Surgical treatment of pyloric stenosis caused by glyphosate poisoning
A case report

Wenjun Luo, MD, Tingting Lu, MD, Fugen Li, MD, Chuan Qian, MD, Liuping Zhang, MD, Meng Sun, MD, Zhengwen Xu, MD, Yingdong Jia, MD

Abstract
Rationale: Oral ingestion of glyphosate can induce gastrointestinal symptoms such as vomiting, abdominal pain, and hematochezia. Timely and effective treatment of pyloric stenosis caused by glyphosate poisoning is important.

Patient concerns: The patient had a poor appetite, accompanied by nausea and vomiting of a small amount of dark brown material that resembled blood clots several times a day. Gastroscopy revealed gastric ulcer, a large pyloric antrum ulcer, and a deformed stomach cavity.

Diagnosis: Pyloric stenosis due to glyphosate poisoning in a 36-year-old man.

Interventions: The patients received distal gastrectomy and subsequently transferred to the ICU for further treatment. A mechanical ventilator was used to assist breathing.

Outcomes: Follow-up was conducted 3 years after surgery. The patient had no problem with food ingestion and experienced no discomfort, such as vomiting, nausea, coughing, or expectoration.

Lessons: Gastrectomy is necessary to treat pyloric stenosis caused by glyphosate poisoning.

Abbreviations: Alb = albumin, CT = computed tomography, Hb = hemoglobin, Pct = procalcitonin.

Keywords: gastrectomy, glyphosate poisoning, pyloric stenosis

1. Introduction
Glyphosate is a herbicide commonly used in agriculture due to its advantages, such as broad spectrum, high effectiveness, low toxicity, and safety.[1] Humans and animals can be poisoned by glyphosate absorption through the respiratory tract, digestive tract, and the skin mucosa. Specifically, oral ingestion of glyphosate can induce gastrointestinal symptoms, such as vomiting, abdominal pain, and hematochezia. In fatal cases, death is primarily due to respiratory failure, shock, coma, and renal failure.

Committing suicide by oral ingestion of glyphosate is not rare in rural areas of China. Here we report a case of surgical treatment of pyloric stenosis caused by oral ingestion of a large dose of glyphosate.

2. Case report
A 36-year-old male patient was admitted to our emergency department more than 5 hours after oral ingestion of glyphosate. The patient developed nausea and vomiting caused by oral ingestion of glyphosate isopropylamine (about 100 mL). His stomach contents had a strong chemical smell. Hematemesis and hematochezia were absent. The patient did not develop fever, hemoptysis, coma, or convulsions. The patient was transferred to our hospital after undergoing gastric lavage at a local hospital.

Upon admission, his pulse was 118 beats/min, blood pressure was 110/63 mmHg, and pupil diameter was 3.0 mm. The patient was mentally conscious; his light sensitivity was normal; and no lip cyanosis was observed. His neck was supple, with no apparent swelling of the superficial cervical lymph nodes. His bilateral lung sounds were coarse, with no apparent wet or dry rales. His heart rate was 118/min; there was no pathological murmur in all valve auscultation areas. The abdomen was flat and supple. There was slight tenderness below the xiphoid process and no rebound tenderness across the abdomen. No apparent abdominal mass was observed; borborygmus was 4 times/min; the shifting dullness test was negative; and there was no apparent edema in all limbs.

On auxiliary examination, there were no abnormalities in routine blood tests, biochemical analysis, myocardial zymography, or coagulation function. By electrocardiography, sinus tachycardia, right axis deviation, and clockwise rotation were present. Chest computed tomography (CT) scan revealed...
The patient in this case developed pyloric stenosis at the early stage after orally ingesting glyphosate. The symptom is an erosive and cicatricial stricture of the pylorus caused by damage and inflammation of the upper gastrointestinal mucosa and submucosa, especially at the pylorus, due to ingestion of corrosive agents. In mild cases, hyperemia, edema, and erosion may be the only symptoms, while, in severe cases, acute ulcer, perforation, and even mediastinitis and peritonitis can develop. Sequelae often include esophageal or pyloric strictures. Upper gastrointestinal scars from minor chemical burn usually fade within 7 to 15 days. However, in severe cases, scarring can cause digestive tract stricture. Pyloric stenosis in the patient was not alleviated after 2 weeks of acid suppression treatment and thus was further treated with subtotal gastrectomy. All patients with pyloric scarring and strictures following corrosive agent ingestion must undergo surgical treatment. It has been reported that benign strictures can be treated with endoscopic balloon dilation. However, this treatment provides less-than-ideal long-term effects and requires several procedures. Surgery is still needed. The patient in this case developed pyloric stenosis in the early stages, indicating that ingestion of large doses of glyphosate may have caused irreversible damage to the stomach. Therefore, surgical treatment was implemented. The patient developed edema at the anastomotic site, which is a common complication in subtotal gastrectomy with an incidence rate of 1.6% to
A tubular anastomat was used in the procedure, thus eliminating the possibility of edema caused by the surgical techniques. Therefore, infection and spasms at the anastomosis site should be considered. This complication may be due to incomplete recovery of the patient from stomach inflammation, indicating that a jejunal feeding tube should be implanted. The tube can provide physical support to the anastomosis site and enteral nutritional support, promoting recovery.

Chest CT scan of the patient after admission suggested that inflammation was present on both lungs, probably caused by accidental inhalation of the toxin during vomiting after glyphosate ingestion. General anesthesia, intubation, and surgery may further aggravate lung damage and cause acute respiratory distress syndrome. Four different scenarios may occur after pulmonary aspiration, depending on the characteristics and amount of substance that was accidentally inhaled and the differential individual response: minor lung damage, subclinical pneumonia, severe pneumonia, and progressive acute respiratory distress syndrome. When respiratory failure is present, only the mechanical ventilator can be utilized to assist breathing until recovery of lung function because of the lack of a specific antidote against glyphosate poisoning. In this case, after using the ventilator, hypoxia symptoms were relieved. Combined with anti-infective treatment and nutritional support therapy, the patient had gradually recovered lung function and was eventually weaned from the ventilator. Therefore, ventilator support treatment is effective for patients experiencing respiratory failure caused by glyphosate poisoning.

Author contributions
Conceptualization: Wenjun Luo.
Investigation: Chuan Qian, Liuping Zhang, Meng Sun.
Validation: Tingting Lu, Fugen Li, Zhengwen Xu, Yingdong Jia.

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