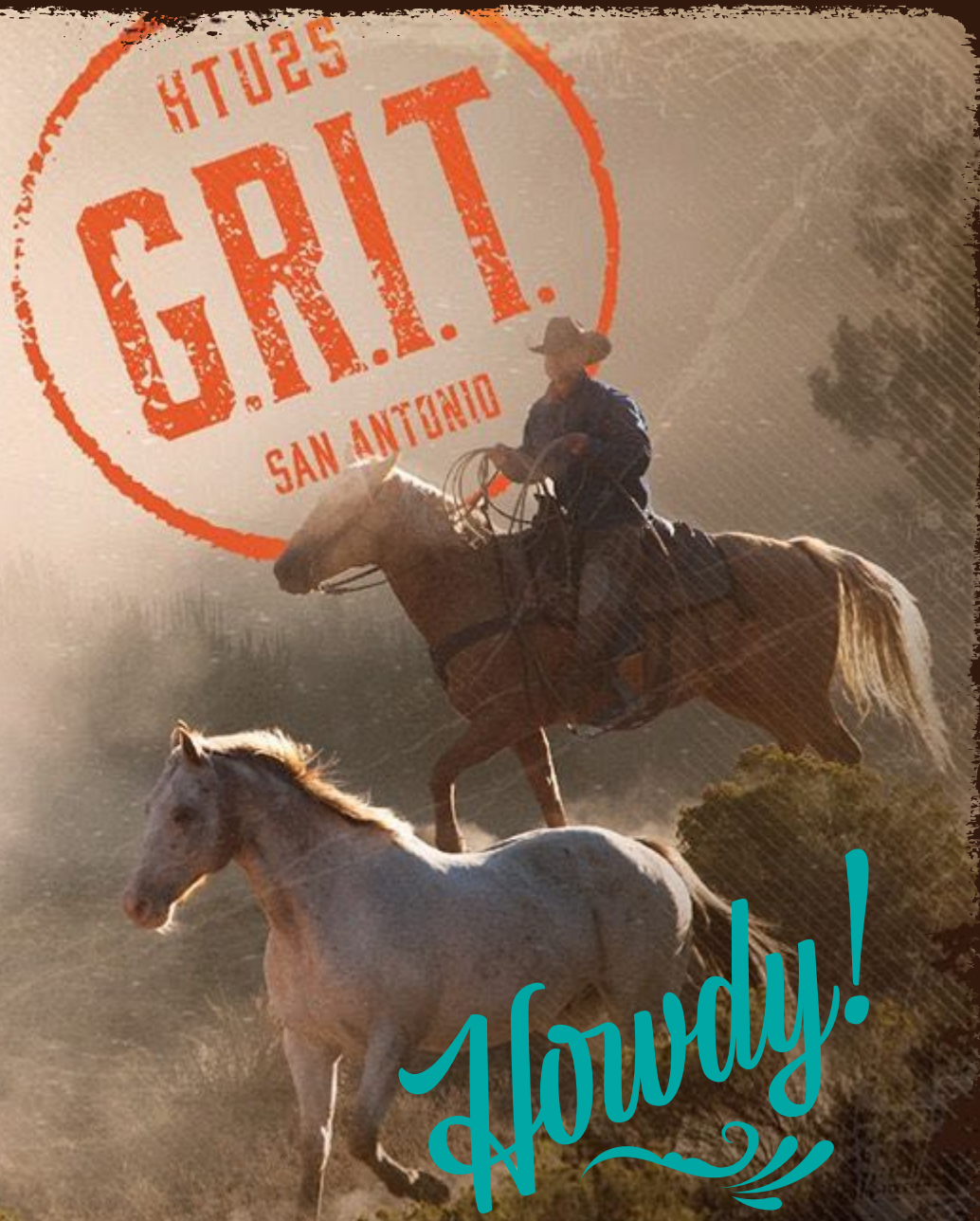
HEALTHTRUST®
UNIVERSITY CONFERENCE

Betting on Better Outcomes: The Two-Bag Method for Diabetic Ketoacidosis in Critical Care

THIS SESSION IS NOT OPEN TO SUPPLIERS

Applying for CE credit or need a Certificate of Participation?
Be sure to snap a pic of the code shown at the end of this session.

CE Deadline: 09/30/25



Presenters

Mikaela Elwell, PharmD, BCPS
Clinical Pharmacy Team Lead,
St. Luke's Meridian Medical Center
Treasure Valley, ID

Kathy Glem, PharmD, BCCCP
Director, Clinical Pharmacy
St. Luke's Health System
Treasure Valley, ID

Howdy!

Disclosures

The presenters have no real or perceived conflicts of interest related to this presentation

Note: The content presented is for informational purposes only and is based upon the presenter(s) knowledge and opinion. It should not be relied upon without independent consultation with and verification by appropriate professional advisors. Individuals and organizations shall have sole responsibility for any actions taken in connection with the content herein. HealthTrust, the program presenter(s) and their employers expressly disclaim any and all warranties as to the content as well as any liability resulting from actions or omissions of any individual or organization in reliance upon the content.

