

Hyperemesis Gravidarum

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THE STORY IN ONE SENTENCE

The mom throws up so much during pregnancy that she loses weight and her body chemistry goes haywire.

“Hyperemesis gravidarum is extreme pregnancy vomiting — so bad the mom can't keep food or water down, loses over 5% of her weight, and runs dangerously low on salts and fluid.”

Normal anatomy — the body's job

In a healthy early pregnancy, the placenta (the disk of tissue linking mom and baby) makes hCG (human chorionic gonadotropin) and estrogen to help the baby grow and the uterus stay thick and nourished. These hormones peak around 9 to 12 weeks, then drop. They also tickle the brainstem's vomiting center — a tiny cluster of nerve cells in the medulla (the lowest part of the brain, right above the spinal cord) — causing mild nausea or occasional vomiting in about 70 to 80% of pregnant people. That's normal morning sickness, and it usually fades by 14 to 16 weeks as hormone levels settle.

BODY'S JOB

The placenta's job is to pump hCG into the blood so the ovary keeps making progesterone (the hormone that keeps the uterine lining thick and prevents miscarriage). Estrogen helps blood vessels grow in the uterus. Both hormones also signal the brainstem's chemoreceptor trigger zone (CTZ) and the vomiting center, which normally protect the body by making you throw up if you eat something toxic. During pregnancy, this system is extra-sensitive to keep the mom cautious about food, but it only causes mild queasiness in most women.

1. Placenta forms and starts making hCG and estrogen → hormones rise fast in the first trimester.
2. hCG and estrogen travel through the blood → reach the brainstem (medulla), where the chemoreceptor trigger zone and vomiting center sit.

3. These brain centers get the hormone signal → send mild nausea messages, causing occasional queasiness or vomiting (morning sickness).
4. By 12 to 14 weeks, hCG peaks and starts dropping → nausea fades and appetite returns.
5. Mom eats normally, stays hydrated, gains weight, and the baby grows steadily.

What breaks

In hyperemesis gravidarum, the mom's brainstem vomiting center reacts way too hard to pregnancy hormones — like an alarm that won't turn off — so she vomits constantly and can't keep food or water down.

CLINICAL TERM

Hyperemesis gravidarum is thought to result from abnormally high or prolonged hCG and estrogen stimulation of the medullary chemoreceptor trigger zone (CTZ) and vomiting center, compounded by placental GDF15 (growth differentiation factor 15) signaling and altered serotonin and dopamine regulation in the brainstem. Risk factors include multiple gestation (twins or triplets raise hCG even higher), molar pregnancy (abnormal placenta making extreme hCG), first pregnancy, history of hyperemesis, and possibly genetic susceptibility (family history, variations in genes for nausea receptors like GDF15 receptor GFRAL). The result is intractable vomiting (often 5+ times per day), inability to tolerate oral intake for days to weeks, and rapid progression to dehydration, electrolyte depletion (hypokalemia, low sodium (hyponatremia), hypochloremia), metabolic alkalosis (the blood turning too alkaline) (from losing stomach acid), ketonuria and ketonemia (from starvation ketosis), and weight loss greater than 5% of pre-pregnancy body weight.

How the body compensates

The body tries to protect the brain and heart by shifting fluid, hoarding salt, and burning fat — so vital signs can look okay for a while even as the mom is crashing inside. The danger is missing the tipping point where compensation fails and the brain or heart suddenly gives out.

1. {'what': 'Blood pressure stays normal at first (even though fluid is low)', 'why': 'The kidneys release renin, which makes angiotensin and aldosterone (hormones that squeeze blood vessels and hold onto sodium and water), keeping blood pressure steady despite dehydration. But this only works until fluid loss is extreme — then pressure crashes suddenly.'}
2. {'what': 'Heart rate rises (tachycardia)', 'why': 'The heart beats faster to pump what little blood volume is left around the body, trying to keep oxygen delivery normal. A resting pulse over 100 is a red flag that compensation is working hard.'}

