

Anaesthetics (Dentistry)

Local anesthetics are substances that block the generation and conduction of excitation in all excitable tissues.

[1] LA causes a decrease in the permeability of Na^+ channels by blocking them on the membranes of nerves and thus disrupting depolarization and preventing the formation of an action potential.

Properties of an ideal anesthetic

- Easy tissue penetration.
- Reversible effect.
- Fast onset after application.
- Low toxicity.
- No allergenic effects, non-irritating.
- Rapid metabolism in the body without toxic metabolites.

Factors affecting anesthetic effectiveness

pH of the environment

- The acidic environment created during inflammation worsens the effect of the anesthetic. (Delayed onset, incomplete analgesia, faster wear-off) because:
 - An acidic environment reduces the formation of the non-ionized fraction of LA and thus the decrease in the ability to penetrate into tissues.
 - Inflammatory exudate inhibits the effect of LA.
 - Hyperemia and vasodilatation in the area of inflammation leads to a faster flushing of LA into the circulation.

Dissociability of LA Concentration

- As the concentration increases, the onset of effect is faster, but the risk of toxic effects on the body increases. Usually, dental anesthetics are in 2-4% solutions.

Solubility in fats

- 90% of the nerve membrane is made up of lipids, with the liposolubility of LA, its effect also increases.

Ability to bind to proteins

- 10% of the nerve membrane is made up of proteins, by forming a bond with this protein component, it prevents LA from leaking into the circulation and prolongs the duration of the effect of LA.

LA application location

- Vascularized tissue impairs the effect. We do not deposit LA in the focus of inflammation, in an abscess, in a blood vessel.

Amount of LA

'Pressure' - the anesthetic works better if the deposition site is under pressure (a small space).

Time of administration - within the circadian rhythm, it is effective for the longest time from 15 to 17 h, it has the shortest duration at night and early in the morning.

It fails more often in smokers.

Degradation takes place in the liver with the participation of pseudocholinesterase. Elimination from the body is ensured by the kidneys.

Division

Ester anesthetics

- The only representative of ester 'natural' anesthetics is *cocaine*. It has good anesthetic and vasoconstrictive effects. It is addictive like an addictive drug. It is used in the ENT, where it is part of Hirsch's solution - it numbs and at the same time causes the nasal mucosa to be slapped.
- The 'synthetic' ester anesthetics include: *procaine*, *tetracaine*, *chlorprocaine* and *benzocaine*. Procaine is not very toxic but penetrates tissues poorly, tetracaine works slowly, chlorprocaine works for a short time and benzocaine is very toxic (used only superficially). They are esters paraaminobenzoic acids.
- They are metabolized both in the liver and in the plasma by pseudocholinesterase.

- The degradation product of PAB can cause an allergic reaction.
- Higher plasma concentration can cause:
 - deceleration of the SA node line,
 - vasodilatation with subsequent hypotension,
 - muscle twitches to tonic-clonic convulsions.
- However, they do not cause malignant hyperthermia.

Amide anesthetics

- Amide anesthetics include: *articaine, lidocaine, trimecaine, prilocaine, cinchocaine, bupivacaine* and *mepivacaine*.
- They generally have a longer duration of action than ester anesthetics.
- They are slowly degraded only in the liver (CYP450).
- Allergies are rare.
- Higher plasma concentration can cause:
 - deceleration of the SA node line,
 - vasodilatation with subsequent hypotension,
 - muscle twitches to tonic-clonic convulsions.
- They can cause malignant hyperthermia.

Pharmacokinetics and dynamics

- The absorption of the substance into the circulation depends mainly on the method of administration, the blood supply to the tissue and the vasodilating/vasoconstricting properties of the anesthetic.
- In the case of mucosal application, the fastest penetration into the circulation occurs from the tracheal mucosa, slower from the oropharyngeal region, and they have the longest half-life in the esophagus.
- Injection administration – depending on the vascularization and properties of the anesthetic.

