Cr - Critical Care & Anaesthesiology
ACUTE PAIN MANAGEMENT IN EMERGENCY

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Introduction

Pain is frequently underestimated as a promoter of hemodynamic imbalance during emergency that results in increased morbidity and mortality indices. Acute pain can occur as result of trauma, bone fractures, ligament distention and a wide range of medical conditions, mainly those associated with inflammatory processes. These inflammatory processes can be related not only with damage in somatic tissues but also with injuries in internal organs, as a consequence of surgical procedures. On these patients, pain should be quickly treated to promote welfare (comfort) and to avoid futures hemodynamic compromises.

Many therapeutics alternatives are available to treat acute pain such as opioids, alpha-2 adrenoceptor agonists, NMDA antagonists, non-steroidal antiinflammatory drugs, corticosteroids and local anesthetics, but the election should be made carefully. For the election of the analgesic, several factors has to be considered, especially those associated with pharmacological aspects of the chosen drug. Other factors are determined by the severity of pain, the duration of treatment, the effective dosages and the preexisting medical conditions, as well as the available nursing care and monitors.

Key Points:

- Knowledge of the basic physiology of pain mechanisms and the basic pharmacology of analgesic drugs is essential for effective pain prevention or alleviation.
- Multiple classes of analgesic drugs administered simultaneously are more effective than a single class of analgesic.
- Pain therapy should not just revolve around drugs; therapies such as surgery and physical therapy also have an important role in providing effective pain relief.
- The best time to start analgesic therapy is as soon as possible in the case of trauma or acute pain

Therapeutics options

Opioids

Opioids are mostly the first option to treat acute pain. The main characteristics of these drugs can be enumerated as following:

- Titrate analgesia (not ceiling effect for mu-receptor agonist).
- Rapid onset for fentanyl and analogous (the peak effect being evident 2 min after i.v. injection).
- Intravenous infusion can be set for long duration treatment (morphine, fentanyl, alfentanil, sufentanil, remifentanil, etc.).
- Bradycardia, resulting in increase of venous returns and cardiac contractility.
- Respiratory depression, slower rate and deeper amplitude (contributing to increase increasing of venous returns and cardiac contractility).
- Reduce the amount of anesthetic agent required for about 80% in critical patients.
- Epidural administration is also possible under critical conditions (morphine persists in the cerebrospinal fluid much longer than in plasma).
- Side effects at suggested doses: unusual.
- Morphine frequently induces vomiting when given in conscious dogs by i.m. and i.v. route; however, this side-effect is seldom observed in animals suffering from acute pain.
- In head injured patients, they should be avoided until diagnosis. When increased intracranial pressure is present, opioids should be combined with mechanical ventilation to reduce the P_aCO_2.

Table 1: Opioids in canine. Doses and intervals

Drug	Dose	Route	Duration(hours)
Morphine	0.1-0.5 mg/kg CRI: 0.05 mg/kg/h	SC; IM; PO; (IV)	4-6
Pethidine	3.5-10 mg/kg	IM	2.5-3.5
Codeine	1–2 mg/kg	PO	6-8
Methadone	0.1-0.25 mg/kg	IM; SC; IV	4-6
Oximorphone	0.05-0.2 mg/kg	IM; SC; IV	2-4
Fentanyl	2 - 10 µg/kg CIR: 5-10 µg/kg/h	IV	0.3-0.5
Sufentanil	0.75 - 2 µg/kg CRI: 1-2 µg/kg/h	IV	0.1-0.25
Alfentanil	15–30 µg/kg CRI: 30-80 µg/kg/h	IV	0.25
Remifentanil	CRI: 0.025–0.1 µg/kg/min	IV	CRI
Buprenorphine	5-20 µg/kg	IM; SC; IV	6-12
Butorphanol	0.2–0.6 mg/kg	IM; SC; IV; PO	2-4
Nalbufine	05-1 mg/kg	IM; SC; IV	4-6
Pentazocin	1–4 mg/kg	IM; IV	2-4
Tramadol	1–2 mg/kg	IM; IV; PO	6-8
Dextropropoxiphen	2-5 mg/kg	IV; IM; PO	4-6

CRI: Constant rate infusion

Table 2: Opioids in feline. Doses and intervals

Drug	Dose	Route	Duration
Morphine	0.1-0.2 mg/kg CRI: 0.03 mg/kg/h	SC; IM	6-8 hour
Pethidin	3.5-10 mg/kg	IM	2-3 hour
Codeine	1-2 mg/kg	PO	6-8 hour
Methadone	0.1-0.2 mg/kg	SC; IV	2-3 hour
Oximorphone	0.01-0.1 mg/kg	IM; SC; IV	2-4 hour
Fentanyl	1-5 µg/kg CRI: 5 µg/kg/h	IV	20-30 min
Sufentanil	0.1-0.5 µg/kg CRI: 0.5-1 µg/kg/h	IV	10-15 min
Buprenorphine	5-20 µg/kg	IM; SC; IV; PO	3-8 hour
Butorphanol	0.2-0.8 mg/kg	IM; SC; IV	2-4 hour
Nalbufine	0.5-3 mg/kg	IM; SC; IV	2-4 hour
Pentazocin	1-4 mg/kg	IM; IV	4-6 hou
Tramadol	1-2 mg/kg	IM; IV; PO	6-8 hour
Dextropropoxiphen	2 mg/kg	IV; IM; PO	4-6 hour

CRI: Constant rate infusion

Non-steroidal antiinflammatory drugs (NSAIDs)

NSAIDs are a group of drugs with antiinflammatory, analgesic and antipyretic properties. These agents act by inhibiting the ciclooxygenases (COX 1, 2 and 3). NSAIDs are widely used to treat acute pain. The analgesic effects can be increased by the combination with opioids, which is a common practice during trauma.

