Received: 10 July 2023 | Revised: 3 October 2023 | Accepted: 18 October 2023

DOI: 10.1111/vsu.14050

CLINICAL RESEARCH

WILEY

Influence of antiseptic lavage during tibial plateau leveling osteotomies on surgical site infection in 1422 dogs

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Abstract

Objective: To determine the influence of preclosure antiseptic versus saline lavage on surgical site infections (SSI) in dogs following tibial plateau leveling osteotomy (TPLO).

Study design: A multicenter retrospective study.

Sample population: Dogs treated with TPLO ($n = 1422$) between December 2019 and October 2021.

Methods: The medical records of dogs treated with TPLO were reviewed for preclosure antiseptic lavage or saline irrigation. Additional collected data included signalment, unilateral or bilateral TPLO, postoperative administration of antimicrobial medications, antibiotic agent, surgeon, and development of SSI within 90 postoperative days. Eleven factors were analyzed for association with SSI using univariate and multivariate analysis.

Results: Data were collected from the records of 519 dogs treated with antiseptic lavage and 903 dogs treated with saline lavage during TPLO. Surgical site infections were diagnosed more frequently in dogs that received preclosure antiseptic lavage (77/519, 14.84%) than those with saline irrigation (80/903, 8.86%) ($p = .001$). Single session bilateral TPLO increased the odds of SSI by 2.5x ($p = .004$). The odds of SSI increased by 11% ($p = .001$) for every 5 kg increase in bodyweight. Postoperative administration of antimicrobials decreased the risk of SSI ($p = .008$).

Conclusion: The preclosure antiseptic lavage tested here did not decrease the incidence of SSI after TPLO.

Clinical significance: The results of this study do not provide evidence to support preclosure antiseptic lavage during TPLOs.

1 | INTRODUCTION

Tibial plateau leveling osteotomy (TPLO) is a common procedure intended to neutralize cranial tibial thrust during the stance phase of gait in dogs with cranial cruciate ligament (CCL) disease.[1–4] However, TPLO is associated with an increased risk of surgical site infections (SSIs) compared to other clean procedures, with incidences

Abbreviations: 95% CI, 95% confidence interval; ACVS, American college of veterinary surgeons; CCL, Cranial cruciate ligament; CDC, Centers for disease control and prevention; EPS, Extracellular polymeric substances; Kg, kilogram; MRSP, Methicillin resistant *Staphylococcus pseudintermedius*; n, number; OR, Odds ratio; SSI, Surgical site infection; Std Dev or SD, Standard deviation; TPLO, Tibial plateau leveling osteotomy.

ranging from 0.8% to 15.8%.[2–10] While superficial TPLO SSIs may be successfully treated with antibiotic therapy, deep surgical site infections (implant-adjacent infections) often require implant removal for resolution due to the development of biofilms.[1,4,5,8,11] In addition to patient morbidity, there is also a substantial financial cost associated with treating TPLO SSIs. In 2014, Nicoll et al. reported the average cost of treating a TPLO SSI was $1559 and that $9.6–$15.9 million were spent on the resolution of TPLO SSIs annually in the United States.[4]

To reduce TPLO SSI rates, veterinary surgeons have reported the use of routine prophylactic antibiotics following TPLO. Some studies have found a decreased incidence of SSI following TPLO surgery where prophylactic antibiotics were used postoperatively,[1–3,5,6,9,10,12–17] while others have disputed this practice as not changing the incidence of SSI.[1,2,14,17] The impact of administering prophylactic antibiotics on bacterial resistance is of concern.[18] As an alternative to routine antibiotic prophylaxis in human patients at risk for implant infections, a nonantibiotic, antiseptic lavage (Bactisure Wound Lavage solution, Next Science Ltd, Jacksonville, Florida; distributed by Zimmer Biomet) consisting of acetic acid, ethanol, sodium acetate, benzalkonium chloride, and water was developed for local administration after implant placement and before the closure of the surgical site with suture.[19–21] The antiseptic lavage is compatible with orthopedic implants, is effective against biofilms and resistant bacteria, and reduces local bioburden, with a reported 99.98% decrease in bacteria and 38% decrease in postoperative periprosthetic infection rate in patients undergoing revision for total knee arthroplasty in a clinical trial.[19–22] The human product was adapted for veterinary medicine in 2019 (Simini Protect, Simini Technologies, Whitby, Ontario, Canada).[19]

The objective of this study was to determine if the use of preclosure antiseptic lavage prior to TPLO wound closure would decrease the cumulative TPLO SSI incidence to <5% when compared to use of traditional saline irrigation techniques. The hypothesis was that dogs receiving preclosure antiseptic lavage prior to TPLO wound closure would have a cumulative SSI incidence of less than 5% compared to TPLO wounds irrigated with saline prior to closure.

