Induction of parturition in swine*

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Introduction

Reduction of preweaning losses, decreasing the number of stillborn piglets and improving piglet survivability and productivity are all realistic goals that can be achieved by the swine industry. Improved knowledge of parturition, the ability to control its onset and the ability to influence the duration of farrowing are important steps in improving performance in the farrowing house.

Keywords: induced parturition, swine, preweaning survival, piglet mortality

The onset of parturition

The gestation length in swine is typically 114-116 days. Variations may be due to the breed of sow and boar involved. Sows with large litters may have slightly decreased gestation length.[1] The initiation of parturition in the pig is apparently controlled by the fetuses,[2] with the presence of at least two live fetuses necessary to initiate the hormonal cascade that results in farrowing. The proposed mechanism functions as follows: at the appropriate time at the end of gestation, the fetuses release adrenocorticotrophic hormone (ACTH) from the fetal pituitary, which stimulates fetal adrenal hypertrophy and production of glucocorticoids (primarily cortisol) by the fetal adrenals. The increased levels of cortisol stimulate prostaglandin F2alpha (PF2a) release from the uterus. The increased concentrations of PGF2a cause luteolysis and a decrease in progesterone concentrations and promote release of relaxin from the corpora lutea and oxytocin from the posterior pituitary. Relaxin acts to soften and relax the cervix, while the absence of progesterone allows the oxytocin and PGF2a to increase myometrial activity and uterine contractions that initiate parturition and result in birth of the piglets.

Induction of parturition

Pharmacological control of the onset of parturition is paramount to maximizing sow productivity and profitability of the swine producer by allowing scheduling of farrowings. Prostaglandin F2alpha and its analogs will induce the onset of parturition. The use of PGF2a or one of its analogs allows more effective utilization of farrowing facilities and farrowing house personnel by minimizing weekend and night farrowings and, when necessary, scheduling additional personnel to supervise farrowings. Improved supervision of farrowing sows should improve piglet survivability. Improved synchrony of farrowing allows for better cross-fostering of piglets. Improved uniformity of piglet age ultimately results in better piglet performance in the farrowing house that ideally is carried over to the nursery. Lastly, induction of parturition with prostaglandin reduces the occurrence of the mastitis-metritis-agalactia (MMA) syndrome in herds with high incidence.[3]

Parturition-inducing compounds

Prostaglandin

Prostaglandin F2alpha is the only prostaglandin approved for use in swine in the United States. Prostaglandin analogs are as efficacious as PGF2a but tend to have fewer and less severe

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side effects. These side effects are usually quite mild and short-lived, and may include restlessness, erythema, increased respiratory rates, salivation, defecation and urination. Vomiting is a rare occurrence. If side effects appear they will occur within ten minutes of administration and dissipate by 60 minutes postinjection.[4]

The dose of PGF2a is 10 mg, i.m. The dose of cloprostenol is 175 ug, i.m., but doses from 125 to 250 ug have been used.[5] A dose of 5 mg PGF2a or 87.5 ug cloprostenol administered in the vulvar mucosa can reliably induce parturition and the side effects are less severe than for i.m. administration of the higher dose.[6]

Administration of a prostaglandin product will result in females farrowing the first piglet 24 to 32 hours after treatment. Hence, most treatments are administered in the morning so the bulk of farrowings will be accomplished during normal hours of the following workday. A shorter treatment to farrowing interval is observed in animals that are close to spontaneous farrowing.[7]

Prostaglandin and progesterone

Prostaglandins have been used in conjunction with progesterone and progesterone-like compounds to improve the synchrony of the onset of farrowing.[8] The use of progestational compounds administered daily on days 109 to 112 during late pregnancy prevented spontaneous farrowings. The subsequent use of prostaglandin at the time of withdrawal of the progesterone compound provided well-synchronized farrowings with no apparent adverse effects on the piglets.

