The complications of local analgesia

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Complications and untoward reactions of local analgesia

General complications
- toxic reactions /overdosage/
- Side effect of adrenaline
- allergic /anaphylactic/ reactions

Local complications
- haematoma formation
- nerve injury
- trismus /limited mouth opening/
- facial paralysis
- injury of soft tissues
The aetiology of complications of local analgesia

**General** complications:

due to the anaesthetic **solution**

**Local** complications:

due to the **technique**
General complications

Toxic reactions /overdosage/

Side effect of adrenaline

Allergic /anaphylactic/ reactions
Local anaesthetic solution =

1. anaesthetic agent
2. vasoconstrictor
3. preservative
The pharmacological properties of local anaesthetics

**Toxicity**

- Therapeutical ratio = \( \frac{LD_{50}}{ED_{50}} \)

- Depends on the metabolism of the local anaesthetic agent
The metabolism of Lidocaine and Articaine

- **Lidocaine** (Amide reaction)
  - Amide reaction leads to the formation of an amide derivative.
- **Articaine** (Amide and Ester reactions)
  - Amide reaction leads to an amide derivative with a lower concentration (<10%).
  - Ester reaction leads to an ester derivative with a higher concentration (>90%).

The diagram illustrates the chemical structures of Lidocaine and Articaine, along with their respective metabolic pathways, including the formation of amide and ester derivatives. The reactions are indicated with specific compositions and bonds.
The symptoms of overdosage of local anaesthetic agents

<table>
<thead>
<tr>
<th>Dose</th>
<th>CNS</th>
<th>CVS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depression phase</td>
<td>Respiratory depression, loss of consciousness, coma</td>
<td>Fall of pulse rate and blood pressure, cardiac arrest</td>
</tr>
<tr>
<td>Excitation phase</td>
<td>Excitement, nausea, tremor, convulsions, hyperventilation</td>
<td>Elevation of pulse rate and blood pressure. Redness of skin.</td>
</tr>
</tbody>
</table>
The comparison of local anaesthetics

<table>
<thead>
<tr>
<th></th>
<th>Articaine</th>
<th>Lidocaine</th>
<th>Bupivacaine</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Relative toxicity</strong></td>
<td>1.5</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>procaine = 1/</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Therapeutical ratio</strong></td>
<td>3.3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><strong>Plasma half time</strong></td>
<td>20 min</td>
<td>96 min</td>
<td>162 min</td>
</tr>
<tr>
<td><strong>Recommended maximum dosage</strong></td>
<td>500 mg</td>
<td>300-500 mg</td>
<td>90 mg</td>
</tr>
<tr>
<td>/70 kg/ with Adrenaline</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local Anaesthetics</td>
<td>Protein-Binding (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------</td>
<td>---------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LIDOCAINE</td>
<td>64</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ARTICAINE</td>
<td>95</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BUPIVACAINE</td>
<td>96</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The advantages of high protein-binding of local anaesthetics

• In pregnancy, less anaesthetic enters into the foetal circulation

• Less CVS and CNS risks
Lidocaine 2% c. Adr. /local anaesthetic solution/

**Anaesthetic agent:** lidocainum hydrochloricum 20 mg/ ml

Maximum dose: 7 mg/kg ~ 500 mg

20 ml ~ 10 Ampulla

**Vasoconstrictor:** epinephrinum /adrenaline/ 1 : 100000

0,01 mg/ml

Maximum dose: 0,20 mg
Ultracaine 4% DS forte
/local anaesthetic solution/

**Anaesthetic agent:** articainum hydrochloricum 40 mg/ ml

Maximum dose: 7 mg/ kg ~ 500 mg

12,5 ml ~ 6 Ampulla

**Vasoconstrictor:** epinephrinum /adrenaline/ 1 : 100000

0,01 mg/ ml

Maximum dose: 0,20 mg
General complications

Toxic reactions /overdosage/

Side effect of adrenaline

Allergic /anaphylactic/ reactions
Receptor stimulation of adrenaline (i.v. application)

1-2 μg / min  Beta-1 and Beta-2-stimulation
2-10 μg / min  Alpha, Beta stimulation
10-20 μg / min  Alpha stimulation

Maximum dose: 0.20-0.25 mg/s.c./
The symptoms of overdosage of adrenaline

Dose

- angina pectoris attack, myocardial infarction, ventricular fibrillation, heart arrest
- nervousness, headache, palpitation paleness, tachycardia, hypertension
- systolic blood pressure ↑
- pulse rate ↑
The concentration of **Adrenaline** in local anaesthetics

1 : 50.000
1 : 80.000
1 : 100.000
1 : 200.000
The maximum doses of Adrenaline in local anaesthetic solutions/0.2mg/condensed as follows:

<table>
<thead>
<tr>
<th>CONCENTRATION</th>
<th>mg/ml</th>
<th>mg</th>
<th>ml</th>
<th>Cartridge/1.7ml/</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 : 50,000</td>
<td>0.02</td>
<td>0.2</td>
<td>10</td>
<td>5½</td>
</tr>
<tr>
<td>1 : 100,000</td>
<td>0.01</td>
<td>0.2</td>
<td>20</td>
<td>11</td>
</tr>
<tr>
<td>1 : 200,000</td>
<td>0.005</td>
<td>0.2</td>
<td>40</td>
<td>22</td>
</tr>
</tbody>
</table>
## Lidocaine containing local anaesthetic solutions in Europe

