

Managing Diabetes and Hyperglycemia in the Hospital:
Focus on the Noncritically Ill Patient
(2023-2026)

REFERENCES

1. Clement S, Baithwaite SS, Magee MF, et al. Management of diabetes and hyperglycemia in hospitals. *Diabetes Care.* 2004;27:553-591.
2. Umpierrez GE, Isaacs SD, Bazargan N, et al. Hyperglycemia: an independent marker of in-hospital mortality in patients with undiagnosed diabetes. *J Clin Endocrinol Metab.* 2002;87:978-982.
3. Furnary A, Zerr K, Grunkemeier G, Starr A. Continuous intravenous insulin infusion reduces the incidence of deep sternal wound infection in diabetic patients after cardiac surgical procedures. *Ann Thorac Surg.* 1999;67:352-362.
4. Furnary AP, Gao G, Grunkemeier GL, et al. Continuous insulin infusion reduces mortality in patients with diabetes undergoing coronary artery bypass grafting. *J Thorac Cardiovasc Surg.* 2003;125:1007-1021.
5. Pomposelli JJ, Baxter JK 3rd, Babineau TJ, et al. Early postoperative glucose control predicts nosocomial infection rate in diabetic patients. *J Parenter Enter Nutr.* 1998;22:77-81.
6. McAlister FA, Majumdar SR, Blitz S, et al. The relation between hyperglycemia and outcomes in 2471 patients admitted to the hospital with community-acquired pneumonia. *Diabetes Care.* 2005;28:810-815.
7. Moghissi ES, Korytkowsk MT, DiNardo M, et al. American Association of Clinical Endocrinologists and American Diabetes Association consensus statement on inpatient glycemic control. *Diabetes Care.* 2009;32:1119-1131.
8. Wesorick D, O'Malley C, Rushakoff R, et al. Management of diabetes and hyperglycemia in the hospital: a practical guide to subcutaneous insulin use in the noncritically ill, adult patient. *J Hosp Med.* 2008;3(suppl 5):s17-s28.
9. Inzucchi SE. Management of hyperglycemia in the hospital setting. *N Engl J Med.* 2006;355:1903-1911.
10. Qaseem A, Humphrey LL, Chou R, et al. Use of intensive insulin therapy for the management of glycemic control in hospitalized patients: a clinical practice guideline from the American College of Physicians. *Ann Intern Med.* 2011;154:260-267.

11. Umpierrez GE, Andres P, Smiley D, et al. Randomized study of basal-bolus insulin therapy in the inpatient management of patients with type 2 diabetes (RAB- BIT 2 trial). *Diabetes Care*. 2007;30:2181-2186.
12. Baldwin D, Zander J, Munoz C, et al. A randomized trial of 2 weight-based doses of insulin glargine and glulisine in hospitalized subjects with type 2 diabetes and renal insufficiency. *Diabetes Care*. 2012;35:1970-1974.
13. Baldwin D, Apel J. Management of hyperglycemia in hospitalized patients with renal insufficiency or steroid-induced diabetes. *Curr Diab Rep*. 2013;13:114-120.
14. Schnipper JL, Ndumele CD, Liang CL, Pendergrass ML. Effects of a subcutaneous insulin protocol, clinical education, and computerized order set on the quality of inpatient management of hyperglycemia: results of a clinical trial. *J Hosp Med*. 2009;4:16-27.
15. Maynard G, Lee J, Phillips G, et al. Improved inpatient use of basal insulin, reduced hypoglycemia, and improved glycemic control: effect of structured subcutaneous insulin orders and an insulin management algorithm. *J Hosp Med*. 2009;4:3-15.
16. Wesorick DH, Grunawalt J, Gianchandani R. Improving glycemic control in noncritically ill hospitalized patients [abstract]. *J Hosp Med*. 2009;4(suppl 1):63-64.
17. Umpierrez GE, Smiley D, Hermayer K, et al. Randomized study comparing a Basal-bolus with a basal plus correction insulin regimen for the hospital management of medical and surgical patients with type 2 diabetes: basal plus trial. *Diabetes Care*. 2013;36:2169-2174.
18. Glycemic Control Resource Room Project Team. Glycemic Control Resource Room. Available at: <http://www.hospitalmedicine.org/ResourceRoomRedesign/GlycemicControl.cfm>. Accessed October 7, 2013.
19. Centers for Disease Control and Prevention. National Center for Chronic Disease Prevention and Health Promotion, Division of Diabetes Translation. National Diabetes Fact Sheet, 2011. Available at: http://www.cdc.gov/diabetes/pubs/pdf/ndfs_2011.pdf. Accessed May 17, 2011.
20. American Diabetes Association. Executive Summary: Standards of medical care in diabetes-2011. *Diabetes Care*. 2010;34(suppl 1):s11-s61. Available at: http://care.diabetesjournals.org/content/34/Supplement_1/S4.full.pdf. Accessed May 17, 2011.
21. O'Malley CW, Emanuele M, Halasyamani L, et al. Bridge over troubled waters: safe and effective transitions of the inpatient with hyperglycemia. *J Hosp Med*. 2008;3:55-65.
22. Underwood et al. Diabetes Care 2014 Mar; 37(3):611-616.
23. Cancienne et al. Spine J. 2017 Aug;17(8):1100-1105.

