What propylene glycol is and where it is found

Propylene glycol is a dissolving agent and vehicle used in a number of medical and nonmedical products. In clinical environments, 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 found 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 matters 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 workup 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 computed

The **anion gap** is a computed value used to detect certain forms of **metabolic acidosis**. It shows the gap between observed cations and measured anions in the blood. The standard **anion gap formula** uses **serum sodium**, **serum chloride**, and **serum bicarbonate**.

A streamlined version is:

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

An **anion gap calculator** automates this calculation and can assist clinicians and patients determine whether the result falls in a normal range or indicates an acid-base imbalance. Because the result relies on the measured electrolyte values, even small electrolyte changes can alter the number.

The anion gap is useful because unmeasured anions can build up 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 abnormality. That is why the **albumin-corrected anion gap** is often more revealing than the unadjusted result.

Why propylene glycol can elevate the anion gap

Indeed, propylene glycol can result in a **high anion gap** in the setting of **propylene glycol toxicity**. The mechanism is usually secondary rather than immediate. After exposure, propylene glycol is broken down into acidic compounds, including **organic acids**, which can promote **high anion gap metabolic acidosis**. In addition, 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 high osmolar gap before the anion gap rises. As metabolism advances, the parent compound falls while acidic **metabolites** accumulate, shifting the pattern from isolated osmolar gap elevation to a combined osmolar gap and high anion gap presentation.

This progression is why the timing of testing matters. A patient may initially have a high osmolar gap and later show progressive acidosis, elevated lactate, and a rising anion gap. In other words, propylene glycol can be part of a combined laboratory pattern that develops over time.

Typical causes of increased anion gap metabolic acidosis

Propylene glycol is only one possible cause of **metabolic acidosis**. A wide **differential diagnosis** is essential whenever the anion gap is elevated. Typical causes include **ketoacidosis**, **lactic acidosis**, **renal failure**, and use of **toxic alcohols**. Each of these can produce 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.

That is why laboratory interpretation should never rely on a single number alone. The anion gap calculator can identify a concerning result, but the final diagnosis depends on the clinical context, medication exposure, and additional testing.

Signs and manifestations of propylene glycol toxicity

The clinical signs of **propylene glycol toxicity** can be unclear at first. Patients may develop **altered mental status**, **hypotension**, and **tachypnea** as the acid-base disturbance worsens. Tachypnea often indicates respiratory compensation for acidosis. Some patients may also show signs of poor perfusion or sedation, depending on the degree of exposure and the drugs involved.

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

Severe cases can deteriorate fast, particularly when the patient has impaired clearance or multiple risk factors. A careful review of medications, infusion history, and serial labs is often the best way to recognize the problem.

Lab tests used to evaluate possible toxicity

When propylene glycol contact is suspected, the workup usually includes **serum osmolality**, determination of the **osmolar gap**, a **blood gas**, and assessment of **renal function**. These studies help determine whether the patient has a mixed toxic and metabolic picture.

Serum osmolality is compared with the calculated osmolarity to identify an osmolar gap. A widened 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. In many cases, the pattern of serum chemistry abnormalities provides the strongest evidence before specialized toxin levels are available.

How to read an Anion Gap Calculator result

An **anion gap calculator** is useful, but the result should always be interpreted in relation. First, check whether the value is in the **normal range** for the laboratory used. Normal ranges can shift somewhat depending on the analyzer and whether potassium is included in the formula. A reading that is borderline in one lab may be obviously abnormal in another.

