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## *Literature Review on the Welfare Implications of Swine Castration*

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### **THE ISSUE**

Castration of male piglets is a common practice in many countries and the vast majority of male piglets in the United States are castrated. Castration is performed to avoid boar taint in the meat of sexually mature male pigs and to reduce aggression toward other pigs and caretakers. Boar taint is an accumulation of compounds, such as skatole and androstenone, in the meat of intact males that cause an unpleasant smell and taste that is released when pork is heated. About 75% of consumers find meat from boars objectionable in comparison with meat from castrated males (barrows).<sup>1</sup> The prevalence and intensity of consumer preference varies on the basis of human genotype.<sup>2</sup> Barrows can be raised beyond puberty without developing strong boar taint, however they have poorer feed conversion and more fat deposits than boars. In addition to a reduction in the risk of boar taint, barrows exhibit less sexual and aggressive behavior,<sup>3</sup> which makes them easier to handle and less likely to fight and injure each other in group pens.

Currently there are two methods of castrating male piglets: surgical castration and immunocastration.

**Surgical Castration**—Surgical castration of piglets is carried out prior to weaning, most commonly within the first three days of life. Piglets may be restrained for castration in a variety of ways including suspension by the hind legs using a castration stand or another stockperson, placement in a V-trough, or being held with a hand or between an individual's legs.<sup>4</sup> After the piglet is secure, either two vertical cuts or one horizontal cut is made to the skin of the scrotum, and the testes are removed by cutting the spermatic cord with a scalpel or pulling until the cord tears.<sup>4</sup> Castration is typically performed without anesthesia or analgesia.<sup>3,4,5,6</sup>

**Immunocastration**—Immunocastration involves injection of a protein compound that works like an immunization to induce antibody production against gonadotropin releasing hormone (GnRH). The process requires two injections: the first 8 to 11 weeks prior to slaughter and the second 4 weeks prior to slaughter. Immunocastration results in decreased production of gonadal steroids (testosterone and androstenone) with an associated increase in metabolism of skatole.<sup>7</sup> Accordingly, there is a reduction in boar taint. Immunocastration is a temporary form of castration. Currently there is one product on the market that can be used for immunocastration of male pigs; Improvest<sup>®</sup> is an FDA-approved veterinary prescription product in the United States. This product is also labeled as Improvac<sup>™</sup>, a global brand that is approved for use in more than 60 other countries. Immunocastration is effective at reducing sexual and aggressive behaviors in male pigs (e.g. mounting,<sup>8,9,10</sup> knocking,<sup>9</sup> and fighting<sup>9</sup>) during the period the pig is immunocastrated.

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Additionally, immunocastrated males have higher growth<sup>11</sup> and lower feed conversion<sup>10,11</sup> rates than physically castrated males. Recently, a pilot study with a limited sample size suggested that immunocastrated males were less vocal during handling and loading for processing, and that fewer dead and non-ambulatory pigs were observed with immunocastration as compared to surgical castration.<sup>12</sup> While reported, the latter finding was not statistically significant.

### HUMAN ATTITUDES

A survey of Flemish pig producers showed that farmers perceive surgical castration without anesthesia as the best strategy with regard to profitability, performance and reduction of boar taint; however, they expected the lowest consumer acceptance for this strategy.<sup>13</sup> The farmers ranked surgical castration with anesthesia as the most labor intensive and production of intact males as the least profitable and least effective at reducing boar taint.<sup>13</sup>

Consumers are not generally aware that pigs are castrated nor are they aware of boar taint.<sup>14,15</sup> When informed, consumers view surgical castration without anesthesia as a serious animal welfare concern.<sup>14,15,16,17,18</sup> A survey of Swedish consumers and Belgian students showed that immunocastration was viewed positively and preferred over surgical castration or no castration,<sup>16,17</sup> while a similar survey of consumers in Norway showed them to be skeptical about the product.<sup>14</sup>

### PAIN

Surgical castration involves cutting and manipulating innervated tissues<sup>18,19</sup> and if anesthesia is not provided it will be painful<sup>6,14,20</sup> as reflected by elevated blood cortisol concentrations,<sup>14,21,22</sup> high-pitched squealing,<sup>22,23,24</sup> and pain-indicative behaviors, such as trembling and lying alone.<sup>25,26</sup> Some behavioral indicators of pain may persist for up to five days.<sup>23</sup> The use of a local or general anesthetic is mandatory in Norway, Switzerland and the Netherlands for pigs entering their domestic markets.<sup>4</sup> To avoid the pain associated with surgical castration other countries, such as the United Kingdom and Ireland, have elected to market nearly all of their male pigs intact.<sup>4</sup>

### COMPLICATIONS

Potential complications associated with surgical castration include hemorrhage, excessive swelling or edema, infection, poor wound healing, and failure to remove both testicles. It has been suggested that surgically castrated barrows suffer from suppressed immunity,<sup>27</sup> and exhibit higher incidences of inflammation, pneumonia and other diseases.<sup>28</sup> With immunocastration, complications are similar to those of any other injection of pigs approaching market weight. These would include injection site lesions, needles snapping off in the pigs, handling stress to the pigs, and specifically for immunocastration, risk of self-injection to the stockperson.

