

# Clinical Presentations with Different Glyphosate Containing Herbicides

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## Background

- Glyphosate is a commonly used herbicide associated with toxicity and death following large ingestions. Surfactants are implicated as the primary cause of toxicity. Glyphosate preparations contain various surfactants and salts which may lead to diverse clinical toxicity.

## Cases

### Case 1

- 50 year-old-man presented with nausea, vomiting, abdominal pain, and encephalopathy 12 hours after ingesting 6.5 ounces of concentrated Roundup<sup>®</sup> containing 50.2% glyphosate as isopropylamine salt (Fig. 1,2).
- Initial electrocardiogram (ECG) QRS was 142 milliseconds (ms) and responsive to sodium bicarbonate (Fig. 3).
- Admission labs presented in Table 1.
- Patient became hypoxic and hypotensive requiring intubation, vasopressors, and continuous veno-venous hemodialysis (CVVHD) for anuric renal failure. A CT scan showed multiple loops of dilated small bowel and possible pneumatosis with negative exploratory surgery on day 1.
- On day 5 he had peritonitis prompting the resection of the ischemic terminal ileum and cecum.
- Over the next 3 weeks he developed recurrent GI hemorrhages unrelated to surgery, remained anuric on CVVHD and ventilator dependent.

### Case 2

- 48 year-old-man landscaper presented with encephalopathy, nausea and vomiting after ingesting 250-350 mL of a concentrated glyphosate herbicide.
- Initial ECG QRS was 192 ms responsive to sodium bicarbonate with a wide complex rhythm and bradycardia (Fig. 4).
- Admission labs presented in Table 1.
- Persistent hyperkalemia continued despite medical treatment and resolved only after 3 hours of hemodialysis (HD). He required ventilatory support for hypoxia and had a negative EGD.

