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Comparison of the effect of intratesticular lidocaine/bupivacaine vs. saline placebo on pain scores and incision site reactions in dogs undergoing routine castration

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ABSTRACT

Post-operative pain scores and incision site reactions were compared in healthy dogs undergoing routine castration at a county animal shelter and assigned to two treatment groups, namely: (1) lidocaine/bupivacaine (1 mg/kg lidocaine + 1 mg/kg bupivacaine mixture; $n = 17$), or (2) placebo (0.9% saline; $n = 16$), administered via intratesticular injection. Dogs were injected with an equivalent volume of solution based on bodyweight. Premedication, induction and anesthetic maintenance protocols were identical in all animals. Pain scores were assessed at 15 min, 60 min, 120 min and 24 h post-recovery from anesthesia. Surgical site evaluation based on swelling and bruising was evaluated at 24 h.

The addition of lidocaine/bupivacaine did not impact pain scores compared to the saline placebo ($P > 0.05$). Incision site reactions were statistically similar between the two groups.

Introduction

Canine castration is a common surgical procedure performed by veterinarians, who aim to provide safe, effective and cost effective analgesia and anesthesia. To achieve these goals, many veterinarians employ a multi-modal approach, which, at least theoretically, allows for increased efficacy with decreased side effects due to the absence of reliance on a single agent. The addition of local anesthetics to various protocols has been researched in human and veterinary medicine (Brower and Johnson, 2003; Moinichem et al., 2002; Skarda and Tranquilli, 2004) but these studies have produced mixed results in terms of the benefit of adding local anesthetic during surgical procedures. Also, while studies investigating the effects of local anesthetic use during castration are available for humans, pigs and horses, there appears to be a paucity of published research in dogs (Kamal, 2002; Aggarwal et al., 2009; Portier et al., 2009).

A potential concern in using local anesthetic techniques is delayed healing or increased incision site reactions. Moreover, there is evidence that the use of local anesthetics in wounds could increase the risk of incision site reactions (Hollman and Durieux, 2003; Brower and Johnson, 2003). Therefore, a technique that allows for administration of a local anesthetic away from the incision site could be beneficial.

The purpose of this placebo-controlled study was to evaluate the effects of an intratesticular local anesthetic combination during canine castration. It was hypothesized that the addition of lidocaine and bupivacaine to a standard anesthetic protocol would diminish pain scores and would not result in additional incision site reactions. The Veterinary Anesthesia and Analgesia Support Group,[1] an online resource dedicated to promoting pain management in the veterinary field, describes and promotes intratesticular lidocaine/bupivacaine injections for canine castrations. The technique described in the website was utilized for this study.

Materials and methods

The clinical study protocol was approved by the North Carolina State University Institutional Animal Care and Use Committee (IACUC). The study was a blinded, parallel group, placebo-controlled clinical study, with an intent-to-treat analysis.

Animals

The aim was to recruit 40 dogs scheduled for routine elective castration at a local animal shelter. Dogs of any breed, age or weight were entered into the study and randomly assigned to one of two treatment groups. Group 1 (placebo group) re-

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ceived an intratesticular injection of 0.9% saline. Group 2 (treatment group) received an intratesticular injection of a 1 mg/kg lidocaine and 1 mg/kg bupivacaine mixture. Group size was based on power calculations following review of data from pilot cases. This indicated that 50% of the dogs undergoing castration surgery had pain scores ⩾2 during the first 24 h after surgery. We made the assumption that if the addition of a local anesthetic block to the surgical procedure was to be considered clinically relevant, it would drop the pain score to <2 in 90% of cases. Using these criteria, we estimated we would need 20 cases per group to achieve a statistical power of 0.8, with alpha set at 0.05.

Inclusion criteria

All dogs were at least 4 months of age (as determined by dentition if date of birth was not known), in general good health, did not require any additional surgery and did not have any evidence of scrotal or testicular disease. All dogs received a pre-surgical examination several hours prior to surgery by senior veterinary students and a veterinary clinician. Breed, age, bodyweight, rectal temperature, heart rate and respiratory rate were recorded.

Group assignment

Dogs were assigned sequential study numbers on qualifying for admission to the study. A dedicated third party then randomly assigned them to either group 1 (placebo) or group 2 (treatment). Each dog was premedicated with a mixture of acepromazine (0.025 mg/kg; Fort Dodge) and morphine (0.5 mg/kg; Baxter) administered IM 20–45 min prior to induction. Anesthetic induction was accomplished with tiletamine and zolazepam (Telazol, Pfizer) administered at 0.22 mL/kg IV. Following induction, dogs were intubated with an endotracheal tube using a laryngoscope for visual guidance. The endotracheal tube was secured in place and general anesthesia was maintained with isoflurane (Isoflurane, Abbott) in O_2.

Routine physiological measurements were performed by a certified veterinary technician to monitor heart rate, respiratory rate and mucous membrane color. Tissue oxygenation was assessed using pulse oximetry. Isoflurane concentration and O_2 flow rate were also recorded throughout the procedure. Recordings were documented at 5 min intervals.

