Dechra

TECH UPDATE

Providing effective pain relief for lambs during mulesing, tail docking and castration.

A better choice

Mulesing, tail docking, castration and other animal husbandry procedures are necessary to improve animal welfare, livestock management and productivity. Until recent years, these procedures have often been performed without any form of pain relief.

Providing pain relief during surgical animal husbandry procedures is a better choice for your livestock, your business and your industry as a whole. Consumers are increasingly demanding food and fibre that have been produced in accordance with their expectations in regards to animal welfare and sustainability. Providing pain relief helps all sectors of the livestock industry to meet these expectations and protect the long-term 'social licence' of our industry.

Australian Animal Welfare Standards and key industry organisations, including the Sheep Sustainability Framework, Meat & LivestockAustralia, Australian Wool Innovation, Sheep Producers of Australia, Wool Producers of Australia and Animal Health Australia, all advocate the provision of pain relief during certain animal husbandry procedures.[1-5]

Pain relief options for lambs

Animals experience acute (fast) and chronic (slow) pain during and after animal husbandry procedures. This pain can be alleviated via the administration of anaesthetic or analgesic products. In general, local anaesthetics provide rapid relief from acute pain but are short-acting. NSAIDs provide longer relief from chronic pain but are less effective in relieving acute pain.

Anaesthesia refers to loss of physical sensation with or without loss of consciousness. Local anaesthetics, such as Tri-Solfen® and Numnuts® reduce or eliminate pain by blocking the nerve signals from damaged tissue that are responsible for the sensation of pain. Examples include lignocaine and bupivacaine, which are commonly used to provide pain relief in humans. Lignocaine provides immediate (within 60 seconds) pain relief on surgical wounds. Bupivacaine provides longer-acting pain relief on surgical wounds.

Analgesia refers to pain relief without total loss of feeling or consciousness. Common analgesic products include Non-Steroidal Anti-Inflammatory Drugs (NSAIDs), which block the synthesis of prostaglandins that cause inflammation, swelling and pain. They are typically used to reduce inflammation, pain and fever in humans. NSAIDs take 15–30 minutes[6] to take effect and can provide pain relief for 24–72 hours.[7] Examples include Butec® OTM and various injectable meloxicam formulations.

Pain relief options for lambs

	TRI-SOLFEN®	NUMNUTS®	BUTEC[8] OTM	BUCCALGESIC[8] OTM	MELOXICAM 20
Manufacturer	Dechra	Dechra	Troy Animal Healthcare	Troy Animal Healthcare	Various
Drug type	Local anaesthetic	Local anaesthetic	NSAID analgesic	NSAID analgesic	NSAID analgesic
Scheduling	S5 (over the counter)	S5 (over the counter)	S6 (over the counter)	S6 (over the counter)	S4 (veterinary prescription)
Active ingredient(s)	40.6 g/L lignocaine (as hydrochloride); 4.2 g/L bupivacaine (as hydrochloride); 24.8 mg/L adrenaline (as acid tartrate); 5.0 g/L cetrimide	17.2 mg/mL lignocaine (as 20 mg/mL lignocaine hydrochloride)	10 mg/mL meloxicam	10 mg/mL meloxicam	20 mg/mL meloxicam
Registered indications	Pain relief on lambs following castration, tail docking and mulesing.	Local anaesthetic injection for use in sheep during tail docking and castration with rubber rings	For the alleviation of pain associated with the routine husbandry procedures of castration, tail docking and mulesing of lambs.	For the alleviation of pain associated with the routine husbandry procedures of castration, tail docking and mulesing of lambs.	For the alleviation of pain and inflammation.
Application method	Fan spray applicator	Sub-cutaneous injection using Numnuts device	Oral application in the buccal (cheek) pouch	Oral application in the buccal (cheek) pouch	Subcutaneous only for sheep
Dose	Mulesing: 6–12 mL Castration: 3–4.5 mL Docking: 1.5–2 mL	1.5 mL (one injection) per ring application	1 mL/10 kg BW	1 mL/10 kg BW	1 mL/20 kg BW
Withholding periods	Meat: 0 days ESI: 90 days	Meat: 0 days ESI: 90 days	Meat: 10 days ESI: 10 days	Meat: 10 days ESI: 10 days	Meat: 11 days ESI: 11 days
Storage	<30°C (room temperature)	<30°C (room temperature)	<30°C (room temperature). Protect from light	<30°C (room temperature). Protect from light	<25°C (air conditioning)
Shelf life after manufacture	18 months	24 months	24 months	24 months	24–36 months