## Figures and Tables

Fig. 1

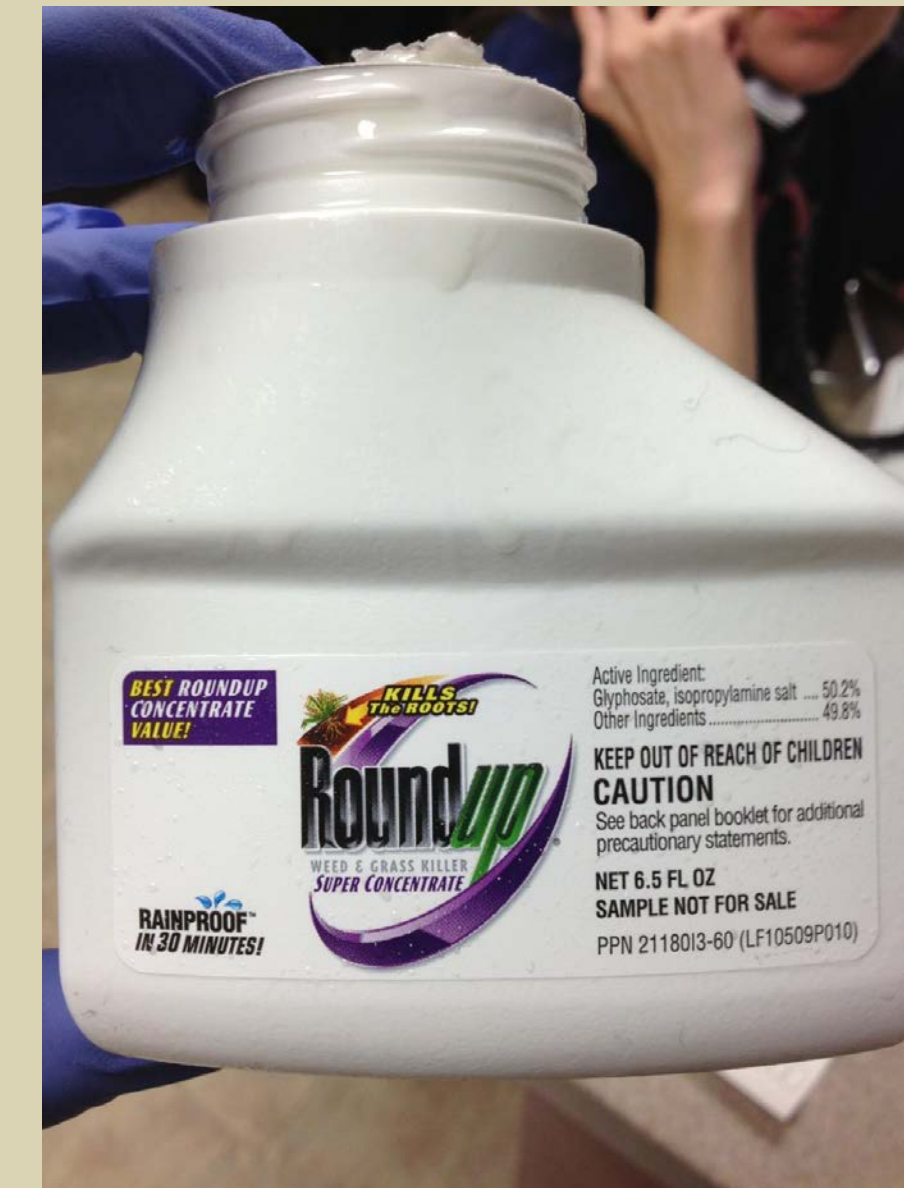


Fig. 2

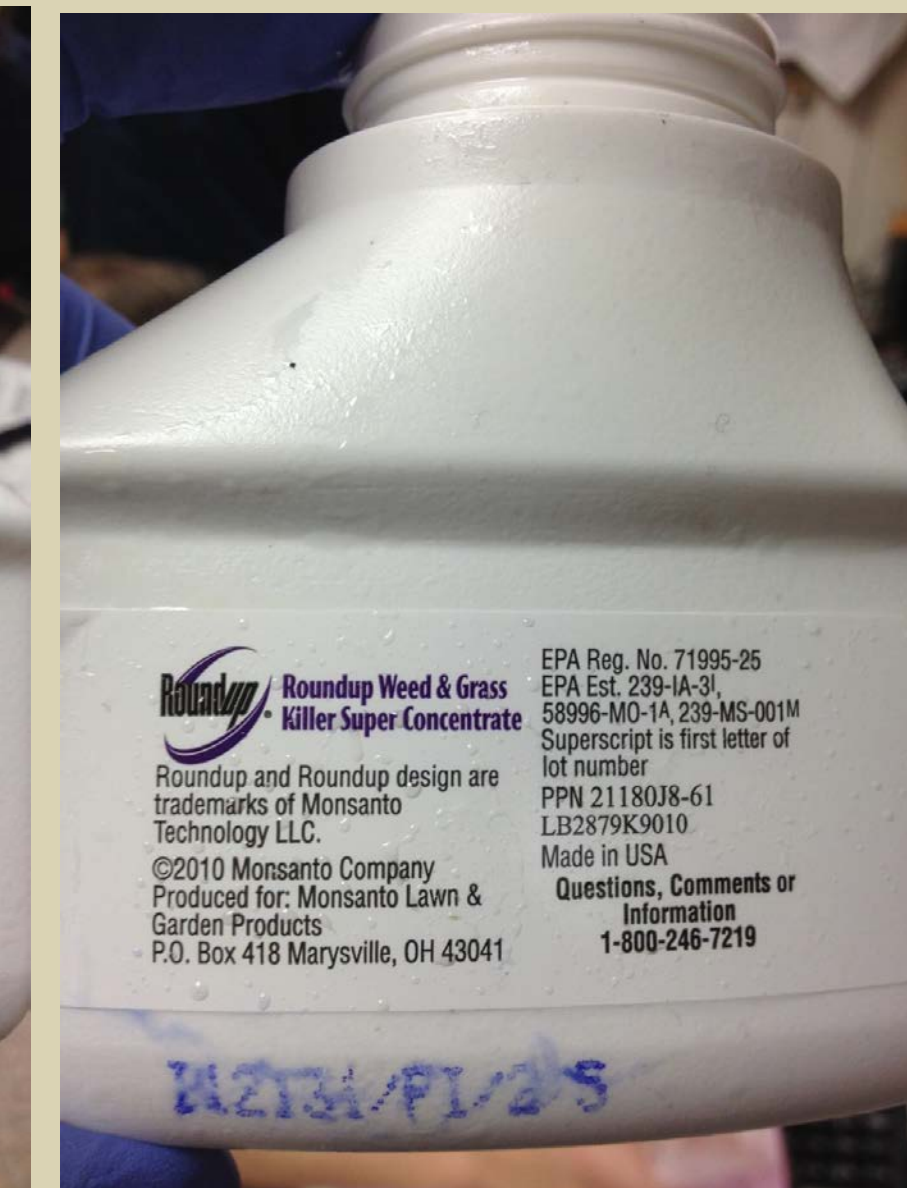


