

Electrolyte Disorder: Common Complications and Conditions

CCC: CCC-007 (ISC)

[Link to Codes](#)

MCG Health
Inpatient & Surgical Care
30th Edition

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Prevention

- Prevention issues and possible preventive measures include(1)(2)(3):

☐ Hyponatremia(4)(5)(6)

- Limit use of NG suction and diuretics.(1)(2)(3)(7)
- Limit use of medications that may cause or contribute to hyponatremia.[A](1)(2)(8)(9)
- Limit use of hypotonic IV fluids, such as half-normal saline (0.45% NaCl) or irrigant solutions.(1)(2)(3)(7)
- Monitor patients at high risk for hyponatremia (eg, heart failure, certain malignancies, liver disease).(1)(2)(3)(6)(7)(8)

☐ Hypernatremia

- Monitor and account for insensible loss of free water (eg, due to fever, diarrhea, draining wounds, surgical drains).(1)(2)(3)(7)
- Limit use of diuretics.(1)(2)(3)(7)
- In patient with ability to drink fluids, ensure access to water (eg, at bedside).(1)(2)(3)(7)
- If patient is unable to voluntarily drink fluids (eg, altered mental status, extremes of age), ensure sufficient administration of free water (eg, in 0.45% NaCl).(1)(2)(3)(7)

☐ Hypokalemia(10)

- Evaluate and monitor potassium-sparing and potassium-depleting diuretics.(1)(2)(3)(7)
- Replace potassium losses with oral or IV potassium.(1)(2)(3)(7)(11)
- Ensure magnesium level at goal.(1)(2)(3)(7)
- Evaluate and treat underlying conditions that contribute to hypokalemia (eg, alcohol abuse, renal tubular acidosis, malnutrition).(1)(2)(3)(7)(10)(12)

☐ Hyperkalemia(13)

- Limit use of drugs that may cause or contribute to hyperkalemia.[B](1)(2)(3)

- Monitor potassium in patient on combined therapy with aldosterone antagonists and ACE inhibitors or angiotensin receptor blockers for chronic heart failure.(1)(2)(3)(7)(14)
- Limit dietary ingestion of potassium (eg, renal diet).(1)(2)(3)(7)
- Monitor patients with renal disease.(1)(2)(3)(7)

☐ Hypocalcemia(1)(15)(16)

- Monitor calcium levels in patient at risk; examples include:
 - Hypoparathyroidism (primary or secondary)(1)(3)(7)
 - Severe malnutrition(1)(3)(7)
 - Pancreatitis(1)(3)(7)
 - Using antiseizure medications, bisphosphonates, or RANKL monoclonal antibody (denosumab)
 - Massive transfusion of blood or blood products(1)(3)(7)(17)
 - Presence of genetic disease affecting calcium absorption or excretion (eg, Bartter syndrome, Gitelman syndrome, Michelis-Castrillo syndrome)(1)(3)(7)
 - Renal disease(1)(3)(7)
- Consider vitamin D supplementation in patients undergoing thyroidectomy(18)

☐ Hypercalcemia(19)

- Limit use of medications that may contribute to hypercalcemia (eg, lithium, thiazide diuretics).(1)(3)(7)
- Avoid dehydration.(1)(3)(7)
- Monitor patients with malignancy, particularly with metastases to bone.(1)(3)(7)(20)
- Limit immobilization when possible.(1)(3)(7)(19)

