Cureus
Part of SPRINGER NATURE

Open Access Case Report

Isolated Proximal Muscle Myopathy and Generalized Fatigability Associated with Severe Zinc Deficiency Following Sleeve Gastrectomy: A Case Report

Ahmad Sawan [1], Mariam S. Bourgleh [2], Joud Asfari [3], Moaz Safwan [2]

1. Department of Internal Medicine, Care Medical AlRawabi Hospital, Riyadh, SAU 2. College of Medicine, Sulaiman Alrajhi University, Al-Bukayriyah, SAU 3. Department of Medicine, AlMaarefa University, Riyadh, SAU

Corresponding author: Mariam S. Bourgleh, mariambour01@gmail.com

Review began 09/21/2026
Review ended 10/18/2026
Published 10/26/2026

© Copyright 2026
Sawan et al. This is an open access article distributed under the terms of the Creative Commons Attribution License CC-BY 4.0., which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

DOI: 10.7759/cureus.118641

Abstract

Zinc is a vital micronutrient that plays a role in many bodily functions, such as controlling the immune system, making proteins, and breaking down cells. Zinc deficiency is commonly acknowledged in post-bariatric patients; however, its manifestation as isolated myopathy without typical dermatological signs is rare and may impede timely diagnosis. We report the case of a 49-year-old woman who presented with a five-month history of progressive generalized fatigue and proximal muscle weakness, resulting in a significant impairment of her activities of daily living. Her past medical history was significant for laparoscopic sleeve gastrectomy five years ago with reported compliance with routine multivitamin supplementation. On clinical examination, the muscle strength was decreased (4/5) without sensory deficits or cutaneous abnormalities. The initial laboratory work-up, including hematologic, metabolic, endocrine, and autoimmune studies, was essentially unremarkable except for an elevated erythrocyte sedimentation rate. Further work-up for trace elements revealed a significantly low serum zinc level with other minerals within normal limits. A diagnosis of myopathy due to severe zinc deficiency was made. The patient received oral zinc supplementation, resulting in complete clinical recovery and normalization of zinc levels within four months. This case demonstrates a unique manifestation of zinc deficiency presenting as isolated proximal myopathy in a post-sleeve gastrectomy patient, years after surgery and without classical features. It stresses the importance of evaluating trace element deficiencies in the differential diagnosis of unexplained neuromuscular symptoms and supports the need for long-term nutritional monitoring after bariatric procedures.

Categories: Nutrition, General Surgery, Internal Medicine
Keywords: bariatric surgery complications, generalized fatigability, isolated proximal myopathy, laparoscopic sleeve gastrectomy, zinc deficiency

Introduction

Zinc is a vital trace element that plays a role in many important body functions, such as protein metabolism, gene expression, and the immune system [1]. It also helps wounds heal and supports the functionality of immune cells like macrophages and neutrophils [2]. The body can't store a lot of zinc, so regular supplementation may be necessary in some circumstances [3].

Zinc deficiency is a common problem around the world and can show up in many ways, such as a weak immune system, stomach problems, and changes to the skin [4]. It also has an effect on muscle function, but this is not as well known. In certain instances, patients may exhibit muscle weakness or fatigue absent the usual dermatological or trichological manifestations, complicating the diagnostic process [5].

Bariatric surgery, including sleeve gastrectomy, is widely used for weight loss but can lead to long-term nutritional deficiencies [6]. Zinc deficiency is one of these complications and may occur due to reduced absorption after surgery [7]. This can happen even in patients who are taking routine supplements.

Case Presentation

Our patient was a 49-year-old female who presented to the outpatient clinic with a five-month history of severe progressive fatigability, generalized lethargy, and profound proximal weakness. She described significant functional impairment, noting marked difficulty during daily activities such as climbing stairs, combing her hair, and performing fine motor tasks like buttoning her shirt.

Her past history was only notable for a laparoscopic sleeve gastrectomy carried out five years prior to the presentation. Following her sleeve surgery, she reported compliance with standard daily multivitamin supplementation (Centrum Adult, one tablet daily).

