Summary: Implementation of piglet castration under inhalation anaesthesia on farrowing farms

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Main Points:

- Castration under isoflurane is more time consuming than without anesthesia, but doesn't require a veterinarian, like it does for injection anesthesia in Germany.
- Adverse outcomes from castration using isoflurane anesthesia does not highly differ compared to anesthesia-free castration.
- Occupational exposure to isoflurane occurred but were below the exposure limits previously described.

Introduction: As of January 1, 2021, all castration of suckling piglets in Germany must be done under anesthesia in combination with a suitable analgesic under the legal requirements of the German Animal Welfare Act. This includes either inhalation using isoflurane gas, or injectable using ketamine and azaperone in which case a veterinarian needs to be present. Using isoflurane can be the better alternative as it can be used by qualified personnel that have completed the required training and are certified in its use. In Switzerland, the use of anesthesia for castration has been in use since 2010 and was already in use in some organic farms in Germany. These changes were enacted for the improvement of animal welfare. The goal of this field study was to utilize three different anesthetic devices for surgical castration on a sample of conventional pig farms in order to investigate depth of anesthesia, labor time compared to anesthetic-free castration, castration-related anesthetic incidents, mortality rate and occupational safety.

Materials and Methods: In Germany, five isoflurane devices are certified for use by the German Agricultural Society and these vary in their time settings but will have a specified number of operating units with/without a heater. The devices themselves are automated using sensors for pig placement that then initiates the isoflurane gas to the pigs. After a 70-90 s initiation time, an indicator light will signal the start of castration. Some of the devices allow for more cycles of gas to be given or allows for extension of the anesthesia but are capped after 30 s. Three of these devices were compared in this experiment.

Piglet losses and castration process duration were measured for each batch, for both anesthesia free (AF) and isoflurane anesthesia (IA). For IA batches, the defensive movements (to measure whether appropriate depth or plane of anesthesia was achieved), anesthesia incidents following castration until 24 hours post castration, and isoflurane consumption were assessed. Additional information on isoflurane exposure for the workers was also measured. At least 30 minutes before castration, all piglets were given an analgesic intra-muscularly and additional management procedures were conducted such as iron supplementation, vaccination, ear tagging and tail docking.

Results: In the end, data from 11,574 piglets from 129 IA batches (piglet mean age 4.94±0.9 days) using three different anesthesia machines were compared to 1,568 piglets from 15 AF batches (piglet mean age 5.0±1.2 days). A total of 1.7% of all anesthetized animals had anesthetic incidents such as apnea, gasp, or cardiovascular arrest, with apnea being the most commonly reported (66.7%). Total mortality of the anesthetized was 0.1%, of which three piglets (0.03%) died during castration and eight (0.07%) occurred within 24hrs following castration. Mortality in AF batches was 0.4% within 24hrs following castration. Depth of anesthesia was seen in 80.1% of the pigs but varied significantly between the three devices. Location of the device (aisle vs. farrowing compartment) did not affect depth of anesthesia. Complete castration process time differed between IA (2.2±0.8 min) and AF (1.7±0/8 min). The average isoflurane consumption differed significantly between the three machines, but the overall mean was 0.57±0.27 mL/piglet. The person castrating was exposed to a higher amount of isoflurane in the ambient air (5.8±5.5 mg/m^3) compared to the person transporting piglets (4.8±2.2 mg/m^3).

Discussion and Conclusion:
Data from a few of the farms and/or batches used for this experiment were unable to be analyzed because there was anesthesia device failure resulting in respiratory arrest and subsequent piglet death. Additionally in one of the farms, both female and male pigs experienced shock conditions within 24hrs of processing and/or castration, and these male pigs were excluded from the study. Depth of anesthesia is an important consideration. Excessive levels of isoflurane can result in respiratory arrest, whereas too little and piglets could be in the awakening phase during the actual castration procedure. This may be largely a management consideration to make sure there are not many piglets being anesthetized and/or have enough staff performing the castrations in a timely manner. The current study also shows, that if isoflurane is used correctly, there should be no increased losses following castration. The timing for each group of castration IA was 4 minutes and 16 seconds to five minutes and 48 seconds more than the AF group but once they had a routine for using the anesthesia devices, this time didn't differ significantly between AF and IA batches. Finally, the mean isoflurane exposure was well below the limit of exposure set by Ontario and Israel of 15 mg/m^3 assuming this procedure is carried out in a well- ventilated area. In conclusion, if used correctly, castration under isoflurane anesthesia should not result in additional losses and is a great improvement for animal welfare.

The fill report can be found at: https://doi.org/10.1186/s40813-022-00263-0