



Diabetic Ketoacidosis (DKA)

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What is a Clinical Pathway?

An evidence-based guideline that decreases unnecessary variation and helps promote safe, effective, and consistent patient care.

Objectives of Pathway

- Establishing a clear, unambiguous, written protocol, adapted to our local circumstances, for appropriate triage and management of mild-moderate DKA.
- Building consensus within all experts who are involved in DKA management to provide highest quality care standard

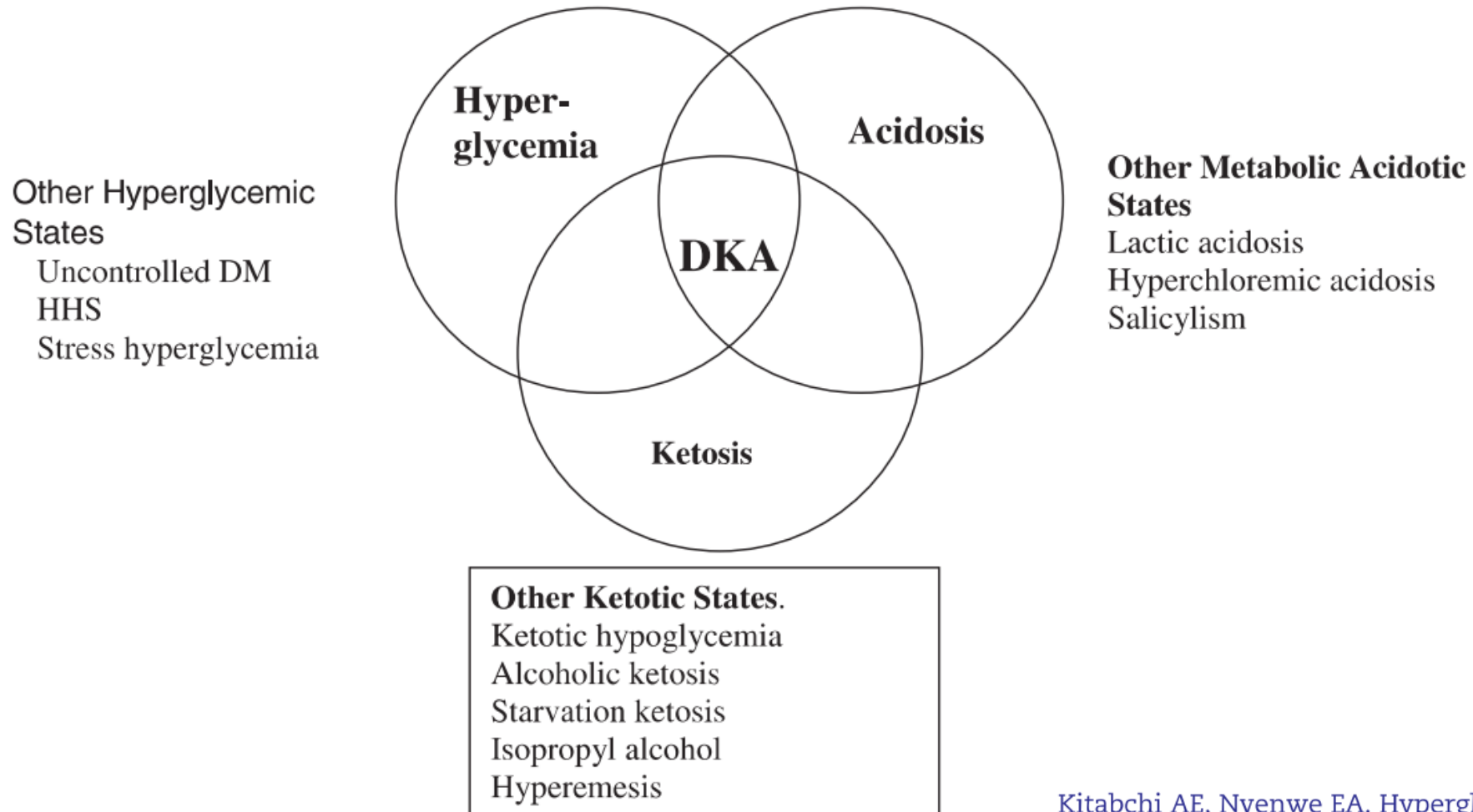
Why is Pathway Necessary?

- DKA can have potentially fatal complications.
- Consistent and meticulous monitoring and treatment guidelines should be followed to carefully correct the metabolic derangement, while avoiding complications of therapy.
- Levels of monitoring and treatment vary based on a patient's initial presentation
- The pathway provides consistent guidelines for care after a patient has been stabilized, and to help them transition back to their routine home care when ready.

Background: DKA Definition

- Hyperglycemia: Blood glucose (BG) > 11mmol/L (~200mg/dL)
- Venous pH < 7.3 OR Bicarbonate <15 mmol/L
- Ketonemia and ketonuria
 - Blood β -hydroxybutyrate (BOHB) concentration ≥ 3 mmol/L
 - Urine ketones are typically $\geq 2+$ ('moderate or large') positive


Background: DKA Definition



Kitabchi AE, Nyenwe EA. Hyperglycemic crises in diabetes mellitus: diabetic ketoacidosis and hyperglycemic hyperosmolar state. *Endocrinol Metab Clin North Am* 2006; 35:725–51.

Clinical manifestations of DKA

Click the link to see
Kussmaul breathing



- Dehydration
- Tachypnea; deep sighing ([Kussmaul](#)) respiration
- Nausea, vomiting, and abdominal pain that may mimic an acute abdominal condition
- Confusion, drowsiness, progressive obtundation and loss of consciousness

DKA risk is increased in:

- Children who omit insulin
- Children with poor metabolic control or previous episodes of DKA
- Gastroenteritis with persistent vomiting and inability to maintain hydration
- Children with psychiatric disorder
- Children with difficult or unstable family circumstances
- Peripubertal and adolescent girls
- Children with limited access to medical services
- Insulin pump therapy



In Children with established diabetes with recurrent DKA, insulin omission or failure to follow sick day or pump failure management guidelines accounts for almost *all* episodes.

DKA Morbidity and Mortality

- In population studies, the mortality rate from DKA in children is 0.15–0.30% and may be decreasing.
- Cerebral injury is the major cause of mortality and morbidity
- Cerebral edema accounts for 60–90% of all DKA deaths
- From 10–25% of survivors of cerebral edema have significant residual morbidity.
- Children without overt neurological symptoms during DKA treatment may have subtle evidence of brain injury, particularly memory deficits, after recovery from DKA.

DKA Morbidity and Mortality: Other complications

- Hypokalemia
- Hypocalcemia, hypomagnesemia
- Severe hypophosphatemia
- Hypoglycemia
- Other central nervous system complications include dural sinus thrombosis, basilar artery thrombosis, intracranial hemorrhage, and cerebral infarction
- Venous thrombosis
- Pulmonary embolism
- Sepsis
- Rhinocerebral or pulmonary mucormycosis
- Aspiration pneumonia
- Pulmonary edema
- Acute respiratory distress syndrome (ARDS)
- Pneumothorax, pneumomediastinum, and SC emphysema
- Rhabdomyolysis
- Ischemic bowel necrosis
- Acute renal failure
- Acute pancreatitis

- Potential risk factors at diagnosis or during treatment of DKA:
 - Greater hypocapnia at presentation after adjusting for degree of acidosis
 - Increased serum urea nitrogen at presentation
 - Severe acidosis at presentation
 - Bicarbonate treatment for correction of acidosis
 - A marked early decrease in serum effective osmolality
 - An attenuated rise in serum sodium concentration or an early fall in glucose-corrected sodium during therapy
 - Greater volumes of fluid given in the first 4 hours
 - Administration of insulin in the first hour of fluid treatment

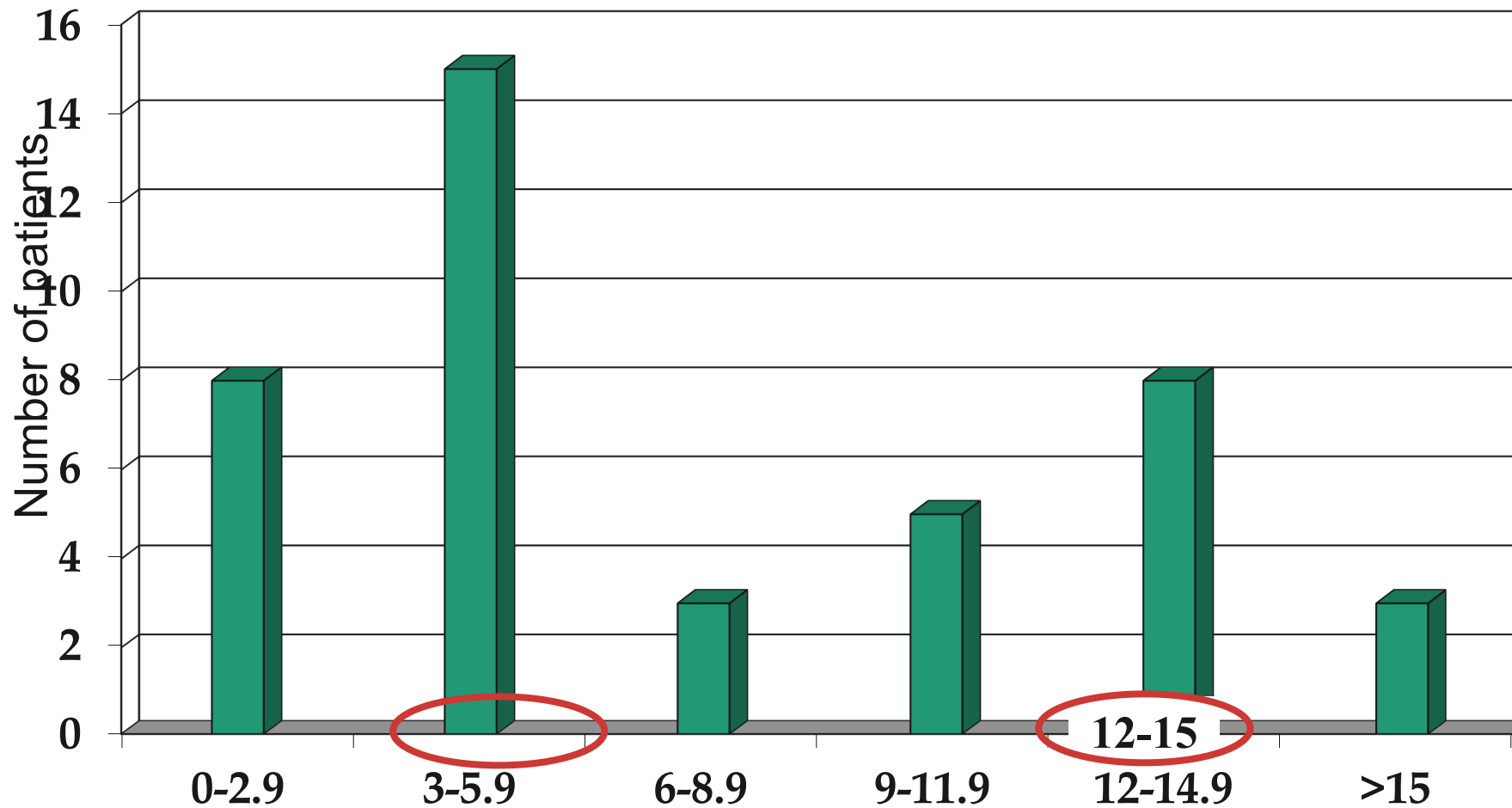
Cerebral Edema: Signs and Symptoms

- Headache and slowing of heart rate
- Change in neurological status (restlessness, irritability, increased drowsiness, and incontinence)
- Specific neurological signs (e.g., cranial nerve palsies, papilledema)
- Rising blood pressure
- Decreased O2 saturation

Cerebral Edema: Diagnostic Criteria

- Abnormal motor or verbal response to pain
- Decorticate or decerebration posture
- Cranial nerve palsy (especially III, IV, and VI)
- Abnormal neurogenic respiratory pattern (e.g., grunting, tachypnea, Cheyne–Stokes respiration, apneusis)

Cerebral Edema: Timing of Onset



Time of onset of Neurological Compromise (hours)

Muir A, et al, Diab Care. July 2004

Cerebral Edema: Treatment

- Treatment should be initiated as soon as the condition is suspected
- Decrease the rate of maintenance fluids
- Hyperosmotic therapies: Mannitol or Hypertonic Saline per pathway guidelines
- Increase the head of bed to 30 degrees
- Intubation as necessary

- *After* treatment for cerebral edema has been started cranial imaging may be considered as with any critically ill patient with encephalopathy or acute focal neurologic deficit
- The primary concern leading to imaging is whether the patient has a lesion requiring emergency neurosurgery
 - (e.g., intracranial hemorrhage) or a lesion that may necessitate anticoagulation (e.g., cerebrovascular thrombosis)

Glasgow Coma Scale (GCS)

- An important tool for monitoring for cerebral edema

Modified Glasgow Coma Scale for Infants and Children


	Child	Infant	Score
Eye opening	Spontaneous	Spontaneous	4
	To speech	To speech	3
	To pain only	To pain only	2
	No response	No response	1
Best verbal response	Oriented, appropriate	Coos and babbles	5
	Confused	Irritable cries	4
	Inappropriate words	Cries to pain	3
	Incomprehensible sounds	Moans to pain	2
	No response	No response	1
Best motor response*	Obeys commands	Moves spontaneously and purposefully	6
	Localizes painful stimulus	Withdraws to touch	5
	Withdraws in response to pain	Withdraws to response in pain	4
	Flexion in response to pain	Abnormal flexion posture to pain	3
	Extension in response to pain	Abnormal extension posture to pain	2
	No response	No response	1

*If patient is intubated, unconscious, or preverbal, the most important part of this scale is motor response. Motor response should be carefully evaluated.


DKA Clinical Pathway

The DKA Clinical Pathway is divided into 5 phases of care:

- 1) Transport Algorithm
- 2) Emergency Room Algorithm
- 3) PICU Management Algorithm
- 4) Med/Surg Management Algorithm
- 5) DKA Resolution and Ongoing Management Algorithm



The first 3 phases of care focus on identification and initial acute management



The last 2 phases of care are for patients who have stabilized and when DKA resolves

We will review each phase of care in the following slides.

DKA – Transport Algorithm

CLINICAL PATHWAY: Diabetes Ketoacidosis (DKA) Transport Algorithm

- The purpose of the Transport Algorithm is to provide guidance for teams transporting patients with suspected DKA to CT Children's Medical Center.
- The main objectives are early identification and initial stabilization.

Inclusion Criteria: Patient of any age presenting with potential Diabetic Ketoacidosis (DKA)
(Consider if history of: weight loss, vomiting, abdominal pain, polyuria, polydipsia, nocturia; Consider if exam findings of: tiredness, Kussmaul respirations, dehydration, mental status changes, abdominal pain (can be severe and present as acute abdomen))
Exclusion Criteria: well-appearing, $HCO_3^- > 18$ mmol/L

ESTABLISH DIAGNOSIS
 Establish DKA diagnosis
 (defined by pH < 7.3, $HCO_3^- < 15$ mmol/L, blood sugar > 200, moderate to large ketones – blood² or urine)
Note: Hyperglycemic Hyperosmolar Syndrome (HHS) is a spectrum with DKA, and may not have acidosis and ketones, but will have severe hyperglycemia and dehydration. Discuss care with PICU/Endocrine.

POCT Blood Ketone Interpretation:

- < 0.6 mmol/L: Low
- 0.6-1.5 mmol/L: Moderate
- > 1.5 mmol/L: Large

INITIAL MANAGEMENT

Labs:

- iSTAT chem 7, venous blood gas
- Repeat Chem 7/VBG after initial NS bolus

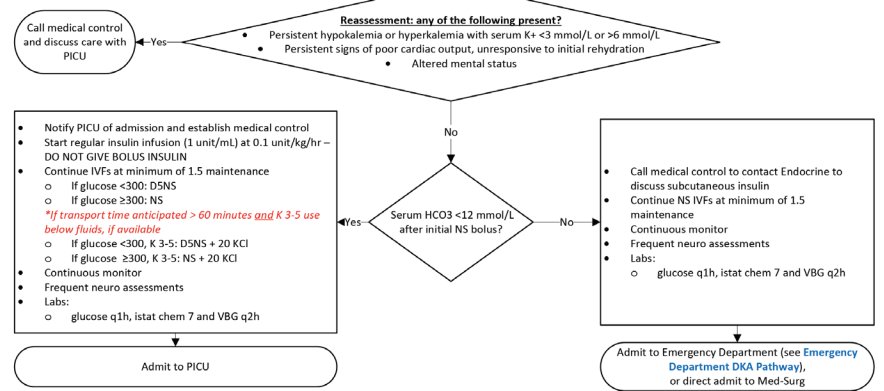
Establish Access:

- PIV x 2

FEN*:

- Make NPO
- Give 0.9% NS bolus 10 mL/kg over 30-60 min
 - Additional fluid bolus *only* if signs of worsening dehydration or presence of shock (hypotension, tachycardia, delayed cap refill, oliguria)
 - Caution needed when using depressed mental status as marker of shock, as it may represent DKA associated brain injury
 - Large volume fluid resuscitation may be associated with increased risk of DKA associated brain injury
- If long transport expected, consider initiation of special maintenance fluids from referring hospital after discussion with medical control

**If fluids and insulin drip already initiated at referring hospital, transport team to call medical control to determine next steps in management.*



Always monitor for DKA Associated Brain Injury and notify the PICU attending if s/s present!

Signs/Symptoms:

- HA, change in neuro status (restlessness, irritability, drowsiness), inappropriate slowing of HR or rise of BP

Treatment: Therapy should always precede imaging!

- (1) Hypertonic Saline(3%) 1.25 – 2.5 mEq/kg (2.5 – 5 ml/kg) IV (over 5 min for acute herniation; over 10 min for increased intracranial pressure) OR Mannitol 0.25 g/kg over 30 minutes
- (2) Ensure pt on 0.9% NS containing fluids
- (3) Discuss criteria for intubation (e.g. respiratory depression, poor airway control, worsening neurologic status despite treatment)
- (4) Consider head CT

*** Do not give sedating meds outside the setting of intubation (may lead to rise of PCO2 and herniation)**



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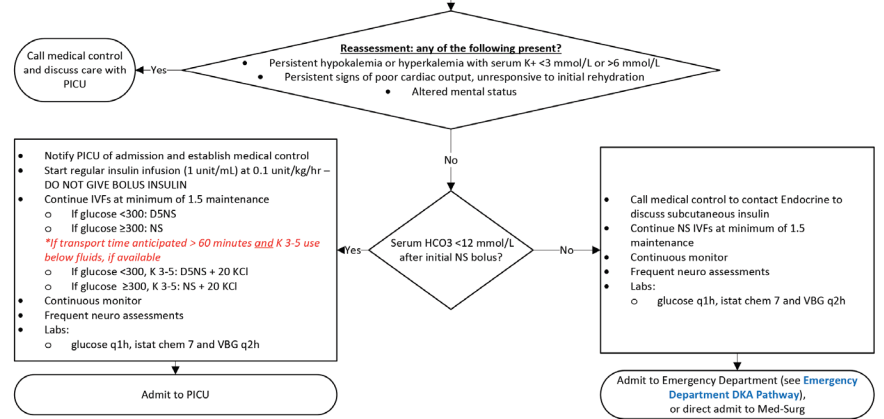
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2026 update

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 - If long transport expected, consider initiation of special maintenance fluids from referring hospital after discussion with medical control
- *If fluids and insulin drip already initiated at referring hospital, transport team to call medical control to determine next steps in management.

- Those with a suspicion of DKA should be included. DKA should be suspected based on concerning components of the history and physical, as outlined above.
- Early identification is key.
- Once DKA is suspected, the diagnosis should be established based on specific criteria:
 - pH <7.3
 - HCO₃ <15 mmol/L
 - Blood sugar >200
 - Moderate-large ketones in the blood or urine



Always monitor for DKA Associated Brain Injury and notify the PICU attending if s/s present!

Signs/Symptoms:

- HA, change in neuro status (restlessness, irritability, drowsiness), inappropriate slowing of HR or rise of BP

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CLINICAL PATHWAY:
Diabetes Ketoacidosis (DKA) Transport Algorithm

THIS PATHWAY SERVES AS A GUIDE AND DOES NOT REPLACE CLINICAL JUDGMENT.

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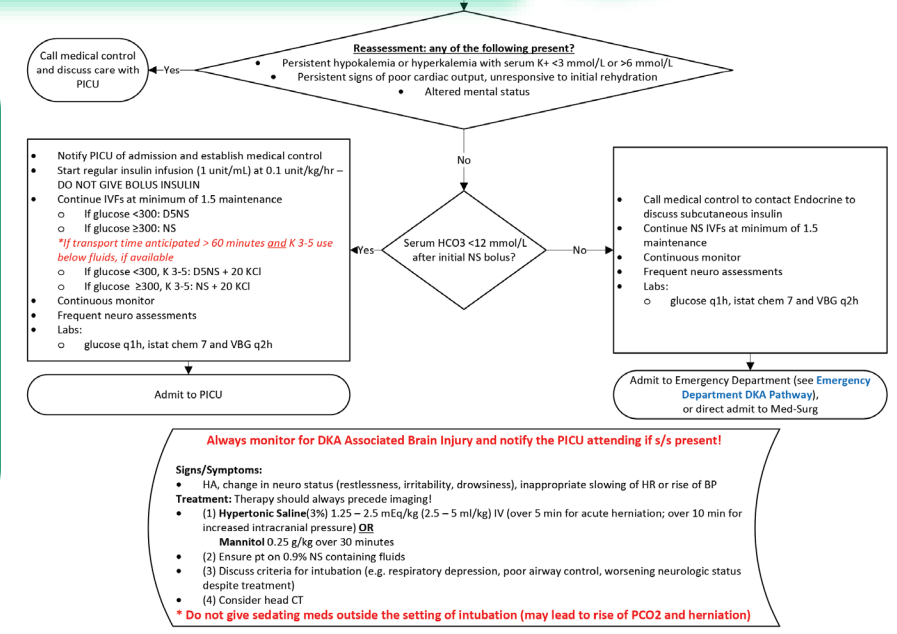
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• Note that Hyperglycemic Hyperosmolar Syndrome (HHS) may present within the spectrum of suspected DKA. If this is present, it is important to discuss the diagnosis and management with the PICU and Endocrinology teams.



