What propylene glycol exposure is and where it is present

Propylene glycol is a dissolving agent and delivery agent used in a number of medical and nonmedical products. In clinical settings, it is most important because it can appear in **IV medications**, especially certain sedatives and other formulations that need a liquid base. It can also be included in some **oral products** and **topical products**. Most exposures are harmless, but large or prolonged exposure can create a **toxicity** problem, especially in hospitalized patients.

This is important because propylene glycol is not just an ingredient; it is a compound that is *metabolized* by the body into other substances. Under the right circumstances, those **metabolites** can affect acid-base balance and lead to abnormal serum chemistry findings. In some patients, the clinical picture includes **high anion gap** findings, especially when the exposure is significant or renal clearance is impaired.

From a diagnostic evaluation standpoint, propylene glycol exposure is often overlooked unless the medication list is reviewed closely. That is why laboratory interpretation must be paired with clinical correlation. The product source, route of exposure, and duration all influence whether propylene glycol becomes clinically relevant.

How the anion gap is determined

The **anion gap** is a derived value used to help identify certain types of **metabolic acidosis**. It reflects the gap between measured cations and measured anions in the blood. The most common **anion gap formula** uses **serum sodium**, **serum chloride**, and **serum bicarbonate**.

A simplified version is:

anion gap = serum sodium − (serum chloride + serum bicarbonate)

An **anion gap calculator** performs this calculation and can assist clinicians and patients determine whether the result sits in a normal interval or suggests an acid-base imbalance. Because the result relies on the measured electrolyte values, even small electrolyte abnormalities can affect the number.

The anion gap is useful because unmeasured anions can accumulate in the blood during conditions such as lactic acidosis, ketoacidosis, or toxin ingestion. When interpreting the number, clinicians also consider **albumin**, since low albumin can reduce the measured gap and mask a clinically important issue. That is why the **albumin-corrected anion gap** is often more revealing than the unadjusted value.

What makes propylene glycol can increase the anion gap

Yes, propylene glycol can lead to a **high anion gap** in the setting of **propylene glycol toxicity**. The mechanism is usually secondary rather than instant. After exposure, propylene glycol is converted into acidic compounds, including **organic acids**, which can promote **high anion gap metabolic acidosis**. In addition, accounting for albumin in AG the body may develop a concurrent **lactic acidosis**, which additionally increases the gap.

Another important clue is the **osmolar gap**. Propylene glycol itself increases serum **osmolarity**, so early toxicity may present with an increased osmolar gap before the anion gap rises. As metabolism proceeds, the parent compound decreases while acidic **metabolites** build up, shifting the pattern from isolated osmolar gap elevation to a combined osmolar gap and high anion gap presentation.

This progression is why the point in time of testing matters. A patient may initially have a high osmolar gap and later show worsening acidosis, elevated lactate, and a rising anion gap. In other words, propylene glycol can be

part of a mixed laboratory pattern that evolves over time.

Common causes of elevated anion gap metabolic acidosis

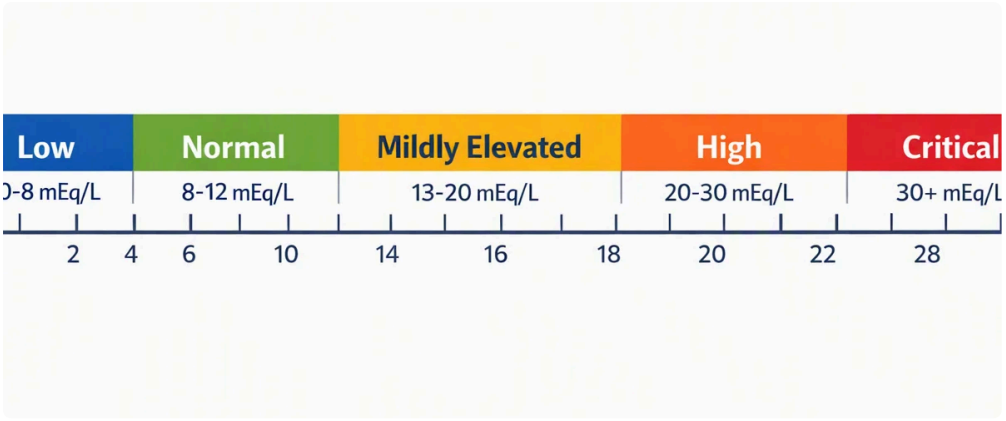
Propylene glycol remains one possible explanation of **metabolic acidosis**. A comprehensive **differential diagnosis** is essential whenever the anion gap is elevated. Common causes include **ketoacidosis**, **lactic acidosis**, **renal failure**, and ingestion of **toxic alcohols**. Any of these can create a similar lab pattern, but the underlying mechanism is different.

