Preface

The development of anaesthesia is currently affected by the growing interest in regional anaesthesia and analgesia. In particular, there is an increasing interest in peripheral nerve blocks, and in many clinics the use of this method is prefered to the central blocks whenever possible, thus becoming increasingly more common. What is the reason of the growing interest and what makes the greater educational and practical efforts involved in the use of regional blocks worthwhile?

First of all, it is the implementation of a perioperative anaesthesia and postoperative analgesia concept. A block initiated preoperatively and used intraoperatively continued via a catheter to provide effective postoperative regional analgesia with a low risk of complications. This concept enables early mobilisation and quicker rehabilitation.

The effects of regional anaesthesia (mostly in the form of central neuraxial blocks) on various outcome parameters were demonstrated in the CORTRA meta-analysis (Rodgers et al., BMJ 2000; 321:1493) based on the evaluation of 141 clinical studies involving approximately 10,000 patients. Patient groups who underwent surgery under general anaesthesia were compared to those who either received regional anaesthesia or combined general – regional anaesthesia. According to the results, regional anaesthesia reduced postoperative complications and the over-all postoperative mortality rate by 30%. The authors concluded that the most likely reason for the reduction of postoperative complications was the decreased intraoperative stress response due to regional anaesthesia block.

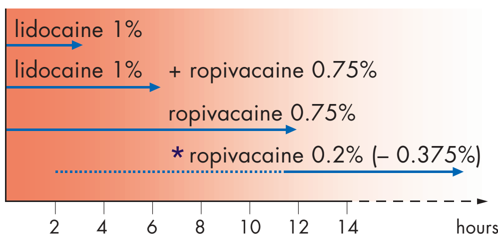
Furthermore, we are well aware of the potential risk of severe pain developing into a chronic pain condition, a situation that can and should be avoided. The most reliable way to prevent pain from becoming chronic comprises regional anaesthesia techniques that block the pain stimulus near its origin, both peri- and postoperatively, thereby eliminating acute pain as a special postoperative risk factor.

The continuing development of regional anaesthesia and analgesia is important when considering the aspects described above but there are also ethical and economical points of view which call for a wider use of regional anaesthesia. With this compendium of peripheral nerve blocks, we present a brief review of the most commonly used techniques. Thereby we hope to stimulate the interest and understanding among our colleagues for the use of regional anaesthesia techniques.

Action time of regional anaesthetics:

Intraoperative and postoperative analgesia

* Start infusion before onset of post operative pain; otherwise start with an initial bolus.



Overview of the most important local anaesthetics for peripheral nerve blocks

Substance	Concentration Anaesthesia Analgesia	Dosage* Anaesthesia Analgesia	Time until effective	Analgesic action time
Ropivacaine (Naropin)	0.5% – 0.75% 0.2% – 0.375%	up to 300 mg up to 28 mg/h	10 – 20 min	8 – 14 h
Lidocaine	1% (– 2%) –	up to 600 mg –	10 – 20 min	2 – 4 h
Mepivacaine	1% (– 2%) –	up to 300 mg –	10 – 20 min	3 – 4 h

	Anaesthetic potency (ratio to procaine = 1)	Protein binding (%)	Distribution volume (L)	Elimination half-life (h) in plasma
Ropivacaine	16	94	59	1.9
Lidocaine	4	64	91	1.6
Mepivacaine	4	77.5	84	1.9

* (manufacturers' recommendations)

Special features:

Ropivacaine
- Favourable effective dose/toxicity ratio
- Good differential block (analgesia >> motor block) at lower concentrations used for analgesia

Lidocaine
- Local anaesthetic with medium action time and low toxicity

Mepivacaine
- Effectiveness comparable to lidocaine, but less toxic and slightly longer duration

