Taming the Acute Pain Beast
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Divinum Est Opus Sedare Dolorem (*Divine Is the Work to Subdue Pain)* -Galen

Why is pain important?

> "Pain is a more terrible lord of mankind than even death itself." - - Albert Schweitzer
> "Pain is inevitable. Suffering is optional." - - Buddhist Proverb

Pain in animals is what ***WE*** say it is. There is tremendous individual variability (both patient and observer), and no one "right" answer. Our moral imperative is to advocate on behalf of a being that cannot advocate for itself...

Acute pain may be planned (surgery) or unplanned (trauma). Acute pain varies in severity, which dictates the intensity of our pain management strategy. Acute pain patients may ALSO be dealing with chronic/maladaptive pain. A multi-modal approach provides us the opportunity to create a rational plan based on specific targets.

For trauma patients, provide a thorough physical examination to assess pain and mobility, and to evaluate for any problems that are not immediately obvious. Extract a careful history from clients to understand current co-morbidities, current medications, etc. We need to ensure that our pain management plan does not create additional problems for the patient. Create appropriate monitoring schedule to ensure ongoing comfort and dose titration as the patient heals (DO NOT FEAR NARCOTICS!!!!).

For surgery patients, this is the greatest opportunity to make a difference. The best pain management strategy begins BEFORE the surgical insult. This decreases the need for induction agents, inhalant agents, and post-op pain medications. We can provide greater comfort for the patient, and set the stage for optimal healing. Targeted therapy means making rational choices about the areas of the nervous system we need to address and how to get there. We need to prevent an unrelenting afferent barrage of nociceptive signals which leads to peripheral and central sensitization and "windup". General anaesthesia only causes unconsciousness - - it does NOT provide ANY analgesia. Without proper intervention (e.g. pre-emptive analgesia), the pain experience upon awakening will be WORSE than we can imagine.

Preventing windup:
Local anesthetics prevent windup by blocking pain signals. Opioids obtund windup. N-methyl-D-aspartic acid (NMDA) receptor antagonists block central sensitization (e.g. ketamine CRI).

Pre-op:

Combine a sedative and opioid (e.g. morphine or hydromorphone & acepromazine). Acepromazine MUST be used at an EXCEPTIONALLY LOW dose (0.02mg/kg)! Dilute it to 1mg/ml before use. Acepromazine potentiates the effects of the opioid (but ace is NOT analgesic - - this is important!). There are no worries about BP at this dose. (Sidebar - - Consider carefully the use of anticholinergics as most patients are already tachycardic.)

Butorphanol has NO PLACE in a perioperative protocol! As a pre-med, the analgesic effects are GONE just in time for the first stroke of the scalpel. It diminishes effectiveness of any subsequent delivery of a pure mu opiate. It is expensive (by comparison) to "real" analgesics, and is still in use due to complacency.

Immediately pre-op:
Position your patient to have an optimal surgical experience, with minimal pain and optimal healing. At induction, take 5 – 10 minutes to help your patient. Pre-oxygenate @ 4 – 6 L/min via mask. Fluid-loading has been de-bunked - - it is NOT recommended any longer (AAHA/AAFP Fluid Therapy Guidelines). The last step is the pre-op - - local anaesthesia. Place your local anaesthetic BEFORE the surgery begins!!! Infusing local after a surgery/after an incision is made is precisely like locking the barn door after the horse is gone. Depending upon the nature of the procedure, local may be best administered via epidural, intra-articular injection, specific nerve block, etc.

Continuous Rate Infusion (CRI):
"Continuous" rather than "constant", because in fact, it changes with the patient's needs. This is an extremely effective way to manage pain intra- and post-op. This dramatically reduces the necessary inhalant concentration. CRI is really the only place for ketamine any more (not induction) and is best accomplished by maintaining control over each and every drug - - NOT mixing 2 or 3 drugs into the maintenance IV fluid bag and calling it pain management!!! One drug, one bag, one line, one pump - - you may need a second IV catheter during the procedure, but not post-op. Opioids targets mu receptors, ketamine targets NMDA receptors, lidocaine for visceral pain (not in cats), +/- alpha-2 agonists (choose your patients carefully).

CRI Fentanyl (our example)
Standard concentration is 0.05 mg/ml = 50 μg/ml. The pre-op bolus is drawn from the standard concentration vial:
0.005mg/kg (5 μg/kg) IV

Intra-op CRI:
20 - 40 μg/kg/hr
Go as high AS NEEDED (I have used 80 μg/kg/hr) depending upon the patient's need. Create a standard dilution of fentanyl for CRI use and then simply vary the flow rate according to the patient's size and need (0.01 mg/ml) (e.g. 50 ml bag, 0.9% NaCl). You do NOT need a syringe pump to do CRI! You do NOT need special IV tubing to do CRI! You DO need a precision IV infusion pump to do CRI correctly! You DO need to have IV fluids flowing with the fentanyl "piggy-backed" in order to overcome the hydrostatic pressure within the vein (22ga x 1 ½" needle into IV line port). This is especially true during the post-op period when flow rates are

exceptionally low. Once you make the above dilution, the 50 ml bag now contains 0.01 mg/ml and flow rate becomes the variable in delivery.

Post-op CRI:
2 - 4 μg/kg/hr (or higher IF NEEDED) using the same standard dilution created using the 50 ml bag of 0.9% NaCl (10 μg/ml).

