

Subarachnoid Hemorrhage

Subarachnoid Bleeding (Hemorrhage) — worst headache ever (like being hit with a bat), get a CT scan right away, do a spinal tap if CT is clean, seal the leak with coils or a clip, and give nimodipine to stop blood vessels from squeezing shut.

THE ONE-LINE TRUTH

Blood bursts into the cushion space around the brain, causing the worst headache of your life.

The chain — how it unfolds

1. Aneurysm or vessel ruptures, blood floods the subarachnoid space — why: The weak balloon or abnormal vessel bursts under pressure, spraying blood into the cushion space around the brain where only clear fluid belongs. This is the upstream break that starts everything.
2. Sudden thunderclap headache, worst of your life — why: Blood irritates pain-sensing nerves in the meninges (brain's protective wrapping) and spikes pressure inside the skull. Your brain's alarm goes off all at once — like being struck by lightning or hit with a bat.
3. Stiff neck, sensitivity to light, nausea, vomiting — why: Irritated meninges trigger neck muscle spasm (nuchal rigidity) to guard the head. The same nerve irritation makes bright light painful (photophobia). Rising pressure squeezes the vomiting center in the brainstem.
4. Confusion, sleepiness, or loss of consciousness — why: High pressure inside the skull squeezes brain tissue and cuts blood flow. The reticular activating system (the brain's wake-up switch in the brainstem) gets compressed, making you drowsy or unresponsive.
5. Blood pressure shoots up (hypertensive response) — why: The brainstem senses dangerously high skull pressure and orders the heart to pump harder (Cushing reflex) to force oxygen through. This keeps the brain alive short-term but risks rebleeding or stroke from the high pressure.
6. Risk of rebleeding before aneurysm is secured (peak in first 24 hours) — why: The torn vessel has only a fragile clot plugging it. Any pressure spike, straining, or time delay can blow the clot out and cause a second, often fatal bleed.

7. Vasospasm (vessel squeezing) days 4–14 after the bleed — why: Blood breakdown products (especially oxyhemoglobin) sitting in the subarachnoid space chemically irritate artery walls, causing smooth muscle to contract and narrow the vessel. This chokes oxygen delivery and can cause delayed stroke (delayed cerebral starved blood flow (ischemia)).
8. Hydrocephalus (fluid backup) or herniation (brain pushes down) — why: Blood clots block the narrow drainage channels for CSF, so fluid backs up and pressure climbs even higher. If unchecked, the swollen brain herniates through the skull base, crushing the brainstem and stopping breathing — the final, irreversible crash.

Spot it — what you see, and why

- Sudden, severe headache — often called the worst headache of your life: Blood bursts into the subarachnoid space (the thin layer between the brain and its protective covering). The blood irritates the meninges (the sensitive membranes that wrap the brain), triggering intense pain signals. The sudden spike in pressure inside the skull also stretches pain-sensing nerves.
- Stiff neck (can't easily bend your chin down toward your chest): The blood in the subarachnoid space irritates the meninges that cover the brain and spinal cord. Your neck muscles tighten up as a protective reflex to guard against moving the inflamed tissue.
- Sudden nausea and vomiting: The sudden rise in pressure inside the skull triggers the vomiting center in the medulla (the lower brainstem that controls automatic body functions like breathing and heart rate). Blood irritating the meninges also sends alarm signals that can make you feel sick to your stomach.
- Sensitivity to light (photophobia — bright light hurts your eyes or makes your headache worse): The irritated meninges connect to the nerve pathways that sense light — the optic nerves (which carry vision signals) and the trigeminal nerve (which senses pain in the face and head). When these pathways are already inflamed, bright light triggers more pain signals.
- Confusion or trouble staying awake (altered level of consciousness): Rising pressure inside the skull squeezes brain tissue and cuts down the blood flow that feeds the brain. The brain needs a steady supply of oxygen and sugar to stay alert. When that supply drops, thinking gets foggy and you may become drowsy or hard to wake up.
- Sudden loss of consciousness or fainting (syncope): The sudden bleed causes a sharp spike in intracranial pressure (pressure inside the skull), which can briefly stop normal blood flow to the brain. Without enough oxygen for a few seconds, you pass out. Some people also have a brief seizure from the irritation to the brain surface.