3. {'what': 'Body burns fat, making ketones', 'why': 'With no food coming in, the liver breaks down fat into ketones (acetoacetate, beta-hydroxybutyrate) to fuel the brain and heart. Ketonuria (ketones in urine) and ketonemia (ketones in blood) tell you the mom is in starvation mode — her body is eating itself to survive.'}
4. {'what': 'Kidneys waste potassium to try to fix too little acid in the blood (alkalosis)', 'why': 'When stomach acid is lost through vomiting, the blood becomes too alkaline (metabolic too little acid in the blood (alkalosis)). The kidneys dump bicarbonate into the urine to bring pH down, but to do that they also have to throw away potassium. So potassium drops dangerously low (hypokalemia), risking fatal heart arrhythmias.'}
5. {'what': 'Mom feels weak, dizzy, and can't think straight', 'why': 'Low potassium makes muscles weak (including the heart). Dehydration drops blood flow to the brain, causing dizziness and confusion. Ketones and low thiamine poison brain cells, worsening confusion and setting the stage for Wernicke encephalopathy.'}
6. {'what': 'The crash point: Wernicke encephalopathy, cardiac arrhythmia, or fetal distress', 'why': 'Once thiamine runs out, giving IV glucose without replacing thiamine first will kill brain cells in the thalamus and mammillary bodies within hours, causing confusion, eye paralysis, loss of coordination (ataxia) (wobbly walk), and possibly permanent memory loss or coma. If potassium drops below 2.5 mEq/L, the heart can develop torsades de pointes (a twisting, deadly rhythm). If the mom stays dehydrated and starving, the placenta can't nourish the baby, risking fetal growth restriction or loss. These are the cliffs — once you tip over, recovery is much harder or impossible.'}
7. {'what': 'Watch the trend, not the snapshot', 'why': 'A mom whose weight keeps dropping, ketones keep rising, and potassium keeps falling — even if her blood pressure is normal today — is on a downhill slide. The body's compensation buys time, but it doesn't fix the problem. Intervene early (IV fluids, antiemetics, thiamine) before the crash, because once Wernicke or arrhythmia hits, the damage is often permanent.'}

Domino effect

1. Pregnancy hormones (hCG, estrogen, placental GDF15) overstimulate the brainstem vomiting center (medulla) — The placenta pumps out hCG and estrogen to support the pregnancy, and also makes GDF15, a protein that signals the brainstem's chemoreceptor trigger zone and vomiting center. In hyperemesis, these signals are way too strong — like a smoke alarm screaming nonstop — so the brain tells the stomach and diaphragm to vomit over and over, even when there's no real danger.
2. Mom vomits constantly (often 5 to 20+ times per day) and cannot keep food or water down — Because the brainstem vomiting center won't quiet down, every attempt to eat or drink triggers more vomiting. The stomach stays empty, and the body gets no calories, no water, and no salts.

3. Dehydration sets in: blood volume drops (hypovolemia), heart rate rises, mom feels dizzy and weak — Each vomit empties the stomach of water, sodium, potassium, and chloride. After days of this, the blood runs low on fluid (hypovolemia), so less blood reaches the brain and muscles. The heart beats faster (tachycardia) trying to push what little blood is left around the body. The kidneys hoard sodium and water, but that only works for a while.
4. Electrolytes crash: low potassium (hypokalemia), low sodium (hyponatremia), low chloride (hypochloremia), blood too alkaline (metabolic too little acid in the blood (alkalosis)) — Stomach acid (HCl) is made of hydrogen and chloride. Vomiting dumps that acid out, so the blood loses chloride and hydrogen ions, making it too alkaline (high pH, high bicarbonate). The kidneys try to fix the too little acid in the blood (alkalosis) by dumping bicarbonate into the urine — but to do that, they also throw away potassium. Meanwhile, dehydration and aldosterone (the salt-hoarding hormone) make the kidneys waste even more potassium. Low potassium makes muscles weak and the heart beat irregularly; low sodium makes the brain swell and function poorly.
5. Body switches to burning fat: ketones appear in blood and urine (ketonemia, ketonuria), mom loses more than 5% of her weight — With no food coming in, the liver runs out of glucose (blood sugar) and starts breaking down fat for energy. This makes ketones (acetoacetate and beta-hydroxybutyrate), which are acids that pile up in the blood and spill into urine. Ketones are a distress signal: the body is eating its own fat and muscle to survive. Weight drops fast — losing more than 5% of pre-pregnancy weight is the clinical cutoff for severe hyperemesis.
6. Thiamine (vitamin B1) stores run out; if IV glucose is given without thiamine, brain cells die → Wernicke encephalopathy (confusion, eye paralysis, loss of coordination (ataxia), coma) — Thiamine is the key vitamin brain cells need to turn glucose into energy. Days of vomiting and starvation deplete the body's small thiamine reserve. If a well-meaning team gives IV dextrose (sugar water) to 'feed' the mom, her brain tries to use that glucose, burns through the last bit of thiamine instantly, and brain cells — especially in the thalamus (the brain's relay station) and mammillary bodies (memory centers) — run out of fuel and die. This causes Wernicke encephalopathy: confusion, wobbly walk (ataxia), paralyzed eye muscles (ophthalmoplegia), and sometimes coma. It can be permanent if not caught immediately. The rule: always give IV thiamine BEFORE any glucose.
7. Repeated hard vomiting tears the esophagus (Mallory-Weiss tear) → vomiting blood (hematemesis), worsening anemia and fluid loss — The esophagus (food tube) has a delicate lining. Forceful, repeated vomiting spikes pressure inside it, tearing the mucosa (inner layer), usually near the stomach junction. Blood vessels in the tear bleed, so the mom vomits bright red or coffee-ground blood. This adds blood loss and iron-deficiency anemia on top of dehydration, making her even weaker.

