Table 9.5 Overview of onset and duration of action of various local anaesthetics (according to Labelle and Clark-Price, 2013)

Local anaesthetic	Onset of effect (min)	Duration of effect (min)	Administration
Lidocaine	5–15	30–120	Topical, infiltration, regional, systemic
Procaine	5–15	30–120	Infiltration, regional
Mepivacaine	5–30	90–180	Infiltration, regional
Bupivacaine	15–45	180–360 (–480)	Infiltration, regional
Ropivacaine	15–45	180–360 (–480)	Infiltration, regional
Proparacaine	<1	5–25	Topical cornea
Tetracaine	<1	5–30	Topical cornea

- Less general anaesthetics are needed, therefore a lighter anaesthesia stage is possible
- Pain relief even in the recovery phase
- However, also be honest about possible side effects!

Clinical relevance

Why local anaesthesia?

The main goal for the patient is to be pain-free postoperatively! This reduces suffering, the animals eat and move again faster and generally have a faster/better recovery phase.

In addition, there is evidence from human medicine that the use of local anaesthesia reduces chronic pain syndromes and the incidence of wound infections. Overall, respiratory and cardiovascular complications are less frequent.

9.4.2 Small animals

In dogs and cats, but also in small mammals, with a little practice, it is relatively easy to perform various local blocks that cause excellent analgesia when carried out correctly. Especially for small dogs, cats or small mammals, it is recommended to use one of the two local anaesthetics (LA) lidocaine 2% (p. 108) or bupivacaine 0.5% (p. 76). Cats are more sensitive to toxic side effects of local anaesthetics, so particular attention should be paid to the dose in these animals. Ropivacaine 0.75% (p. 137) is particularly well suited for neuroaxial and

regional anaesthesia of the limbs as it causes differential blockade (more sensory than motor blockade).

Local anaesthesia for procedures on the head

Targeted local anaesthesia provides reliable analgesia in the area of the head in order to carry out procedures in the oral cavity or dental treatment, rhinoscopy, wound care or other operations without pain. It is worth having a cat or dog skull for anatomical comparison in order to reliably find the anatomical landmarks.

Again, always aspirate before injecting, if blood is aspirated, re-position the cannula. If blood is aspirated again, the procedure should be aborted.

Rostral part of the maxilla: Infraorbital nerve (n. infraorbitalis)

▶ **Sensory blockade**

- Teeth in the maxilla rostral to the infraorbital foramen (from P3)
- Skin, mucosa and gingiva in the upper jaw rostral to the infraorbital foramen
- Upper lip
- Parts of the nasal cavity and dorsum of the nose

▶ **Approach and localisation in the dog**

- 22–25 G, 2.5 cm cannula
- Palpation of the infraorbital foramen in the dog approx. 1 cm above the distal root of P3
- Puncture through the skin or with the lip raised through the mucosa (▶ Fig. 9.2)
- Advance the cannula approx. 1 cm rostral to the foramen, under the mucosa into the hole; be careful in brachycephalic dogs, do not advance!
- The further you can advance the needle (without resistance) into the hole, the larger the desensitised area will be; caution eyeball! Again, do not advance in brachycephalic dogs!
- Injection volume depending on the size of the dog from 0.2–0.5 ml LA after aspiration

aus: Eberspächer-Schweda, AnaesthesiaSkills in veterinary medicine (ISBN 9783132444744)

Fig. 9.2 Local anaesthesia of the infraorbital nerve in dogs for extraction of a persistent canine tooth.

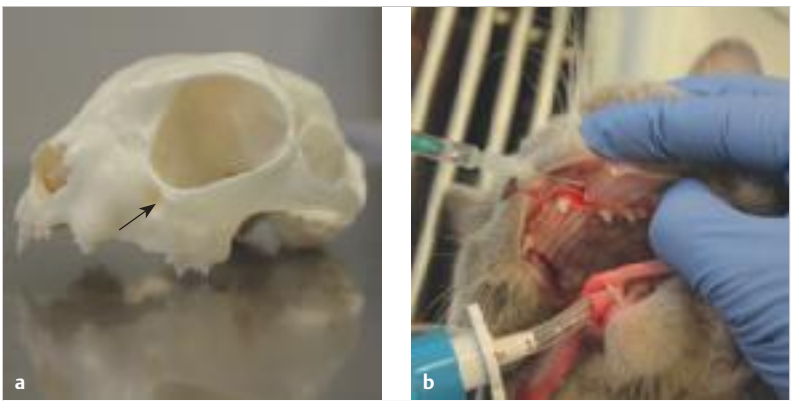

Fig. 9.3 Local anaesthesia of the infraorbital nerve in the cat.
a Anatomical localisation of the infraorbital foramen in the cat skull.
b Injection of local anaesthetics at the infraorbital nerve in the cat.