Clinical Indications for Ongoing Inpatient Care

- Ongoing inpatient care is indicated for **1 or more** of the following^[C](1)(2)(3)(7):
 - Sodium^[D] less than 130 mEq/L (mmol/L) not corrected to near normal or near chronic baseline despite appropriate treatment(5)(21)
 - Sodium^[D] less than 135 mEq/L (mmol/L) with (or presumed new) severe finding requiring inpatient management (eg, Altered mental status, seizures)(5)(21)(22)
 - Sodium greater than 150 mEq/L (mmol/L) not corrected to near normal or near chronic baseline despite appropriate treatment(21)
 - Sodium greater than 145 mEq/L (mmol/L) with (or presumed new) severe finding requiring inpatient management (eg, Altered mental status, seizures)(21)
 - Potassium less than 2.5 mEq/L (mmol/L) not corrected to near normal or near chronic baseline despite appropriate treatment(7)(23)
 - Potassium less than 3 mEq/L (mmol/L) with (or presumed new) severe finding requiring inpatient management (eg, ECG findings,^[E] paresis, paralysis)(7)(23)
 - Potassium greater than 6.5 mEq/L (mmol/L) not corrected to near normal or near chronic baseline despite appropriate treatment(23)(25)
 - Potassium greater than 5 mEq/L (mmol/L) with (or presumed new) severe finding (eg, ECG findings,^[F] paresis, paralysis, arrhythmia, cardiac conduction disturbance)(7)(22)(23)
 - Calcium^[G] less than 7 mg/dL (1.75 mmol/L) or ionized calcium less than 3.2 mg/dL (0.8 mmol/L) not corrected to near normal or near chronic baseline despite appropriate treatment(26)(27)
 - Calcium^[G] less than 8.6 mg/dL (2.15 mmol/L) or ionized calcium less than 4.65 mg/dL (1.16 mmol/L) with (or presumed new) severe finding requiring inpatient management (eg, Altered mental status, seizures, arrhythmia, cardiac conduction disturbance)(26)(27)
 - Calcium^[G] greater than 14 mg/dL (3.5 mmol/L) or ionized calcium greater than 10.0 mg/dL (2.50 mmol/L) not corrected to near normal or near chronic baseline despite appropriate treatment(19)(27)

- o Calcium[G] greater than 12 mg/dL (3 mmol/L) or ionized calcium greater than 8.0 mg/dL (2.0 mmol/L) with (or presumed new) severe finding requiring inpatient management (eg, Altered mental status, arrhythmia, cardiac conduction disturbance)(19)(27)
- o Phosphorus less than 1 mg/dL (0.32 mmol/L) not corrected to near normal or near chronic baseline despite appropriate treatment(28)
- o Phosphorus less than 1.5 mg/dL (0.48 mmol/L) with new (or presumed new) severe finding requiring inpatient management (eg, Altered mental status, seizures)(28)
- o Phosphorus greater than 10 mg/dL (3.2 mmol/L) not corrected to near normal or near chronic baseline despite appropriate treatment(28)
- o Phosphorus greater than 4.5 mg/dL (1.45 mmol/L) with new (or presumed new) severe finding requiring inpatient management (eg, crush injury, Altered mental status, seizures, arrhythmia, cardiac conduction disturbance)(28)
- o Magnesium less than 1.0 mg/dL (0.41 mmol/L) not corrected to near normal or near chronic baseline despite appropriate treatment(28)
- o Magnesium less than 1.5 mg/dL (0.62 mmol/L) with (or presumed new) severe finding requiring inpatient management (eg, Altered mental status, seizures, arrhythmia, cardiac conduction disturbance)(28)
- o Magnesium greater than 4.9 mg/dL (2.01 mmol/L) not corrected to near normal or near chronic baseline despite appropriate treatment(28)
- o Magnesium greater than 3.0 mg/dL (1.23 mmol/L) with (or presumed new) severe finding requiring inpatient management (eg, Altered mental status, arrhythmia, cardiac conduction disturbance)(28)

Alternatives to Inpatient Care

- Alternatives to inpatient stay extension include(3)(5)(7):
 - o Outpatient care
 - Fluid restriction(1)(3)(8)(29)
 - Oral potassium supplementation for hypokalemia(1)(2)(3)
 - Potassium binders for hyperkalemia(1)(2)(3)
 - Oral calcium and vitamin D supplementation for hypocalcemia(1)(3)(16)
 - Oral sodium and urea for hyponatremia(1)(3)(8)(30)
 - Discontinuation of drugs causing electrolyte imbalance(1)(2)(3)
 - Repeat serum electrolytes(1)(2)(3)
 - Outpatient dialysis(1)(2)(3)
 - o Home care
 - Nursing visit for assessment, including primary diagnosis(1)(7)
 - Repeat serum electrolytes(1)(7)
 - Outpatient dialysis(1)(7)
 - o Recovery facility
 - Parenteral fluid and electrolyte correction(1)(7)
 - Cardiac monitoring(1)(7)
 - Repeat serum electrolytes(1)(7)
 - Dialysis(1)(7)