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INITIAL MANAGEMENT

Labs:

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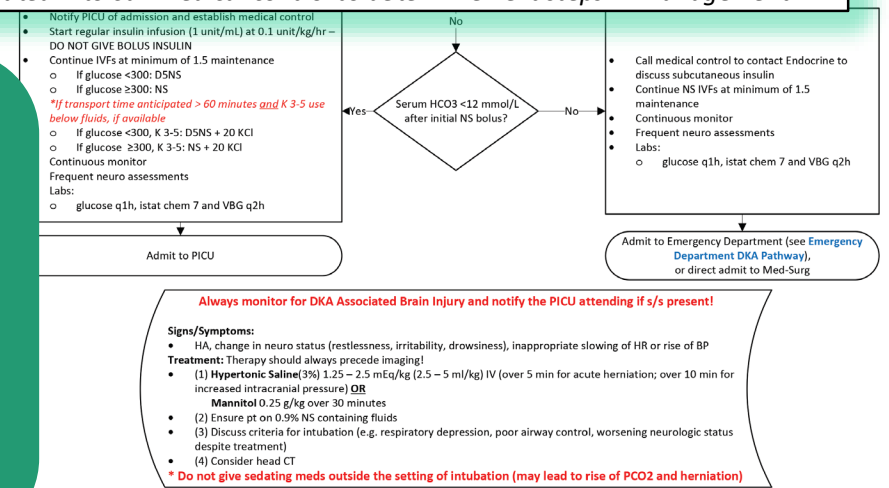
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- If long transport expected, consider initiation of special maintenance fluids from referring hospital after discussion with medical control

**If fluids and insulin drip already initiated at referring hospital, transport team to call medical control to determine next steps in management.*

- The initial management is focused on stabilization.
- Labs:
 - It is important to get “baseline” and repeat labs after the NS bolus is given.
- Access: 2 IV lines should be placed whenever possible



INITIAL MANAGEMENT

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- Repeat Chem 7/VBG after initial NS bolus

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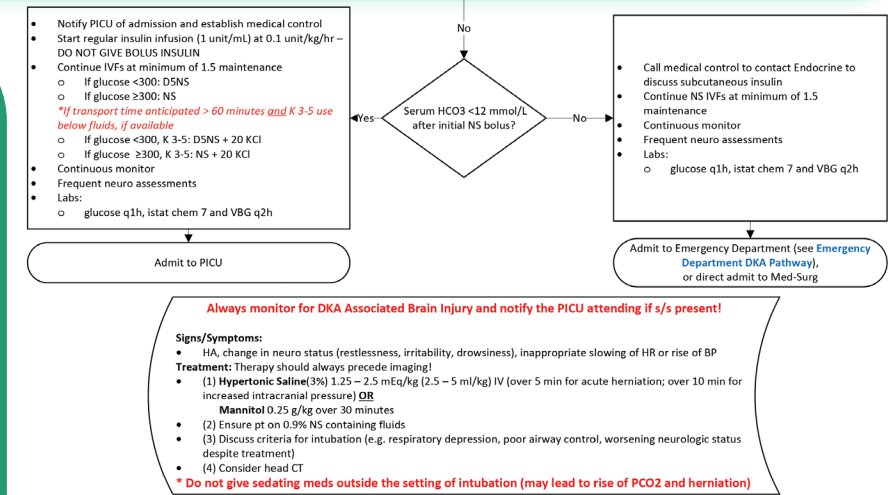
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*If fluids and insulin drip already initiated at referring hospital, transport team to call medical control to determine next steps in management.

- It is important to make the patient NPO and give a 0.9% NS bolus 10 ml/kg over 30-60 minutes. Large volume fluid resuscitation may increase the risk of DKA associated brain injury.
- Additional fluid boluses should only be given if there is worsening dehydration or shock (as defined by hypotension, tachycardia, delayed cap refill and oliguria, not depressed mental status)



INITIAL MANAGEMENT

Labs:

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- Repeat Chem 7/VBG after initial NS bolus

Establish Access:

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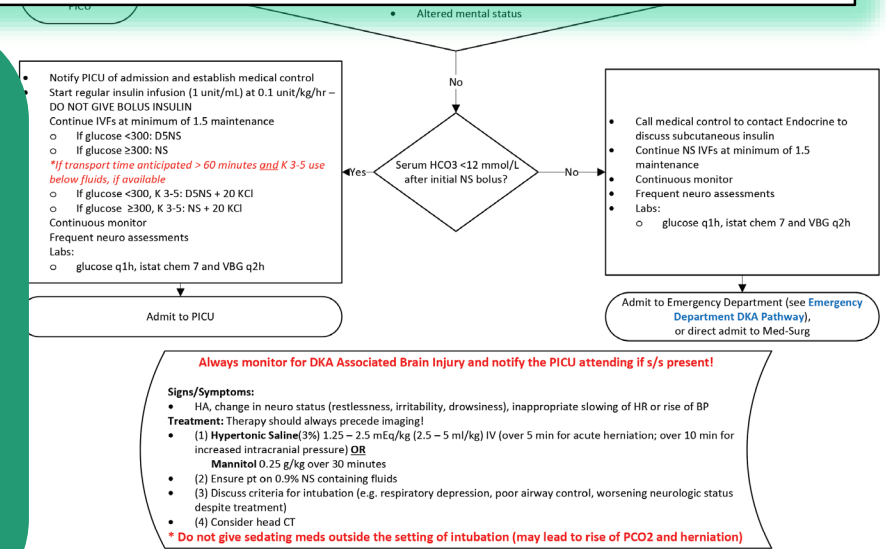
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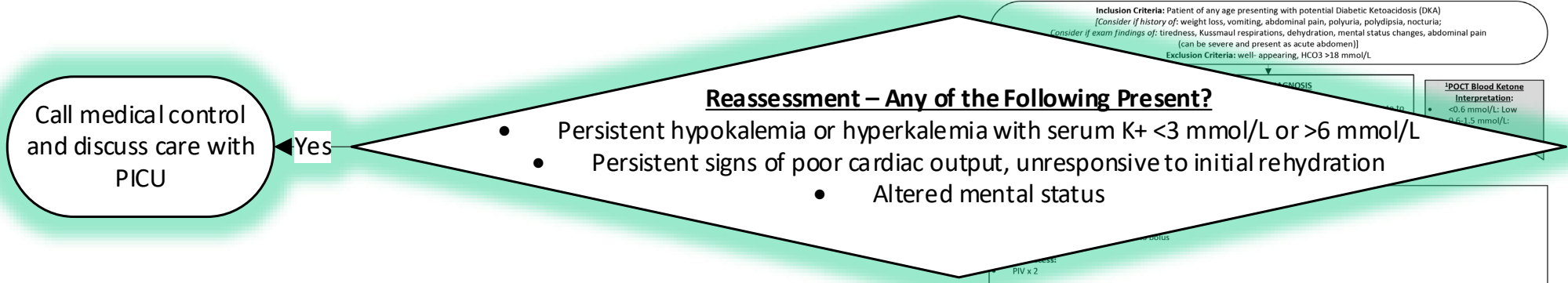
Transport Considerations:

- If the patient was already started on fluids and an insulin drip at an outside hospital, call medical control to discuss with endocrinology.
- If there is a longer transport expected, discuss starting special maintenance fluids with medical control.

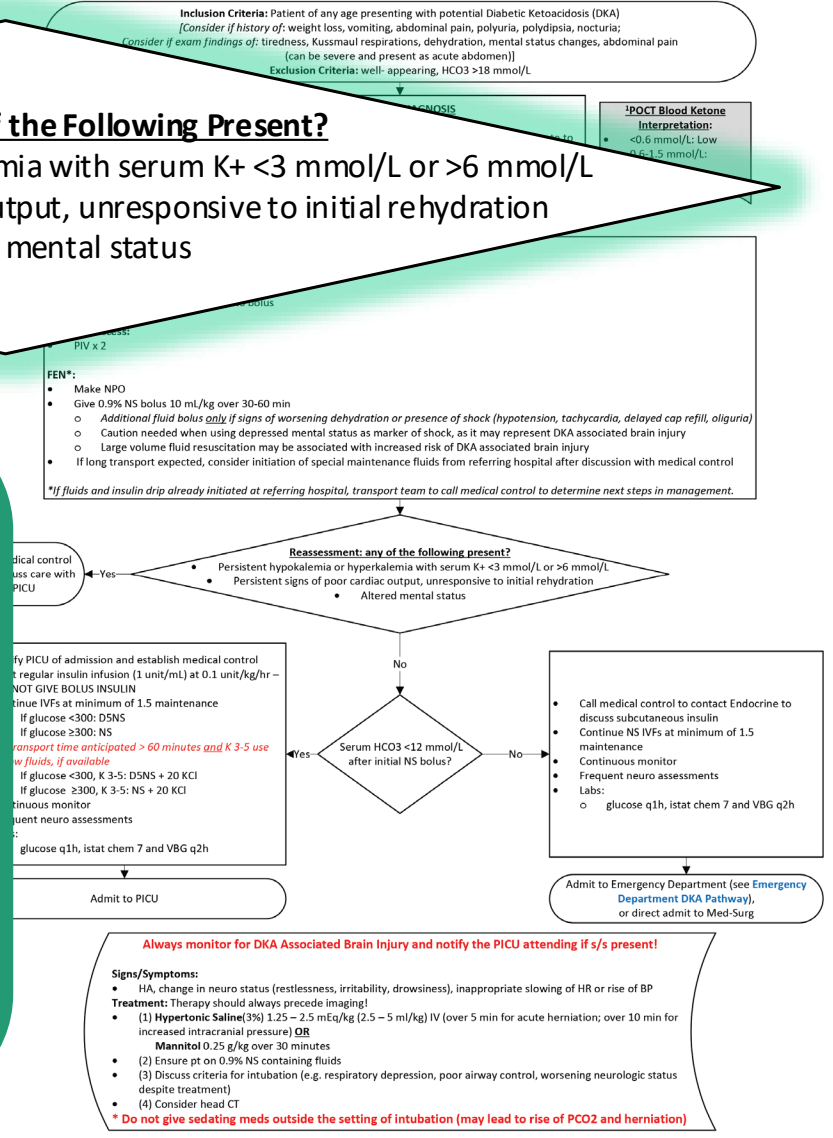


CLINICAL PATHWAY:
Diabetes Ketoacidosis (DKA) Transport Algorithm

THIS PATHWAY
SERVES AS A GUIDE
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- After the bolus is given, reassessment should occur.
- Clinical signs that would prompt a PICU admission include:
 - Hypokalemia (<3 mmol/L) or hyperkalemia (>6 mmol/L)
 - Signs of poor cardiac output, unresponsive to the initial rehydration efforts
 - Or altered mental status



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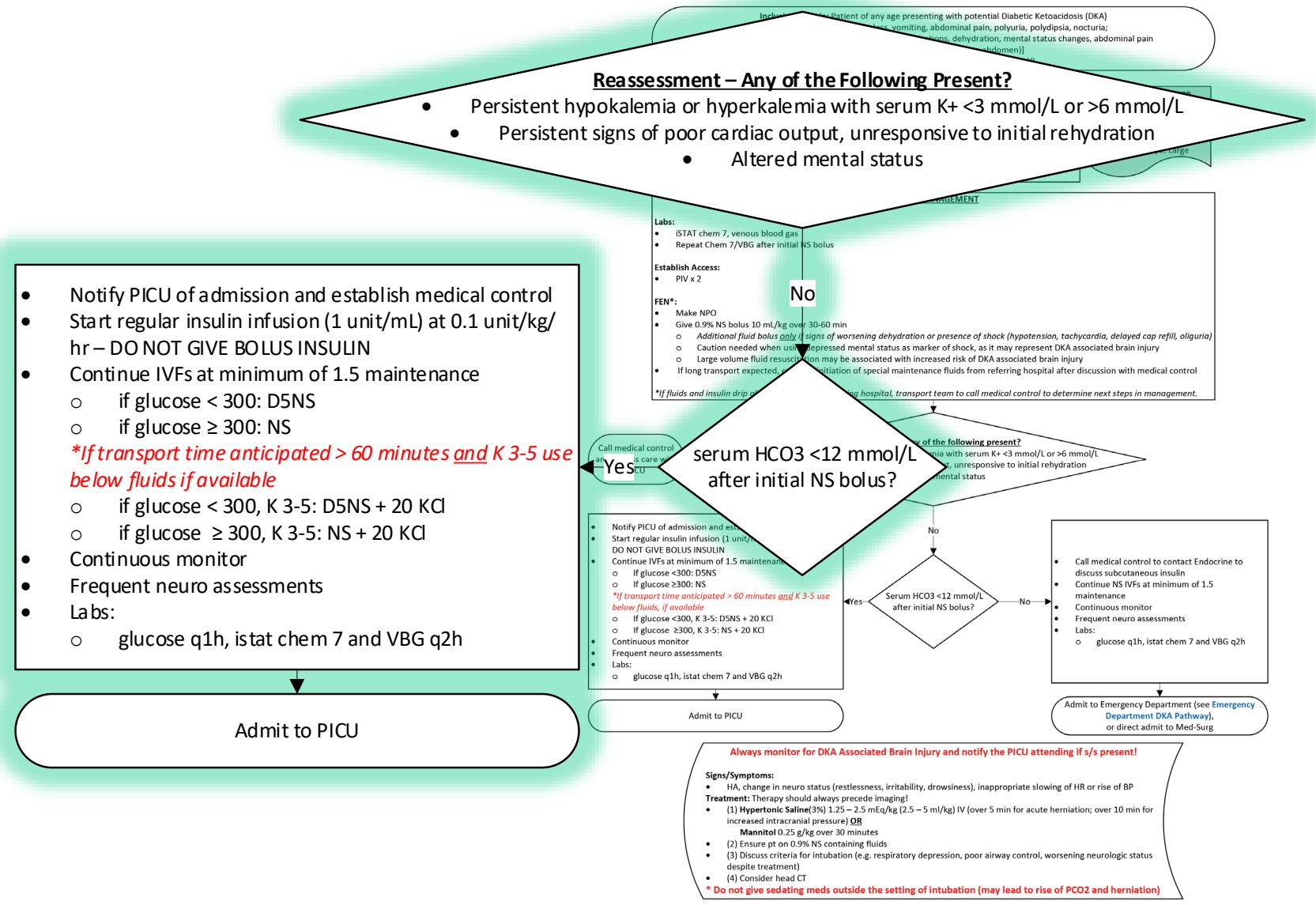


- Additionally, a PICU admission should occur if there is a serum $\text{HCO}_3^- < 12 \text{ mmol/L}$ present after the initial NS bolus
- If $\text{HCO}_3^- < 12 \text{ mmol/L}$, a regular insulin infusion should be given (NOT a bolus) and IVF should continue.
 - Guidelines for fluid type are given here.
- Frequent monitoring, including labs, are indicated.
- Once the patient arrives in the PICU, the PICU management algorithm should be followed.

CLINICAL PATHWAY:

Diabetes Ketoacidosis (DKA) Transport Algorithm

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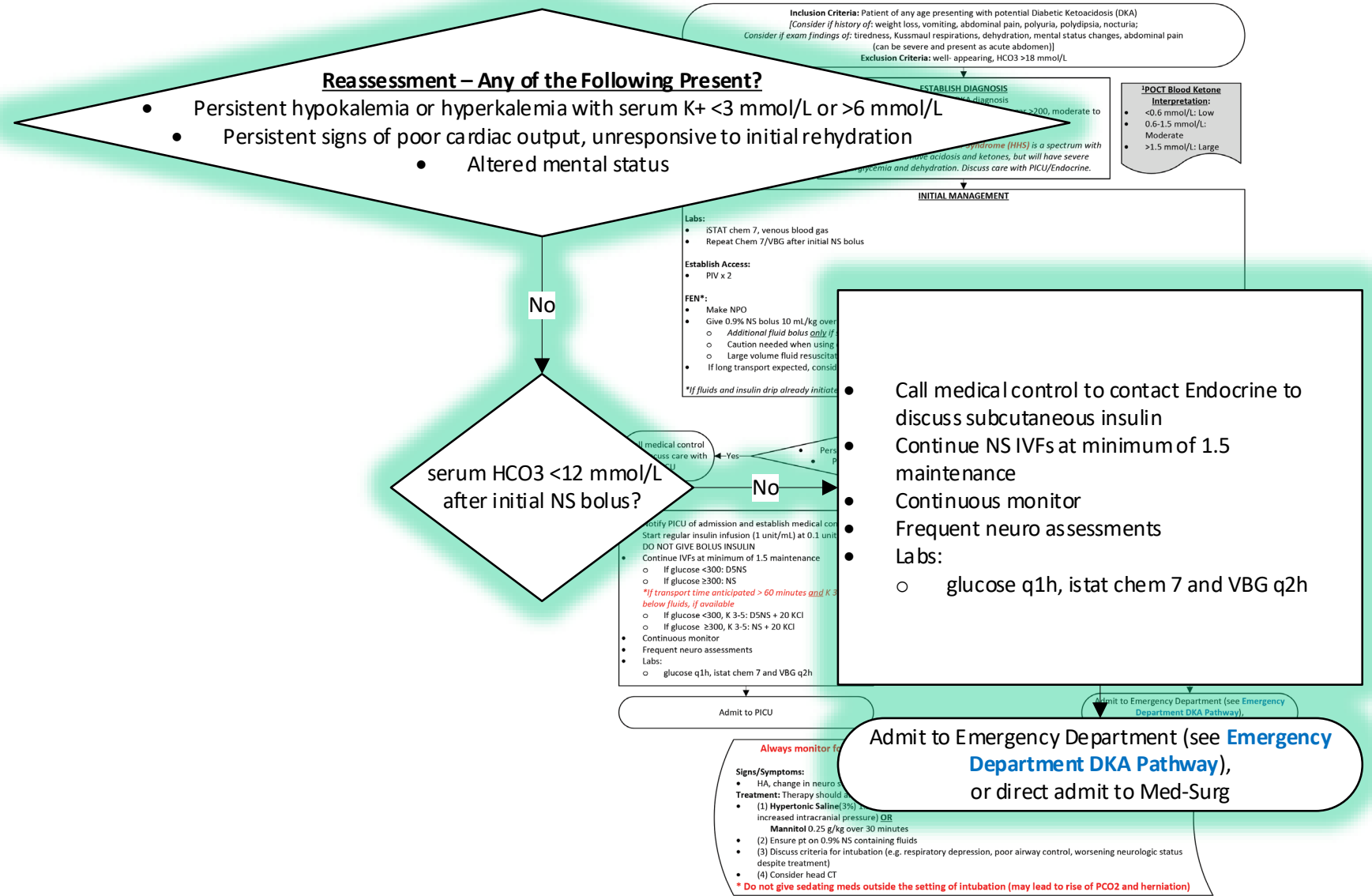
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CLINICAL PATHWAY:
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- If none of the PICU criteria are met, subcutaneous insulin may be considered and IVF should be started/maintained, with frequent neuro and lab assessments.
- Admission may occur through the Emergency Department or as a direct admit to the Med-Surg Units, in which the appropriate algorithm should be followed.



Always monitor for DKA Associated Brain Injury and notify the PICU attending if s/s present!

Signs/Symptoms:

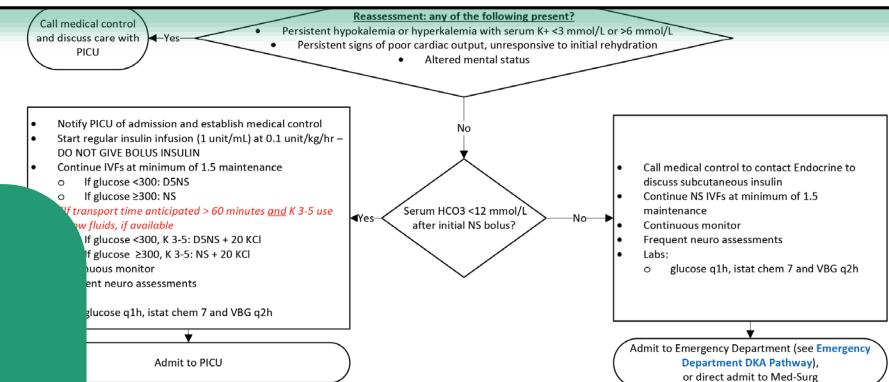
- HA, change in neuro status (restlessness, irritability, drowsiness), inappropriate slowing of HR or rise of BP

Treatment: Therapy should always precede imaging!

- (1) **Hypertonic Saline**(3%) 1.25 – 2.5 mEq/kg (2.5 – 5 ml/kg) IV (over 5 min for acute herniation; over 10 min for increased intracranial pressure) **OR**
Mannitol 0.25 g/kg over 30 minutes
- (2) Ensure pt on 0.9% NS containing fluids
- (3) Discuss criteria for intubation (e.g. respiratory depression, poor airway control, worsening neurologic status despite treatment)
- (4) Consider head CT

*** Do not give sedating meds outside the setting of intubation (may lead to rise of PCO2 and herniation)**

- At all times, clinicians should monitor for DKA associated brain injury and notify the PICU attending if present.
- Treatment should always precede imaging.
- It is important to avoid sedating medications as it may lead to a rise of PCO2 and herniation!



Always monitor for DKA Associated Brain Injury and notify the PICU attending if s/s present!