Fig. 3

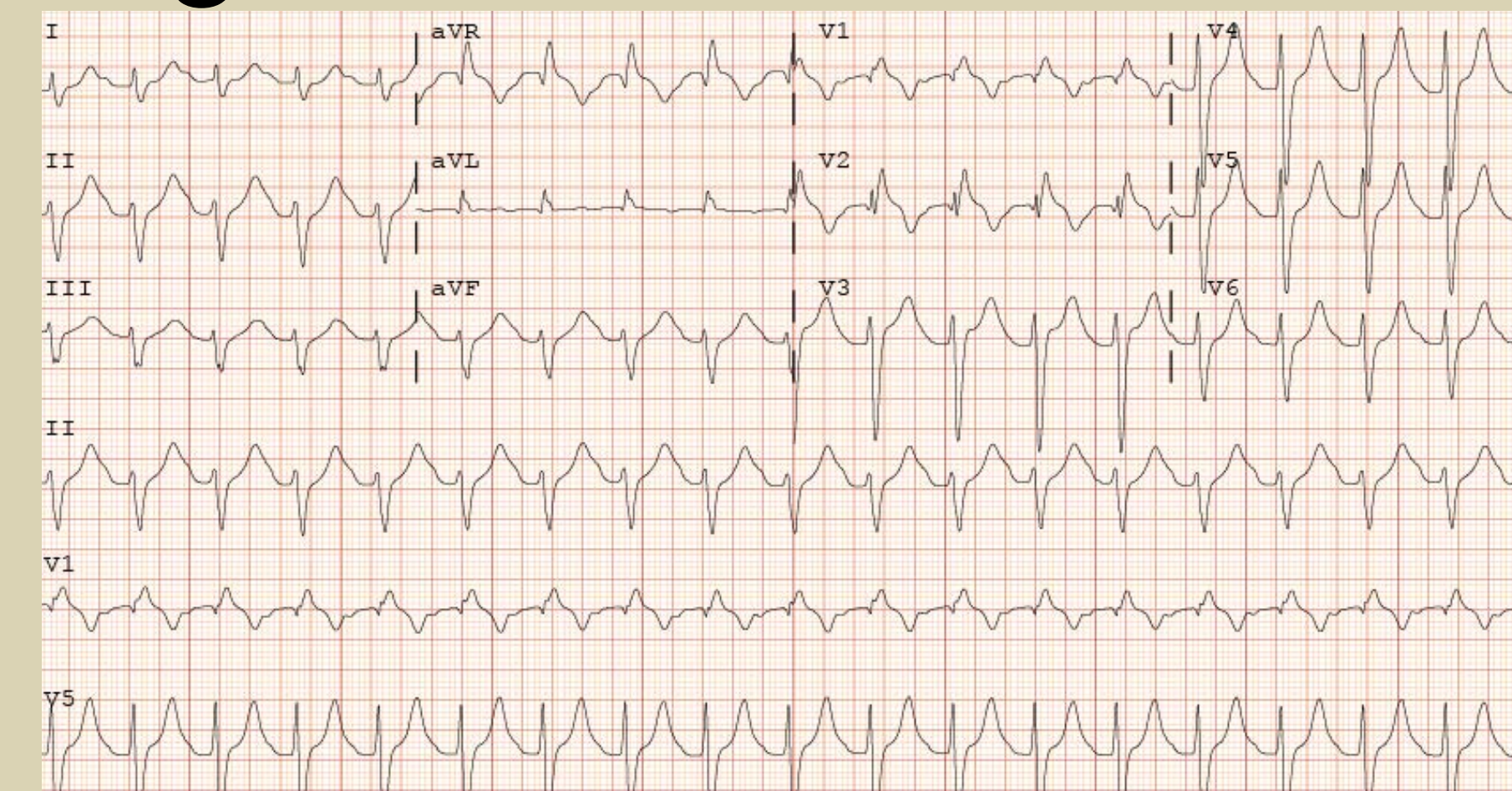
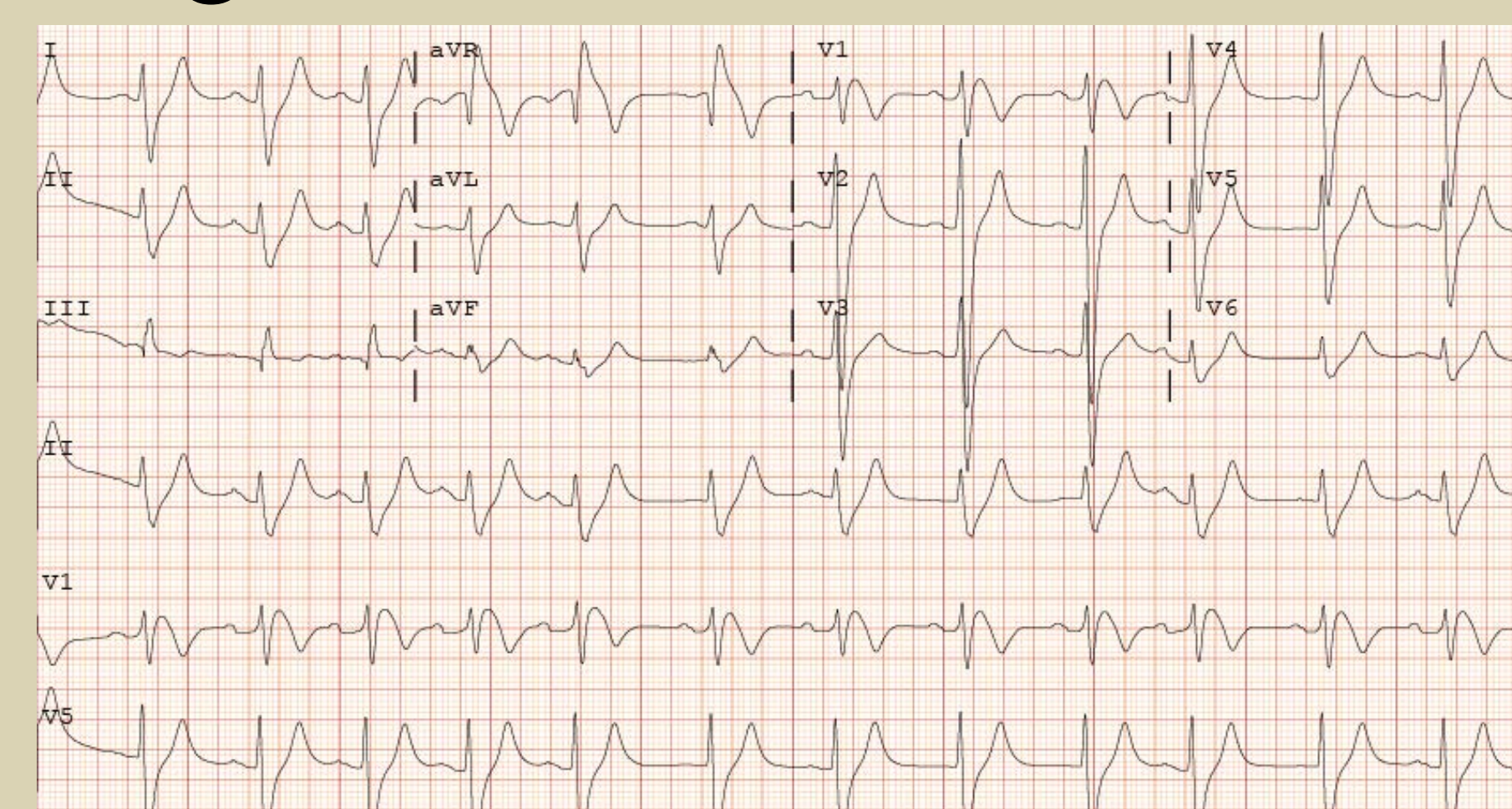


