

Recurrent abdominal laparotomy wound infection and dehiscence in a patient with zinc and selenium deficiency associated with Roux-en-Y gastric bypass: Case report and literature review

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ABSTRACT

We report a case of a 72-year-old woman who developed recurrent abdominal laparotomy wound dehiscence and infection following a hepatico-jejunostomy. Her surgical history included a Roux-en-Y gastric bypass (RYGB) that was carried out 11 years ago. Upon further assessment in the current admission, she was found to be deficient in both selenium and zinc. Daily multivitamin and mineral tablets and a nutritional supplement drink were prescribed to address her deficiencies. After 2 months of supplementation, the laparotomy wound had made significant healing progress and no further surgical input was required. This case illustrates the importance of assessing micronutrient levels in patients with a history of bariatric surgery who present with poor wound healing and infection. Bariatric patients should also be educated about the risks of nutritional deficiencies and encouraged to adhere to prescribed dietary and lifestyle changes. Importantly, family medicine and primary care physicians need to consider an adequate level of supplementation of micronutrients in all patients with RYGB surgery.

Keywords: Bariatric surgery, selenium, zinc

Introduction

Bariatric surgery is widely performed due to the high prevalence of obesity across the globe. Roux-en-Y gastric bypass (RYGB) is a combination surgery where there is a large reduction in gastric

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Received: 11-01-2023

Revised: 24-03-2023

Accepted: 19-05-2023

Published: 21-11-2023

Access this article online

Quick Response Code:



Website:
<http://journals.lww.com/JFMPC>

DOI:
10.4103/jfmpc.jfmpc_84_23

capacity and repositioning of the small intestines resulting in reduced caloric intake and decreased absorption of nutrients.^[1] Zinc is the most abundant intracellular metal in the human body and can be found in foods such as red meat and seafood. 3000 proteins require zinc, and thus it is necessary for many enzymatic processes, transport, and storage.^[2] The absorption of zinc takes place in the proximal jejunum and duodenum. It is instrumental in fibroblast proliferation and collagen production, which are both important in wound healing. Zinc also has a role in both cellular and humoral immunity which affects wound

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How to cite this article: Chizooma E, Fabyan S, Panda A, Ahmed MH, Panourgia M, Owles H, *et al.* Recurrent abdominal laparotomy wound infection and dehiscence in a patient with zinc and selenium deficiency associated with Roux-en-Y gastric bypass: Case report and literature review. *J Family Med Prim Care* 2023;12:2979-82.

infections.^[3] Selenium is noted to be an important co-factor for certain antioxidant reactions in the body which leads to a decrease of immunosuppression. It plays an integral role in thyroid function, immunity, and muscle metabolism.^[3] Both micronutrients are important in promoting wound healing as illustrated in our case report. The first point of contact in the community for individuals with RYGB bariatric surgery will be family medicine physicians. Therefore, this case report highlights the important role of family medicine or primary care physicians in ensuring adequate supplementation of micronutrients and most importantly, an excellent level of compliance.

Case Report

A 72-year-old woman presented to the emergency department (Milton Keynes University Hospital, United Kingdom) with a fall and a dehisced midline laparotomy wound 18 days after having a hepatico-jejunostomy. She stated that she had been feeling weak since having the surgery and had fallen numerous times at home after her legs gave way. She was also concerned that her surgical wound was not healing properly as there was a persistent purulent discharge emanating from it. Her past medical history included congestive heart failure, anemia, atrial fibrillation, hypertension, depression, subclinical hypothyroidism, acute cholecystitis, and back pain. Her surgical history included a RYGB (11 years ago), total prosthetic replacement of the left knee joint (one year ago), ultrasound-guided gallbladder drainage (one year ago), and the aforementioned hepatico-jejunostomy which was done due to a common bile duct injury during a laparoscopic cholecystectomy (6 months ago).

Upon initial assessment, the patient was febrile, hypotensive, and had raised inflammatory markers. Empirical antibiotic treatment with intravenous co-amoxiclav was started due to the possibility of a wound infection and sepsis. Computed tomography imaging of the abdomen and pelvis revealed a non-obstructed right paramedian anterior abdominal wall hernia containing small bowel. The patient was taken to theatres on the same day for a laparotomy and closure of the abdominal wall wound dehiscence. After the surgery, intravenous co-amoxiclav was continued for 2 more days before being switched to the oral formulation.