Signs/Symptoms:

- HA, change in neuro status (restlessness, irritability, drowsiness), inappropriate slowing of HR or rise of BP

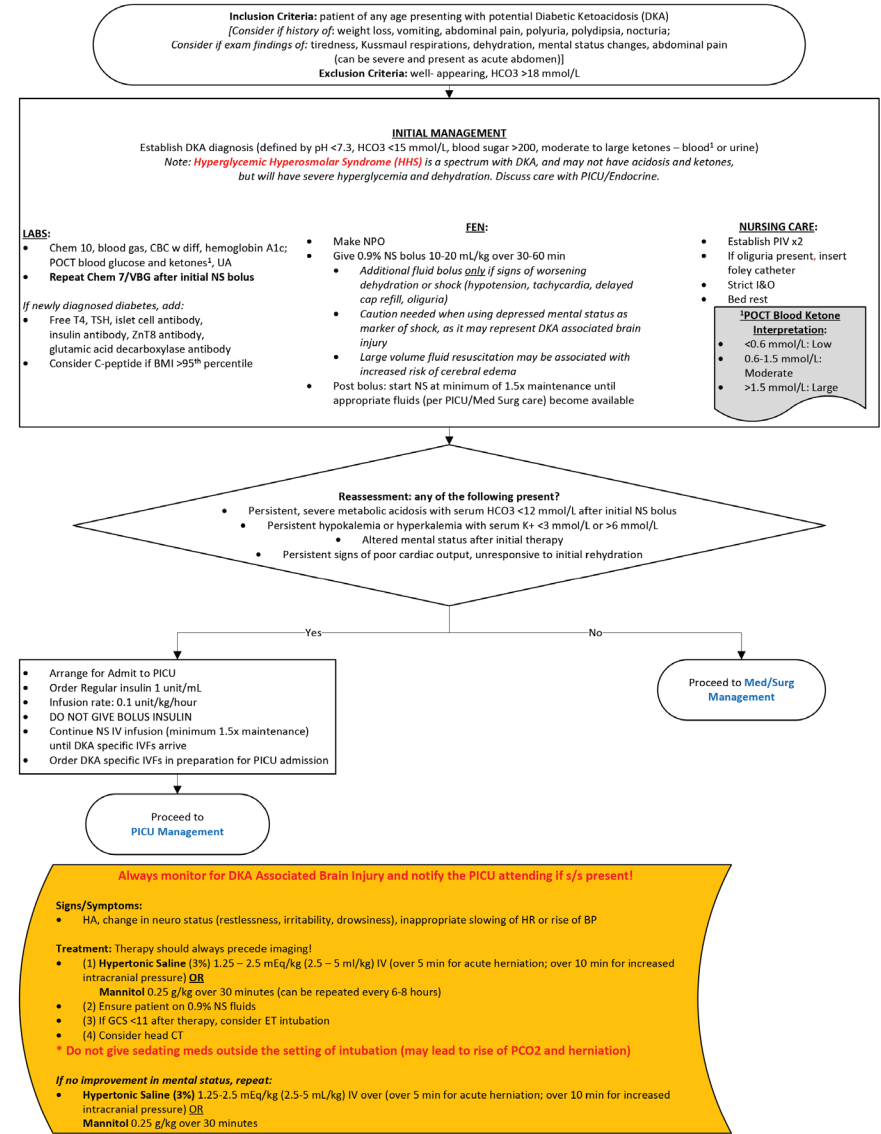
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- (3) Discuss criteria for intubation (e.g. respiratory depression, poor airway control, worsening neurologic status despite treatment)
- (4) Consider head CT

*** Do not give sedating meds outside the setting of intubation (may lead to rise of PCO2 and herniation)**

DKA – Emergency Room Algorithm

- The purpose of the Emergency Room Algorithm is to quickly establish the diagnosis of DKA and provide initial management considerations.
- The point of entry into this algorithm is if a patient presents with suspected DKA in the emergency room, or if they were transported from an outside hospital.
- This algorithm is similar to the Transport Algorithm, but provides additional interventions.



- Those with a suspicion of DKA should be included. DKA should be suspected based on concerning components of the history and physical, as outlined.

- Early identification is key.

- Once DKA is suspected, the diagnosis should be established based on specific criteria:

- pH <7.3
- HCO₃ <15 mmol/L
- Blood sugar >200
- Moderate – large ketones in the blood or urine



2026 update

CLINICAL PATHWAY:

Diabetes Ketoacidosis (DKA) Emergency Room Algorithm

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[Consider if history of: weight loss, vomiting, abdominal pain, polyuria, polydipsia, nocturia; Consider if exam findings of: tiredness, Kussmaul respirations, dehydration, mental status changes, abdominal pain (can be severe and present as acute abdomen)]

Exclusion Criteria: well- appearing, HCO₃ >18 mmol/L

Establish DKA diagnosis (defined by pH <7.3, HCO₃ <15 mmol/L, blood sugar >200, moderate to large ketones – blood¹ or urine)

INITIAL MANAGEMENT

Establish DKA diagnosis (defined by pH <7.3, HCO₃ <15 mmol/L, blood sugar >200, moderate to large ketones – blood¹ or urine)

*Note: **Hyperglycemic Hyperosmolar Syndrome (HHS)** is a spectrum with DKA, and may not have acidosis and ketones, but will have severe hyperglycemia and dehydration. Discuss care with PICU/Endocrine.*

LABS:

- Chem 10, blood gas, CBC w diff, hemoglobin A1c; POCT blood glucose and ketones¹, UA
- Repeat Chem 7/VBG after initial NS bolus**

If newly diagnosed diabetes, add:

- Free T4, TSH, islet cell antibody, insulin antibody, ZnT8 antibody, glutamic acid decarboxylase antibody
- Consider C-peptide if BMI >95th percentile

FEN:

- Make NPO
- Give 0.9% NS bolus 10-20 mL/kg over 30-60 min
 - Additional fluid bolus only if signs of worsening dehydration or shock (hypotension, tachycardia, delayed cap refill, oliguria)*
 - Caution needed when using depressed mental status as marker of shock, as it may represent DKA associated brain injury*
 - Large volume fluid resuscitation may be associated with increased risk of cerebral edema*
- Post bolus: start NS at minimum of 1.5x maintenance until appropriate fluids (per PICU/Med Surg care) become available

NURSING CARE:

- Establish PIV x2
- If oliguria present, insert foley catheter
- Strict I&O
- Bed rest

¹POCT Blood Ketone Interpretation:

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2026 update

Proceed to PICU Management

Always monitor for DKA Associated Brain Injury and notify the PICU attending if s/s present!

Signs/Symptoms:

- HA, change in neuro status (restlessness, irritability, drowsiness), inappropriate slowing of HR or rise of BP

Treatment: Therapy should always precede imaging!

- (1) **Hypertonic Saline (3%)** 1.25 – 2.5 mEq/kg (2.5 – 5 mL/kg) IV (over 5 min for acute herniation; over 10 min for increased intracranial pressure) **OR**
 - Mannitol** 0.25 g/kg over 30 minutes (can be repeated every 6-8 hours)
- (2) Ensure patient on 0.9% NS fluids
- (3) If GCS <11 after therapy, consider ET intubation
- (4) Consider head CT

* Do not give sedating meds outside the setting of intubation (may lead to rise of PCO₂ and herniation)

If no improvement in mental status, repeat:

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 - Mannitol** 0.25 g/kg over 30 minutes

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 Consider if exam findings of: tiredness, Kussmaul respirations, dehydration, mental status changes, abdominal pain
 (can be severe and present as acute abdomen)]
Exclusion Criteria: well- appearing, HCO3 >18 mmol/L

Note: Hyperglycemic Hyperosmolar Syndrome (HHS) is a spectrum with DKA, and may not have acidosis and ketones, but will have severe hypernatremia and dehydration. Discuss care with PICU/Endocrine.

INITIAL MANAGEMENT

Establish DKA diagnosis (defined by pH <7.3, HCO3 <15 mmol/L, blood sugar >200, moderate to large ketones – blood¹ or urine)
 Note: **Hyperglycemic Hyperosmolar Syndrome (HHS)** is a spectrum with DKA, and may not have acidosis and ketones, but will have severe hyperglycemia and dehydration. Discuss care with PICU/Endocrine.

LABS:

- Chem 10, blood gas, CBC w diff, hemoglobin A1c; POCT blood glucose and ketones¹, UA
- Repeat Chem 7/VBG after initial NS bolus**

If newly diagnosed diabetes, add:

- Free T4, TSH, islet cell antibody, insulin antibody, ZnT8 antibody, glutamic acid decarboxylase antibody
- Consider C-peptide if BMI >95th percentile

FEN:

- Make NPO
- Give 0.9% NS bolus 10-20 mL/kg over 30-60 min
 - Additional fluid bolus only if signs of worsening dehydration or shock (hypotension, tachycardia, delayed cap refill, oliguria)
 - Caution needed when using depressed mental status as marker of shock, as it may represent DKA associated brain injury
 - Large volume fluid resuscitation may be associated with increased risk of cerebral edema
- Post bolus: start NS at minimum of 1.5x maintenance until appropriate fluids (per PICU/Med Surg care) become available

NURSING CARE:

- Establish PIV x2
- If oliguria present, insert foley catheter
- Strict I&O
- Bed rest

¹POCT Blood Ketone

Interpretation:

- <0.6 mmol/L: Low
- 0.6-1.5 mmol/L: Moderate
- >1.5 mmol/L: Large

Proceed to PICU Management

Always monitor for DKA Associated Brain Injury and notify the PICU attending if s/s present!

Signs/Symptoms:

- HA, change in neuro status (restlessness, irritability, drowsiness), inappropriate slowing of HR or rise of BP

Treatment: Therapy should always precede imaging!

- (1) **Hypertonic Saline** (3%) 1.25 – 2.5 mEq/kg (2.5 – 5 mL/kg) IV (over 5 min for acute herniation; over 10 min for increased intracranial pressure) **OR**
 - Mannitol** 0.25 g/kg over 30 minutes (can be repeated every 6-8 hours)
- (2) Ensure patient on 0.9% NS fluids
- (3) If GCS <11 after therapy, consider ET intubation
- (4) Consider head CT

* Do not give sedating meds outside the setting of intubation (may lead to rise of PCO2 and herniation)

If no improvement in mental status, repeat:

- Hypertonic Saline** (3%) 1.25-2.5 mEq/kg (2.5-5 mL/kg) IV over (over 5 min for acute herniation; over 10 min for increased intracranial pressure) **OR**
 - Mannitol** 0.25 g/kg over 30 minutes

CLINICAL PATHWAY:
Diabetes Ketoacidosis (DKA) Emergency Room Algorithm

THIS PATHWAY SERVES AS A GUIDE AND DOES NOT REPLACE CLINICAL JUDGMENT

Inclusion Criteria: patient of any age presenting with potential Diabetic Ketoacidosis (DKA)
 [Consider if history of: weight loss, vomiting, abdominal pain, polyuria, polydipsia, nocturia;
 Consider if exam findings of: tiredness, Kussmaul respirations, dehydration, mental status changes, abdominal pain
 (can be severe and present as acute abdomen)]
Exclusion Criteria: well- appearing, HCO3 >18 mmol/L

Note: Hyperglycemic Hyperosmolar Syndrome (HHS) is a spectrum with DKA, and may not have acidosis and ketones, but will have severe hyperglycemia and dehydration. Discuss care with PICU/Endocrine.

INITIAL MANAGEMENT

Establish DKA diagnosis (defined by pH <7.3, HCO3 <15 mmol/L, blood sugar >200, moderate to large ketones – blood¹ or urine)
 Note: **Hyperglycemic Hyperosmolar Syndrome (HHS)** is a spectrum with DKA, and may not have acidosis and ketones, but will have severe hyperglycemia and dehydration. Discuss care with PICU/Endocrine.

<p>LABS:</p> <ul style="list-style-type: none"> Chem 10, blood gas, CBC w diff, hemoglobin A1c; POCT blood glucose and ketones¹, UA Repeat Chem 7/VBG after initial NS bolus <p><i>If newly diagnosed diabetes, add:</i></p> <ul style="list-style-type: none"> Free T4, TSH, islet cell antibody, insulin antibody, ZnT8 antibody, glutamic acid decarboxylase antibody Consider C-peptide if BMI >95th percentile 	<p>FEN:</p> <ul style="list-style-type: none"> Make NPO Give 0.9% NS bolus 10-20 mL/kg over 30-60 min <ul style="list-style-type: none"> Additional fluid bolus <u>only</u> if signs of worsening dehydration or shock (hypotension, tachycardia, delayed cap refill, oliguria) Caution needed when using depressed mental status as marker of shock, as it may represent DKA associated brain injury Large volume fluid resuscitation may be associated with increased risk of cerebral edema Post bolus: start NS at minimum of 1.5x maintenance until appropriate fluids (per PICU/Med Surg care) become available 	<p>NURSING CARE:</p> <ul style="list-style-type: none"> Establish PIV x2 If oliguria present, insert foley catheter Strict I&O Bed rest <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>¹POCT Blood Ketone Interpretation:</p> <ul style="list-style-type: none"> <0.6 mmol/L: Low 0.6-1.5 mmol/L: Moderate >1.5 mmol/L: Large </div>
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Proceed to
 PICU Management

Always monitor for DKA Associated Brain Injury and notify the PICU attending if s/s present!

Signs/Symptoms:

- HA, change in neuro status (restlessness, irritability, drowsiness), inappropriate slowing of HR or rise of BP

Treatment: Therapy should always precede imaging!

- (1) **Hypertonic Saline (3%)** 1.25 – 2.5 mEq/kg (2.5 – 5 mL/kg) IV (over 5 min for acute herniation; over 10 min for increased intracranial pressure) **OR**
- Mannitol** 0.25 g/kg over 30 minutes (can be repeated every 6-8 hours)
- (2) Ensure patient on 0.9% NS fluids
- (3) If GCS <11 after therapy, consider ET intubation
- (4) Consider head CT

* Do not give sedating meds outside the setting of intubation (may lead to rise of PCO2 and herniation)

If no improvement in mental status, repeat:

- Hypertonic Saline (3%)** 1.25-2.5 mEq/kg (2.5-5 mL/kg) IV over (over 5 min for acute herniation; over 10 min for increased intracranial pressure) **OR**
- Mannitol** 0.25 g/kg over 30 minutes

• Labs include a more thorough evaluation than the Transport Algorithm, and are listed here.

★ 2026 update • Note the inclusion of hemoglobin A1c and newly available POCT blood glucose and ketones for all patients

★ 2026 update • If newly diagnosed, also add ZnT8 antibody to listed labs

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CLINICAL PATHWAY:
Diabetes Ketoacidosis (DKA) Emergency Room Algorithm

- Make the patient NPO and give 0.9% NS bolus **10-20 ml/kg over 30-60 minutes** as a large volume fluid resuscitation may be associated with an increased risk of cerebral edema.
- Repeat boluses should only be given if worsening dehydration or shock (hypotension, tachycardia, delayed cap refill, oliguria; not depressed mental status)
- After the initial bolus is given, repeat chem7/VBG and start NS at minimum of 1.5x maintenance until more appropriate fluids are available in PICU/Med Surg.

Inclusion Criteria: patient of any age presenting with potential Diabetic Ketoacidosis (DKA)
[Consider if history of: weight loss, vomiting, abdominal pain, polyuria, polydipsia, nocturia; Consider if exam findings of: tiredness, Kussmaul respirations, dehydration, mental status changes, abdominal pain (can be severe and present as acute abdomen)]
Exclusion Criteria: well- appearing, HCO3 >18 mmol/L

Note: Hyperglycemic Hyperosmolar Syndrome (HHS) is a spectrum with DKA, and may not have acidosis and ketones, but will have severe hyperosmolality and dehydration. Discuss care with PICU/Endocrine.

INITIAL MANAGEMENT

Establish DKA diagnosis (defined by pH <7.3, HCO3 <15 mmol/L, blood sugar >200, moderate to large ketones – blood¹ or urine)
 Note: **Hyperglycemic Hyperosmolar Syndrome (HHS)** is a spectrum with DKA, and may not have acidosis and ketones, but will have severe hyperglycemia and dehydration. Discuss care with PICU/Endocrine.

<p>LABS:</p> <ul style="list-style-type: none"> • Chem 10, blood gas, CBC w diff, hemoglobin A1c; POCT blood glucose and ketones¹, UA • Repeat Chem 7/VBG after initial NS bolus <p><i>If newly diagnosed diabetes, add:</i></p> <ul style="list-style-type: none"> • Free T4, TSH, islet cell antibody, insulin antibody, ZnT8 antibody, glutamic acid decarboxylase antibody • Consider C-peptide if BMI >95th percentile 	<p>FEN:</p> <ul style="list-style-type: none"> • Make NPO • Give 0.9% NS bolus 10-20 mL/kg over 30-60 min <ul style="list-style-type: none"> • <i>Additional fluid bolus <u>only</u> if signs of worsening dehydration or shock (hypotension, tachycardia, delayed cap refill, oliguria)</i> • <i>Caution needed when using depressed mental status as marker of shock, as it may represent DKA associated brain injury</i> • <i>Large volume fluid resuscitation may be associated with increased risk of cerebral edema</i> • Post bolus: start NS at minimum of 1.5x maintenance until appropriate fluids (per PICU/Med Surg care) become available 	<p>NURSING CARE:</p> <ul style="list-style-type: none"> • Establish PIV x2 • If oliguria present, insert foley catheter • Strict I&O • Bed rest <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>¹POCT Blood Ketone Interpretation:</p> <ul style="list-style-type: none"> • <0.6 mmol/L: Low • 0.6-1.5 mmol/L: Moderate • >1.5 mmol/L: Large </div>
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Proceed to
PICU Management

Always monitor for DKA Associated Brain Injury and notify the PICU attending if s/s present!

Signs/Symptoms:

- HA, change in neuro status (restlessness, irritability, drowsiness), inappropriate slowing of HR or rise of BP

Treatment: Therapy should always precede imaging!

- (1) **Hypertonic Saline (3%)** 1.25 – 2.5 mEq/kg (2.5 – 5 mL/kg) IV (over 5 min for acute herniation; over 10 min for increased intracranial pressure) **OR**
- **Mannitol** 0.25 g/kg over 30 minutes (can be repeated every 6-8 hours)
- (2) Ensure patient on 0.9% NS fluids
- (3) If GCS <11 after therapy, consider ET intubation
- (4) Consider head CT

* Do not give sedating meds outside the setting of intubation (may lead to rise of PCO2 and herniation)

If no improvement in mental status, repeat:

- **Hypertonic Saline (3%)** 1.25-2.5 mEq/kg (2.5-5 mL/kg) IV over (over 5 min for acute herniation; over 10 min for increased intracranial pressure) **OR**
- **Mannitol** 0.25 g/kg over 30 minutes



• Nursing care is outlined here.

• 2 PIV lines should be established, and foley catheter inserted if oliguria is present.

Inclusion Criteria: patient of any age presenting with potential Diabetic Ketoacidosis (DKA)
 [Consider if history of: weight loss, vomiting, abdominal pain, polyuria, polydipsia, nocturia;
 Consider if exam findings of: tiredness, Kussmaul respirations, dehydration, mental status changes, abdominal pain
 (can be severe and present as acute abdomen)]

Exclusion Criteria: well- appearing, HCO3 >18 mmol/L

Note: Hyperglycemic Hyperosmolar Syndrome (HHS) is a spectrum with DKA, and may not have acidosis and ketones, but will have severe hyperosmolality and dehydration. Discuss care with PICU/Endocrine.

INITIAL MANAGEMENT

Establish DKA diagnosis (defined by pH <7.3, HCO3 <15 mmol/L, blood sugar >200, moderate to large ketones – blood¹ or urine)
 Note: **Hyperglycemic Hyperosmolar Syndrome (HHS)** is a spectrum with DKA, and may not have acidosis and ketones, but will have severe hyperglycemia and dehydration. Discuss care with PICU/Endocrine.

<p>LABS:</p> <ul style="list-style-type: none"> Chem 10, blood gas, CBC w diff, hemoglobin A1c; POCT blood glucose and ketones¹, UA Repeat Chem 7/VBG after initial NS bolus <p><i>If newly diagnosed diabetes, add:</i></p> <ul style="list-style-type: none"> Free T4, TSH, islet cell antibody, insulin antibody, ZnT8 antibody, glutamic acid decarboxylase antibody Consider C-peptide if BMI >95th percentile 	<p>FEN:</p> <ul style="list-style-type: none"> Make NPO Give 0.9% NS bolus 10-20 mL/kg over 30-60 min <ul style="list-style-type: none"> <i>Additional fluid bolus <u>only</u> if signs of worsening dehydration or shock (hypotension, tachycardia, delayed cap refill, oliguria)</i> <i>Caution needed when using depressed mental status as marker of shock, as it may represent DKA associated brain injury</i> <i>Large volume fluid resuscitation may be associated with increased risk of cerebral edema</i> Post bolus: start NS at minimum of 1.5x maintenance until appropriate fluids (per PICU/Med Surg care) become available 	<p>NURSING CARE:</p> <ul style="list-style-type: none"> Establish PIV x2 If oliguria present, insert foley catheter Strict I&O Bed rest <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>¹POCT Blood Ketone Interpretation:</p> <ul style="list-style-type: none"> <0.6 mmol/L: Low 0.6-1.5 mmol/L: Moderate >1.5 mmol/L: Large </div>
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Proceed to
PICU Management

Always monitor for DKA Associated Brain Injury and notify the PICU attending if s/s present!

Signs/Symptoms:

- HA, change in neuro status (restlessness, irritability, drowsiness), inappropriate slowing of HR or rise of BP

Treatment: Therapy should always precede imaging!

