Choice of anesthetic method and anesthetic agents

Anesthesia must ensure freedom from pain, suppression of autonomic reactions and good surgical working conditions. Depending on the nature of the operation, the patient's health and wishes, this can be achieved with local, regional and general anesthesia, or with a combination of the methods.

When choosing an anesthetic method and anesthetic agents, it is important to emphasize both the performance of the procedure and the effects post-operatively, such as pain relief, alertness, functional ability and the absence of nausea. Regional anesthesia, including especially epidural anesthesia and analgesia, has been shown to reduce the incidence of pulmonary complications and chronic pain after certain types of major surgery.

In the case of general anesthesia, the choice will be between inhalation agents, intravenous sleeping agents and potent opioids. Most often, two or more agents are used in combination. Inhalation anesthesia, which has been shown to have cardioprotective properties in cardiac surgery, is recommended for cardiac patients in major non-cardiac surgery, although the clinical evidence is sparse, the choice of anesthetic method/agent may also have an impact on the result.

Interventions stimulate and cut peripheral nerve fibers, pain experience and autonomic secondary reflexes will occur when the stimulation is strong enough.

Local anesthetics block signal transmission at several levels: with local anesthesia in the operating area, with blockade of nerve conduction into the spinal cord in the case of spinal and epidural anesthesia. General anesthesia means that transmission in the central nervous system and awareness is blocked(with opioids, inhalation anesthetics and sleeping aids).

Local anesthesia - blocks pain fibers and receptors outside the tissue so that nociceptive stimulation does not take place

Regional anesthesia – blocks the conduction of nociceptive pain stimuli on the way from damaged tissue to the first synapse in the posterior horn of the spinal cord (conduction anesthesia, nerve plexus anesthesia, epidural and spinal anesthesia)

Reducing surgery-induced stress will to some extent counteract muscle tightness and defensive movements. Often, the anesthesia must also include peripheral blockade of striated muscles with intravenous curare agents to ensure good working conditions.

The choice between local anesthesia, regional anesthesia, and general anesthesia, should be made after assessment of the type of intervention and based on consideration of the patient's health and physiological reserves as well as the person wishes .

Local anesthesia

Local anesthesia involves infiltrating local anesthetics into the tissue to be operated on. These block sodium channels reversibly for a few hours, so that pain receptors are blocked upon stimulation and conduction of the action potential along the nerve is stopped. The difference between the commonly used agents (lidocaine, bupivacaine, levobupivacaine, ropivacaine) lies mostly in how long they work and how toxic they are if large amounts enter the bloodstream.

Pain from extensive injections and general toxic reactions (such as sensory phenomena, general convulsions and arrhythmias) limit the use of large amounts of local anesthesia as the only method in extensive surgery.

Regional anesthesia

This means here the nerve cord is anesthetized into the spinal cord. In addition to various forms of plexus anesthesia, one or more individual nerves can be anesthetized during interventions such as hernia operations, knee operations, eye operations, etc.

A special principle is to anesthetize nerve fibers just before they transmit impulses to the posterior horn of the spinal cord, either with local anesthesia lumbarly on the outside of the dura mater (epidural anesthesia) or by inserting a smaller amount into the spinal cord itself (spinal anesthesia).

In the case of such central blockades, you receive a comprehensive anesthetic, usually from the waist down. The disadvantage is that this produces autonomic responses to blood pressure and heart rate, which must be carefully monitored.

Prolonged blockade can cause urinary retention and unnecessary bed rest. Epidural anesthesia can also be applied in the thoracic spine, with selective anesthesia of the thorax and upper abdomen. Epidural technique means that a catheter is usually inserted for refilling anesthetic when needed.

Postoperatively, weaker solutions are used with local anesthetics with added adjuvants, such as opioids and adrenaline.

General anesthesia

-Sleeping aids Barbiturates: (eg thiopental) very fast acting, slow awakening after repeated doses

-Propofol: fast-acting, rapid awakening, antiemetic and slightly euphoric effect .

