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Opinions & Hypotheses

Transfer of a single embryo versus drainage of subordinate follicles to prevent twin pregnancies in dairy cows. Why not both?

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Running head: EMBRYO TRANSFER AND FOLLICULAR DRAINAGE

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Abstract

In this study, we present two proposed approaches to prevent twin pregnancies in dairy cattle: 1) single, *in vitro*-produced embryonic transfer into a recipient cow or 2) subordinate follicle drainage at the time of insemination. Both procedures lead to improved embryonic survival. As the use of sexed semen generates herd replacements and additional heifers, we propose the transfer of a single female cattle embryo into cows that are not suitable for producing replacements, and follicular drainage in lactating cows with genetic merit. This should eliminate economic losses associated with twin pregnancies and increase cattle output of the herd.

Keywords: Double ovulation, Follicular co-dominance, CL function, Early fetal loss, Greenhouse gas emissions

The problem of twin pregnancies in dairy herds

Twinning rates in dairy herds have increased considerably in parallel with milk production during the last 30 years [1], possibly due to a higher double ovulation rate being associated with a high level of milk production [2, 3]. Twin pregnancies, more frequent in older cows, may account for 25 % of all pregnancies on Day 60 of gestation in cows in their third lactation or more [4], and are classified into bilateral (one fetus in each uterine horn: 44 %) and unilateral (both fetuses in the same uterine horn, right or left: 56 %) [5]. Twin pregnancy is not desirable for the dairy cattle economy [5–9]. The risk of pregnancy loss during the first trimester of gestation for twin-carrying cows is three to seven times higher than that for cows carrying singletons [1], with an economic burden estimated at $ 97–$ 225 per pregnancy depending on twin pregnancy laterality (unilateral vs. bilateral), parity, and the days in milk when the twin pregnancy occurs [6]. This impact could become even greater due to the incidence of abortion among pregnant cows during the second or third trimester of gestation. In an extensive study on 1194 twin pregnancies, abortion was recorded in 278 (23.3 %) cows before Day 260 of pregnancy: 7/522 (1.3 %) in bilateral and 271/672 (40.3 %) in unilateral pregnancies [5]. In this latter study, the presence of live twins was determined by transrectal ultrasonography between 55 and 61 days of gestation. Furthermore, losses after twin delivery in cows reaching parturition should be added to the economic impact of twin pregnancies. Higher incidence of peripartum reproductive disorders, freemartins, stillbirths, and calf mortality has been related to twin births [7–9]. Thus, both a higher culling rate and reduced mean production lifespan (by 200 days) have been reported for cows delivering twins versus singletons [7–9]. These are all cogent reasons to try to reduce the incidence of twin births. Proposed approaches to prevent twin pregnancies are 1) the transfer of a single embryo to a non-inseminated cow or 2) the follicular drainage of subordinate follicles at the time of insemination [10].

Transfer of a single *in vitro*-produced embryo

Fertility rates for *in vitro*-produced (IVP) bovine embryos are lower than those achieved with *in vivo*-derived embryos [11]. However, the global use of IVP embryos has increased over the past twenty years, probably due to the increasing benefits and lower costs of IVP procedures [10]. Effectively, embryo transfer (ET) is considered the most effective mechanism for maximizing fertility during heat stress, improving fresh IVP embryo pregnancy results comparable to artificial insemination (AI) under heat stress conditions [12]. Treatment with GnRH on Day 5 post-estrus increases the corpus luteum (CL) blood flow area, thus improving luteal function assessed on Day 7 at ET [13] and prompting additional corpora lutea formation [14]. This treatment improves embryonic survival in IVP embryo recipients [14].

Puncture and drainage of subordinate follicles at the time of insemination

Puncture and drainage without suction of subordinate follicles—either ultrasound-guided [15, 16] or by using a simple transvaginal device [17]—at the time of insemination has proved efficient to eliminate the risk of twin pregnancy without reducing fertility. Only bi-ovular cows with a size difference of less than 2 mm between the two follicles were included in these studies [15–17]. This technique increases the incidence of additional drained follicle-derived corpora lutea. The function of the drainage-induced CL was improved with GnRH treatment on Day 7 post-drainage [16, 17]. This treatment improved embryonic survival in drained cows [17]. It should be noted here that an ultrasound-guided training before follicular puncture should be considered by inseminators. Furthermore, a potential problem related to the technique is the fact that the smaller follicle is not always the subordinate follicle at the time of insemination. More extensive studies are thus needed that take into account the ranges between the dominant and drained subordinate follicle diameter.

The use of sexed semen helps twin prevention strategies

The use of sexed semen has been traditionally recommended only for heifers [18, 19], as pregnancy rates are reduced in cows [20, 21]. Although its usage is low (< 5%) within the AI market [22], it generates herd replacements and additional heifers [23]. Sexed sperm have been successfully used in *in vitro* fertilization procedures [24, 25] so that embryos of a desired sex may be transferred.

Concluding remarks

In herds where sexed semen is used in heifers thus providing sufficient herd replacements, the strategies proposed to prevent twin pregnancies could increase herd profitability in a number of ways:

- By conducting both, the embryo transfer of a single cattle embryo to cows that are not suitable for producing replacements and the follicular drainage in lactating cows with genetic merit, the economic losses associated with twin pregnancies should be prevented.
- Following both procedures, induced additional corpora lutea [14, 17] will reduce the risk of pregnancy loss [26].
- Use of female cattle embryos or sexed semen, should reduce the incidence of male calf-related dystocia, improving animal health. Gestation of a female calf has also been related to increased milk production [27, 28].
- Introducing ET into the breeding program should improve the fertility of older cows under heat stress conditions [12].
- Compared with the use of conventional semen, sexed semen used in heifers and follicular drained parous cows should expedite herd expansion and increase the sale value of calves.
- While increasing cattle output from a dairy herd, greenhouse gas emissions will be lower compared with beef cow herds, and land use will be more efficient [23].

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