Previous A1C
- History of how sugars have been running

Further history:

The patient himself offers no history whatsoever. Mom confirmed that her son was responsible for administering his own insulin.

Initial vital signs and laboratory results:

- Height is 163 cm
- Weight is approximately 65 Kg
- Blood pressure: 101/72
- Heart rate: 123
- Respiratory rate: 32 breaths/minute; lungs are clear, respiratory pattern is that of rapid and deep breathing ("Kussmaul" breathing)
- Oral temperature: 37.6° C
- Oxygen saturation: 100% on room air
- Glasgow Coma Scale score: 9 (eye opening = 3, best motor response = 4, best verbal response = 2)

- Pupils are bilaterally equal
- Bedside glucose measures “too high to read.”
- Presence of large urine ketones
- Head and neck are normal, except for his oropharynx, which demonstrates very dry mucous membranes
- Abdomen exam is negative
- There are no other pathological findings upon physical examination

Management:

What would your ED staff do in the first hour? *Choose most appropriate answer*

- Give IV fluid of 0.9% NS at maintenance
- Give an IV fluid bolus of 10-20 mL/kg 0.9% NS over the first hour
- Give IV fluid bolus 15-20 mL/kg 0.45% NaCl over the first hour
- Administer insulin drip of 0.1 units/kg/hour
- Wait for more laboratory results before giving any fluids or insulin

What diagnostic studies would be ordered at this time? *Check all that apply*

- Venous blood gas
- CBC with differential
- Urinalysis
- Blood glucose
- Plasma osmolality
- Hemoglobin A_{1c}
- Electrolytes (Na, K, Cl, HCO₃)
- BUN and Creatinine
- Ca, Mg, Phos
- Serum ketones [beta-hydroxybutyrate (BOH)]
- Pancreatic antibodies
- Urine culture
- Urine toxicology screen
- Blood culture
- Chest radiograph
- Head CT
- Electrocardiogram (EKG)
- None

Initial lab results:

- Venous blood gas pH = 6.85
- HCO₃ = 2 mEq/L
- WBC count = 62.6 K/mm
- Hemoglobin = 14.4 mg/dL
- Hematocrit = 43.5%

Chemistry panel results:

- Blood glucose = 1,582 mg/dL
- Sodium = 121 mEq/L
- Potassium = 3.2 mEq/L
- Chloride = 87 mEq/L
- CO₂ = 5 mEq/L
- BUN = 32 mg/dL
- Creatinine = 1.5 mg/dL
- Serum ketones (BOH) were positive

What do these results tell you about the patient's condition? *Check all that apply*

- Severe metabolic acidosis secondary to DKA
- Moderate metabolic acidosis secondary to DKA
- Very high WBC could indicate an infection
- Very high WBC could indicate a stress reaction
- Very high WBC could indicate profound dehydration

What would your ED staff do next? *Check all that apply*

- Continue IV fluids only; would not start insulin in the ED
- Administer an insulin bolus of 0.1 units/kg
- Administer an insulin drip of 0.1 units/kg/hour
- Administer starting dose of subcutaneous insulin of 0.25 - 0.5 units/kg/day
- Administer broad spectrum antibiotics
- Call pediatric endocrinology service for treatment suggestions
- Begin transfer process to your hospital's PICU/Pediatric unit
- Begin transfer process to a receiving hospital with a higher level of care

With hydration and insulin therapy, the patient showed an increased level of consciousness, was able to converse with his mother, and stated he was feeling "a little better." He was now able to tell us that he had not been taking his insulin "for a few days" and had been experiencing a mild cough.

Where would your ED admit or transfer this child? *Choose most appropriate answer*

- PICU
- Pediatric Intermediate Care (step-down) Unit
- General Pediatric Unit
- General Medical Unit
- Observation Unit within the ED

Adapted from:
REACH Air Medical Services Diabetic Ketoacidosis (DKA) Case Study
451 Aviation Blvd., Ste. 201
Santa Rosa, CA 95403