Definition

Regional Anesthesia is a reversible blockade of a nerve conduction in nerve endings, peripheral nerves and nerve roots induced by local anesthetic agent.
History

Invention of a needle and syringe – 1853. (Charles Paravaz from Lyon, Aleksander Wood Edynburg)
History

1884 - Austrian oculist Carl Kaller anesthetized cornea using cocaine

In 1884 the surgeons Halsted and Hall in New York performed anesthesia of a single nerve – they used cocaine to block mandible nerve

In 1885 James Leonard Corning, a neurologist from New York he performed spinal anesthesia by accidental injection of cocaine to the dog's subarachnoidal space (He was experimenting with cocaine on the spinal nerves of a dog when he accidentally pierced the dura mater)
History

In 1891 Heinrich Quincke described lumbar puncture as a simple medical procedure.
History

In 1898 August Bier (father of regional anesthesia) first spinal anesthesia done to a man

In 1901 Fernand Cathelin – first epidural anesthesia
History

Local anesthetic agent:
History

Local anesthetic agents:

1860 – extraction of Cocaine
1891 – synthesis Cocaine
1905 – synthesis Procaine
1943 – synthesis Lignocaine
1957 – synthesis Bupivacaine
1957 – synthesis Ropivacaine
1959 – synthesis Prilocaine
1971 – synthesis Etidocaine

synthetized by Swedish chemist Nils Löfgren
Local anesthetic agent

Mechanism of action – the LAA blocks the generation and conduction of nerve impulses. LAA penetrates through cell membrane and binds to the intracellular portion of sodium channels and blocks influx into nerve cell, which prevents depolarization.
Leki znieczulające miejscowo

Figure 27.2 Mechanism of action of local anesthetics. Top: An injury produces pain impulses (action potentials) that are conducted and transmitted in an area of the brain in which pain is perceived. (A) Conduction of the pain impulse has been blocked by infiltration anesthetics at the site of the injury. (B) A nerve block at some distance from the injury. Local anesthetics block the movement of sodium into the nerve and prevent nerve depolarization, stopping the transmission of the pain impulse.
LIGNOCAINUM HYDROCHLORICUM 2%
Lidocaini hydrochloridum
Roztwór do wstrzykiwań 20 mg/ml

10 ampulek po 2 ml

Warszawskie Zakłady Farmaceutyczne Polla
ul. Karolikowii 22/24
01-207 Warszawa
Lignocaine

- for all technics of regional anesthesia,
- antiarrythmic agent callified as IB (Vaughan Williams Classification) used in ventricular arrhythmias -VT, VF, extrasystolic beats
- in general anesthesia used to stabilize cardiovascular system before intubation (eg. before operation of aneurysm of brain blood vassels)

- Dosage as LAA 3mg/kg, or 7mg/kg with adrenaline
- maximal single dose 200mg or 500mg with adrenaline
BUPIVACAINUM hydrochloricum 0,5%
Bupivacaine

- Only as LAA, not to use in intravenous regional anesthesia (IVRA)
- If given intravenously is deeply cardiotoxic
- Acts later but much longer than Lignocaine
- Dosage: 2mg/kg (with or without adrenaline)
- Works stronger on sensory fibres rather than movement fibres. That's why it is used in continuous epidural anesthesia in labour

- Dosage 2mg/kg (with or without adrenaline) (adrenaline does not prolong action)
- Maximal dose/day 5mg/kg
Naropin®
(ropivacaine HCl) Injection

0.5% (5 mg/mL)

For Infiltration, Nerve Block, and Epidural Administration Only. Not for Intravenous Administration.

30 mL Single Dose Vial

Rx only
Naropin

- Less cardiotoxic than Bupivacaine
- Effect on sensory fibres is much stronger than on motoric fibres (fits perfectly for analgesia in labour)
- Slow absorption from epidural space
- Dosage 3mg/kg, max 150mg
Benzocaine

- low solubility in water, only as topical LAA
- It is the active ingredient in many over-the-counter anesthetic
Cocaine

- alkaloid isolated from leaves of *Erythroxylon coca*
- quickly absorbed from mucous membrane
- in contrast to other LAA causes vasoconstriction (used in the past by ENT surgeon)
- halftime 45min
- systemic effects: inhibition of dopamine and noradrenaline reuptake from synapse (euphoria, lack of fear, rised BP..)
Toxicity of local anesthetic agents

High concentration of LAA in blood may occur in case of:
- Overdose
- Giving directly into blood vessels
- Fast absorption from well vascularized tissue
- Accumulation after multiple administration
Toxicity of local anesthetic agents

Symptoms of intoxication:

- slight intoxication: formication around lips, metallic taste in mouth, noise in ears, difficulty speaking and visual disturbances