This program may contain the mention of suppliers, brands, products, services or drugs presented in a case study or comparative format using evidence-based research. Such examples are intended for educational and informational purposes and should not be perceived as an endorsement of any particular supplier, brand, product, service or drug.

Learning Objectives

At the end of this session, participants should be able to:

- Recognize the pathophysiology and critical need for timely intervention in Diabetic Ketoacidosis (DKA).
- Recall the two-bag approach for fluid management in adult DKA.
- Identify strategies for implementing the two-bag method for fluid management in adult DKA.

PATHOPHYSIOLOGY IN DKA

Assessment Question #1

Which of the following best explains the primary metabolic disturbance in Diabetic Ketoacidosis (DKA)?

A. Hyperglycemia due to excessive carbohydrate intake
B. Insulin deficiency leading to increased ketogenesis and acidosis
C. Insulin resistance leading to lactic acidosis
D. Excess insulin resulting in electrolyte shifts and hypoglycemia

Source: Kitabachi A, Umpierrez G, Miles J, et al. Hyperglycemic Crises in Adult Patients with Diabetes. *Diabetes Care*. 2009;32:1335-1343

What is DKA?

Life-threatening complication of diabetes

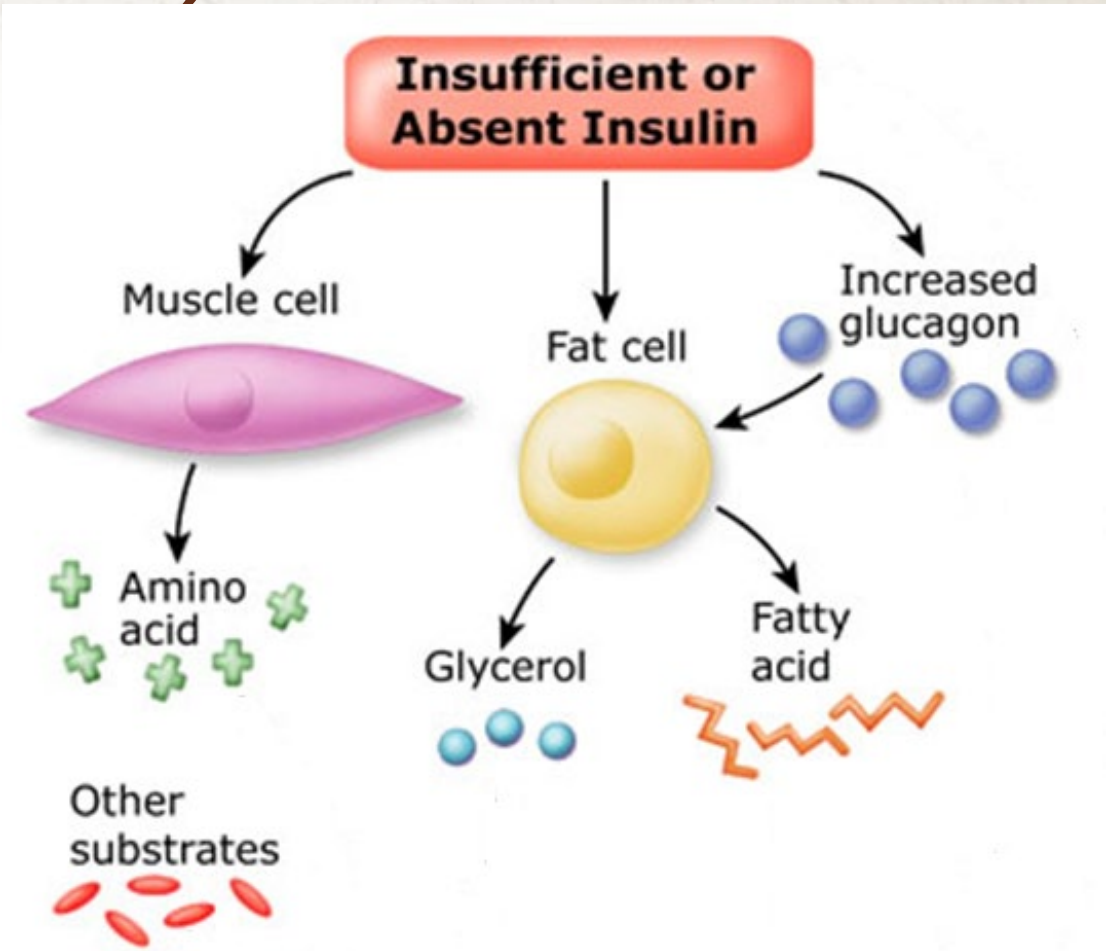
Characterized by absolute or relative insulin deficiency and excess counter-regulatory hormones

Unchecked lipolysis and ketogenesis, resulting in metabolic acidosis

Source: Kitabachi A, Umpierrez G, Miles J, et al. Hyperglycemic Crises in Adult Patients with Diabetes. *Diabetes Care*. 2009;32:1335-1343; 2. Umpierrez G, Davis G, Elsayed N, et al. Hyperglycemic Crises in Adults With Diabetes: A Concensus Report. *Diabetes Care*. 2024;47:1257-1275