Anesthetic additives

Vasoconstrictive ingredients

- Adrenaline – the only vasoconstrictive ingredient of local anesthetics registered in the Czech Republic.
- Noradrenaline
- Octapressin (synthetic vasopressin)

Importance:

- they slow down the rate of anesthetic absorption;
- prolong the duration of the anesthetic effect;
- reduce the amount of anesthetic consumed;
- reduce the risk of a toxic reaction;
- reduce bleeding.

Adrenaline is mostly used in a concentration of 1:200 000 (i.e. 1 mg/200 ml = 5 ug/ml).

Predisposed patients are at risk of increased blood pressure, tachycardia, cardiac arrhythmia. We consider patients with the following diseases to be at risk:

- hypertension,
- heart disease,
- thyrotoxicosis,
- decompensated diabetes mellitus,
- glaucoma,
- risky pregnancy,
- therapy with some antidepressants (MAO inhibitors, thymoleptics).

In patients with a significant risk, we prefer anesthetics without a vasoconstrictor additive (Mepivacaine). [2]

Preservatives

- Methylparahydroxybenzene
- Propylparahydroxybenzene

They are used in concentrations of 0.055-0.1%. In food and cosmetics they are referred to as E216 and E218.

Stabilizers

Stabilizers are used to prevent the breakdown of catecholamines.

Local anesthesia

 For more information see *Local and Seductive Anesthesia (Dentistry)*.

Infiltration Anesthesia

Infiltration anesthesia is used in the entire upper jaw and in the frontal section of the lower jaw, because in these areas there is cancellous bone, into which the anesthetic can penetrate by diffusion to temporarily inactivate the excitability of the nerve running in it. The total volume of anesthetic used varies between two and four milliliters. A larger amount is applied from the vestibule (1.5 ml). The remaining 0.5 ml is applied from the oral side.

■ Injection technique:

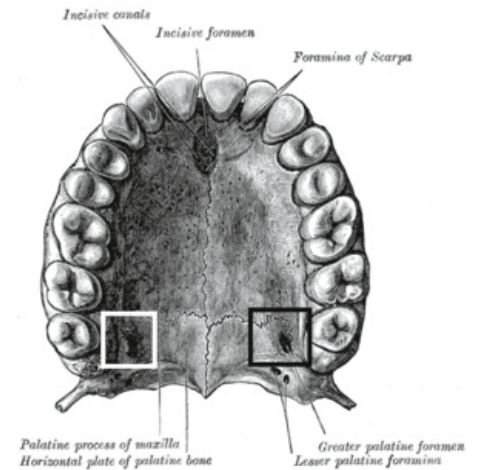
Anesthetic is applied submucosally but supraperiosteally to the transitional vestibule. For the extraction, the anesthetic is applied from the oral side, in the place of the expected root tip. The needle is inserted with the sharpened side towards the tooth. Anesthetic is injected already after penetrating the mucous membrane, so that the further progress of the needle is painless.

Seductive Anesthesia

Anesthetic is applied near the nerve fiber before it enters or exits the jawbone.

- In the 'upper jaw' there are application sites:
 - *foramen infraorbitale* - we find it at the intersection of the so-called Černý line with the perpendicular from the pupil of the eye, *nervus infraorbitalis*, *rami alveolares superiores medii et anteriores*;
 - "tuber maxillae" - "rami alveolares superiores posteriores";
 - *foramen incisivum* - *nervus nasopalatinus*;
 - *foramen palatinum majus* - *nervus palatinus*.
- In the 'lower jaw' there are application sites:
 - *foramen mandibulae* - *nervus alveolaris inferior*;
 - *foramen mentale* - emerges dorsocranially, *nervus mentalis*.
- **Injection technique:**

Seductive anesthesia is most often used in the *foramen mandibulae* area. The needle is inserted from the opposite corner 1 cm above the occlusal plane of the lower molars, 1 cm behind the last molar vertically. After contact with the bone and negative aspiration, we apply 2 ml of anesthetic. With this anesthesia, we only achieve numbness from the oral side. From the vestibular side, we have to use the infiltration method of anesthesia. For this we need 1-2 ml of anesthetic.