- moderate intoxication: psychomotor agitation, seizures, coma

- severe intoxication: cardiac arrest
**Toxicity of local anesthetic agents**

1. Stop administering
2. Call for help
3. ABC, give oxygen, intubate if necessary
4. Start resuscitation and get lipid emulsion
5. Protect vascular access
6. Proceed according to the state of ECG
7. Administer 20% lipid emulsion iv
8. Resuscitate for a long time (>1h), if there is no response consider
9. ECMO

10. If there wasn't cardiac arrest, treat with standard method (fluids, catecholamines)
11. In convulsion use: Diazepam, Thiopental
Toxicity of local anesthetic agents

"Lipid rescue"

- At the beginning it was used as specimen for TPN (total parenteral nutrition)
- Lipid emulsion absorbs LAA decreasing its concentration in blood
LipidRescue™

TREATMENT FOR LOCAL ANESTHETIC-INDUCED CARDIAC ARREST

PLEASE KEEP THIS PROTOCOL ATTACHED TO THE INTRALIPID BAG

In the event of local anesthetic-induced cardiac arrest that is unresponsive to standard therapy, in addition to standard cardiopulmonary resuscitation, Intralipid 20% should be given intravenously in the following dose regimen:

- Intralipid 20% 1.5 mL/kg over 1 minute
- Follow immediately with an infusion at a rate of 0.25 mL/kg/min.
- Continue chest compressions (pump until circulate)
- Repeat bolus every 3 to 5 minutes up to 3 mL/kg total dose until circulation is restored
- Continue infusion until hemodynamic stability is restored. Increase the rate to 0.5 mL/kg/min if BP declines
- A maximum total dose of 8 mL/kg is recommended

In practice, in resuscitating an adult weighing 70kg:

- Take a 500 mL bag of Intralipid 20% and a 500 mL syringe.
- Draw up 50 mL and give stat iv., 2x2
- Then attach the Intralipid bag to an IV administration set (macrodrip) and run at 1x2 the next 10 minutes
- Repeat the initial bolus to a total dose if spontaneous circulation has not returned.

If you use Intralipid to treat a case of local anaesthetic toxicity, please report it at www.lipidrescue.org. Remember to rescan the lipid.

Ver 7198
TREATMENT FOR LOCAL ANESTHETIC-INDUCED CARDIAC ARREST

PLEASE KEEP THIS PROTOCOL ATTACHED TO THE INTRALIPID BAG

In the event of local anesthetic-induced cardiac arrest that is unresponsive to standard therapy, in addition to standard cardio-pulmonary resuscitation, Intralipid 20% should be given i.v. in the following dose regime:

- Intralipid 20% 1.5 mL/kg over 1 minute
- Follow immediately with an Infusion at a rate of 0.25 mL/kg/min,
- Continue chest compressions (lipid must circulate)
- Repeat bolus every 3-5 minutes up to 3 mL/kg total dose until circulation is restored
- Continue infusion until hemodynamic stability is restored. Increase the rate to 0.5 mL/kg/min if BP declines
- A maximum total dose of 8 mL/kg is recommended

In practice, in resuscitating an adult weighing 70kg:

- Take a 500ml bag of Intralipid 20% and a 50ml syringe.
- Draw up 50ml and give stat i.v., X2
- Then attach the Intralipid bag to an iv administration set (macrodrip) and run it i.v over the next 15 minutes
- Repeat the initial bolus up to twice more – if spontaneous circulation has not returned.

If you use Intralipid to treat a case of local anaesthetic toxicity, please report it at www.lipidrescue.org. Remember to restock the lipid.
Bupivacaine-Induced Cardiac Collapse in an Anesthetized Rat (Rescue with Lipid Emulsion Infusion)
Regional anesthesia

- Central blockade
  - Spinal anesthesia
  - Epidural anesthesia
- Peripheral blockade
  - Peripheral nerves anesthesia
  - Infiltration anesthesia
  - Surface anesthesia
surface (topical) analgesia

analgesia of Mucous membrane

in this type anesthetize are: mucos membrane of nose, mouth, throat, larynx, pharynx, trachea, bronchi, oesophagus, eye, genitourinary system by direct sprinkling or putting on surface an anesthetic agent

To do it we can use:
10% Lidocaine in aerosol, 2% Lidocaine in gel
these two are rapidly absorbed from mucos membrane
surface (topical) analgesia
EMLA Cream

- EMLA Cream – is an emulsion which contains Lidocaine and Prilocaine in ratio 1:1 by weight.

