



CALCIUM CHLORIDE NONSURGICAL STERILIZATION: BIBLIOGRAPHY

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KEY STUDIES

Leoci, R et al. 2014: [A dose-finding, long-term study on the use of calcium chloride in saline solution as a method of nonsurgical sterilization in dogs: evaluation of the most effective concentration with the lowest risk](#). *Acta Vet Scand*. 40 dogs plus controls.

Leoci, R et al. 2014: [Alcohol diluent provides the optimal formulation for calcium chloride non-surgical sterilization in dogs](#). *Acta Vet Scand*. 42 dogs plus controls.

- Long-term, 12-month studies to determine the best CaCl₂ dosage and solution for dog sterilization. The first study compared different concentrations of CaCl₂ (10%-60%). A 20% concentration was determined to be most effective with the fewest side effects. The second study compared a 20% concentration of CaCl in saline, alcohol or lidocaine. Alcohol was determined to be the most effective solvent. Calcium chloride in alcohol resulted in complete azoospermia over the entire 12-month study, while CaCl in lidocaine was 100% effective for 6 months but saw return of a few sperm in 4 of 21 dogs by 12 months. Testosterone levels remained low for the alcohol solution but began to increase by the end of the study for the lidocaine solution. Sexual behavior disappeared with CaCl treatment. Conclusion: 20% CaCl in alcohol is the most effective formulation for permanent effect

PUBLISHED LITERATURE AND PROFESSIONAL PRESENTATIONS

Farm Animals:

Koger, 1977. [Calcium chloride, Practical necrotizing agent](#). Abstract from Am Soc Anim Science Annual Mtg.

- The very first known publication on calcium chloride, explaining how the Washington State University researchers got the idea, the results of their first pilot studies, and why they found an alcohol base to be better than a water/saline base.

Koger, 1977. [Calcium Chloride, Practical necrotizing agent](#). *Bovine Practitioner*.

- Further details on the genesis of the idea and pilot studies in 45 bull calves.

Koger, 1978. [Calcium chloride castration](#). *Modern Veterinary Practice*.

- Study in bulls and dogs with photos.

Bowman and Koger, 1978. [Blockage of sperm transport using intraepididymal calcium chloride injections in rams](#). *Journal of Animal Science*.

- Intrepididymal injections (as opposed to into the testicular tissue) resulted in sterilization without hormonal neuter.

Jana, Samanta, Ghosh, 2005. [Evaluation of single intratesticular injection of calcium chloride for nonsurgical sterilization of male Black Bengal goats \(*Capra hircus*\): a dose-dependent study](#) *Animal Reprod Sci*.

- 18 goats plus controls

Canpolat and Bulut, 2006. [An evaluation of the outcome of bull castration by intra-testicular injection of ethanol and calcium chloride](#). *Revue Méd. Vét*

- Poor results (scrotal abscesses and longer-lasting scrotal swelling, with inconsistent necrosis and minimal impact on serum testosterone) of calcium chloride in aqueous solution in 12 young bulls, in fact poorer than ethanol alone. Includes photos. Concludes that calcium chloride injection in saline is not effective in bulls.

• Ibrahim, Ali, et al, 2016. [Evaluation of chemical castration with calcium chloride versus surgical castration in donkeys: testosterone as an endpoint marker](#). *BMC Vet Res*

- 6 donkeys plus controls: 20% CaCl₂ in alcohol. 60 day study measuring testosterone and testicular measurements. No change in testosterone, significant swelling and fistulas in 4/6 donkeys.

Dogs and Cats:

Koger, 1978. [Calcium chloride castration](#). *Modern Veterinary Practice*.

- Key study: First report of pilot results in dogs (in addition to more bull calves); photos. Fascinating, plain-English report of pilot studies.

Samanta and Jana: Published a number of dose-finding studies with extensive physiological measurements, including: testosterone, cortisol, LH/FSH, testicular function measurements, blood values and histology. Results support use of CaCl₂ for chemical sterilization.

Samanta, 1998. [Chemosterilization of stray dogs](#). *Indian J Anim Health*

- First controlled study of CaCl- 48 dogs plus controls

Jana, Samanta, 2007. [Sterilization of male stray dogs with a single intratesticular injection of calcium chloride: a dose-dependent study](#). *Contraception*.

- 24 dogs plus controls, 5-20 mg/kg CaCl dosages evaluated

Baran and Ozdas, 2010. [Pilot Study: Intratesticular injection induces sterility in male cats](#). Poster at the Alliance for Contraception in Cats & Dogs 4th International Symposium on Non-Surgical Contraceptive Methods of Pet Population Control, April 8-10, 2010, in Dallas, Texas.

- Good safety and efficacy results at higher doses in 3 cats.