How to cite this article
Sawan A, Bourgleh M S, Asfari J, et al. (October 26, 2026) Isolated Proximal Muscle Myopathy and Generalized Fatigability Associated with Severe Zinc Deficiency Following Sleeve Gastrectomy: A Case Report . Cureus 18(10): e118641. DOI 10.7759/cureus.118641

On physical examination, a predominantly proximal reduction in muscle strength graded at 4/5 was noted, specifically involving the shoulder abductors bilaterally and hip flexors bilaterally. Distal muscle power was fully preserved (5/5) in the wrist extensors, finger flexors, ankle dorsiflexors, and plantarflexors. The remainder of the physical and neurological examination was unremarkable. Cranial and bulbar assessments were fully intact, with no ptosis, extraocular movement restriction, facial weakness, or dysarthria. Neck flexor strength was preserved (5/5), and the patient exhibited a non-ataxic gait without foot drop, although rising from a seated position was difficult due to proximal pelvic girdle weakness. Muscle tone was normal throughout. Deep tendon reflexes were symmetric and preserved (2+) without hyperreflexia, and formal sensory examination of light touch, pinprick, vibration, and proprioception was entirely intact. The patient's reported fatigue was generalized and non-fluctuating, lacking the classic activity-dependent patterns characteristic of neuromuscular junction disorders such as myasthenia gravis. Furthermore, there was no clinical evidence of an acute necrotizing, inflammatory, or destructive myopathy, such as severe myalgias or muscle tenderness. Finally, no evidence of alopecia, characteristic skin rashes, joint swelling, or limited range of motion of any joint was observed. The patient was not on regular medications other than multivitamin supplementation, including proton pump inhibitors or those known to cause myopathy such as statins.

In order to determine the etiology behind her generalized fatigue and myopathy, we initiated an extensive laboratory workup. The results of the initial investigations, including complete blood count and serum iron studies, were within normal levels. Subsequent metabolic and endocrine tests revealed normal serum levels of thyroid-stimulating hormone, 25-hydroxyvitamin D, calcium, alanine aminotransferase, blood urea nitrogen, and creatinine.

Because of the patient’s progressive weakness, an autoimmune cause was initially considered. While the erythrocyte sedimentation rate (ESR) was elevated, comprehensive rheumatologic serologies revealed negative rheumatoid factor, antinuclear antibodies, and anti-cyclic citrullinated peptide.

Following the exclusion of standard endocrine, metabolic, and autoimmune causes, trace element deficiencies were suspected secondary to her bariatric surgery. Serum evaluation demonstrated normal copper and magnesium levels but a significantly decreased serum zinc concentration (< 19.70 ug/dL). Consequently, the diagnosis of severe zinc deficiency manifesting as profound myopathy was established.

Tables *1*-*2* summarize the results of the relevant laboratory investigations conducted.

Test Category/Name	Result	Reference Range	Unit
Hematology			
White Blood Cell	4.75	4 – 11	10^9/L
Red Blood Cell	4.20	3.8 – 4.8	10^12/L
Hemoglobin	12.70	12 – 15	g/dL
Platelets	296.00	150 – 450	10^9/L
Erythrocyte Sedimentation Rate	20 (High)	0 – 10	mm/hr
Chemistry & Nutritional Markers			
Blood Urea Nitrogen	3.6	1.8 – 6.4	mmol/L
Creatinine	52 (Low)	53 – 115	umol/L
Alanine Transaminase	11.00	0 – 55	U/L
Sodium	138	135 – 145	mmol/L
Potassium	4.40	3.5 – 5.1	mmol/L
Magnesium	0.79	0.7 – 1.0	mmol/L
Calcium (Corrected)	2.16	2.1 – 2.55	mmol/L
Copper	142	100 – 200	µg/dL
Iron	16.7	9 – 30.4	umol/L
Ferritin	75.48	4.6 – 204	ng/mL
Vitamin B12	359.0	187 – 883	pg/mL
25-Hydroxy Vitamin D	34.60	30.0 – 100	ng/mL
Serology			
Rheumatoid Factor	< 20.0	< 20	IU/ml
Anti-cyclic Citrullinated Peptide	< 0.5	Up to 5.0	U/mL
Antinuclear Antibody	<1:40	< 1:40	-