2 | MATERIALS AND METHODS

2.1 | Preliminary data

Medical records of 333 consecutive dogs (antiseptic lavage, $n = 138$; saline irrigation, $n = 195$) receiving TPLO procedures at three veterinary surgical referral hospitals in the same geographical area between December 2019 and October 2021 were reviewed for preliminary data to perform a power analysis. The TPLO SSI rate across the entire population was 8.5%. Based on preliminary population's allocation ratio of 1.4, a power $(1-\beta) = 0.8$ and a TPLO SSI rate of 8.4% in the preliminary population, a required sample size of 1334 was estimated if the antiseptic lavage was effective at reducing the TPLO SSI incidence to 5%. While not eliminating the risk of SSI altogether, decreasing the SSI rate from a baseline of 8%–9% down to 5% was set as clinically relevant to monitor the efficacy of the antiseptic lavage.

2.2 | Population, treatment protocol, and data collection

Medical records at six veterinary referral hospitals were reviewed to identify dogs that had TPLO procedures performed between December 2019 and October 2021. All dogs had their surgical sites irrigated with either the antiseptic lavage or 0.9% saline between implantation of the TPLO plate and screws and wound closure. All dogs received intraoperative antibiotics to be included in this study. Relevant data were collected including signalment, surgical report, recheck examination and client communication notes within the first 90 postoperative days to monitor for evidence of SSI, and intraoperative and postoperative antibiotic prescription. All TPLO cases were included whether performed as a single-session procedure, staged bilateral, or single-session bilateral procedure. There were no restrictions on the age, breed, or sex of the dogs included. Dogs had a minimum of 1-year follow-up from the time of surgery and dogs that were diagnosed by a surgeon as having an SSI within the first 90-days were recorded as either having a superficial infection, deep infection, or no infection according to the guidelines outlined by the Centers for Disease Control and Prevention (CDC) (Table 1).[23] Dogs that had a culture and sensitivity performed or implant removal were recorded. Medical records from referring clinics were also reviewed in the follow-up period so that all wound-healing complications were accounted for, even for dogs that did not return to the hospital where the original surgery was performed.

Exclusion criteria included dogs that failed to meet any of the inclusion criteria, dogs that were not prescribed intraoperative antibiotics during the TPLO procedure, or dogs that were already being treated with antibiotics for an existing infection when the TPLO was performed. For intraoperative antibiotics, the first dose was given ~30 min prior to the first skin incision and subsequent doses were administered every 90 min intraoperatively. Postoperative antibiotic type and duration of treatment were prescribed at the discretion of the attending surgeon. This information was recorded. The anesthetic records

TABLE 1 Criteria for defining surgical site infection (SSI).[23]

Variable	Superficial SSI	Deep SSI	Organ/space SSI
Timing	Within 30 days of the procedure	Within 90 days of the procedure or 1 year if implant	Within 90 days of the procedure or 1 year if implant
Location	Involves skin and subcutaneous tissue of the incision	Involved deep soft tissues of the incision	Involves any part of the body deeper than the fascial/muscle layers that is opened or manipulated during the operative procedure, example joint or bone
Patient has one or more of the following clinical signs	- Purulent drainage from superficial incision - Organisms identified from superficial incision or subcutaneous tissue by culture or nonculture based microbiological testing - Patient has localized pain, tenderness, swelling, erythema, or heat with or without culture - Diagnosis of a superficial incisional SSI by a physician	- Purulent drainage from the deep incision - Deep incision that dehisces or is opened by a surgeon and organisms are identified from the deep soft tissues of the incision by culture or nonculture based microbiological testing and patient has either fever, localized pain, or tenderness - Abscess is detected or there is other evidence of deep incisional infection	- Purulent drainage from a drain that is placed into the organ/space - Organisms identified from fluid or tissue in the organ/space by a culture or nonculture based microbiological testing method - Abscess or other evidence of infection involving organ/space

were reviewed to determine which dogs received bupivacaine liposome injectable solution and iodine-impregnated incision drape during the TPLO procedure, though further details about the protocol for application of these products or quantity were not investigated. Which hospital and surgeon performed the TPLO procedure was also noted, though further information about the surgeon such as gender, whether they were left versus right-handed, or experience level, was outside the scope of our investigation into efficacy of antimicrobial lavage.