TRI-SOLFEN®

Four-in-one

First choice for acute pain relief

Tri-Solfen is the first choice for acute pain relief and wound care during surgical procedures (e.g. mulesing, tail docking and castration) in lambs. This easy-to-apply, spray-on gel provides immediate and lasting relief against acute pain, reduces bleeding; protects against infection; and facilitates wound healing. It is applied using a special spray applicator that turns the liquid formulation into a foaming gel that adheres to the wound. Tri-Solfen is available in 1, 5 and 20 L packs from your rural supplier or veterinarian.

Tri-Solfen contains four active ingredients:

• **Lignocaine** and **bupivacaine**, two local anaesthetics commonly used to provide pain relief in humans. Lignocaine provides immediate (within 60 seconds) pain relief on surgical wounds. Bupivacaine provides longer-acting (up to 24 hours) pain relief on surgical wounds. Lignocaine and bupivacaine block the nerve signals from damaged tissue that are responsible for the sensation of pain, reducing the animal's pain response.

• **Adrenaline**, which reduces bleeding and slows the 'inflammatory cascade'.[4] Adrenaline constricts blood vessels that have been cut during surgery, reducing blood loss and the risks associated with increased stress and shock to the animal. Reducing blood flow to surgical wounds means nerve endings are not exposed to inflammatory compounds that would normally sensitise them. Adrenaline also reduces the rate of systemic absorption of lignocaine and bupivacaine, prolonging their anaesthetic effect.[7]

• **Cetrimide**, an antiseptic and surfactant that helps to start the healing process and protect against infection. The gel formulation helps to seal and protect the wound for improved wound healing. Tri-Solfen is ideal for use in combination with NSAID treatments (e.g. meloxicam) to provide multi-modal relief from both acute and chronic pain.

The beneficial effects of Tri-Solfen in reducing pain following mulesing, tail docking and castration in lambs has been confirmed in numerous scientific papers.[8-12] Clinical studies conducted by leading Australian universities have found Tri-Solfen provides rapid and effective pain relief for up to 24 hours after mulesing and surgical tail docking and/or castration.

Pain relief during mulesing

A series of three trials investigated the impact of Tri-Solfen on pain alleviation and wound healing in lambs undergoing mulesing.[8] Each mob comprised between 60 and 263 Merino lambs. Wound pain was assessed using 10 and 75 g calibrated Von Frey monofilaments to determine sensitivity to light touch and pain stimulation over a four to eight hour period. Pain-related behaviour was observed and recorded. Wound healing rates were determined using scaled digital photography and image analysis software to calculate contraction in wound surface area two and four weeks after mulesing.

In this trial, Tri-Solfen provided rapid (within three minutes) and prolonged (up to eight hours) wound analgesia as shown by pain response scores ($P \leq 0.01$), with no or significantly reduced primary and secondary hyperalgesia ($P \leq 0.01$).[8] Treated lambs also exhibited significantly less pain-related behaviours ($P < 0.001$) compared to untreated lambs. Improved wound healing was observed in treated lambs ($P \leq 0.05$).[8] This trial concluded Tri-Solfen provided rapid and prolonged pain relief in mulesing wounds, reduced pain-related behaviour and improved wound healing in lambs.