▶ Approach and localisation in the cat

- 25 G, 1.5 cm cannula
- Locate the infraorbital foramen directly ventral to the orbit
- **Do not advance the cannula** into the hole, as there is a risk of puncturing the eyeball, as the infraorbital foramen is directly adjacent to the orbit (▶ Fig. 9.3a)
- Injection volume of 0.2–0.3 ml LA relatively superficially in the mucosa above the foramen (▶ Fig. 9.3b)

Entire upper jaw: Maxillary nerve (n. maxillaris)

Anatomically, the nerve at this level is the caudal portion of the infraorbital nerve, but it is often referred to as the maxillary nerve. There are different approaches to anaesthetise the maxillary nerve caudal to the pterygopalatine fossa: from intraoral or extraoral, i. e. through the skin (dog and cat), as well as via the infraorbital canal as when anaesthetising the infraorbital nerve (p. 418). The approach via the infraorbital canal is used rather rarely and should only be performed in dogs, otherwise the eyeball may be punctured. To deposit LA up to the maxillary nerve, a larger volume must be used. The highest success rate seems to be achieved with an intraoral access using a bent cannula (90° angle).

▸ Sensory blockade

- All teeth in the upper jaw, adjacent gingiva, mucosa and bone
- Maxillary sinus
- Roof of the mouth, hard and partly soft palate
- Skin including nose up to the medial septum

▸ Approach and localisation in dogs and cats

- **Intraoral approach**, can be done from laterally (▸ Fig. 9.4) or ventrally with a bent cannula:
  - 22–25 G, 1.5–2.5 cm cannula
  - Insert the cannula caudal to the last molar a few millimetres vertically from ventral to dorsal

Fig. 9.4 Local anaesthesia of the maxillary nerve in the cat.

- **Extraoral approach** (dog):
  - 22–25 G, 2.5 cm cannula
  - The ventral rim of the zygomatic arch is palpated
  - At the most rostral point, at the border of the last molar, the cannula is inserted at a slight angle towards rostral and ventral
  - It is advanced a few millimetres and LA (0.2–0.5 ml) is injected after aspiration

Rostral part of the mandible: Mental nerve (n. mentalis)

▶ Sensory blockade

- All structures rostral to the (medial) mental foramen
- Incisors
- Lips

▶ Approach and localisation in dogs and cats

- 22–25 G, 2.5 cm cannula
- Palpation of the medial mental foramen (cannot really be palpated in the cat) on the lateral side of the rostral mandible just below the mesial root of P2 (dog) or medial to the labial frenulum (dog and cat)
- In small dogs and cats, it is sufficient to deposit approx. 0.2–0.3 ml LA above the hole (▶ Fig. 9.5); the foramen is so small that you can hardly insert a cannula

Fig. 9.5 Local anaesthesia of the medial mental foramen in the cat.

Fig. 9.6 Local anaesthesia of the mental nerve in dogs.
a Approach.
b Anatomical localisation of the mental foramen.

- In larger dogs, the cannula can be advanced a few millimetres into the hole from rostral to caudal and then the LA (0.3–0.5 ml) injected after aspiration (▶ Fig. 9.6)

Entire body of the mandible: Inferior alveolar nerve (n. alveolaris inferior)

The inferior alveolar nerve, which originates from the mandibular nerve, can again be accessed from intra- or extraorally. In smaller animals, the extraoral approach is easier.

▶ Sensory blockade

- All teeth in the lower jaw, adjacent gingiva and bone
- Skin over the entire quadrant

▶ Approach and localisation in dogs and cats

- **Intraoral approach** (▶ Fig. 9.7):
  - 22–25 G, 1.5–2.5 cm cannula
  - Intraoral palpation of the mandibular foramen on the medial side of the mandibular ramus with one finger
  - Leave the fingertip "lying" over the hole
  - Advance the cannula along the periosteum until the tip of the cannula lies in the mucosa under the fingertip
  - After aspiration, inject a volume of 0.2–0.5 ml, a bubble should form under the fingertip in the mucosa
- **Extraoral approach** (well suited for small animals, ▶ Fig. 9.8):
  - 22 G, 2.5 cm cannula or longer for larger animals

Fig. 9.7 Local anaesthesia of the inferior alveolar nerve in dogs (intraoral approach).

