



A RESEARCH REVIEW™
PRODUCT REVIEW

Meloxicam in the Disbudding of Dairy Calves

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2019

About the Reviewer



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This product review summarises relevant pharmacological properties of meloxicam (Metacam 20) when used for pain management in cattle disbudding procedures. This article is supported by an educational grant from Boehringer Ingelheim.

Pain management for disbudding

Changes in physiological, behavioural, and neuroendocrine parameters observed with disbudding indicate a stressful or painful response in cattle.¹ Typically, an acute pain response is observed within the first 30 min after the procedure, which is followed by a period of inflammatory pain lasting up to 8 hrs. In addition, one report suggests that disbudding wounds may remain sensitive for at least 75 hrs after the procedure.²

The acute pain response can be mitigated with the use of local anaesthetics, systemic non-steroidal anti-inflammatory drug (NSAIDs), and, when possible, sedatives with analgesic properties, with NSAIDs also helping to attenuate the subsequent inflammatory-mediated pain response.^{1,2}

Based on plasma cortisol level, pain behaviour, and pressure sensitivity results in prospective non-randomised and randomised clinical trials (RCTs) included in a comprehensive meta-analysis, the use of local anaesthetic and a NSAID is best practice for pain mitigation for disbudding of calves.³ In individual studies, sedation added to local anaesthesia has also been demonstrated to mitigate pain and stress responses due to disbudding.^{4,5}

Recognising that disbudding or dehorning of cattle is a painful procedure, Regulations 57 and 58 of the Animal Welfare (Care and Procedures) Regulations 2018 require local anaesthesia to be used for this procedure.⁷ The New Zealand Veterinary Association recommends that a combination of local anaesthetic, NSAID, and sedation should be considered to optimally manage the pain and distress associated with disbudding or dehorning.⁸

Meloxicam

Meloxicam (Metacam 20) is a NSAID belonging to the oxicam class, which induces anti-inflammatory, anti-endotoxic, anti-exudative, analgesic, and antipyretic properties via the inhibition of prostaglandin synthesis.⁹

Meloxicam is indicated for use to assist in the control of pain following the disbudding of cattle particularly that following heat cauterisation of young cattle.⁹ For full prescribing details of meloxicam refer to the Metacam 20 [Product Leaflet](#).

Dosage and administration

Parenteral meloxicam should be administered approximately 10 min before disbudding together with a corneal nerve block anaesthesia.⁹

The recommended dosage in cattle is meloxicam 0.5 mg/kg bodyweight (i.e. 2.5 mL/100 kg bodyweight) as a single subcutaneous (SC) or intravenous (IV) injection.⁹ For young calves weighing <50 kg, the appropriate dose rate of meloxicam is 0.5 mL/20 kg. The withholding period is 10 days from last treatment for meat. These dosage and withholding period recommendations pertain specifically to Metacam 20. They may differ for other registered meloxicam products.

Precautions and contraindications

Meloxicam should not be administered to cattle with impaired hepatic, cardiac, or renal function; haemorrhagic disorders; or evidence of gastrointestinal ulceration.⁹

Concurrent administration of meloxicam with glucocorticosteroids, other NSAIDs, or anticoagulants is contraindicated.⁹ Meloxicam should be used with caution in conjunction with other highly protein bound drugs.

Pharmacological properties

The duration of action of meloxicam 0.5 mg/kg is up to 72 hrs post administration,¹⁰ and a single injection of meloxicam 0.5 mg/kg is as effective as three daily injections of the same dose.¹¹

An evaluation of the compartmental pharmacokinetics of IV meloxicam 0.5 mg/kg in calves after disbudding without local anaesthesia demonstrated the following:¹²

Pharmacokinetic findings

- Plasma meloxicam (M) concentrations detectable for 50 hrs after IV administration.
- 2-compartment model: Rapid distribution of M from the circulation to body tissues ($t_{1/2\alpha}$ 0.22 hrs) followed by a slower decline in plasma M concentrations ($t_{1/2\beta}$ 21.86 hrs) due to elimination and excretion.
- Elimination half-life of M was longer than that previously reported for other NSAIDs.

Clinical implications

- ➔ Long-term effects post-surgery.
- ➔ Infrequent drug administration may be sufficient to mitigate pain responses due to post-surgical inflammation.
- ➔ Suggests a longer duration of action of M versus other NSAIDs.



Effects on pain and behavioural responses

Four RCTs have assessed meloxicam (IV or SC) in the management of pain and distress in calves following disbudding:

Study 1: Effects of meloxicam on stress response to disbudding.¹³

Treatment details	Results (vs placebo)	Clinical implications
<ul style="list-style-type: none"> – 60 Calves – 2 Groups (all received prior local anaesthesia): <ol style="list-style-type: none"> 1. Meloxicam 0.5 mg/kg (M) 2. Placebo 	<ul style="list-style-type: none"> • ↓Serum cortisol levels for 6 hrs with M. • ↓Heart rates with M. • ↓Respiratory rates with M. 	<ul style="list-style-type: none"> ➔ Changes in physiological parameters suggest that M reduced the stress response to disbudding.