Another trial investigated the effect of Tri-Solfen upon pain alleviation and 'mothering up' of Merino lambs after mulesing and marking over a 24-hour period.[7] Two separate trials were performed. In both trials, lambs were assigned to one of three treatment regimens: non-mulesed and untreated (i.e. control); mulesing without treatment with Tri-Solfen (i.e. untreated); and mulesing and treatment with Tri-Solfen (i.e. treated). Body weight, skin and wound sensitivity to light touch and pain stimulation, behavioural responses and time to 'mother up' and time to feed were observed. In both trials, Tri-Solfen provided rapid (one minute) and prolonged (up to 24 hours) wound analgesia, as shown by lower scores for light touch ($P < 0.001$) and pain responses ($P < 0.001$), with no or significantly reduced primary and secondary hyperalgesia ($P \leq 0.05$).[7] Treated lambs exhibited significantly less pain-related behaviours ($P < 0.001$) compared to untreated lambs.[7]

pain relief and wound care.

Multi-modal pain relief during mulesing

Other studies have examined the effectiveness of a multi-modal analgesia in reducing pain-related behavioural responses to mulesing in Merino lambs. In one trial, a total of 140 Merino lambs were allocated to one of seven treatment groups: non-mulesed (control); mulesed with no pain relief; a sub-cutaneous injection of meloxicam administered 15 minutes before mulesing; Tri-Solfen administered at time of mulesing; Tri-Solfen and saline injection 15 minutes before mulesing; Tri-Solfen and a. sub-cutaneous injection of meloxicam 15 minutes before mulesing; and a sub-cutaneous injection of meloxicam at time of mulesing.

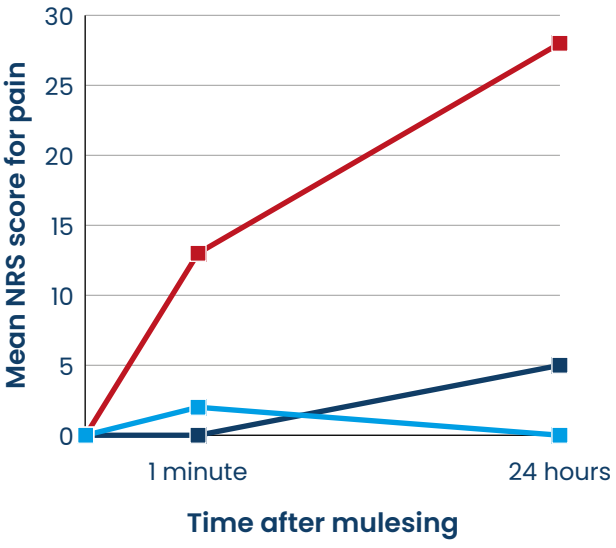
Behavioural responses, such as standing, walking and lying, were measured every 15 minutes for six hours on the day of marking and every two hours for four days thereafter. Standing posture (hunched v. normal) and walking posture (stiff v. normal) were observed and measured. In this trial, lambs that received a combination of pain relief displayed significantly less pain-related behaviour than mulesed lambs with no pain relief on the day of mulesing (0.85 v. 1.22 out of a total score of 3; RSD=1.15).[9] Mulesed lambs with no pain relief displayed significantly more pain-related behaviours than control lambs during the first six hours post-mulesing (1.22 v. 0.22 out of a total score of 3; RSD=1.15).[9]

