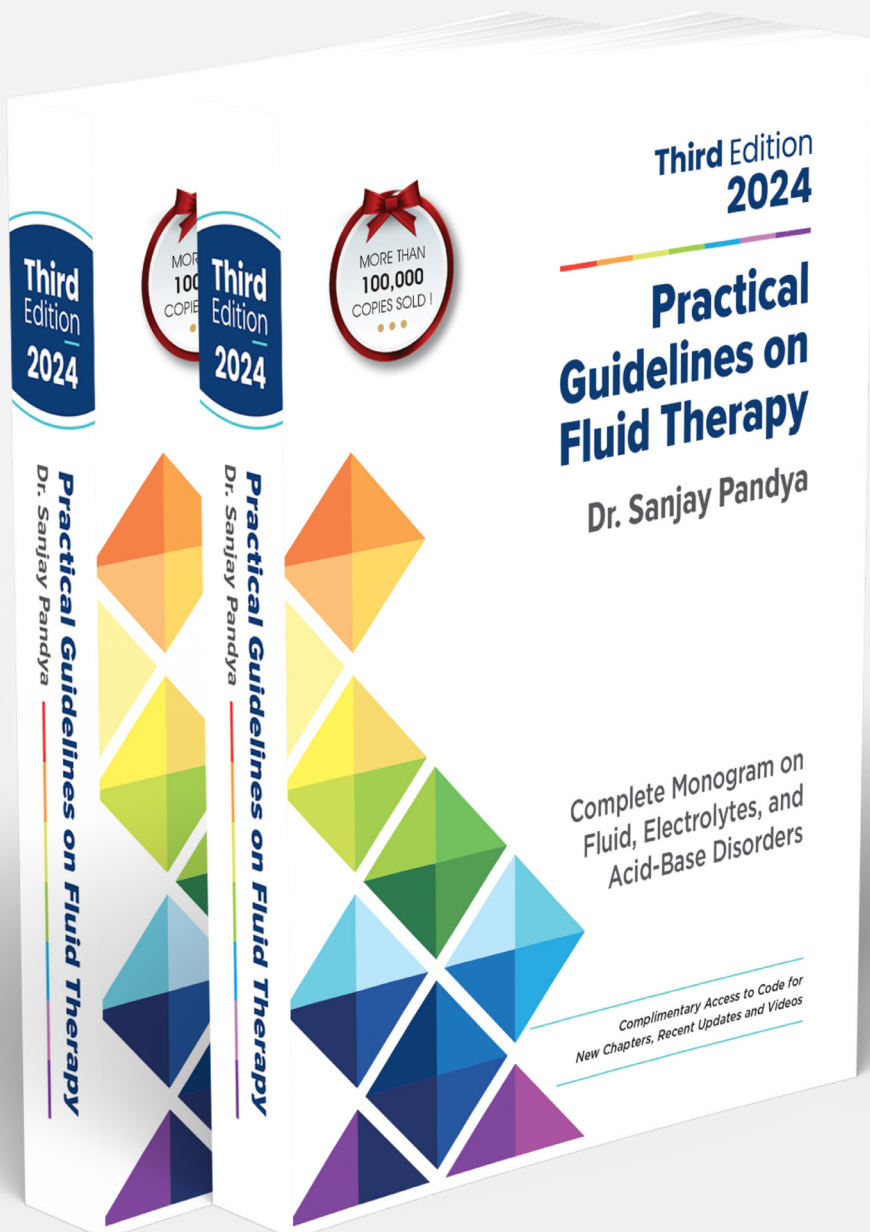




Fluid
therapy.org

Chapter 24: Hypocalcemia



To get a copy of the book, visit: www.fluidtherapy.org

24 | Hypocalcemia

Basic Physiology	288	Diagnosis	292
Distribution	288	History and physical examination ..	293
Serum calcium.....	288	Confirm the diagnosis.....	293
Ionized calcium.....	289	Measure serum PTH	293
Corrected total calcium.....	289	Measure serum phosphate, magnesium, and vitamin D status..	293
Regulation	289	Order other tests	293
Role of parathyroid hormone	289	Management	293
Role of vitamin D	290	Acute management	294
Role of calcitonin	290	Emergency therapy	294
Calcium sensing receptor system..	290	Calcium gluconate infusion	295
Effect of pH.....	290	Monitoring.....	295
Effect of phosphate and magnesium level	291	Calcium chloride.....	295
		Massive transfusion.....	295
		Precautions	295
		Long term management	296
HYPOCALCEMIA		Calcium supplementation	296
Etiology	291	Vitamin D supplementation	297
Postsurgical.....	291	Treatment of underlying etiology ..	297
Vitamin D deficiency	292		
Acute pancreatitis.....	292		
Clinical Features	292		

BASIC PHYSIOLOGY

Calcium (Ca) is essential for bone formation, neuromuscular function, and blood coagulation. If calcium intake is inadequate, it may impair bone mineralization in children and accelerate bone loss in adults.

Distribution

An average adult's body contains 20 to 25 gm/kg or 1.2 to 1.4 kg of calcium,

so it is the most abundant cation in the body. Out of this, about 99% is present in the bone, 1% in the soft tissue cells, and 0.15% in the extracellular fluid (ECF). As serum calcium concentration constitutes less than 1% of the total body calcium, it is a poor marker of overall total body calcium content.

Serum calcium

The normal value is about 8.5 to 10.5 mg/dL (4.3 to 5.2 mEq/L, 2.2 to 2.6 mmol/L).