Red flags — act now

- Sudden, worst headache of your life — especially if it peaks within seconds to minutes (thunderclap headache)
- Loss of consciousness, seizure, or trouble staying awake after the headache starts
- Sudden weakness, numbness, trouble speaking, or vision loss on one side
- Stiff neck with severe headache and sensitivity to light — may signal bleeding around the brain
- Headache after head injury, especially if you passed out or vomited

Treat it — in this order

1. Secure the airway and stabilize blood pressure — target systolic BP 140-160 mmHg (or MAP 70-110 mmHg) until the aneurysm is repaired → Prevents rebleeding (which happens in about 4% of patients in the first 24 hours and jumps to 40% if untreated over 4 weeks) while keeping enough pressure to feed the injured brain. Too high and the aneurysm can burst again; too low and the brain starves because autoregulation (the brain's ability to control its own blood flow) is broken after the bleed. Intubation protects the airway if GCS < 8.
2. Aneurysm repair — endovascular coiling or surgical clipping within 24 hours (earlier if feasible) → Seals the aneurysm sac so no more blood leaks into the subarachnoid space. This stops the upstream break that caused everything. Coiling threads platinum coils through a catheter (thin tube) inserted in the groin and guided into the aneurysm sac; clipping places a metal clip across the aneurysm neck during open brain surgery. Current guidelines (AHA/ASA 2012, updated 2023) favor early repair (< 24 hours) to prevent rebleeding. Choice between coiling and clipping depends on aneurysm location, shape, patient age, and neurosurgeon/interventionalist skill.
3. Nimodipine 60 mg by mouth or nasogastric tube every 4 hours for 21 days → Prevents delayed cerebral starved blood flow (ischemia) (stroke from vasospasm, blood vessels squeezing shut) that peaks on days 4-14 after the bleed. Nimodipine (a calcium channel blocker that relaxes smooth muscle in vessel walls) is the ONLY medication proven in randomized trials to reduce death and severe disability (relative risk reduction about 34%). It works even if vasospasm still occurs on imaging, possibly by protecting neurons directly.

4. External ventricular drain (EVD) placement if hydrocephalus develops (ventricular enlargement with rising intracranial pressure or declining mental status) → Drains excess cerebrospinal fluid when blood clogs the arachnoid granulations or the fourth ventricle outlet and fluid backs up in the brain ventricles (fluid-filled chambers). Without drainage, rising intracranial pressure causes coma, herniation (brain squeezing down through the skull base), and death. About 20-30% of patients need an EVD. Target intracranial pressure < 20 mmHg.
5. Seizure prevention (prophylaxis) — levetiracetam 500-1000 mg intravenously or by mouth twice daily for 3-7 days → Prevents early seizures (within the first 72 hours) from blood irritating the cerebral cortex (the brain's outer processing layer). Seizures raise intracranial pressure, increase oxygen demand, and worsen brain injury. Routine long-term prevention (prophylaxis) (beyond 1 week) is NOT recommended unless a clinical or electrographic seizure actually occurs, because antiseizure drugs do not improve outcomes and may harm recovery.

Your top priorities at the bedside

1. Check airway patency and oxygen saturation every 15 minutes and prepare for intubation if Glasgow Coma Scale drops below 8 — why: A dropping level of consciousness means brain swelling or rebleeding and the patient cannot protect their airway from vomit or secretions which causes death from aspiration
2. Keep systolic blood pressure between 140 and 160 mmHg using IV labetalol or nicardipine until the aneurysm is secured — why: High blood pressure above 160 can blow open the aneurysm clot and cause rebleeding but too-low pressure under 140 starves the injured brain of oxygen and blood flow
3. Perform hourly neurological checks including Glasgow Coma Scale score and pupil size and reaction to light — why: Sudden changes in Glasgow Coma Scale or a blown pupil (dilated and not reactive) signal rebleeding or herniation where the brain pushes through the skull opening and death follows in minutes