

WebM&M

Morbidity and Mortality Rounds on the Web

Spotlight

Inpatient Stroke Management in a Patient with Type 1 Diabetes and Home Insulin Pump



Agency for Healthcare Research and Quality
Advancing Excellence in Health Care



Source and Credits

- This presentation is based on the October 2020 AHRQ WebM&M Spotlight Case
 - See the full article at <https://psnet.ahrq.gov/webmm>
 - CME credit is available
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- AHRQ WebM&M Editors in Chief: Patrick Romano, MD, MPH and Debra Bakerjian, PhD, APRN, RN
 - Spotlight Editors: Ulfat Shaikh, MD and JoAnne Natale, MD
 - Managing Editor: Meghan Weyrich, MPH

Objectives

At the conclusion of this educational activity, participants should be able to:

- Highlight the challenges of using home medical devices in hospitalized patients
- Describe when common diabetes technologies – including insulin pumps and continuous glucose monitoring – can be safely utilized in an inpatient setting
- Discuss recommended practices to optimize patient safety when managing hospitalized patients on home insulin pumps

INPATIENT STROKE MANAGEMENT IN A PATIENT WITH TYPE 1 DIABETES AND HOME INSULIN PUMP

A case describing how suboptimal inpatient management of diabetes technology may have contributed to avoidable hyperglycemia after acute stroke

Case Details

- 14-year-old girl with a history of type 1 diabetes (T1D) presented to her local ED with two weeks of heavy menstrual bleeding
 - Treated with tranexamic acid and oral contraceptives
- Presented the following day to a different ED with continued symptoms, as well new blurred vision, headache, and left arm numbness
 - Head CT was normal
 - Transferred to academic medical center for further management

Case Details

- Upper extremity symptoms worsened; brain MRI revealed right middle cerebral artery (MCA) strokes
- Further workup diagnosed antiphospholipid syndrome
 - Treated with aspirin, mycophenolate, hydroxychloroquine, and prednisone
- Following week, patient developed new upper extremity weakness and left upper extremity, chest, and facial paresthesia
 - Imaging confirmed new MCA, and splenic and renal infarcts
 - Treated with high dose steroids and three rounds of plasmapheresis
- Discharged home three weeks later

Case Details

- Throughout hospitalization, patient's T1D was managed using home insulin pump and continuous glucose monitor (CGM)
- Despite persistent hyperglycemia, patient's mother resisted recommendations to discontinue pump and initiate IV insulin
 - Patient's blood glucose values were routinely above 180 mg/dL and rose further after glucocorticoid therapy was initiated
 - Patient had several instances of insulin pump infusion site leakage and multiple occurrences of incorrect management related to CGM for calculation of insulin doses
 - Consult from Endocrinology and diabetes nurse specialist occurred late in the hospital course

INPATIENT STROKE MANAGEMENT IN A PATIENT WITH TYPE 1 DIABETES AND HOME INSULIN PUMP

THE COMMENTARY

By Berit Bagley, MSN, Dahlia Zuidema, PharmD,
Stephanie Crossen, MD, and Lindsey Loomba, MD

Background (1)

- Insulin pump and CGM technology are increasingly utilized by patients of all ages, with higher rates among younger ages (e.g., 51% of those <6 years of age)
 - Insulin pumps deliver continuous rapid-acting insulin via a subcutaneous cannula and perform precise, customized dose calculations.
 - CGM devices measure glucose levels at frequent (1-5 minute) intervals via a subcutaneous sensor and relay these values to an external device.
 - Newer insulin pumps can receive data from CGMs and employ automated algorithms (called “hybrid closed-loop systems”) to adjust insulin delivery in response to glucose levels.