- (1) **Hypertonic Saline (3%)** 1.25 – 2.5 mEq/kg (2.5 – 5 mL/kg) IV (over 5 min for acute herniation; over 10 min for increased intracranial pressure) **OR**
- Mannitol** 0.25 g/kg over 30 minutes (can be repeated every 6-8 hours)
- (2) Ensure patient on 0.9% NS fluids
- (3) If GCS <11 after therapy, consider ET intubation
- (4) Consider head CT

* Do not give sedating meds outside the setting of intubation (may lead to rise of PCO2 and herniation)

If no improvement in mental status, repeat:

- Hypertonic Saline (3%)** 1.25-2.5 mEq/kg (2.5-5 mL/kg) IV over (over 5 min for acute herniation; over 10 min for increased intracranial pressure) **OR**
- Mannitol** 0.25 g/kg over 30 minutes

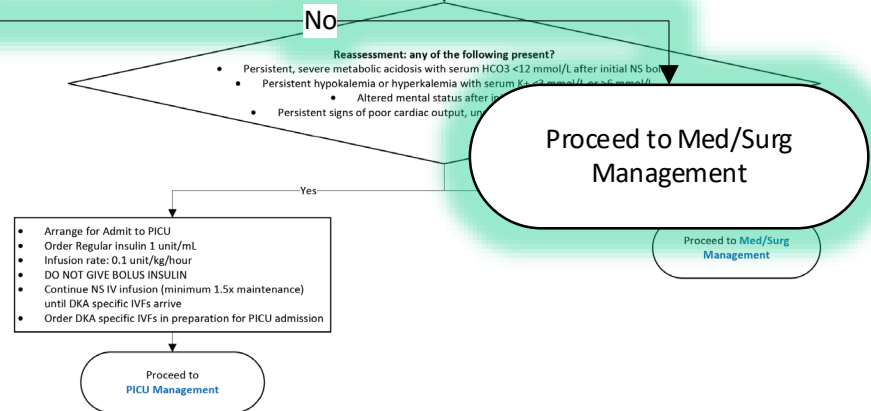
Inclusion Criteria: patient of any age presenting with potential Diabetic Ketoacidosis (DKA)
 [Consider if history of: weight loss, vomiting, abdominal pain, polyuria, polydipsia, nocturia;
 Consider if exam findings of: tiredness, Kussmaul respirations, dehydration, mental status changes, abdominal pain
 (can be severe and present as acute abdomen)]
Exclusion Criteria: well-appearing, HCO₃ >18 mmol/L

Reassessment – Any of the Following Present?

- Persistent, severe metabolic acidosis with serum HCO₃ <12 mmol/L after initial NS bolus
- Persistent hypokalemia or hyperkalemia with serum K⁺ <3 mmol/L or >6 mmol/L
 - Altered mental status after initial therapy
- Persistent signs of poor cardiac output, unresponsive to initial rehydration

Large ketones – blood¹ or urine)
 and ketones.
CARE:
 Establish PIV x2
 • If oliguria present, insert foley catheter
 • Strict I&O
 • Bed rest
POCT Blood Ketone Interpretation:
 • <0.6 mmol/L: Low
 • 0.6-1.5 mmol/L: Moderate
 • >1.5 mmol/L: Large
 • Large volume fluid resuscitation may be associated with increased risk of cerebral edema
 • Post bolus: start NS at minimum of 1.5x maintenance until appropriate fluids (per PICU/Med Surg care) become available
 • Altered mental status as marker of shock, as it may represent DKA associated brain injury
 • Large volume fluid resuscitation may be associated with increased risk of cerebral edema
 • Post bolus: start NS at minimum of 1.5x maintenance until appropriate fluids (per PICU/Med Surg care) become available

- After the initial care is given, reassessment should occur. This will determine the need for Med/Surg or PICU management.
- If none of the listed concerning signs are present, the patient can be managed on the Med/Surg floors. Clinicians should follow the Med/Surg Management Algorithm.



Always monitor for DKA Associated Brain Injury and notify the PICU attending if s/s present!

Signs/Symptoms:

- HA, change in neuro status (restlessness, irritability, drowsiness), inappropriate slowing of HR or rise of BP

Treatment: Therapy should always precede imaging!

- (1) **Hypertonic Saline (3%)** 1.25 – 2.5 mEq/kg (2.5 – 5 mL/kg) IV (over 5 min for acute herniation; over 10 min for increased intracranial pressure) **OR**
- **Mannitol** 0.25 g/kg over 30 minutes (can be repeated every 6-8 hours)
- (2) Ensure patient on 0.9% NS fluids
- (3) If GCS <11 after therapy, consider ET intubation
- (4) Consider head CT

* Do not give sedating meds outside the setting of intubation (may lead to rise of PCO₂ and herniation)

If no improvement in mental status, repeat:

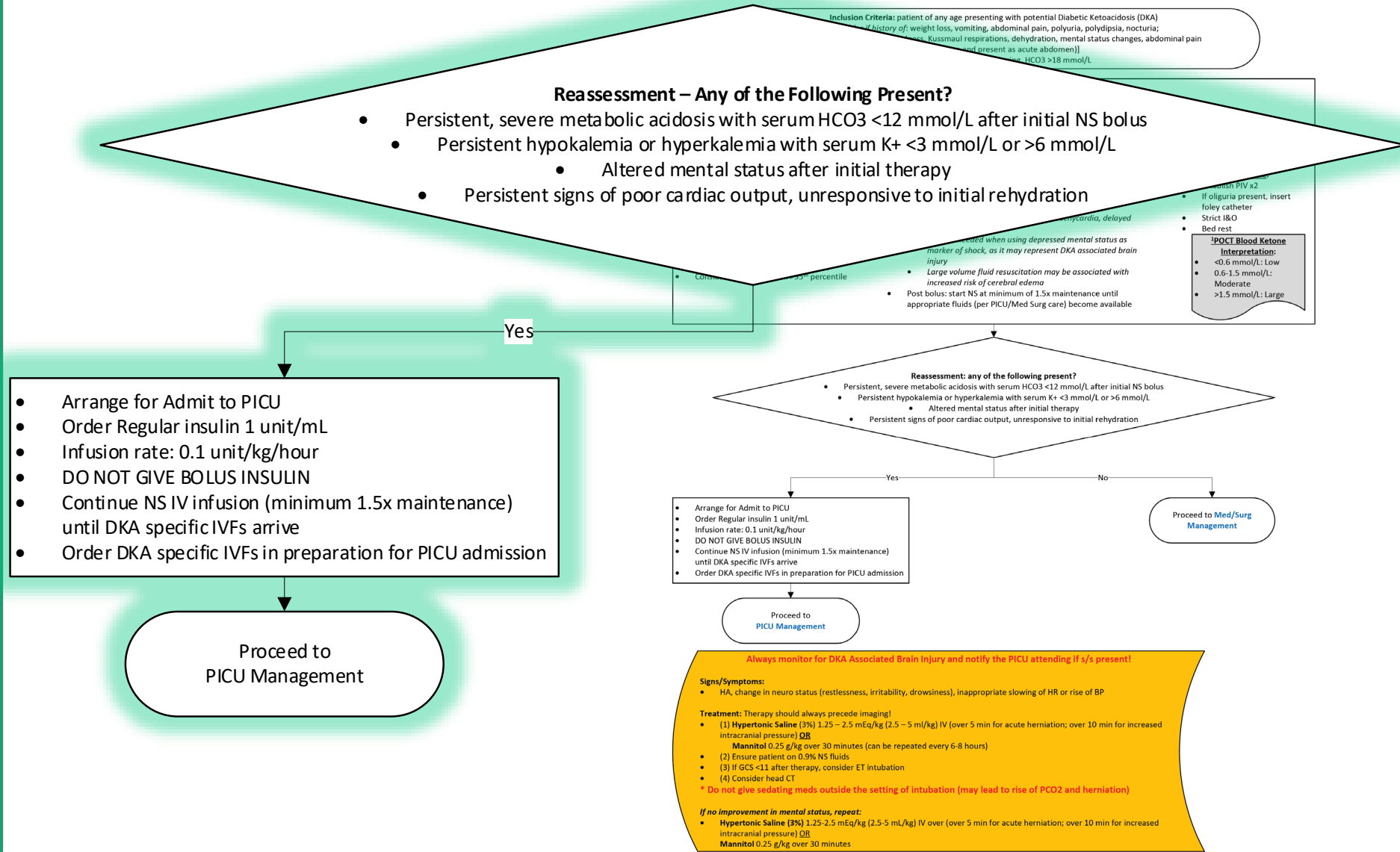
- **Hypertonic Saline (3%)** 1.25-2.5 mEq/kg (2.5-5 mL/kg) IV over (over 5 min for acute herniation; over 10 min for increased intracranial pressure) **OR**
- **Mannitol** 0.25 g/kg over 30 minutes

- If any of these concerning signs are present, then the patient should be admitted to the PICU.
- While awaiting PICU admission, regular insulin infusion should be ordered/started (NOT the bolus)
- NS IV infusions should be continued until DKA specific IVF arrives. These DKA specific IVF should be ordered to in preparation for PICU admission.
- Once admitted to the PICU, follow the PICU Management Algorithm.

CLINICAL PATHWAY:

Diabetes Ketoacidosis (DKA) Emergency Room Algorithm

THIS PATHWAY SERVES AS A GUIDE AND DOES NOT REPLACE CLINICAL JUDGMENT.



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Always monitor for DKA Associated Brain Injury and notify the PICU attending if s/s present!

Signs/Symptoms:

- HA, change in neuro status (restlessness, irritability, drowsiness), inappropriate slowing of HR or rise of BP

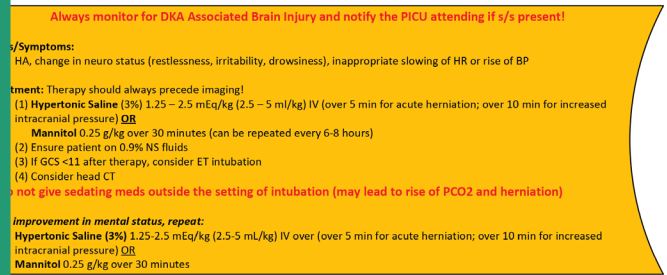
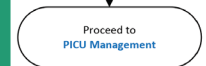
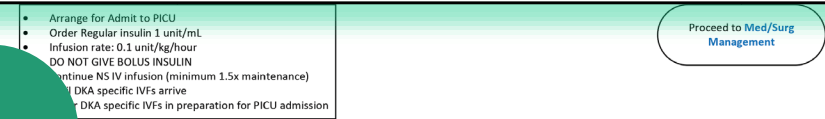
Treatment: Therapy should always precede imaging!

- (1) **Hypertonic Saline (3%)** 1.25 – 2.5 mEq/kg (2.5 – 5 ml/kg) IV (over 5 min for acute herniation; over 10 min for increased intracranial pressure) OR **Mannitol** 0.25 g/kg over 30 minutes (can be repeated every 6-8 hours)
- (2) Ensure pt on 0.9% NS fluids
- (3) If GCS <11 after therapy, consider ET intubation
- (4) Consider head CT

*** Do not give sedating meds outside the setting of intubation (may lead to rise of PCO2 and herniation)**

If no improvement in mental status, repeat:

- **Hypertonic Saline (3%)** 1.25-2.5 mEq/kg (2.5-5 mL/kg) IV over (over 5 min for acute herniation; over 10 min for increased intracranial pressure) OR **Mannitol** 0.25 g/kg over 30 minutes



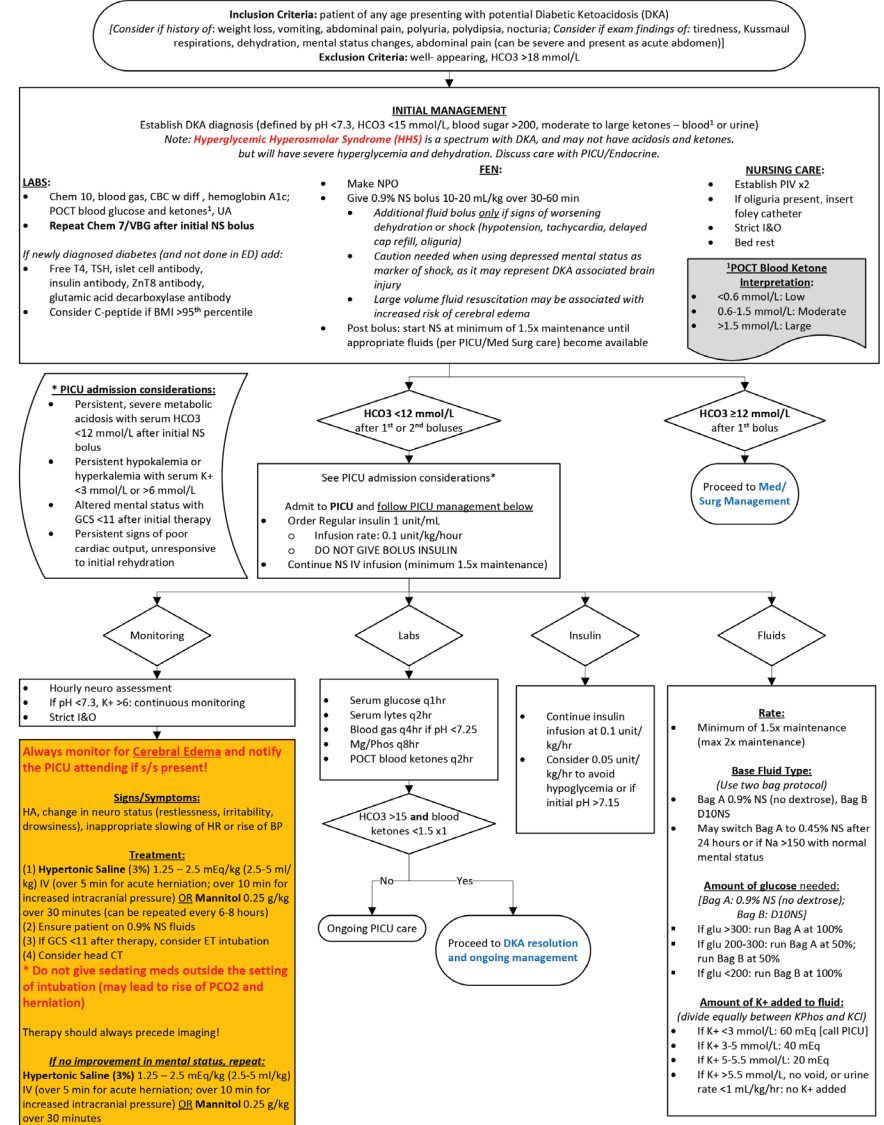
- At all times, clinicians should monitor for DKA associated brain injury and notify the PICU attending if present.
- Treatment should always precede imaging.
- It is important to avoid sedating medications as it may lead to a rise of PCO2 and herniation!

DKA – PICU Management Algorithm

CLINICAL PATHWAY: Diabetic Ketoacidosis PICU Management

THIS PATHWAY
SERVES AS A GUIDE
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REPLACE CLINICAL
JUDGMENT

- The purpose of the PICU algorithm quickly establish DKA diagnosis, stabilize the patient with DKA specific IVF and insulin and provide close monitoring of the patient's status.



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CLINICAL PATHWAY: Diabetic Ketoacidosis PICU Management

THIS PATHWAY
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Inclusion Criteria: patient of any age presenting with potential Diabetic Ketoacidosis (DKA)
[Consider if history of: weight loss, vomiting, abdominal pain, polyuria, polydipsia, nocturia; Consider if exam findings of: tiredness, Kussmaul respirations, dehydration, mental status changes, abdominal pain (can be severe and present as acute abdomen)]

Exclusion Criteria: well- appearing, HCO₃ >18 mmol/L

Inclusion Criteria: patient of any age presenting with potential Diabetic Ketoacidosis (DKA)
[Consider if history of: weight loss, vomiting, abdominal pain, polyuria, polydipsia, nocturia; Consider if exam findings of: tiredness, Kussmaul respirations, dehydration, mental status changes, abdominal pain (can be severe and present as acute abdomen)]

INITIAL MANAGEMENT
 Establish DKA diagnosis (defined by pH <7.3, HCO₃ <15 mmol/L, blood sugar >200, moderate to large ketones – blood¹ or urine)
 Note: **Hyperglycemic Hyperosmolar Syndrome (HHS)** is a spectrum with DKA, and may not have acidosis and ketones. but will have severe hyperglycemia and dehydration. Discuss care with PICU/Endocrine.

LABS:

- Chem 10, blood gas, CBC w diff, hemoglobin A1c; POCT blood glucose and ketones¹, UA
- Repeat Chem 7/VBG after initial NS bolus**

If newly diagnosed diabetes (and not done in ED) add:

- Free T4, TSH, islet cell antibody, insulin antibody, ZnT8 antibody, glutamic acid decarboxylase antibody
- Consider C-peptide if BMI >95th percentile

FEN:

- Make NPO
- Give 0.9% NS bolus 10-20 mL/kg over 30-60 min
 - Additional fluid bolus *only* if signs of worsening dehydration or shock (hypotension, tachycardia, delayed cap refill, oliguria)
 - Caution needed when using depressed mental status as marker of shock, as it may represent DKA associated brain injury
 - Large volume fluid resuscitation may be associated with increased risk of cerebral edema
- Post bolus: start NS at minimum of 1.5x maintenance until appropriate fluids (per PICU/Med Surg care) become available

NURSING CARE:

- Establish PIV x2
- If oliguria present, insert foley catheter
- Strict I&O
- Bed rest

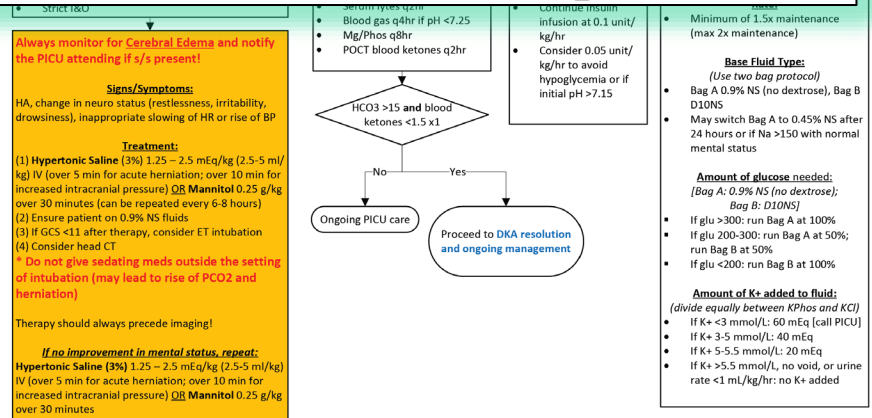
¹POCT Blood Ketone Interpretation:

- <0.6 mmol/L: Low
- 0.6-1.5 mmol/L: Moderate
- >1.5 mmol/L: Large



2026 update

- Inclusion criteria and initial management boxes are the same as the Emergency Room algorithm.
- The focus is on laboratory monitoring, NPO status, and 0.9% NS bolus 10-20 ml/kg over 30-60 min and post-bolus IVF initiation.



