



Feline Dentistry Mini Series

Session Two: FCGs and Analgesia

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Periodontal Disease

This may typically be divided into gingivitis and periodontitis. It is important to identify where extension into gingivostomatitis occurs, according to the tissues involved with the inflammatory process.

Gingivitis

- Gingival inflammation

Severity determined by the Modified Loe & Sillness bleeding score, from 0-3

- Plaque caused

Gingivitis is a result of host immune response to antigenic stimulation and inflammatory mediator release

- Juvenile form / 'eruption gingivitis'

Noted in some individuals during the dentition transition stage (deciduous to permanent). It is usually transient (several weeks) and resolves spontaneously on full eruption of permanent teeth.

Clinical signs

- red, swollen, gums. Bleeding on probing in severe cases (score 2-3)
- halitosis
- hyperplasia in some individuals
- discomfort is unusual and more likely to be seen in juvenile form

Treatment

- Homecare: daily brushing +/- chlorhexidine gluconate oral rinse
- Topical Antimicrobials: chlorhexidine gluconate oral rinse
- Antibiotics: used only in severe cases (eg some juvenile cases where topical application is impossible or ineffective). Short term only.

Periodontitis

- Inflammation of the four periodontal tissues - gingiva, periodontal ligament, alveolar bone, cementum – resulting in loss of attachment to the affected tooth/teeth
- Plaque caused
- Progression
 - Damage predisposes to further plaque retention and stagnation thus periodontitis is self-perpetuating.
 - Site-specific
 - Teeth may no longer be viable
- Juvenile
 - dentition transition period
 - rapid progression, extractions likely

Clinical signs

- periodontal pockets, gingival recession, root exposure, furcational bone loss, tooth mobility
- halitosis

Treatment

- Homecare: daily brushing +/- chlorhexidine gluconate oral rinse
- Topical Antimicrobials: chlorhexidine gluconate oral rinse
- Antibiotics: used only in severe cases (eg some juvenile cases where topical application is impossible or ineffective). Short term only.
- Extraction: non-viable teeth and where homecare is not possible

Gingivo-Stomatitis

'Caudal stomatitis' / 'oral mucositis' / 'gingivostomatitis' - inflammation of gingiva and oral mucosa, where stomatitis (oral inflammation) relates to the non-gingival, mucosal component. Inflammation is thus apparent beyond the mucogingival line; ie affecting delicate, sensitive oral mucosa, which often results in greater pain than the (relatively) insensitive, highly keratinised gingiva.

Feline chronic gingivostomatitis 'FCGS' is often called 'plasmacytic-lymphocytic stomatitis', describing the cell types found histopathologically and expected with the inflammatory condition.

- Inappropriate immune response to plaque antigens– likely shift of immune response from Type1 (cellular) to mixed Type1&2 (humoral) response.

Factors

Gingivostomatitis is a multifactorial disease and depends on both the animal's immune status and dental status.

- **Immune Status**

This may be broadly divided into systemic and local immunities:

- Systemic immune status

Organ function – renal compromise, diabetes etc

Viruses – FeLV, FIV

- Local immune status

Genetic variation

Viral – eg FCV / calicivirus

- **Dental Status**

The vast majority of cases exhibit dental pathology however this is often unclear and goes un-noted without detailed oral investigation including intra-oral radiography.

- No dental pathology

- Periodontitis

It is difficult to discern whether periodontitis (loss of attachment) was present prior to the onset of stomatitis or is a later development as a result of the inflammation.

- Resorptive lesions

Type 1 and Type 2 may be found; Type 1 may be as a result of the chronic inflammation.

- Fractured teeth

Radiography is essential to fully assess cases and guide treatment.

Clinical Signs

- Severe gingival and oral mucosal inflammation
- Ulceration
- Hyperplasia
- Granulation
- Pain!!
- Dysphagia & eating difficulty
- Grooming difficulty
- Weight loss
- Halitosis
- Ptyalism

Disease Patterns

Inflammatory extension within the oral cavity may be described; inflammation most localised/ focal to the dentition appears most responsive to treatment anecdotally.