The total ECF calcium exists in three forms:

1. Bound to proteins: About 40% of calcium is bound to protein (mainly albumin) which will not be diffusible and biologically active.
2. Free-ionized: 50% of calcium is in an ionized form which is diffusible and

biologically active.

3. Bound to anions: 10% calcium is complexed with the anions of organic acids such as phosphate, bicarbonate, citrate, lactate, or sulfate phosphate. This form of calcium is diffusible but biologically inactive.

Want to read more?

Get Printed Version

Get Kindle Version

REFERENCES

1. Steen O, Clase C, Don-Wauchope A. Corrected calcium formula in routine clinical use does not accurately reflect ionized calcium in hospital patients. *Can J Gen Int Med.* 2016;11(3):14–21.
2. Lian IA, Asberg A. Should total calcium be adjusted for albumin? A retrospective observational study of laboratory data from central Norway. *BMJ Open.* 2018;8(4):e017703.
3. Kenny CM, Murphy CE, Boyce DS, et al. Things We Do for No Reason™: Calculating a “Corrected Calcium” Level. *J Hosp Med.* 2021;16(8):499–501.
4. Conigrave AD. The Calcium-Sensing Receptor and the Parathyroid: Past, Present, Future. *Front Physiol.* 2016;7:563.
5. Witteveen JE, van Thiel S, Romijn JA, et al. Hungry bone syndrome: still a challenge in the post-operative management of primary hyperparathyroidism: a systematic review of the literature. *Eur J Endocrinol.* 2013;168(3):R45–53.
6. Kaya C, Tam AA, Dirikoç A, et al. Hypocalcemia development in patients operated for primary hyperparathyroidism: Can it be predicted preoperatively? *Arch Endocrinol Metab.* 2016;60(5):465–471.
7. Jain N, Reilly RF. Hungry bone syndrome. *Curr Opin Nephrol Hypertens.* 2017;26(4):250–255.
8. Kelly A, Levine MA. Hypocalcemia in the critically ill patient. *J Intensive Care Med.* 2013;28(3):166–77.
9. Ahmed A, Azim A, Gurjar M, et al. Hypocalcemia in acute pancreatitis revisited. *Indian J Crit Care Med.* 2016;20(3):173–177.
10. Cooper MS, Gittoes NJL. Diagnosis and management of hypocalcaemia. *BMJ* 2008;336:1298–1302.
11. Pepe J, Colangelo L, Biamonte F, et al. Diagnosis and management of hypocalcemia. *Endocrine.* 2020;69(3):485–495.
12. Kakava K, Tournis S, Papadakis G, et al. Postsurgical Hypoparathyroidism: A Systematic Review. *In Vivo.* 2016;30(3):171–9.
13. Augustine M, Horwitz MJ. Are You Sure the Patient Has Hypocalcemia? *Hypocalcemia Endocrinology Metabolism, Endocrinology Adviser February 4, 2019.* Accessed on 27 Nov 2021: <https://www.endocrinologyadvisor.com/author/mara-j-horwitz-dsm/>.
14. Walsh J, Gittoes N, Selby P. Society for Endocrinology Endocrine Emergency Guidance: Emergency management of acute hypocalcemia in adult patients. *Endocr Connect.* 2016;5(5):G9–G11.
15. Bove-Fenderson E, Mannstadt M. Hypocalcemic disorders. *Best Pract Res Clin Endocrinol Metab.* 2018;32(5):639–656.
16. Byerly S, Inaba K, Biswas S, et al. Transfusion-Related Hypocalcemia After Trauma. *World J Surg.* 2020;44(11):3743–3750.
17. Hall C, Nagengast AK, Knapp C, et al. Massive transfusions and severe hypocalcemia: An opportunity for monitoring and supplementation guidelines. *Transfusion.* 2021;61:S188–S194.
18. Kyle T, Greaves I, Beynon A, et al. Ionised calcium levels in major trauma patients who received blood en route to a military medical treatment facility. *Emerg Med J.* 2018;35(3):176–179.
19. Fong J, Khan A. Hypocalcemia: updates in diagnosis

- and management for primary care. *Can Fam Physician*. 2012;58(2):158–62.
20. Mannstadt M, Clarke BL, Vokes T, et al. Efficacy and safety of recombinant human parathyroid hormone (1–84) in hypoparathyroidism (REPLACE): a double-blind, placebo-controlled, randomised, phase 3 study. *Lancet Diabetes Endocrinol* 2013;1(4):275–83.
 21. Vokes TJ, Mannstadt M, Levine MA, et al. Recombinant Human Parathyroid Hormone Effect on Health-Related Quality of Life in Adults with Chronic Hypoparathyroidism. *J Clin Endocrinol Metab*. 2018;103(2):722–731.
 22. Mannstadt M, Clarke BL, Bilezikian JP, et al. Safety and efficacy of 5 years of treatment with recombinant human parathyroid hormone in adults with hypoparathyroidism. *J Clin Endocrinol Metab*. 2019;104(11):5136–5147.
 23. Laurer E, Grünberger J, Naidoo U, et al. Recombinant human parathyroid hormone (1–84) replacement therapy in a child with hypoparathyroidism. *Bone*. 2021;144:115834.

KidneyEducation

Join the Mission to Fight Kidney Diseases

Explore the world's largest multilingual website created by a global team of over 100 nephrologists.

www.KidneyEducation.com

- » Read online or download the 200-page book "Save Your Kidneys" in 40 languages—completely free.
- » This comprehensive resource offers valuable information on preventing and managing common kidney problems, tailored for kidney patients and their families.
- » It's an authentic guide, prepared by nephrologists and free from any external funding.