In the antiseptic lavage group, administration of the lavage product was performed according to the manufacturer's recommended methodology. Three to six milliliters of antiseptic lavage (dose dependent on surface area of wound) were aseptically withdrawn from the dosing vial with a sterile syringe and needle prior to being dosed into the surgical wound. The antiseptic solution was allowed to pool in the surgical wound, covering tissue and implants for 60 s prior to removal with surgical suction. The site was then rinsed with an equal amount of saline prior to routine wound closure. In the saline group, a bulb syringe was used to administer copious (unrestricted) irrigation of the entire surgical site to provide a mechanical scrub and dilution of bacteria from the site. Storage of the antiseptic lavage was followed according to manufacturer guidelines.

2.3 | Statistical analysis

All analyses were performed using statistical software (SAS 9.4, SAS Institute, Cary, North Carolina). Descriptive statistics were performed to characterize clinical features, including age, weight, sex, breed, laterality of limb, surgeon, administration of postoperative antibiotics, procedure(s) performed, use of iodine-impregnated incision drape (Ioban, 3M, Saint Paul, Minnesota), use of bupivacaine liposome injectable solution (Nocita, Elanco, Greenfield, Indiana), and use of an antiseptic lavage (Simini Protect, Simini Technologies).

A χ-square test was used to measure the cumulative incidence of SSI in dogs with adequate follow-up. A Poisson regression test was used to compare incidence rates between control and treatment groups. Multivariable logistic and Poisson regression tests were used to adjust for any confounding factors. Exact binomial confidence intervals were calculated. Univariable and multivariable logistic regressions were utilized to test risk factors for effects on odds of SSI and to estimate odds ratios (OR) and 95% confidence intervals (95% CI). For multivariable analysis, the initial model included all risk factors except for breed (which due to the large number of breeds caused numerical difficulties and the p-value was .93 upon univariable analysis).

Then iteratively the factor with the highest p-value was removed until all factors retained in the model had $p < .05$. Log-likelihood p-values were used and reported. In all statistical analyses, a 95% confidence interval was used, and findings were deemed statistically significant when $p < .05$.

3 | RESULTS

A total of 1422 dogs met the inclusion criteria. Hospital locations included three specialty hospitals in North Carolina ($n = 312$) and three specialty hospitals in Georgia ($n = 1110$).

Data were collected from the records of 519 dogs treated with antiseptic lavage and 903 dogs treated with sterile saline lavage during TPLO. Of the dogs that were treated with saline ($n = 903$), 80 (8.86%, 95% CI: 7%–11%) developed an SSI. Of the dogs that were treated with antiseptic lavage ($n = 519$), 77 (14.84%, 95% CI: 12%–18%) developed an SSI. A total of 157 dogs were positive for SSI (11.04%). Ninety-six (61.15%) were classified as superficial SSI and 61 (38.85%) were classified as deep SSI. Using univariable analysis, administration of antiseptic lavage did not decrease the odds of TPLO SSI (OR 1.8, 95% CI: 1.3–2.5, $p = .001$).

A total of 26 breeds were represented with the most common being retrievers ($n = 348$, 24.47%), pitbulls (or pitbull crosses) ($n = 175$, 12.3%), and mixed breed dogs ($n = 162$, 11.39%). There were 24 (1.69%) intact females, 40 (2.81%) intact males, 591 (41.56%) neutered males, and 767 (53.94%) spayed females. The mean age of enrolled dogs was 6 years, 8 months (range, 6 months–15 years, SD 2.9 years, $p = .353$) (Table 2).

