The Veterinary Journal 229 (2017) 26–30

Contents lists available at ScienceDirect

The Veterinary Journal

journal homepage: www.elsevier.com/locate/tvjl

Post-operative outcomes of surgical and chemical castration with zinc gluconate in dogs presenting to veterinary field clinics

Brian A. DiGangi[a,*], Jaime Grijalva[b], Erika Pamela Puga Jaramillo[c], Ivette Dueñas[d], Christine Glenn[e,1], María Emilia Calero Cruz[f], Renán Patricio Mena Pérez[c]

[a] Department of Small Animal Clinical Sciences, University of Florida College of Veterinary Medicine, Gainesville, FL 32610, United States
[b] Department of Large Animal Clinical Sciences, University of Florida College of Veterinary Medicine, Gainesville,FL 32610, United States
[c] Universidad Central del Ecuador, Facultad de Medicina Veterinaria y Zootecnica, Ciudadela Universitaria Av. América, Quito, Ecuador
[d] Universidad San Francisco de Quito, Escuela de Medicina Veterinaria, Diego de Robles s/n y Pampite, Quito, Ecuador
[e] Humane Society of Tampa Bay, 3809 North Armenia Avenue, Tampa, FL 33607, United States
[f] Centro de Gestión Zoosanitaria, CEGEZOO URBANIMAL, Calle las Semillas, Quito, Ecuador

ARTICLE INFO

Article history:
Accepted 22 October 2017

Keywords:
Chemical
Non-surgical
Castration
Zinc gluconate
Field clinic

ABSTRACT

The objective of this study was to characterize post-operative outcomes of chemical castration as compared to surgical castration performed by existing municipal field clinics. Fifty-four healthy adult male dogs underwent chemical castration with zinc gluconate solution and 55 healthy adult male dogs underwent surgical castration in veterinary field clinics. Dogs in each group were evaluated for swelling, inflammation, and ulceration (chemical castration) or dehiscence (surgical castration) at Days 3, 7, and 14 following castration. More surgically castrated dogs required medical intervention than chemically castrated dogs ($P = 0.0328$); the number of dogs requiring surgical repair within each group did not differ ($P = 0.3421$). Seven chemically castrated dogs and 22 surgically castrated dogs experienced swelling, inflammation, and/or ulceration; all were managed medically. Two chemically castrated dogs experienced scrotal ulceration requiring surgical castration at Days 3 and 7. One surgically castrated dog experienced partial incisional dehiscence requiring surgical repair at Day 3. Our results suggest that chemical castration of dogs in field clinics is a feasible alternative to surgical castration, but proper follow-up care should be ensured for at least 7 days post-procedurally.

Introduction

Non-surgical contraception for companion animals has been an area of active research for many years, however few products have successfully made it to market for regular use. An injectable sterilant for male dogs containing zinc gluconate neutralized by arginine was first approved by the FDA and introduced in the United States in 2003 (ACC&D, 2016). Shortly thereafter production and distribution was discontinued for business reasons unrelated to safety and efficacy. After release in select Central and South American countries from 2008 to 2010, the product was reintroduced in the United States by a new manufacturer. At this time, mandatory manufacturer-led pre-purchase training programs for veterinarians were instituted to ensure correct administration technique and minimize associated risks (Griffin, 2013). In 2016, the product was removed from the market citing poor sales, distribution difficulties, and poor acceptance in the veterinary community (Lau, 2016).

According to the product manufacturer, intra-testicular injection of zinc gluconate results in local necrosis of testicular tissue. Initial atrophy of the testicles, epididymides, and seminiferous tubules are followed by scar tissue formation and permanent fibrosis, preventing normal movement of sperm from the seminiferous tubules to the epididymis (Product insert. Zeuterin™, Ark Sciences, Inc. New York). Absorption and metabolism of the compound is complete within 72 h of injection (ACC&D, 2016). Although highly variable, testosterone production can be expected to decrease following treatment. In a dose determination study in Beagles >4 months of age, testosterone levels were 41–52% lower but remained in the same range as control dogs 2 years after treatment (NADA, 2003). A field study of free-roaming dogs >4 months of age found that testosterone levels were equivalent to surgically castrated dogs in 66% of cases 6 months after injection (Vanderstichel et al., 2015). Despite the continued presence of