- Applied to intact skin under occlusive dressing provides dermal analgesia by accumulation in the vicinity of dermal pain receptors and nerve endings. The absorption is very slow, the results can be noticed after an hour, depth ca. 5 mm. EMLA is used before venal access in small children.
- or in small procedures in dermatology
Transdermal 5% lidocaine patch

- **Versatis® 5% lidocaine**
  - Mechanical effect:
    - Plaster protects hypersensitive skin
    - Soothing effect of the hydrogel
  - Pharmacological effect:
    - Analgesia with Lidocaine 5%

- **Treatment: co-analgesics**
  - Neuropathic pain
    - Local anesthetics
      - Transdermal lidocaine patch 5% (Versatis®)
    - Indications
      - Peripheral neuropathies
      - Areas of sensory disturbances and/or pain
      - Painful bone structures (e.g., spine)
    - No systemic absorption
    - Quick onset pain control
    - No tolerance
    - Side effects: skin reactions
Treatment: co-analgesics

- **Neuropathic pain**
  - Local anesthetics
    - Transdermal lidocaine patch 5% (Versatis®)
      - Indications
        - Peripheral neuropathies
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Infiltration anesthesia

In this kind of anesthesia, a local anesthetic agent is given intradermal, subcutaneous, or intramuscular, which blocks the nerve endings.
Intravenous local anesthesia

Intravenous local anesthesia: it's a special variation of infiltration anesthesia.

Bier block anesthesia
Block of peripheral nerves/plexus

Brachial plexus block
Lumbar plexus block
Sciatic nerve block
Periauricular block
Jugular plexus block
TAP block

......
Central blockade

Figure 1 - Method of CSTEa.

- spinal cord
- dura mater
- epidural space
- cannula with catheter
- thoracic spine
- T8, T10, T12
- lumbar spine
- L1, L3
- sacrum
- nerv fiber
- injection site for deep thoracic epidural catheter
- injection site for spinal anesthesia
- liquor
Spinal anesthesia

- Definition: it is a reversible stop of conduction in the nerve roots after injecting the subarachnoid space with local anesthetic agent
Spinal anesthesia

• Quick effect onset, good muscle flaccidity, small number of drugs used, easiness of anesthetization characterize subarachnoid anesthesia.

• After injecting the subarachnoid the local anesthetic agent is absorbed by nerve tissue causing nerve block, which takes place in a specific order.
Spinal anesthesia

• The order of block occurrence: first, the sympathetic preganglionic nerve fibres (vassal dilation – skin warming, drop of BP), next fibre responsible for temperature sensation, pain and touch sensation, then motor fibres and as the last fibres conducting vibration and sense of position.

• The return of physiological function is in reverse order. First the motor functions come back, then sensation, and as the last autonomic functions
Spinal anesthesia
General results of the subarachnoid anesthesia

- Administration of local anesthetics into subarachnoid space cause not only the local nerve block in the area corresponding to innervation, but also, depending on extent of anesthesia, the general effects of direct and indirect character, which have essential clinical meaning.
Influence on the circulatory system

- Reversible block of sympathetic preganglionic fibers supplying blood vessels cause the dilation of them.
- That is why the block leads to:
  Drop in arterial BP
  Decrease in venous return
  Relative hypovolemia

- In healthy patients drop of BP causes contraction of the vessels located above the anesthetized area, which is head, neck, and upper limbs. It is an autonomic reaction coming from baroreceptors from which stimulus spread through the unblocked fibres Th 1-4 contracting bloodvessels (as long as they are not blocked)

- If the block includes also the Th 1-4 fibers, then the total sympathetic block spreads from Th1-L2. Clinically, the symptoms of block is the drop of BP, CO and SVR. Autonomic reactions of circulatory system are blocked compleatly and there is particular sensitivity to the lack of circulating blood.
Influence on the functions of respiratory system:

The influence is minimal as long as the phrenic nerve C 3-5 is not blocked and there is no risk of respiratory failure.

Influence on the functions of the urinary bladder:

The block of sacral sympathetic segments S 2-4 causes the urinary bladder atony with urinary pressure inhibition. After anesthetization, the function of autonomic fibres S 2-4 comes back as the last one.
Absolute contraindications to subarachnoid anesthesia:

- lack of patient’s consent
- Blood coagulation disorders
- Sepsis
- Shock
- Severe heart disease (aortic/mitral stenosis)
- Skin infections in the area of injection
- General critical condition
- Surgical procedure duration <0, 5 hours > 3 hours
Relative contraindications

- some neurological disorders (e.g. multiple sclerosis) - Legal and medical difficulties
- Severe spine deformation, spine surgery - Technical difficulties
The most common complications of the subarachnoid anesthesia:

Early onset:

Drop of BP
Bradycardia
Nausea and vomiting
Drop in body temperature
Late onset

Postdural puncture headache
Urinary bladder disorders
Backaches
Neurological complications:
Direct spinal cord injury/Chemical injury – local anesthetics, skin disinfecting agents
Hematoma of the vertebral canal
Bacterial infection:
spinal cord inflammation
abscess of the suba. space
Cauda equine syndrome
Meningitis
Epidural anesthesia

Definition – epidural anesthesia consists in stopping the nerve conduction by injecting the local anesthetic agent to the epidural space of the vertebral canal

main purpose: postoperative analgesia
The needle goes through the subcutaneous tissue, supraspinous ligament, interspinous ligament, **ligamentum flavum**, epidural space[stop]. (...dura mater, subarachnoid space)
Contents of the epidural space:

- roots of the spinal nerves, blood vessels, connective and adipose tissue
Epidural Catheter
**Nerve blockade in epidural anesthesia**

In the epidural anesthesia, the anesthetic starts working after a long time of latency and the motor functions are not always completely blocked. To gain full anesthesia in epidural we need about 15 – 20 minutes.

