ABSTRACTS

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Going LO for ET and AI in felids – Challenges, strategies and successes

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OBJECTIVES AND METHODS: Assisted reproduction in felids has shown tremendous promise for propagation of companion animals, laboratory cats of biomedical importance and endangered nondomestic cat species. The ultimate success or failure of assisted reproduction in cats is dependent on the ability to produce viable offspring in an efficient and humane manner for population or species management. The application of laparoscopy to reproductive studies in felids has been invaluable for helping to alleviate animal welfare concerns while allowing access to intra-abdominal reproductive organs through a minimally-invasive, minimally-traumatic approach. Without laparoscopy, extrapolation of assisted reproduction to the genetic management of non-domestic cats likely would be unattainable. Laparoscopic methods for oocyte collection and intrauterine insemination have been used extensively over the past 20 years with numerous cat species (2-4). More recently, laparoscopic approaches have been developed and applied in cats for gaining access to the oviduct, specifically to conduct laparoscopic oviductal embryo transfer (LO-ET) and artificial insemination (LO-AI) procedures (1, 5, 6). In going LO, our primary objective was to overcome some of the anatomical, behavioral, and physiological challenges intrinsic to ET and AI in felids and begin producing genetically-valuable offspring in both domestic and nondomestic cats with improved efficiency while minimizing procedural discomfort.

Challenges to ET and AI in felids include anatomical constraints such as a constricted vaginal lumen, obliquely orientated cervical os, elongated bicornuate uterus and relatively small ovaries, combined with behavioral factors including overt aggression, intractability, and occurrence of ‘silent’ estrus in some females. Other challenges are related to feline reproductive physiology including seasonality, variable ovulatory mechanisms (spontaneous or induced), limited sperm production, and a poor understanding of sperm transport, embryo developmental requirements or appropriate ovarian synchronization methods. With LO-ET and LO-AI, most anatomical barriers can be bypassed and the ovaries and uterus directly visualized to assess ovulatory responses and potential pathology. With LO-ET, transfer of early cleavage stage embryos reduces any detrimental effects of in vitro culture on embryo viability, whereas, with LO-AI, the need for extensive sperm transport in vivo is eliminated and much lower sperm numbers may be used. These laparoscopic approaches require only two small skin incisions for mid-ventral abdominal insertion of a 7-10 mm laparoscope and right lateral insertion of 5 mm grasping forceps. The craniodiagonal edge of each ovarian bursa then can be grasped and everted to visualize the oviductal abdominal os for direct cannulation and deposition of spermatozoa or embryos deep within the oviductal lumen. Surgical closure consists of 1-2 sutures per incision, and cats typically return to normal activities shortly following anesthetic recovery.

RESULTS: Over the past decade, LO-ET has been used extensively in our laboratory for reproductive studies with domestic cats and propagation of cat models of hereditary disease. Pregnancy percentages of 80-90% were observed following LO-ET of non-frozen IVF-derived embryos into synchronized recipients in our laboratory cat colony, with ~60% of transferred embryos implanting in pregnant females. To date, LO-ET of non-frozen or frozen-thawed IVF embryos has allowed propagation of eight cat hereditary disease models and production of multiple pregnancies and viable offspring in two nondomestic cat species, the ocelot (Leopardus pardalis) and sand cat (Felis margarita). With LO-AI in domestic cats, pregnancy percentages of 50-75% were obtained following insemination with low numbers (~2 million motile) of freshly-collected spermatozoa. Using slightly higher numbers (2-8 million motile) of frozen-thawed spermatozoa, LO-AI also has been used to produce several pregnancies and offspring in domestic cats, including four pregnancies and 22 kittens with one cat hereditary disease model. Viable kittens also have been born in ocelots and Pallas’ cats (Otocolobus manul) following LO-AI with freshly-collected semen. The success of these LO methods has benefited substantially from concurrent modification of exogenous gonadotropin regimens for recipient synchronization as well as development of a feline-specific culture medium for semen processing, IVF and embryo culture.

CONCLUSION: The application of LO-ET and LO-AI has resulted in meaningful improvements in pregnancy percentages and offspring production in domestic cats and nondomestic cat species. Continued refinement, especially further investigation of recipient synchronization methods, may be necessary to obtain greater efficiency for routine use with genetic management of valuable domestic and wild cat populations.