* Corresponding author. Current address: P.O. Box 142275, Gainesville, FL 32614, United States.
E-mail address: brian.digangi@aspca.org (B.A. DiGangi).
[1] Current address: Pasco County Animal Services, 19640 Dogpatch Lane, Land O Lakes, FL 34638, United States.

https://doi.org/10.1016/j.tvjl.2017.10.016
1090-0233/

testosterone, dogs are rendered sterile 30 days after treatment with zinc gluconate, a similar time frame to that found with surgical castration (ACC&D, 2016).

Injection complications are relatively few, though can be severe in nature. After chemical castration with zinc gluconate, the most common local reaction reported by the product manufacturer was scrotal pain, associated with testicular swelling the first 2 days after injection, in 6.3% of dogs. The most common systemic reactions reported included neutrophilia, vomiting and anorexia (Product insert. Zeuterin™, Ark Sciences, Inc. New York). The most common local reaction reported by an independent retrospective study was necrotizing injection-site reactions requiring surgical correction (Levy et al., 2008). Such reactions are reportedly due to improper injection technique and/or self-trauma, although reactions are not always associated with the injection site, suggesting the influence of other factors (Forzán et al., 2014).

Based on the studies submitted for FDA approval, the commercial solution of zinc gluconate neutralized by arginine was only labeled for use in male dogs between 3 and 10 months of age with testicular widths 10–27 mm (Product insert. Zeuterin™, Ark Sciences, Inc. New York). However, it has been successfully used in adult dogs and the product formulation has been licensed for use in any dog over 3 months of age in countries other than the United States (Esquivel LaCroix, 2006; Forzán et al., 2014). Its use may be desirable in cases where anesthetic risks are high, where inhalant anesthesia and surgical facilities are not available, where cultural or societal pressures value the presence of testicles in male dogs, or where the continued presence of testosterone without fertility is desired.

Veterinary field clinics are a widely used model for delivering veterinary care throughout the world, including elective sterilization. Operating in the model of Mobile Army Surgical Hospitals (MASH), such programs bring supplies and equipment to remote locations for the provision of veterinary care. The model carries the benefits of low start-up costs, quick start-up times, and the ability to work directly in areas of greatest need regardless of geographic, economic, or other limitations. Such clinics typically utilize a temporary and/or volunteer veterinary work force (Makolinski, 2013). Due to the nature of this work, follow-up care is often limited. Although standard veterinary care guidelines relevant to the operation of all types of spay-neuter clinics have been published (Griffin et al., 2016), full adherence remains a significant challenge for field clinics operating in remote locations with limited infrastructure and strict pharmaceutical regulations. For these reasons, chemical castration could be utilized to provide a safe and affordable means of controlling pet overpopulation in such operations. The objective of this study was to characterize post-operative outcomes of chemical castration as compared to surgical castration as performed by existing municipal field clinics.

Materials and methods

Study locations

Three University of Florida-Universidad Central del Ecuador cooperative veterinary clinics in the metropolitan area of Quito, Ecuador in June 2014 were selected as study sites for chemical castration. Five areas in the metropolitan area of Quito, Ecuador in October–November 2015 were selected as study sites for surgical castration. Clinic locations were each selected by URBANIMAL, a municipal organization charged with implementing animal welfare ordinances in Ecuador. Adherence to standard guidelines for spay-neuter clinic operation varied across each of the clinic sites for surgical castration; no attempts were made to alter existing clinic protocols.

Animals

Dogs presenting to the field clinics underwent physical examination by program veterinarians and veterinary students to determine overall fitness for each procedure. All healthy dogs presenting for castration were eligible for inclusion provided their testicular width was between 10–27 mm and there was no evidence of previous irritation or trauma of the scrotal tissue. Standardized medical health forms were completed with information on each dog including patient signalment and physical examination findings.