The scope depends on volume and in the lumbar area in adults to block one segment we need on average 1,5 ml, and in the thoracic it is 0,5 ml/segment.
Normogram Bromag

Dawka (ml/segment)

Wiek (lata)

Wzrost (cm)

190
180
170
160
150
140
General results of the epidural anesthesia

In the L-S segment – the same effect as in subarachnoid anesthesia
In the Thoracic segment:

- Function of the heart – sympathetic block of the segments Th 1-5 causes drop in the heart rate, cardiac output, and systemic vascular resistance.
- Coronary circulation – based on the trials on animals the Th 1-5 block improves the coronary flow.

- Lung function – in patients with healthy lungs it does not significantly influence the function of respiratory system. In patients with the respiratory disease in which additional work of respiratory muscles is necessary, high thoracic block may cause respiratory dysfunctions.
Indications for epidural anesthesia

Surgery
Thoracic surgery, Cardiosurgery, Angiosurgery, GI surgery, Obstetrics and Gynecology, Urology, Orthopedics and Traumatology

Treatment of acute pain
Postoperative analgesia
Trauma
Others (Diabetes, ischaemic pain of limb)

Palliative medicine
Treatment of chronic and cancer pain
Surgery
Thoracicsurgery, Cardiosurgery, Angiosurgery, GI surgery, Obstetrics and Gynecology, Urology, Othopedics and Traumatology
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Treatment of chronic and cancer pain
<table>
<thead>
<tr>
<th></th>
<th>Epidural</th>
<th>Spinal</th>
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</thead>
<tbody>
<tr>
<td>Place of needle insertion</td>
<td>LS, Th, C</td>
<td>LS</td>
</tr>
<tr>
<td>Technique</td>
<td>difficult</td>
<td>easy</td>
</tr>
<tr>
<td>Administration of LAA</td>
<td>Epidural</td>
<td>Subarachnoidial</td>
</tr>
<tr>
<td>Volume of LAA</td>
<td>10-20ml</td>
<td>3-4 ml</td>
</tr>
<tr>
<td>Onset of action</td>
<td>20-30 min</td>
<td>2-5 min</td>
</tr>
<tr>
<td>Duration of action</td>
<td>3-5h, several days</td>
<td>2-3h</td>
</tr>
<tr>
<td>Quality of surgical anesthesia</td>
<td>average</td>
<td>high</td>
</tr>
<tr>
<td>Motor blockage</td>
<td>average/weak</td>
<td>deep</td>
</tr>
<tr>
<td>PDPH</td>
<td>-</td>
<td>possible</td>
</tr>
<tr>
<td>Possible usage</td>
<td>Unlimited (OT, ICU..)</td>
<td>operating theatre</td>
</tr>
</tbody>
</table>
Combined spinal epidural anesthesia

**BD™ Combined Spinal/Epidural (CSE) System**

**BD Durasafe™ CSE Needle Set**

- Provides rapid onset, extended duration, and pain management
- The only CSE matched-set system with BD™ Whitacre high flow pencil point needle
- BD Durasafe™ matched sets are designed to allow 12 mm extension of spinal needle when matched hubs are fully engaged

**BD Durasafe™ Needle Sets**

<table>
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<tr>
<th>PROD #</th>
<th>DESCRIPTION</th>
<th>PACKAGING</th>
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<td>405139</td>
<td>25 GA x 4 11/16 in. Whitacre / 17 GA x 3 1/2 in. Weiss Needle</td>
<td>10/box, 50/case</td>
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<tr>
<td>405452</td>
<td>27 GA x 4 11/16 in. Whitacre / 18 GA x 3 1/2 in. Weiss Needle</td>
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McGill Pain Index

Comparison of pain scores using the McGill Pain Questionnaire, obtained from:
- Patients in a general hospital pain clinic  Melzack 1975 Pain 1(3):277-299
- Patients in a hospital emergency department  Melzack & Wall 1982 Pain 14(1):33-43
- Patients with a firm diagnosis of causalgia  Tahmoush 1981 Pain 10(2):187-197
Anticoagulation and neuraxial blockade

Conclusions

Regional anesthesia is a safe alternative for general anesthesia.