Studies on the endotoxin-induced mechanisms of ovarian dysfunction and development of novel treatment of uterine inflammatory diseases in cows

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Uterine inflammatory diseases commonly occur in postpartum cows and depress reproductive performance by disrupting uterine and ovarian functions. Infection of the uterus with gram-negative bacteria resulted in the detection of bacterial endotoxin, lipopolysaccharide (LPS), in the plasma and follicular fluid of cows along with uterine inflammation. LPS acted on follicular components such as the theca and granulosa cells or follicle-enclosed oocytes and impaired the follicular activity. In follicles with a high LPS environment, follicular steroidogenesis was diminished by suppressing the transcription of steroidogenic enzymes [1]. Primary cell cultures of bovine granulosa and theca cells revealed that LPS acted on the follicular cells and impairs steroid production, which may disturb follicle growth or reduce their ability to ovulate. Even if ovulation occurs, cows with uterine inflammation are less likely to conceive, as LPS impairs the developmental competence of oocytes [2]. LPS perturbed the maturation of bovine oocytes, and oocytes matured under an LPS treatment showed decreased potential to develop to the blastocyst stage.

To improve the LPS-induced follicular dysfunction and impaired developmental competence of oocytes, we focused on the establishment of technology to produce and select embryos with high implantation potential. Time-lapse monitoring enables the continuous and noninvasive evaluation of embryos. Thus, the growth potential of bovine embryos presenting abnormal cleavage was investigated through time-lapse monitoring [3]. Approximately 36% of embryos that developed into a blastocyst presented abnormal cleavage. Embryos with abnormal cleavage revealed impaired hatchability and presented increased chromosomal aneuploidy. These results suggest a low implantation potential of embryos with abnormal cleavage. Results indicate that the kinetic evaluation of bovine embryos using the time-lapse imaging system will be beneficial for selecting embryos with a high implantation potential.

Taken together, the detrimental effects of LPS on ovarian activity may be part of the infertility mechanism in cows with uterine inflammation. Production of embryo with high implantation potential is expected to improve the fertility in cows.

References

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