8. If the cycle isn't broken, the final dominoes fall: fatal heart arrhythmia (from low potassium), permanent brain damage (from Wernicke), fetal growth restriction or loss (from mom's starvation and dehydration) — Every one of these problems — dehydration, low potassium, low sodium, ketones, thiamine depletion — is the body's emergency response trying to keep the brain and heart alive. But compensation has limits. Once potassium drops below 2.5 mEq/L, the heart can develop torsades de pointes (a twisting, deadly rhythm). Once thiamine is gone and glucose floods in, brain cells die within hours. And if the mom stays starving and dehydrated, the placenta can't deliver enough oxygen and nutrients to the baby, risking growth restriction or pregnancy loss. The key is recognizing the pattern early — intractable vomiting plus weight loss plus ketonuria plus low potassium equals hyperemesis gravidarum — and intervening with IV fluids, thiamine (100 mg IV before any glucose), potassium and electrolyte repletion, and antiemetics (ondansetron, metoclopramide, or promethazine) to stop the vomiting and break the cycle before any domino crashes.

Symptoms · what the patient feels, and why

- Severe nausea and vomiting that won't stop (far worse than typical morning sickness): The hormone hCG (human chorionic gonadotropin, made by the growing placenta) spikes during early pregnancy and triggers the area postrema (the brain's vomiting center in the brainstem); in hyperemesis, the signal is extra strong and unrelenting, so the nausea-vomit cycle never lets up
- Not enough water in the body (dehydration) — dry mouth, dizziness, dark urine, feeling very weak: Relentless vomiting dumps out fluid and the body can't take in enough liquid to replace it, so blood volume drops and tissues dry out like a sponge left in the sun
- Ketones in the urine (ketonuria): Because vomiting blocks food from staying down, the body runs out of sugar for fuel and starts burning its own fat instead; burning fat makes chemicals called ketones that spill into the urine—a sign the body is starving
- Body salts out of balance (electrolyte imbalance) — low potassium, low sodium, or low chloride in the blood: Vomit carries away the body's key salts (potassium, sodium, chloride); without them nerves and muscles can't fire properly, the heart's rhythm can turn dangerous, and the brain can get foggy
- Weight loss — dropping more than 5 percent of body weight from before pregnancy: The body can't hold down calories, so it taps into stored energy (fat and muscle); steady weight loss signals the body is starving despite being pregnant and needing extra fuel for the baby
- Fast heart rate (tachycardia) and low blood pressure: Dehydration shrinks the blood volume like a half-empty water tank, so the heart pumps faster to try to deliver oxygen to all the tissues; blood pressure drops because there's less fluid pushing through the vessels

- Very tired and weak, trouble standing or walking: Muscles need steady sugar and electrolytes to contract; when both are depleted by vomiting, muscles feel heavy like dead weight and the brain struggles to stay alert
- Increased saliva (ptyalism): The same hormone surges and nerve signals that trigger nausea can also rev up the salivary glands, making the mouth fill with extra spit that can worsen the urge to vomit

Focused exam

- Dry mucous membranes and poor skin turgor: When the mom throws up over and over, her body loses so much water that the tissues dry out. Dry lips and mouth, plus skin that stays tented instead of snapping back when you pinch it, tell you she is severely dehydrated and needs IV fluids right away.
- Weight loss more than 5 percent from pre-pregnancy weight: Losing more than 5 percent of body weight means the mom is starving because she cannot keep food down. Her body is breaking down its own muscle and fat for fuel, and the baby may not be getting the nutrients it needs to grow.
- Rapid heart rate (tachycardia, usually above 100 beats per minute): When vomiting drains fluid from the body, there is less blood for the heart to pump. The heart speeds up to try to push what little blood is left around fast enough to deliver oxygen to the brain, muscles, and baby.
- Low blood pressure (systolic below 90 mmHg or dropping when standing): Not enough fluid in the blood vessels means the pressure drops. Low blood pressure can make the mom dizzy or pass out, and it means the baby and her organs are not getting steady blood flow.
- Ketonuria (ketones in the urine): When the mom cannot eat, her body runs out of sugar and starts burning fat for energy. Burning fat makes waste chemicals called ketones that spill into the urine. Finding ketones proves her body is in starvation mode.
- Pale, tired appearance and weakness: Dehydration and starvation drain energy from every cell. Pale skin and severe fatigue show the body is struggling to keep up basic functions, and the mom needs immediate help to restore fluids and nutrition.

Diagnostics · every test answers a question

- Basic metabolic panel (BMP or Chem-7) → Are the body's electrolytes (sodium, potassium, chloride, bicarbonate) and kidney function normal, or has vomiting washed them away?
- Urinalysis with ketones → Is the mom's body burning fat for fuel because she cannot eat?
- Thyroid-stimulating hormone (TSH) and free T4 → Is the thyroid acting up and making the vomiting worse, or is this just a normal hormone response to pregnancy?