TABLE 1: Comprehensive Laboratory Panel

Clinical Phase	Date Collected	Result	Reference Range	Unit
Initial Presentation	09-11-2025	< 19.70 (Low)	70 – 120	ug/dL
Post Treatment	17-03-2026	100.63	70 – 120	ug/dL

TABLE 2: Serum Zinc Levels Pre- and Post-treatment

Following diagnosis, the patient was initiated on oral supplementation with oral zinc gluconate at a dose of 100 mg three times daily, providing approximately 42 mg elemental zinc per day.

At her four-month follow-up visit after continuous therapy, she reported a complete resolution of her fatigue and muscle weakness, with a return to her baseline functionality. When laboratory testing was repeated, the results demonstrated that her serum zinc levels had normalized (100.63 ug/dL).

A timeline of the case presentation is shown in Figure *1*.

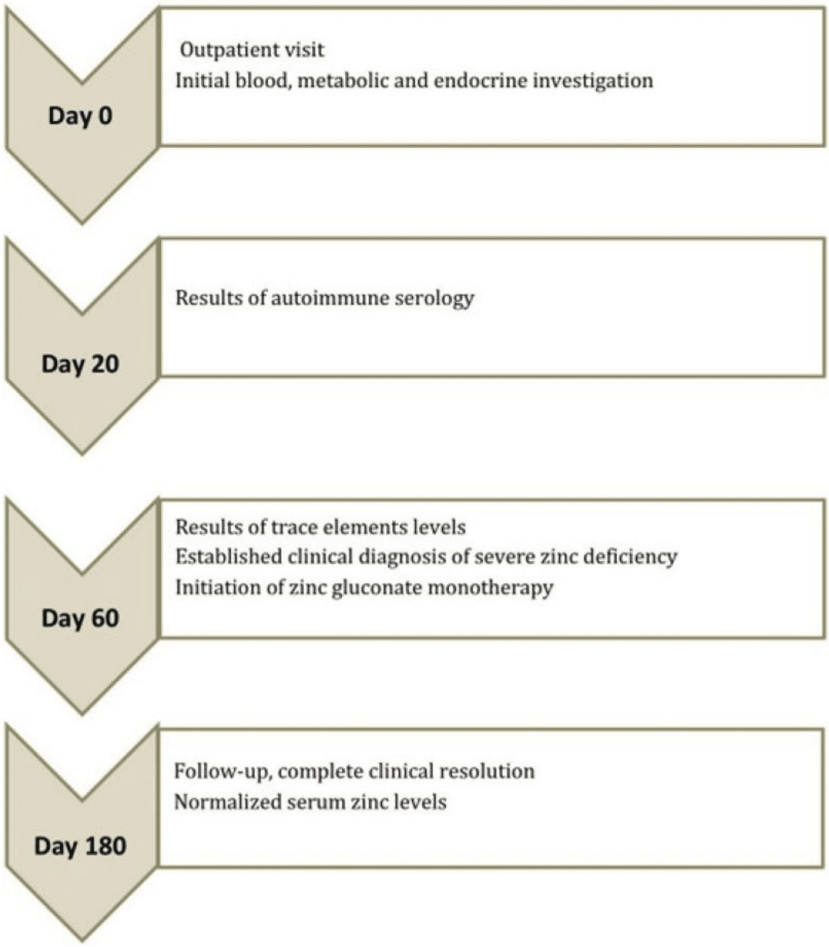


FIGURE 1: The chronological timeline of the case presentation.

Discussion

We report a rare presentation of severe zinc deficiency associated with an isolated, severe myopathy with generalized fatigability five years after a laparoscopic sleeve gastrectomy. Importantly, our case lacked the classic mucocutaneous manifestations commonly seen with hypozincemia, such as alopecia or acrodermatitis enteropathica [8]. This delayed the clinical diagnosis until trace elements were finally investigated.