Pain relief during surgical tail docking and castration

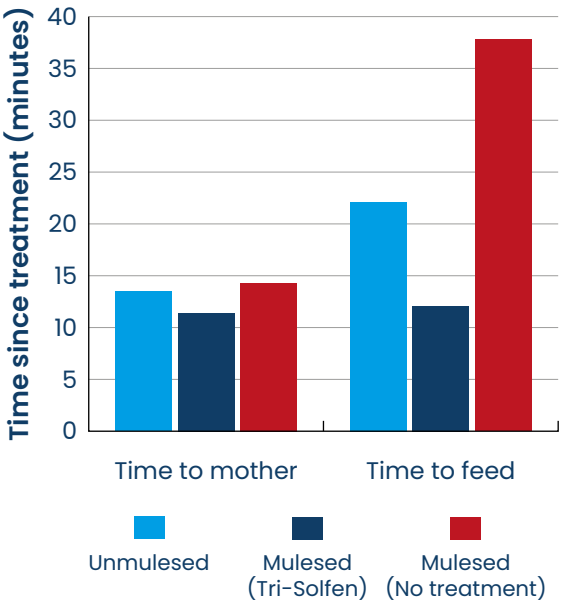
The vast majority of lambs are tail-docked and castrated between the ages of 4 and 12 weeks. Docking and castration can be performed with a hot or cold knife or most commonly, via the application of rubber rings to the tail or testes. All methods cause acute pain, which diminishes substantially after the first hour. Tri-Solfen significantly reduces pain-related behaviours in lambs undergoing surgical tail docking and castration.

In one trial involving 149 Merino lambs, wound pain was assessed using calibrated Von Frey monofilaments over a four-hour period. Pain-related behaviours were observed and recorded over five hours. Wound healing was assessed at 14 and 28 days. Rapid hyperalgesia was observed in untreated and placebo-treated lambs following surgical or hot-knife tail docking and surgical castration. Lambs treated with Tri-Solfen showed no hyperalgesia following surgical castration and significantly reduced levels of hyperalgesia following surgical or hot-knife tail-docking.[10] There was a significant reduction in pain-related behaviours in treated lambs, which were not significantly different in their behaviour to the sham lambs.[10]

Mean head and rump response scores to pain stimulation of wound after mulesing.[7a]



Mean time taken for lambs to mother up and to feed after mulesing.[7b]



[a]*Lambs tail docked at the same time as mulesing.*

[b]*Lambs tail docked prior to mulesing.*

numnuts®

Ring application

Pain relief during ring application

Numnuts is the first choice for acute pain relief in lambs during tail docking and castration using rubber rings. The application of rubber rings for tail docking and/or castration causes intense acute pain due to the restriction of blood supply (ischemia). Peak pain levels typically occur about 15 to 45 minutes after ring application. During this time, lambs display a range of pain-related behaviours, such as kicking, foot stamping, hunching, hopping, lying down and rolling.[12] After 60 minutes, the rubber ring has largely disabled the nerve function and the level of acute pain decreases and the slower, chronic pain associated with injury and healing begins.[12]

Numnuts was developed specifically to address the acute pain experienced by lambs following tail docking or castration using rubber rings. Numnuts is the world's first all-in-one rubber ring applicator and targeted pain relief delivery mechanism. This patented device applies a standard Elastrator® rubber ring and then safely injects a calibrated dose of NumOcaine® (lignocaine). Lignocaine is a rapid-acting local anaesthetic that numbs the site within 60 seconds and blocks acute pain for 60 minutes. Numnuts, NumOcaine and replacement parts can be purchased from your rural supplier or veterinarian without a prescription.

The Numnuts system has been extensively evaluated for use in Australia using funding from Meat & Livestock Australia and Australian Wool Innovation. Trials involving more than 15,000 lambs have shown that the administration of NumOcaine using the Numnuts device significantly reduces acute pain caused by tail docking and/or castration using rubber rings.[12,13]