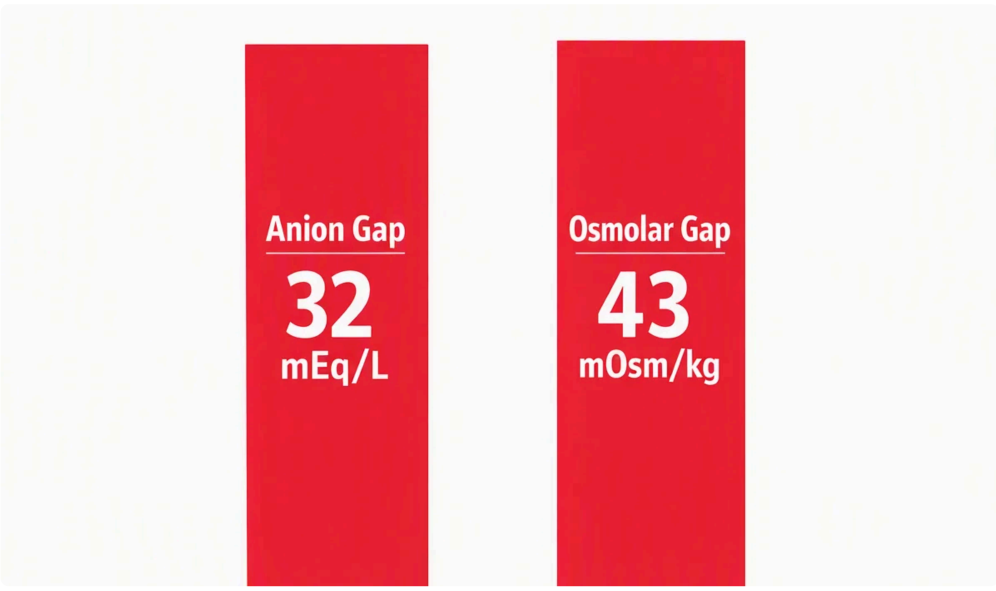
Then, evaluate the possibility of hypoalbuminemia. Because **albumin** is a major unmeasured anion, low albumin can mask a true **acidosis**. An **albumin-corrected anion gap** gives a better estimate of the underlying acid burden when albumin is reduced. This adjustment is most useful in critically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

Lastly, ask whether the result corresponds to the overall picture. A high anion gap with normal lactate and normal ketones may point toward 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 contact becomes dangerous

Danger increases with **dose-dependent toxicity**, extended exposure, and reduced ability to remove the compound. This is especially relevant with some **benzodiazepines** and other **intravenous medications** that include propylene glycol as a solvent. Continuous or high-dose **infusion** can cause buildup over time.

Renal impairment raises risk because the kidneys play a major role in clearing the compound and its byproducts. If renal clearance is reduced, propylene glycol and its metabolites may collect, pushing the patient toward osmolar gap elevation, lactic acidosis, and high anion gap metabolic acidosis.



Risk is highest when multiple factors come 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. Stopping the offending medication or exposure can avoid more accumulation. 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 resolving. 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 progressive confusion, marked weakness, trouble breathing, collapse, or signs of shock. A patient with suspected **toxic exposure** and a quickly using AG to monitor DKA evolving condition should not wait for regular follow-up.

Worrisome findings include **severe acidosis**, markedly low bicarbonate, persistent hypotension, or fast-rising lactate. These findings may signal a severe acid-base disorder that needs prompt treatment. If propylene glycol exposure is possible, a rapid **medical assessment** can determine whether the patient needs hospital monitoring, medication changes, or hemodialysis.

As the disorder can overlap with other causes of high anion gap metabolic acidosis, clinicians should evaluate the entire presentation 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?

Yes. 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** shows unmeasured charged particles and helps identify causes of **metabolic acidosis**. The **osmolar gap** reflects the difference between measured and calculated **osmolarity** and suggests unmeasured dissolved substances, such as propylene glycol or other **toxic alcohols**. Both are important, 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 checked carefully.

What indications suggest propylene glycol toxicity?

Potential signs include **changes in consciousness**, **low blood pressure**, **tachypnea**, and signs of increasing acidosis. A rising **serum lactate** may also be present. Because these findings are not specific, they must be interpreted with exposure history, lab results, and total clinical correlation.

How is propylene glycol toxicity treated?

Treatment 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 clear the toxin and improve severe acidosis.