- Complete blood count (CBC) → Is the blood too thick from dehydration, or is there anemia from poor nutrition?
- Liver function tests (AST, ALT, bilirubin) → Has severe vomiting and dehydration started to damage the liver?
- Ultrasound of the uterus → Is the pregnancy normal (one baby), or is there a molar pregnancy or twins that could explain why the hormone levels and vomiting are so severe?

Treatment logic

- Thiamine 100 mg IV or IM before giving any dextrose → Thiamine (vitamin B1) is the key that lets brain cells safely burn sugar for energy. Giving thiamine first protects the brain from Wernicke encephalopathy, a type of brain damage that can happen when a starving body suddenly gets sugar without enough thiamine to handle it.
- IV fluids (normal saline or lactated Ringer solution) with dextrose added after thiamine is given → IV fluids restore the water and salt balance in the blood, bringing sodium, potassium, and chloride back to safe levels so the heart, nerves, and muscles work correctly again. Dextrose (sugar) gives the body fuel so it stops burning fat and making ketones.
- Pyridoxine (vitamin B6) 10 to 25 mg three to four times daily plus doxylamine 12.5 mg three to four times daily → This combination is the safest first choice for nausea in pregnancy. Pyridoxine and doxylamine work together to calm the vomiting center in the medulla (the base of the brainstem that controls nausea), letting the mom keep food and liquids down.
- Ondansetron 4 to 8 mg IV or by mouth every 8 hours if pyridoxine-doxylamine is not enough → Ondansetron blocks serotonin receptors (5-HT₃ receptors — docking sites for serotonin, a brain messenger that triggers nausea) in the vomiting center and gut, stopping the nausea signal before it triggers vomiting. This lets the mom eat and drink without throwing up.
- Metoclopramide 10 mg IV or by mouth every 6 to 8 hours if ondansetron fails or is not safe → Metoclopramide speeds up stomach emptying and blocks dopamine receptors (docking sites for dopamine, a brain messenger) in the chemoreceptor trigger zone (the brain's nausea alarm in the medulla), cutting nausea and helping food move through the gut faster.
- Correct electrolytes — add potassium chloride and sodium chloride to IV fluids as needed to bring levels back to normal → Replacing potassium (goal above 3.5 mmol/L), sodium (goal 135 to 145 mmol/L), and chloride (goal 98 to 106 mmol/L) restores normal nerve signals and heart rhythm, stopping muscle weakness, cramps, and dangerous irregular heartbeats.

- Enteral nutrition by nasogastric or nasojejunal tube, or total parenteral nutrition (TPN) through a central IV line, if vomiting continues and weight loss goes on for more than one week despite treatment → Tube feeding or IV nutrition bypasses the stomach and vomiting reflex entirely, delivering calories, protein, vitamins, and minerals directly into the gut or bloodstream so the mom and baby get the fuel they need to survive and grow.

Medications

Thiamine (vitamin B1) · Vitamin supplement

Thiamine is a vitamin that every cell needs to turn sugar into energy, like fuel for a car. When you vomit so much that you cannot eat for days, your body's thiamine stores run out. If doctors then give you IV fluids with sugar (dextrose) before replacing thiamine, your brain cells try to burn that sugar and use up the last bit of thiamine left — and then they die. This causes permanent brain damage called Wernicke encephalopathy. Giving thiamine BEFORE or WITH the first sugar-containing IV prevents this disaster.

1. Thiamine enters cells and is changed into thiamine pyrophosphate, a helper molecule.
2. This helper lets enzymes break down glucose (sugar) step by step to make ATP, the cell's energy currency.
3. Brain cells get the fuel they need and survive, even when the body is starving.

SAFETY WATCH

Very safe; serious allergic reactions are extremely rare. · Always give BEFORE or WITH the first IV fluid that contains dextrose (sugar) — never after. · Standard dose: 100 mg by IV or IM (muscle injection) once daily. · Critical in any patient who has vomited for days and not eaten — do not skip this step.

Intravenous fluids (normal saline or lactated Ringer's solution) · Fluid and electrolyte replacement

When you vomit many times a day, you lose water and salts (sodium, potassium, chloride) faster than you can drink them back. Your blood volume drops, like a car running low on coolant. Your heart beats faster to try to keep up, your blood pressure falls, and your kidneys cannot filter waste. IV fluids pour water and salts directly into your veins to refill your blood vessels, rehydrate every cell, and restore normal blood flow so your kidneys and heart can work again.

1. Fluid enters the vein and raises blood volume right away.
2. Blood pressure stabilizes and the heart slows to a normal rate.
3. Kidneys receive enough blood flow to filter waste and adjust salt and acid levels.

