Technique Report

Canine transcervical insemination: history and technique

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Abstract

Artificial insemination in the dog was first described nearly 250 years ago. Until the 1970s, the process remained predominantly in depositing semen in the cranial vagina. Initially, surgery was required to successfully deposit frozen–thawed semen in uterus. However, societal demands to eliminate the need for general anesthesia and surgery for breeding have led to development of reliable and successful transcervical insemination procedures. Common barriers to perform successful transcervical inseminations include equipment expense and developing skills. In addition to practice, adopting suggestions provided by the author will improve practitioner's success.

Keywords: canine, dog, artificial insemination, transcervical, endoscope, history, technique

History and refinements

Advances in veterinary medicine often lagged behind human medicine; however, the field of artificial insemination (AI) is an exception. Anecdotal reports of the first human AI date backs to Henry IV (nicknamed 'Henry the Impotent') of England (1425–1474), whose wife produced a daughter Joanna.[1] However, veterinary literature alleges that the first AI was performed by an Arab chief in 1322, who stole semen from the stallion of a rival chief to place in his mares.[2] Human and dog sperm were first described by Leeuenhoek and Ham in the Netherlands in 1678, but it was not until 1784 that Spallanzani described the birth of three pups after AI of a dog.[1] One of the earliest reports of successful canine pregnancy with frozen semen was in 1969.[3] However, it was not until 1981 that the American Kennel Club would allow a litter of pups conceived using frozen semen to be registered.[4] References to first registry dates in other countries are not available.

Transcervical insemination (TCI) was first reported in the mid to late 1960s, but there was skepticism about the actual ability to do so blindly.[3,5] By the mid-1980s, surgical AI became the most commonly recommended procedure for inseminating dogs using frozen semen because of its short lifespan in the reproductive tract. In the early 1990s, reports of laparoscopic AI appeared.[6] TCI in dogs using a Norwegian catheter designed for foxes was introduced in 1975 but did not gain much popularity in the United States due to its steep learning curve and level of difficulty, especially in larger and obese dogs.[7] Endoscope-assisted TCI (using a human cystoscope) was described in 1973.[7] Refinements in this procedure have evolved, and today, there are instruments available specifically designed for TCI in dogs. Some TCI equipment manufacturers offer a variety of diameters and lengths of scopes for various size dogs and breeds.

Surgical AI has certain advantages over endoscope-assisted TCI. First, with surgical AI, it is possible to confirm ovulation at insemination and visually/digitally evaluate reproductive tract for pathology. Second, with surgical AI, semen can be distributed into both uterine horns, whereas in TCI, presumably, whole semen is deposited into a uterine horn or the uterine body. This theoretical advantage toward an increased chance of pregnancy or litter size does not withstand scrutiny as conception rates are reported to be higher using endoscopic TCI compared to surgical AI.[8] A possible explanation of lower conception rate with surgical AI is due to the stress of surgery and/or anesthesia.[8] Apparently, this explanation was rejected since there was no difference in conception rate or litter size between dogs bred naturally and via laparoscopic AI.[6] This implies that the natural act of canine coitus is as stressful as general anesthesia and surgical insemination.

Although laparoscopic AI and surgical AI were not compared, comparisons of laparoscopic ovariectomy and ovariohysterectomy via laparotomy indicated that laparoscopic surgery may

*Presented at the 2022 Society for Theriogenology Conference (Canine Symposium), published after peer-review.

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Citation line: Clinical Theriogenology 2023, 15, 9320, http://dx.doi.org/10.58292/CT.v15.9320

or may not take longer, and postoperatively, the patient appeared to be slightly less painful.[9,10] Since the incision length and amount of tissue handling in a surgical AI are substantially less than an ovariohysterectomy, the last remaining variable is the insemination process itself. Studies directly comparing fertility rates using laparoscopic AI versus conventional surgical AI are unlikely to ever be performed for ethical and financial reasons. Although the cause of lower fertility rates of surgical AI compared to TCI may never be elucidated, some clients still insist on surgical AI.

An advantage of endoscope-assisted TCI over surgical AI is the ability to perform intrauterine insemination without the need for general anesthesia and surgery. Another advantage of endoscope-assisted TCI is that it allows multiple inseminations during the fertilization window of estrus. This is not typically performed in surgical AI, as it would require additional general anesthesia and surgery within a 96-hour window. Although there was no significant difference in conception rates between single and double inseminations, pregnancy rate in the group inseminated twice was numerically lower (62%) than a single insemination (69%).[8] The mechanism by which multiple endoscope-assisted TCI procedures performed in an estrous period reduce pregnancy rate remains unclear. The decision to breed twice was based on client preference and/or low numbers of live morphologically normal sperm and availability of semen.[8] These authors also determined serum progesterone concentrations as often as daily in some cases to decide on insemination timing. Although ideal, that level of accuracy may not always be obtainable for every patient. Frozen semen quality can vary even within samples collected from the same male, making the decision to perform endoscope-assisted AI more than once in estrus, which is still a 'judgement call'.