### ANESTHESIA AND ANALGESIA

**General anesthesia**—Anesthesia can be induced by use of inhalation agents. Carbon dioxide<sup>29</sup> is effective but causes distress in piglets.<sup>30,31</sup> Halothane<sup>27</sup> and isoflurane<sup>32,33,34</sup> are also effective and do not seem to cause distress. Nitrous oxide is effective in inducing anesthesia, but is not effective at preventing pain from castration.<sup>35</sup> On-farm use of anesthesia is rare due to a range of economic, logistical and safety issues, both for the pig and the herdsman. Use of injectable general anesthetics is not recommended because of high mortality rates,<sup>36</sup> and long recovery periods and risk of crushing by the sow.<sup>37</sup>

**Local anesthesia**—The most commonly used local anesthetic is lidocaine,<sup>38,39</sup> which has been shown to reduce responses (as measured by EEG) that are indicative<sup>40</sup> of nociception and behavioral responses that are indicative of pain.<sup>41,42</sup> Piglets castrated with lidocaine also produce lower intensity vocalizations<sup>3,22</sup> and struggle less during the procedure.<sup>3</sup> Another study found that piglets that received

lidocaine nursed significantly sooner after castration and those same piglets huddled less than a control group in which saline was used.<sup>43</sup> Local anesthesia during castration is mandatory in Norway<sup>38</sup> although its overall efficacy in improving welfare is questioned by some farmers because it requires extra handling, an injection and castration is performed at a later age.<sup>44</sup> Procedures such as removal of piglets from the sow and injections cause marked discomfort and might be further refined.<sup>45</sup>

**Analgesia**—Lidocaine in combination with meloxicam may provide the most comprehensive pain relief for surgically castrated piglets.<sup>40,45</sup> Piglets that received both lidocaine and meloxicam at castration nursed significantly sooner after the procedure and were more social at 24 hours after the procedure.<sup>43</sup> In one study piglets given meloxicam displayed fewer pain-related behaviors including: huddling, spasms, rump scratching, stiffness and prostration.<sup>3</sup> Flunixin has also been used;<sup>46</sup> however, its effectiveness is unknown and may be poor.<sup>28</sup> Aspirin and butorphanol appear to be ineffective.<sup>47</sup>

**Availability and use of pharmaceuticals**— Although combined use of an anesthetic and analgesic appears to be the most effective method for controlling pain associated with surgical castration, regulatory requirements and cost remain obstacles to practical application. Use of pharmaceuticals can burden producers with direct and indirect costs; the latter are associated with time delays and a potential need for additional veterinary assistance. Extra-label use of anesthetics and analgesics, while an option, is not ideal. Knowledge of effectiveness is not as great as it is for drugs approved for particular species and purposes. Extra-label use can also discourage research and development necessary to approve drugs for specific purposes.

## ALTERNATIVES

Surgical castration has not been performed for many years in some countries including the United Kingdom, Ireland, New Zealand, and Australia. In most cases the approach to minimizing boar taint was slaughter of pigs before puberty. One study has shown that entire males spend more time performing social behaviors, including aggressive behaviors and mounting than surgical or immunocastrated males at 21 weeks of age.<sup>48</sup> However, another recent study on raising entire males in stable groups showed that while there is a higher level of agonistic behavior after transfer to the finishing pen, there are not strong negative behavioral consequences overall.<sup>49</sup> In Australia and New Zealand immunocastration has been in use since 1998.<sup>12</sup>

**Selection**—Boar taint has a genetic component and may be reduced through breeding.<sup>50</sup>

**Sperm selection**—Although current technology is not efficient enough for commercial use, it might be further developed to allow the production of only female piglets.<sup>51</sup>

## SUMMARY

Surgical castration is a painful procedure and animal welfare would be improved if it was performed with pain management, or replaced by a less invasive procedure. Immunocastration is a viable alternative to surgical castration that requires veterinary oversight within the United States.

## FOOTNOTES

<sup>3</sup>Improvest is a registered trademark of Zoetis

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