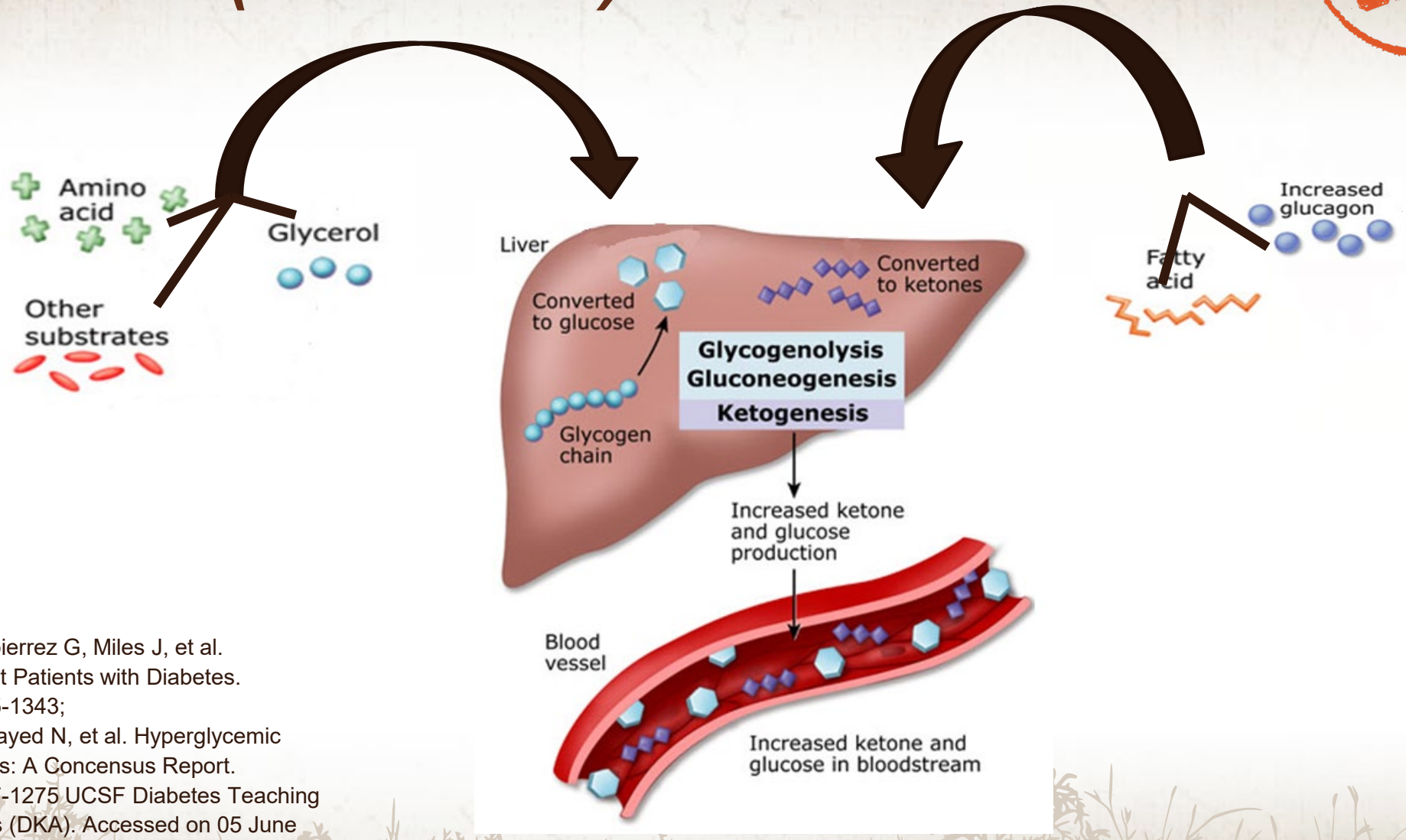
What is DKA? *(continued)*

- Starvation state
- Proteolysis
- Lipolysis



Sources: 1. Kitabachi A, Umpierrez G, Miles J, et al. Hyperglycemic Crises in Adult Patients with Diabetes. *Diabetes Care*. 2009;32:1335-1343; 2. Umpierrez G, Davis G, Elsayed N, et al. Hyperglycemic Crises in Adults With Diabetes: A Concensus Report. *Diabetes Care*. 2024;47:1257-1275 3. UCSF Diabetes Teaching Center. Diabetic Ketoacidosis (DKA). Accessed on 05 June 2025: Diabetic Ketoacidosis | Diabetes Teaching Center

What is DKA? *(continued)*



Sources: 1. Kitabachi A, Umpierrez G, Miles J, et al. Hyperglycemic Crises in Adult Patients with Diabetes. *Diabetes Care*. 2009;32:1335-1343;
2. Umpierrez G, Davis G, Elsayed N, et al. Hyperglycemic Crises in Adults With Diabetes: A Concensus Report. *Diabetes Care*. 2024;47:1257-1275 UCSF Diabetes Teaching Center. Diabetic Ketoacidosis (DKA). Accessed on 05 June 2025: Diabetic Ketoacidosis | Diabetes Teaching Center

DKA Diagnosis

DKA Diagnostic Criteria		
DKA	**D**iabetes/hyperglycemia	Glucose ≥ 200mg/dL OR prior history of diabetes
	Ketosis	Beta (β)-hydroxybutyrate concentration ≥ 3mmol/L OR urine ketone strip 2+ or greater
	Acidosis	pH < 7.3 and/or bicarbonate concentration < 18 mmol/L

Source: Umpierrez G, Davis G, Elsayed N, et al. Hyperglycemic Crises in Adults With Diabetes: A Concensus Report. *Diabetes Care*. 2024;47:1257-1275.

