

COMPLICATIONS OF LOCAL ANAESTHESIA

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Local anaesthesia is a common used ,safe procedure.

There are few complications are encountered.

The possible complications may be classified into two groups:

General: in connection with the nature and the composition of the anaesthetic

Local complications: in connection with the method of anaesthesia



GENERAL COMPLICATIONS

- Systemic toxicity

 - Accidental administration to vessels**

 - Changed metabolism**

 - Absolut overdose**

- Allergic reactions

- Idiosyncratic reactions



Systemic toxicity

Local anesthetics inhibit a number of ion channel.

The voltage-gated sodium channels, all-irritant sensitive cells are present in body.

- Accidental administration to vessels, unexpected rapid absorption or altered metabolism cause a relative or absolute overdose, so the drug's free blood level is increased :

large doses of local anesthetic other excitable structures contact:

- CNS
- Cardiovascular system



Systemic toxicity

- The central nervous system toxicity usually precedes the cardiac toxicity
- The risk of toxicity increases:
 - **Low temperature, decreased metabolism**
 - **Respiratory or metabolic acidosis**
 - **Hypoxia**
 - **Kidney and liver failure**
 - **Neonatal and infancy, old age**
 - **Existing heart disease (conduction disturbances)**
- Normal oxygenation and CO₂ are very important
- Pregnancy increases the risk of cardiac toxicity.



CNS

1. Prodromal stage: (peripheral afferent and efferent nerve's paralysis)

Numbness around the mouth, dizziness, metallic taste in the mouth, more or less pronounced hyperacusis, anxiety, panic

2. Preconvulsive stage : (loss of inhibitory cortical neurons)

Ringling in the ears, blurred vision, tremor, uncontrollable tremors,, uncoordinated movements of the muscles (nystagmus) may also have loss of consciousness

3. Convulsive stage :

- Tonic-clonic seizures, unconsciousness, apnoe periods

4. Central nervous system depression stage : (total CNS paralysis)

- Deep coma, hypotension, bradycardia, respiratory arrest



Cardiovascular toxicity

- **Indirect effect: mediated by the CNS, biphasic (sympathetic increase of tonus: hyperdynamic circulation, CNS paralysis: expressed hypotension, bradycardia)**
- **Direct cardiac effects : the formation of the impulse decreases because of the direct effect to the cardiac muscle cells and the impulse conducting system, the impulse conduction slows, the pump function decreases, the refractory period increases**
- **Widening of QRS complex, PQ interval prolongation, complete atrio-ventricular dissociation, spontaneous pacemaker activity reduction or complete abolition of sinus node**
- **Ventricular arrhythmias**
- **Cardiac arrest**



Cardiovascular toxicity

■ **Symptoms:**

Chest pain

Shallow breathing

Palpitations, rapid heartbeat

Bradycardia

Arrhythmias

Dizziness

Sweating

Low blood pressure

Loss of consciousness

Circulatory collapse

Cardiac arrest

The epinephrine-containing solutions can cause hypertension, tachycardia and cardiac ischaemia .



Factors determining the measured concentrations in the systemic circulation.

- The absorption rate depends on the dose, injection speed, the vascularisation of the area, the amount of fat in the place of administration.
- In the vessels protein bindings reduce the concentration of free drug
- They are sequestered in various organs, then and the amide-types are metabolized by cytochrome in the liver via several steps, the esters are metabolized by plasma pseudocholinesterase.
- The rapid metabolisation reduces the toxicity.



Treatment of overdose

- **All the resuscitation equipment should be kept available to the local anesthetic solution prior to administration**
 - **Insurance airway, oxygen administration**
 - **Spasm solution (if the attack longer than 15 to 20 seconds)**
 - **Thiopental 100 - 150 mg IV rapid effect**
or Diazepam 5 mg - 20 mg IV
100% oxygen
- Cardiovascular toxicity: a complex resuscitation**
Bupivacain overdose difficult resuscitation
20 % Intralipid in case of bupivacain toxicity



Prevention

- **Local anesthetic is not completely safe!**
 - **Systemic toxicity may occur if an overdose!**
 - **Application minimum required dose, concentration.**
 - **Never exceed the recommended maximum dose**
 - **Clarify the possible factors predisposing to toxicity**
 - **For children, the maximum dose mg / kg body weight to apply!**
 - **Administration in vessel can be avoid by reabsorption of the slow entry of needle**
 - **Inject slowly, the patient communicates.**
 - **High doses, low toxicity drugs are recommended.**
 - **The additive effect of local anesthetic!**
 - **In case of unwanted side effects the necessary drugs must be available.**