/not complete/

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Proprietary name</th>
<th>Anaesthetic concentration</th>
<th>Vasoconstrictor concentration (Adrenaline)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Astra Chemicals GmbH</td>
<td>Xylocain 2% Adrenaline</td>
<td>2%</td>
<td>1:100 000</td>
</tr>
<tr>
<td></td>
<td>Xylocain 2% Spezial Adrenaline</td>
<td>2%</td>
<td>1: 50 000</td>
</tr>
<tr>
<td>ESPE GmbH</td>
<td>Xylestesin-A</td>
<td>2%</td>
<td>1: 80 000</td>
</tr>
<tr>
<td></td>
<td>Xylestesin cento</td>
<td>2%</td>
<td>1:100 000</td>
</tr>
<tr>
<td></td>
<td>Xylestesin-S „special”</td>
<td>2%</td>
<td>1: 50 000</td>
</tr>
</tbody>
</table>
Articaine containing local anaesthetic solutions in Europe

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Proprietary name</th>
<th>Anaesthetic concentration</th>
<th>Vasoconstrictor concentration (Adrenaline)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESPE GmbH</td>
<td>Ubistesin</td>
<td>4%</td>
<td>1:200 000</td>
</tr>
<tr>
<td></td>
<td>Ubistesin forte</td>
<td>4%</td>
<td>1:100 000</td>
</tr>
<tr>
<td>Hoechst AG</td>
<td>Ultracain D-S</td>
<td>4%</td>
<td>1:200 000</td>
</tr>
<tr>
<td></td>
<td>Ultracain D-S forte</td>
<td>4%</td>
<td>1:100 000</td>
</tr>
</tbody>
</table>
Aspirating syringe equipment
The possible cause of intravasal injection at negative aspiration-test.
General complications

Toxic reactions /overdosage/

Untoward reactions of adrenaline

Allergic /anaphylactic/ reactions
The incidence of allergic responses to local anaesthetic agents

**Procaine**

**Articaine – Lidocaine**

**Bupivacaine**

Para-allergy
Local anaesthetic solution =

1. anaesthetic agent

2. vasoconstrictor

3. preservative
Preservative agents in the local anaesthetic solutions

- Methylparaben: antimicrobial effect – allergic reactions

- Sodium metabisulfite: reducing agent – protects the stability of adrenaline – allergic reactions at asthmatic patients
„Risk-patients” regarding to local analgesia

- cardiovascular diseases
- hyperthyroidism
- hepatic insufficiency
- polyallergy
- pregnancy
- anxiety from the dental treatment
„Risk-patients” regarding to local analgesia

- cardiovascular diseases
- Acute myocardial infarction
- Cardial decompensation
The advantages of high protein-binding of local anaesthetics

• In pregnancy, less anaesthetic enters into the foetal circulation

• Less CVS and CNS risks
“Risk-patients” regarding to local analgesia

- cardiovascular diseases
- hyperthyroidism
„Risk-patients” regarding to local analgesia

- cardiovascular diseases
- hyperthyroidism
- hepatic insufficiency
Hepatic insufficiency: reduced metabolism of amid type of local anaesthetics

- Hypoproteinaemia: alcoholic disease, malnutrition, malabsorption, nephrosis-syndrome, enteropathia

Repeated doses are to avoid!
„Risk-patients” regarding to local analgesia

• cardiovascular diseases
• hyperthyroidism
• diabetes
• hepatic insufficiency
• polyallergy
„Risk-patients” regarding to local analgesia

- cardiovascular diseases
- hyperthyroidism
- diabetes
- hepatic insufficiency
- polyallergy
- pregnancy
“Risk-patients” regarding to local analgesia

- cardiovascular diseases
- hyperthyroidism
- diabetes
- hepatic insufficiency
- polyallergy
- pregnancy

- anxiety from the dental treatment
The comparison of the amounts of adrenaline given at dental treatment, and the catecholamines secreting in the adrenal medulla:

**Dental treatment:**

4 ml Lidocaine c. Adr. = 0.04 mg

**“Stress” situation; pain, anxiety:**

Adrenal medulla = cca. 0.30 mg/min.
Local complications

Haematoma formation

Nerve injury

Trismus /limited mouth opening/

Facial paralysis

Injury of soft tissues
The position of needle and blood vessels at tuberal analgesia
Haematoma formation at tuberal analgesia
Local complications

Haematoma formation

Nerve injury

Trismus /limited mouth opening/

Facial paralysis

Injury of soft tissues
THE DIFFERENT POSITIONS OF THE NEEDLE AT THE NERVE BLOCK ANALGESIA OF THE INFERIOR ALVEOLAR NERVE
Local complications

Haematomata formation

Nerve injury

Trismus /limited mouth opening/

Facial paralysis

Injury of soft tissues
Transitory facial palsy on the left side after mandibular nerve-block analgesia
Local complications

Haematoma formation
Nerve injury
Trismus /limited mouth opening/
Facial paralysis

Injury of soft tissues
TRAUMATIC ULCERATION DUE TO LOCAL ANALGESIA
Necrosis on the hard palate after infiltration analgesia
Thank you for your attention!