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Bovine Embryo Implants

by
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The purpose of this paper is to describe in part, the process a group of large animal practitioners in Alberta, Canada, have developed to successfully implant bovine embryos from one donor cow to several recipient cows.

At the convention of the American Association of Bovine Practitioners in December, 1972, I had the privilege of meeting Dr. Ed Moss who interned in Field Services at Iowa State in 1970–1971. He and a group known as “Alberta Implants” are commercially operating an implant clinic at Calgary, Alberta. The word “implant” is used instead of transplant since no rejection concept develops in this process.

The idea of embryo transplants is nothing new. It was first successfully done in rabbits and mice about thirty years ago and was successfully done in the bovine around ten years ago. Most of the work on cattle has been done by a group at Cambridge University since 1967, but a year ago, Dr. Moss and his associates began the first embryo implant program on a commercial basis subsidized by private firms.

The primary objective of embryo implants is to increase the genetic potential of an already genetically superior female, the same type of concept practiced in artificial insemination. In Calgary, donor females, which are yearlings to 16 month old heifers, are commercially obtained and are usually purebred breeding stock such as Limousin, Maine-Anjou, Gelbvieh, and Fleckvieh. A thorough genital exam is given checking for tone, attachment, and anatomy of the uterus so good surgical exposure can be made. Good breeding records must be kept before the donor is admitted to the implant clinic. This includes at least 2 to 3 recorded heat cycles. The donor cow is then held at the facility for 2 more cycles while her nutritional plane is gradually raised. Then on the 16th day of her cycle, she’s induced to superovulate with FSH in the form of pregnant mare’s serum. A dose of 2500–3000 units of PMS has been used depending on the animal and on the different standards of PMS. On the 18th day, the donor cow is given 12–16 mg. of prostaglandins to bring the animal into heat. A rectal is done then and the ovaries are evaluated. A minimum of 3 follicles have to be present before an implant attempt is made. On the 20th day, the cows are bred whether they are in standing heat or not. They are serviced by artificial insemination from purebred bulls of the various breeds for 2 to 4 breedings every 6 hours until the cervix closes. The passage of ova from the fimbria to the uterus takes 2 to 5 days, so 5 days after the donor cow was in standing heat, she is ready for surgery. She is starved 36 to 48 hours prior to the surgical procedure.

The recipient herd of 600 heifers, mostly Jerseys and Holsteins, are kept under very close observation so their heat cycles can be noted. A penectomized bull

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and KaMar heat detectors are used to note the heat cycles of the recipient herd so on almost any given day, a heifer in good standing heat can be obtained. Prostaglandins for heat synchronization in the recipient herd are not routinely used, but have been tried with some success. The main objective is the synchronization of heat between both donor and recipient cows.

When the donor animal is ready for surgery, she is induced with Surital at the dosage of 1 gram per 250 pounds and then intubated for gas anesthesia with Halothane. The parameters for anesthesia are mainly the vital signs. There is the lack of a palpebral reflex, some corneal reflex, but the "Ping" technique or the use of the needle and the animal's response to pain is the main parameter on insuring that light surgical anesthesia is being used. The animal is clipped and scrubbed and placed in dorsal recumbancy.

A ventral midline incision is made from the area behind the umbilicus extending as far back as the anterior brim of the pelvis so maximum exposure of the uterus can be made. The udder is no problem with heifers being used, but in the case of a high producing dairy animal, it could be a different situation. The uterus is exposed and ligatures of umbilical tape are placed at the junction of the body and a horn. This stops any retrograde flushing of the embryos when they are removed from the uterus. A 9 inch stainless steel bar is laid across the incision to hold the uterus up and to hold it stable. The ovary is exposed and the C.L.'s are counted since as many ova or embryos should be found. Work is also being done on the ratio of follicles that have occurred with the use of LH and without its use. A canula is placed in a flask with TCM-99 media for receiving the embryos. The horn is held off and TCM-99 is injected with a hypodermic syringe. The horn is flushed with gradual pressure from the syringe causing the endometrium to stretch to such an extent that the embryos are released and flushed into the nutrient dish.

The embryos are then rushed into the "Egg Room" where a reproductive physiologist employed by the clinic separates the embryos from the debris flushed from the uterus, evaluates and studies each embryo, and then incubates them at 37°C until a recipient is found and readied for surgery. With experience it has been found that 90–95% of the ova found are fertilized, but for some reason early embryonic death is what causes more infertility than is probably suspected.

The same surgical procedure is followed for the recipient animal. A negative recipient, or one that was in heat before the donor, or at zero time, one that has synchronized estrus with the donor are the ideal recipient animals. A plus 1 recipient or one that is in heat a day after the donor, has been found not to work as well even though there is some degree of leeway due to the development of the embryo. The uterus is penetrated with the blunt end of a surgical needle and the embryo is injected into the lumen with 0.1 ml. of media. It takes about 20 minutes for this procedure, and there is a 70% conception rate so far with implanted embryos.

At the end of gestation, a C-section is usually done to deliver the calf. The donor cows are allowed to go through natural birth at every other calving interval for best success and it has been the experience of the Alberta group that a cow can be superovulated and have her embryos surgically removed at least 3 times before adhesion problems develop.

The potential of the procedure I have described seems fantastic if one considers the interest in the exotic breeds. Even when these breeds are established, the potential for using this technique for increasing dairy production is quite great. Embryos in their 8-cell stage have been divided and these "sub-cellular" parts have rolled down a rabbit uterus and covered with mucin so 8 separate individuals with total genetic potential have been created. With this procedure and using the concept of superovulation, a cow in a million could be selected for her best traits and could conceivably have a hundred calves in one
year. It would really be something to be able to build a herd of cows in one year with each of them producing over 20,000 pounds of milk a year.

I have gone through a few of the advantages of this embryo implantation concept, but of course there are a few disadvantages. The Alberta clinic had an initial investment of $200,000 to get going with this program illustrating that capital would be necessary for private practitioners to get started. The surgery and technology are complex, but a non-surgical approach for successfully implanting embryos is possibly within reach in a few years. Overall, this is a concept that could offer as much to the cattle industry as A.I. if its exploited to its fullest extent.

BIBLIOGRAPHY


What a Veterinarian Should Know About Swine Confinement

by

Charles L. Christenson*

The veterinarian's role in the food animal industry has changed significantly in the last few years. Instead of treating sick animals on an individual basis, he is called upon to establish herd health programs and consult with swinemen on their problems no matter what phase of their hog management is involved. With the trend toward confinement hog rearing, veterinarians in the Midwest are sometimes perplexed by the rapidity with which the industry is changing. Whether entering the swine industry for the first time or trying to maintain their position as a leading pork producer, swinemen today are confronted with the question of what type of facility is best for their operation. With a confinement set-up the producer can double his production volume with existing labor and free land for crop production that is presently tied up with pig production. As a swineman views the problem or newness of a confinement operation, he must decide whether he is going to remodel old facilities in making the shift or does he plan to construct a completely new physical structure in keeping up with the trends and needs. Many pork producers today want to know if the gases emitted from their confinement pits are toxic to their pigs and thus curtailing increased output. Also a big question is how will the new confined environment affect his disease problem.

The starting point is first to decide on a waste management system for your operation. Anaerobic lagoons, aerobic stabilized systems, and a new aerobic solid-liquid separation system are the three basic methods being used to process swine wastes.

Processing wastes by anaerobic decomposition in lagoons has come under criticism by environmentalists due to their extensive odor production.

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