Background (2)

- Hospital environment poses unique challenges to diabetes management due to rapidly changing insulin needs (e.g., illness, new medications, diet changes, surgical procedures)
- Symptoms of hyper- and hypoglycemia are more difficult to detect in the context of ongoing pain, sedation, or altered mental status

Background (3)

- Patients and caregivers are often frustrated sharing diabetes management tasks with medical providers who:
 1. Typically have less detailed diabetes knowledge than the patient/caregiver
 2. Must follow hospital protocols designed to be maximally safe but minimally flexible to an individual patient's needs
- These issues are exacerbated when a patient uses an insulin pump and/or CGM device since they allow improved customization of diabetes management but require additional expertise

Background (4)

- American Diabetes Association (ADA) recommends that patients be allowed to use home insulin pumps and CGMs during hospitalizations when possible
- Guidance from ADA and recent publications emphasizes:
 - Proper patient selection – with critical illness and neurologic impairment as contraindications to pump use
 - Necessity of collaboration between patients/families and providers
 - Need for standardized hospital protocols

Approach to Optimizing Patient Safety

Approach to Improving Safety (1)

Several contributing issues to patient's persistent hyperglycemia, worsened neurologic outcomes, and/or recovery time

1. Patient/caregiver resistance – patients with T1D and their caregivers are accustomed to knowing more about diabetes technology than their providers and may be skeptical about inpatient recommendations
2. Lack of provider awareness and understanding of existing hospital policy regarding how insulin pump and CGM use alters routine care
3. Lack of integration of hospital insulin pump protocol with the EHR
4. Technology limitations – patient's device did not interface with the EHR, leading to inefficiencies and potential for error

Approach to Improving Safety (2)

Patient Involvement and Provider Education

- Shared decision making with the patient is imperative.
- Providers need to understand contraindications to insulin pump therapy and discuss contraindications with the patient, family, and other members of the care team.
- Admitting provider should decide whether to continue insulin pump therapy in collaboration with the endocrinologist or diabetes team, who should be consulted at time of admission.
- Endocrinologist or diabetes team should be involved throughout the hospitalization to interrogate the insulin pump and recommend changes to insulin dosing based on current health and expected plan of care.
- Assessment of patient ability, disparities and cultural barriers – some patients may be adept at using their home devices in an outpatient setting but cannot demonstrate critical skills during a hospitalization.

Approach to Improving Safety (3)

Patient Involvement and Provider Education (cont.)

- Diabetes specialists can help establish trust with the patient/family in the overall care plan and help to understand glycemic goals for the hospitalization.
- Diabetes specialists should provide training in diabetes technology use to other members of the care team (physicians, pharmacists, nurses).
- Diabetes specialists must document pump settings in the EHR and discuss how typical diabetes protocols/practices should be altered for use of a pump.
- Designated units for patients using diabetes technology allows for specialization of bedside nurses who gain proficiency with diabetes technology and expertise recognizing/managing problems.

Approach to Improving Safety (4)

Protocols and Technology

- Hospital-wide insulin pump policy and standardized insulin pump order set can facilitate safe pump use during hospitalizations.
- Hospitals do not typically stock pump or CGM supplies – patients should be responsible for bringing them from home and patients should be informed of this policy upon admission.
 - If a patient has an immediate need, care may be affected to lack of supply availability

Approach to Improving Safety (5)

Protocols and Technology (cont.)

- Even with CGM use, hospital-supplied point-of-care blood glucose values may be necessary for documentation in the EHR and for insulin dosage decision making.
- All bolus doses administered through the pump must be communicated and clearly documented in the medical record.

Approach to Improving Safety (6)

Protocols and Technology (cont.)

- Integrated computerized insulin pump protocols into the EHR has the potential to improve outcomes and reduce errors related to insulin pump management in hospitalized patients.
 - This integration will be increasingly important as more patients use CGMs and hybrid closed-loop systems in the future.
 - Desire to achieve tight glycemic control may favor continuing these technologies in the hospital, but potential for errors will increase if data cannot be accessed or understood by inpatient medical teams.

TAKE HOME POINTS

Take-Home Points (1)

- Decisions about use of home diabetes devices during hospitalization should be made in consultation with a diabetes specialist, the patient/family, and published guidelines.
- When insulin pumps and/or CGMs are used during hospitalizations, the inpatient medical team will require additional education about these devices.

Take-Home Points (2)

- Use of standardized protocols, order-sets, and clear documentation practices can minimize the risks for confusion and errors in medical management.
- Daily communication about the goals of therapy can reduce patients' and caregivers' resistance to changes in home insulin regimens.