Tissue toxicity

- **Local anaesthetics use in very high dose cause irreverzible inhibition (blokage) within 5 minutes after administration :**
 - **Peripheral neurotoxicity: a prolonged paresthesia, motorical deficit**
 - **Skeletal muscle damage is reversible**

Examples:

- **Chloroprocaine**
 - Low pH and presence of metabisulfite**
- **Lidocain**
 - First it was observed in associated with 10% dextrose**
 - Each sale occurred**
 - It is not used for spinal anesthesia**
- **Bupivacaine seems not to cause neurotoxicity**



Allergy against the local anesthetic agents

- Local anesthetic allergy is often reported in patients.
- Analyzing the allergy reaction:

Psychogenic reaction

Caused by latex or preservatives. (metabisulfite)

Epinephrine-induced cardiovascular response

The long-term surface benzocain can often causes contact dermatitis or mucositis



Allergies

- Amid derivatives

The real allergy is very rare

- Ester derivatives: frequency 1 %

The allergic reactions occur because of PABA.

Frequent component of sunscreen products

Local benzocain exposition



Allergic reactions

I.type allergic reaction:

- IgE mediated reaction
- „immediate” (after the meeting with the allergenic factor the reaction appears in 4 hours)
- symptoms caused by mediators from mastocytes, basophilic and eosinophilic cells, makrophags és trombocytas

Mediators

mastocytes/basophilic cells	eosinophilic cells	macrophags	trombocytas
Histamin, triptase	ECP	proteases	serotonine
PGD2, LTC4	MBP	PGD2, PGE2	histamin
PAF			
TxA2, LTB4	TxA2		
IL-1, IL-4, IL-5	LTC4, PAF	LTC4, PAF	
TNFalfa, IFNgamma	IL-5	IL-1, TNF	



Allergic reactions

■ Symptoms:

- Rash, skin redness
- Itching, hives (urticaria)

Allergic reactions

■ Symptoms:

- Swelling of the face and lips (angioneurotic edema)
The throat, pharyngeal swelling (edema)
- Bronchospasm (bronchospasm),
difficulty breathing, asthma attack
- Abdominal cramps
- Low blood pressure (hypotension)
- shock



Management of allergic reactions

- Epinephrine 0,3-0,5 mg sc injection
immediate effect
- Solu-Medrol (corticosteroid , reduces the
generalized allergic reactions, long-term
effect)
- Aminophyllin (bronchodilatator)
- Suprastin



Management of allergic patients

- **Exclusion of other frequent failure, syncope, tachycardia caused by epinephrine**
- **The reaction type: redness, urtica, itching, swelling, shortness of breath**
- **If the drug is known, the other amide-type drug choice (free from epinephrin and bisulphite)**
- **If the drug is not known allergy check-up**
- **If there is no way for investigation of allergy, vein supply , epinephrin 0,3-0,5 mg sc ill. 0,05-0,1 mg iv. one dose,**
- **steroid (Solu-Medrol) 125 mg**



Idiosyncratic reactions

- These are that kind of defective reactions of the organ in which the abnormal metabolism of the medicines does not depends on their's pharmacology

Example: loss of glukose-6-phosphate dehydrogenase , which causes haemolytic anaemia



Loss of consciousness in the dental chair

■ COLLAPSE

peripheral circulatory insufficiency
(psychological and physiological factors)

symptoms:

- pallor
- perspiration
- deep,rapid breathing
- fall in blood pressure and bradycardia

things to do:

- interruption of treatment
- Trendelenburg position
- Movements of arms, legs
- Pressure against the head



Local complications

They are ususally connected with the method of anaesthesia

- needle breakage
- pain at injection
- lack of effect
- anaemic zone
- injuries of the nerves
- intraglandular injection
- injuries of the blood vessels
- trauma of the muscles
- Injuries of soft tissues
- Punctional abscess
- Other dental solutions unintentional injection



Needle breakage

- more frequent in lower nerve block anaesthesia
- it can cause incorrect technique and sudden movement of the patient or the practitioner
- What to do when the needle breaks?
 - to stay calm
 - to try to localise the broken hypodermic part and remove carefully, antibiotics, analgesics, careful oral hygiene
 - if we don't find refer the patient to the oral and maxillofacial surgery with radiographs or ultrasonographs



