Annex C – Evidence

Please note that this is not an exhaustive list of evidence.

Method of castration and/or tail docking		
Surgical	This method can cause more pain than any alternative.	(Lester, et al., 1991; Lester, et al., 1996; Melches, et al., 2007; Mellor & Stafford, 1999; Mellor & Stafford, 2000; Thornton & Waterman-Pearson, 1999)
	Topical anaesthetic can reduce acute pain caused by this method.	(Ferrer, et al., 2020; Lomax, et al., 2010; Paull, et al., 2009)
	Injected or oral NSAID can reduce acute pain caused by this method.	(Marini, et al., 2017; Paull, et al., 2009; Small, et al., 2014)
Rubber ring	This method can cause significant acute pain (at any age) that can last up to 4 hours.	(Dinniss, et al., 1999; Graham, et al., 1997; Grant, 2004; Kent, et al., 1993; Kent, et al., 1995; Lester, et al., 1996; Masłowska, et al., 2020; Molony, et al., 1993; Molony, et al., 2002; Thornton & Waterman-Pearson, 2002)
	This method can cause lesions and chronic pain that can last more than 40 days.	(Kent, et al., 1997; Kent, et al., 1999; Kent, et al., 2000; Melches, et al., 2007)
	Injected local anaesthetic can reduce acute pain caused by this method.	(Dinniss, et al., 1997a; Dinniss, et al., 1999; Graham, et al., 1997; Kent, et al., 1998; Kent, et al., 2000; Melches, et al., 2007; Mellema, et al., 2006; Mellor & Stafford, 1999; Sutherland, et al., 1999; Thornton & Waterman-Pearson, 1999)
	Injected NSAID can reduce acute pain caused by this method.	(Anderson, et al., 2020; Paull, et al., 2009; Paull, et al., 2012; Schllemer, et al., 2021)
Combined method	This method can cause less acute pain than standard rubber ring use.	(Graham, et al., 1997; Kent, et al., 1993; Kent, et al., 1995; Kent, et al., 1998; Kent, et al., 2000; Mellor & Stafford, 1999; Molony, et al., 1993; Thornton & Waterman-Pearson, 1999)
	This method can cause as much acute pain as standard rubber ring castration if the crush is not full width.	(Dinniss, et al., 1997a; Dinniss, et al., 1997b; Dinniss, et al., 1999)
	This method can improve wound healing and chronic pain compared to standard rubber ring use.	(Kent, et al., 2000; Sutherland, et al., 2000)

	Injected local anaesthetic can reduce acute pain caused by this method.	(Dinniss, et al., 1997a; Dinniss, et al., 1999; Graham, et al., 1997; Kent, et al., 1998; Molony, et al., 1997; Thornton & Waterman-Pearson, 1999)
Numnuts	This method can cause less acute pain than standard rubber ring castration and tail docking performed together.	(Small, et al., 2020; Small, et al., 2021a; SRUC, Numnuts Project)
	This method can cause less acute pain than standard rubber ring tail docking.	(Small, et al., 2020; Small, et al., 2021a; Small, et al., 2021b; SRUC, Numnuts Project)
	This method can cause as much acute pain as standard rubber ring castration.	(SRUC, Numnuts Project)
ClipFitter	This method (for lambs <7 days) can reduce acute pain from castration to the level of uncastrated lambs, which is less than that from standard rubber ring castration with injected local anaesthetic and NSAID.	(SRUC, ClipFitter Project)
	This method (for lambs 4-6 weeks) can cause more acute pain than clamp castration with injected local anaesthetic and NSAID.	(SRUC, ClipFitter Project)
	This method can cause as much acute pain as standard rubber ring tail docking with injected local anaesthetic and NSAID.	(SRUC, ClipFitter Project)
	This method can improve wound healing and chronic pain compared to standard rubber ring use.	(SRUC, ClipFitter Project)
Lidocaine bands	This method can cause less acute pain than standard rubber ring use.	(Roche, et al., 2024; Ross, et al., 2024; Stewart, et al., 2014)
	This method can cause more acute pain than standard rubber ring use with injected local anaesthetic.	(Stewart, et al., 2014)
Method of castration only		
Short scrotum	This method can cause less acute pain than standard rubber ring castration.	(Dinniss, et al., 1997a; Dinniss, et al., 1999; Lester, et al., 1996; Masłowska, et al., 2020; Mellor & Stafford, 2000; Molony, et al., 2002)
	This method can cause more acute pain than standard rubber	(Dinniss, et al., 1997a; Mellor & Stafford, 2000)

	ring castration with injected local anaesthetic.	
	This method can cause more acute pain than combined method castration.	(Masłowska, et al., 2020)
Clamp	This method can cause less “unavoidable” acute pain than rubber rings.	(Kent, et al., 1995)
	This method can improve wound healing and chronic pain compared to standard rubber ring castration.	(Melches, et al., 2007)
	Injected local anaesthetic can reduce acute pain caused by this method.	(Durand, et al., 2019; Melches, et al., 2007; Mellema, et al., 2006; Molony, et al., 1997)
	Injected NSAID can reduce acute pain caused by this method.	(Durand, et al., 2019; Mellor & Stafford, 1999; Molony, et al., 1997)
Method of tail docking only		
Hot iron	This method can cause less acute pain than standard rubber ring tail docking.	(Graham, et al., 1997; Grant, 2004; Lester, et al., 1991; Lester, et al., 1996)
	This method can increase time to mother up, increased pain sensitivity and chronic pain.	(Larrondo, et al., 2019; Lomax, et al., 2010; Lomax, et al., 2013)
	Injected or topical anaesthetic can reduce acute pain caused by this method.	(Graham, et al., 1997; Lomax, et al., 2010)
	Oral NSAID can reduce acute pain caused by this method.	(Small, et al., 2014)
Effects of age		
Young lambs	Painful procedures in the first 24 hours can interfere with mother-newborn bonding and ingestion of colostrum, making lambs more susceptible to fatal infections.	(Collins, et al., 1985; Hodgson, 1999; Mellor & Stafford, 2004)
	Lambs castrated at one day of age perceive a greater intensity of pain after subsequent tail docking than lambs castrated at 10 days of age.	(McCracken, et al., 2010)
Older lambs	Neonate ram lambs can be more sensitive to pain than older rams, and neonate ewe lambs equally sensitive to pain as older ewes.	(Guesgen, et al., 2011)
	Inflammatory lesions following castration by ringing can be larger and more likely to become septic in older lambs.	(Kent, et al., 1999)

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