-Benzodiazepines: slower onset and cessation of effect, less respiratory and circulatory influence (mostly for sedation)

-Analgesics; -Fentanyl: potent opioid, medium fast-acting, slow awakening/good pain relief after repeated/high doses

-Alfentanil: potent opioid, very fast-acting, rapid awakening

-Remifentanil: potent opioid, very fast-acting, ultra-rapid awakening even after prolonged infusion and large doses

-Ketamine: analgesic and hypnotic with sympathetic stimulating and hallucinogenic effects

Inhalation anesthetics

Nitrous oxide: not potent enough to be used alone in surgery, rapid onset and cessation of effect, little circulatory and respiratory effect

Isoflurane: relatively slow onset of effect and prolonged awakening

Sevoflurane: quick start and end of effect, little respiratory irritation and suitable for starting inhalation

Anesthetic suppression of the central nervous system's response to nociceptive stimulation can be achieved with single agents or with combinations of potent and controllable intravenous hypnotics and opioids.

Inhalation anesthetics cause amnesia, sleep, unconsciousness and, at high doses, analgesia and loss of reflex movements to pain stimuli, in addition to dose-dependent respiratory depression and cardio-depression. The patient can breathe himself into anesthesia.

Nitrous oxide is very controllable and has less effect on circulation and respiration, but is too weakly potent to be used as the only anesthetic, except in situations where moderate analgesia is sufficient (vaginal birth and contractions). Nitrous oxide has been popular as a supplement to other means, but its use is decreasing due to contamination problems, inactivation of vitamin B 12 and possible DNA toxicity with long-term use .

Choice of opioid

is largely determined by pharmacokinetic properties. All potent opioids cause respiratory depression and some tendency to nausea as long as the analgesic effect persists. Morphine works late and causes non-specific side effects

with slow awakening after high doses, so that the agent is used sparingly in general anesthesia. Fentanyl is still widely used, it is potent and has a relatively quick onset of effect which gradually decreases after the procedure and ensures some pain relief.

Remifentanil has a rapid onset and a very special liver-independent enzymatic breakdown that causes spontaneous breathing and cessation of effect within a few minutes after the infusion is stopped

Sedation

Light sedation means that the patient is under the influence of sleeping pills and/or opioids, but still contactable verbally and self-breathing with free airways. Deep sedation means that the patient sleeps so deeply that the airways may not be free for periods.

Sedation with benzodiazepines or propofol does not provide pain relief, but anxiolysis, amnesia and eventually full sleep if the simultaneous pain stimulation is not strong. Sedation with opioids provides analgesia in everyone, while fatigue and amnesia can be more variable and possibly absent.

Sedation can be used as the only method for anxiety-filled or painful examinations (e.g. endoscopy) and procedures (e.g. plastic surgery, dentistry, wound care). Sedation is often used with local anesthesia or regional anesthesia. Since sedation can cause respiratory depression that requires treatment, it is important to have good procedures for choosing agents, doses and monitoring of the patient.

Choice of method and combinations

A number of conditions in the patient and the nature of the operation are important for the choice of anesthetic method and drugs .

Local anesthesia can be chosen for limited and superficial interventions where it is easy to infiltrate without exceeding the maximum dose of the agent. Local anesthesia dampens much of the stress response and ensures good analgesia

for some time after the operation. Good postoperative analgesia also means that the need for opioids is reduced,

Regional anesthesia may be the only method for suitable interventions on the extremities.

Spinal anesthesia can be used alone, possibly together with light sedation, for most interventions below the navel level. The advantage is that the patient can be fully awake and self-breathing.

Epidural anesthesia can be used alone, but is often used in combination with general anesthesia for major interventions in the thorax, abdomen or lower extremities. The advantage is that epidural anesthesia provides pain relief during the procedure, so that the need for general anesthetics is reduced and the patient can wake up more easily.

Epidural analgesia can be used in the first days after surgery and provides faster mobilization, normalization of bowel function and physiology and a reduced need for opioids

The risk of thrombosis, respiratory failure and the need for ventilator treatment and intensive care in moderate- to high-risk operations is reduced. One danger when using spinal and epidural anesthesia is hematomas and infections in the back.

There are three main methods of general anesthesia:

Total intravenous anesthesia (TIVA), inhalation anesthesia, and a mixture of inhalation and intravenous methods. In general, pure inhalation anesthesia will provide safer sleep and better spontaneous respiration than total intravenous anesthesia with propofol and an opioid.

Falling asleep with inhalation anesthetics may take a few minutes longer than with propofol or barbiturates, awakening may be a few minutes shorter. Inhalation anesthetics increase the incidence of nausea and vomiting postoperatively.