

Anesthesia Safety

What is anesthesia and how does it work?

Anesthesia uses drugs or other methods to create a loss of awareness and block feelings of pain. It increases patient comfort and safety during medical procedures.

Medical imaging exams may use local, regional, general, or monitored care anesthesia.

Local anesthesia

A local anesthetic numbs the treated area and blocks or reduces pain and sensation.

Local anesthesia blocks the electrical signals that transfer pain sensation from sensory nerves to the brain. It only affects sensation in and around the treated area. It does not affect memory or a patient's ability to breathe.

Doctors use local anesthesia alone for short procedures, when the patient is calm and can tolerate discomfort. They may also use other medications that can affect memory, anxiety and feelings of pain in areas other than the treatment area.

Local anesthetics may be administered on the skin (topically), under the skin (subcutaneously) and regionally.

- **Topical** anesthesia — a cream, patch or spray — numbs the skin surface. The skin absorbs the medication and creates numbness where it is applied. Anesthetic spray numbs the lining of the nose, mouth or throat.
- **Subcutaneous** anesthesia injections numb the nerve fibers on the surface of the skin and immediately below.
- **Regional** anesthesia provides a more generalized area of numbness. Types of regional anesthesia include:
 - Spinal Block anesthesia (subarachnoid block) injects a local anesthetic into the subarachnoid space, which is the area around the spinal cord that contains the cerebrospinal fluid. This fluid acts as a sort of cushion that protects and surrounds the spinal cord. The local anesthesia spreads throughout this fluid and after a few minutes will block pain signals traveling to your brain.
 - Epidural anesthesia typically requires a larger dose of the local anesthetic because it has to travel through and around more tissue. Often the patient will be required to have an intravenous (IV) line to administer fluids during an epidural procedure. The anesthetic is injected into the epidural space of the spine. This is the outermost space of the spinal canal. It contains the spinal cord, spinal fluid, and the subarachnoid space mentioned above. A special needle is placed into this area and a small catheter is slipped into place to deliver anesthetic as needed. It is removed after the procedure. After a few minutes, the "feeling sensation" (pain signals from the area of interest) will be blocked from traveling to your brain.
 - A nerve block (<https://www.radiologyinfo.org/en/info/nerveblock>) injects a local anesthetic into specific areas to block pain signals from the nerve(s) in that area. This provides temporary pain relief.

General anesthesia

Under general anesthesia, the patient is unaware and does not sense pain. Because the patient cannot breathe without help, a breathing machine is required.



A breathing tube or other airway device delivers general anesthesia and maximizes patient safety. General anesthesia uses a variety of drugs and methods. The most common method is through breathing gas after an intravenous (IV) injection. The patient breathes in gases that are absorbed by the lungs and delivered through the bloodstream to the brain and spinal cord.

An anesthesiologist administers general anesthesia. This medical doctor completes three years of specialized training in anesthesia beyond medical school. A specially trained nurse anesthetist may also provide general anesthesia under the supervision of an anesthesiologist. The anesthesia provider stays with the patient and carefully monitors their heart rate, electrocardiogram, blood pressure and oxygen delivery.

Patients typically have no memory of what happened during general anesthesia. Only rarely do some patients remember events.

Deep sedation/ monitored anesthesia care

Sedatives are drugs that reduce a patient's ability to feel and/or remember pain. Doctors usually give them by vein through an IV catheter. An anesthesiologist, anesthetist, or qualified non-anesthesiologist delivers deep sedation.

Deep sedation (monitored anesthesia care) allows the patient to breathe without the assistance of a breathing machine. It relieves pain, reduces discomfort and reduces the likelihood of recalling a painful procedure.

There are levels of sedation. A patient passes through minimal and moderate levels before entering deep sedation. An anesthesiologist may not always administer these levels. The level of sedation reflects the patient's ability to sense and respond to pain and verbal commands.

Minimal/Moderate Sedation

Under minimal or moderate sedation, patients can respond to questions, follow instructions, and breathe without assistance. During minimal or moderate sedation, the patient's sense of pain or discomfort is very dull or not felt. If the patient experiences excessive discomfort, an additional dose of sedation may be administered. Minimal or moderate sedation is good for procedures that require the patient to respond to the physician, or for those that may have a complication to deep sedation. Recovery from this type of sedation is usually much quicker.

Which imaging exams may require anesthesia or sedation?

Some patients undergoing imaging (MRI, for example) may need sedation or general anesthesia to stay relaxed and lie motionless.

Sedatives or anesthesia help:

- patients who have anxiety, a fear of closed spaces, or medical conditions that prevent them from remaining motionless for the exam.
- infants, children and adolescents who cannot stay still and understand directions.

Many common pediatric interventional radiology procedures, such as PICC Line Placement (<https://www.radiologyinfo.org/en/info/picc-line-placement>), will require sedation. *See the Pediatric Sedation* (<https://www.radiologyinfo.org/en/info/safety-pediatric-sedation>) page for information specific to children.

Some procedures may use two different types of anesthesia. Angiography, angioplasty, biopsies and embolization may use a local anesthetic to numb the skin where a needle or catheter is used, and deep sedation or general anesthesia to keep the patient calm and relaxed.

Are there alternatives to anesthesia and sedation?

Patients may choose drug-free approaches such as guidance in relaxation, reframing of distress and hypnosis. These methods

reduce pain, anxiety, and sedation side effects such as nausea. They can also help patients overcome claustrophobia during MRI exams.

Ask your facility if drug-free approaches are available. This kind of patient guidance requires a trained medical team member. Comforting language and effective phrasing help patients find the best comfort solutions while participating in their own care.