General technical aspects on peripheral nerve blocks

- Use aseptic technique.
- Resuscitation equipment and drugs should always be available when regional anaesthesia is used.
- Local cutaneous infiltration anaesthesia.
- Skin incision with a lancet before insertion of a short-beveled needle (e. g. 45° bevel).
- Nerve stimulation: Ascending from 0.1 – 1.0 mA, until visible muscle contractions in the corresponding innervation area; then reduction to between 0.3 – 0.5 mA/0.1 ms before injection of the local anaesthetic.
- Repeated aspiration attempts before and during injection of the local anaesthetic. A negative aspiration test does not completely exclude an intravascular needle position.
- With larger doses of a local anaesthetic, use fractional injection and verbal patient monitoring for early recognition of accidental intravascular injection.
- In poorly cooperative patients, patients under sedation or when performing a block distal to an established central block (e. g. femoral nerve block in the presence of spinal anaesthesia) a nerve stimulator and unipolar needle should be used (no neuromuscular relaxation!). Exception: Infiltration anaesthesia of purely sensory nerves.
- Catheter technique: Placement of the catheter tip 3 – 5 cm beyond the tip of the introducing needle, to be inserted normally after injecting the loading dose of the local anaesthetic.
- Monitoring: When performing blocks in the head and neck area and when larger doses of local anaesthetic are used the patient should have an i.v. cannula, ECG and pulse oximetry applied before the block. Standard monitoring includes ECG, pulse oximetry, blood pressure and the degree of consciousness.
- Catheter: Daily control of the catheter insertion site, written documentation (see p. 9).

Side effects, complications/contraindications (general)

Side effects and complications

- Systemic toxicity of the local anaesthetic
  Most common reason: Unintended intravascular injection
  Minimize risk by
  - Adhering to the recommended dosages
  - Repeated aspiration and fractional injection
  - Slow injection, observe and maintain verbal contact with the patient (NB: negative aspiration does not entirely exclude intravascular injection!)

- Nerve damage (extremely rare)
  Minimize risk by
  - Trying to avoid paresthesias when inserting the needle
  - Correct use of a suitable nerve stimulator (≥ 0.3 – 0.5 mA/ 0.1 ms)
  - The use of atraumatic needles

- Hematoma
  Minimize risk by
  - No blocks in the presence of a clinically manifest coagulation disorder or anticoagulation treatment

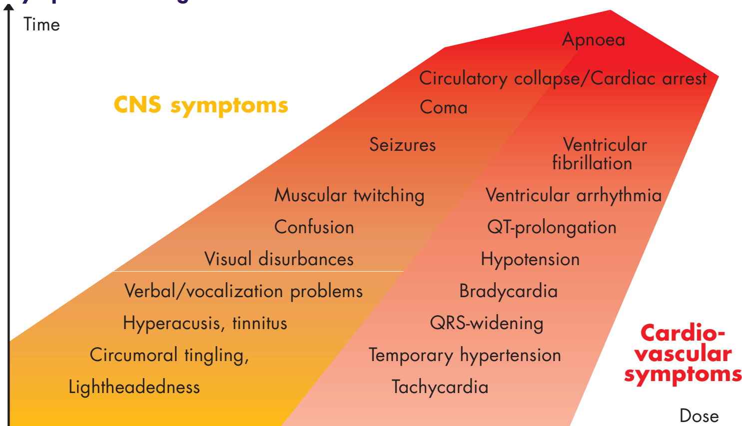
- Infection (especially when using continuous techniques)
  Minimize risk by
  - Aseptic needle insertion
  - Regular planned checks of the catheter insertion site (at least once a day)
  - Most sensitive indicator: Tenderness at the point of catheter entry (requires immediate removal of the catheter)

General contraindications to regional anaesthesia

- Rejection of the technique by the patient
- Clinically manifest coagulation disorders
- Infection or hematoma at the injection site
- Relative contraindication: Neurological deficits (previous documentation necessary)