Jana and Samanta, 2010. [History of calcium chloride injectable sterilization in male dogs and first report of use in cats](#). Poster at the Alliance for Contraception in Cats & Dogs 4th International Symposium on Non-Surgical Contraceptive Methods of Pet Population Control, April 8-10, 2010, in Dallas, Texas.

- In 6 cats each at 5%, 10%, or 20% CaCl in lidocaine, 20% was determined to be the optimal concentration, and had effects on behavior.

Jana and Samanta, 2011. [Clinical evaluation of non-surgical sterilization of male cats with single intratesticular injection of calcium chloride](#). *BCM Vet Research*

- Key cat study: 18 cats plus controls. Dose-finding, testosterone, cortisol, testicular function measures; castration and histology at 2 months. 20% CaCl optimal in cats.

Leoci, R et al. 2014: [A dose-finding, long-term study on the use of calcium chloride in saline solution as a method of nonsurgical sterilization in dogs: evaluation of the most effective concentration with the lowest risk](#). *Acta Vet Scand*. 40 dogs plus controls.

Leoci, R et al. 2014: [Alcohol diluent provides the optimal formulation for calcium chloride non-surgical sterilization in dogs](#). *Acta Vet Scand*. 42 dogs plus controls.

Paranzini, Souza, et al., 2017. [Effects of chemical castration using 20% CaCl₂ with 0.5% DMSO in tomcats: Evaluation of inflammatory reaction by infrared thermography and effectiveness of treatment](#). *Theriogenology*

- 6 cats: 20% CaCl₂ with 0.5% DMSO, 80-day study using infrared thermography to evaluate inflammation. Method was effective with minimal adverse reactions.

Silva, Paranzini, et al, 2018. [Calcium chloride combined with dimethyl sulphoxide for the chemical sterilization of dogs](#). *Reproduction in Domestic Animals*.

- 6 dogs: 7.5% CaCl₂ with 0.5% DMSO, 60-day study measuring testosterone, semen characteristics, testicular size. Dogs became azoospermic at 15 or 30 days post injection, with no difference in testosterone.

Ijaz, Aleem, et al., 2019. Comparative evaluation of single, bilateral intra-testicular injection of hypertonic saline solution and calcium chloride as chemical sterilizing agents in male cats. *Biomedical Journal of Scientific & Technical Research*.

- Comparison of 20%, 30% NaCl to 20% CaCl in 15 tomcats with 5 controls. The 30% NaCl and 20% CaCl caused necrosis of the testicular tissue by 4 weeks post injection. All experimental groups had significant reductions in testosterone.

Small animals:

Jana, Samanta, Ghosh, 2002. [Dose-dependent response to an intratesticular injection of calcium chloride for induction of chemosterilization in adult albino rats](#). *Veterinary Res Comm*

- 48 rats plus controls

Jana, Samanta, 2006. [Evaluation of single intratesticular injection of calcium chloride for nonsurgical sterilization in adult albino rats](#). *Contraception*

- 48 rats plus controls. These two studies (2002, 2006) concluded that 10-20 mg of CaCl₂ in saline produced infertility, measured by epididymal sperm count and mating studies

Sen, Yumusak, et al., 2017. [Evaluation of intra-testicular injections of calcium chloride and 4-vinylcyclohexene 1,2 monoepoxide for chemical sterilization in guinea pigs](#). *Polish J Vet Sci*.

- A study of intratesticular injection of guinea pigs with 15 mg/100g weight of CaCl₂ in lidocaine, provided as one injection or three daily doses, resulted in significantly decreased testosterone and sperm count, but not azoospermia. No fertility assessment was completed.

Paranzini, 2019. Effects of calcium chloride with DMSO injection on testicular function and fertility in rats. Dissertation from Universidade Estadual Paulista.

- A large-scale study of intratesticular injection of 20% CaCl₂ in 0.5% dimethyl sulfoxide (DMSO) in 96 rats was completed by researchers in Brazil. One hundred days after the injection, rats were azoospermic, infertile, and evidenced testicular atrophy. Only one rat had complications.

UNPUBLISHED REPORTS

Collagross-Schouten, Allison. [The use of calcium chloride dihydrate in ethyl alcohol to nonsurgically sterilize adult male African pygmy goats \(*Capra hircus*\)](#).

- The first study to evaluate serial injections of CaCl₂ in an effort to determine an effective dose in adult goats. No residual effect of the repeated lower volume solutions (4 ml). Higher dose (10 ml) was effective at sterilizing the male goats, but not without complications.

Parsemus Foundation, 2019. [Calcium chloride chemical castration in the rat: A possible solution for pocket pets?](#)

- A pet rat was injected with 20% CaCl₂ in 95% ethyl alcohol without complications. Significant reduction in testicular volume resulted although fertility was not assessed.

*For more information on Calcium Chloride Nonsurgical Neuter, please visit our website
Parsemus.org*

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