How should I prepare for my imaging test or treatment with anesthesia?

To prepare for your procedure with anesthesia:

- Tell your doctor about all of the medications you take, including herbal supplements and vitamins. Your doctor may advise you to stop taking aspirin, nonsteroidal anti-inflammatory drugs (NSAIDs) or other regular medications for a time before your procedure.
- List any allergies to food, medications or contrast materials.
- Report any family history of problems with anesthesia, any medical conditions or recent illnesses including any recent upper respiratory tract infections (colds or flus).
- Tell your doctor about your prior surgeries, any problems with anesthesia, or airway abnormalities you may have.

Your doctor may test your blood to assess your ability to form blood clots and to determine how your liver and kidneys are functioning.

The doctor may also perform a physical exam and other tests.

Tell your physician or technologist if there is any possibility you are pregnant or you are breastfeeding. *See the Safety in X-ray page (<https://www.radiologyinfo.org/en/info/safety-radiation>) for more information about pregnancy, breastfeeding and imaging.*

Your doctor may tell you not to eat or drink anything for up to eight hours before receiving sedation or anesthesia. Some institutions may allow you to have a few sips of a drink prior to the exam. These instructions may differ based on the procedure, patient's age and medical history, or the institution's guidelines.

You may be asked to remove your clothes and wear a gown during the exam. Remove jewelry, eyeglasses, dentures, and any metal objects or clothing that might interfere with the images.

If you have sedation or general anesthesia, someone must drive you home afterwards. Anesthesia may impair your memory for up to 24 hours, and compromise your ability to concentrate, make decisions and operate machinery.

How safe is anesthesia?

Anesthesia and sedation are generally safe for most patients.

Some studies have suggested that children under the age of four may experience adverse effects following prolonged or repeated anesthesia. However, more research is needed. *For more information on pediatric anesthesia research, visit [SmartTots.org \(https://smarttots.org\)](https://smarttots.org).*

Regardless of the level of sedation or anesthesia used, a trained healthcare professional closely monitors the patient.

Side effects and adverse and allergic reactions

Serious side effects and allergic reactions resulting from anesthesia are rare.

After sedation or general anesthesia, some patients may have nausea, vomiting, dizziness, headache, sore throat, blood pressure

changes and pain. These side effects are usually mild, brief and treatable.

Some patients, both adults and children, may not achieve adequate sedation. The doctor will reschedule the procedure with general anesthesia.

More serious anesthesia complications are rare. They are more likely to occur in patients with complex, serious medical conditions.

What will I experience during and after the procedure?

During the procedure

The doctor attaches special devices to monitor your heart rate and other vital body functions. If you have general anesthesia, you will be unconscious for the entire procedure under the direct care of an anesthesia professional.

Doctors usually give sedation through an IV catheter. You may feel slight pressure or a sharp pinch when the doctor or nurse inserts the catheter, but you should not experience any serious discomfort.

After the procedure

If you only received a local anesthetic, you should be able to go home soon depending on the procedure. If you received general anesthesia, you will remain in the recovery room until you have reached your normal level of consciousness.

The medication takes up to 24 hours to leave your body. You may feel tired. **You should not drive, operate equipment or make important decisions for at least 24 hours after you have had anesthesia.**

Children respond differently to sedatives and anesthesia. Some may become agitated, inconsolable or restless. Others may be sleepy and unsteady on their feet for the rest of the day.

Most pediatric patients are able to resume their normal activity within six to eight hours. Monitor children for 12 to 24 hours after sedation. Delay activities that require coordination and balance, such as swimming, climbing and riding a bike for 24 hours.

Pregnancy and anesthesia

Prior to any imaging exam, women should always tell their doctor if they are pregnant. Many imaging tests are not performed during pregnancy unless they are medically necessary and cannot be safely delayed.

Doctors protect mothers and their unborn babies when anesthesia or sedation is required during pregnancy. Women who are concerned about surgery and anesthesia during pregnancy should consult their doctor.

Women who are breastfeeding should consult their doctor before taking any medications that can pass through breast milk. *See the Safety in X-ray page (<https://www.radiologyinfo.org/en/info/safety-radiation>) for more information about pregnancy, breastfeeding and imaging.*

Disclaimer

This information is copied from the RadiologyInfo Web site (<http://www.radiologyinfo.org>) which is dedicated to providing the highest quality information. To ensure that, each section is reviewed by a physician with expertise in the area presented. All information contained in the Web site is further reviewed by an ACR (American College of Radiology) - RSNA (Radiological Society of North America) committee, comprising physicians with expertise in several radiologic areas.

However, it is not possible to assure that this Web site contains complete, up-to-date information on any particular subject. Therefore, ACR and RSNA make no representations or warranties about the suitability of this information for use for any particular purpose. All information is provided "as is" without express or implied warranty.

Please visit the RadiologyInfo Web site at <http://www.radiologyinfo.org> to view or download the latest information.

Note: Images may be shown for illustrative purposes. Do not attempt to draw conclusions or make diagnoses by comparing these images to other medical images, particularly your own. Only qualified physicians should interpret images; the radiologist is the physician expert trained in medical imaging.

Copyright

This material is copyrighted by either the Radiological Society of North America (RSNA), 820 Jorie Boulevard, Oak Brook, IL 60523-2251 or the American College of Radiology (ACR), 1891 Preston White Drive, Reston, VA 20191-4397. Commercial reproduction or multiple distribution by any traditional or electronically based reproduction/publication method is prohibited.

Copyright © 2022 Radiological Society of North America, Inc.