Prostaglandin and oxytocin

Improved synchronization and a decreased interval from treatment to parturition can be obtained by using oxytocin. Five to 30 units of oxytocin administered 20 to 24 hours after prostaglandin treatment will result in the onset of farrowing within three to six hours in approximately 50% of the females.[9] Twenty to 30 units of oxytocin will usually result in shorter intervals to birth of the first piglet but may also result in a higher incidence of dystocia due to stimulation of strong, asynchronous uterine contractions. The intravenous injection of two to three units of oxytocin intensifies normal myometrial activity within 20 seconds in sows, while dosages of ten units result in uterine spasms lasting ten to 15 minutes.[7] Dosages of oxytocin greater than ten units may also interfere with the sow's ability to release milk early in the postpartum period. Therefore, the dose of oxytocin to assist parturition in swine should be five to ten units administered i.m. to the sow no sooner than 20 hours after induction with PGF2a.[5]

Dexamethasone

Administration of dexamethasone (75 mg/sow/day s.c. for three days) on days 101 to 103 of gestation resulted in a shortened gestation, 112 days versus 114 days.[10] The need for repeated treatment, inability to accurately and efficiently control the onset of farrowing and decreased piglet birthweights and viability make this an unacceptable method of induction. Furthermore, the addition of dexamethasone to PGF2a-induced farrowing does not suggest a beneficial role for the use of corticosteroids in farrowing induction.[11]

Development of new compounds and regimens

The increased use of drugs for parturition induction and synchronous farrowing will depend in large part on governmental approval of compounds. The prostaglandin analogs are prime examples of efficacious compounds that will be increasingly utilized in the future as they become legally available. Among the other induction agents is epostane, a competitive inhibitor of the 3-beta hydroxysteroid dehydrogenase enzyme system. This system is responsible for the conversion of metabolic precursors to progesterone. Administration of epostane at oral dosages

of 5 to 10 mg/kg bodyweight or s.c. injections of 5 mg/kg bodyweight results in a decrease in progesterone concentrations and the initiation of parturition within approximately 32 hours.[12] Epostane is currently not approved for use in the United States.

Agents that improve the synchrony of the onset of parturition may also be commercially utilized. Relaxin is effective at improving the synchrony of farrowing following prostaglandin induction with more sows farrowing within a 12-hour time span.[13] The administration of xylazine (2 mg/kg bodyweight i.m.) 20 hours after prostaglandin treatment resulted in the birth of the first piglet 1.5 hours after xylazine.[14] Some of the treated sows showed signs of sedation following xylazine administration. Neither relaxin nor xylazine are approved for such use in swine.

Tocolytic compounds

The use of tocolytic compounds may enhance our abilities to improve the survivability of neonatal pigs. Clenbuterol is a beta 2-sympathomimetic compound shown to have long-lasting uterine relaxant effects.[15] Clenbuterol stimulates adenyl cyclase in cell membranes and outflow of intracellular calcium from the myometrial cells, making them unresponsive to oxytocin. This results in an interruption of the parturition process, which can occur within five minutes after administration. Although the greatest benefits may be the use of cloprostenol during Stage I parturition to prevent the onset of Stage II and farrowing during night-time hours, it can interrupt Stage II labor even after the birth of several piglets. Resumption of normal parturition occurs in a few hours when the drug's effects wear off, with no apparent adverse effects on the health or vitality of the piglets. In contrast, injection of PGF2a followed by injection of propanolol, which blocks beta1- and beta 2-adrenergic receptors, did not influence time of onset of parturition.[16]

Disadvantages

The results achievable with induced parturition are directly attributable to the level of care provided during the peripartum period. The use of prostaglandin to induce farrowing may actually increase the number of piglets which expire at or shortly after birth by causing the premature birth of some piglets or the birth of smaller piglets that are more susceptible to the extra-uterine environment.[17] Likewise, stillbirth rates will not be improved unless trained personnel are present to assist with the delivery and care of neonates.

Conclusions

The routine use of parturition induction is a valuable tool in modern swine production. Correct implementation can improve efficiency of labor and facility utilization, and decrease neonatal death loss, thus increasing profitability.

The routine use of parturition induction by itself will not improve piglet survivability without a commitment by the swine producer to: 1) provide personnel to supervise and assist at the time of farrowing; 2) provide a warm, dry environment for the newborn piglet; 3) ensure colostral intake by the newborn piglet; and 4) utilize management strategies (cross-fostering of piglets, all in-all out batch farrowings) made possible by the use of parturition induction.

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