Discharge

- Extended stay beyond goal length of stay for primary condition may be needed until **ALL** of the following are present(1)(2)(3)(5)(7)(15):
 - o Sodium greater than or equal to 135 mEq/L (mmol/L) and less than or equal to 145 mEq/L (mmol/L) or acceptable for next level of care(1)(2)(3)(7)(8)(9)
 - o Potassium greater than or equal to 3 mEq/L (mmol/L) and less than or equal to 5 mEq/L (mmol/L) or acceptable for next level of care(1)(2)(3)(7)

- o Calcium greater than or equal to 8.6 mg/dL (2.15 mmol/L) or ionized calcium greater than or equal to 4.65 mg/dL (1.16 mmol/L) and less than or equal to 12.0 mg/dL (3.0 mmol/L) or ionized calcium less than or equal to 8.0 mg/dL (2.0 mmol/L) or acceptable for next level of care(1)(3)(7)
- o Magnesium greater than or equal to 1.5 mg/dL (0.62 mmol/L) and less than or equal to 3.0 mg/dL (1.23 mmol/L) or acceptable for next level of care
- o Appropriate oral intake(1)(2)(3)(7)
- o Appropriate urinary output(1)(2)(3)(7)

References

1. Smith SG, Schreiber MA. Shock, electrolytes, and fluid. In: Townsend CM, Beauchamp RD, Evers BM, Mattox KL, editors. Sabiston Textbook of Surgery. 21st ed. Elsevier; 2022:44-94. [Context Link 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51]
2. Mount DB. Fluid and electrolyte disturbances. In: Loscalzo J, Fauci A, Kasper D, Hauser S, Longo D, Jameson JL, editors. Harrison's Principles of Internal Medicine. 21st ed. McGraw Hill Education; 2022:338-356. [Context Link 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30]
3. Kliegman RM, et al. Electrolyte and acid-base disorders. In: Kliegman RM, et al., editors. Nelson Textbook of Pediatrics. 22nd ed. Elsevier; 2025:485-525. [Context Link 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43]
4. Martin-Grace J, Tomkins M, O'Reilly MW, Thompson CJ, Sherlock M. Approach to the patient: hyponatremia and the syndrome of inappropriate antidiuresis (SIAD). Journal of Clinical Endocrinology and Metabolism 2022;107(8):2362-2376. DOI: 10.1210/clinem/dgac245. [Context Link 1] View abstract...
5. Adroque HJ, Tucker BM, Madias NE. Diagnosis and management of hyponatremia: a review. Journal of the American Medical Association 2022;328(3):280-291. DOI: 10.1001/jama.2022.11176. [Context Link 1, 2, 3, 4, 5] View abstract...
6. Baker CM, Goh GS, Tarabichi S, Sherman MB, Khan IA, Parvizi J. Hyponatremia is an overlooked sign of trouble following total joint arthroplasty. Journal of Bone and Joint Surgery. American Volume 2023;105(10):744-754. DOI: 10.2106/JBJS.22.00928. [Context Link 1, 2] View abstract...
7. Pfennig CL, Slovis CM. Electrolyte disorders. In: Walls RM, editor. Rosen's Emergency Medicine: Concepts and Clinical Practice. 10th ed. Elsevier; 2023:1525-1542.e2. [Context Link 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44]
8. Adroque HJ, Madias NE. The syndrome of inappropriate antidiuresis. New England Journal of Medicine 2023;389(16):1499-1509. DOI: 10.1056/NEJMc2210411. [Context Link 1, 2, 3, 4, 5, 6] View abstract...
9. Bembenick KN, et al. Hyponatremia with anticonvulsant medications: a narrative review. Cureus 2024;16(4):Online. DOI: 10.7759/cureus.57535. [Context Link 1, 2, 3] View abstract...
10. Casey B, Hofstrand R, Patel D, Bahekar A, Chapa-Rodriguez A. Hypokalemia-induced cardiac arrest. Cureus 2023;15(2):Online. DOI: 10.7759/cureus.35034. [Context Link 1, 2] View abstract...
11. Zhang B, et al. Preoperative hypokalemia can increase complications after colorectal cancer surgery: a propensity score matching analysis. BMC Cancer 2022;22(1):Online. DOI: 10.1186/s12885-022-09950-1. [Context Link 1] View abstract...
12. Chu T, Wu Z, Xu A. Association between preoperative hypokalemia and postoperative complications in elderly patients: a retrospective study. BMC Geriatrics 2022;22(1):Online. DOI: 10.1186/s12877-022-03445-1. [Context Link 1] View abstract...
13. Rafique Z, et al. Hyperkalemia in acute heart failure: Short term outcomes from the EAHFE registry. American Journal of Emergency Medicine 2023;70:Online. DOI: 10.1016/j.ajem.2023.05.005. [Context Link 1] View abstract...
14. Beavers CJ, Greene SJ. Hyperkalemia in heart failure with reduced ejection fraction: implications and management. Heart Failure Reviews 2025;DOI: 10.1007/s10741-025-10549-4. [Context Link 1] View abstract...
15. Nadar R, Shaw N. Investigation and management of hypocalcaemia. Archives of Disease in Childhood 2020;105(4):399-405. DOI: 10.1136/archdischild-2019-317482. [Context Link 1, 2] View abstract...
16. Chindris AM, Desai K, Ozgursoy SK, Heckman MG, Casler JD. A parathyroid hormone-guided calcium and calcitriol supplementation protocol reduces hypocalcemia-related readmissions following total thyroidectomy. Endocrine Practice 2023;29(4):260-265. DOI: 10.1016/j.eprac.2023.01.009. [Context Link 1, 2] View abstract...