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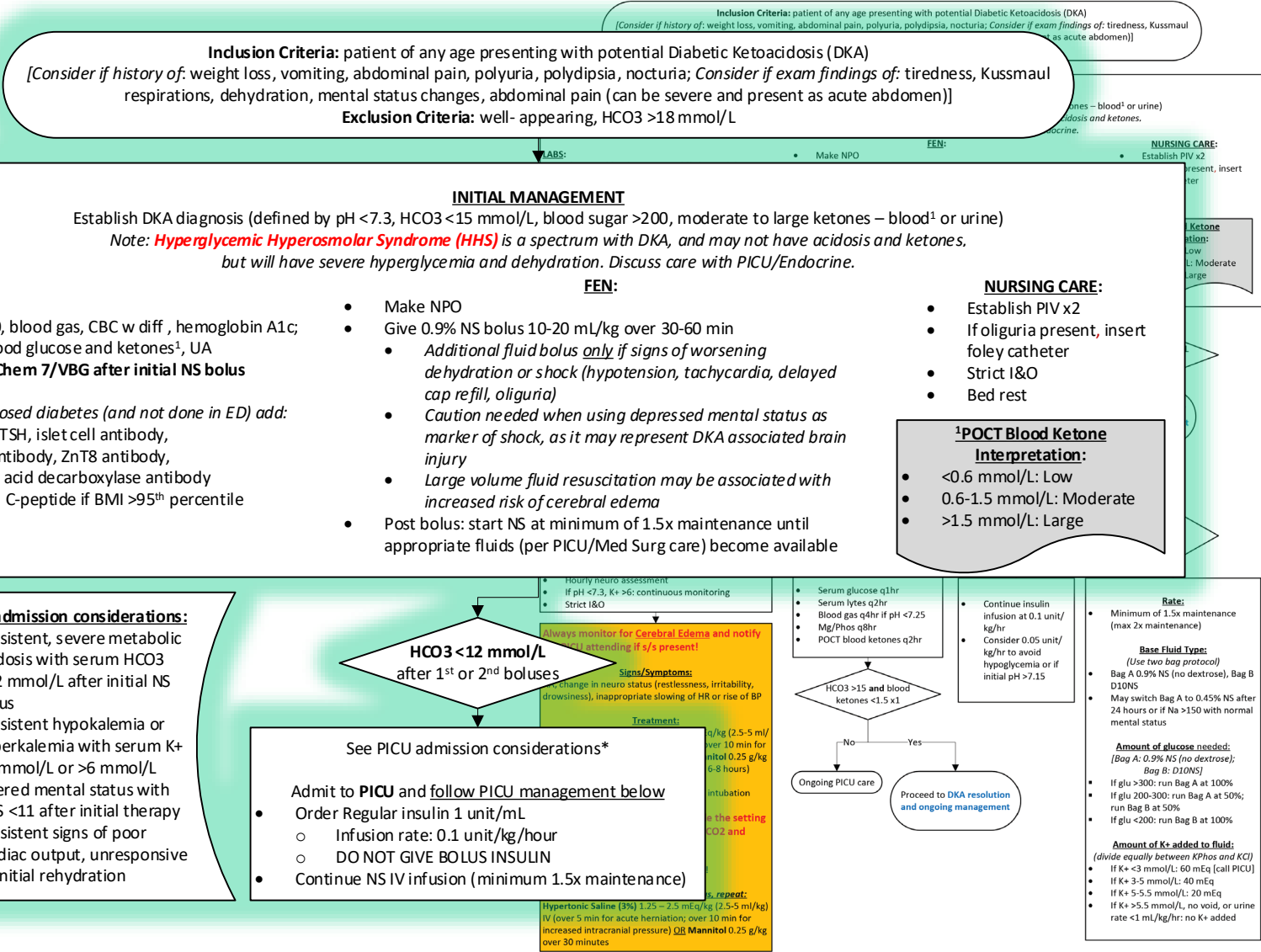


CLINICAL PATHWAY: Diabetic Ketoacidosis PICU Management

THIS PATHWAY
SERVES AS A GUIDE
AND DOES NOT
REPLACE CLINICAL
JUDGMENT

The patient is admitted to the PICU if there is:

- Persistent and severe metabolic acidosis with serum $\text{HCO}_3^- < 12$ mmol/L after the initial NS bolus is given
- Persistent hypokalemia (< 3 mmol/L) or hyperkalemia (> 6 mmol/L)
- Altered mental status with GCS < 11 after initial therapy
- Persistent signs of poor cardiac output, unresponsive to initial rehydration



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CLINICAL PATHWAY: Diabetic Ketoacidosis PICU Management

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JUDGMENT

Regular insulin infusion should be ordered (NOT the bolus insulin) and NS IV infusions at minimum of 1.5x maintenance should be continued until the DKA specific fluids arrive

Inclusion Criteria: patient of any age presenting with potential Diabetic Ketoacidosis (DKA)
(Consider if history of: weight loss, vomiting, abdominal pain, polyuria, polydipsia, nocturia; Consider if exam findings of: tiredness, Kussmaul respirations, dehydration, mental status changes, abdominal pain (can be severe and present as acute abdomen))

Exclusion Criteria: well- appearing, HCO₃ >18 mmol/L

Inclusion Criteria: patient of any age presenting with potential Diabetic Ketoacidosis (DKA)
(Consider if history of: weight loss, vomiting, abdominal pain, polyuria, polydipsia, nocturia; Consider if exam findings of: tiredness, Kussmaul respirations, dehydration, mental status changes, abdominal pain (can be severe and present as acute abdomen))

INITIAL MANAGEMENT

Establish DKA diagnosis (defined by pH <7.3, HCO₃ <15 mmol/L, blood sugar >200, moderate to large ketones – blood¹ or urine)
*Note: **Hyperglycemic Hyperosmolar Syndrome (HHS)** is a spectrum with DKA, and may not have acidosis and ketones, but will have severe hyperglycemia and dehydration. Discuss care with PICU/Endocrine.*

LABS:

- Chem 10, blood gas, CBC w diff, hemoglobin A1c; POCT blood glucose and ketones¹, UA
- Repeat Chem 7/VBG after initial NS bolus**

If newly diagnosed diabetes (and not done in ED) add:

- Free T4, TSH, islet cell antibody, insulin antibody, ZnT8 antibody, glutamic acid decarboxylase antibody
- Consider C-peptide if BMI >95th percentile

FEN:

- Make NPO
- Give 0.9% NS bolus 10-20 mL/kg over 30-60 min
 - Additional fluid bolus only if signs of worsening dehydration or shock (hypotension, tachycardia, delayed cap refill, oliguria)
 - Caution needed when using depressed mental status as marker of shock, as it may represent DKA associated brain injury
 - Large volume fluid resuscitation may be associated with increased risk of cerebral edema
- Post bolus: start NS at minimum of 1.5x maintenance until appropriate fluids (per PICU/Med Surg care) become available

NURSING CARE:

- Establish PIV x2
- If oliguria present, insert foley catheter
- Strict I&O
- Bed rest

¹POCT Blood Ketone Interpretation:

- <0.6 mmol/L: Low
- 0.6-1.5 mmol/L: Moderate
- >1.5 mmol/L: Large

*** PICU admission considerations:**

- Persistent, severe metabolic acidosis with serum HCO₃ <12 mmol/L after initial NS bolus
- Persistent hypokalemia or hyperkalemia with serum K⁺ <3 mmol/L or >6 mmol/L
- Altered mental status with GCS <11 after initial therapy
- Persistent signs of poor cardiac output, unresponsive to initial rehydration

HCO₃ <12 mmol/L after 1st or 2nd boluses

See PICU admission considerations*

Admit to PICU and follow PICU management below

- Order Regular insulin 1 unit/mL
 - Infusion rate: 0.1 unit/kg/hr
 - DO NOT GIVE BOLUS INSULIN
- Continue NS IV infusion (minimum 1.5x maintenance)

Treatment:

q/kg (2.5-5 ml/over 10 min for initial 0.25 g/kg 6-8 hours)

intubation

the setting

CO₂ and

repeat:

Hypertonic Saline (3%) 1.25 – 2.5 mL/kg (2.5-5 mL/kg) IV (over 5 min for acute herniation; over 10 min for increased intracranial pressure) OR Mannitol 0.25 g/kg over 30 minutes

Hourly neuro assessment

- If pH <7.3, K⁺ >6: continuous monitoring
- Strict I&O

Always monitor for Cerebral Edema and notify Endocrine attending if s/s present!

Signs/Symptoms:

- Change in neuro status (restlessness, irritability, drowsiness), inappropriate slowing of HR or rise of BP

Treatment:

- q/kg (2.5-5 ml/over 10 min for initial 0.25 g/kg 6-8 hours)
- intubation
- the setting
- CO₂ and
- repeat:
- Hypertonic Saline (3%) 1.25 – 2.5 mL/kg (2.5-5 mL/kg) IV (over 5 min for acute herniation; over 10 min for increased intracranial pressure) OR Mannitol 0.25 g/kg over 30 minutes

Rate:

- Minimum of 1.5x maintenance (max 2x maintenance)

Base Fluid Type:
(Use two bag protocol)

- Bag A 0.9% NS (no dextrose), Bag B D10NS
- May switch Bag A to 0.45% NS after 24 hours or if Na >150 with normal mental status

Amount of glucose needed:
[Bag A: 0.9% NS (no dextrose); Bag B: D10NS]

- If glu >300: run Bag A at 100%
- If glu 200-300: run Bag A at 50%; run Bag B at 50%
- If glu <200: run Bag B at 100%

Amount of K⁺ added to fluid:
(divide equally between KPhos and KCl)

- If K⁺ <3 mmol/L: 60 mEq [call PICU]
- If K⁺ 3-5 mmol/L: 40 mEq
- If K⁺ 5-5.5 mmol/L: 20 mEq
- If K⁺ >5.5 mmol/L, no void, or urine rate <1 mL/kg/hr: no K⁺ added

Flowchart:

- Decision: HCO₃ >15 and blood ketones <1.5 x1
- No: Ongoing PICU care
- Yes: Proceed to DKA resolution and ongoing management

CONTACTS: CEM DEMIRCI, MD | EMILY GERMAIN-LEE, MD

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CLINICAL PATHWAY: Diabetic Ketoacidosis PICU Management

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See PICU admission considerations*

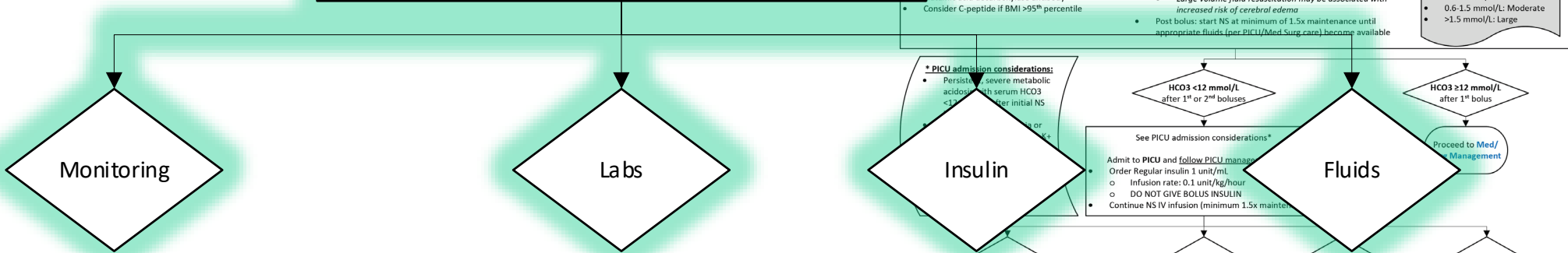
Admit to **PICU** and follow PICU management below

- Order Regular insulin 1 unit/mL
 - Infusion rate: 0.1 unit/kg/hour
 - DO NOT GIVE BOLUS INSULIN
- Continue NS IV infusion (minimum 1.5x maintenance)

Inclusion Criteria: patient of any age presenting with potential Diabetic Ketoacidosis (DKA)
 (Consider if history of: weight loss, vomiting, abdominal pain, polyuria, polydipsia, nocturia; Consider if exam findings of: tiredness, Kussmaul respirations, dehydration, mental status changes, abdominal pain (can be severe and present as acute abdomen))
Exclusion Criteria: well-appearing, HCO₃ >18 mmol/L

INITIAL MANAGEMENT
 Establish DKA diagnosis (defined by pH <7.3, HCO₃ <15 mmol/L, blood sugar >200, moderate to large ketones – blood¹ or urine)
 Note: **Hyperglycemic Hyperosmolar Syndrome (HHS)** is a spectrum with DKA, and may not have acidosis and ketones, but will have severe hyperglycemia and dehydration. Discuss care with PICU/Endocrine.

- FEN:**
- Make NPO
 - Give 0.9% NS bolus 10-20 mL/kg over 30-60 min
 - Additional fluid bolus only if signs of worsening dehydration or shock (hypotension, tachycardia, delayed cap refill, oliguria)
 - Caution needed when using depressed mental status as marker of shock, as it may represent DKA associated brain injury
 - Large volume fluid resuscitation may be associated with increased risk of cerebral edema
 - Post bolus: start NS at minimum of 1.5x maintenance until appropriate fluids (per PICU/Med Surg care) become available
- NURSING CARE:**
- Establish PIV x2
 - If oliguria present, insert Foley catheter
 - Strict I&O
 - Bed rest
- POCT Blood Ketone Interpretations:**
- <0.6 mmol/L: Low
 - 0.6-1.5 mmol/L: Moderate
 - >1.5 mmol/L: Large



PICU specific care is divided into the following categories:

- Monitoring
- Labs
- Insulin
- Fluids

Monitoring

- Hourly neuro assessment
- If pH <7.3, K⁺ >6: continuous monitoring
- Strict I&O

Always monitor for Cerebral Edema and notify the PICU attending if s/s present!

Signs/Symptoms:
 HA, change in neuro status (restlessness, irritability, drowsiness), inappropriate slowing of HR or rise of BP

Treatment:
 (1) Hypertonic Saline (3%) 1.25 – 2.5 mEq/kg (2.5-5 ml/kg) IV (over 5 min for acute herniation; over 10 min for increased intracranial pressure) **OR** Mannitol 0.25 g/kg over 30 minutes (can be repeated every 6-8 hours)
 (2) Ensure patient on 0.9% NS fluids
 (3) If GCS <11 after therapy, consider ET intubation
 (4) Consider head CT
 * Do not give sedating meds outside the setting of intubation (may lead to rise of PCO₂ and herniation)
 Therapy should always precede imaging!

If no improvement in mental status, repeat:
 Hypertonic Saline (3%) 1.25 – 2.5 mEq/kg (2.5-5 ml/kg) IV (over 5 min for acute herniation; over 10 min for increased intracranial pressure) **OR** Mannitol 0.25 g/kg over 30 minutes

Labs

- Serum glucose q1hr
- Serum lytes q2hr
- Blood gas q4hr if pH <7.25
- Mg/Phos q8hr
- POCT blood ketones q2hr

Insulin

- Continue insulin infusion at 0.1 unit/kg/hr
- Consider 0.05 unit/kg/hr to avoid hypoglycemia or if initial pH >7.15

Fluids

Rate:
 Minimum of 1.5x maintenance (max 2x maintenance)

Base Fluid Type:
 (Use two bag protocol)
 • Bag A 0.9% NS (no dextrose), Bag B D10NS
 • May switch Bag A to 0.45% NS after 24 hours or if Na >150 with normal mental status

Amount of glucose needed:
 [Bag A: 0.9% NS (no dextrose); Bag B: D10NS]
 • If glu >300: run Bag A at 100%
 • If glu 200-300: run Bag A at 50%; run Bag B at 50%
 • If glu <200: run Bag B at 100%

Amount of K+ added to fluids:
 (divide equally between KPhos and KCl)
 • If K+ <3 mmol/L: 60 mEq [call PICU]
 • If K+ 3-5 mmol/L: 40 mEq
 • If K+ 5-5.5 mmol/L: 20 mEq
 • If K+ >5.5 mmol/L, no void, or urine rate <1 mL/kg/hr: no K+ added

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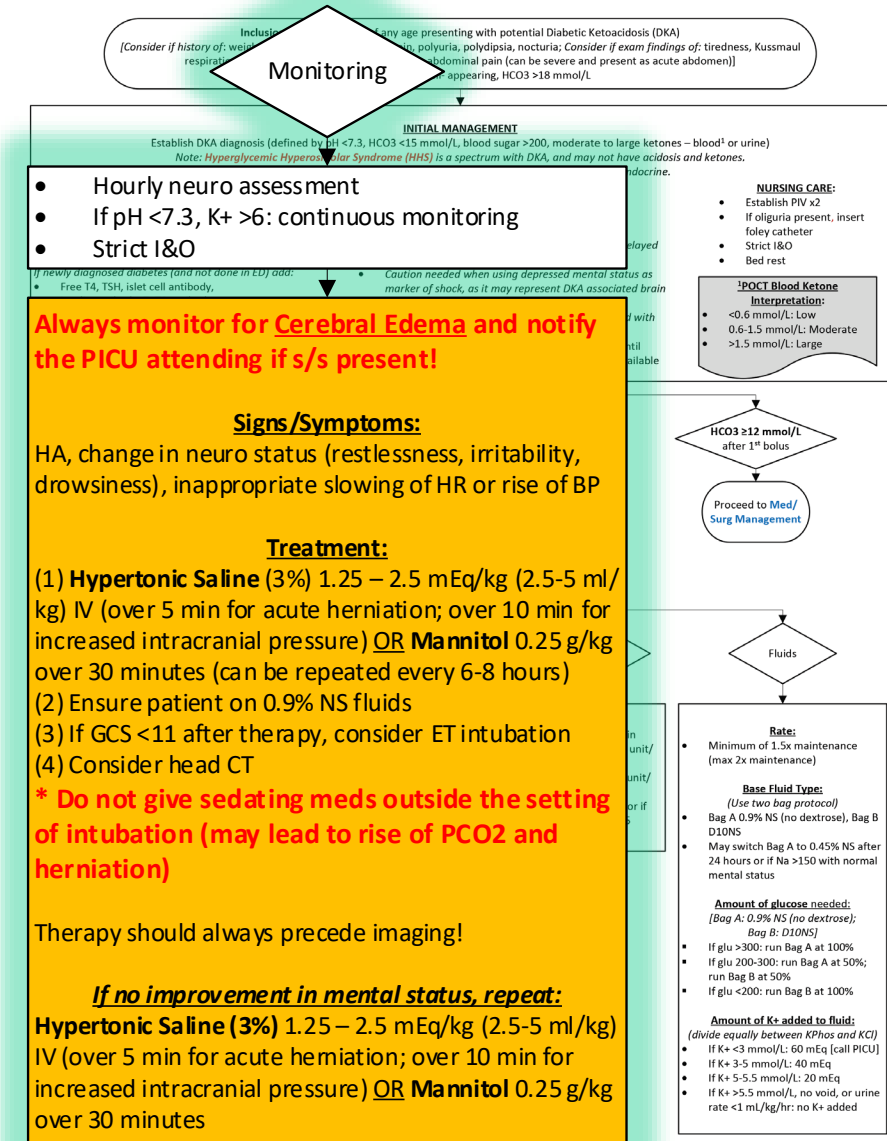
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CLINICAL PATHWAY:
Diabetic Ketoacidosis PICU Management

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- Clinical monitoring in the PICU includes hourly neuro assessments, with continuous monitoring if pH >7.3 and K+ >6 mmol/L
- As always, clinicians should monitor for DKA associated brain injury and notify the PICU attending if present.
- Treatment should always precede imaging.
- If there is no improvement in the patient's mental status, then hypertonic saline or mannitol can be repeated.
- It is important to avoid sedating medications as it may lead to a rise of PCO2 and herniation!



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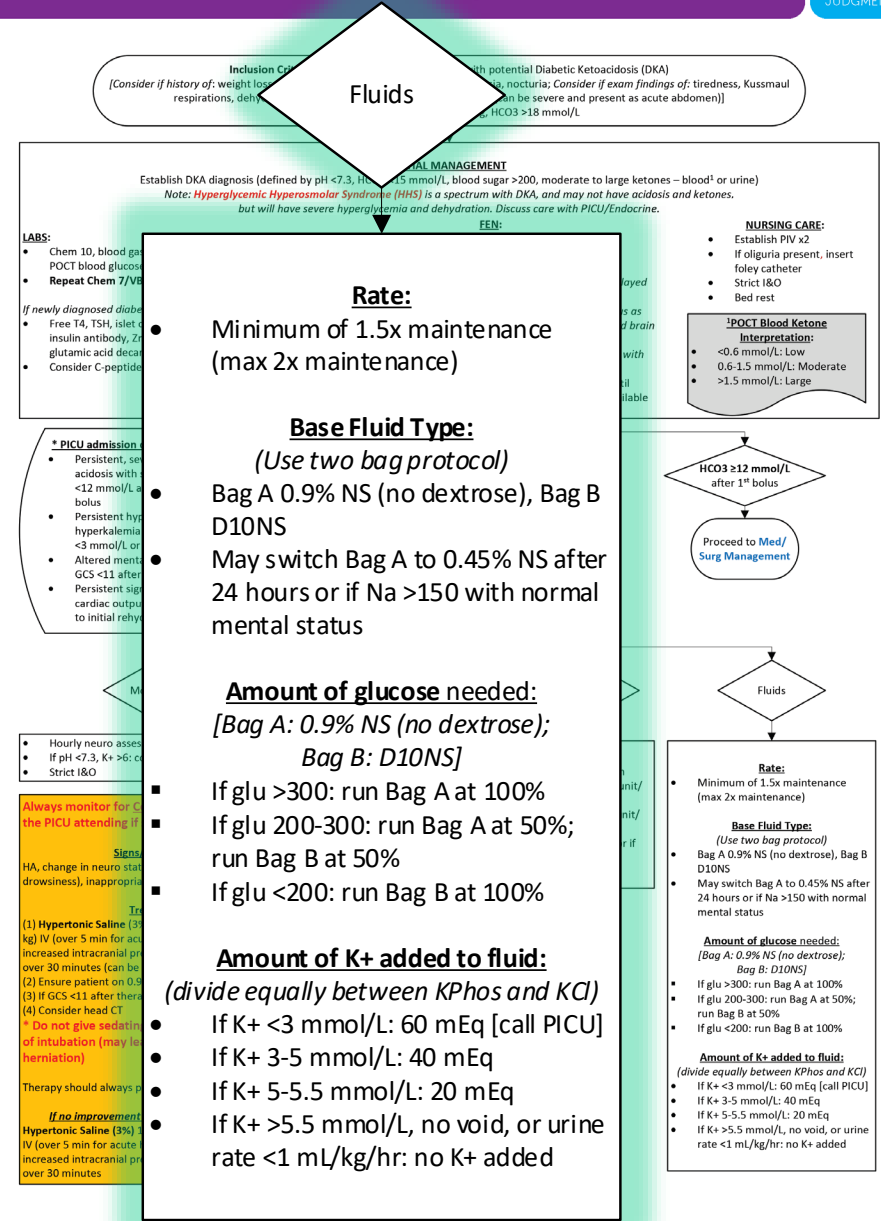
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- DKA specific fluids are listed here.
- The rate is always a minimum of 1.5x maintenance rate with a max of 2x maintenance.
- The base fluid type utilizes a 2 bag protocol. Bag A is 0.9% NS and Bag B is D10NS. Bag A can be changed to 0.45% NS after 24 hours or sodium >150 with normal mentation
- The amount of glucose added to the fluids is based on the patient's glucose values and given via Bag B
- The amount of K+ added to the fluid will be divided equally between Kphos and KCl. The amount given depends on the patient's K values.