Fig. 9.8 Local anaesthesia of the inferior alveolar nerve in dogs (extraoral approach).

- Again, palpate the mandibular foramen intraorally with one finger and leave the fingertip over it
- Insert a cannula from the outside on the medial side of the most ventral point of the mandible and slide the cannula in the mucosa along the bone until it lies under the fingertip (**caution**: do not poke yourself!), then proceed as described above

Local anaesthesia for enucleation: Retrobulbar block

The retrobulbar block is not without risk but, if performed correctly, can provide excellent analgesic care for the patient during and after this painful procedure.

▶ Sensory blockade

- Eyeball, partially eyelids (some tone may be maintained)
- Parts of the skin or tissue around the eye

▶ Risks

- Puncture of the eyeball, optic nerve or vessels
- Haemorrhage
- Injection of LA into the cerebrospinal fluid surrounding the optic nerve
- Triggering the oculo-cardiac reflex

▶ Approach and localisation in dogs and cats

- There are several ways to access the retrobulbar space
- An injection via the dorso-lateral approach is often used
- 22 G, 2–3 inch spinal cannula (1 inch = 2.54 cm), cannula should be bent (▶ Fig. 9.9a)
- Volume of LA should be adjusted to the size of the animal: Cat and small dog approx. 0.5–2 ml LA, large dog up to 5 ml LA; maximum dose should be calculated as always
- The upper eyelid is pulled slightly upwards and the cannula is inserted through the conjunctiva at the dorso-lateral orbital rim
- Cannula is pushed along the bony orbit to above and behind the eyeball (▶ Fig. 9.9b)
- Stop in time to avoid puncturing the nerve sheath around the optic nerve
- Aspirate – if blood or cerebrospinal fluid is aspirated, the procedure should be aborted! Inject slowly while monitoring vital signs.
- Another option is the **peribulbar block**, which is associated with fewer risks, but large volumes of LA are injected into the conjunctiva.

Fig. 9.9 Retrobulbar block in the cat.
a Pre-bending the spinal cannula.
b Advancing on the dorsolateral orbital rim.

Limbs

There are many simple, but also technically more demanding ways of administering local anaesthesia to parts of the limb. A few of them are described below:

- Intraarticular administration
- Regional anaesthesia: Ring block, brachial plexus block, femoral and sciatic nerve block
- Central anaesthesia: Epidural or spinal anaesthesia (discussed separately below as this type of local anaesthesia not only affects the limbs)

Intraarticular administration

Before or after arthroscopy and arthrotomy, local injection of opioids (usually **morphine** 0.1 mg/kg) can provide analgesia. The use of local anaesthetics (especially **bupivacaine**) is controversially discussed as study results indicate that

chondrocytes can be damaged by high-dose, high-concentration LA administered continuously. However, a diluted single injection in a low dose is still considered harmless.

If drugs are injected intraarticularly preoperatively, care should be taken to ensure absolute sterility and a sufficiently long exposure time before washing them out of the joint with irrigation solution. Otherwise, injection after closure of the joint capsule is recommended.

Distal forelimb, hindlimb or tail: Ring block

The ring block is a simple local analgesia technique for performing procedures on the distal limb or distally on the tail.

▸ Sensory blockade

- Distal to the ring block if injection is without gaps

▸ Approach and localisation

- The injection site should be clipped, washed and disinfected
- Using a thin cannula (22–25 G), LA is injected into the subcutaneous tissue forming a ring around the limb (proximal to the site to be operated on, ▸ Fig. 9.10)

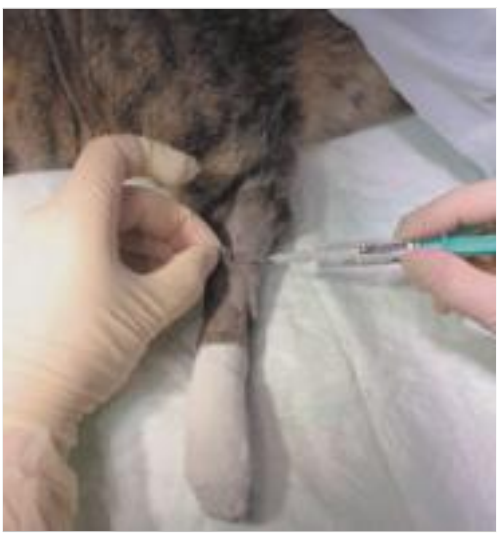

Fig. 9.10 Ring block of the distal forelimb of a cat.