17. Ciaraglia A, et al. Retrospective analysis of the effects of hypocalcemia in severely injured trauma patients. *Injury* 2024;55(5):Online. DOI: 10.1016/j.injury.2024.111386. [Context Link 1] View abstract...
18. Jullamusi W, Ratanaprasert N, Pongsapich W, Kasemsuk N. Preoperative calcium or vitamin D supplement in thyroidectomy: a systematic review and meta-analysis. *Laryngoscope* 2024;DOI: 10.1002/lary.31860. [Context Link 1] View abstract...
19. Walker MD, Shane E. Hypercalcemia: a review. *Journal of the American Medical Association* 2022;328(16):1624. DOI: 10.1001/jama.2022.18331. [Context Link 1, 2, 3, 4, 5] View abstract...
20. Guise TA, Wysolmerski JJ. Cancer-associated hypercalcemia. *New England Journal of Medicine* 2022;386(15):1443-1451. DOI: 10.1056/NEJMcp2113128. [Context Link 1] View abstract...
21. Al-Awqati Q, Radhakrishnan J. Disorders of sodium and water. In: Goldman L, Cooney KA, editors. *Goldman-Cecil Medicine*. 27th ed. Elsevier; 2024:733-744.e1. [Context Link 1, 2, 3, 4, 5]
22. Beuschlein F, et al. European Society of Endocrinology and Endocrine Society Joint Clinical guideline: diagnosis and therapy of glucocorticoid-induced adrenal insufficiency. *Journal of Clinical Endocrinology and Metabolism* 2024;109(7):1657-1683. DOI: 10.1210/clinem/dgae250. [Context Link 1, 2] View abstract...
23. Seifter JL. Potassium Disorders. In: Goldman L, Cooney KA, editors. *Goldman-Cecil Medicine*. 27th ed. Elsevier; 2024:745-752. [Context Link 1, 2, 3, 4]
24. Mirvis DM, Goldberger AL. Electrocardiography. In: Libby P, Bonow RO, Mann DL, Tomaselli GF, Bhatt DL, Solomon SD, editors. *Braunwald's Heart Disease: A Textbook of Cardiovascular Medicine*. 12th ed. Elsevier; 2022:141-174.e3. [Context Link 1, 2]
25. Sandau KE, et al. Update to practice standards for electrocardiographic monitoring in hospital settings: a scientific statement from the American Heart Association. *Circulation* 2017;136(19):e273-e344. DOI: 10.1161/CIR.0000000000000527. [Context Link 1] View abstract...
26. Chonchol M, Smogorzewski MJ, Stubbs JR, Yu AS. Disorders of calcium, magnesium, and phosphate balance. In: Yu AS, Chertow GM, Luyckx VA, Marsden PA, Skorecki K, Taal MW, editors. *Brenner and Rector's The Kidney*. 11th ed. Philadelphia, PA: Elsevier; 2020:580-613 e10. [Context Link 1, 2, 3]
27. Thakker RV. The parathyroid glands, hypercalcemia, and hypocalcemia. In: Goldman L, Cooney KA, editors. *Goldman-Cecil Medicine*. 27th ed. Elsevier; 2024:1652-1662. [Context Link 1, 2, 3, 4]
28. Yu ASL. Disorders of magnesium and phosphorus. In: Goldman L, Cooney KA, editors. *Goldman-Cecil Medicine*. 27th ed. Elsevier; 2024:766-769.e1. [Context Link 1, 2, 3, 4, 5, 6, 7, 8]
29. Cooper O, et al. Fluid restriction reduces delayed hyponatremia and hospital readmissions after transsphenoidal surgery. *Journal of Clinical Endocrinology and Metabolism* 2023;108(8):e623- e633. DOI: 10.1210/clinem/dgad066. [Context Link 1] View abstract...
30. Moritz ML. Syndrome of inappropriate antidiuresis. *Pediatric Clinics of North America* 2019;66(1):209-226. DOI: 10.1016/j.pcl.2018.09.005. [Context Link 1] View abstract...