Australian trial data

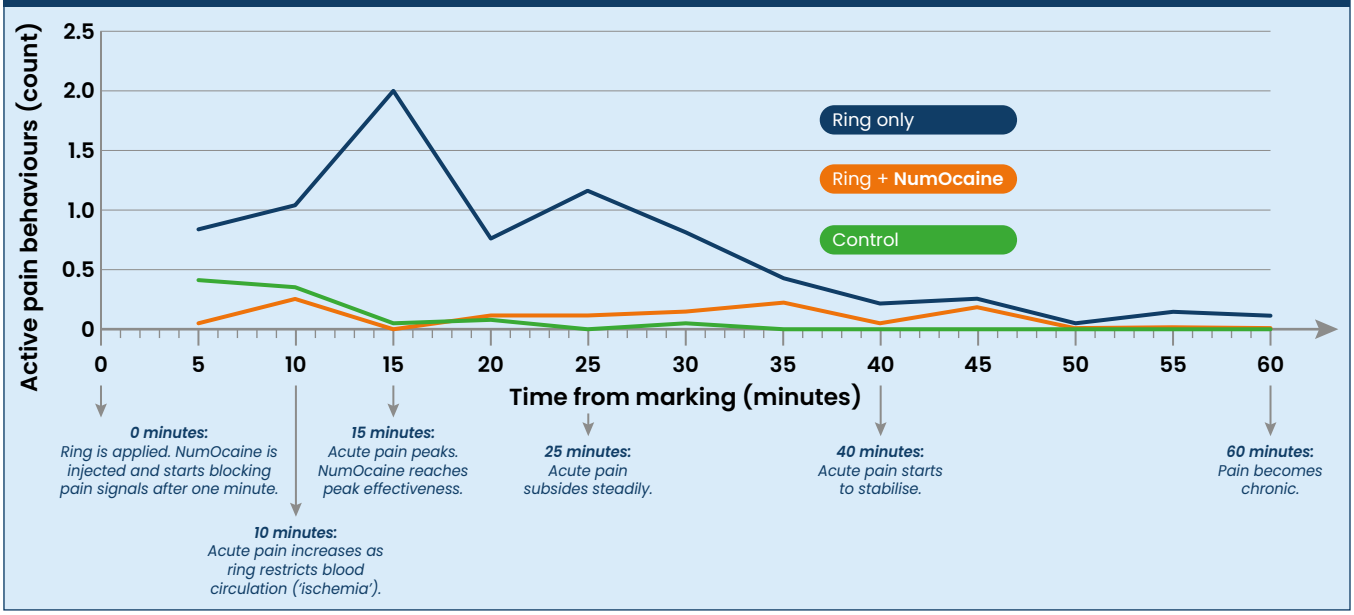
One trial found the delivery of lignocaine using the Numnuts device greatly reduced the degree of acute pain observed in docked lambs to levels similar as undocked lambs.[13] On two commercial farms, 150 prime lambs aged four to 10 weeks were randomly allocated to three treatment groups: handled in a lambing cradle but not marked (i.e. sham treatment); handled and marked with rubber rings (i.e. untreated); or handled and marked with rubber rings and treated with 1.5 mL of NumOcaine using the Numnuts device (i.e. treated). Acute pain-related behaviours were observed and recorded at 5, 20, 35 and 50 minutes. Postures were observed and recorded at 10-minute intervals from 60 to 180 minutes.

and targeted pain relief.

Acute pain behaviours were significantly more frequent in treated and untreated lambs compared to the control group (P<0.001).[13] Acute pain behaviours in treated lambs were significantly lower than untreated lambs at 5 minutes (P<0.001) and 20 minutes (P=0.001).[13] Abnormal postures in treated and untreated lambs were higher at 60, 70, 80, 90 and 150 minutes (P<0.048) compared to sham lambs. There was no difference in posture of treated and untreated lambs at any time point between 60 and 180 minutes, supporting the use of a multi-modal approach for longer-term relief against chronic pain. On one farm, lambs treated with Numnuts mothered up more quickly than untreated lambs (P=0.09) and more slowly than sham lambs (P=0.07).[13]