The underlying mechanism behind the zinc-associated myopathy can be explained by the fundamental role of zinc in skeletal muscles. Intracellular zinc modulates the phosphatidylinositol 3-kinase (PI3K) and Akt/mammalian target of rapamycin (mTOR) signal transduction cascades, which are critically required for myocyte protein synthesis, cellular homeostasis, and muscle regeneration [9-10]. Furthermore, zinc directly facilitates skeletal muscle excitation-contraction coupling through its binding to the C-terminal domain of the ryanodine receptor type 1 (RyR1). This ensures the precise structural integrity necessary for proper calcium release during muscle contraction [11]. Beyond its cellular functions, zinc plays a major role in dictating the bioavailability of intracellular trace elements important for muscle metabolism, such as iron [12]. Studies have shown that zinc promotes iron uptake and transcellular transport via the induction of divalent metal iron transporter-1 (DMT1) and ferroportin (FPN1) expression. Subsequently, zinc deficiency can lead to impaired iron uptake and disrupted myoglobin metabolism [13].

Hypozincemia is a common complication following bariatric surgery. A recent systematic review and meta-analysis demonstrated that the total prevalence of zinc deficiency at one year following surgery is 26.1%. The mean reduction in the serum zinc level at one year of follow-up was 9.33% compared to pre-surgery levels [14]. Although patients undergoing Roux-en-Y gastric bypass or biliopancreatic diversion with duodenal switch are at a higher risk due to alterations in the gastrointestinal anatomy, this risk cannot be excluded after a sleeve gastrectomy [15]. Patients undergoing gastric sleeve surgery are inherently vulnerable to significantly decreased gastric acid secretion, which is mandatory for the absorption and extraction of protein-bound dietary zinc [16]. While there is no current consensus on the optimal postoperative zinc supplementation dosage and protocol [15], our case demonstrates that standard

multivitamin supplementation (in our case, Centrum Adult, one tablet daily, containing 11 mg of elemental zinc (100% daily value)) is often insufficient to overcome this chronic absorptive deficit over a prolonged period.

During the evaluation of our patient, we systematically ruled out other possible etiologies. Although her ESR level was high, we considered this to be a nonspecific sign of physiological stress, especially with her negative autoimmune serologies. The normal copper and B12 levels ruled out secondary deficiencies, which are well-documented causes of myeloneuropathy in post-bariatric patients [17, 18]. Our workup did not include electromyography, muscle biopsy, or baseline serum creatine kinase, as diagnostic options were limited by financial constraints in a private healthcare setting. However, the absence of clinical features suggesting an inflammatory or necrotizing process, combined with the characteristic biochemical profile and rapid, complete resolution of symptoms following oral zinc gluconate monotherapy, strongly supported zinc deficiency as the primary underlying cause.

This case emphasizes that bariatric surgeons, neurologists, and primary care physicians must maintain a high clinical index of suspicion for trace element deficits, specifically zinc, in post-sleeve surgery patients presenting with unexplained neuromuscular complaints. Lifelong metabolic surveillance and targeted nutritional panels must remain a cornerstone of post-bariatric care, even in the absence of classic physical signs.

Conclusions

Severe zinc deficiency may be associated with profound muscle weakness years after a sleeve gastrectomy, even in the absence of classic skin or hair changes. Because this presentation is highly unusual, it can easily be missed. This presentation serves as a clinical reminder for healthcare providers to consider trace mineral deficiencies when evaluating post-bariatric surgery patients with unexplained muscle fatigue or weakness. Lifelong nutritional monitoring is essential to ensure the long-term health and safety of patients following weight loss surgeries.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Acquisition, analysis, or interpretation of data: Mariam S. Bourgleh, Moaz Safwan, Ahmad Sawan, Joud Asfari

Critical review of the manuscript for important intellectual content: Mariam S. Bourgleh, Moaz Safwan, Ahmad Sawan

