Hydrogen Peroxide Poisoning—A Rare Cause of Portal Venous Gas

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Abstract

Hydrogen peroxide is a clear and odorless liquid at room temperature that can easily be mistaken for water. Its ingestion results in varied clinical and radiological squeals depending on the volume and concentration of the liquid. We present a case of a 22-year-old lady who accidentally ingested 30 to 40 mL of 3% hydrogen peroxide and presented with hematemesis and abdominal pain. On further radiological evaluation, she was found to have portal venous gas and pneumatosis of the bowel wall. She was conservatively managed with 100% oxygen and nil per os for 2 days following which the portal venous gas resolved. Hydrogen peroxide ingestion causes a massive release of oxygen and when its volume exceeds its solubility in blood, gas embolism occurs that is responsible for portal venous gas and pneumatosis. Close monitoring with conservative management will suffice in mild cases without the need for any therapeutic intervention.

Keywords
- gas embolism
- hydrogen peroxide poisoning
- hyperbaric oxygen therapy
- portal venous gas

Case Report

A 22-year-old lady presented to the emergency with an alleged history of accidental ingestion of 30 to 50 mL of 3% hydrogen peroxide from an unlabeled container mistaking it for water. Following this, she had a burning type of pain in the epigastric region and the oropharyngeal region. She also complained of nausea associated with multiple episodes of vomiting, which were nonprojectile and bilious, and blood clots and partially digested food materials. She complained of vague abdominal distention and bloating sensation that relieved with multiple episodes of belching.

She did not complain of any cough, breathlessness, cyanosis, or stridor. She did not complain of any convulsions or any other neurovascular deficits. On examination, she was conscious, oriented, and afebrile. She had no pallor, icterus, or cyanosis. She had tachycardia of 100 beats per minute and blood pressure was 110/70 mm Hg and the respiratory
rate was 16/min. She had a posterior pharyngeal wall congestion without any oropharyngeal erosions or blistering of mucosae to the visualized extent. Bilateral normal vesicular breath sounds were heard with no additional sounds. On per-abdominal examination, the patient’s abdomen was soft with mild epigastric tenderness with no guarding or rigidity and normal bowel sounds were heard. Per-rectal examination showed normal stool stain with no melena. Initial blood investigations including liver and renal function tests were unremarkable. An abdominal X-ray was taken that revealed linear branching air shadows overlying the liver shadow. No free air or altered bowel pattern was seen (►Fig. 1). Abdominal ultrasonography showed linear echogenic shadows within the parenchyma of the liver reaching up to its periphery. Intravenous contrast-enhanced computed tomography (CT) scan showed portal venous gas in the intrahepatic portal vein radicals and pneumatosis of the antropyloric region of the stomach and the first part of the duodenum (►Figs. 2 and 3). Lungs appeared unremarkable. Upper gastrointestinal endoscopy was done after 48 hours and it revealed linear erosions in the body of the stomach with edema and erythema in the antral region with no active bleeding from any of the erosions. She was kept on nil per os started on pantoprazole infusion and antiemetics along with intravenous fluid supplementation. She did not have any further episodes of hematemesis during her course of hospital stay. As the patient was asymptomatic, she was kept under close observation and conservatively managed with 100% oxygen in for 2 days. She was started on oral sips at the end of the second post-admission day that she had tolerated. Follow-up ultrasonography and plain CT showed complete resolution of the portal venous gas and pneumatosis of the stomach and duodenal wall (►Fig. 4). Oral intake was escalated to a normal diet and she was discharged from the hospital in a stable condition and was advised to follow up on an outpatient department basis.

Discussion

Hydrogen peroxide is an oxidizing and bleaching agent and has a wider application as a common ingredient in

Fig. 1 Abdominal X-ray showing linear branching shadows over liver shadow (arrow).
domiciliary, industrial, and medical products such as hair
dyes, bleaching agents, wound irrigation, and instrument
sterilization liquids. By forming oxygen free radicals, it
mainly exerts its effects by causing corrosive damage, lipid
peroxidation, and changes in normal acid–base balance.

Only minor irritation of skin and mucosa occurs on its
exposure in dilute concentrations. But, on ingestion, it causes
painful gastric dilation, nausea, vomiting, belching, and other
gastrointestinal symptoms. Respiratory symptoms ranging
from mild cough and transient dyspnea to severe stridor,
cyanosis resulting in cardiopulmonary arrest were reported
depending on various concentrations ingested. Ocular expo-
sure produces irritation and blurred vision but severe injury
is unlikely. In cases of severe respiratory distress, immediate
endotracheal intubation is advised for laryngeal edema. In
the case of hematemesis, persistent vomiting, or significant
dysphagia, upper gastrointestinal endoscopy is indicated.

It releases oxygen in large quantities and when the gas
levels exceed that of the maximum solubility in blood, air
embolism occurs. This can have varied presentations such as
multiple cerebral infarcts and loss of cardiac output based on
the organ system involved.

Portal venous gas is a condition in which there is gas accumu-
lation in the portal vein and its branches. Generally, it
occurs due to conditions that involve bowel wall (bowel isch-
emia, inflammatory bowel disease, and peptic ulcer perfor-
rations) and inflammatory conditions (diverticulitis, colitis,
or pancreatitis). Most of these conditions require aggressive
intervention as it indicates serious underlying bowel pathol-
gy. It should be differentiated from pneumobilia in which
the pattern of gas occurrence is central in contrast with
peripheral gas formation in portal venous gas.

But its occurrence can also be seen in less common and
benign conditions such as hydrogen peroxide poisoning in
which the underlying pathology is a gas embolism. In these
cases, hyperbaric oxygen therapy will reduce the volume
of gas emboli according to Boyle’s law. In certain cases by
administering 100% oxygen, these emboli can be resolved as
occurred in this present case.

**Conclusion**

Hydrogen peroxide ingestion causes gas embolism that may
present with radiological findings like gastritis, pneumatoses,
perforation, and portal venous gas. Active close monitoring
with 100% oxygen in the Trendelenburg position can be con-
sidered in mild and asymptomatic cases instead of hyper-
baric oxygen therapy.

**Declaration of Patient Consent**

Informed consent was taken from the patient for publica-
tion of the clinical details without revealing the identity.

**References**

1. Urban MV, Rath T, Radtke C. Hydrogen perox-
ide (H2O2): a review of its use in surgery. Wien Med
Wochenschr 2019;169(9-10):222–225
2. Youssef EW, Chukwueke VS, Elsamaloty L, Moawad S,
Elsamaloty H. Accidental concentrated hydrogen peroxide
ingestion associated with portal venous gas. J Radiol Case
Rep 2018;12(8):12–16
3. Papafragkou S, Gasparyan A, Batista R, Scott P. Treatment of
portal venous gas embolism with hyperbaric oxygen after
accidental ingestion of hydrogen peroxide: a case report and
4. Finnegan M, Linley E, Denyer SP, McDonnell C, Simons C,
Maillard JY. Mode of action of hydrogen peroxide and other
oxidizing agents: differences between liquid and gas forms.
J Antimicrob Chemother 2010;65(10):2108–2115
6. Kesarwani V, Ghelani DR, Reece G. Hepatic portal venous
gas: a case report and review of literature. Indian J Crit Care
7. Sebastià C, Quiroga S, Espin E, Boyé R,
Alvarez-Castells A, Armengol M. Portomesenteric vein
gas: pathologic mechanisms, CT findings, and prognosis.
8. Dunbar EM, Fox R, Watson B, Akrill P. Successful late treat-
ment of venous air embolism with hyperbaric oxygen. Postgrad Med
J 1990;66(776):469–470