Once an appropriate anesthetic plane was achieved, group 1 dogs received an injection of 0.9% normal saline into each testicle. The volume was equivalent to the volume of the lidocaine/bupivacaine mixture based on the dog's bodyweight. Group 2 animals received a mixture of 2% lidocaine (1.0 mg/kg; Phoenix Pharmaceuticals) and 0.5% bupivacaine (1.0 mg/kg; Marcaine, Hospira) intratesticularly. Each drug was drawn up into an individual syringe and mixed into a single syringe just prior to injection. The saline injections were also presented to the administrator in two separate syringes and were combined into a single syringe for injection. Injections were performed with a 22 g 1 in. (25 mm) or 1.5 in. (38 mm) needle starting at the caudal pole of the testis and directing the needle towards the spermatic cord. The syringe was aspirated before injection. Injection was performed while slowly withdrawing the needle. It was expected that one-third to a half of the total volume would be injected into each testicle, leaving the organ turgid. The total volume injected into each testicle and the times of intratesticular injection and surgery were recorded.

The clinician administering the injection, the students and the clinician assessing pain and performing the incision site scoring were blinded to the content of the syringes. For consistency, one individual performed all the intratesticular injections and one clinician also performed all the surgical site and pain score evaluations.

After injection the animals underwent standard open castration surgery (Hedlund, 2007). The surgical and closing techniques and the suture materials used were consistent among the students. The vascular bundle and tunics were ligated using 2–0 or 3–0 Vicryl (Novartis) and 3–0 Vicryl was used for subcutaneous and subcuticular closure. Students were asked to note whether the dog exhibited a cremastor muscle twitch during the procedure.

At the completion of the surgical procedure isoflurane was discontinued and the dogs were extubated when swallowing. Each dog received carprofen at recovery (4.4 mg/kg SC; Rimadyl, Pfizer) and for the following 4 days (4.4 mg/kg PO every 24 h).

Dogs were evaluated for pain at 15 min, 1, 2 and 24 h post-surgery using a pain score evaluation modified from that described by Sammarco et al. (1996; Table A1). In accordance with our IACUC protocol, any dog with a pain score of ⩾6 received rescue analgesia of either morphine (0.5 mg/kg IM; Baxter) or tramadol (1–2 mg/kg PO; Janssen). At 24 h post-surgery, incision sites were evaluated for swelling and bruising using a scale that was in routine use at the facility (Table A2).

Statistical analysis

Following testing of the data for normality, one way ANOVA was used to evaluate randomization based on age, weight and length of time from injection to the commencement of surgery. Presence or absence of a cremastor twitch was evaluated using a Pearson chi-squared and reported in a contingency table. For pain score analysis, the composite pain scores were regrouped into success/fail categories. Dogs with a composite pain score of 0–1 were given the value 0 and considered a success. Animals with a pain score of 2–4 were given a value of 1 and considered a fail. A Pearson chi-squared analysis was utilized during each time frame analysis for pain. Incisional site reactions were also evaluated utilizing the Pearson chi-squared analysis contingency table. A P value of <0.05 was considered significant and data were presented as mean ± SD. Statistical analysis was performed using statistical software (JMP, SAS).

Table 1
Dog characteristics and length of procedure in the two treatment groups.

	Group 1 placebo (n = 16)	Group 2 treatment (n = 17)	P
Age (years) mean ± SD	2.43 ± 0.39	2.29 ± 0.38	0.490
Weight (kg) mean ± SD	17.7 ± 2.0	20.6 ± 2.0	0.400
Time from testicular injection to start of surgery (min) mean ± SD	23.8 ± 1.8	22.2 ± 1.8	0.660

kg, kilograms; SD, standard deviation.

Table 2
Occurrence of cremastor twitch during the surgical procedure.

	No twitch	Twitch	P
Group 1 (n = 16)	1	15	
Group 2 (n = 17)	8	9	
			0.009

Table 3
Pain score results at various time points post-procedure.

	15 min		60 min		120 min		24 h	
	Fail[a]	Success[a]	Fail	Success	Fail	Success	Fail	Success
Group 1	14	2	15	1	15	1	16	0
Group 2	13	4	13	4	16	1	17	0
P	0.410		0.160		0.960		1.000	

[a] Pain scores of 0–1 constitute 'success' and pain scores of 2, 3, or 4 constitute 'fail'.

Table 4
Results of evaluation of the wound for bruising and edema at 24 h post-procedure.

Score	Swelling				Bruising			
	0	1	2	3	0	1	2	3
Group 1	12	5	0	0	11	5	0	0
Group 2	11	4	1	0	11	6	0	0
P	0.569				0.805			

Results

Thirty-eight dogs initially met study admission criteria but data from five dogs were excluded as they were unavailable for the 24 h assessment. Thirty-three dogs met the inclusion criteria and were used in the study; 16 were in the placebo group (group 1) and 17 in the treatment group (group 2). There was no significant difference between groups regarding age, weight or length of time from injection to start of surgery (Table 1).

All but three dogs received the total volume of agent supplied in the syringe. The three dogs that did not receive the total calculated volume received 90%, 90% and 75% of the calculated volume, respectively, and they were included in study analysis (see Table 2).

Dogs in group 1 (placebo) were more likely to produce a cremastor muscle twitch during ligation than those in group 2 (treatment; P = 0.009) and 15/16 dogs in group 1 demonstrated a twitch. In group 2, eight dogs did not twitch during the procedure and nine dogs produced a cremastor twitch.