



Animal Welfare Approved Technical Advice Fact Sheet No. 9

Castration of cattle

Animal Welfare Approved has the most rigorous standards for farm animal welfare currently in use by any United States organization. Its standards have been developed in collaboration with scientists, veterinarians, researchers, and farmers across the globe to maximize practicable, high-welfare farm management.

Why castrate cattle?

Castration is probably the most common procedure carried out on cattle across the world. Castration involves the removal or destruction of the testes or testicles and is carried out in order to stop the production of male hormones.

Entire bulls tend to be more aggressive to both stock people and other cattle, and can cause problems with unwanted breeding. They also generally produce lower quality meat. Castration eliminates all these problems.

What do the *Animal Welfare Approved* standards require?

The *Animal Welfare Approved* standards allow the castration of calves as long as it is performed by someone who is competent to carry out the operation, either through training or experience. The standards also place restrictions on which methods of castration can be used, as well as the age of the animal to be castrated.

What are the different methods of castration?

A number of different methods of castration are available. Physical methods – such as the use of elastrator bands or emasculators – are most common but chemical and hormonal methods are also often used.

Immunocastration and chemical castration

Immunocastration involves the use of hormones to suppress the production of testosterone. Chemical castration includes the injection of toxic chemicals, such as lactic acid, directly into the testes to cause irreparable damage. Immunocastration only offers a temporary effect and the injections must be repeated (usually at six month intervals) throughout the animal's life. Chemical castration requires a lot more skill than other methods of castration and has a much longer healing time – and therefore a greater negative impact on animal welfare than other forms of castration. It also has a high failure rate: one study showed that 17% of animals continued to produce male hormones after chemical castration.

Immunocastration and chemical castration are therefore not recommended and any producer who wishes to use these methods must provide justification and get prior approval from *Animal Welfare Approved*.

Surgical castration

Surgical castration involves the complete removal of the testicles using a scalpel or Newberry knife.

Animal Welfare Approved allows surgical castration without the use of pain relieving drugs for calves up to the age of two months. You may surgically castrate calves that are older than two months but only when appropriate pain relief is provided.

Emasculator or Burdizzo castration

This method of castration uses a clamp which crushes the blood vessels around the testes, cutting off blood supply and causing them to die and drop off.

Animal Welfare Approved allows emasculator or Burdizzo castration without the use of pain relieving drugs for calves up to the age of two months. You can castrate a calf older than two months using this method but only when appropriate pain relief is provided.

Ting *et al* (2005) showed that the calves castrated with Burdizzo at 1.5 months old showed lower cortisol readings (an indication of stress), less scrotal swelling and lower scrotal temperature (a measure of inflammation) than calves castrated by Burdizzo at 5.5 months of age. Calves castrated at 2.5 months and 3.5 months had intermediate reactions to the two extremes, strongly suggesting that pain and inflammation increase with age.

Rubber rings and high tension latex bands

Ring or band castration involves fitting a tight rubber or latex ring or band to the neck of the scrotum to cut off the blood supply to the testes, causing them to die and drop off.

Animal Welfare Approved allows the use of rubber rings or high tension latex bands – such as Callicrate or Eze bands – without the use of pain relieving drugs for calves up to the age of one week. Note that you must not castrate any calves older than one week of age using rings or bands, regardless of whether pain relief is provided.

It's common practice to use elastrator rings or high tension bands on cattle older than one week of age – why doesn't *Animal Welfare Approved* allow this?

A number of procedures that are regarded as common practice in farming are not permitted in the *Animal Welfare Approved* standards. While *Animal Welfare Approved* obviously wants to ensure that approved farms are commercially viable, we have to balance production with animal welfare.

In recent years a lot of research has been carried out on the effects of castration on both cattle and sheep. Overall, this research has shown that the castration of older and heavier bulls causes more pain and stress, whatever the method used.

The older the animal, the greater the pain and stress

Further research has examined the effects of different types of castration and their effect on bulls of different ages. Most of this research shows that using bands or rings on calves older than a week old increases the pain response and so reduces welfare. In some countries the weight of evidence was considered sufficient enough to affect legislation. In the United Kingdom, for example, it is illegal to use elastrator rings on calves older than a week old, while farmers in New Zealand can only castrate using high tension bands when pain relief is provided.

Research on age of ringing

According to Mellor (1991), calves of one to seven days that were castrated using elastrator rings exhibited few behaviors associated with pain or distress, and plasma cortisol concentrations of castrated calves did not significantly differ from those of uncastrated controls. However, Thuer *et al* (2007) found evidence of chronic pain for several weeks among calves of three to four weeks old after castration with rubber rings.