The patient was discharged home 6 days postoperatively; however, she returned to the emergency department the following day after experiencing another fall. On evaluation, she was found to have a periprosthetic fracture of the left distal femur, a right axillary hematoma, and sepsis which required vasopressor support. There was a significant amount of slough and a purulent discharge oozing from the abdominal wound, and the staples were barely holding it together in some areas. The patient received joint care from a multidisciplinary team consisting of intensive care specialists, orthopedic and general surgeons, geriatricians, dieticians, physiotherapists, and tissue viability nurses.

Importantly, surgical intervention on the laparotomy wound was deemed unnecessary, and thus it was managed with antibiotics

and vacuum-assisted closure (VAC) therapy. Wound swabs were taken for microscopy, culture, and sensitivity analysis. The wound culture grew extended-spectrum beta-lactamases (ESBLs) like *Escherichia coli*, *Pseudomonas aeruginosa*, and *Klebsiella*. Antibiotic treatment included intravenous co-amoxiclav, gentamicin, metronidazole, and meropenem. After 2 weeks, antibiotic treatment was discontinued as there was no purulent discharge from the wound, and inflammatory markers were significantly reduced. There were still a lot of sloughs in the wound bed, thus making it difficult to suture [Figure 1a].

Considering the patient's prior gastric bypass surgery and its association with micronutrient deficiencies, we decided to assess her zinc and selenium levels as they are vital for wound healing. Laboratory test results showed low serum levels of zinc (7.3 $\mu\text{mol/L}$, normal reference range 10–20 $\mu\text{mol/L}$) and selenium (0.43 $\mu\text{mol/L}$, normal reference range 0.75–1.46 $\mu\text{mol/L}$). The patient was therefore prescribed daily multivitamin and mineral tablets and a nutritional supplement containing zinc and selenium. The combined amount of zinc and selenium from both supplements was 25.8 mg and 100 μg , respectively. After 2 months of supplementation and VAC therapy, the wound showed no signs of infection and appeared to be healing well [Figure 1b]. The patient gave consent for the publication of case report and publication of the image.

Discussion

Bariatric surgery is an ideal option for obese patients striving to lose weight and mitigate risk associated with life-threatening comorbidities; however, occurrences of micronutrient deficiencies are common after surgery.^[4] This is particularly the case with malabsorptive procedures such as RYGB, which is currently the most common bariatric procedure globally.^[5] Reports on the prevalence of specific vitamin and trace element deficiencies after bariatric surgery are highly variable due to differences in procedure types, follow-up periods, and patient characteristics between studies. 2-5-fold increases in zinc deficiency rates, from preoperative levels, have been reported

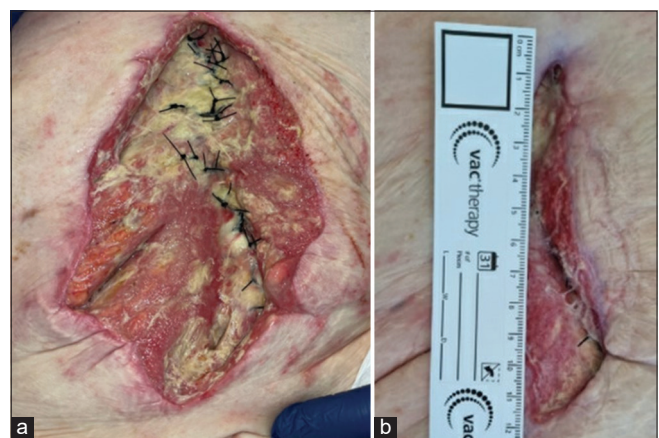


Figure 1: Midline laparotomy wound before (a) and 2 months later after daily multivitamin and mineral supplementation (b)

in the literature, with follow-up periods ranging between 6 and 60 months after RYGB.^[6-10] Ruz *et al.*^[11] observed a reduction in zinc absorption from 32.3% to 13.6% in morbidly obese female patients 6 months after RYGB. Selenium deficiency rates of up to 46% have been reported 2 years after RYGB.^[12] There are scarce reports of long-term zinc and selenium deficiency following bariatric surgery, primarily due to inadequate monitoring and follow up. Our patient was found to be deficient in both selenium and zinc, 11 years after RYGB.