Ketoacidosis is often seen with diabetes, starvation, or prolonged vomiting, while lactic acidosis may occur with shock, sepsis, hypoperfusion, or certain drugs and toxins. Renal failure can raise the gap because the kidneys cannot clear acid effectively, allowing unmeasured acids to accumulate. Toxic alcohols, such as methanol or ethylene glycol, can also lead to an elevated anion gap and osmolar gap pattern.

This is why laboratory interpretation should not rely on a single number alone. The anion gap calculator can identify a worrisome result, but the final diagnosis depends on the clinical context, medication exposure, and additional testing.

Symptoms and manifestations of propylene glycol toxicity

The symptoms of **propylene glycol toxicity** can be unclear at first. Patients may present with **altered mental status**, **hypotension**, and **tachypnea** as the pH disturbance worsens. Tachypnea often suggests respiratory compensation for acidosis. Some patients may also show signs of poor perfusion or sedation, depending on the degree of exposure and the medications involved.



A rising **serum lactate** can be an key clue, especially when the clinical picture suggests an unexplained acid-base disorder. Elevated lactate does not prove propylene glycol as the cause, but it raises concern when combined with medication exposure, abnormal serum chemistry, and a high anion gap. Because the findings overlap with other illnesses, **clinical correlation** is important.

Severe cases can worsen rapidly, particularly when the patient has poor elimination or multiple risk factors. A careful review of medications, infusion history, and serial labs is often the fastest way to recognize the problem.

Lab tests used to evaluate possible toxicity

If propylene glycol contact is suspected, the workup usually includes **serum osmolality**, calculation of the **osmolar gap**, a **blood gas**, and evaluation of **renal function**. These measures help determine whether the patient has a blended toxic-metabolic presentation.

Serum osmolality is compared with the calculated osmolarity to identify an osmolar gap. An elevated gap suggests unmeasured osmotically active substances, which may include propylene glycol or other toxic alcohols. The blood gas helps define the severity of the acid-base disorder and shows whether the patient has metabolic acidosis with respiratory compensation. Renal function testing is important because reduced clearance can worsen toxicity and prolong exposure.

Further laboratory tests often include serum lactate, electrolytes, and repeat chemistry panels. Serial testing can show whether the anion gap is rising or resolving after intervention. Often, the pattern of serum chemistry abnormalities provides the strongest evidence before specialized toxin levels are available.

How to interpret an Anion Gap Calculator result

An **anion gap calculator** is valuable, but the result should carefully be interpreted in relation. To begin, determine whether the value is in the **normal range** for the lab used. Normal ranges can shift somewhat depending on the analyzer and whether potassium is included in the formula. A result that is borderline in one lab may be definitely out of range in another.

Then, evaluate the possibility of hypoalbuminemia. Since **albumin** is a major unmeasured anion, low albumin can mask a true **acidosis**. An **albumin-corrected anion gap** gives a improved estimate of the underlying acid burden when albumin is reduced. This adjustment is especially useful in critically ill patients, where albumin is often low.

Finally, ask whether the result fits the overall picture. A high anion gap with normal lactate and normal ketones may suggest a toxin, while a high gap with elevated lactate may point to tissue hypoperfusion, sepsis, or propylene glycol toxicity. Good interpretation depends on **clinical context**, not just the number.