DKA Diagnosis

HHS Diagnostic Criteria		
HHS	**H**yperglycemia	Plasma Glucose ≥ 600mg/dL
	Hyperosmolarity	Calculated effective serum osmolality >300mOsm/kg
	Ab**S**ence of significant ketonemia	β-hydroxybutyrate concentration <3mmol/L OR ketone urine strip <2+
	Absence of acidosis	pH ≥ 7.3 and bicarbonate ≥ 15mmol/L

Source: Umpierrez G, Davis G, Elsayed N, et al. Hyperglycemic Crises in Adults With Diabetes: A Concensus Report. *Diabetes Care*. 2024;47:1257-1275.

TREATMENT STRATEGY IN DKA

Treatment Strategy in DKA

Treating More Than Blood Sugar: The Case for Insulin Rethink

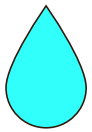
- Discordance of care for insulin management
- Hypoglycemia incidence
- Lack of standard in initial fluid resuscitation
- Variation in maintenance fluid management

Source: Pham T, Glem K. Adult patients diagnosed with DKA review for hypoglycemia (defined < 70), fluid resuscitation, and potassium repletion in St. Luke's Health System [Unpublished data]. Accessed via SlicerDicer in Epic. Retrieved 10/2023.

PGY-1 Pharmacy Resident Project

50 Adult DKA Cases Reviewed

Hypoglycemia occurred in 12% of cases



Inconsistent fluid resuscitation

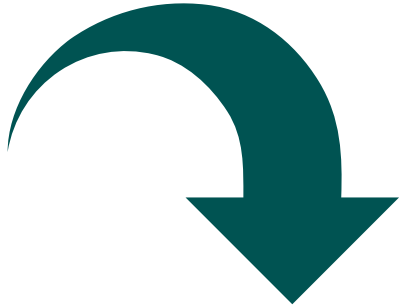
Delayed potassium repletion

Source: Pham T, Glem K. Adult patients diagnosed with DKA review for hypoglycemia (defined < 70), fluid resuscitation, and potassium repletion in St. Luke's Health System [Unpublished data]. Accessed via SlicerDicer in Epic. Retrieved 10/2023.

Reframing Insulin Strategy: Pathophysiology Over Glucose

- Weight-based insulin infusion
- Correction factor risks
- Shift focus in treatment

Hyperglycemia



Acidosis Resolution

Sources: 1. Kitabachi A, Umpierrez G, Miles J, et al. Hyperglycemic Crises in Adult Patients with Diabetes. *Diabetes Care*. 2009;32:1335-1343; 2. Umpierrez G, Davis G, Elsayed N, et al. Hyperglycemic Crises in Adults With Diabetes: A Concensus Report. *Diabetes Care*. 2024;47:1257-1275. 3. Umpierrez G, Korytkowski M. Diabetic emergencies – ketoacidosis, hyperglycaemic hyperosmolar state and hypoglycaemia. www.nature.com/nrendo. Published 19 Feb 2016. Accessed 15 May 2025.

TWO-BAG METHOD: AN OVERVIEW

Assessment Question #2

Which is a key advantage of the two-bag method for DKA?

A. It eliminates the need for insulin infusions
B. It shortens ICU length of stay by 24 hours
C. It allows individualized dextrose delivery while reducing hypoglycemia risk
D. It avoids the use of electrolyte supplementation in fluid management

Source: Hass A, McDonnell M, Donihi A, Hipskind C, et al. Two-Bag System for the Management of Adult Patients with Diabetic Ketoacidosis: A Retrospective Cohort Study. *J Emergency Medicine*. 2018; 55(5):578-586.

Traditional Method

Titrated Insulin Infusion

0-10 units/kg/hr*

*Titrated based on institution-specific nomogram

Bag #1

½ NS / NS / LR

Fixed Rate Infusion

IVF changed when BG falls below 250 mg/dL

Bag #1

D5-NS
+/- KCl 20mEq

Fixed Rate Infusion

Source: Munir I, Fargo R, Garrison R, et al. Comparison of a 'two-bag system' versus conventional treatment protocol ('one-bag system') in the management of diabetic ketoacidosis. *BMJ Open Diab Res Care.* 2017;5:e000395, 1-7.