- **Gingivitis+stomatitis:** localised to teeth. Caudal dentition most affected
- **Stomatitis+gingivitis:** diffuse/ generalised; buccal mucosa (eg buccal fold/ retromolar region), tissue rostral to the palatoglossal folds. Very painful!
- **Fauces:** inflammation of mucosa of the fauces; tissue of, and between, the palatoglossal and pterygopalatine folds/ 'pillars', ie peritonsillar.
- **Glossitis:** lingual/ tongue inflammation. Typically with FCV, resulting in depapillation.
- **Pharyngitis:** inflammation caudal to fauces.

Investigation

It is essential to consider the cat as a whole and perform general testing before focusing on swabs for FCV. FIV and FeLV results may alter the owner's wish to pursue treatment further while FCV is primarily of use for potential adjunctive Interferon treatment if required. Detailed oral assessment is essential to guide treatment and surgical approach.

- Blood testing
 - Organ status: biochemistry
 - Haematology: especially re PCV and anaemia
 - Viral: FIV, FeLV

- Oral Assessment
 - Probe & chart
 - Radiography

- Swab sampling (oropharyngeal)
 - FCV (by virus isolation, University of Glasgow Veterinary School) - however this rarely affects initial treatment & is found in most cases.

- Biopsy
 - Cytology / histopathology – wedge biopsy is useful to rule out SCC; cytology is of minimal value. Biopsy of asymmetrical, unusual or non-healing tissue is advised.

Treatment

Treatment of gingivostomatitis is very commonly essentially surgical. Extraction of associated teeth removes the non-shedding tooth surfaces and their plaque biofilm, thus the antigenic load of plaque bacteria. In many cases compromise to teeth or periodontal tissues would necessitate extraction irrespective of stomatitis and the plaque biofilm issue, however in some individuals, to permanently remove biofilm sadly often means extraction of healthy teeth.

If meticulous tooth-brushing, thus mechanical removal of plaque, could be performed on a daily basis it is likely that this would greatly assist resolution, however this is rarely a practical option in these cats due to pain. Concurrent pathology such as periodontitis and resorptive lesions also compromise brushing efficacy. Owners may, however, try in some suitable cases and will often be able to clean canine teeth following extraction of cheek teeth, once healed. This can be of profound value in achieving resolution.

Medical treatment is typically adjunctive and the vast array exists as none have proven fully successful alone. Interferon too is designed to be used in appropriate, virus-positive cases, often following radical extractions where surgery alone fails, or where teeth and their attachment are proven to be healthy. Treatment should be instituted as soon as possible for both the immediate welfare reasons and the potential for neoplastic transformation (squamous cell carcinoma) with chronic inflammation.

- **Medical**
 - Address underlying disease
eg stabilisation of diabetic patients. This may be more difficult where unchecked oral inflammation and infection exists and oral surgery may first be necessary.

 - Antimicrobials
Systemic eg amoxicillin clavulanate, clindamycin. Metronidazole beneficial where anaerobes are suspected and may also give an immunomodulatory effect.
Topical – chlorhexidine gluconate oral rinse; may be impractical due to oral pain and palatability issues.

 - Analgesia
NSAIDs- meloxicam at standard, long-term low dose rates (dose as per 1kg cat) where renal function is appropriate
Opioids- Buprenorphine may be useful initially but can suppress appetite after 2-3days

 - Interferon – FCV+ve cases. Care in additionally FeLV / FIV cases.

Multiple protocols exist –

1) Oral Pulverisations: 0.10MU (100,000 IU) 1ml pulverisation squirted into the mouth once daily. Usually tolerated well by patients and the most economic method. Author's protocol of choice.

2) Subcutaneous Injections: 1MU/kg SC EOD, 5 injections from day 60 post-operatively. Can repeat after 30days.

3) Subgingival/ intra-lesional: 1-2MU intralesional every 15days from day 30 post-operatively (ie d30,45 &60).

4) Combinations:

a. Subgingival/ intra-lesional: 1-2MU intralesional every 15days from day 30 post-operatively (ie d30,45 &60) *then*: 0.1MU SID for 100days from d90 (ie 1month after end intralesional).

b. 5MU (ie 0.5vial) intralesional, single day. Dilute remaining 5MU in 50ml saline. Give 1ml squirted into mouth (pulverisation) daily. Pulverisations are aimed at palliation, comfort & economic usage.