Places of application of shunt anesthesia in the foramen palatinum majus with the palatine nerve and the foramen incisivum with the nasopalatine nerve

Local complications of injection anesthesia

- **Nerve injury** - it is possible to injure: lingual nerve (paresthesia to anaesthesia), VII nerve - peripheral palsy, alveolar nerve inf. - long-term paresthesia in the area of the lower lip. ! neurodystrophic ulcer – pac. with numbness (face area, lips), possible infection (rinse with antiseptics, possibly use ATB). It is treated by administering vitamin B (Thiamine and B₁₂);
- **Facial nerve palsy** - during mandibular anesthesia;
- **Vessel injury** - formation of hematoma and subsequent contracture (can also be myogenic in case of injury to the pterygoideus med. muscle), first aid: ice pack, compression, antibiotics are administered in case of inflammation;
- **Anemic zones** - frequent, white spot at the injection site, mod. vasoconstrictors;
- **Post-injection necrosis** - caused by vasoconstriction, further toxic necrosis. In the area of the palate = Williger's necrosis. Pac. performs mouth rinses with chamomile decoction, analgesics, anesthetic and granulation-supporting paste;
- **Muscle injury** - no. m. pterygoideus med., the formation of a hematoma between the muscle bundles, this leads to a loss of elasticity, the so-called "myogenic contracture", the situation is solved by rehabilitation + warming up;
- 'Infection';
- **Swelling** - a symptom based on a hematoma. It can also be caused by an allergic reaction (diffuse swelling). No. injury to the pterygoid plexus (great risk during anesthesia on the tuber maxillae);
- **Visual disturbances** - reflex spasm of the retinae centralis + irritated sympathetic nerve. !KI for application of anesthetic – glaucoma. Solution - mainly calm the patient (diazepam), give papaverine 2 ml s.c.;
- **Needle kink** - today it doesn't happen much anymore, before because of repeated sterilization. The bent needle must be removed either with pean forceps or surgically (if it does not protrude);



Anesthesia in the foramen incisivum

General complications after injection anesthesia

- **Collapse** - not directly related to the anesthetic, rather a stress reaction (a sudden event), syncope.
- **Allergic reaction** - antihistamines and corticoids are used for treatment. First aid: adrenaline – 2 ml + 8 ml

of physical solution, i.v. application, I can repeat in short intervals, or epinephrine.;

- **Anaphylactic reaction** - treatment uses adrenaline 1 mg i.v., hydrocortisone 400–600 mg i.v., antihistamines i.v., [[noradrenaline]] 1–2 mg by infusion, the patient should be placed in the Trendelenburg position;
- **Sudden collapses to death** - the patient is placed in a horizontal position, we undress him, the next procedure is different;
- **Toxic reaction** - overdose of pac. pharmacem - absolute (extremely large amount at once) / relative (adequate amount, but incorrectly, e.g. intravasally), depends on the concentration, dose and technique of anesthetic administration! Evaluate: age, general health. condition (!!! he. liver and kidneys), weight. First aid – anxiolytic – 5–10 mg of diazepam i.v., i.m., Apaurin, Seduxen. Next, oxygen. Zdroj (https://books.google.cz/books?id=Wd76i-2zT6cC&pg=PA72&lpg=PA72&dq=Apaurin+a+toxick%C3%A1+reakce&source=bl&ots=1hIX_vJlL4&sig=8Jy8GWU2Qi0vVSfWj5e5p-EVQil&hl=cs&sa=X&ei=l-qKUNftEo7IsbgbpoH4CA).
- **Spasms**;

Links

Related Articles

- Anesthesia
- Local and Seductive Anesthesia
- Anesthetics/Complications

External links

- Template:Acute

References

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2. PAZDERA, Henry. *fundamentals of oral and maxillofacial surgery*. 1. edition. Olomouc : Palacký University in Olomouc, 2007. ISBN 978-80-244-1670-0.

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