Chemical castration

To ensure patient comfort and consistent injection technique, all dogs were sedated with dexmedetomidine (10 mcg/kg) IV. All procedures were conducted by veterinarians who had undergone manufacturer-provided training in proper product usage, including injection technique. Briefly, the injection site was gently cleaned with a dilute chlorhexidine solution (no hair clipping was performed) and calipers were used to determine testicular width. A commercially-available solution of zinc gluconate neutralized by arginine (Zeuterin™, Ark Sciences, Inc. New York) was drawn into two new 1cc syringes at a dose according to the manufacturer's recommendations based on testicular width. A new needle (28G-1/2" or 30G-3/4") was placed on each syringe and the right testicle was gently grasped in order to insert the needle in a dorso-cranial to ventro-caudal direction just ventral to the head of the epididymis. The solution was injected slowly over 10–12 s and the needle withdrawn while the testicle was released. The procedure was repeated on the left side with the second needle and syringe. Each dog was marked as sterilized with a scoring tattoo consisting of two small parallel lines placed in the prescrotal region. The dogs were allowed to recover in a designated recovery area and atipamezole (5 mcg/kg) was administered IM. Once recovered, all dogs were discharged with 3 doses of firocoxib (5 mg/kg PO once daily). No attempt was made to confine the dogs or prevent access to the injection site (i.e., through the use of an Elizabethan collar).

Surgical castration

Surgical castration was performed by veterinarians according to existing standard operating procedures of the municipal field clinics. In order to compare chemical castration to surgical castration as typically performed, no attempts were made to alter the existing anesthetic, surgical or analgesic protocols of the surgical clinics. All dogs were pre-medicated with a combination of tramadol (2 mg/kg), acepromazine (0.1 mg/kg) and atropine (0.025 mg/kg) given SC or IM; anesthesia was induced and maintained with a combination of ketamine (10 mg/kg) and diazepam (0.25 mg/kg) IV. After completion of the procedure, dogs were allowed to recover in a designated recovery area; no anesthetic reversal was administered. Each patient was treated with an injectable penicillin procaine, benzathine and dihydrostreptomycin combination product (30,000 U/kg) as well as long-acting flunixin meglumine (1.5 mg/kg) SC. No attempt was made to confine the dogs or prevent access to the injection site (ie, through the use of an Elizabethan collar).

Follow-up

Each dog was evaluated for degree of swelling and inflammation, and either ulceration (chemical castration) or dehiscence (surgical castration) on Days 3, 7, and 14 after the procedure. Swelling and inflammation were recorded as mild, moderate, or severe according to standardized definitions (see Appendix A: Supplementary material). Ulceration was recorded as present or absent; if present, the length of the ulcerated region was noted. Dehiscence was recorded as absent, partial, or complete. Follow-up evaluations of chemically castrated dogs were conducted by at least one of the authors (BD, JG, EP, CG), however; evaluation duties were overlapped on each individual's first evaluation to ensure consistency of scoring. Follow-up evaluations of surgically castrated dogs were all conducted by one of the authors (EP). Patients found to have moderate or severe swelling or inflammation were treated according to standardized protocols which included the following measures: application of an Elizabethan collar, activity restriction, extended courses of firocoxib, injectable or oral antibiotics. Instances of ulceration or dehiscence were surgically corrected if indicated or non-responsive to medical management (see Appendix A: Supplementary material).

Statistical analysis

Descriptive statistics were calculated for each group. Chi square or Fisher's exact tests, as appropriate, were performed to compare differences in treatment groups (Epi Info Version 7.2.1.0, Centers for Disease Control and Prevention). $P < 0.05$ was considered significant.

The study protocol was approved by the Institutional Animal Care and Use Committee at the University of Florida.

Results

A total of 109 dogs were enrolled in the study: 54 underwent chemical castration and 55 were surgically castrated. All dogs were between 4 months and 8 years of age and had a median body weight of 10 kg (range 3–37 kg). Testicular width was a median of