Reminder of important clinical lesson

Severe hypoxaemia due to methaemoglobinaemia and aspiration pneumonia

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Correspondence to Dr Tomonori Mizutani, tomomizu1234@ybb.ne.jp**Summary**

The authors report a case of a previously healthy 40-year-old man who was admitted to the emergency department due to severe hypoxaemia after emesis. He vomited after a cup of coffee with the milk at his office. On admission, he showed cyanosis and oxygen saturation measured by pulse oximetry was extremely low (86%) in spite of the administration of 10 litres of oxygen. The authors suspected pneumonia, but oxygen saturation was disproportionately low to pneumonia severity. Oxygen saturation measured by pulse oximetry was significantly different from oxygen saturation calculated from arterial blood gas analysis, suggesting the existence of haemoglobin abnormality. The level of methaemoglobin was 9.3% (reference range, 1–2%). The patient was treated by antibiotics for pneumonia, and his methaemoglobinaemia was spontaneously ameliorated. The authors later found that the patient drank bleach containing hypochlorous acid instead of milk by mistake. To conclude, the patient's hypoxaemia was due to pneumonia and drug-induced acquired methaemoglobinaemia.

BACKGROUND

Methaemoglobinaemia is a disorder characterised by the presence of elevated methaemoglobin level in the blood. Some drugs induce acquired methaemoglobinaemia.¹ Ferric haemes of methaemoglobin is incapable of binding oxygen and impair the release of oxygen. Dyspnoea, respiratory depression, shock and death may occur when methaemoglobin level increases. Here, we will show a patient showing severe hypoxaemia due to suspected aspiration pneumonia complicated with acquired methaemoglobinaemia by accidental ingestion of hypochlorous acid. This case suggests the importance of careful medical history-taking, and the possibility of methaemoglobinaemia when we see patients with disproportionately low oxygen saturation (SpO_2), measured by pulse oximetry, to the severity of respiratory diseases.

CASE PRESENTATION

A 40-year-old man was admitted to the emergency department due to nausea and severe hypoxaemia after emesis. He was healthy until the episode, and had no allergic history, nor family history of specific hereditary diseases. He had suddenly vomited after drinking a cup of coffee with the milk at his office, and was admitted to our hospital. On admission, he was conscious, could answer the questions and showed cyanosis. SpO_2 was extremely low (86%) in spite of the administration of 10 litres of O_2 . Respiratory rate was 18 breaths per minute, body temperature was 37.2°C and auscultation of the chest revealed coarse crackles at the right lower lung zone.

INVESTIGATIONS

Laboratory data showed elevated white blood cell (WBC) count of 16300/ μl with 85% neutrophils and increased serum lactate dehydrogenase (LDH) level of 373 U/l.

ECG and echocardiogram showed no abnormality. Chest x-ray was almost normal (figure 1), and contrast material-enhanced CT demonstrated mild pneumonia in the right lower lobes, but showed no signs of pulmonary thromboembolism (figure 2).

DIFFERENTIAL DIAGNOSIS

We suspected mild pneumonia in the right lower lobes by medical examination, laboratory data and chest CT. But SpO_2 was disproportionately low to the severity of pneumonia. Arterial blood gas analysis revealed 267 mm Hg of oxygen pressure (pO_2) and 99.8% saturation of oxygen (SaO_2) on the administration of 10 litres O_2 (table 1).

We noticed the existence of a 'saturation gap,' which means that SpO_2 is significantly different from SaO_2 . This suggested the presence of abnormality of haemoglobin, such as methaemoglobin. The level of methaemoglobin was 9.3% (reference range, 1–2%).

His SpO_2 was normal last year, indicating a low probability of congenital methaemoglobinaemia. As a result of analyses of the coffee and milk which he drank before the onset of hypoxaemia, we found that the patient drank his coworker's bleach containing hypochlorous acid instead of milk by mistake, developing acquired methaemoglobinaemia.

TREATMENT

The patient was subsequently treated with antibiotics for the treatment of suspected pneumonia, and methaemoglobinaemia was spontaneously ameliorated (table 2).