Another trial determined investigated the efficacy of Numnuts in reducing acute pain following tail docking using rubber rings in two to four-week-old lambs.[12] A total of 30 ewe lambs were randomly allocated to three treatment groups: handled in a lambing cradle but not docked (i.e. sham treatment); handled and docked with rubber rings (i.e. untreated); or handled and docked with rubber rings and treated with 1.5 mL of NumOcaine using the Numnuts device. Posture, movement and feeding behaviour were observed and recorded every five minutes for the first hour and then every ten minutes for another two hours. Untreated lambs showed significant higher levels of pain-related behaviours (P<0.001) and abnormal posture (P<0.001) in the first 60 minutes than treated or sham lambs.[12]

Figure 1: Lamb pain behaviours following docking with and without NumOcaine® local anaesthetic[12]



Best practice pain relief

Best practice guidelines recommend the provision of both acute and chronic pain relief (i.e. multi-modal programs) during mulesing, docking and castrating lambs.[1,2] Ideally, this should involve the administration of an anaesthetic to manage acute pain and an analgesic to manage chronic pain.

There are practical and economic limitations to implementing best practice pain relief programs. For example, some products must be prescribed and administered by a veterinarian, which may not always be feasible.

In most situations, best practice pain relief during and after mulesing, docking and castrating lambs will involve the concurrent use of Tri-Solfen or Numnuts and a buccal analgesic (e.g. Butec OTM). Both products are available from rural suppliers and veterinarians.

BETTER CHOICES®
A better life for livestock

Demonstrate your commitment to delivering best-practice animal welfare standards by registering in the Better Choices program. This independently-audited program enables livestock producers to certify they implement best-practice animal welfare standards. To create or renew your registration, visit **betterchoices.com.au** or call **1300 595 250**.

ACUTE PAIN RELIEF		CHRONIC PAIN RELIEF
Tri-Solfen (surgical procedures) or **Numnuts** (ring application)	+	**Non-steroidal anti-inflammatory drugs** (e.g. meloxicam)

Contact your Dechra territory manager, rural reseller or veterinarian about how you can deliver Gold Standard pain relief in your livestock business.

References: 1. Australian Animal Welfare Standards and Guidelines – Sheep Animal Health Australia (AHA) 2014. Publication record: Edition 1 Version: 1.0 January 2016 Endorsed. 2. Meat & Livestock Australia (2020.), Fact sheet – Pain mitigation in sheep and cattle. 3. Australian Wool Innovation Limited. (2020). Anaesthetics and Analgesics at Lamb Marking. 4. Wool Producers Australia, 2023/24 Policy document. 5. Responsible Wool Standard 2.2, 2021. 6. Colditz, I. *et al.* (2019). Efficacy of meloxicam in a pain model in sheep. *Aust Vet J.* 97:23-32. 7. Lomax, S., *et al.* (2013). Duration of action of a topical anaesthetic formulation for pain management of mulesing in sheep. *Aust. Vet. J.* 91:160-167. 8. Lomax, S., *et al.* (2008). Impact of topical anaesthesia on pain alleviation and wound healing in lambs after mulesing. *Aust Vet J.* 86:159-168. 9. Inglis, L., *et al.* (2019). Behavioural measures reflect pain-mitigating effects of meloxicam in combination with Tri-Solfen in mulesed Merino lambs. *Animal* 13(11): 2586-2593. 10. Lomax, S., *et al.* (2010). Topical anaesthesia alleviates the pain of castration and tail docking in lambs. *Aust Vet J.* 88:67-74. 11. Lomax S., *et al.* Quantitative Sensory Testing for assessing wound pain in livestock. Faculty of Veterinary Science, University of Sydney, PMB 3, Camden, NSW 2570 Australia. 12. Small, A. *et al.* (2021). Local anaesthetic delivered with a dual action ring and injection device Numnuts reduces the acute pain response of lambs during tail docking; *Animals.* 11(8):2242. 13. Small, A., *et al.* (2020). Efficacy of precisely injected single local bolus of lignocaine for alleviation of behavioural responses to pain during tail docking and castration of lambs with rubber rings. *Res Vet Sci.* 133:210-218.

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