Assessing the Effectiveness of Euthanasia Methods for Suckling Piglets Using Signs of Sensibility and Behavioural Indicators

Teresa M. Casey-Trott¹, Suzanne T. Millman², Penny Lawlis³, and Tina M. Widowski¹
¹Department of Animal & Poultry Science, University of Guelph, Guelph, ON Canada N1G, 2W1, ²Veterinary Diagnostic & Production Animal Medicine, Iowa State University, Ames, IA, USA 50011, ³Ontario Ministry of Agriculture, Food & Rural Affairs, Ontario, N1G 4Y2
tcasey@uoguelph.ca (519) 824-4120 ext 58580

Introduction
On-farm euthanasia is a topic that every producer has to consider. With both economic and welfare concerns at stake, it is essential to determine when euthanasia is necessary and how best to carry out the process. When done properly, euthanasia can free the animal from unnecessary suffering and allow for greater well-being within the group.

In terms of both welfare and economics, timely euthanasia offers several benefits. Low birth weight piglets (< .9 kg) are often recommended for euthanasia due to low pre-weaning and nursery survival rates (Smith et al., 2007). These higher mortality rates negatively impact the producer particularly in terms of lost feed costs and a reduction in market value of the surviving low quality piglets. Euthanasia of most piglets in this low birth weight category cuts feed and maintenance costs for the producer as well as improves the overall finishing market value of the entire herd (Fix et al., 2010). Selecting out compromised piglets improves the overall welfare scores of the herd and provides a greater chance of success for the remaining piglets (Morrow et al., 2006; Fix et al., 2010).

Acceptable Methods for Euthanasia
Three methods are accepted for euthanasia of suckling piglets. The most common method remains blunt force trauma (BFT) for piglets up to 12 lbs; however, anaesthetic overdose and carbon dioxide (CO₂) gas inhalation are considered acceptable alternatives (Ontario Pork, 2008).

While blunt force trauma remains the most common technique practiced, there has been recent controversy over the aesthetics of this method. As a physical means of euthanasia, the cranium of the piglet is struck by either a heavy instrument or a hard flat surface with enough power to cause concussion and irreversible brain damage (Chevillon et al., 2004; Widowski et al., 2008). Widowski et al. (2008) confirmed that blunt force trauma reliably rendered piglets immediately insensible without return to consciousness. Although aesthetically objectionable, BFT is humane. A possible alternative to blunt force trauma is a non-penetrating captive bolt (NPCB). Recent research showed the NPCB effectively causes immediate insensibility in neonatal piglets (Widowski et al., 2008) and, following a modification of the bolt head to a more conical shape, consistently inflicted irreversible brain damage leading to a timely death, averaging 3 minutes and 45 seconds (Casey-Trott et al., 2010). Using a conical bolt head with a depth of depression of at least 9 mm is recommended (Widowski unpublished data). NPCB is currently recognized by the National Pork Board as an acceptable means of euthanasia for piglets less than 5.5 kg, and research is underway assessing the effectiveness of NPCB on piglets up to 9 kg (NPB, 2009; Casey-Trott in progress).

Carbon dioxide gas inhalation is another method of euthanasia accepted for neonatal piglets. Euthanasia by CO₂ requires exposure to ≥ 90% CO₂ for at least five minutes in either a pre-charged or gradual fill system (NPB, 2009). Although CO₂ is effective for causing death, this method is controversial; loss of consciousness is not immediate (Chevillon et al., 2004), and vocalizations, signs of breathlessness and active avoidance are observed during the inhalation phase (Raj and Gregory, 1996). It has been suggested that the pre-charged system is more humane for piglets than the gradual
fill; however, both methods have reported asphyxiation, escape attempts, and consciousness for piglets up to 6 weeks of age (Bryer et al., 2010). The dramatic rise in cortisol following euthanasia by CO$_2$ inhalation (Bryer et al., 2010) suggests the process is stressful to the piglet and perhaps the acceptability of this method should be reconsidered.

With any euthanasia it is essential to choose a method that causes the animal minimal pain and distress and ensures the safety of the personnel completing the task. A proper protocol should be designed and discussed with all employees responsible for care and euthanasia of any piglets (AVMA, 2007). Key features should be identified that designate specific piglets for euthanasia followed by a clear outline of subsequent steps required to carry out the process. The producer should also ensure that all responsible personnel are both physically and emotionally capable of completing the task and are comfortable with the chosen method.

**Assessing signs of sensibility**

A simple way to ensure that euthanasia is effective and humane is to observe the procedure until it is complete. It is essential to check signs of sensibility immediately following each technique to guarantee the animal does not perceive any pain and is progressing towards a timely death. Observing brainstem and spinal (nociceptive) reflexes provides insight into whether the animal is sensible or experiencing any pain (Erasmus et al., 2010). Some of the key brainstem reflexes include the corneal, palpebral, and pupillary light reflexes. The animal is considered-insensible when they do not exhibit a blink response when either the eyelid or cornea is touched, and when the pupil remains fixed and dilated in the presence of light (Gregory, 2008). If any natural blinking is noted, the animal is considered sensible (Grandin, 2010), and the technique must be reapplied or an alternative method must be immediately completed. Spinal reflexes should also be used to assess insensibility. Examples of spinal reflexes are the pedal reflex, response to nose prick, or anal reflex (Kaiser et al., 2006). The absence of a withdrawal response to the above painful stimuli indicates the animal no longer senses pain.

Behavioural indicators also aid in insensibility assessment. Behavioural observations are particularly useful when direct contact with the piglet is not possible (CO$_2$ gas inhalation). Absence of rhythmic breathing, absence of vocalizations, and loss of muscle tone indicate an effective euthanasia (Gregory, 2008). Ideally, behavioural indicators should be considered in conjunction with direct observation of the reflexive signs of sensibility previously mentioned. Return of rhythmic breathing has been recorded as one of the first signs of returning consciousness (Anil, 1991). Vocalizations are a sign of pain or distress and should not be present at any time during the euthanasia process (Warris et al., 1994). Loss of muscle tone is associated with loss of consciousness and a limp jaw or tongue is a reliable indicator of insensibility in pigs (Grandin, 2010).

**Conclusion**

When any euthanasia is properly carried out, the handler should, at a minimum, observe the following signs to ensure that the euthanasia was effective: absence of a corneal and palpebral reflex, a fixed and dilated pupil nonresponsive to light, no withdrawal reflex to a painful stimulus, and the absence of any rhythmic breathing, vocalization, and muscle tone. With physical methods of euthanasia (blunt force trauma and non-penetrating captive bolt) the onset of clonic muscle spasms, characterized by kicking or paddling movements, and tonic muscle spasms, characterized by rigid extension of the limbs, can be expected. Both convulsive episodes are considered involuntary muscle spasms and should not be confused with voluntary movements or deliberate escape attempts (Grandin, 2010).
References