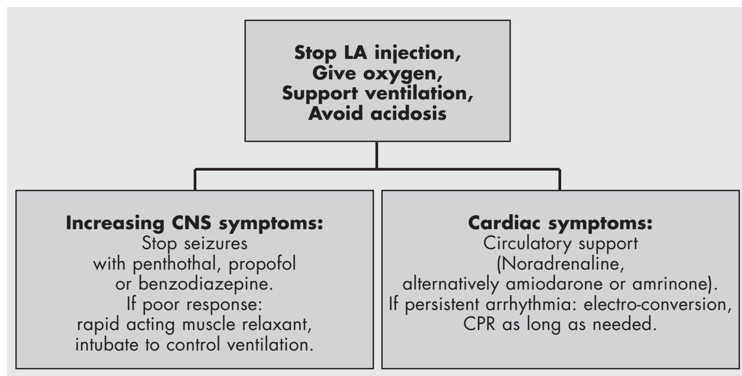
Systemic effects of local anaesthetic intoxication

Symptoms and signs of local anaesthetic intoxication



A relative small dose of local anaesthetic, if accidentally injected intravasculary, may lead directly to seizures with both respiratory and cardiovascular problems, depending on drug and patient conditions.

Treatment of local anaesthetic intoxication



Allergy for amide local anaesthetics is extremely rare and should be treated like any allergic reaction.

Mobile pump system (CADD-Legacy PCA) for administration of Naropin® Polybag

Pump and Polybag in a carrier bag for mobile patient use

Naropin® 2 mg/ml, 200 ml Polybag
analgesically effective concentrations

*Real volume of Naropin® in 200 ml Polybag is 210 ml	ml additional volume	total mg	total volume ml*	concentrations mg/ml
Reduce	**80**	420	290	**1,4**
concentration	**60**	420	270	**1,6**
by dilution	**40**	420	250	**1,7**
with NaCl 0.9 %	**20**	420	230	**1,8**
Polybag	**standard**	420	210	**2**
Increase	**10**	520	220	**2,4**
concentration	**20**	620	230	**2,7**
by adding	**40**	820	250	**3,3**
Naropin® 10 mg/ml	**60**	1020	270	**3,8**

Check-up rounds

- At least once a day
  - – Check catheter insertion site
  - – Assess effectiveness
  - – Analyse indications critically
  - – Careful documentation (see p. 9)
- In case of insufficient effectiveness
  - – Catheter positioned correctly? Dislocated?
  - – In case of partial effectiveness: Injection of a bolus (e. g. 20 ml ropivacaine 0.75%)
  - – Supplemental analgesics (NSAID, opiods orally) as needed
  - – Additional pain medication when removing catheter
- Duration of treatment
  - – Up to 4 – 5 days – depending on the indication. (For chronic pain therapy a duration of more than 100 days has been described.)
  - – Analgesic catheter can be used in out-patients, but the corresponding prerequisites must be considered

Requirements for a nerve stimulator (acc. to Kaiser)

Electrical layout:

- – Adjustable constant current in the presence of a load of 0.5 – 10 kOhm
- – Monophasic square output impulse
- – Selectable impulse width (0.1 – 1.0 ms)
- – Impulse amplitude (0 – 5.0 mA) with precision adjustment and digital display of the actual current
- – Impulse frequency 1 – 2 Hz

Safety device:

- – Alarm upon interruption of circuit
- – Alarm when the max. impedance is exceeded
- – Alarm when an error occurs inside the device
- – Unmistakable assignment of outputs
- – Adequate operating instructions for use, indicating the deviations tolerated

Documentation example

BERUFSGENOSSENSCHAFTLICHE UNFALLKLINIK MURNAU

Department of Anaesthesia

Pain service

Name: ____________________ Regional anaesthesia: ____________________

Date of birth: ____________________ Date inserted: ____________________

Ward: __________ Room no.: __________ Skin - nerve space (cm): ____________________

Indication: ____________________ Distance catheter tip - skin (cm): ____________________

Comments:

Date	Time	Anaesthetic agent mg/ml	ml/h	Insertion site	Patient's condition	VAS at rest	VAS at movement	Signature

Catheter removed: ____________________ Bacteria test: yes ☐ no ☐

Results: pos ☐ neg ☐

Comments: ____________________

This side for patient's records. Signature:

Copy side for department's documentation

(1-10: Max. imaginable pain

0: No pain

VAS: Visual analog scale (0 - 10; 0 = no pain, 10 = maximum imaginable pain)