Robertson *et al* (1994) looked at the effect of castration on calves at three different ages: six days, 21 days and 42 days. Six-day-old bull calves exhibited fewer violent pain responses than 21- or 42-day-old calves after castration, although some pain-associated behaviors were observed in all groups. They found that the 42-day-old calves exhibited a high incidence of pain-associated behaviors and a marked increase in plasma cortisol concentration, indicating that these animals experienced more pain than six- or 21-day-old calves.

Research on rings versus bands

Other research looked at the difference between elastrator ring castration – which by the size of the ring limits the age of application – and high tension latex band castration, commonly known as Callicrate or Eze castration.

Stafford *et al* (2002) found that band castration caused a greater cortisol response than ring castration. The level of blood cortisol is used to evaluate stress in an animal as it rises very quickly in response to pain or stress. An older study by Magrath (1954) suggested that banding was more of a problem than ringing. The older age of the animal meant there was more scrotal tissue and this tissue, which becomes necrotic after banding, is prone to infection with pathogens. Although this research is rather dated the findings are backed up by current recommendations to vaccinate against tetanus and blackleg when banding as these infections are relatively common when older calves are banded – yet it is almost unheard of in calves that are castrated with rings before seven days old.

The use of high tension bands in three-month old calves resulted in increased cortisol secretion. Stafford *et al* (2005) carried out another study and concluded that band castration was acutely painful and distressing. Although the magnitude of pain

responses to bands were generally of the same order as with castration by rubber ring, they occurred earlier after band application, involved immediate maximal pain responses, and were higher during that earlier period. In addition, the behaviour of calves castrated with bands indicated severe pain: they lay on the ground with their hind legs extended, a posture not seen with rubber rings.

Acute pain versus chronic pain

Acute pain is the pain that occurs at the point of carrying out the castration operation; chronic pain is the ongoing pain that may continue for weeks after the operation. When looking at the type of pain which results from different methods of castration it is important to assess both acute and chronic pain.

Some research shows that cattle seem to behave and grow 'normally' in the days immediately following castration by high tension bands – that is, without an apparent effect of castration. Cattle that have been castrated surgically, however, show an immediate pain effect and reduced growth rates in the first few days after castration.

However, the situation changes when you look at research that was continued for a number of weeks after castration. For example, a study cited by Dr Robert Larson of Kansas State in *Hereford World* (Gugelmeyer 2008) showed that banded calves performed better for the first few weeks after castration. At two weeks, the banded calves had less decrease in feed intake and better weight gain than surgically castrated calves. However, at three to four weeks the situation changed and the surgically castrated calves did better. By this time, the surgically castrated calves had mostly healed, while the banded calves were just at the point when they were sloughing their scrotums.

Healing can take significant periods of time – at least 42–51 days after rubber ring or band castration of calves, depending on the method used and the age of the animals. For example, studies show that calves healed fastest after surgical methods of castration, while healing was most prolonged in older animals using high tension bands (Molony *et al* 1995 and Fisher *et al* 2001).

Lesions following high tension banding

Evidence suggests that the application of high tension latex bands to calves of three to four months of age causes significant pain, while lesions associated with poor healing can be seen in some animals.

Persistent wounds were observed in 14-month-old bull calves castrated using emasculator bands; such wounds are highly likely to produce chronic pain. On the basis of behavioral parameters and the presence of inflammation and sepsis, it appears that castration with rubber rings or bands produces both acute and chronic pain, whereas application of the Burdizzo clamp and surgical castration produce less chronic pain.

Potential complications associated with castration include hemorrhage, excessive swelling or edema, infection, poor wound healing, and failure. Risk of haemorrhage is greater after surgical castration, while excess swelling and oedema is greater after banding.

Pressure from bands versus pressure from rings

The New Zealand National Animal Welfare Advisory Committee (NAWAC) has produced data on the pressure exerted by high tension bands versus elastrator rings. The high tension bands can exert up to 260 Newtons compared with perhaps 100 Newtons from a conventional rubber ring. The conclusion they draw is that high tension bands cause significant pain. NAWAC's Animal Welfare (Painful Husbandry Procedures) Code of Welfare (2005) states that:

Since high tension bands result in animals experiencing additional acute pain, compared with castration by conventional rubber rings, NAWAC is of the opinion that the latter are a less noxious alternative.

NAWAC went on to legislate that New Zealand farmers can only use high tension bands when pain relief is used – regardless of the age of the calf.

Overall, *Animal Welfare Approved* believes that the weight of research evidence proves that the use of any type of band or ring on calves of more than seven days old will cause greater pain and stress than other types of castration at this age, such as Burdizzo or scalpel.

What about growth rates?

The most common justification given for later castration is based on an assumption that it will allow sufficient time for the animal to produce some male hormones, which will have a beneficial effect on growth rates.

Scientific studies have shown that bulls left entire grow faster than castrated animals. However, it is worth noting that the growth rate benefit comes from testosterone – which the animal won't produce until he is between 3.5–5.5 months old. So castrating up to and around this age won't actually produce any growth benefits.