4. Water moves from blood into cells and tissues, ending dehydration.

SAFETY WATCH

Give thiamine FIRST if the patient has vomited for days and not eaten — prevents Wernicke encephalopathy when dextrose-containing fluid is given. · Watch for fluid overload (swelling, shortness of breath, lung crackles) if fluids are given too fast or in very large amounts, especially in patients with heart or kidney disease. · Check blood levels of potassium, sodium, chloride, and bicarbonate and adjust the type of IV fluid if needed. · Typical initial rate: 1–2 liters over the first few hours, then adjust based on hydration status and lab results.

Pyridoxine (vitamin B6) plus doxylamine · Vitamin and antihistamine combination (first-line antiemetic in pregnancy)

Pyridoxine (vitamin B6) helps brain cells make serotonin (a brain messenger that steadies mood and the gut) and GABA (the brain's main calming signal). These messengers quiet the vomiting center in the brainstem. Doxylamine is an antihistamine that blocks histamine H1 receptors (histamine is a wake-up and nausea alarm) in the vomiting center and the chemoreceptor trigger zone. Together they turn down the nausea signals and help the stomach settle.

1. Pyridoxine enters cells and helps enzymes make serotonin and GABA, which calm overactive nausea pathways.
2. Doxylamine blocks H1 histamine receptors, stopping histamine from turning on nausea signals.
3. The vomiting center receives fewer alarm signals, and the urge to vomit drops.

SAFETY WATCH

Considered very safe in pregnancy; recommended as FIRST CHOICE by ACOG (American College of Obstetricians and Gynecologists) and other pregnancy guidelines. · Doxylamine causes drowsiness — warn patients not to drive or use machinery until they know how it affects them. · Available as a combination pill (Diclegis or Bonjesta in the U.S.) or can be given as separate over-the-counter tablets. · Typical dose: pyridoxine 10–25 mg plus doxylamine 12.5 mg, taken up to four times daily (often at bedtime and upon waking). · Start here before moving to stronger antiemetics.

Promethazine · Antihistamine and dopamine blocker (phenothiazine antiemetic)

Promethazine blocks two types of alarm signals that trigger vomiting. It blocks histamine H1 receptors (histamine is a wake-up and nausea messenger) and dopamine D2 receptors

(dopamine is another nausea trigger) in the brainstem's vomiting center and chemoreceptor trigger zone. By plugging both receptors, it turns down the volume on the nausea alarm and stops the brain from sending the vomit signal.

1. Promethazine enters the brainstem and binds to H1 histamine receptors, blocking histamine from activating nausea pathways.
2. It also blocks D2 dopamine receptors in the CTZ, stopping dopamine from triggering the vomiting reflex.
3. With both alarm signals blocked, nausea and vomiting decrease.

SAFETY WATCH

Causes drowsiness; patients should not drive or operate machinery. · Can cause dry mouth, blurred vision, and constipation (because it also blocks acetylcholine receptors). · Rarely causes dystonia (sudden painful muscle spasms, especially of the face, neck, or back) or restlessness (akathisia). · NEVER give by fast IV push — can cause severe tissue damage and vein injury. Give slowly over several minutes or by IM injection. · Safe in pregnancy when used short-term; used if pyridoxine-doxylamine does not work. · Typical dose: 12.5–25 mg by mouth, IV (slow), or IM every 4–6 hours as needed.

Metoclopramide · Dopamine blocker and prokinetic agent

Metoclopramide works in two places. In the brainstem, it blocks dopamine D2 receptors in the chemoreceptor trigger zone, stopping dopamine from turning on the vomiting reflex. In the stomach and upper gut, it also blocks dopamine receptors that normally slow stomach movement, so the stomach squeezes more strongly and empties faster. Food moves forward instead of sitting and causing nausea.

1. Metoclopramide enters the brainstem and blocks D2 dopamine receptors in the CTZ, reducing nausea signals sent to the vomiting center.
2. In the stomach, it blocks dopamine receptors that normally relax the stomach, so the stomach muscles squeeze harder and push food into the small intestine.
3. It slightly raises acetylcholine (a muscle-tightening messenger) at the lower esophageal sphincter, reducing acid reflux.

SAFETY WATCH

Can cause drowsiness, diarrhea, or restlessness. · Rarely causes dystonia (sudden muscle spasms of the face, neck, or back) — more common in young women and children. · Long-term use (months) can cause tardive dyskinesia (permanent involuntary movements of the face and tongue) — keep use SHORT. · Avoid in patients with bowel obstruction, perforation, or bleeding. · Safe in pregnancy when used short-term; ACOG considers it acceptable if first-line options fail. · Typical dose: 5–10 mg by mouth, IV, or IM every 6–8 hours. · FDA black-box warning: use the lowest effective dose for the shortest time to reduce risk of tardive dyskinesia.