CLINICAL PATHWAY: Diabetic Ketoacidosis PICU Management

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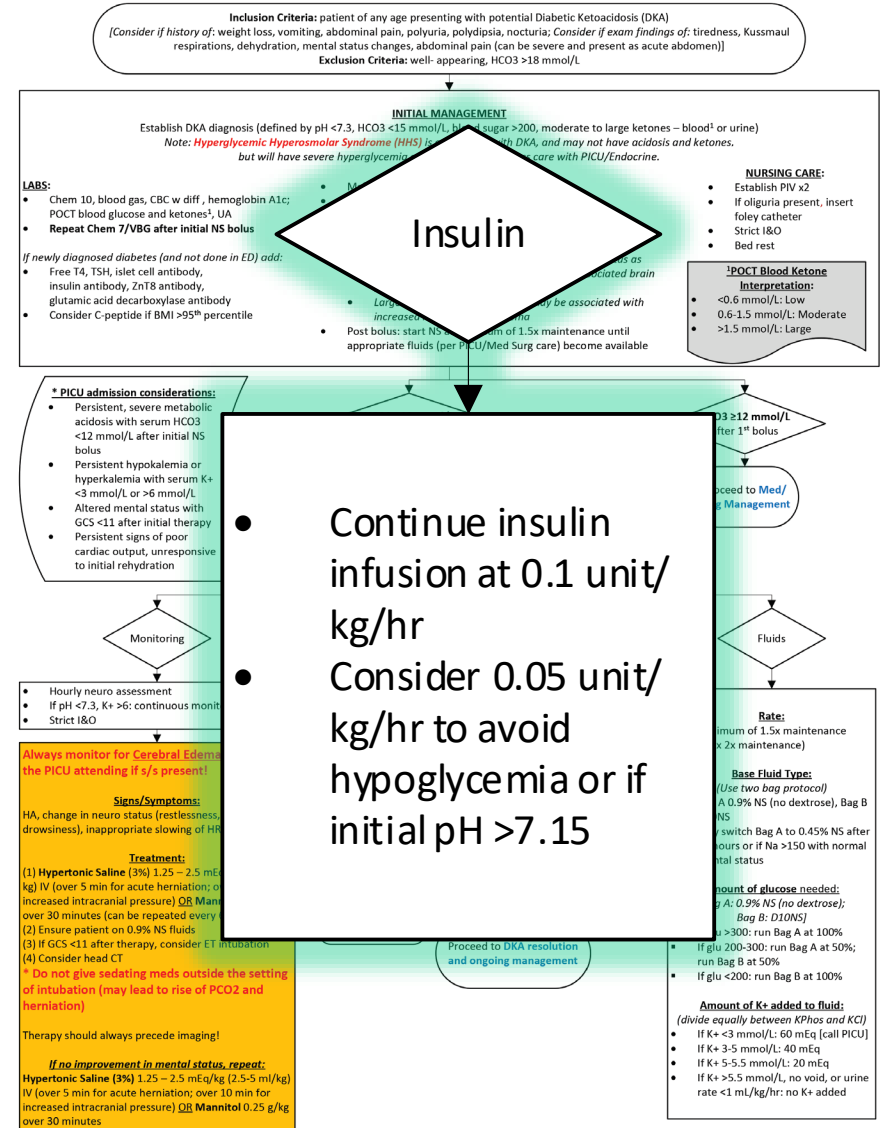
CLINICAL PATHWAY: Diabetic Ketoacidosis PICU Management

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2026 update

- Insulin infusions should be continued. Boluses are not ordered at this time.
- An alternative option for insulin has been provided to avoid hypoglycemia or if the initial pH >7.15



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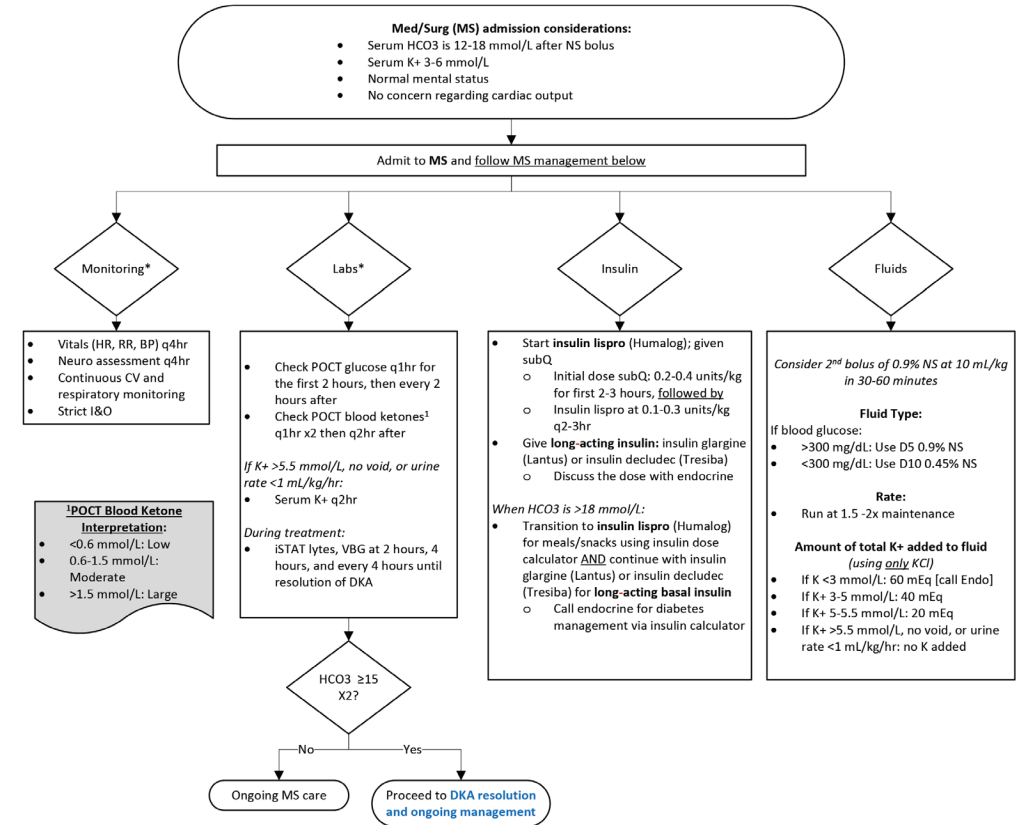


DKA – Med/Surg Management Algorithm

CLINICAL PATHWAY: Diabetic Ketoacidosis (DKA) Med/Surg Management

THIS PATHWAY
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- The purpose of the Med/Surg Algorithm is to provide ongoing management to a stabilized patient with DKA.



***Call Endocrinology anytime during assessment or treatment if patient develops:**

- Headache
- Altered mental status
- Poor circulation despite adequate hydration
- HCO₃ level <12 mmol/L
- Hyperkalemia (K⁺ >6 mmol/L) or hypokalemia (K⁺ <3 mmol/L)

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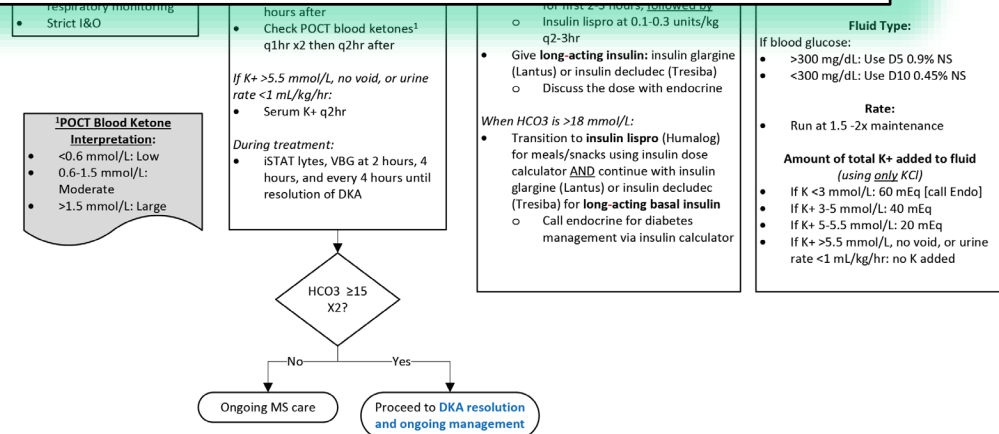
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Med/Surg (MS) admission considerations:

- Serum HCO₃ is 12-18 mmol/L after NS bolus
- Serum K⁺ 3-6 mmol/L
- Normal mental status
- No concern regarding cardiac output

Admit to **MS** and follow MS management below



Patients appropriate for Med/Surg should meet the following criteria:

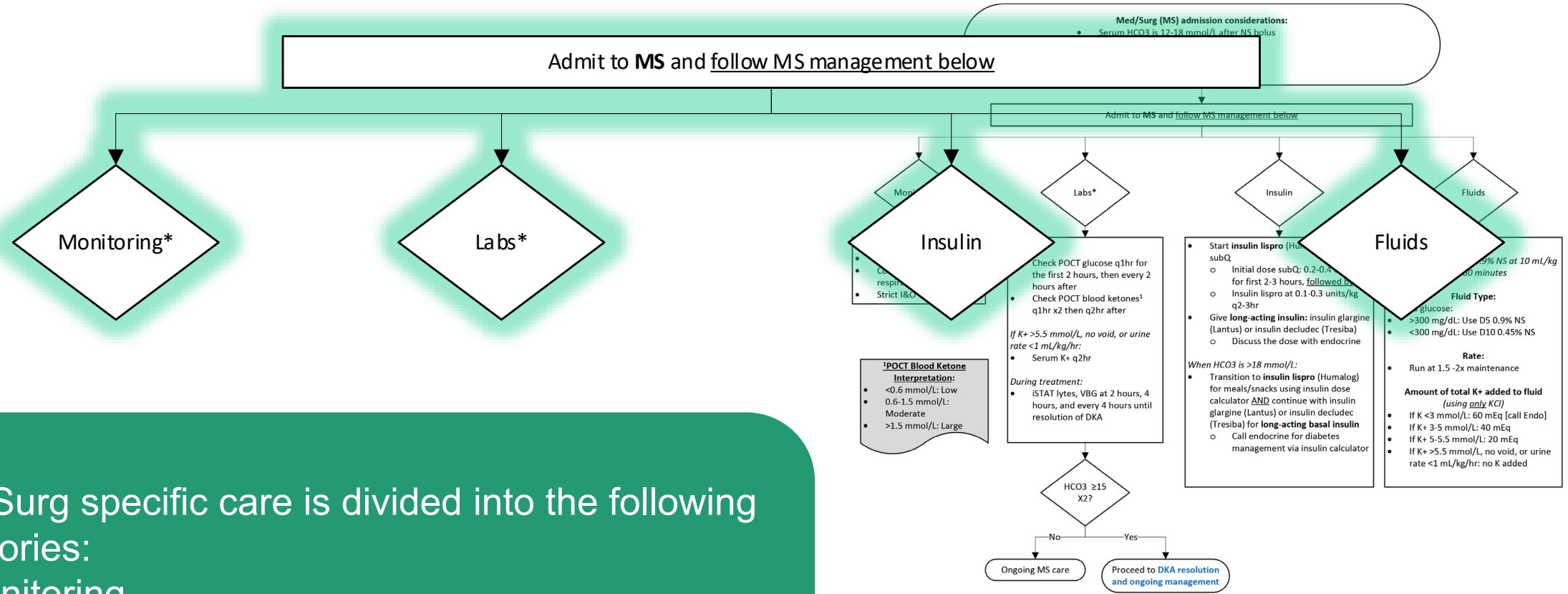
- Serum HCO₃ is 12-18 mmol/L after the NS bolus is given
- Serum K⁺ is 3-6 mmol/L
- Mentation is normal
- There is no concern regarding cardiac output

***Call Endocrinology anytime during assessment or treatment if patient develops:**

- Headache
- Altered mental status
- Poor circulation despite adequate hydration
- HCO₃ level <12 mmol/L
- Hyperkalemia (K⁺ >6 mmol/L) or hypokalemia (K⁺ <3 mmol/L)

CLINICAL PATHWAY: Diabetic Ketoacidosis (DKA) Med/Surg Management

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Med/Surg specific care is divided into the following categories:

- Monitoring
- Labs
- Insulin
- Fluids

***Call Endocrinology anytime during assessment or treatment if patient develops:**

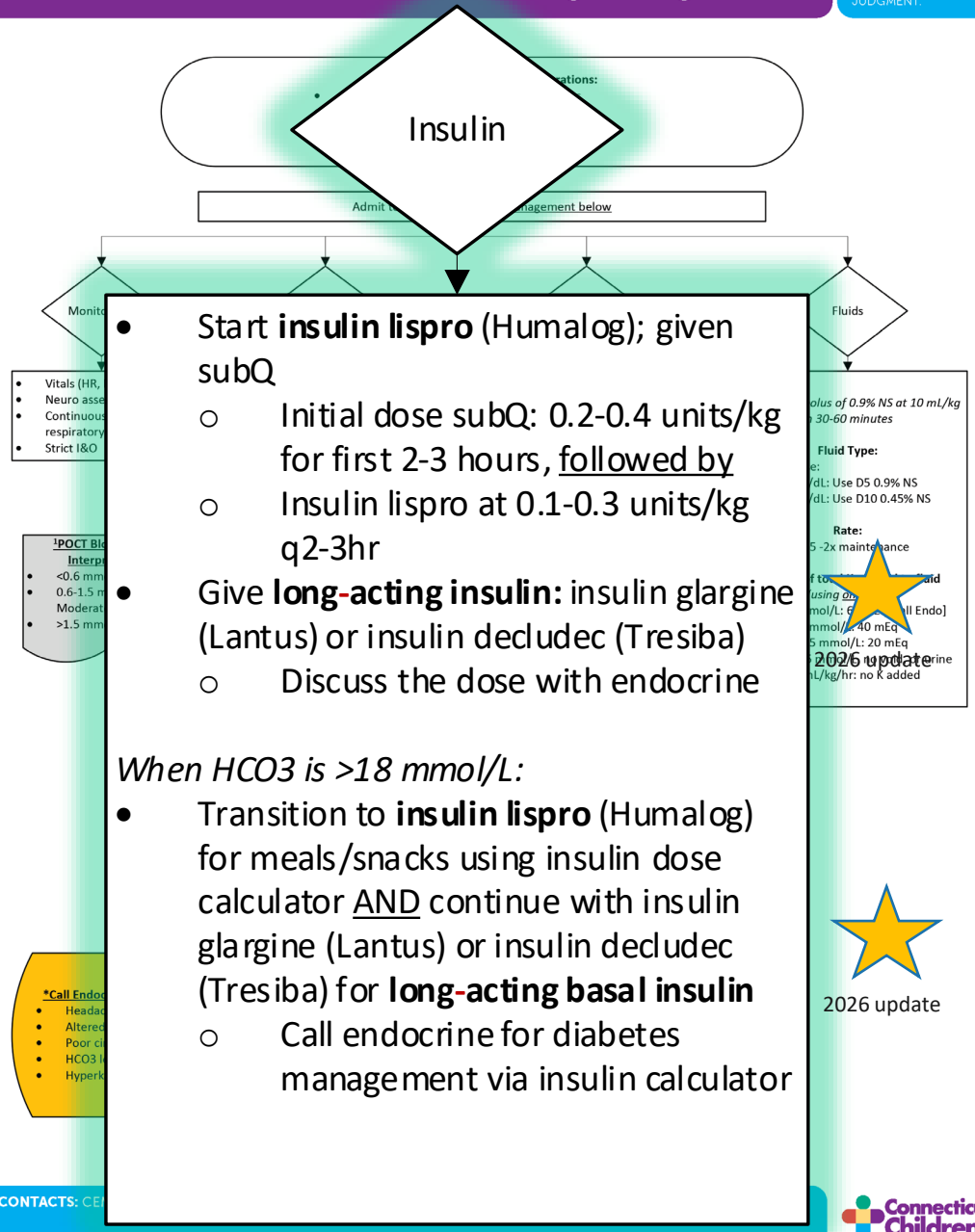
- Headache
- Altered mental status
- Poor circulation despite adequate hydration
- HCO₃ level <12 mmol/L
- Hyperkalemia (K⁺ >6 mmol/L) or hypokalemia (K⁺ <3 mmol/L)

The insulin infusion can now be changed to the following:

- Insulin lispro (Humalog) given q2-3hrs around the clock (previously q4hrs)  2026 update
- Long-acting insulin: Insulin glargine (Lantus), or insulin deludec (Tresiba) [formerly detemir (Levemir)]  2026 update

Once HCO₃ has improved further to >18 mmol/L, insulin can then be changed to:

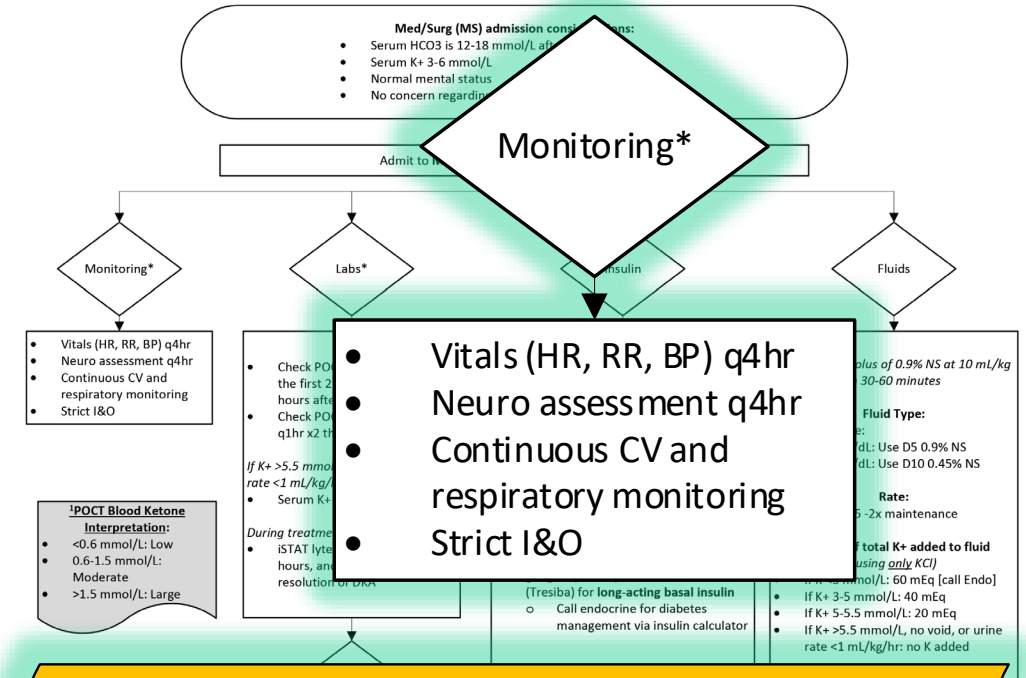
- Insulin lispro (Humalog) with meals, and
- Long acting basal insulin



CLINICAL PATHWAY:
Diabetic Ketoacidosis (DKA) Med/Surg Management

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- Monitoring includes vitals and neuro checks every 4 hours (note the decreased frequency compared to the PICU).
- Endocrinology should be contacted if there is any headache, altered mental status, or poor circulation despite adequate hydration.

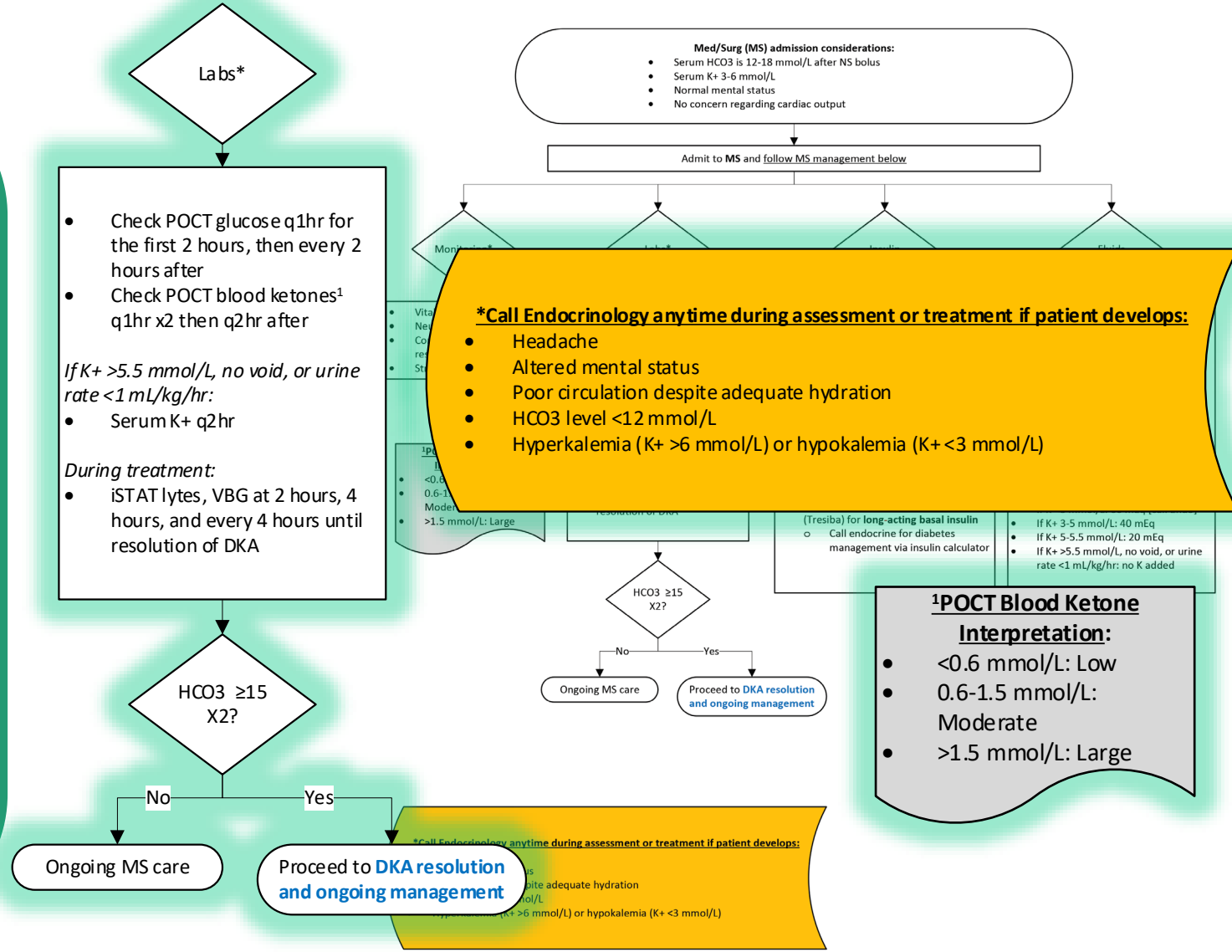


- *Call Endocrinology anytime during assessment or treatment if patient develops:**
- Headache
 - Altered mental status
 - Poor circulation despite adequate hydration
 - HCO₃ level <12 mmol/L
 - Hyperkalemia (K⁺ >6 mmol/L) or hypokalemia (K⁺ <3 mmol/L)

CLINICAL PATHWAY:
Diabetic Ketoacidosis (DKA) Med/Surg Management

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- Labs are monitoring frequently at first and then spaced out over time.
- ★ 2026 update • Glucose can be checked with POCT
- ★ 2026 update • POCT blood ketones monitoring has been added
- ★ 2026 update • During treatment, you no longer have to check STAT beta-hydroxybutyrate