Two-bag Method

Fluid Resuscitation (20 ml/kg x 1) +/- Electrolyte correction

Fixed Rate Insulin Infusion

0.1 units/kg/hr*

Bag #1

IVF Base:
½ NS / NS / LR

+/- KCl 20 mEq

Rate X

Bag #2

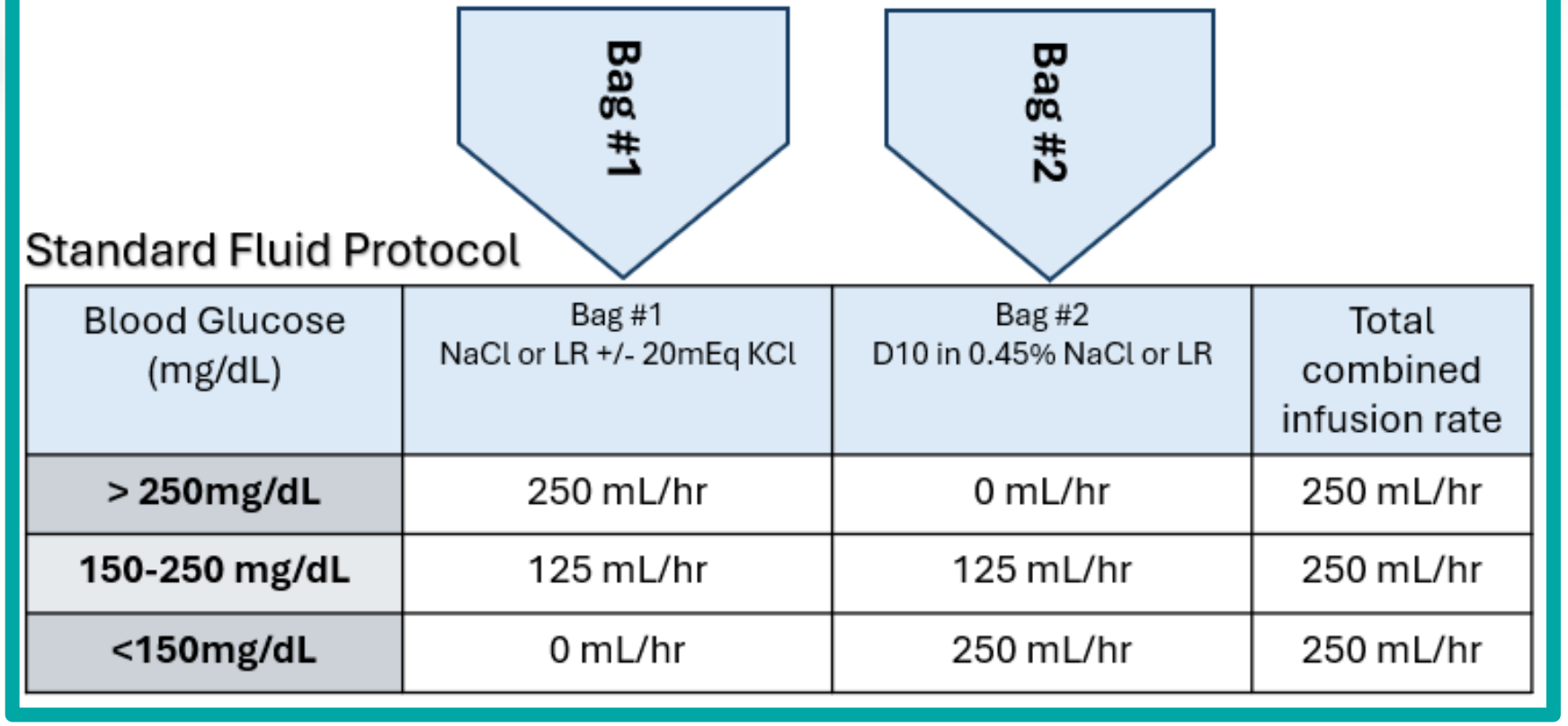
D10W in ½ NS or LR

Rate Y

Combined X+Y rate remains consistent

Source: Hass A, McDonnell M, Donihi A, Hipskind C, et al. Two-Bag System for the Management of Adult Patients with Diabetic Ketoacidosis: A Retrospective Cohort Study. *J Emergency Medicine*. 2018; 55(5):578-586.

Standard Fluid Protocol



Blood Glucose (mg/dL)	Bag #1 NaCl or LR +/- 20mEq KCl	Bag #2 D10 in 0.45% NaCl or LR	Total combined infusion rate
> 250mg/dL	250 mL/hr	0 mL/hr	250 mL/hr
150-250 mg/dL	125 mL/hr	125 mL/hr	250 mL/hr
<150mg/dL	0 mL/hr	250 mL/hr	250 mL/hr

Sources: 1. Hass A, McDonnell M, Donihi A, Hipskind C, et al. Two-Bag System for the Management of Adult Patients with Diabetic Ketoacidosis: A Retrospective Cohort Study. *J Emergency Medicine*. 2018; 55(5):578-586. 2. Munir I, Fargo R, Garrison R, et al. Comparison of a 'two-bag system' versus conventional treatment protocol ('one-bag system') in the management of diabetic ketoacidosis. *BMJ Open Diab Res Care*. 2017;5:e000395, 1-7.