10MU (1vial) in 100ml saline provides 0.10MU (100,000 IU)/ml solution for use as pulverisations.

Refrigerate solutions (up to 21d). Frozen solutions (in plain urine pots) stable up to 1year.

Erythema intensity may remain. See also Virbac/ handbook re care if FIV+ etc. Improvement may take 3months +.

Cease treatment once 3swabs (once weekly) give negative FCV results.

- Diet- anecdotally, hypoallergenic/ additive-free, wet diets have been of merit eg Butcher's Classic Cat Food, Hill's a/d, Royal Canin sensitivity, Applaws, Lily's. The latter two are available as fish-based (see below) but avoid tuna re toxins.
Antioxidant food additives have been reported as helpful eg Petplus and/or a pinch of ginger or turmeric added to food.
Balance of omega oils may be beneficial (feeding white & oily fish, eg mackerel 1-2x per week).
- Bowl material- avoidance of plastic, metal and artificial coatings (this may rarely also apply to food containers eg pouch/tin material). Use ceramic water & food bowls.
- Immunomodulatory –
Corticosteroids- avoid where possible, especially with viral +ve cats. Initial improvement is followed by reflex worsening of inflammation with increasingly poor response to subsequent doses.
Cyclosporine – statistically significant improvement identified in study for cats with refractory stomatitis *following previous cheek teeth or full mouth extractions*.
Cimetidine – to restore the Type1 immune response. Off license use. Cimetidine oral syrup 0.1ml/kg PO TID-QID, trial 1month initially.

Other.....slippery elm (&clove oil) & honey – apply to mucosa
lactoferrin
gold salts.....?!

Unfortunately medical Tx is usually of adjunctive-only help.

• Surgical

Radical extraction is the most effective treatment. Success rates have been listed as around 70-80% (two studies) however this is in a referral situation with radiographic control and 'perfect' extractions. Poor curative response will be observed in patients where this is not the case; root remnants, missed pathology and trauma at extraction sites (eg spicules of alveolar bone) will inhibit healing and resolution. Funds are best spent on oral examination, investigation and surgery before advancing to costly medication.

- Detailed oral investigation is essential
- Intra-oral radiography is essential to guide surgery
- Compromised dentition should be extracted
- Dentition adjacent to inflammation should be removed
- Start caudally (ie cheek teeth; molars and premolars), especially in patients showing inflammation in only the posterior regions
- Where canine and incisor teeth are healthy this author would extract only cheek teeth initially
- Full mouth extractions/ clearance may be required in cases with widespread inflammation

Ensure extractions are perfect!

Owners should be advised of options available and the potential for variable response to treatment. Some individuals will remain visually inflamed while returning to normal feeding and grooming while others appear improved but fail to resolve sufficiently. Cases may exhibit apparently spontaneous resolution weeks to months after treatment and require adjunctive medication after surgery. Re-checks and monitoring via telephone are performed as required and dependant on post-operative recovery however a rough guide is: 1-2days, 5-7days, 10-14days, 1month, 3months. Some colleagues advise routine feeding tube placement and 24-48hr hospitalisation however this author has not found that necessary and an individual approach is used. Where sutures are inhibiting resolution these may be removed from 7days onwards – typically a rapidly resorbing, soft suture material is appropriate (eg Vicryl Rapide, 5/0 on reverse-cutting needle). This author prefers closed extraction where possible to avoid/ minimise foreign material however extraction quality must not be compromised.

Local Analgesia for Feline Dentistry & Oral Surgery

The value of pre-emptive analgesia is well documented for any procedure where noxious stimulus is involved. It is accepted that multi-modal analgesia, using a balanced combination of compatible analgesic drugs, gives most complete analgesia by blocking nociceptive pathways at various levels.

To prevent the phenomenon of 'wind-up' and a self-perpetuating cascade of inflammatory mediators from noxious stimulus, analgesia is required prior to applying the stimulus. Where central sensitisation or wind-up has already occurred it becomes difficult to arrest this process and return the animal to a pain-free state. This is important for the animal's welfare and to aid healing. Encouraging rapid recovery provides better service to client and patient and benefits staff and efficiency by minimising hospitalisation time and drug usage.

