

Surgical treatment of pyloric stenosis caused by glyphosate poisoning

A case report

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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 hour 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. The patient had no notable medical history.

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

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Patient has provided written informed consent for publication of the case.

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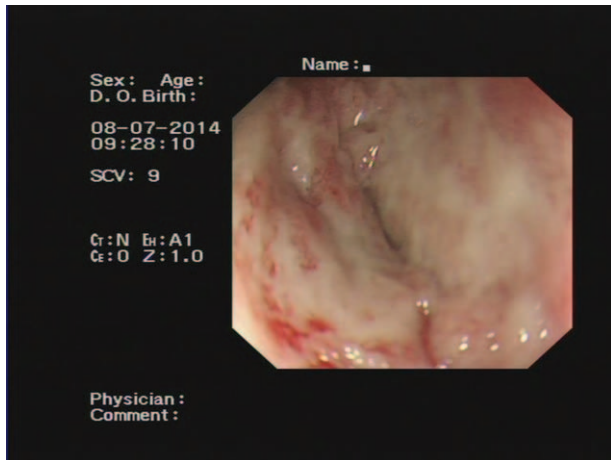


Figure 1. Gastroscope before distal gastrectomy. We observed gastric ulcer, a large pyloric antrum ulcer, and a deformed stomach cavity, and the gastroscope was unable to pass the stomach.

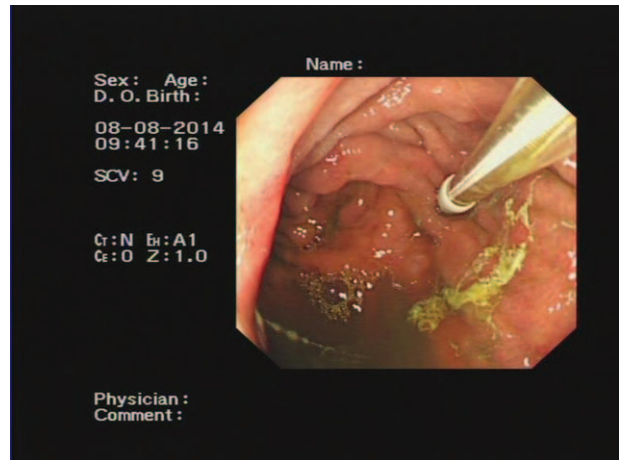


Figure 2. Gastroscope after distal gastrectomy. We observed severe edema at the anastomosis site. A jejunum feeding tube was placed to provide both enteral and parenteral nutrition support.

bilateral flocculent and patchy hyperdense shadows. After admission, fluid replacement and symptomatic treatment were administered. 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. Gastroscope revealed gastric ulcer (stage A1) and a large pyloric antrum ulcer according to Sakita's classification;^[2] the gastroscope was unable to pass the stomach (Fig. 1). A nasogastric tube was placed for gastrointestinal decompression, acid suppression, and parenteral nutrition support. Reexamination showed the following results: hemoglobin (Hb) 114 g/L, albumin (Alb) 22.1 g/L, procalcitonin (Pct) 1.20 ng/mL, Ca^{2+} 1.53 g/L, and K^+ 2.77 mmol/L. Hematuria amylase level was normal. Reexamination of gastroscope after 2 weeks resulted in the same observations as before. Barium meal examination indicated pyloric stenosis, which was not observed in the duodenum. Conservative treatment of pyloric stenosis was ineffective. Therefore, distal gastrectomy with Billroth operation II gastroenterostomy was performed. The surgery was successful. Five days after the surgery, the patient started vomiting again after ingestion of a fluid diet, accompanied by dyspnea. Arterial blood gas test indicated type II respiratory failure. The patient was subsequently transferred to the ICU for further treatment. A mechanical ventilator was used to assist breathing. Gastroscope was performed again and indicated severe edema at the anastomosis site. A jejunum feeding tube was placed, and both enteral and parenteral nutrition support was given (Fig. 2). The patient was successfully weaned from the ventilator and discharged. 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.

3. Discussion

The mechanism of glyphosate toxicity is believed to be the blockage of mitochondrial oxidative phosphorylation, and the lack of energy will cause cell death and lead to tissue damage and organ failure.^[1] When >85 mL of glyphosate is ingested, the patient will experience upper abdominal pain caused by erosion of the gastrointestinal mucosa, which is often accompanied by

liver and kidney damage.^[3] The patient may also develop unconsciousness, respiratory distress, and even shock. In severe cases, death may occur because of multiple organ failure and disseminated intravascular coagulation.

Most experts suggest that patients who orally ingest glyphosate should be treated with gastric lavage and catharsis in early stages, as well as blood purification when necessary. Large volumes of fluid should be infused for diuresis and to promote excretion.^[4] Multiple organ support therapy may be implemented, and a low cholinesterase level can be treated with a small dose of atropine. The key to treatment is to prevent and treat pulmonary edema, heart failure, and liver and kidney damage and protect the gastrointestinal mucosa from erosion. Although there is no specific antidote for glyphosate poisoning, aggressive resuscitation usually results in positive outcomes.

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.^[5] Upper gastrointestinal scars from minor chemical burn usually fade within 7 to 15 days. However, in severe cases, scarring can cause digestive tract stricture.^[6] 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.^[7] It has been reported that benign strictures can be treated with endoscopic balloon dilation.^[8,9] 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

31.0%.^[10] 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. During the follow-up visit at 3 years post-surgery, the patient did not develop pulmonary sequelae. Therefore, ventilator support treatment is effective for patients experiencing respiratory failure caused by glyphosate poisoning.

Author contributions

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References

- [1] Tominack RL, Yang GY, Tsai WJ, et al. Taiwan National Poison Center survey of glyphosate – surfactant herbicide ingestions. *J Toxicol Clin Toxicol* 1991;29:91–109.
- [2] Sakita T. Endoscopy in the diagnosis of early ulcer cancer. *Clin Gastroenterol* 1973;2:345–60.
- [3] Bradberry SM, Proudfoot AT, Vale JA. Glyphosate poisoning. *Toxicol Rev* 2004;23:159–67.
- [4] Garlich FM, Goldman M, Pepe J. Hemodialysis clearance of glyphosate following a life-threatening ingestion of glyphosate-surfactant herbicide. *Clin Toxicol (Phila)* 2014;52:66–71.
- [5] Leung KK, Yusuf TE. Education and imaging. Gastrointestinal: gastrointestinal injury caused by sulfuric acid. *J Gastroenterol Hepatol* 2008;23:159.
- [6] Gilvetti C, Porter SR, Fedele S. Traumatic chemical oral ulceration: a case report and review of the literature. *Br Dent J* 2010;208:297–300.
- [7] Jaffn BW, Kaye MD. The prognosis of gastric outlet obstruction. *Ann Surg* 1985;201:176–9.
- [8] Cherian PT, Cherian S, Singh P. Long-term followup of patients with gastric outlet obstruction related to peptic ulcer disease treated with endoscopic balloon dilatation and drug therapy. *Gastrointest Endosc* 2007;66:491–7.
- [9] Kochhar R, Kochhar S. Endoscopic balloon dilation for benign gastric outlet obstruction in adults. *World J Gastrointest Endosc* 2010;2:29–35.
- [10] Carrodeguas L, Szomstein S, Zundel N, et al. Gastrojejunal anastomotic strictures following laparoscopic Roux-en-Y gastric bypass surgery: analysis of 1291 patients. *Surg Obes Relat Dis* 2006;2:92–7.