Fluid-restricted Protocol

Blood Glucose (mg/dL)	Bag #1 0.45% or 0.9% NaCl or LR +/- 20mEq KCl	Bag #2 D10 in 0.45% NaCl or D10 in LR	Total combined infusion rate
> 250mg/dL	125 mL/hr	0 mL/hr	125 mL/hr
150-250 mg/dL	75 mL/hr	125 mL/hr	200 mL/hr
<150mg/dL	0 mL/hr	250 mL/hr	250 mL/hr

Sources: 1. Hass A, McDonnell M, Donihi A, Hipskind C, et al. Two-Bag System for the Management of Adult Patients with Diabetic Ketoacidosis: A Retrospective Cohort Study. *J Emergency Medicine*. 2018; 55(5):578-586. 2. Munir I, Fargo R, Garrison R, et al. Comparison of a 'two-bag system' versus conventional treatment protocol ('one-bag system') in the management of diabetic ketoacidosis. *BMJ Open Diab Res Care.* 2017;5:e000395, 1-7.

Focus on Fluids

- DKA → osmotic diuresis → severe dehydration
- Average fluid deficit in DKA = 4–6 liters In DKA, hyperglycemia clears faster than acidosis.
  - Strategic management of dextrose-containing fluids = decreased risk of a hypoglycemic events

"Loss of fluids and electrolytes are significant causes of mortality and morbidity in DKA." – BMJ (2017)

Source: Munir I, Fargo R, Garrison R, et al. Comparison of a 'two-bag system' versus conventional treatment protocol ('one-bag system') in the management of diabetic ketoacidosis. *BMJ Open Diab Res Care.* 2017;5:e000395, 1-7.

Clinical Benefits

Two-bag Method

- Decreased time to β-hydroxybutyrate normalization
- Decreased time to anion gap closure
- Decreased time to HCO3 correction
- Decreased overall duration of insulin infusion
- Decreased time to plasma glucose < 250 mg/dL
- Decreased incidence of hypoglycemia*
  *defined as a blood glucose <70mg/dL

Sources: 1.Gilchrist HE, Hatton CJ, Roginski MA, Esteves AM. Impact on Diabetic Ketoacidosis Resolution After Implementation of a 2-Bag Fluid Order Set. *Annals of Pharmacotherapy*. 2023;57(12):1361-1366. 2.Hass A, McDonnell M, Donihi A, Hipskind C, et al. Two-Bag System for the Management of Adult Patients with Diabetic Ketoacidosis: A Retrospective Cohort Study. *J Emergency Medicine*. 2018; 55(5):578-586. 3.Nahle J, Langford S, Albright J, Sudekum DM. Analysis of the 2-Bag Method for the Management of Diabetic Ketoacidosis: A Retrospective before and after Study. *Journal of Pharmacy Practice*. 2024;38(1):21-27.

Two-bag Method

- At SLHS, all DKA patients require ICU admission
- Nationwide, estimated mean expenses for a single hospitalization = ~$1,300 to $36,000
- Itemized expense calculation of DKA costs shows that a significant cost in DKA management involves the cost of the ICU stay and laboratory testing
  - Decreased duration of insulin infusion = decreased ICU length of stay + decreased laboratory testing
  - Possible treatment of DKA in non-ICU settings

Source: Hass A, McDonnell M, Donihi A, Hipskind C, et al. Two-Bag System for the Management of Adult Patients with Diabetic Ketoacidosis: A Retrospective Cohort Study. *J Emergency Medicine*. 2018; 55(5):578-586.

The Normal (NS) vs. Lactated Ringers (LR) Debate

- Large volume resuscitation with NS → hyperchloremia → non-anion gap metabolic acidosis
  - Possible increased risk of kidney injury
- Evolving evidence appears to favor LR > NS for IVF resuscitation
  - Treatment with LR has been associated with more rapid resolution of DKA and decreased time to discontinuation of insulin infusion
- Concerns with LR
  - Possible metabolic alkalosis, elevated serum lactate

Bottom Line: Use patient-specific factors to guide selection of IVF

Sources: 1.Jamison A, Mohamed A, Chedester C, Klindworth K, Hamarshi M, Sembroski E. Lactated Ringer's versus normal saline in the management of acute diabetic ketoacidosis (RINSE-DKA). Pharmacotherapy. 2024 Aug;44(8):623-630. 2. Self WH, Evans CS, Jenkins CA, et al. Clinical Effects of Balanced Crystalloids vs Saline in Adults With Diabetic Ketoacidosis: A Subgroup Analysis of Cluster Randomized Clinical Trials. *JAMA Netw Open*. 2020;3(11). 3. Carrillo AR, Elwood K, Werth C, Mitchell J, Sarangarm P. Balanced Crystalloid Versus Normal Saline as Resuscitative Fluid in Diabetic Ketoacidosis. Ann Pharmacother. 2022 Sep;56(9):998-1006.

IMPLEMENTATION IN PRACTICE

Assessment Question #3

Which of the following strategies was most critical in achieving successful implementation of the two-bag DKA protocol ?