Concept and design: Moaz Safwan, Ahmad Sawan, Joud Asfari

Drafting of the manuscript: Moaz Safwan, Joud Asfari

Supervision: Ahmad Sawan

Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

References

1. Kiouri DP, Tsoupra E, Peana M, Perlepes SP, Stefanidou ME, Chasapis CT: Multifunctional role of zinc in human health: an update. EXCLI J. 2023, 22:809-27. 10.17179/excli2023-6335
2. Lin PH, Sermersheim M, Li H, Lee PH, Steinberg SM, Ma J: Zinc in wound healing modulation. Nutrients. 2017, 10:16. 10.3390/nu10010016
3. Schoofs H, Schmit J, Rink L: Zinc toxicity: understanding the limits. Molecules. 2024, 29:3130. 10.3390/molecules29133130
4. Wapnir RA: Zinc deficiency, malnutrition and the gastrointestinal tract. J Nutr. 2000, 130:1388S-92S. 10.1093/jn/130.5.1388S
5. Ogawa Y, Kinoshita M, Shimada S, Kawamura T: Zinc and skin disorders. Nutrients. 2018, 10:199.

10.3390/nu10020199

6. Mulita F, Lampropoulos C, Kehagias D, et al.: Long-term nutritional deficiencies following sleeve gastrectomy: a 6-year single-centre retrospective study. Prz Menopauzalny. 2021, 20:170-6. 10.5114/pm.2021.110954
7. Sallé A, Demarsy D, Poirier AL, et al.: Zinc deficiency: a frequent and underestimated complication after bariatric surgery. Obes Surg. 2010, 20:1660-70. 10.1007/s11695-010-0237-5
8. Baddam S, Maxfield L, Shukla S, Crane JS: Zinc deficiency. StatPearls [Internet]. StatPearls Publishing, Treasure Island, FL; 2025.
9. Gumpper K, Ma J: Zinc signaling in skeletal muscle . Zinc Signaling. Fukada T, Kambe T (ed): Springer, Singapore; 2019. 123-37. 10.1007/978-981-15-0557-7_7
10. Ohashi K, Nagata Y, Wada E, Zammit PS, Shiozuka M, Matsuda R: Zinc promotes proliferation and activation of myogenic cells via the PI3K/Akt and ERK signaling cascade. Exp Cell Res. 2015, 333:228-37. 10.1016/j.yexcr.2015.03.003
11. Taweechat P, Boonamnaj P, Samsó M, Sompornpisut P: Significance of Zn(2+) in RyR1 for structural integrity and ligand binding: insight from molecular dynamics. J Phys Chem B. 2024, 128:4670-84. 10.1021/acs.jpcb.4c01189
12. Rolić T, Yazdani M, Mandić S, Distante S: Iron metabolism, calcium, magnesium and trace elements: a review. Biol Trace Elem Res. 2025, 203:2216-25. 10.1007/s12011-024-04289-z
13. Kondaiah P, Yaduvanshi PS, Sharp PA, Pullakhandam R: Iron and zinc homeostasis and interactions: does enteric zinc excretion cross-talk with intestinal iron absorption?. Nutrients. 2019, 11:1885. 10.3390/nu11081885
14. Jiao Y, Liu Y, Chen S, Tang L: Zinc deficiency after bariatric surgery: a systematic review and meta-analysis . Indian J Surg. 2025, 87:10-7. 10.1007/s12262-024-04082-1
15. O'Kane M, Parretti HM, Pinkney J, et al.: British Obesity and Metabolic Surgery Society Guidelines on perioperative and postoperative biochemical monitoring and micronutrient replacement for patients undergoing bariatric surgery-2020 update. Obes Rev. 2020, 21:e13087. 10.1111/obr.13087
16. Mohapatra S, Gangadharan K, Pitchumoni CS: Malnutrition in obesity before and after bariatric surgery. Dis Mon. 2020, 66:100866. 10.1016/j.disamonth.2019.06.008
17. Huang YH, Chou MC, Tsai JJ: Severe copper deficiency-related polyneuropathy following laparoscopic sleeve gastrectomy: a case report and literature review. Nutrition. 2026, 143:113036. 10.1016/j.nut.2025.113036
18. Majumder S, Soriano J, Louie Cruz A, Dasanu CA: Vitamin B12 deficiency in patients undergoing bariatric surgery: preventive strategies and key recommendations. Surg Obes Relat Dis. 2013, 9:1013-9. 10.1016/j.soard.2013.04.017