Benefits are listed line-down.

- Good analgesic effects to treat visceral pain (ketoprofen, flunixin meglumine, metamizol).
- Efficacious plasma levels of NSAIDs are reached after approximately 1 hour after oral administration.
- For pain caused by acute inflammatory diseases NSAIDs seem to be more effective than opioids.
- Newer NSAIDs (carprofen, meloxicam, etodolac) has high safety margins in dogs.
- Intravenous fluids should be administered before NSAIDs use and the blood pressure should be monitored because of renal concerns.
- NSAIDs should not be administered to patients with renal or hepatic diseases, dehydration, hypotension, coagulopathies and concurrent use of other NSAIDs or corticosteroids.

Table 3: NSAIDs in canine. Doses and intervals

Drug	Dose Canine	Via	Interval
Paracetamol (Acetominophen)	15 mg/kg	PO	6-8 hour
Acetylsalicylic acid	10-25 mg/kg	PO	8-12 hour
Tolfenamic acid	up to 4 mg/kg	SC, PO	24 hour
Carprofen	2-4 mg/kg	PO	12-24 hour
Deracoxib	2-4 mg/kg	PO	24 hour
Dipyrone (Metamizol)	20-30 mg/kg	IV, SC, IM	8 hour CRI: 10 mg/kg/h
Etodolac	10-15 mg/kg	PO	24 hour
Phenylbutazone	10-25 mg/kg	PO	8-12 hour
Flunixin	0.5-1 mg/kg	IV, SC, IM	24 hour
Ibuprofen	5-10 mg/kg	PO	24-48 hour
Ketoprofen	1-2j mg/kg	IV, SC, IM, PO	24 hour
Ketorolac	0.3-0.5 mg/kg	IV, IM	8-12 hour
Meloxicam	0.1- 0.2 mg/kg	IV, SC, PO	24 hour
Naproxen	1-2 mg/kg	PO	24 hour
Piroxicam	0.3 mg/kg	PO	24 hour
Tepoxalin	10 mg/kg	PO	24 hour
Vedaprofen	0.5 mg/kg	PO	24 hour

Table 3: NSAIDs in feline. Doses and intervals

Drug	Dose Feline	Via	Interval
Paracetamol (Acetominophen)	Contraindicated	----------	----------
Acetylsalicylic acid	10-15 mg/kg	PO	48 hour
Tolfenamic acid	4 mg/kg	SC, PO	24 hour
Carprofen	4 mg/kg	PO	24 hour
Metamizol	20-30 mg/kg	IV, SC, IM	8 hour
Phenylbutazone	10-25 mg/kg	PO	8 a 12 hour
Flunixin	0.5-1 mg/kg	IV, SC, IM	Only one dose
Ketoprofen	1-2 mg/kg	IV, SC, IM, PO	24 hour
Ketorolac	0.25 mg/kg	IM	12 hour
Meloxicam	0.1-0.2 mg/kg	IV, SC, PO	24 hour
Piroxicam	1 mg/cat	PO	24 hour

Alpha-2 adrenoceptor agonists

Alpha-2 agonists xylazine, medetomidine and dexmedetomidine are commonly used in small animals and possess analgesic, sedative and muscle-relaxant properties. Despite the fact that these drugs are usually reserved for healthy animals because of the cardiopulmonary depression that accompanies their use, its use during acute pain could be beneficial.

- Produce profound sedation (alpha-2 agonists are some of the most potent sedatives available).
- Potent analgesics (can be as effective as opioids in many situations).
- Adverse affects depending on dose, rate and the concurrent use of other CNS depressants.
- Their short duration (20-40 min depending on the agent) can be increased with constant rate infusion in small doses.
- Good bioavailability by the oral route.
- The combination of low doses of alfa-2 agonists, opioids and benzodiazepines results in a synergistic response.
- Good immobilization when combined with ketamina.
- The hemodynamic effects can be lessened by administering in small doses.
- Alfa-2 agonists may be used as an infusion after a loading dose.
- This group of drugs has specific antagonists for their reversal.

Table 4: Alfa-2 agonists and antagonists in small animals

Drug	Canine	Feline	Via
Xilazine	0.4-1 mg/kg CIR:0.1 mg/kg/h	0.2-0.5 mg/kg CIR:0.1 mg/kg/h	IM; (IV)
Medetomidine	10-40 µg/kg CIR:1-3 µg/kg/h	40-80 µg/kg CIR:1-3 µg/kg/h	IM; (IV)
Dexmedetomidine	5-20 µg/kg CIR:0.5-1 µg/kg/h	20-40 µg/kg CIR:0.5-1 µg/kg/h	IM; (IV)
Romefidine	40-80 µg/kg	80-160 µg/kg	IM; (IV)
Yohimbine	0.1-0.15 mg/kg	0.1 mg/kg	IV; (IM)
Atipamizol	0.2 mg/kg	0.2 mg/kg	IV; (IM)

NMDA Antagonist (Ketamine)

The NMDA receptor plays an important role in central sensitization, and there is much interest in developing drugs that can inhibit this receptor. Ketamine is widely use in clinical practice to provide anesthesia and restraint. It is, however, a potent analgesic in its own right. Low doses (1.0-2.0 mg/kg, canine and feline) are used to provide both preemptive analgesia and acute pain control. In low doses, ketamine acts in a synergic manner with opioids enhancing its analgesic effects. Recently, the opioids-sparing effects of ketamine in dogs after major surgery have been demonstrated.

References

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