Ondansetron · 5-HT₃ receptor antagonist (serotonin blocker)

Ondansetron blocks serotonin 5-HT₃ receptors in the chemoreceptor trigger zone (the brain's nausea alarm) and on vagus nerve endings in the gut. When the gut is irritated or damaged by vomiting, cells release serotonin. That serotonin floods 5-HT₃ receptors and screams 'vomit now!' to the brain. Ondansetron plugs those receptors so serotonin cannot deliver the alarm, and nausea stops.

1. Ondansetron enters the bloodstream and travels to the brainstem and gut.
2. It binds tightly to 5-HT₃ serotonin receptors, blocking them.
3. Serotonin released by irritated gut cells can no longer activate these receptors, so the alarm signal never reaches the vomiting center.
4. Nausea and the urge to vomit drop sharply.

SAFETY WATCH

Very effective, but use with CAUTION in the first trimester. Some studies suggest a small possible increase in cleft palate or heart defects (septal defects) if used before 10 weeks — ACOG and other guidelines say use only if benefit outweighs risk and after other options have failed. · Very commonly causes constipation (up to 10% of patients). · Can cause headache. · Rarely prolongs the QT interval on ECG (can lead to dangerous heart rhythms) — avoid in patients with known long QT syndrome or who take other QT-prolonging drugs. Check ECG if concerned. · Typical dose: 4–8 mg by mouth, IV, or IM every 8 hours. · Often used in severe hyperemesis after first-line and second-line options, balancing benefit and risk.

Dimenhydrinate · Antihistamine (H₁ blocker)

Dimenhydrinate is a mix of diphenhydramine (an antihistamine) and a mild stimulant. It blocks histamine H₁ receptors in the vomiting center and the vestibular system (inner ear balance

organs). Histamine is a wake-up and nausea signal; blocking it calms the nausea reflex, especially nausea triggered by motion, dizziness, or inner ear problems.

1. Dimenhydrinate enters the brain and binds to H1 histamine receptors.
2. It blocks histamine from turning on nausea and vomiting pathways.
3. Balance signals from the inner ear are dampened, reducing motion-related nausea.
4. The vomiting center becomes less sensitive, and the urge to vomit drops.

SAFETY WATCH

Causes drowsiness; patients should not drive or use machinery. · Can cause dry mouth, blurred vision, and difficulty urinating (blocks acetylcholine receptors). · Safe in pregnancy; often used for motion sickness and mild nausea in the first trimester. · Typical dose: 50–100 mg by mouth or IV every 4–6 hours as needed. · Available over the counter (Dramamine).

Methylprednisolone · Corticosteroid (synthetic glucocorticoid)

Methylprednisolone is a synthetic version of cortisol, the body's main stress and inflammation-control hormone. In severe hyperemesis, it is thought to quiet overactive immune and inflammatory signals in the gut lining and brainstem that may be ramped up by pregnancy hormones (like hCG and estrogen). By damping down inflammation and immune activity, nausea and vomiting can decrease. The exact way it works in hyperemesis is not fully understood, but steroids turn down many nausea-causing pathways.

1. Methylprednisolone enters cells and binds to glucocorticoid receptors in the cell nucleus.
2. It turns down genes that make inflammatory molecules (cytokines like IL-1, IL-6, TNF; and prostaglandins).
3. Inflammation and immune overactivity in the gut and brain decrease.
4. Nausea and vomiting lessen, usually within 2–3 days.

SAFETY WATCH

Reserved for SEVERE hyperemesis that has NOT responded to multiple other antiemetics and IV fluids. · Do NOT use in the FIRST trimester (before 10 weeks) — small risk of oral clefts if used before 10 weeks. Use only AFTER 10 weeks. · Can raise blood sugar (monitor glucose, especially if diabetic), increase infection risk, cause mood swings or insomnia, raise blood pressure, and suppress the adrenal glands with prolonged use. · Must TAPER the dose slowly when stopping (do not stop suddenly) to let the adrenal glands start making cortisol again. · Typical regimen: methylprednisolone 16 mg by mouth or IV every 8 hours (or 48 mg once daily) for 3 days, then taper over 1–2 weeks. · Use the shortest course possible — usually 2 weeks or less. · ACOG and other guidelines suggest trying this only after other options have failed.

Proton pump inhibitors (omeprazole, pantoprazole, lansoprazole) · Proton pump inhibitor (acid blocker)

Proton pump inhibitors (PPIs) shut down the tiny acid-making pumps in the stomach lining. These pumps (called H⁺/K⁺ ATPase enzymes) normally squirt hydrogen ions (acid) into the stomach. When you vomit a lot, acid splashes up into the esophagus and throat, burning the tissue and worsening nausea. PPIs disable most of these pumps, so the stomach makes 90–95% less acid. Less acid means less heartburn and less acid-triggered nausea.