Hypochlorous acid ingestion is sometimes complicated with oesophagitis or haemorrhagic gastritis similar to that of *Helicobacter pylori* infection,² and hypochlorous acid inhalation can cause acute respiratory distress syndrome. We assessed gastrointestinal complications by upper gastrointestinal endoscopy.

Figure 1 Chest x-ray showed an almost normal image.

Figure 2 Axial image in lung algorithm shows ground glass opacity and reticular shadow in the right lower lobes.

Table 1 Results of arterial blood gas studies and oximetry on 10 litres O₂

pH	7.371
pCO ₂ (mm Hg)	35.2
pO ₂ (mm Hg)	267.5
SaO ₂ (%)	99.8
SpO ₂ (%)	86

Table 2 Change of arterial blood gas studies and oximetry

	Emergency room	2 h later	6 h later
FiO ₂	0.8	0.5	0.28
SaO ₂ (%)	99.8	98.5	99.4
SpO ₂ (%)	86	90	95

OUTCOME AND FOLLOW-UP

SpO₂ was almost normal by the next day, and he left our hospital 3 days after admission.

DISCUSSION

Since acquired methaemoglobinaemia can be a life threatening disease,¹ it is important to diagnose it immediately. Our case indicates the difficulty of the diagnosis of methaemoglobinaemia when other diseases causing hypoxaemia such as pneumonia coexists. Our patient, lacking severe respiratory distress, was suspected of aspiration on the grounds of high number of WBCs, acute respiratory distress after vomiting, and chest CT images showing ground glass opacity in the right lower lobes, a common image in aspiration pneumonia. However, the SpO₂ was disproportionately low to the severity of pneumonia. This inconsistent finding lead us to search for another possible cause of desaturation.

Methaemoglobinaemia is clinically suspected by the presence of cyanosis when arterial pO₂ is normal. The existence of the 'saturation gap,' which means that SpO₂ is significantly different from SaO₂, could be an important clue to the presence of methaemoglobinaemia. Diagnosis is made by high blood methaemoglobin levels.

Methaemoglobinaemia is classified into congenital and acquired methaemoglobinaemia.

Most cases of congenital methaemoglobinaemia are due to deficiency of cytochrome b5R reductase. Acquired methaemoglobinaemia can be a fatal disease. If the patient is symptomatic, immediate use of intravenous methylene blue is recommended for the treatment of methaemoglobinaemia.³ But if a patient is asymptomatic with a low level of methaemoglobin, medication may not be required. Ingestion of some drugs has been reported to cause an increase in the production of methaemoglobin.¹ Dapsone (diamino-diphenyl sulfone)-induced methaemoglobinaemia which is used for the treatment of *Mycobacterium leprae* infections, has been previously

reported.⁴⁻⁶ As a result of the analyses of coffee and milk which he drank before the onset of hypoxaemia, we found that the patient drank coworker's bleach containing hypochlorous acid instead of milk by mistake, developing acquired methaemoglobinaemia.

The patient was suspected of aspiration on the grounds of high number of WBCs, acute respiratory distress after vomiting, and chest CT images showing ground glass opacity in the right lower lobes, a common image in aspiration pneumonia. However, the patient had severe desaturation, an inconsistent finding regarding the patient's clinical presentations and the severity of pneumonia. This inconsistent finding led us to search for another possible cause, leading us to the diagnosis.

To our knowledge, our report is the first to present a case with severe hypoxaemia due to hypochlorous acid-induced methaemoglobinaemia complicated with suspected aspiration pneumonia.

Learning points

- ▶ Methaemoglobinaemia should be considered as one of the causes of hypoxaemia.
- ▶ The presence of cyanosis with normal arterial pO₂ and blood colour may be a clue for diagnosis.
- ▶ 'Saturation gap' which means that SpO₂ is significantly different from SaO₂, is useful to find methaemoglobinaemia, especially when it is complicated with other diseases causing hypoxaemia.
- ▶ Acquired methaemoglobinaemia can be a fatal disease. If the patient presents with symptoms, immediate use of intravenous methylene blue is recommended.
- ▶ We always have to fight against preconceived ideas to correct a diagnosis.

Competing interests None.

Patient consent Obtained.

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