When propylene glycol exposure becomes hazardous

Danger grows with **dose-dependent toxicity**, extended exposure, and reduced ability to remove the compound. This matters especially with some **benzodiazepines** and other **intravenous medications** that use propylene glycol as a solvent. Continuous or high-dose **infusion** can result in accumulation over time.

Renal impairment increases risk because the kidneys play a major role in removing the compound and its byproducts. If renal clearance is reduced, propylene glycol and its metabolites may collect, contributing to osmolar gap elevation, lactic acidosis, and high anion gap metabolic acidosis.

The risk is greatest when multiple factors stack together: high medication dose, prolonged infusion, critical illness, dehydration, and impaired kidney function. In that setting, monitoring should be closer and clinicians should stay highly alert for toxicity.

Treatment and management of suspected propylene glycol toxicity

The first step in management is **discontinuation** of the suspected source. Discontinuing the offending medication or exposure can stop additional buildup. Depending on the severity of the case, the patient may also need **supportive care**, including fluid resuscitation, correction of electrolyte abnormalities, and treatment of acidosis.

Monitoring is essential after the exposure is stopped. Serial serum chemistry testing, blood gas assessment, serum lactate, and renal function checks help show whether the acid-base disorder is improving. If the patient has severe symptoms, rapidly worsening acidosis, or significant renal dysfunction, more aggressive treatment may be needed.

Hemodialysis can be considered in severe cases because it helps remove propylene glycol and correct associated metabolic derangements. It may be especially useful when there is significant acidosis, hemodynamic instability, or impaired renal clearance. The decision is based on the full clinical picture rather than the anion gap alone.

When to seek prompt medical evaluation

Prompt evaluation is warranted if there are **emergency symptoms** such as worsening confusion, marked weakness, respiratory distress, collapse, or evidence of shock. A patient with suspected **toxic exposure** and a suddenly worsening condition should not wait for regular follow-up.

Alarm signs include **severe acidosis**, extremely low bicarbonate, sustained hypotension, or rapidly increasing lactate. These findings may signal a dangerous acid-base disorder that needs urgent treatment. If propylene glycol exposure is possible, a prompt **medical assessment** can identify whether the patient needs hospital monitoring, medication changes, or hemodialysis.

Because the condition can overlap with other causes of high anion gap metabolic acidosis, clinicians should evaluate the full clinical picture early. Early review of medication exposure, serum osmolality, blood gas results, and renal function can prevent delays in care.

Frequently asked questions about propylene glycol and the anion gap

Can propylene glycol cause a high anion gap?

It can. Propylene glycol can cause a **high anion gap**, especially when exposure is marked or prolonged. It may first raise the **osmolar gap** and then, as it is metabolized into acidic **metabolites**, contribute to **high anion gap metabolic acidosis** and **lactic acidosis**.

What is the difference between an anion gap and an osmolar gap?

The **anion gap** represents unmeasured charged particles and helps detect causes of **metabolic acidosis**. The **osmolar gap** represents the difference between measured and calculated **osmolarity** and suggests unmeasured dissolved substances, such as propylene glycol or other **toxic alcohols**. Both are useful, but they serve different questions.

Which medications contain propylene glycol?

Propylene glycol can be found in some **intravenous medications**, including certain **benzodiazepines**, sedatives, and other formulations that use it as a solvent. It may also appear in some **oral products** and **topical products**. The exact formulation depends on the drug and manufacturer, so the medication list should be reviewed carefully.

What signs suggest propylene glycol toxicity?

Possible symptoms include **confusion**, **low blood pressure**, **rapid breathing**, and evidence of increasing acidosis. A increasing **serum lactate** may also be noted. Since these findings are non-specific, they must be interpreted with history of exposure, lab values, and general clinical correlation.

How is propylene glycol toxicity treated?

Therapy usually starts with **discontinuation** of the source and **supportive care**. Clinicians follow the patient closely with repeat labs, including blood gas, serum chemistry, and renal function. In serious cases, **hemodialysis** may be used to eliminate the toxin and improve severe acidosis.