Pain at injection

- pain during the injection of the anaesthetic solution can have many causes
- low pH of the solution
- temperature of the solution (warmer feeling more comfortable)
- incorrect technique (fast injection, aggressive insertion of the needle)



Lack of effect

- the patient still feels pain during the treatment
- reasons of failure:
 - anatomical: anatomical variations
 - pathological: trismus because of infection, inflammation, trauma, previous surgery
 - psychological: fear and anxiety
 - poor technique



Anaemic zone

- it is caused by adrenaline's vasoconstrictor effect
- Symptoms:
 - at the region of administration the patient feels burn and the anaemic zone appears in place of supply place of artery
 - numbness in same time
 - the anaemic spot appears in the alveolar process
- Treatment:
 - no needed, the anaemic zone will cease in 15-20 minutes spontaneously



Injuries of the nerves

- Most commonly during inferior alveolar nerve block.

The nerves which can injure:

- inferior alveolar nerve
- lingual nerve

The symptom is electric shock-like feeling in the lip or the tongue

Cave: nerve afferentation points!



Injuries of the nerves

Symptoms:

- Paresthesia: spontaneously weed skin sensation
- Hyperesthesia : hypersensitivity of the skin
- Dysesthesia.: the sensation of the stimulus is different like the normal (example the pressure can cause pain)
- Hypaesthesia: hyposensitivity of the skin



Injuries of the nerves

- Because of the injury of chorda thympani nausea and xerostomy may occur
- Nerve-related complications (not direct trauma)-
diffusion of the anaesthetic through the orbit
 - diplopia,
 - amaurosis,
 - enophthalmus,
 - miosis
 - palpebral ptosis



Injuries of the nerves

Symptoms can last for weeks or months

- treatment: high dose vitamin B, which support the regeneration of the nerves



Intraglandular injection

- Facial paresis:

the etiology is the too deeply applicated needle during inferior alveolar nerve block anaesthesia, when we reach the fibres or facial nerve comes through the parotid gland

- Symptoms (transitonals): on the side of paresis the patient will be unable to pucker his brows and close the eye, the corner of the mouth does not move and it is more below than on the other side
- Treatment no needed

Intraglandular injection

- Facial paresis:



Injuries of the blood vessels

- vascular damage and hemorrhage with hematoma formation
- more frequent in tuberal, rare in lower nerve block anaesthesia
- if a vein injured bleeding is minimal and usually is evidenced a few days after injection
- if an artery damaged it will produce rapid bleeding with significant swelling (haematoma formation)
- treatment: pressure over the injection site, cold compress, antibiotics (to avoid abscedation!)



Haematoma

- Symptoms
swelling rapidly forms, which transparents
with bluish color through the mucosa
- It can cause the discoloration of the skin



Haematoma



Trauma of the muscles

- During inferior alveolar nerve block anaesthesia the fibres of medial pterygoid muscle can hurt.



Trauma of the muscles

- Symptoms:
- Trismus: limited ability to open the mouth, the interincisal wideness reduces
- rare, it can occur 2-5 days after lower nerve block
- intramuscular injection can result haematoma formation, infection and fibrosis inside the muscles
- Treatment: muscle relaxant, soft diet, mouth opening exercises, if caused by infection antibiotics



Injuries of soft tissues

- Inferior alveolar nerve block anaesthesia causes the numbness of the mouth and half of the tongue; it can cause damage of the soft tissues (mainly in case of children chewing of the numb lip and tongue)

Information of the patient or the parents is very important!



Functional abscess

- During intraoral anaesthesia the needle goes via the mucosa. Bacteria exist in oral cavity can pass into connective tissues with the needle that can cause the formation of an abscess.
- Prevention : rinsing with CHX before injection



Other dental solutions unintentional injection

- Solutions used in other dental interventions (parodontal or root canal treatment) can be injected accidentally instead of anaesthetic compound.

Solutions:

- CHX
- physiologic salt solution
- H₂O₂
- NaOCl



Other dental solutions unintentional injection

■ Symptoms :

- Inflammatory symptoms:
pain, swelling, redness of skin ,trismus,
fever
- Necrosis of tissues



Other dental solutions unintentional injection

■ Treatment

- immediate hospitalisation of the patient,
there observation or treatment if needed:

Treated like inflammation:

incision, drainage

rinsing of the opened area

antibiotics



References:

Stanley F. Malamed: Handbook of Local Anesthesia, 6th Edition, Mosby, 2013 ISBN: 978-0-323-07413-1 Part IV. (local and systemic complications)

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