REFERENCES

References (1)

1. Chen R, Ovbiagele B, Feng W. Diabetes and Stroke: Epidemiology, Pathophysiology, Pharmaceuticals and Outcomes. *The American journal of the medical sciences* 2016;351:380-6.
2. Jauch EC, Saver JL, Adams HP, Jr., et al. Guidelines for the early management of patients with acute ischemic stroke: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke* 2013;44:870-947.
3. Sherr JL, Tauschmann M, Battelino T, et al. ISPAD Clinical Practice Consensus Guidelines 2018: Diabetes technologies. *Pediatr Diabetes* 2018;19 Suppl 27:302-25.
4. American Diabetes A. 7. Diabetes Technology: Standards of Medical Care in Diabetes-2020. *Diabetes Care* 2020;43:S77-S88.
5. Foster NC, Beck RW, Miller KM, et al. State of Type 1 Diabetes Management and Outcomes from the T1D Exchange in 2016-2018. *Diabetes technology & therapeutics* 2019;21:66-72.
6. Munt R, Hutton A. Type 1 diabetes mellitus (T1DM) self management in hospital; is it possible? A literature review. *Contemporary nurse* 2012;40:179-93.
7. Shah AD, Rushakoff RJ. Patient Self-Management of Diabetes Care in the Inpatient Setting: Con. *Journal of diabetes science and technology* 2015;9:1155-7.
8. Germain CP, Nemchik RM. Diabetes self-management and hospitalization. *Image--the journal of nursing scholarship* 1988;20:74-8.
9. Thompson B, Leighton M, Korytkowski M, Cook CB. An Overview of Safety Issues on Use of Insulin Pumps and Continuous Glucose Monitoring Systems in the Hospital. *Curr Diab Rep* 2018;18:81.
10. Umpierrez GE, Klonoff DC. Diabetes Technology Update: Use of Insulin Pumps and Continuous Glucose Monitoring in the Hospital. *Diabetes Care* 2018;41:1579-89.
11. Bhatt D, Reynolds LR. Keep Your Hands Off My Insulin Pump! The Dilemma of the Hospitalized Insulin Pump Patient. *The American journal of medicine* 2015;128:936-7.
12. Weiss MA. Patient self-management of insulin doses in the hospital. *Diabetes Care* 2006;29:951.
13. Grunberger G, Abelseth JM, Bailey TS, et al. Consensus Statement by the American Association of Clinical Endocrinologists/American College of Endocrinology insulin pump management task force. *Endocrine practice : official journal of the American College of Endocrinology and the American Association of Clinical Endocrinologists* 2014;20:463-89.
14. Kannan S, Satra A, Calogeras E, Lock P, Lansang MC. Insulin pump patient characteristics and glucose control in the hospitalized setting. *Journal of diabetes science and technology* 2014;8:473-8.

References (2)

15. Addala A, Auzanneau M, Miller K, et al. A Decade of Disparities in Diabetes Technology Use and HbA1c in Pediatric Type 1 Diabetes: A Transatlantic Comparison. *Diabetes Care* 2020.
16. Commissariat PV, Boyle CT, Miller KM, et al. Insulin Pump Use in Young Children with Type 1 Diabetes: Sociodemographic Factors and Parent-Reported Barriers. *Diabetes technology & therapeutics* 2017;19:363-9.
17. American Diabetes A. 15. Diabetes Care in the Hospital: Standards of Medical Care in Diabetes-2020. *Diabetes Care* 2020;43:S193-S202.
18. Draznin B, Gilden J, Golden SH, et al. Pathways to quality inpatient management of hyperglycemia and diabetes: a call to action. *Diabetes Care* 2013;36:1807-14.
19. Davis GM, Galindo RJ, Migdal AL, Umpierrez GE. Diabetes Technology in the Inpatient Setting for Management of Hyperglycemia. *Endocrinology and metabolism clinics of North America* 2020;49:79-93.
20. <https://www.jointcommission.org/resources/for-consumers/speak-up-campaigns/>.
21. Mendez CE, Umpierrez GE. Management of Type 1 Diabetes in the Hospital Setting. *Curr Diab Rep* 2017;17:98.
22. Wallia A, Umpierrez GE, Rushakoff RJ, et al. Consensus Statement on Inpatient Use of Continuous Glucose Monitoring. *Journal of diabetes science and technology* 2017;11:1036-44.
23. Gomez AM, Umpierrez GE. Continuous glucose monitoring in insulin-treated patients in non-ICU settings. *Journal of diabetes science and technology* 2014;8:930-6.