In addition to the advantages of safety, cost, and ability to perform more than one insemination, TCI allows visualization of vaginal wall crenulation and any other vaginal abnormalities that might affect normal vaginal delivery (e.g. septum and adhesions). Timing of AI is determined by a few methods. If a practitioner is routinely performing vaginal cytologies as a method, large and giant breeds pose a problem (not able to reach the cranial vagina) with the standard 6-inch swab (Sterile Polyester Tipped Applicators, Puritan Medical Products, Guilford, ME). To solve this problem, the length of the swab can be increased by inserting 1 cm of the swab handle into the lumen of a 0.5 ml semen straw, held in place with a drop of cyano-acrylic glue and allowed a few minutes to dry.

Technique improvements

Sedation

Sedation for an endoscope-assisted TCI is practitioner's discretion. In author's practice, sedation has rarely been used except for an occasional uncooperative dog. Other practitioners report sedating almost every dog for endoscope-assisted TCI. To some degree, the decision to sedate may depend on the availability of assistance to restrain the dog. Author prefers to use a minimal amount of dexmetdetomidine (Dexdomitor®, Orion Pharma, Espoo, Finland; Zoetis Inc, Kalamazoo, MI) for most fidgety dogs to have them remain standing. An occasional aggressive dog that resents manipulation of the vulva may require higher doses of dexmetdetomidine and a muzzle.

Although most estrous dogs tolerate the endoscope-assisted TCI procedure with little perceived discomfort, occasionally, a dog will violently and/or vocally object to the procedure. Topical vaginal application of lidocaine is an alternate method instead of sedation. Author instills 1–2 ml of lidocaine (Lidocaine 2%, Vet One, MWI, Boise, ID) via a closed end 3.5 French tom cat catheter (Argyle™ [closed end catheter with 5.5 inch adapter] Coviden, LLC, Mansfield, MA) that is inserted into the caudal vagina, and 5 minutes allowed for topical desensitization.

Difficulty navigating cranial vagina

Transcervical insemination scope is occasionally difficult to navigate beyond cranial vagina (approximately the level of the pubis). Author has not arrived at a consistently reliable way to advance the scope except by: (1) increasing insufflation of the vagina; (2) increasing pressure on the endoscope; and (3) rotating the scope 180 degrees to alter the field of view (or some combination of all 3).

Improving external cervical os visualization

In author's practice, a 'shunt' (TCI Shunt System, Minitube, Verona, WI) with an inflatable cuff and sealing O-ring is utilized for majority of moderate-size dogs. Digital pressure on the vulvar lips around endoscope shaft is applied on smaller dogs and those that resist shunt insertion. If shunt is difficult to insert, careful evaluation for a vestibulo-vaginal septal remnant is indicated. Occasionally, these septal remnants can be overlooked if the endoscope is small enough to reach the cervix because caudal vagina and vestibule escape from examination during initial insertion.

If identifying external os is difficult, stimulating defecation typically improves visualization. Defecation can be stimulated using the 'match in the anus' technique. Whether the phosphorus on the match head makes a difference is debated.

Most endoscope-assisted TCIs are performed without applying pressure to the ventral abdomen, but occasionally, manipulation of the cervix transabdominally is attempted when visual identification of the external cervical os is difficult.

Majority of endoscope-assisted TCIs performed in author's practice are with the patient standing on an adjustable height table that comfortably accommodates various size dogs. Although most endoscope-assisted TCI procedures are performed with operator standing, if TCI is difficult, performing the procedure sitting on an adjustable stool may facilitate success. Apparently, subtle difference in orientation helps in some cases.

Occasionally, the cranial vagina is filled with estrual fluids, making external os visualization difficult. If the procedure is performed toward end of estrus, sheets of epithelial cells occasionally occlude the camera and even the external cervical os. Aspiration of the fluid with the catheter can improve visualization. If the dog is large enough, passing a 16-inch rayon swab (Scopettes®, Birchwood Laboratories, Eden Prairie, MN) into the cranial vagina to absorb fluids and dislodge shed epithelium can be helpful. Swabs can either be purchased individually packaged sterile or can be steam-autoclaved (but the plastic shaft does bow slightly during autoclaving).

Catheterizing cervix

Cervix of the dog typically points in a ventral direction with some variation from straight downward to slightly to either side. Extending the catheter a minimum, typically ≤ 1 cm, and gently lifting the external cervical os with the scope and catheter while simultaneously advancing both sometimes allow cervical entry. Excessive downward or lateral orientation of cervix can be problematic to inseminate and, in some cases, necessitates putting a slight curve or 'crook' in the tip of the catheter with the stylet in place. Extent of curve varies among clinicians and even among dogs. If catheter tip can be started into cervix but becomes difficult to advance, withdrawing the stylet 1–2 cm allows it to 'find its own way' by becoming more flexible. If the stylet is removed partially and reinserted, care must be taken not to allow stylet tip to exit the 'eye' on the side of the catheter. This can be accomplished by visualizing the opening and ensuring that the stylet wire goes beyond the 'eye' into the tip either through the scope or after removing the scope or catheter from vagina.