24. Rationalization, Development, and Implementation of a Preoperative Diabetes Optimization Program Designed to Improve Perioperative Outcomes and Reduce Cost. Setji et al. *Diabetes Spectrum*. Vol 30. Num 3, Summer 2017. 217-223.
25. Umpierrez, Schwartz *Endo Practice* 2014 Sep;20(9):933-44
26. Schwartz, DeFronzo, Umpierrez *Postgraduate Medicine* 2015;127(2):251-257
27. Umpierrez, Gianchandani, *Diabetes Care* 2013 Nov;36(11):3430-5
28. Heise, Kaplan, Haahr. *J Diabetes Sci Technol.* 2017 Sep 1. E pub.
29. Heise, Norskov et al. *Diabetes Obes Metab.* 2017 Jul;19(7):1032-1039
30. Russell-Jones, Gall, et al. *Nutr Metab Cardiovasc Dis* 2015 Oct;25(10):898-905
31. Rodbard, Gough et al. *Endocr Pract.* 2014 Apr;20(4):285-92
32. Mathieu, Bode et al. *Diabetes Obes Metab.* 2018 Jan 8.
33. Centers for Disease Control and Prevention. National Diabetes Statistics Report, 2017.
34. Umpierrez GE, Hellman R, Korytkowski MT, et al. Management of hyperglycemia in hospitalized patients in non-critical care setting: an endocrine society clinical practice guideline. *J Clin Endocrinol Metab.* 2012;97(1):16-38.
35. Umpierrez GE, Endocrine Society. Management of hyperglycemia inhospitalized patients in non-critical care setting: an endocrine society clinical practice guideline
36. Umpierrez GE, Reyes D, Smiley D, et al. Hospital discharge algorithm based on admission HbA1c for the management of patients with type 2 diabetes. *Diabetes Care.* 2014;37(11):2934-2939.
37. Martin ET, Kaye KS, Knott C, et al. Diabetes and Risk of Surgical Site Infection: A Systematic Review and Meta-analysis. *Infect Control Hosp Epidemiol.* 2016;37(1):88-99
38. Schuster JM, Rechtine G, Norvell DC, Dettori JR. The influence of perioperative risk factors and therapeutic interventions on infection rates after spine surgery: a systematic review. *Spine (Phila Pa 1976).* 2010;35(9 Suppl):S125-137.
39. Godoy DA, Di Napoli M, Biestro A, Lenhardt R. Perioperative glucose control in neurosurgical patients. *Anesthesiol Res Pract.* 2012;2012:690362.
40. Han HS, Kang SB. Relations between long-term glycemic control and postoperative wound and infectious complications after total knee arthroplasty in type 2 diabetics. *Clin Orthop Surg.* 2013;5(2):118-123.
41. ADA. Diabetes Care in the Hospital. In. Vol 39: *Diabetes Care*; 2016:(Suppl. 1): S99-S104.