1. The PPI enters the bloodstream and concentrates in the acid-secreting parietal cells of the stomach.
2. Inside the cell, it is activated by acid and binds permanently to the H⁺/K⁺ ATPase enzyme (the proton pump), shutting it down.
3. Acid production drops by 90–95%.
4. The stomach and esophagus become much less acidic, reducing heartburn, reflux, and acid-related nausea.
5. The body makes new pumps over 1–2 days, so the drug must be taken daily for continued effect.

SAFETY WATCH

Very safe in pregnancy; ACOG, FDA, and multiple studies show no increased birth defect risk. · Long-term use (months to years) may slightly lower magnesium, calcium, and vitamin B12 levels — monitor if used for many weeks. · Very long-term use (years) has rare links to kidney disease and bone fractures, but not a concern for short hyperemesis treatment. · Typical dose: omeprazole 20 mg or pantoprazole 40 mg by mouth or IV once daily. · Often used if reflux and heartburn are making nausea worse.

Enteral nutrition (nasogastric or nasojejunal tube feeding) · Nutritional support intervention (not a drug)

Enteral nutrition means giving liquid nutrition through a thin tube placed through the nose down into the stomach (nasogastric, NG) or past the stomach into the jejunum, the middle part of the small intestine (nasojejunal, NJ). This bypasses the mouth and the nausea reflex. Liquid formula (containing protein, carbohydrates, fats, vitamins, and minerals) is dripped slowly into the gut. The gut absorbs the nutrients, delivering the calories and building blocks the mother and baby need to survive when vomiting is so severe that the mother cannot eat by mouth.

1. A thin flexible tube is placed through the nose and guided down the esophagus. Correct placement (stomach or jejunum) is checked by X-ray.
2. Liquid nutrition formula is dripped slowly through the tube, either continuously by pump or in small boluses several times a day.
3. The gut absorbs the nutrients — proteins, fats, sugars, vitamins, minerals — into the blood.
4. Calories and nutrients reach the mother and fetus, preventing weight loss, muscle wasting, and vitamin deficiencies.

SAFETY WATCH

The tube can be uncomfortable and may cause nosebleeds, sore throat, or irritation. · Risk of aspiration (liquid going into the lungs) if the tube is placed incorrectly or if the patient vomits — always check placement by X-ray before starting feeds. · NJ tubes are harder to place (may need fluoroscopy or endoscopy) but better tolerated than NG tubes in hyperemesis. · Stop and remove the tube as soon as the mother can eat by mouth again. · Use enteral feeding BEFORE parenteral nutrition if the gut works — safer and cheaper.

Parenteral nutrition (total parenteral nutrition, TPN) · Nutritional support intervention (not a drug)

Parenteral nutrition means giving all nutrients — glucose (sugar), amino acids (protein building blocks), lipids (fats), electrolytes (salts), vitamins, and trace minerals — directly into a large vein, completely bypassing the gut. A central IV line (usually a PICC line threaded from the arm into a large vein near the heart) is placed. The nutrient solution is infused continuously or over several hours each day. Nutrients enter the bloodstream and fuel all body cells, preventing starvation, muscle breakdown, and life-threatening deficiencies when the gut cannot be used.

1. A central IV line (PICC, central venous catheter) is placed under sterile conditions.
2. A custom nutrient solution (containing dextrose, amino acids, lipid emulsion, electrolytes, vitamins, trace elements) is prepared by a pharmacist.
3. The solution is infused slowly over 12–24 hours each day.

4. Nutrients enter the blood and are delivered to every cell, providing the fuel and building blocks needed to prevent weight loss, muscle wasting, organ failure, and fetal harm.

SAFETY WATCH

Higher risk than enteral feeding: infection at the IV site or in the bloodstream (line sepsis), blood clots in the vein (thrombosis), liver inflammation and damage (especially with long-term use), and blood sugar swings (hyperglycemia or low blood sugar (hypoglycemia)). · Requires close daily monitoring of blood sugar, electrolytes (sodium, potassium, magnesium, phosphate), liver enzymes, and triglycerides. · The IV line must be cared for with strict sterile technique to prevent infection. · Reserved for TRUE gut failure or intolerance — when enteral feeding fails or is not safe. · Stop and switch to enteral or oral feeding as soon as the mother can tolerate it — the gut should be used whenever possible.

Electrolyte replacement (potassium chloride, magnesium sulfate, sodium phosphate) · Mineral and electrolyte supplements

When you vomit repeatedly, you lose not just water but also crucial minerals (electrolytes) like potassium, magnesium, chloride, and phosphate. These minerals are essential for life: potassium keeps the heart beating in a steady rhythm and nerves firing, magnesium helps muscles relax and hundreds of enzymes work, chloride balances acid in the blood, and phosphate is part of ATP (the molecule that powers every cell). Replacing these minerals by IV or by mouth corrects dangerous imbalances, prevents heart rhythm problems (arrhythmias), muscle weakness, seizures, and confusion, and lets every cell function normally again.