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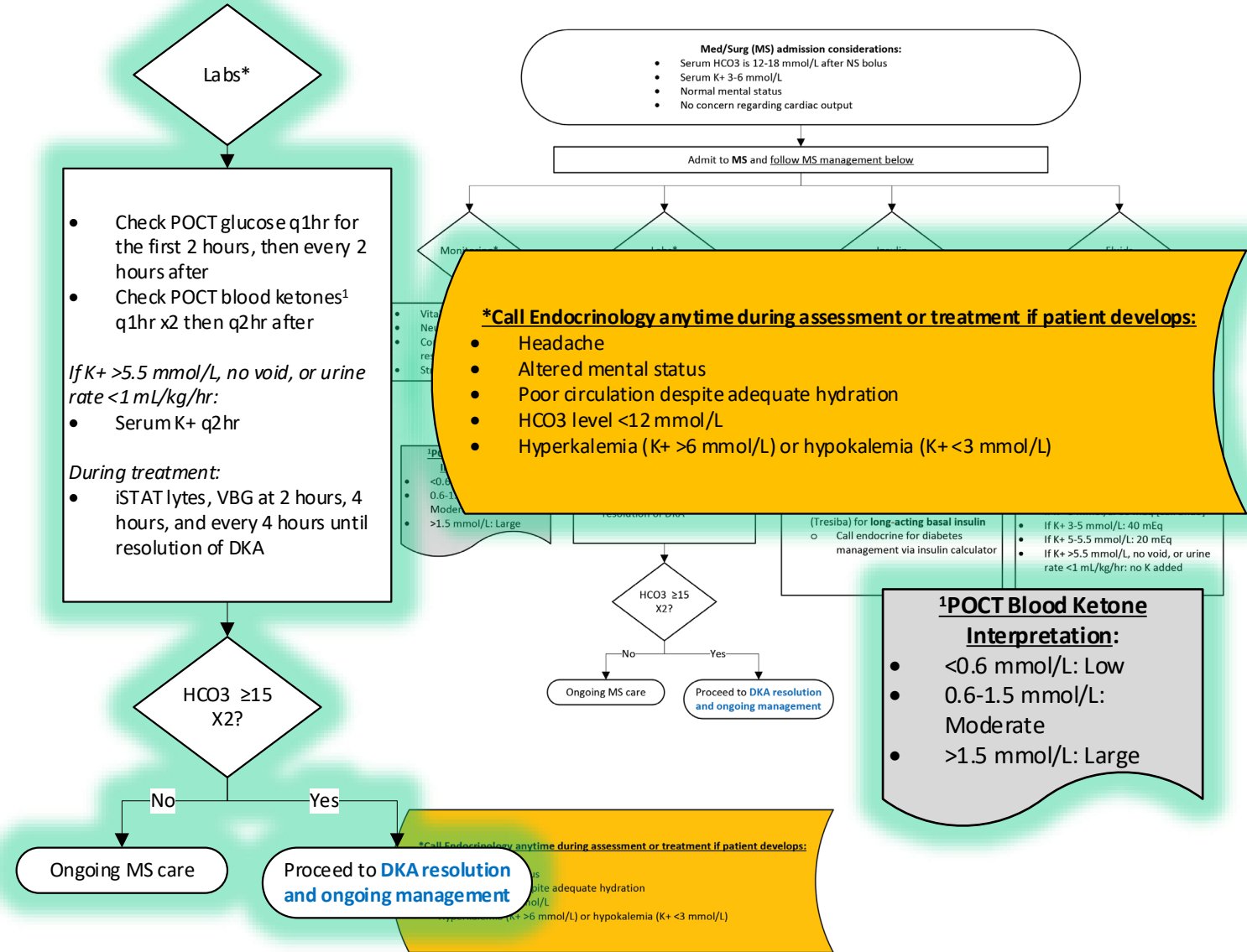
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CLINICAL PATHWAY:
Diabetic Ketoacidosis (DKA) Med/Surg Management

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- Endocrinology should be notified if HCO₃ drops to <12 mmol/L or there is hypokalemia (<3 mmol/L) or hyperkalemia (>6 mmol/L) at any time.
- HCO₃ determines if the patient stays on ongoing Med/Surg management or if they proceed to the DKA resolution and ongoing management algorithm.



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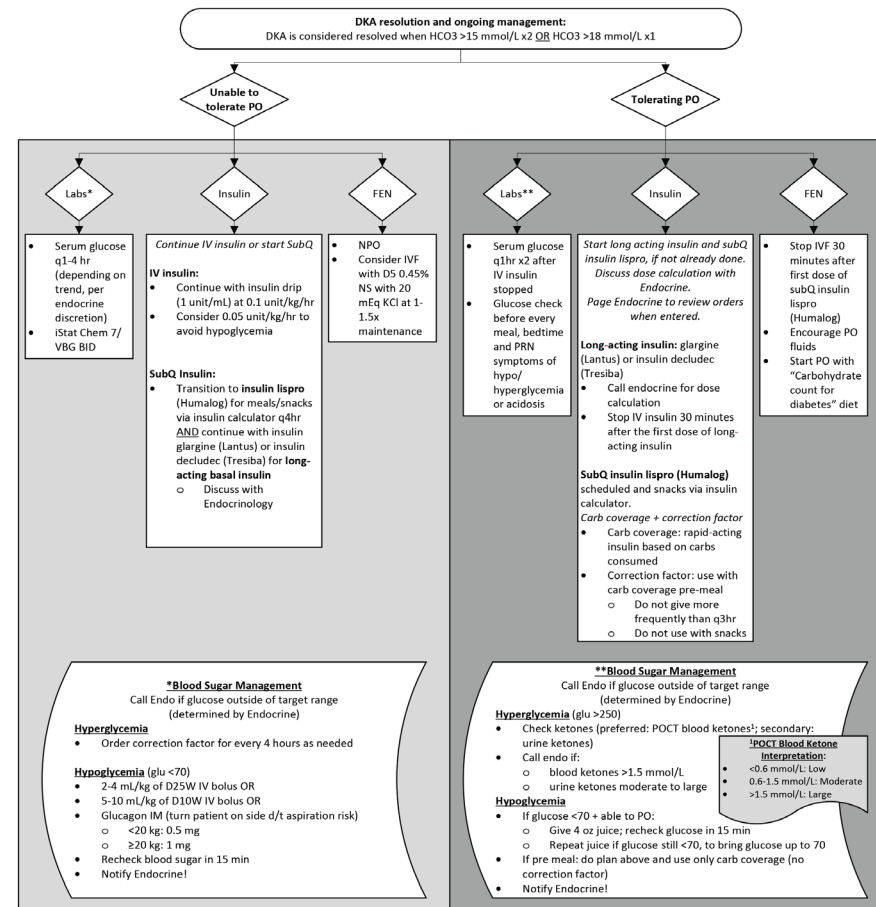
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DKA – Resolution and Ongoing Management Algorithm

The purpose of the Resolution and Ongoing Management algorithm is to provide care once DKA is resolved and avoid further glucose and electrolyte imbalances.



Discharge Criteria:

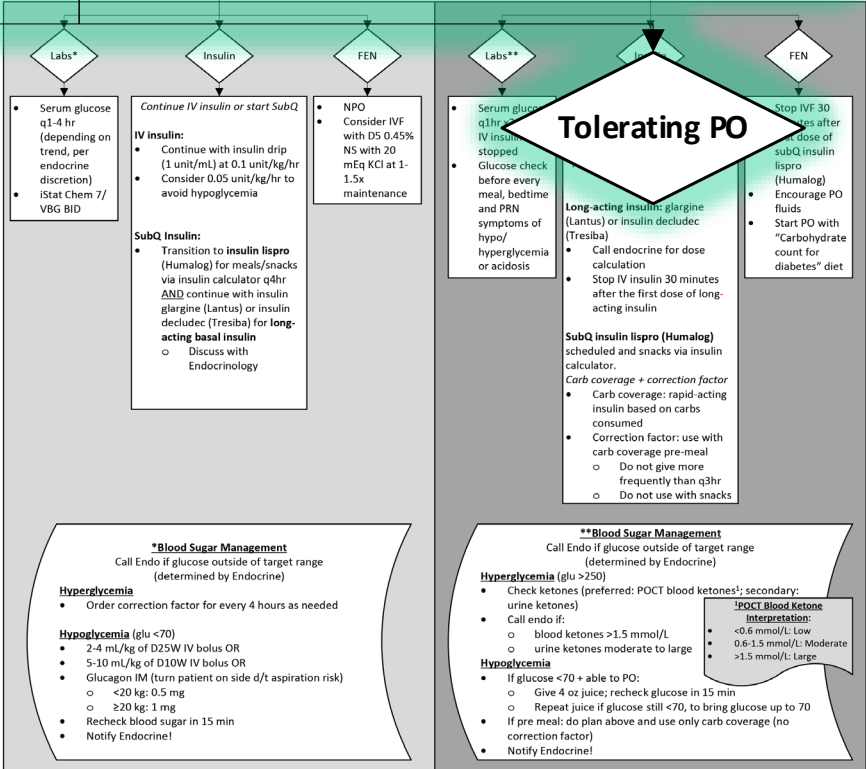
- Clinically stable, blood glucose in acceptable ranges, education scheduled/planned as outpatient by endocrine (see below), scheduled discharge times and outpatient visits (see below)

Discharge Instructions:

- Education:** RN provides basic diabetes education using Basic Diabetes Education for patients and families, and Nursing Guidelines for Basic Diabetes Education to patients/families; Encourage family to view available educational videos on diabetes; Patient and family to perform as much care as possible, under RN supervision (glucose monitoring with home meter if applicable, insulin injections) and demonstrate understanding of concepts and techniques; RD/Educator to provide education on carb counting (outpt or inpt)
- Suggested discharge times and outpatient visits:**
 - (1) If discharged after dinner: present to endo clinic pre-breakfast the following day OR
 - (2) If discharged on the weekend: discharge Sunday evening to present to endo clinic pre-breakfast on Monday OR
 - (3) If discharged Monday prior 11 AM: present to endo clinic pre-lunch (12:30 PM)

DKA resolution and ongoing management:
DKA is considered resolved when $\text{HCO}_3^- > 15 \text{ mmol/L} \times 2$ OR $\text{HCO}_3^- > 18 \text{ mmol/L} \times 1$

Unable to tolerate PO



- DKA is considered resolved when $\text{HCO}_3^- > 15 \text{ mmol/L}$ **twice**, or if $\text{HCO}_3^- > 18 \text{ mmol/L}$ **once**
- If DKA is resolved, resolution management depends on the ability to tolerate PO or not.

Discharge Criteria:

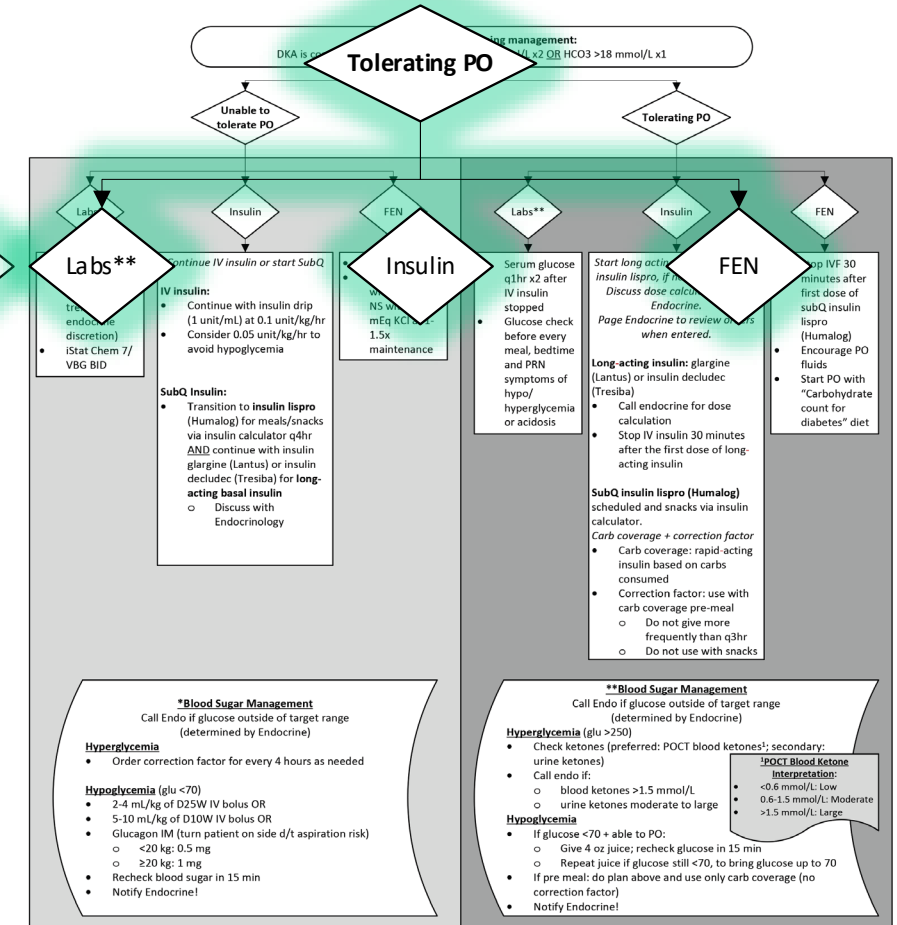
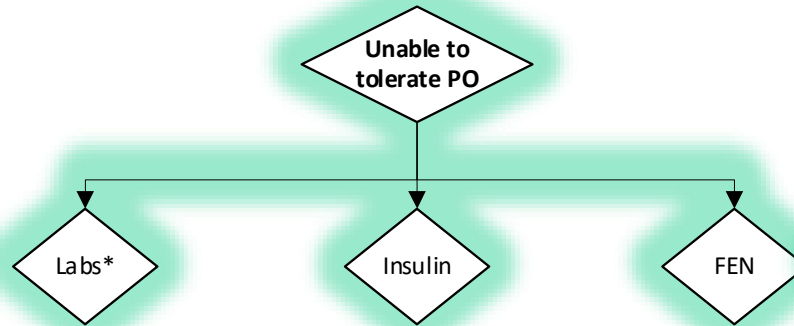
- Clinically stable, blood glucose in acceptable ranges, education scheduled/planned as outpatient by endocrine (see below), scheduled discharge times and outpatient visits (see below)

Discharge Instructions:

- Education: RN provides basic diabetes education using Basic Diabetes Education for patients and families, and Nursing Guidelines for Basic Diabetes Education to patients/families; Encourage family to view available educational videos on diabetes; Patient and family to perform as much care as possible, under RN supervision (glucose monitoring with home meter if applicable, insulin injections) and demonstrate understanding of concepts and techniques; RD/Educator to provide education on carb counting (outpt or inpt)
- Suggested discharge times and outpatient visits:
 - (1) If discharged after dinner: present to endo clinic pre-breakfast the following day OR
 - (2) If discharged on the weekend: discharge Sunday evening to present to endo clinic pre-breakfast on Monday OR
 - (3) If discharged Monday prior 11 AM: present to endo clinic pre-lunch (12:30 PM)

CLINICAL PATHWAY:
Diabetic Ketoacidosis (DKA) Resolution and Ongoing Management

THIS PATHWAY
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***Blood Sugar Management**
 Call Endo if glucose outside of target range (determined by Endocrine)

Hyperglycemia

- Order correction factor for every 4 hours as needed

Hypoglycemia (glu <70)

- 2-4 mL/kg of D25W IV bolus OR
- 5-10 mL/kg of D10W IV bolus OR
- Glucagon IM (turn patient on side d/t aspiration risk)
 - <20 kg: 0.5 mg
 - ≥20 kg: 1 mg
- Recheck blood sugar in 15 min
- Notify Endocrine!

****Blood Sugar Management**
 Call Endo if glucose outside of target range (determined by Endocrine)

Hyperglycemia (glu >250)

- Check ketones (preferred: POCT blood ketones¹; secondary: urine ketones)
- Call endo if:
 - blood ketones >1.5 mmol/L
 - urine ketones moderate to large

Hypoglycemia

- If glucose <70 + able to PO:
 - Give 4 oz juice; recheck glucose in 15 min
 - Repeat juice if glucose still <70, to bring glucose up to 70
- If pre meal: do plan above and use only carb coverage (no correction factor)
- Notify Endocrine!

¹POCT Blood Ketone Interpretation:

- <0.6 mmol/L: Low
- 0.6-1.5 mmol/L: Moderate
- >1.5 mmol/L: Large

Discharge Criteria:

- Clinically stable, blood glucose in acceptable ranges, education scheduled/planned as outpatient by endocrine (see below), scheduled discharge times and outpatient visits (see below)

Discharge Instructions:

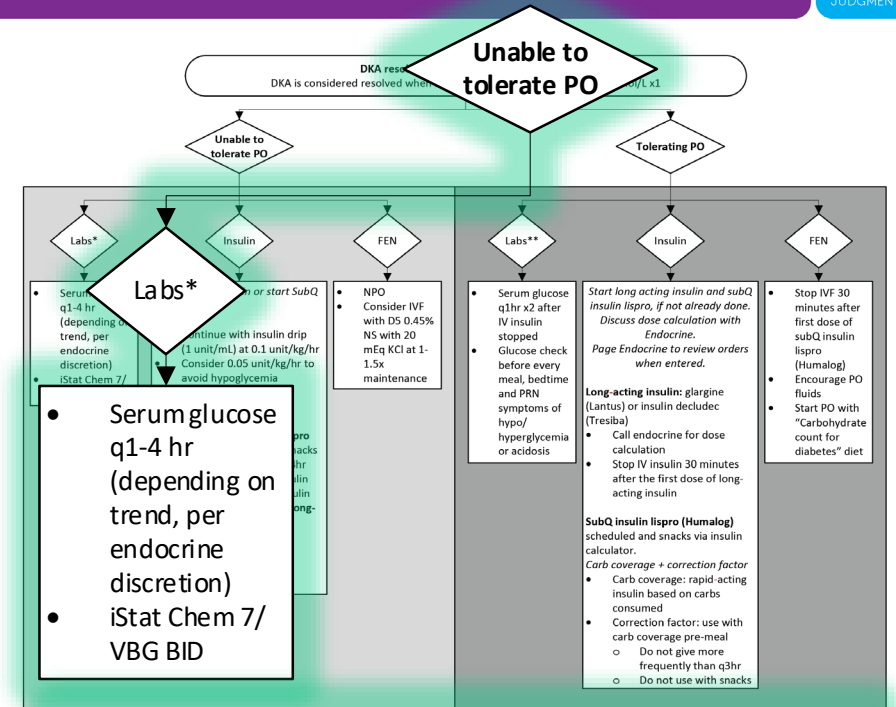
- Education: RN provides basic diabetes education using Basic Diabetes Education for patients and families, and Nursing Guidelines for Basic Diabetes Education to patients/families; Encourage family to view available educational videos on diabetes; Patient and family to perform as much care as possible, under RN supervision (glucose monitoring with home meter if applicable, insulin injections) and demonstrate understanding of concepts and techniques; RD/Educator to provide education on carb counting (outpt or inpt)
- Suggested discharge times and outpatient visits:
 - (1) If discharged after dinner: present to endo clinic pre-breakfast the following day OR
 - (2) If discharged on the weekend: discharge Sunday evening to present to endo clinic pre-breakfast on Monday OR
 - (3) If discharged Monday prior 11 AM: present to endo clinic pre-lunch (12:30 PM)

• Care is divided into labs, insulin and FEN considerations for both categories.



Unable to tolerate PO

- Labs are spaced depending on the patient's trends.
- Glucose target ranges will be provided by endocrine. If the glucose falls outside of the range, endocrinology should be notified.
- If hyperglycemia is present, correction factor should be ordered.
- If hypoglycemia is present, options for glucose replacement are given here.



***Blood Sugar Management**

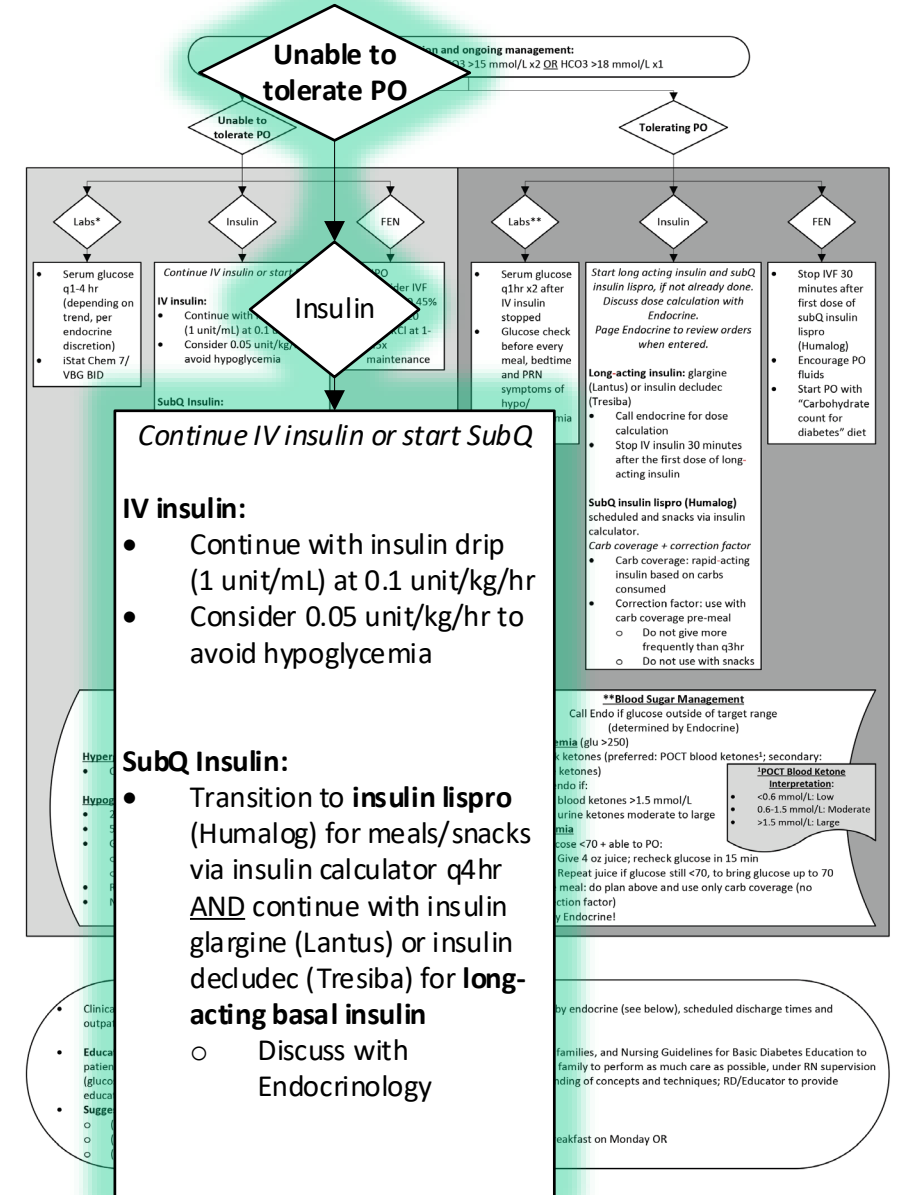
Call Endo if glucose outside of target range (determined by Endo)

Hyperglycemia

- Order correction factor for every 4 hours as needed

Hypoglycemia (glu <70)

- 2-4 mL/kg of D25W IV bolus OR
- 5-10 mL/kg of D10W IV bolus OR
- Glucagon IM (turn patient on side d/t aspiration risk)
 - <20 kg: 0.5 mg
 - ≥ 20 kg: 1 mg
- Recheck blood sugar in 15 min
- Notify Endocrine!