Fig. 4



## Admission Labs

	Case 1	Case 2
White blood count (K/mm <sup>3</sup> )	41.5	13.7
Hemoglobin (g/dL)	17.7	19
Glucose (g/dL)	225	129
Blood Urea Nitrogen (mg/dL)	23	14
Creatinine (mg/dL)	2.8	1.1 (baseline 0.6)
Sodium (mmol/L)	137	137
Potassium (mmol/L)	4.5	7.1
Chloride (mmol/L)	90	104
Calcium (mg/dL)	10.4	11.4
CO <sub>2</sub> (mmol/L)	12	14
Anion gap metabolic acidosis	40	10
Lactate (mmol/L)	9.2	0.7
ALT (IU/L)	38	91
AST (IU/L)	26	39

## Discussion

- Case 1 and 2 developed encephalopathy, renal failure, mechanical ventilation and a prolonged QRS.
- Differences consisted of anuric renal failure, high anion gap metabolic acidosis, ischemic bowel and vasopressor support in case 1.
- We suspect case 2 ingested a potassium salt preparation due to the persistent hyperkalemia that only resolved with HD in comparison to case 1 who ingested an isopropylamine salt. The exact formulation was not identified.
- Other potential differences that affected morbidity and outcome could have been the amount ingested, concentration and formulation.
- The prolonged QRS was responsive to sodium bicarbonate in both cases.
- It is unclear whether glyphosate or the surfactant results in QRS prolongation in overdose.
- Supportive care is the mainstay of treatment.

## Conclusions

Glyphosate containing herbicides may have diverse clinical toxicity depending on surfactant, concentration and salt preparation.