Footnotes

[A] Medications that may cause or contribute to hyponatremia include diuretics and antiseizure medications.(8)(9) [A in Context Link 1]

[B] Medications that may cause or contribute to hyperkalemia include ACE inhibitors, angiotensin receptor blockers, NSAIDs, and potassium-sparing diuretics.(2)(7) [B in Context Link 1]

[C] ICU admission may be indicated for severe electrolyte disturbances or those associated with significant clinical manifestations, such as change in mental status, seizures, severe weakness, arrhythmias, or hemodynamic instability.(1)(2)(3)(7) [C in Context Link 1]

[D] In patients with hyperglycemia, a corrected serum sodium should inform decision-making.(21) [D in Context Link 1, 2]

[E] ECG manifestations of hypokalemia include ST-segment depression, flattened T-waves, and increased U-wave prominence.(24) [E in Context Link 1]

[F] ECG findings include peaked T-waves, PR interval greater than 0.20 seconds, QRS interval greater than 0.12 seconds, and arrhythmia.(24) [F in Context Link 1]

[G] An ionized calcium level may be more accurate than a total serum calcium level, especially in the setting of acidosis, renal failure, multiple transfusions, hypoalbuminemia, or the presence of a paraprotein.(19)(26) [G in Context Link 1, 2, 3, 4]

Definitions

Altered mental status

- Altered mental status (ie, different from baseline), as indicated by **1 or more** of the following(1)(2)(3)(4):
 - Confusional state (eg, disorientation, difficulty following commands, deficit in attention)
 - Lethargy (eg, awake or arousable, but with drowsiness; reduced awareness of self and environment)
 - Obtundation (ie, arousable only with strong stimuli, lessened interest in environment, slowed responses to stimulation)
 - Stupor (ie, may be arousable but patient does not return to normal baseline level of awareness)
 - Coma (ie, not arousable)

References

1. Maher PJ. Confusion. In: Walls RM, editor. Rosen's Emergency Medicine: Concepts and Clinical Practice. 10th ed. Elsevier; 2023:126-131.e1.
2. Lei C, Smith C. Depressed consciousness and coma. In: Walls RM, editor. Rosen's Emergency Medicine: Concepts and Clinical Practice. 10th ed. Elsevier; 2023:117-125.e1.
3. Abraham G, Maher PJ. Delirium and dementia. In: Walls RM, editor. Rosen's Emergency Medicine: Concepts and Clinical Practice. 10th ed. Elsevier; 2023:1269-1280.e2.
4. Holler-Managan YF. Neurologic evaluation. In: Kliegman RM, et al., editors. Nelson Textbook of Pediatrics. 22nd ed. Elsevier; 2025:3550-3560.

Codes

ICD-10 Diagnosis: E87.1, E87.5, E87.6

MCG Health
Inpatient & Surgical Care 30th Edition
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Last Update: 1/25/2026 6:32:56 AM
Build Number: 30.0.2026012500524.025256