A. Standardizing insulin infusions across all care areas without modifying fluid management strategies

B. Limiting education to ICU nurses and pharmacists only, where most DKA occurs

C. Relying on retrospective data alone to support the practice change without engaging frontline physicians

D. Developing standardized and fluid-restricted protocols, with early interdisciplinary education and clinical champions

Sources: 1. Hass A, McDonnell M, Donihi A, Hipskind C, et al. Two-Bag System for the Management of Adult Patients with Diabetic Ketoacidosis: A Retrospective Cohort Study. *J Emergency Medicine*. 2018; 55(5):578-586. 2. Munir I, Fargo R, Garrison R, et al. Comparison of a 'two-bag system' versus conventional treatment protocol ('one-bag system') in the management of diabetic ketoacisosis. *BMJ Open Diab Res Care.* 2017;5:e000395, 1-7.

Where to Begin

- Recognize a clinical concern
- Validate the concern with internal data
- Share findings broadly
- Identify and engage key stakeholders early

Building the DKA Protocol

Protocol

- Two-bag system
- Insulin Dosing
- Electrolyte Management

Build

- Submission
- Validation

Sources: 1. Hass A, McDonnell M, Donihi A, Hipskind C, et al. Two-Bag System for the Management of Adult Patients with Diabetic Ketoacidosis: A Retrospective Cohort Study. *J Emergency Medicine*. 2018; 55(5):578-586. 2.Umpierrez G, Davis G, Elsayed N, et al. Hyperglycemic Crises in Adults With Diabetes: A Concensus Report. *Diabetes Care*. 2024;47:1257-1275. 3. Dhatariya K. The management of diabetic ketoacidosis in adults – An updated guideline from the Joint British Diabetes Society for Inpatient Care. *Diabetic Medicine*. 2022;39;e14788, 1-20.

Training & Buy-in

Educating staff

Challenges

- Resistance to change
- Adjustments for special populations
- Build constraints

Implementation in Practice

Next Steps

- Monitor clinical outcomes
- Protocol adherence and feedback
- Ongoing education and support

REDEFINING DKA MANAGEMENT

KEY LESSONS & TAKEAWAYS

Key Lessons & Takeaways

Clinical Takeaways

- Shift in mindset: Acidosis resolution over hyperglycemia alone
- Two-bag method
- Implementation through interdisciplinary team

Source: 1. Kitabachi A, Umpierrez G, Miles J, et al. Hyperglycemic Crises in Adult Patients with Diabetes. 2. Umpierrez G, Davis G, Elsayed N, et al. Hyperglycemic Crises in Adults With Diabetes: A Concensus Report. *Diabetes Care*. 2024;47:1257-1275. 3. Hass A, McDonnell M, Donihi A, Hipskind C, et al. Two-Bag System for the Management of Adult Patients with Diabetic Ketoacidosis: A Retrospective Cohort Study. *J Emergency Medicine*. 2018; 55(5):578-586 4. Munir I, Fargo R, Garrison R, et al. Comparison of a 'two-bag system' versus conventional treatment protocol ('one-bag system') in the management of diabetic ketoacisosis. *BMJ Open Diab Res Care*. 2017;5:e000395, 1-7..

Assessment Question #1

Which of the following best explains the primary metabolic disturbance in DKA?

A. Hyperglycemia due to excessive carbohydrate intake
B. Insulin deficiency leading to increased ketogenesis and acidosis
C. Insulin resistance leading to lactic acidosis
D. Excess insulin resulting in electrolyte shifts and hypoglycemia

Source: Kitabachi A, Umpierrez G, Miles J, et al. Hyperglycemic Crises in Adult Patients with Diabetes. *Diabetes Care*. 2009;32:1335-1343 A

Assessment Question #1: Correct Response

Which of the following best explains the primary metabolic disturbance in DKA?

A. Hyperglycemia due to excessive carbohydrate intake

B. **Insulin deficiency leading to increased ketogenesis and acidosis**

C. Insulin resistance leading to lactic acidosis

D. Excess insulin resulting in electrolyte shifts and hypoglycemia

Source: Kitabachi A, Umpierrez G, Miles J, et al. Hyperglycemic Crises in Adult Patients with Diabetes. *Diabetes Care*. 2009;32:1335-1343 A

Assessment Question #2

Which is a key advantage of the two-bag method for DKA?

A. It eliminates the need for insulin infusions
B. It shortens ICU length of stay by 24 hours
C. It allows individualized dextrose delivery while reducing hypoglycemia risk
D. It avoids the use of electrolyte supplementation in fluid management

Source: Hass A, McDonnell M, Donihi A, Hipskind C, et al. Two-Bag System for the Management of Adult Patients with Diabetic Ketoacidosis: A Retrospective Cohort Study. *J Emergency Medicine*. 2018; 55(5):578-586.

Assessment Question #2: Correct Response

Which is a key advantage of the two-bag method for DKA?

A. It eliminates the need for insulin infusions

B. It shortens ICU length of stay by 24 hours

C. **It allows individualized dextrose delivery while reducing hypoglycemia risk**

D. It avoids the use of electrolyte supplementation in fluid management

Source: Hass A, McDonnell M, Donihi A, Hipskind C, et al. Two-Bag System for the Management of Adult Patients with Diabetic Ketoacidosis: A Retrospective Cohort Study. *J Emergency Medicine*. 2018; 55(5):578-586.

Assessment Question #3

Which of the following strategies was most critical in achieving successful implementation of the two-bag DKA protocol ?