42. American Diabetes Association Professional Practice Committee; 16. Diabetes Care in the Hospital: *Standards of Medical Care in Diabetes—2022*. *Diabetes Care* 1 January 2022; 45 (Supplement_1): S244-S253. <https://doi.org/10.2337/dc22-S016>
43. Gracia-Ramos AE, Cruz-Domínguez MP, Madrigal-Santillán EO. Incretin-based therapy for glycemic control of hospitalized patients with type 2 diabetes: a systematic review. *Rev Clin Esp (Barc)*. 2022 Mar;222(3):180-189. doi: 10.1016/j.rceng.2021.09.003.
44. Duggan EW, Carlson K, Umpierrez GE. Perioperative Hyperglycemia Management: An Update. *Anesthesiology*. 2017 Mar;126(3):547-560. doi: 10.1097/ALN.0000000000001515. Erratum in: *Anesthesiology*. 2018 Nov;129(5):1053. PMID: 28121636; PMCID: PMC5309204.
45. Polderman JAW, van Steen SCJ, Thiel B, Godfried MB, Houweling PL, Hollmann MW, DeVries JH, Preckel B, Hermanides J. Peri-operative management of patients with type-2 diabetes mellitus undergoing non-cardiac surgery using liraglutide, glucose-insulin-potassium infusion or intravenous insulin bolus regimens: a randomised controlled trial. *Anaesthesia*. 2018 Mar;73(3):332-339. doi: 10.1111/anae.14180.
46. Kaneko S, Ueda Y, Tahara Y. GLP1 Receptor Agonist Liraglutide Is an Effective Therapeutic Option for Perioperative Glycemic Control in Type 2 Diabetes within Enhanced Recovery After Surgery (ERAS) Protocols. *Eur Surg Res*. 2018;59(5-6):349-360. doi: 10.1159/000494768.
47. Fayfman M, Galindo RJ, Rubin DJ, Mize DL, Anzola I, Urrutia MA, Ramos C, Pasquel FJ, Haw JS, Vellanki P, Wang H, Albury BS, Weaver R, Cardona S, Umpierrez GE. A Randomized Controlled Trial on the Safety and Efficacy of Exenatide Therapy for the Inpatient Management of General Medicine and Surgery Patients With Type 2 Diabetes. *Diabetes Care*. 2019 Mar;42(3):450-456. doi: 10.2337/dc18-1760.
48. Fushimi N, Shibuya T, Yoshida Y, Ito S, Hachiya H, Mori A. Dulaglutide-combined basal plus correction insulin therapy contributes to ideal glycemic control in non-critical hospitalized patients. *J Diabetes Investig*. 2020 Jan;11(1):125-131. doi: 10.1111/jdi.13093.
49. Salah HM, Al'Aref SJ, Khan MS, Al-Hawwas M, Vallurupalli S, Mehta JL, Mounsey JP, Greene SJ, McGuire DK, Lopes RD, Fudim M. Efficacy and safety of sodium-glucose cotransporter 2 inhibitors initiation in patients with acute heart failure, with and without type 2 diabetes: a systematic review and meta-analysis. *Cardiovasc Diabetol*. 2022 Feb 5;21(1):20. doi: 10.1186/s12933-022-01455-2.
50. Voors AA, Angermann CE, Teerlink JR, Collins SP, Kosiborod M, Biegus J, Ferreira JP, Nassif ME, Psotka MA, Tromp J, Borleffs CJW, Ma C, Comin-Colet J, Fu M, Janssens SP, Kiss RG, Mentz RJ, Sakata Y, Schirmer H, Schou M, Schulze PC, Spinarova L, Volterrani M, Wranicz JK, Zeymer U, Zieroth S, Brueckmann M, Blatchford JP, Salsali A, Ponikowski P. The SGLT2 inhibitor empagliflozin in patients hospitalized for acute heart failure: a multinational randomized trial. *Nat Med*. 2022 Mar;28(3):568-574. doi: 10.1038/s41591-021-01659-1.

51. Joshi SR, Singh G, Marwah A, Mittra S, Suvarna VR, Athalye SN. Comparative clinical efficacy and safety of insulin glargine 300 U/ml (Toujeo) versus insulin glargine 100 U/ml in type 2 diabetes and type 1 diabetes: A systematic literature review and meta-analysis. *Diabetes Obes Metab*. 2023 Feb 6. doi: 10.1111/dom.15007.
52. Giori, NJ, Ellerbe LS, Bowe T, et al. Many Diabetic Total Joint Arthroplasty Candidates Are Unable to Achieve a Preoperative Hemoglobin A1c Goal of 7% or Less. *J Bone Jt Surg* 2014;96(6):500-504.
53. Shohat N, Tarabichi M, Tan TL, et al. John Insall Award: Fructosamine is a better glycaemic marker compared with glycated haemoglobin (HbA1C) in predicting adverse outcomes following total knee arthroplasty: a prospective multicentre study. *Bone Joint J* 2019; 101-B(7_Supple_C): 3-9.
54. Cohen DA, Ricotta DN, Parikh PD. Things we do for no reason: Routinely holding metformin in the hospital. *J Hosp Med* 2022 Mar;17(3):207-210. doi 10.12788/jhm.3644.