CASE REPORT

Copper deficiency caused by excessive alcohol consumption

Shunichi Shibazaki,1 Shuhei Uchiyama,2 Katsuji Tsuda,3 Norihide Taniuchi4

SUMMARY
Copper deficiency is a disease that causes cytopaenia and neuropathy and can be treated by copper supplementation. Long-term tube feeding, long-term total parenteral nutrition, intestinal resection and ingestion of zinc are known copper deficiency risk factors; however, alcohol abuse is not. In this case, a 71-year-old man had difficulty waking. He had a history of drinking more than five glasses of spirits daily. He was well until 3 months ago. A month before his visit to our hospital, he could not eat meals but continued drinking. He had macrocytic anaemia on admission. Copper and ceruloplasmin levels were markedly low, and we diagnosed copper deficiency. There were no other known risk factors for copper deficiency. After he began drinking cocoa as a copper supplement, the anaemia ameliorated and he was able to walk. This is the first report showing alcohol abuse as a risk factor for copper deficiency.

BACKGROUND
Copper deficiency is a disease that causes blood cell abnormalities such as anaemia and leucopaenia, and neurological symptoms such as neuropathy, myelopathy and vision loss. It needs to be differentiated from vitamin B12 deficiency. Although the precise frequency is unknown, primary copper deficiency is relatively rare because copper is universally included in the diet. Therefore, it should be suspected when the patient has a known risk factor. Current known risk factors include special nutritional conditions such as long-term tube feeding and long-term total parenteral nutrition, gastrointestinal problems such as postgastrectomy and postobesity surgery and other conditions, such as ingestion of zinc. There are also several copper deficiency case reports of unknown causes, which suggests that there are other risk factors. Currently in the literature, there are no case reports of alcohol abuse as a risk for copper deficiency. We experienced a case of copper deficiency due to alcohol abuse without other known risk factors.

CASE PRESENTATION
A 71-year-old man was a long-term alcoholic that drank more than five glasses of spirits daily. Beginning 3 months ago, he began to eat less at meals that consisted mostly of raw fish and meat and continued to drink alcohol. However, he had no other problems in daily life. One month ago, he could no longer eat meals but continued drinking. At about this time, he became unable to walk and managed by crawling. A day before his visit to our hospital, his behaviour became unintelligible, and he was brought to our hospital by ambulance. He had a history of hypertension and dyslipidaemia and took amiodipine and rosuvastatin. He has no history of surgery and he did not take zinc medication or supplementation.

Vital signs were the following: blood pressure 96/72 mm Hg, pulse 89/min, body temperature 36.7°C, respiration rate 15/min at time of visit. He lost consciousness and could not understand where he was or respond to instructions. His ocular conjunctiva was yellow tinged and he had a flapping tremor. He had an abdominal bulge and no knock pain around his liver. He had brown diarrhoea, not tarry stool. He was unable to stand up to both knees. Babinski reflection was positive. He was uncooperative with our physical examination, and as such, a detailed neurological examination including serial exams was not possible.

INVESTIGATIONS
Blood tests revealed a white blood cell count of 5190×10⁶/L without abnormal fractionation. His haemoglobin (Hb) was 7.8 g/dL (normal range 13.5–17.6 g/dL), mean corpuscular volume was 96.4 fl (normal range 83–93 fl), reflecting macrocytic anaemia. Platelet count was 11.7×10⁹/L (normal range 13.1×10⁹–36.2×10⁹/L), reflecting mild thrombocytopenia. Aspartate aminotransferase was 477 IU/L (normal range 7–97 IU/L), alanine aminotransferase was 155 IU/L (normal range 6–43 IU/L), blood urea nitrogen was 26.7 mg/dL (normal range 10–20 mg/dL), creatinine 2.41 mg/dL (normal range 0.6–1.0 mg/dL), that is, liver and kidney dysfunction were also observed. Blood glucose level was normal (137 mg/dL). Ammonia level increased up to 166 μg/dL (normal range 30–80 μg/dL). His serum ferritin also significantly increased up to 9506 ng/mL (normal range 39.4–340 ng/mL). C-reactive protein was 5.89 mg/dL (normal range 0.0–0.3 mg/dL). However, urinary white blood cells and bacterial urine were negative, thus excluding pyelonephritis. In addition, ascites had no bacteria, while white blood cell count in ascites was 32/μL, thus also excluding spontaneous bacterial peritonitis. The following data are reference values because these blood tests were investigated after vitamin ingestion at the emergency department; serum vitamin B1 91 ng/mL (normal range 24–66 ng/mL) and serum vitamin B12 >1500 pg/mL (normal range 180–914 pg/mL). Prothrombin time (PT) was 16.5 s (normal range