There is also significant evidence to show that the stress of later castration actually results in a *decreased* growth rate in the weeks following the operation. This is likely to wipe out any benefit from the production of male hormones before castration.

Researchers in many countries have studied the effects of castration on live weight gains. In general, there are no differences in live weight gains for bulls and steers in the 21 days following castration at one month of age. However, there are significant differences with castration at older ages. Some studies failed to detect differences related to castration method, whereas others – notably Fisher *et al* (2001) – found that cattle castrated using bands had slower growth rates and lower average daily gains than surgically castrated or uncastrated control animals.

Fisher *et al* (2001) and Heaton *et al* (2004) show that delaying castration also results in no benefit in terms of carcass weight, while taste panels suggest that consumers prefer beef from cattle that are castrated at an early age.

Why do pain relieving drugs have to be used when castrating with an emasculator or a scalpel after two months of age?

The testes and scrotum are richly supplied with nerves and any modification to them will cause immediate pain that can last for some time. All physical methods of castration will cause some degree of pain that can be exhibited both during and after castration. The research conducted to date looks at varying ages and types of castration with varying results in terms of what is considered to be the most painful method or age. However, the consensus among researchers is that younger animals appear to be less affected by castration than older ones. Therefore, the castration of older male animals without anaesthesia is increasingly seen as inhumane and unethical.

Different countries across the world have different legal requirements for the age after which farmers must provide cattle with pain relief at castration. Australia allows castration with no pain relief until six months of age; Switzerland requires pain relief at any age.

Animal Welfare Approved has assessed the available evidence on pain at castration and has set an age limit of two months above which pain relief must be provided when castrating cattle with an emasculator or scalpel.

Aside from this research, there are a number of other sources which justify the 'two month' cut off point for whether or not pain relieving drugs must be used. The Federation of Animal Science Societies (1999) *Guide for the Care and Use of Agricultural Animals in Agricultural Research and Teaching* advises that castration is least stressful when performed at a few days of age. Local anesthesia is recommended for calves older than two to three months of age or greater than 230kg where spermatic cords are crushed or surgical castration is performed.

In the United Kingdom, legislation requires that a veterinary surgeon must carry out the castration of any animal over two months old with pain relieving drugs. Advice given to vets from North Carolina State University among others is to 'strongly recommend' castration takes place before two months of age.

Short term versus long term pain – another issue with rings and bands

It is clear that pain relieving drugs can have a definite positive effect on the animal at the point of being castrated. The fact that managing the long term pain of cattle over one week old that are castrated using high tension bands or rings is much more difficult than managing the short term, acute pain at the point of castration when using a scalpel or Burdizzo is further justification for not allowing this procedure.

Animal Welfare Approved accepts the use of rings without pain relief for very young calves. Research shows that the pain response for these young animals is generally

minor. However, the evidence suggests that there is justification for far greater concern in older calves as the pain response is greater.

What pain relieving drugs can be used?

Options for anesthesia and pain relief include short acting local anaesthetics such as lidocaine that will have an effect for around 45–90 minutes. This can be delivered as an epidural injection to block pain in the entire hindquarters and testicular region, or as a local anaesthetic into the testicles or spermatic cord.

Longer acting pain relief drugs such as xylazine (given alone or in conjunctions with local anesthetics) will last for several hours. Non-steroidal anti-inflammatory drugs (NSAIDS) such as ketoprofen used alone, with local anaesthetics or with xylazine, can also aid in pain relief.

Local anaesthesia eliminates the acute pain caused by rubber-ring or latex-band castration. While this is not required by the *Animal Welfare Approved* standards (as this type of castration is limited to very young calves) it should be viewed as best practice.

Local anaesthesia combined with a systemic analgesic, such as the non-steroidal anti-inflammatory drug ketoprofen, eliminates pain caused by Burdizzo or surgical castration. However, ketoprofen alone may not eliminate pain-induced behaviour seen during the castration process.

Can I get pain relieving drugs?

Obstacles to the provision of pain relief to cattle include limited availability of some drugs. For example, the only NSAID approved for use in cattle in the United States is flunixin meglumine; however, it is approved for the control of fever associated with respiratory disease or mastitis and fever and inflammation associated with endotoxemia, rather than for control of pain. Use of flunixin meglumine is complicated by its intravenous route of administration (significant tissue reactions have occurred after intramuscular administration).

Animal Welfare Approved recommends that farmers should castrate cattle as early as possible to avoid the need for pain relieving drugs. If you cannot avoid later castration then discuss the suitable options for pain relief during castration with your vet.

Summary

All types of castration will cause pain and stress to cattle. However, scientific research shows that young calves will recover more quickly from castration, with fewer complications when compared to older calves.

