

THE USE OF CONSTANT RATE INFUSION ANALGESIA IN EXOTIC COMPANION MAMMALS

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Constant rate infusion (CRI) of intravenous (IV) analgesics during anesthesia is thought to reduce the amount of general anesthesia required to achieve a desired endpoint (e.g. abolition of motor movement). Amount of general anesthetic required is measured as the Mean Alveolar Concentration (MAC) of the agent in question. Reduction of MAC is desirable, as the untoward effects of inhalant anesthesia are dose dependant. Another advantage of analgesics delivered via CRI is the ability to titrate dosages to effect; for example, CRI rate can be increased during more painful portions of a surgical procedure. The ability of certain agents administered as CRI to reduce inhalant anesthetic MAC has been demonstrated in various animal species, most commonly dogs, cats and horses. Investigated drugs for CRI include ketamine, fentanyl, remifentanyl, morphine, lidocaine, dexmedetomidine and others. For example, the use of a fentanyl CRI reduced the end-tidal sevoflurane concentration required to prevent movement in dogs¹. Use of a midazolam CRI produced the same effect in dogs anesthetized with isoflurane². Similar studies in exotic mammal species are sparse. The rabbit has been used extensively as a model for methods to determine MAC. A 2012 study demonstrated the ability of a ketamine CRI to reduce isoflurane MAC in this species³. There is evidence of acute opioid tolerance in certain species, for example, the rat. In one study, remifentanyl tolerance was observed after 90 minutes, requiring an increase in dosage to maintain the minimum MAC of isoflurane⁴. The same effect is not seen in all species tested. This potential acute tolerance should be considered when using CRI of opioids in unfamiliar species, especially rats.

Lichtenberger suggested use of CRI analgesics as a part of a surgical protocol, or for delivery of drugs to the hospitalized critical patient. Dosages are extrapolated from those used in dogs, and modified based on known species differences and clinical response. The author and others have used ketamine combined with a variety of opioids (butorphanol, buprenorphine and hydromorphone) for CRI in a variety of exotic mammal species, including rabbits, guinea pigs and rats. Suggested dosages/rates are given in Table 1, and include a loading pre-surgical dose, CRI rate, and post-operative dose. It should be noted there are no clinical trials objectively evaluating safety and efficacy of these combination in exotic companion mammal species. Recommendations represent anecdotally reported experiences only.

CRI requires vascular access. In exotic companion mammals, ease in achieving IV access varies. However, the use of intraosseous (IO) catheterization is an attractive and effective

alternative, even in very small species. IO catheterization is well described and tolerated, with few reports of complication.

Surgical fluid rate is 10 ml/kg/hour IV and administered with a pediatric infusion or syringe pump. Medications can be calculated and added directly to these fluids, or administered separately via a separate infusion pump. At the conclusion of the procedure, a post CRI dosage is given, or the rate of fluid administration reduced to maintenance.

Table 1. Suggested dosages used for CRI of analgesics in exotic companion mammal species. Note dosages for various rodent species may need to be higher.

Drug	Loading dose mg/kg	CRI rate mg/kg/hr	Post-operative dose mg/kg
Ketamine	0.4-0.5	0.4-1.0	0.3-0.4
Butorphanol	0.02-0.06	0.1-0.2	0.02-0.06
Hydromorphone	0.05	0.025-0.05	0.05



A sedated guinea pig with a cephalic IV catheter in preparation for surgery.

LITERATURE CITATIONS

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