Zinc and selenium are known to play a critical role in wound healing, along with other essential macro and micronutrients. Over 200 zinc-related molecules are involved in the process of wound healing.^[13] Examples include matrix metalloproteinases, superoxide dismutase, alkaline phosphates, acetylserotonin methyltransferases, integrins, and zinc-finger proteins.^[14,15] In addition to antioxidant functions, zinc-containing enzymes modulate cell proliferation, tissue repair, growth, immune system function, and nucleic acid metabolism.^[16] Zinc deficiency increases the susceptibility to microbial infections as it impairs the function of natural killer cells, macrophages, and neutrophils. It also leads to a reduction in the number of granulocytes and B-lymphocytes.^[17] Selenoproteins, which are organic forms of selenium, are important during the wound-healing process as they reduce oxidative stress, inhibit inflammatory cytokines, and increase vascular endothelial growth factor and angiogenesis.^[18,19]

While our patient was deficient in both zinc and selenium, it is prudent for us to acknowledge that she may also have been deficient in other micronutrients that are vital for wound healing such as copper, iron, magnesium, vitamin A, and vitamin C.^[20] The patient's available history did not have any record of micronutrient level monitoring before or after the RYGB; however, she admitted that her multivitamin and mineral supplement intake was inconsistent. It was therefore necessary to start the patient on a complete multivitamin and mineral supplement to address the confirmed selenium and zinc deficiency, as well as other potential micronutrient deficiencies. We believe that nutritional supplementation contributed significantly to the improved wound resolution seen after 2 months. Treating the wound infection with antibiotics was also very important as bacterial infections can delay wound healing.^[21]

The British Obesity and Metabolic Surgery Society (BOMSS) recommends zinc supplementation following RYGB at a ratio of 8–15 mg of zinc per 1 mg of copper. The measurement of zinc levels annually is also recommended.^[22] Similar guidance is provided by the American Society for Metabolic and Bariatric Surgery (ASMBS).^[23] Both bodies do not provide guidance on the specific dose required; however, they recommend an intake of 2 mg of copper per day after RYGB. It can thus be assumed that the dose of zinc should not exceed 30 mg/day. Some authors have called for doses as high as 60 mg/day due to common reports of asymptomatic zinc deficiency in patients taking between 7.5 mg and 25 mg/day.^[23] Although rare, there is

a possibility of zinc toxicity when taken at doses above the safe upper limit (40 mg/day).^[11] Furthermore, high zinc doses can interfere with the absorption of iron and copper.^[24]

The recommended dietary allowance of selenium is 55 µg/day for adults.^[11] A complete multivitamin and mineral supplement that includes selenium is deemed sufficient following RYGB; however, patients can also opt for selenium tablets or selenium-rich foods such as Brazil nuts, seafood, and organic meats. Both BOMSS and ASMBS do not recommend routine selenium testing following RYGB. They only recommend testing if a patient presents with selenium deficiency symptoms which include chronic diarrhea, metabolic bone disease, heart failure, anemia, or unexplained fatigue. Therefore, it is crucial to look for micronutrient deficiencies in individuals with RYGB.^[24,25] Although the case provide level V evidence, the patient journey support the relevance of selenium and zinc testing and monitoring in patients experiencing delayed wound healing and infection. Furthermore, it highlights the important role of primary care and family medicine physicians in ensuring adequate compliance with supplementation of micronutrients as this will be lifelong process.

Conclusion

Micronutrients play a crucial role in the wound-healing process. Zinc and selenium deficiency may have contributed to poor wound healing and infection in the case presented. A key lesson here for clinicians is to suspect micronutrient deficiencies in bariatric patients with poor wound resolution and incorporate adequate supplementation in their management plans. The number of patients showing up for nutritional status follow-up appointments generally wanes over time, thus highlighting the need for novel strategies and systems to increase attendance. Healthcare professionals should make it a habit to enquire about adherence to respective dietary supplements in every bariatric patient encounter, not only during nutritional status follow-up appointments. Patients should also be educated about the risks of nutritional deficiencies and encouraged to comply with prescribed dietary and lifestyle changes.

Key points

- Individuals with a RYGB surgery may present with clinical features related to deficiency of both selenium and zinc.
- This case illustrates the importance of assessing micronutrient levels in patients with a history of bariatric surgery who present with poor wound healing and infection.
- Family medicine and primary care physicians need to consider an adequate level of supplementation of micronutrients in all patients with RYGB surgery.

Take home message

Detailed dietary history and focus clinical examination looking at clinical features related to micronutrients deficiencies need to be part of the assessment of patients with the history of RYGB surgery.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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