Unable to tolerate PO

- Insulin IV should be continued if the patient is unable to tolerate PO, although subQ may be started in discussion with endocrinology.
- Note that insulin detemir (Levemir) has been replaced by insulin deludec (Tresiba).



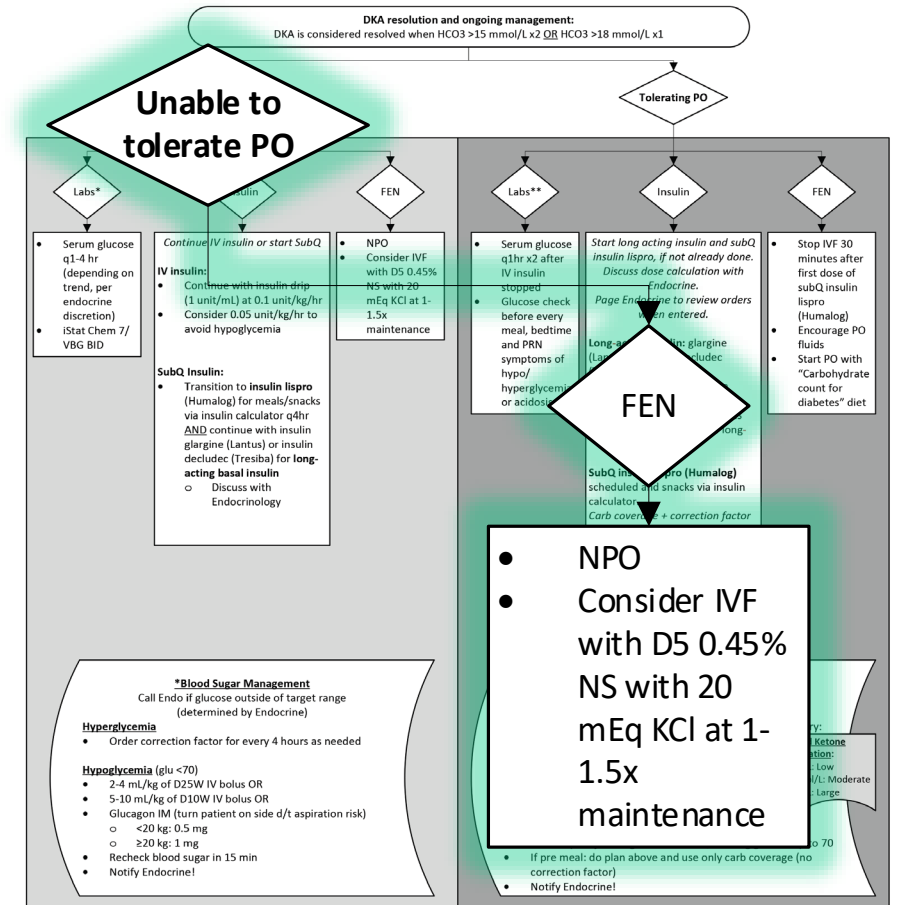
2026 update

CLINICAL PATHWAY:
Diabetic Ketoacidosis (DKA) Resolution and Ongoing Management

THIS PATHWAY SERVES AS A GUIDE AND DOES NOT REPLACE CLINICAL JUDGMENT.

Unable to tolerate PO

- If the patient is unable to tolerate PO, keep them NPO and consider IVF at 1-1.5x maintenance.
- Fluid composition should be D5 0.45% NS with 20 mEq KCl.
 - Note that this is different from DKA specific fluids.



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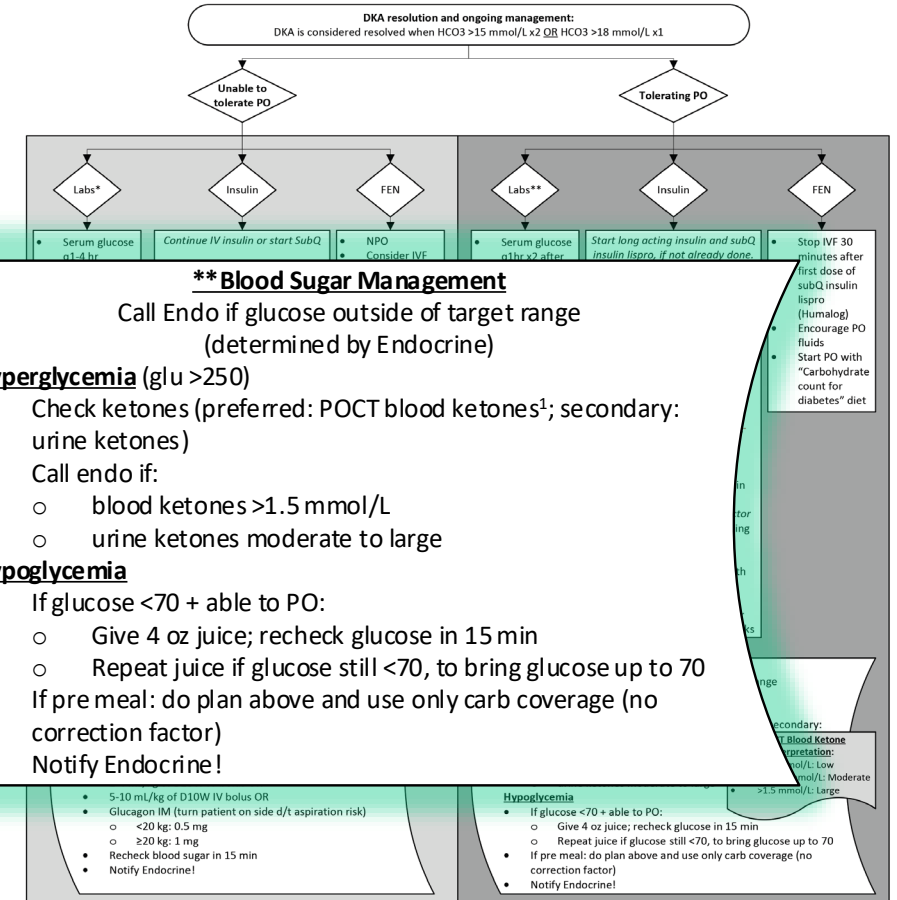


CLINICAL PATHWAY:
Diabetic Ketoacidosis (DKA) Resolution and Ongoing Management

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Unable to tolerate PO

- Blood sugar management is outlined here.
- Target blood glucose ranges are determined by Endo



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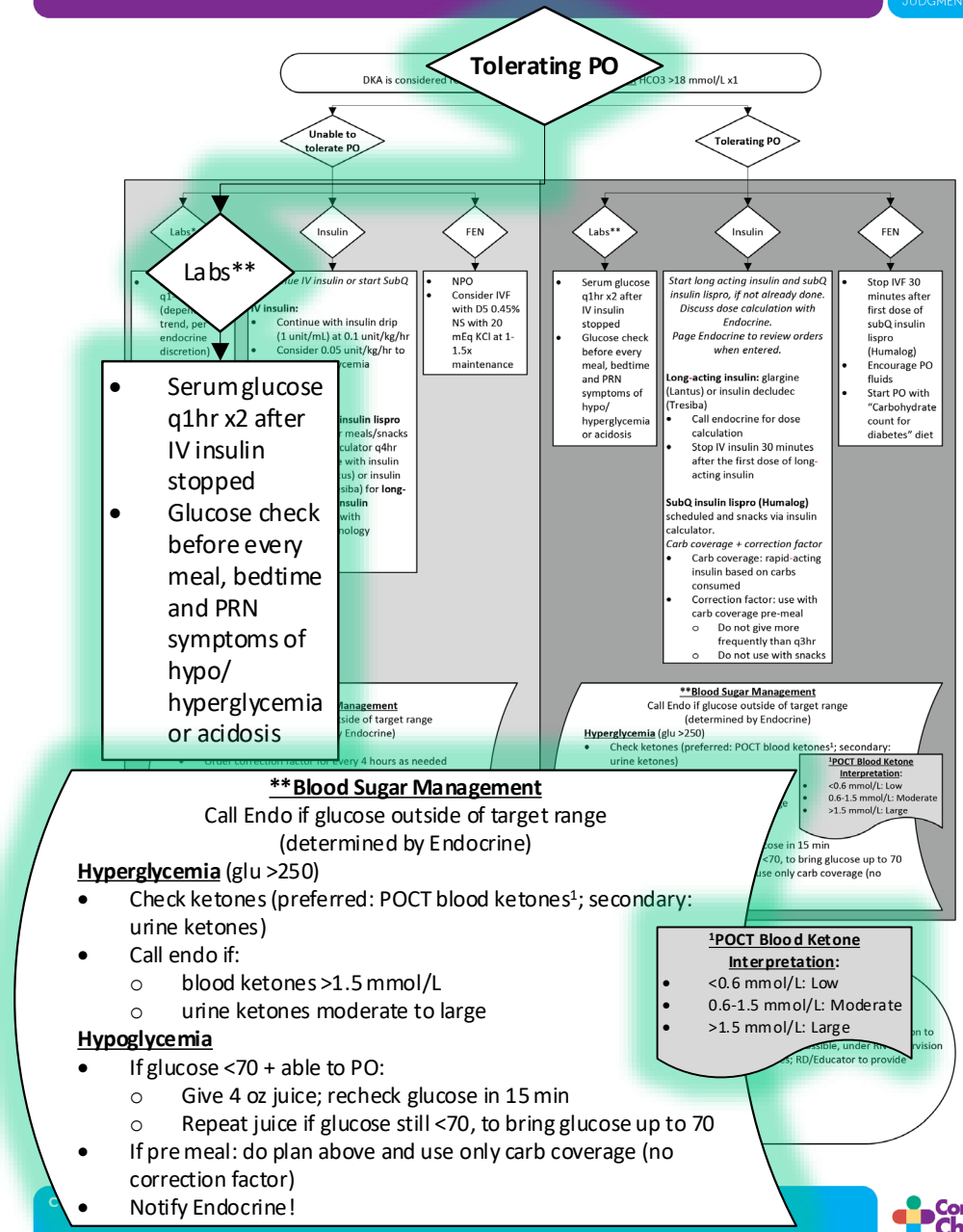
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Tolerating PO

- If the patient is tolerating PO, the labs will be scheduled q1hr x2 after the IV insulin is stopped with glucose checks surrounding meals and PRN.
- Target glucose ranges will be provided by endocrinology.
- If hyperglycemia is present, ketones should be checked (POCT blood ketones preferred). Endo should be notified if ketones are mod-large or blood ketones are large (>1.5 mmol/L).
- If hypoglycemia is present, options to replace glucose are listed.



2026 update



Tolerating PO

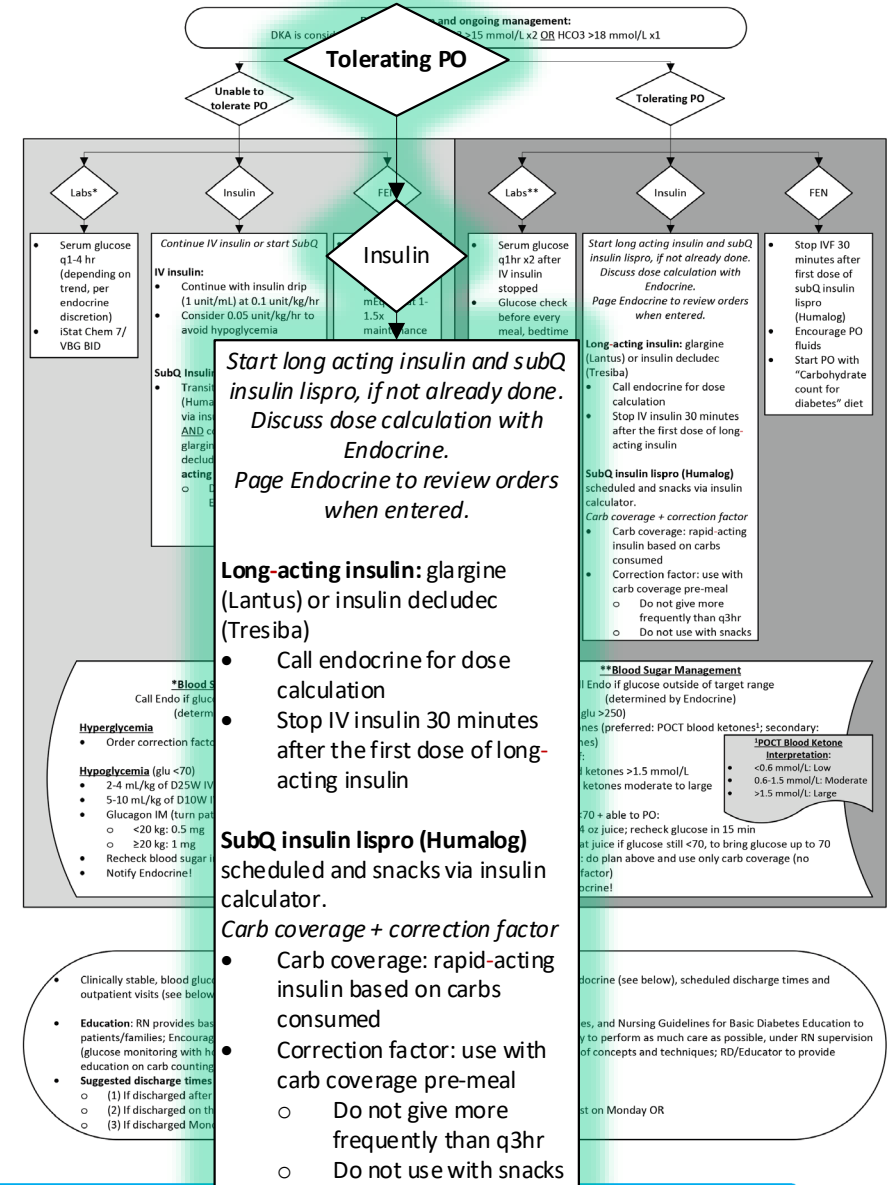
- Once the patient is reliably tolerating PO, long acting insulin and subQ insulin lispro should be started.
- Note that insulin detemir (Levemir) has been replaced by insulin degludec (Tresiba)
- Doses and orders should be discussed and reviewed with Endocrinology.



2026 update

CLINICAL PATHWAY: Diabetic Ketoacidosis (DKA) Resolution and Ongoing Management

THIS PATHWAY
SERVES AS A GUIDE
AND DOES NOT
REPLACE CLINICAL
JUDGMENT.



Discharge Criteria:

- Clinically stable, blood glucose in acceptable ranges, education scheduled/planned as outpatient by endocrine (see below), scheduled discharge times and outpatient visits (see below)

Discharge Instructions:

- **Education:** RN provides basic diabetes education using Basic Diabetes Education for patients and families, and Nursing Guidelines for Basic Diabetes Education to patients/families; Encourage family to view available educational videos on diabetes; Patient and family to perform as much care as possible, under RN supervision (glucose monitoring with home meter if applicable, insulin injections) and demonstrate understanding of concepts and techniques; RD/Educator to provide education on carb counting (outpt or inpt)
- **Suggested discharge times and outpatient visits:**
 - (1) If discharged after dinner: present to endo clinic pre-breakfast the following day OR
 - (2) If discharged on the weekend: discharge Sunday evening to present to endo clinic pre-breakfast on Monday OR
 - (3) If discharged Monday prior 11 AM: present to endo clinic pre-lunch (12:30 PM)

- Discharge criteria and instructions are listed here.
- RN will provide basic diabetes education to the patients and families.
- Encourage families to view available educational videos on diabetes.
- It is the goal that patients/families should perform much of the care during their stay as possible, with RN supervision.
- RN or the educator will provide education on carbohydrate counting, either inpatient or outpatient.
- Specific times for endocrinology follow up are given depending on discharge time.



2026 update

SubQ Insulin:

- Transition to insulin lispro (Humalog) for meals/snacks via insulin calculator q4hr AND continue with insulin glargine (Lantus) or insulin deludec (Tresiba) for long-acting basal insulin
 - Discuss with Endocrinology

Long-acting insulin: glargine (Lantus) or insulin deludec (Tresiba)

- Call endocrine for dose calculation
- Stop IV insulin 30 minutes after the first dose of long-acting insulin

SubQ insulin lispro (Humalog) scheduled and snacks via insulin calculator.

Carb coverage + correction factor

- Carb coverage: rapid-acting insulin based on carbs consumed
- Correction factor: use with carb coverage pre-meal
 - Do not give more frequently than q3hr
 - Do not use with snacks

****Blood Sugar Management**
Call Endo if glucose outside of target range (determined by Endocrine)

Hyperglycemia

- Order correction factor for every 4 hours as needed

Hypoglycemia (glu <70)

- 2-4 mL/kg of D25W IV bolus OR
- 5-10 mL/kg of D10W IV bolus OR
- Glucagon IM (turn patient on side d/t aspiration risk)
 - <20 kg: 0.5 mg
 - ≥20 kg: 1 mg
- Recheck blood sugar in 15 min
- Notify Endocrine!

****Blood Sugar Management**
Call Endo if glucose outside of target range (determined by Endocrine)

Hyperglycemia (glu >250)

- Check ketones (preferred: POCT blood ketones¹; secondary: urine ketones)
- Call endo if:
 - blood ketones >1.5 mmol/L
 - urine ketones moderate to large

Hypoglycemia

- If glucose <70 + able to PO:
 - Give 4 oz juice; recheck glucose in 15 min
 - Repeat juice if glucose still <70, to bring glucose up to 70
- If pre meal: do plan above and use only carb coverage (no correction factor)
- Notify Endocrine!

POCT Blood Ketone Interpretation:

- <0.6 mmol/L: Low
- 0.6-1.5 mmol/L: Moderate
- >1.5 mmol/L: Large

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Review of Key Points

- Severity of DKA will define the level of care needed.
- Initial fluid management is 0.9% (normal) saline given in 10-20 mL/kg boluses until the patient has adequate peripheral perfusion.
- Fluid management is then aimed at replacing intra- and extracellular water and electrolytes, while flushing out glucose and ketones in the urine.
- PICU attending and/or Endocrinology should be notified immediately with ANY evidence of cerebral edema.
- Once a patient's blood glucose and bicarbonate have corrected, they will be transitioned to subQ insulin on an individualized plan from Endocrine team

Quality Metrics

- Percentage of patients with pathway order set usage
- Percentage of patients on pathway for ≤ 24 hours (excluding patients with $\text{pH} \leq 6.9$)
- Percentage of patients without hypoglycemic episodes while on pathway (defined as blood glucose < 70 mg/dl)
- Percentage of patients with 1-2 episodes of hypoglycemia after pathway completed
- Percentage of patients with 3 or more episodes of hypoglycemia after pathway completed
- Percentage of patients with documented (by endocrine team) reason(s) for DKA
- Percentage of patients follow-up appointment scheduled at the time of discharge
- Length of stay

Pathway Contacts

- **Cem Demirci, MD**
 - Department of Endocrinology
- **Emily Germain-Lee, MD**
 - Department of Endocrinology

References

- Wolfsdorf J, Craig ME, Daneman D, Dunger D, Edge J, Lee WR, Rosenbloom A, Sperling MA, Hanas R; International Society for Pediatric and Adolescent Diabetes. [Diabetic ketoacidosis](#). *Pediatr Diabetes*. 2007 Feb;8(1):28–43.
- Cooke DW, Plotnick L. [Management of diabetic ketoacidosis in children and adolescents](#). *Pediatr Rev*. 2008 Dec;29(12):431-5.
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- Nyenwe EA, Kitabchi AE. [The evolution of diabetic ketoacidosis: An update of its etiology, pathogenesis and management](#). *Metabolism*. 2016 Apr;65(4):507-21.

Thank You!



About Connecticut Children's Pathways Program

Clinical pathways guide the management of patients to optimize consistent use of evidence-based practice. Clinical pathways have been shown to improve guideline adherence and quality outcomes, while decreasing length of stay and cost. Here at Connecticut Children's, our Clinical Pathways Program aims to deliver evidence-based, high value care to the greatest number of children in a diversity of patient settings. These pathways serve as a guide for providers and do not replace clinical judgment.