Thorough analgesia should be employed for the more routine procedures of extraction as well as maxillofacial surgery. The degree of noxious stimulation is easily underestimated in dental cases; conditions resulting in necessity for extraction are frequently painful and are then followed by the surgical stimulus.

Employment of appropriate technique and gentle tissue handling during surgery is of great importance in reducing the noxious stimulus inherent in surgery. Surgical extractions are classed as severely painful. However, it is preferable to utilise a surgical ('open') extraction technique with controlled bone removal via a mucogingival flap where simple ('closed') technique may cause inadvertent tissue damage. Uncontrolled tissue trauma such as bone crushing and gingival maceration is associated with increased pain and healing delay.

Local analgesia is particularly effective used pre-operatively as it blocks transmission of the noxious stimulus at the local level. If pain is never perceived maximal analgesia is enabled and wind-up is prevented. Its usage reduces requirement of post-operative 'rescue' pain relief by other drugs. The author finds this of particular value in feline patients where radical extractions may be required but NSAID use of concern.

Multi-modal analgesia is recommended; local analgesic plus analgesics such as opiates and NSAIDs provide a rounded approach to pain prevention. Correct usage is of benefit in reducing inhalant anaesthetic required to maintain stability during surgery.

Example Multi-modal Protocols

Cat, 12yr old, multiple extractions for resorptive lesions

Pre-med: acepromazine 0.01ml/kg + buprenorphine 0.05-0.07ml/kg

Intra-operative: nerve blocks and/or infiltration

Post-operative: buprenorphine 0.05-0.07ml/kg e6-8hr IV/PO(transmucosal) 1-3days

(transmucosal method is off-license and uses absorption of the injectable form via the oral mucosa. Use for more than 3 days may cause anorexia.)

Local anaesthesia is simple, quick and effective making it suitable to employ as a routine modality. The most common methods of usage are to block nerves or infiltrate a local area. Alternatives include intra-ligamentary and intra-osseous injection however the high-pressure injection requires specific equipment.

Local Anaesthesia: General technique

Insulin needles are useful in terms of needle gauge and volume limit (e.g. ceiling of 0.5ml per cat).

The needle should slide gradually over bone to its destination. This method reduces risk of redirection and neurovascular trauma. Aspirate to ensure intravascular injection does not occur. The required volume is slowly injected.

One study demonstrated that needle gauge exceeding 27 may cause greater nerve damage and should thus be avoided. Needles should only be used once, ie new needles used for each injection, should bone be contacted at any stage. Even minimal distortion of the tip can cause barbing and nerve and soft tissue injury.

INFILTRATION

This involves the sub-mucosal deposition of local anaesthetic around and within the area for surgery. Orally this involves depositing small volumes into gingiva and sub-mucosal periosteum of alveolar (socket) bone. Where analgesia of a specific tooth is required the deposition is at the position of the root apices. It is used for extraction of individual teeth and works most effectively in the maxilla where bone density is lower enabling its dispersal into the target area. It may be of use in the mandibles of juveniles with lower bone density. The benefit of this technique is low risk of nerve damage or intravascular injection. Bleb volume is typically 0.1-0.2ml for a cat.

SPLASH BLOCK

This technique is used intra-operatively and involves dripping local anaesthetic into the wound. Maxillofacial surgery cases would be most likely to benefit. It is very simple and no evidence of wound healing delay has been found, however its inherent timing of usage makes it suitable only as an adjunct, rather than pre-emptive.

NERVE BLOCK

This technique results in lack of sensation (except pressure) to the area supplied by the nerve blocked. The field size and location is thus dictated by the nerve or nerves blocked and level at which the block occurs. A more posterior block will provide analgesia to a greater area since branches anterior to this will be affected. The nerve and point of exit from foramina must be located.

- 1)Infraorbital
- 2)Maxillary
- 3)Middle Mental
- 4)Anterior Mental
- 5)Posterior/ caudal Mental
- 6)Inferior Alveolar ('mandibular')

MAXILLA

CARE! Risk of intra-ocular injection is high.