Study 2: Effects of meloxicam on behaviour post disbudding.¹⁴

Treatment details	Results (vs placebo)	Clinical implications
<ul style="list-style-type: none"> – 60 Calves – 2 Groups (all received prior local anaesthesia): <ol style="list-style-type: none"> 1. Meloxicam 0.5 mg/kg (M) 2. Placebo 	<ul style="list-style-type: none"> • ↓Ear flicking for 44 hrs with M. • ↓Head shaking for 9 hrs with M. • ↓sensitivity to pressure for 4 hrs with M. 	<ul style="list-style-type: none"> ➔ Changes in behavioural parameters suggest that M reduced post-surgical pain and distress due to calf disbudding.

Study 3: Effects of meloxicam on physiological responses immediately after hot iron disbudding and during the time that local anaesthesia wears off.¹⁵

Treatment details	Results	Clinical implications
<ul style="list-style-type: none"> – 46 Calves – 6 Groups: <ol style="list-style-type: none"> 1. Disbudding (D) 2. Sham disbudding (SD) 3. D + Local (LA) 4. SD + LA 5. D + LA + Meloxicam (M) 6. SD + LA + M 	<ul style="list-style-type: none"> • Disbudding with LA or M ↑heart rate in first 5 mins, remaining ↑ for 3 hrs. • At 2–3 hrs post disbudding in LA-treated calves, eye temperature ↓, heart rate ↑, and changes in heart rate variability indicated onset of pain as LA effects wore off. • These changes were not seen with M. 	<ul style="list-style-type: none"> ➔ LA and M in combination mitigated the onset of pain responses when LA effect wanes.

Study 4: Effects of meloxicam on physiological responses and weight gain after disbudding without local anaesthesia.¹²

Treatment details	Results (vs placebo)	Clinical implications
<ul style="list-style-type: none"> – 12 Calves – 2 Groups (none received prior local anaesthesia): <ol style="list-style-type: none"> 1. Meloxicam 0.5mg/kg (M) 2. Placebo 	<ul style="list-style-type: none"> • No ↓ in cortisol levels with M. • ↓Pain perception (substance P levels) with M. • ↓Heart rate with M. • No change in lying behaviour with M. • ↑Weight gain with M. 	<ul style="list-style-type: none"> ➔ M alone immediately prior to disbudding may not adequately mitigate signs of acute distress but may have long-term positive physiological, behaviour, and productivity effects.

Effects on calf productivity

In addition to having beneficial effects on calf welfare, there is evidence that pain management after disbudding may also be beneficial for calf productivity.^{5,16}

Three RCTs have demonstrated that the combination local anaesthetic, meloxicam, and sedation administered at the time of the disbudding procedure in dairy calves was associated with:

- Daily weight gain.^{5,12}
- Daily weight gain and increased milk intake.¹⁶

Tolerability

SC and IV administration of meloxicam is well tolerated, with transient minor swelling at the injection site following SC administration being observed in <10% of animals treated in clinical studies.⁹ Anaphylaxis, which may be serious, is a rare side effect that should be treated symptomatically.

EXPERT'S CONCLUDING COMMENTS

The weight of scientific evidence, for the use of analgesics such as meloxicam in this and other painful procedures in cattle, has grown rapidly in recent years and is becoming compelling. To be honest, I don't think it should surprise us to discover that full thickness removal of innervated and vascularised cutaneous tissue using hot iron cautery is painful and that therefore the inclusion of analgesics can mitigate some of these effects.

As a profession, we should be honest with ourselves and accept that the most significant barriers to the use of multimodal analgesia for disbudding are industry culture, farm protocols, and established practice norms. Established norms can be extremely resistant to change, despite overwhelming evidence of the necessity to reconsidering the existing approach. Driving change requires leadership and an understanding and then acceptance of the necessity for change.

TAKE-HOME MESSAGES:

- Pain relief should be routinely used when disbudding calves.
- A multimodal approach to pain relief for disbudding procedures, including the use of a local anaesthetic, a NSAID, and, when possible, a sedative-analgesic, is recommended.
- Pharmacokinetic data suggest that meloxicam has a longer duration of action than other NSAIDs.
- RCTs in dairy calves undergoing disbudding indicate that meloxicam and local anaesthesia in combination, with or without sedation:
 - Reduces pain and stress responses to disbudding.
 - Has potential productivity benefits.

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