1. Electrolytes are given by IV (diluted and infused slowly) or by mouth if tolerated.
2. They enter the bloodstream and distribute into cells and the fluid around cells, restoring normal concentrations.
3. Heart muscle cells regain normal electrical activity, preventing dangerous arrhythmias like torsades de pointes (from low potassium or magnesium).
4. Skeletal muscle cells can contract and relax properly, ending weakness and cramps.
5. Enzymes that depend on these minerals (especially magnesium and phosphate) can do their jobs again, letting cells make energy and repair damage.

SAFETY WATCH

MUST be guided by blood tests — giving too much potassium can cause life-threatening heart arrhythmias or cardiac arrest; giving too much magnesium can slow breathing and reflexes. · Potassium must be given SLOWLY by IV (usually no faster than 10–20 mEq per hour through a peripheral IV) — rapid infusion causes severe vein pain and can stop the heart. Higher rates require a central line and cardiac monitoring. · Recheck blood levels (electrolyte panel) frequently during treatment — daily or more often if severely low. · Correct dehydration and restore kidney blood flow FIRST — kidneys need good blood flow (perfusion) to handle and retain electrolytes safely. Do not give large potassium loads if the kidneys are not making urine. · Magnesium sulfate IV can cause flushing, warmth, and low blood pressure if given too fast. Check deep tendon reflexes (they disappear if magnesium is too high). · Phosphate replacement can lower calcium — monitor calcium levels. · Common regimens: potassium chloride 10–40 mEq IV over several hours (repeat as needed based on labs); magnesium sulfate 1–2 grams IV over 1–2 hours; sodium or potassium phosphate 15–30 mmol IV over several hours.

Red flags

- Cannot keep down any food or liquid for 24 hours or longer
- Blood in vomit or vomit that looks like coffee grounds (a sign of bleeding in the stomach or esophagus)
- Severe belly pain (not just nausea) or fever over 100.4°F
- Confusion, slurred speech, or severe headache (signs of dangerously low sodium or severe dehydration hitting the brain)
- No urine for many hours or urine that is very dark and scanty (a warning that the kidneys are struggling)

Nursing priorities

1. Give thiamine 100 mg IV or IM before starting any IV fluids that contain dextrose (sugar) — Dextrose without thiamine can trigger Wernicke encephalopathy (brain damage) because the brain needs thiamine to use glucose; malnourished patients from vomiting have low thiamine stores already
2. Start IV hydration with normal saline or lactated Ringer solution at 125 to 250 mL per hour, then add dextrose after thiamine is given — Severe vomiting causes hypovolemia (low blood volume) and hemoconcentration (thick blood), which reduces blood flow to the placenta and kidneys; dextrose stops ketone production from starvation

3. Check electrolytes (sodium, potassium, chloride, magnesium), kidney function (creatinine, BUN), and urine ketones on admission — Vomiting loses stomach acid and causes metabolic alkalosis (the blood turning too alkaline) (blood too basic) and low potassium (hypokalemia) (low potassium), which can cause dangerous heart rhythms; ketones confirm starvation state needing dextrose
4. Give pyridoxine (vitamin B6) 25 mg by mouth or IV every 8 hours plus doxylamine 12.5 mg every 8 hours as first-line antiemetic (anti-nausea) treatment — This combination is Category A in pregnancy (safest level) and works on the vomiting center in the brain; ACOG (American College of Obstetricians and Gynecologists) recommends it before other medicines
5. Replace potassium chloride IV if serum potassium is below 3.5 mEq per L, keeping infusion rate at or below 10 mEq per hour through peripheral IV — Low potassium (Hypokalemia) (low potassium) from vomiting causes muscle weakness and cardiac arrhythmias (irregular heartbeats); too-fast replacement through small veins causes pain and vein inflammation
6. Monitor intake and output every shift, daily weights at the same time each morning, and assess mucous membranes and skin turgor every 4 hours — These measurements track rehydration progress; dry mucous membranes and tenting skin show ongoing dehydration; weight gain of 1 to 2 pounds daily shows effective fluid replacement
7. Keep the patient NPO (nothing by mouth) until vomiting stops for 12 to 24 hours, then advance diet slowly starting with bland crackers or toast — The stomach and esophagus need rest after severe inflammation from vomiting; too-early feeding restarts the vomit cycle and delays recovery; bland foods are less likely to trigger nausea
8. Administer ondansetron 4 to 8 mg IV every 8 hours or metoclopramide 10 mg IV every 6 hours if first-line treatment fails after 24 hours — Ondansetron blocks serotonin receptors in the gut and brain that trigger vomiting; metoclopramide speeds gastric emptying (moves food out of stomach faster) and blocks dopamine receptors that cause nausea

Sources

- ACOG Practice Bulletin No. 189, 2018 (Nausea and Vomiting of Pregnancy)
- American Journal of Obstetrics & Gynecology
- UpToDate clinical reference
- Cochrane Database of Systematic Reviews

Last reviewed: 2026-07-07