1. MAXILLARY

This location may be used to block all dentition of one maxillary side. The location between zygomatic arch and jaw body is highly complex with a mass of neurovascular tissue present and globe beyond. Placement precision, immediately caudal to the maxillary molar with minimal depth, is essential to minimise the risk of trauma. Additionally it is easy to miss the target nerve and block thus fail. True maxillary block provides analgesia to buccal and palatal tissue.

2. INFRAORBITAL

The infra-orbital nerve runs within the infraorbital canal in bilateral fashion, exiting the canal at the infraorbital foramen. This foramen is located rostro-ventral to the orbit and directly above the distal (caudal) roots of 107 and 207 (maxillary PM3s). Branches of this sensory nerve supply the ipsilateral pulps of premolar, canine and incisor teeth. It is also sensory to buccal and external nasal tissues, the cheeks and dorsally towards the eyes. The area of tissue blocked depends on position of deposition of local anaesthetic agent along the canal. Hard and soft tissue is blocked resulting in analgesia for the teeth and buccal bone and soft tissue – some effect is infiltrative. Location of local anaesthesia and estimated margins rostral to the block:

foramen level – canines, incisors (of treated side)

mid-canal - rostral/anterior premolars, canines, incisors (of treated side)

posterior canal – all premolars, canines, incisors (of treated side)

Tissues affected comprise teeth (pulp), plus buccal bone and overlying gingiva, mucosa, connective tissue, muscle and skin. Since palatal tissues are not affected this block alone would be inadequate for extraction – palatal analgesia is also required. Also note that contralateral cross-over innervation occurs at the incisors



Infraorbital block; the needle is directed along the bone to the foramen.

WARNING! Injection within the canal increases risk of intraocular injection, intravascular injection or nerve damage by injection into the nerve or pressure from the injected volume. A neuropraxia and paresthesia may result. Slow injection of appropriate volumes at the foramen only is thus advised.

3. MAJOR PALATINE

The major palatine neurovascular bundle is located mid-way between each maxillary arcade and the palatal midline. It runs within the palatine canal caudally, exiting at approximately the level of the mesial roots of 108,208 (right and left maxillary 4th premolars) in the cat.

Block of this nerve affects sensory perception from the palate and is of use in surgery such as pre and rostral maxillectomy.

4. INCISIVE

The caudal nasal / sphenopalatine nerve runs within the nasal cavity and incisive branches exit at the ipsilateral palatine fissure. Along with major palatine nerve branches (met at the palatine fissures), this innervates incisive bone and soft tissue of the premaxilla and features extensive left-right cross-over.

MANDIBLE

1. INFERIOR ALVEOLAR/ MANDIBULAR

The inferior alveolar/ mandibular nerve enters the mandibular canal at the inferior alveolar foramen, located caudo-ventral to the last molar (cats and dogs). It may be located by palpating the ventral border of the jaw in slim animals, locating the slight concavity and moving to the medial/ lingual aspect of the jaw at this point. Local anaesthetic may be injected around the foramen via both intra and extra-oral techniques, resulting in block of the ipsilateral mandible and its dentition. Since clipping is required for the latter method, preparation is reduced by intra-oral technique. Patients for posterior extractions or mandibulectomies will benefit from this analgesia, combined appropriately with additional blocks (lingual and buccal).



Intra-oral technique for inferior alveolar block



Extra-oral position for inferior alveolar block - the area should be clipped and surgically prepared if used.

2. BUCCAL

This sensory nerve crosses the posterior mandible immediately caudal to the last molar to innervate the buccal mucosa, gingival and bone. Block is afforded by shallow injection at the buccal aspect of the above site.

3. LINGUAL

The lingual nerve arises close to the inferior alveolar foramen and progresses in rostral direction to supply the ipsilateral lingual soft tissues (mucosa, gingiva and anterior two-thirds of the tongue) and bone of the mandible. Analgesia of this nerve is thus required for extractions; it is usually inadvertently anaesthetised by the mandibular block.

4. MENTAL

The mental foramina provide exit for the mental branches of the mandibular nerve. They exit in an anterior position with the middle mental foramen being of most significant size. This middle mental foramen is located at the root apex (tip) of 304,404 (left and right mandibular canines) and posterior/caudal to the labial frenulum. It innervates the canine and ipsilateral incisors with crossover to the contralateral incisors usual. Other tissues affected are the labial soft tissues and bone rostrally. Deposition at the foramen level is excellent for extraction of canine teeth when in combination with lingual infiltration. This may also be used bilaterally, for small rostral mandibulectomy. Bilateral consideration should be given to extraction of incisors.