1Department of Emergency and General Internal Medicine, Hitachinaka General Hospital, Hitachinaka, Ibaraki, Japan
2Department of General Internal Medicine, Tokyo Bay Urayasu Ichikawa Medical Center, Urayasu, Chiba, Japan
3Department of Nephrology, Suwa Central Hospital, Chino, Nagano, Japan
4Department of Gastroenterology and Internal Medicine, Suwa Central Hospital, Chino, Nagano, Japan

Correspondence to Dr Shunichi Shibazaki, sn1.shibazaki@gmail.com

Accepted 12 September 2017
OUTCOME AND FOLLOW-UP

Serum copper and ceruloplasmin recovered rapidly, serum ferritin declined and blood cell count recovered after just a few days of drinking cocoa. His delirium also disappeared rapidly from the day after starting cocoa. Moreover, activity of daily life recovered rapidly (figure 1). Because he became cooperative with medical treatment, we used diuretics and BCAA sequentially. Eventually, he could walk on his own and was discharged on the 74th day and was ambulatory.

The blood cells subsequently recovered: Hb 14.3 g/dL, however, Babinski reflexion remained positive 4 months after the start of copper supplementation. He continued abstinence after being discharged from our hospital and had no relapse after 2 years of follow-up.

DISCUSSION

This is the first case report clinically, suggesting that excessive alcohol consumption can be a risk factor for copper deficiency.

Copper is an essential element in the body, absorbed from the jejunum to duodenum, and it spreads throughout the body via the liver. It acts as a coenzyme for many enzymes, and in particular, plays an important role in the bone marrow and nervous system. Therefore, copper deficiency can result in blood cell abnormalities such as various types of anaemia (microcytic, normocytic, macrocytic anaemia) and leucopenia, and neurologic symptoms such as neuropathy, myelopathy, and vision loss. In particular, it is important to differentiate this from vitamin B12 deficiency because the phenotypes are similar. Copper supplementation recover blood cell abnormalities favourably. For neurological symptoms, however, the recovery is partial, and it is thought that neurologic symptoms will become irreversible if treatment is delayed. Therefore, it is important to diagnose copper deficiency and start treatment early.

Copper deficiency may be overlooked. Although the exact frequency of copper deficiency is unknown, primary copper deficiency is considered relatively rare as copper is included in most diets. Typically, clinician awareness is low, which makes correct diagnosis difficult. Generally, we suspect copper deficiency if the patient has a known risk factor. Known risk factors include special nutritional conditions such as long-term tube feeding and long-term parenteral nutrition or gastrointestinal problems such as postgastrectomy and postobesity surgery or other conditions, such as zinc intake. There are several case reports about copper deficiency of unknown cause. This suggests that clinically there may be other risk factors.

This case clinically suggests that excessive alcohol consumption can be a risk factor for copper deficiency. There are three reasons supporting this. First, the patient did not have any other known risk factors, and he was not a candidate for any other remarkable cause other than excessive alcohol consumption. Moreover, he had no recurrence after abstinence and after the copper supplementation. It was possible that a decreased volume of meals might have affected the onset of copper deficiency, however, this alone could not explain the progression speed of the disease such that the condition emerged after only 3 months of not eating properly. It is most likely that prior to 3 months ago he had small meals. Moreover, he was eating fish and meat, which contain ample amounts of copper. Therefore, we think that it was less likely that he became copper deficient from diet alone. In previous reports, it takes more than a half year to 1 year for copper deficiency to emerge in long-term tube feeding or parenteral nutrition. Thus, an insufficient intake by itself would not explain the short 3-month course. Second,
We experienced a case of copper deficiency due to an excessive habitual alcohol consumption. We encourage clinicians to suspect copper deficiency when patients with an alcohol habit have blood cell abnormalities and neurological symptoms. Further investigation is needed to elucidate the mechanism causing copper deficiency with excessive alcohol consumption.

**Contributors** Authors’ contributions are following: SS, corresponding author wrote the draft. SU, KT and NT revised the article for intellectual content.

**Competing interests** None declared.

**Patient consent** Obtained.

**Provenance and peer review** Not commissioned; externally peer reviewed.

**Open Access** This is an Open Access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: http://creativecommons.org/licenses/by-nc/4.0/

**REFERENCES**


**Learning points**

- Copper deficiency should be part of the differential if patients have blood cell abnormalities and neurological symptoms.
- Alcohol abuse can be a risk factor for copper deficiency.
- Cocoa can easily replenish copper requirements.