- If the maximum calculated dose is not sufficient in terms of volume, it can be diluted with 0.9% NaCl
- Aspirate prior to each injection and, of course, never inject into vessels or infected or tumorous tissue

Forelimb distal to the elbow: Brachial plexus block

The brachial plexus is composed of the ventral branches of C6, C7, C8 and Th1. The most important nerves from cranial to caudal are: Suprascapular nerve, axillary nerve, musculocutaneous nerve, radial nerve, median nerve and ulnar nerve. The brachial plexus is most easily and traditionally located with a nerve stimulator and an insulated cannula; depending on the equipment available, the plexus can also be located with better reliability using ultrasound.

▶ Sensory blockade

- Distal humerus
- Elbow joint and all distal structures if the plexus has been completely desensitised

▶ Risks

- Incomplete effect if the nerve bundle has only been partially desensitised
- Puncture of the axillary artery and vein, haemorrhage
- Infection in case of unsterile procedure

▶ Approach and localisation

- First, locate the most important anatomical landmarks: Shoulder joint, acromion, greater tuberosity of the humerus and the jugular vein (▶ Fig. 9.11a)
- Prepare a 22 G, 50 mm (cats and small dogs) or 100 mm (large dogs) insulated cannula for the nerve stimulator
- Patient in lateral position, the limb to be anaesthetised is on top
- Puncture site medial to the shoulder joint should be clipped, washed and disinfected, the entire site should be sterile
- After flushing the injection line, connecting the electrical line and connecting the neutral electrode, the cannula is inserted and slowly advanced caudally towards the middle of the scapula (▶ Fig. 9.11b)
- The nerve stimulator is switched on with a low mA value; the closer the tip of the cannula is to the nerve, the lower the current required to trigger depolarisation (if the tip of the cannula is in the nerve, depolarisation is no longer triggered)

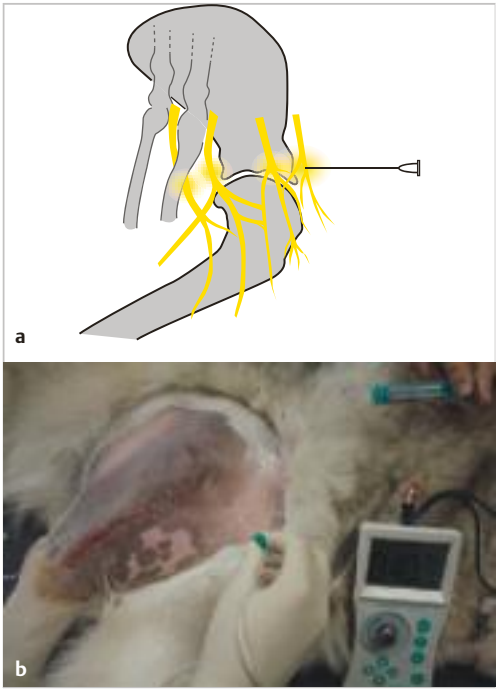

Fig. 9.11 Local anaesthesia of the brachial plexus in dogs.
a Schematic overview. (Source: Graphic designer: Attilio Rocchi)
b Performing local anaesthesia of the brachial plexus in dogs with the aid of a nerve stimulator.

- Stimulation of each individual nerve causes a characteristic muscle contraction: e.g. extension of the elbow = radial nerve, flexion of the elbow = musculocutaneous nerve; if the nerve response is observed, the local anaesthetic (e.g. bupivacaine 0.5%, volume depending on the calculated dose) can be injected after aspiration; it can be combined with e.g. dex-/medetomidine (1–5 µg for each ml LA)

Block of the femoral and sciatic nerve

Nerves can be desensitised with local anaesthetics via different approaches and different procedures. Depending on which approach is chosen, the desensitised area varies and the time and equipment required changes depending on the procedure. In practice, it is worth choosing a simple approach, which is sufficient for most surgeries in the knee joint and distally. The **femoral nerve**can be reached paravertebrally or with a lateral preiliac or inguinal approach. The