LOCAL ANAESTHETICS

Volumes used per site:

CAT = 0.1-0.5ml (generally approx 0.2ml)

DOG = 0.2-1ml (generally 0.2ml small dogs, 0.5ml large dogs)

NOTE MAX TOTAL DOSAGE LEVELS FOR DRUG USED!!!

Bupivacaine

Onset = 10-30min (close nerve proximity gives most rapid onset)

Duration = up to 6hr (in foramen); 4-6hr (diffusion infiltration); 1.5hr(pulp)

Maximum dose = 2mg/kg

Formulation = 0.5% (5mg/ml)

Mepivacaine

Onset = 1-5min

Duration = 10-60min (teeth); 2-3hr (soft tissue)

Maximum dose = 4mg/kg

Formulation = 2% (20mg/ml)

Lidocaine

Onset = 5-10min

Duration = 1-2hr

Max dose = 4mg/kg

Formulation = 2% (20mg/ml)

Combinations of local anaesthetics would appear to offer benefits of their onset and duration periods, however their toxic effects are additive and bupivacaine alone has the greatest duration of action on soft tissues; it does not offer benefits to pulpal analgesic period. Drugs may be diluted to reduce local tissue irritation and neurotoxicity.

Mepivacaine is available in vials for use with special syringes and long, fine needles (27-31G) as used by dentists. While this is useful, the increased needle length can be unwieldy in cats and risk of trauma by over insertion increased.

Ensure that the total dose of all blocks is well below the animal's overall maximum dosage!

Toxicity due to overdose of local anaesthetic agents may cause cardiopulmonary depression, seizures and death. Seizures should be treated with diazepam.

Epinephrine/ adrenaline is commonly added in preparations for humans to counter the local anaesthetics vasodilatory effects, maintain the agent locally within the target tissue and thereby prolong the anaesthesia.

It is contraindicated for surgery of extremities due to local ischaemia. Multiple systemic contraindications also exist.

Adrenaline: CONTRAINDICATIONS

Hyperthyroidism

Dysrhythmias

Asthma

Halothane general anaesthesia (due to myocardial catecholamine sensitisation)

Complications

The likelihood of complication is reduced by gentle, accurate technique and anatomic knowledge.

Differences in species and specific breeds must be borne in mind when locating position for nerve blocks.

Injection within the confined space of a canal may increase risk, as does repeated needle use/ redirection.

Ineffective Analgesia

Due to changes in pH, where inflamed tissue is already present local anaesthetic agents may be less effective despite accurate positioning. Incorrect deposition of analgesic agent, however, remains the most common cause of failure!

Haematoma

Bruise formation secondary to vascular puncture. This risks prolonged paraesthesia, discomfort and wound infection. Trismus (difficulty in jaw movement) may result.

Nerve damage

Local anaesthetic agents are potentially neurotoxic although this may be due to high concentration of some agents. It has also been suggested that microscopic needle-tip damage via bone-contact then withdrawal of the needle through the nerve could account for this. Nerve damage such as neurapraxia (nerve contusion eg via pressure), laceration or injection into the nerve may result in:

Paresthesia – abnormal sensation

Hyperesthesia – increased sensitivity

Allodynia – normal stimulus causing pain

Hypoesthesia – reduced sensitivity

Vascular injection

Local analgesic agents can cross the blood-brain barrier. CNS signs are seen at lower doses than those resulting in cardiovascular abnormalities.

CNS: Sedation, Ataxia, Tremor, Convulsions

Cardiovascular: Tachycardia, Dysrhythmias, Hypotension

Respiratory: Respiratory depression, , Bronchospasm

SUMMARY

Patients for dental, oral and maxillofacial surgery experience severe, noxious stimulus. To protect their welfare and avoid complication careful, appropriate technique coupled with appropriate analgesia must be used. Local anaesthetic techniques are both effective and simple to use; unless a specific contraindication exists, their usage should thus become routine for our patients.