A. Standardizing insulin infusions across all care areas without modifying fluid management strategies
B. Limiting education to ICU nurses and pharmacists only, where most DKA occurs
C. Relying on retrospective data alone to support the practice change without engaging frontline physicians
D. Developing standardized and fluid-restricted protocols, with early interdisciplinary education and clinical champions

Source: 1. Hass A, McDonnell M, Donihi A, Hipskind C, et al. Two-Bag System for the Management of Adult Patients with Diabetic Ketoacidosis: A Retrospective Cohort Study. *J Emergency Medicine*. 2018; 55(5):578-586. 2. Munir I, Fargo R, Garrison R, et al. Comparison of a 'two-bag system' versus conventional treatment protocol ('one-bag system') in the management of diabetic ketoacisosis. *BMJ Open Diab Res Care*. 2017;5:e000395, 1-7.

Assessment Question #3: Correct Response

Which of the following strategies was most critical in achieving successful implementation of the two-bag DKA protocol ?

A. Standardizing insulin infusions across all care areas without modifying fluid management strategies

B. Limiting education to ICU nurses and pharmacists only, where most DKA occurs

C. Relying on retrospective data alone to support the practice change without engaging frontline physicians

D. **Developing standardized and fluid-restricted protocols, with early interdisciplinary education and clinical champions**

Source: 1. Hass A, McDonnell M, Donihi A, Hipskind C, et al. Two-Bag System for the Management of Adult Patients with Diabetic Ketoacidosis: A Retrospective Cohort Study. *J Emergency Medicine*. 2018; 55(5):578-586. 2. Munir I, Fargo R, Garrison R, et al. Comparison of a 'two-bag system' versus conventional treatment protocol ('one-bag system') in the management of diabetic ketoacisosis. *BMJ Open Diab Res Care.* 2017;5:e000395, 1-7.

References:

1. Kitabachi A, Umpierrez G, Miles J, et al. Hyperglycemic Crises in Adult Patients with Diabetes. *Diabetes Care*. 2009;32:1335-1343
2. Umpierrez G, Davis G, Elsayed N, et al. Hyperglycemic Crises in Adults With Diabetes: A Concensus Report. *Diabetes Care*. 2024;47:1257-1275
3. UCSF Diabetes Teaching Center. Diabetic Ketoacidosis (DKA). Accessed on 05 June 2025: Diabetic Ketoacidosis | Diabetes Teaching Center
4. Pham T, Glem K. Adult patients diagnosed with DKA review for hypoglycemia (defined < 70), fluid resuscitation, and potassium repletion in St. Luke's Health System [Unpublished data]. Accessed via SlicerDicer in Epic. Retrieved 10/2023.
5. Umpierrez G, Korytkowski M. Diabetic emergencies – ketoacidosis, hyperglycaemic hyperosmolar state and hypoglycaemia. www.nature.com/nrendo. Published 19 Feb 2016. Accessed 15 May 2025.

References:

6. Hass A, McDonnell M, Donihi A, Hipskind C, et al. Two-Bag System for the Management of Adult Patients with Diabetic Ketoacidosis: A Retrospective Cohort Study. *J Emergency Medicine*. 2018; 55(5):578-586.
7. Munir I, Fargo R, Garrison R, et al. Comparison of a 'two-bag system' versus conventional treatment protocol ('one-bag system') in the management of diabetic ketoacidosis. *BMJ Open Diab Res Care.* 2017;5:e000395, 1-7.
8. Gilchrist HE, Hatton CJ, Roginski MA, Esteves AM. Impact on Diabetic Ketoacidosis Resolution After Implementation of a 2-Bag Fluid Order Set. *Annals of Pharmacotherapy*. 2023;57(12):1361-1366.
9. Nahle J, Langford S, Albright J, Sudekum DM. Analysis of the 2-Bag Method for the Management of Diabetic Ketoacidosis: A Retrospective before and after Study. *Journal of Pharmacy Practice*. 2024;38(1):21-27.

References:

10. Dhatariya K. The management of diabetic ketoacidosis in adults – An updated guideline from the Joint British Diabetes Society for Inpatient Care. *Diabetic Medicine*. 2022;39;e14788, 1-20.
11. Jamison A, Mohamed A, Chedester C, Klindworth K, Hamarshi M, Sembroski E. Lactated Ringer's versus normal saline in the management of acute diabetic ketoacidosis (RINSE-DKA). Pharmacotherapy. 2024 Aug;44(8):623-630.
12. Self WH, Evans CS, Jenkins CA, et al. Clinical Effects of Balanced Crystalloids vs Saline in Adults With Diabetic Ketoacidosis: A Subgroup Analysis of Cluster Randomized Clinical Trials. JAMA Netw Open. 2020;3(11).
13. Carrillo AR, Elwood K, Werth C, Mitchell J, Sarangarm P. Balanced Crystalloid Versus Normal Saline as Resuscitative Fluid in Diabetic Ketoacidosis. Ann Pharmacother. 2022 Sep;56(9):998-1006.

HEALTHTRUST®
UNIVERSITY CONFERENCE

Thanks y'all!

- Mikaela Elwell – elwelle@slhs.org
- Kathy Glem – glemk@slhs.org