Seemingly counter intuitive, larger dog cervices appear harder to traverse than smaller dogs. Author speculates that this is due to higher rigidity of a larger cervix (makes lifting of the external cervical os to straighten it out more difficult). If a smaller (4 French) catheter becomes difficult, use of a 5 or 6 French catheter might improve success. Although 8 French catheters are available, they are used almost exclusively for diagnostic purposes in author's practice.

Insemination

Author typically does not thaw frozen semen until the catheter has successfully been advanced into uterus. This necessitates additional labor but avoids semen remaining in thawed condition for an excessive interval if catheter insertion becomes difficult. Chilled semen is kept in the shipper, whereas fresh semen is kept at room temperature away from light until inseminated. If fresh or chilled semen volume is excessive, semen is centrifuged to an amount adequate for dog size. In some instances, it is a 'judgement call' with regards to whether centrifugation or retrograde leakage will result in the greatest loss of sperm.

Insemination proceeds slowly with constant visualization of the external cervical os for retrograde leakage. Following insemination, catheter retrieval involves removing the entire scope with catheter still extended rather than retracting the catheter into the scope first. In the author's practice, one catheter broke at withdrawal to scope before removal, necessitating surgery to retrieve the retained piece from uterus.

Final thoughts

From an animal pain and stress perspective, endoscope-assisted TCI is superior to surgical AI when frozen semen used. In parts of Europe (Norway, Sweden, UK), canine surgical AI has been banned because it is considered as an invasive technique interfering with animal welfare.[11] International breeding rules of the Federation Cynologique Internationale (FCI) states that 'Dogs should be able to reproduce naturally. AI should not be used on animals which have not reproduced naturally before. Exceptions can be made by the national canine organizations to improve the health of the breed, for the welfare of the bitch or to preserve or increase the genetic pool of the breed'.[12] Although most of Europe, Asia, South America, and Oceania are FCI members, United Kingdom, United States, and Canada are not. It will be interesting to monitor if these philosophies become universal in the future.

For the ultimate question to our profession regarding endoscope-assisted TCI is, just because we can, should we?

Conflict of interest

Authors disclose no conflicts of interest.

Acknowledgment

Author expresses gratitude to Charles Estill, Eleas Wu, Vanessa Peixoto de Souza, and Olivia Stricklin for cohorts in the adventure of trial and error to find some of the procedures described.

References

1. Ombelet W, Van Robays J: Artificial insemination history: hurdles and milestones. Facts Views Vis Obgyn 2015;7:137–143.
2. Bowen JM: Artificial insemination in the horse. Equine Vet J 1969;1:98–110. doi: 10.1111/j.2042-3306.1969.tb03355.x
3. Fielden ED: Artificial insemination in the dog. N Z Vet J 1971;19:178–184. doi: 10.1080/00480169.1971.33962
4. Given W: The 411 on frozen semen. Canine Chronicle 2017; 42(8):134–138.
5. Leonard EP: Dogs. In: Perry E, ed. The artificial insemination of farm animals. 4th ed. New Brunswick, NJ: Rutgers University Press; 1968, p. 310.
6. Silva LD, Onclin K, Snaps F, et al: Laparoscopic intrauterine insemination in the bitch. Theriogenology 43;1995:615–623. doi: 10.1016/0093-691X(94)00067-5
7. Mason SJ: Current review of artificial insemination in dogs. Vet Clin N Am Small Anim Pract 2018;48:567–580. doi: 10.1016/j.cvsm.2018.02.005
8. Mason SJ, Rous NR: Comparison of endoscopic-assisted transcervical and laparotomy insemination with frozen-thawed dog semen: a retrospective clinical study. Theriogenology 2014; 82:844–850. doi: 10.1016/j.theriogenology.2014.06.014
9. Shariati E, Bakhtiari J, Khalaj A, et al: Comparison between two portal laparoscopy and open surgery for ovariectomy in dogs. Vet Res Forum 2014;5:219–223.
10. Davidson E, Moll H, Payton M: Comparison of laparoscopic ovariectomy and ovariohysterectomy in dogs. Vet Surg 2004;33:62–69. doi: 10.1111/j.1532-950X.2004.04003.x
11. Quartuccio M, Biondi V, Liotto L, et al: Legislative and ethical aspects of canine artificial insemination in the 21st century. Italian J Anim Sci 2020;19:630–643. doi: 10.1080/1828051X.2020.1775503
12. International Breeding Rules of the FCI (Federation Cynologique Internationale). [cited 2022 Jan 12]. Available from: http://www.fci.be/medias/ELE-REG-en-10990.pdf