High tension bands exert greater pressure on the testes than standard emasculator rings and can cause significant pain. The pain experienced is also likely to become more severe over time than at the point of applying the rings, and may last for days – or even weeks. Using bands or rings in older calves can also increase the risk of secondary infection and the development of lesions. Castration using bands and

rings has a greater potential to cause ongoing or chronic pain than scalpel or Burdizzo castration.

Animal Welfare Approved recommends that castration is carried out as soon as possible – ideally within the first seven days of the life of a calf. In farming systems where this is not possible the method of castration is limited to emasculator or scalpel because the pain, stress and potential complications associated with banding is considered too great to justify its use.

Where castration must be carried out above the age of two months the farmer must provide appropriate pain relief. Later castration is more stressful and painful for the calf and research shows that pain relief can be effective.

Research shows that early castration does not penalise the growth rate of the animal to a point where it will affect the economic viability of the farm and the difference in growth rate from early versus later castration is likely to be very minor for most farms.

References and further information

Federation of Animal Science Societies (1999). *Guide for the Care and Use of Agricultural Animals in Agricultural Research and Teaching*, Ed 1 (revised). Savoy, IL, FASS.

Fisher, A.D., Knight, T.W., Cosgrove, G.P., Death, A.F., Anderson, C.B., Duganzich, D.M., Matthews, L.R. (2001). 'Effects of surgical or banding castration on stress responses and behaviour of bulls'. *Aust Vet J* 79:279–284.

Heaton, K., ZoBell, D.R., Cornforth, D. (2004). 'Effects of delayed castration of British cross-bred cattle on weight gain, carcass traits, and consumer acceptability'. *Proceedings, Western Section, American Society of Animal Science*, vol. 55. 2004.

Gugelmeyer, S. (2008). 'Castration Do's and Don'ts: Pointers to help producers sell heavier, healthier steers'. *Hereford World*, February 2008:28–29.

Magrath, L.A., Magrath, J.M. (1954). 'Tetanus in calves from elastration'. *J Am Vet Med Assoc* 125:451.

Mellor, D.J. (1991). 'Effects of castration on behaviour and plasma cortisol concentrations in young lambs, kids, and calves'. *Res Vet Sci* 51:149–154.

Molony, V., Kent, J.E., Robertson, I.S. (1995). 'Assessment of acute and chronic pain after different methods of castration of calves'. *Appl Anim Behav Sci* 46:33–48.

Robertson, I.S., Kent, J.E., Molony, V. (1994). 'Effect of different methods of castration on behaviour and plasma cortisol in calves of three ages'. *Res Vet Sci* 56:8–17.

Stafford, K.J., Mellor, D.J. (2005). 'The welfare significance of the castration of cattle: a review'. *New Zeal Vet J* 53:271–278.

Stafford, K.J., Mellor, D.J., Dooley, A.E. *et al.* (2005). 'The cost of alleviating the pain caused by the castration of beef calves'. *Proc N.Z. Soc Anim Prod.* 65:123–126.

Stafford, K.J., Mellor, D.J., Todd, S.E., Bruce, R.A., Ward R.N. (2002). 'Effects of local anaesthesia or local anaesthesia plus a non-steroidal anti-inflammatory drug on the acute cortisol response of calves to five different methods of castration'. *Res Vet Sci* 73 (1): 61–70.

Thuer, S., Mellema, S., Doherr, M.G., *et al.* (2007). 'Effect of local anaesthesia on short- and long-term pain induced by two bloodless castration methods in calves'. *Vet J* 173:333–342.

Ting, STL, Earley, B, Veissier, I, Gupta, S, Crowe, M.A. (2005). 'Effects of age of Holstein-Friesian calves on plasma cortisol, acute-phase proteins, immunological function, scrotal measurements and growth in response to Burdizzo castration'. *Animal Science* 80, 377–386.

Further information

Information from the American Veterinary Medical Association on the welfare implications of the castration of cattle:

http://www.avma.org/reference/backgrounders/castration_cattle_bgnd.asp#references

Factsheet on castration from the Ontario Ministry of Agriculture Food and Rural Affairs:

<http://www.omafra.gov.on.ca/english/livestock/beef/facts/07-029.htm>

Paper on method and timing of castration and the effects on performance:

<http://www.ansi.okstate.edu/research/2001rr/48/48.htm>

Detailed review of operations carried out on all farm animals including castration:

<http://www.biosecurity.govt.nz/files/regs/animal-welfare/req/codes/painful-husbandry/painful-husbandry-report.pdf>

Castration Do's and Don'ts: Pointers to help producers sell heavier, healthier steers by Sara Gugelmeyer (*Hereford World*, February 2008):

http://www.herefordworld.org/HW/Documents/0208_Castration.pdf

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