Case Example:
66# dog = 30 kg
Pre-op bolus:
5 μg/kg X 30 kg = 150 μg
150 μg / 50 μg/ml = 3 ml of standard concentration fentanyl
Intra-op:
20 μg/kg/hr X 30 kg = 600 μg/hr
Using this standard dilution, a 250 ml bag contains 10 μg/ml (the bigger the dog, the bigger the bag)
600 μg/hr / 10 μg/ml = 60 ml/hr
Increase flow rate if dog needs more fentanyl to achieve the desired result
Post-op:
2 μg/kg/hr X 30 kg = 60 μg/hr
We use the standard dilution, 250 ml bag which contains 10 μg/ml
60 μg/hr / 20 μg/ml = 6 ml/hr
Again, adjust flow rate as needed

Practice tip:
Create spread sheets in Excel to lower the risk for miscalculations of flow rates. Use increments of 0.2# (or kg), use the standard dilution described above, and have Excel calculate flow rates based on the 20 μg/kg/hr intra-op and 2 μg/kg/hr post-op dosing. Then simply multiply flow rates to increase the delivered dose if needed.

Intra-op:
Inhalant doesn't provide analgesia. Pre-meds need long enough duration to cover surgery time. Longer procedures, consider epidural and/or CRI. Good surgical techniques assist with pain management by minimizing trauma to tissues. Keep your patient warm (the "big chill")!

Post-op:
Continue CRI's if they are in place. Titrate dose over time as patient recovers and gains strength. Do not stop CRIs abruptly. Begin NSAIDs at this time if appropriate for the patient. Regularly assess patient and revise pain plan. Opioids post-op pulse-dosed for patients who do not need/receive CRIs. Traditional buprenorphine may be used in cats and small dogs - - IV, IM, or buccal delivery. Onset @ 30 minutes, duration @ 6 – 12 hours. Dose and dosing interval depend upon level of pain (0.03 – 0.05 mg/kg - - Can pre-load TB syringes for dosing at home). Simbadol® for cats - - coming to Canada!

Give the patient the benefit of the doubt when assessing for pain. Pain is easier to prevent than to reverse. NSAIDs alone are not as effective as NSAIDs combined with an opioid. The

therapeutic AND side-effects of opioids are generally dose-dependent. Don't be afraid to let the patient sleep post-op provided they have stable vital signs. Reduce potential adverse side effects by choosing drugs and doses to meet the patient's needs. Transition to oral meds for going home.

NSAIDs - - Choose according to the best fit for the patient. Determine how long the patient will benefit from their use. If you are using meloxicam in cats be sure to precision dose. There is NO compelling evidence to suggest that NSAID should be given BEFORE the anaesthetic event and it provides an increased risk of complications.
Buprenorphine - - As previously discussed, we can pre-load TB syringes for home delivery. If you need to give it for a longer period of time, it can be transferred into a glass vial with an injection port, and TB syringes (no needles). Transmucosal absorption in dogs as well, but the low concentration makes the volumes impractical. Simbadol® for cats, coming to Canada…

Tramadol - - ***THIS IS NOT AN ANALGESIC DRUG IN DOGS!!*** In humans, it affects mu receptors, serotonin pathways, and norepinephrine pathways. BUT in dogs, the M1 metabolite is not present for a relevant period of time. Add to that NO SAFETY DATA in either dogs or cats. Knowing what we now know, we have no business using this drug…

Gabapentin - - This drug affects α-2-δ ligand of the calcium channel in the dorsal horn of the spinal cord - - post-op can help prevent central sensitization. It decreases consumption of morphine & improves functional recovery in humans with total knee arthroplasty (Pain Res Manage 2009;14(3):217-222). Compared with placebo, perioperative administration of gabapentin produced significantly better postoperative analgesia *(*Reg Anesth Pain Med 2006;31:237-247). Sedation is dose-limiting side effect, and it has non-linear pharmacokinetics. So far only one study in veterinary medicine (canine amputees) - - the drug failure was ***predictable/expected*** due to very low dose chosen - - opioids will also fail if the dose is too small. Clinically, in "big pain" cases, gabapentin improves outcomes in pain scores and function – both short and mid-term. Use at 5 – 20 mg/kg PO BID – TID. You will see effects within 24 hours – consistent effects within 3 – 5 days.

Remember physical medicine options to enhance pain management post-op. You can use these techniques immediately post-op as well as at home when appropriate. Don't forget to employ good general nursing care - - keep the patient warm, turn regularly, keep bladder empty, keep clean of soiling. Cryotherapy over surgery site decreases pain and swelling. Acupuncture/acupressure, therapeutic LASER, and medical massage techniques can all help.

Build your "pain management pyramid" based on several factors. What is the anticipated pain resulting from the procedure? Routine castration < routine OHE or cryptorchid castration < toe amputation < large tumor removal < total ear ablation < limb amputation or other orthopedic procedure. Give the patient the benefit of the doubt. Layer your modalities to meet the patient's needs both immediately post-op and as recovery proceeds. Pre-op medication, induction agents, and inhalant will not change much, no matter the procedure. These form the foundational level of the pain management pyramid. The next layer includes local anaesthesia - - local blocks, regional blocks, epidural infusion. The next layer includes CRI. The next layer includes post-op choices. NSAID (if appropriate) – 1st layer; CRI continuation if needed – 2nd layer; Gabapentin

– 2nd layer; Buprenorphine – 2nd layer; Oral morphine – 3rd layer (poor absorption); Physical medicine options – 2nd & 3rd layer.

For "big pain" procedures, make a detailed plan for reassessments and revisions of the pain management plan. Titrate doses down as the patient recovers and becomes more functional. Disassemble the pain management pyramid as it is assembled - - one layer at a time…