Of the 157 dogs that had signs supportive of an SSI, one (0.64%) was an intact female, nine (5.73%) were intact males, 71 (45.22%) were neutered males, and 76 (48.41%) were spayed females. For intraoperative antibiotics, 155 (98.7%) received cefazolin. Most commonly, a cephalosporin was prescribed postoperatively ($n = 127$, 80.9%). There were 23 dogs (14.6%) that did not have postoperative antibiotics prescribed. Of dogs that developed an SSI, 96 (61.15%) were classified as a superficial SSI and 61 (38.85%) were classified as a deep SSI. A total of 59 (96.72%) of the 61 dogs with a deep SSI had implant removal within the study period. The remaining two dogs with a deep SSI were advised to have the implant removed, but this did not occur within the study window.

Primary surgeons for the TPLO procedures reported here included 12 diplomates of the American College of Veterinary Surgeons (ACVS) (Table 3). A correlation between the surgeon and TPLO SSI ($p = .001$) was present. In this population, heavier dogs were associated with an increased risk of developing TPLO SSI ($p = .001$). Dogs receiving a single-session bilateral TPLO procedure were more likely to develop a TPLO SSI compared to dogs receiving unilateral

TABLE 3 Surgeons and percentages of TPLO procedures with SSI.

	Positive SSI		
Surgeon	**Y**	**N**	**Total**
A	46 (11.03%)	371 (88.97%)	417
B	8 (13.33%)	52 (86.67%)	60
C	6 (13.33%)	39 (86.67%)	45
D	11 (12.5%)	77 (87.50%)	88
E	17 (12.14%)	123 (87.86%)	140
F	6 (6.38%)	88 (93.62%)	94
G	12 (8.7%)	126 (91.3%)	138
H	11 (15.28%)	61 (84.72%)	72
I	20 (18.18%)	90 (81.72%)	110
J	9 (16.98%)	44 (83.02%)	53
K	3 (2.24%)	131 (97.76%)	134
L	8 (11.27%)	63 (88.73%)	71
Total	157	1265	1422

Abbreviations: SSI, surgical site infection; TPLO, tibial plateau leveling osteotomy.

TABLE 2 Descriptive statistics including age and weight of 1422 dogs that underwent tibial plateau leveling osteotomy procedure at one of six referral hospitals between 2019 and 2021.

Risk factor	Positive SSI	*N* Obs	*N*	Mean	Std Dev	Median	Lower quartile	Upper quartile	Minimum	Maximum
Age at surgery	None	1265	1265	6.7	2.9	6.8	4.3	9.0	0.0	15.8
	Superficial	96	96	6.5	3.1	6.6	4.1	9.0	0.9	13.0
	Deep	61	61	5.8	2.5	6.0	4.2	7.3	1.0	11.9
Weight of dog	None	1265	1181	22.8	13.7	21.0	12.4	32.0	1.0	96.2
	Superficial	96	92	24.6	16.5	20.2	13.2	32.8	2.0	90.9
	Deep	61	59	27.5	13.0	26.4	15.8	39.0	5.1	55.3

Abbreviation: SSI, surgical site infection.

TABLE 4 Analysis of variables predicted to be associated with surgical site infection for 1422 dogs that underwent tibial plateau leveling osteotomy procedure at one of six referral hospitals between 2019 and 2021.

		Odds ratio (OR), (95% CI)		*p*-value	
Variable	**Effect**	**Univariable**	**Multivariable**	**Univariable**	**Multivariable**
Group	Antiseptic lavage vs. saline	1.8 (1.3–2.5)	1.6 (1.03–2.6)	.001	.042
Age at surgery	Per 5 years	1.1 (0.9–1.5)	-	.353	-
Sex	Female vs. female spayed	0.55 (0.17–2.0)	-	.199	-
	Male vs. female spayed	2.5 (0.98–5.7)	-	.199	-
	Male neutered vs. female spayed	1.0 (0.7–1.5)	-	.199	-
	Male vs. female	0.22 (0.05–1.0)	-	.199	-
	Female vs. male neutered	0.53 (0.16–1.9)	-	.199	-
	Male vs. male neutered	2.4 (0.9–5.5)	-	.199	-
Breed	-	-	-	.233	-
Single session procedure(s)	Bilateral vs. unilateral TPLO	1.0 (0.5–2.1)	2.5 (1.3–4.5)	.942	.004
Surgeon	-	-	-	.001	.008
Postoperative antibiotics	Yes vs. No	0.5 (0.3–0.8)	-	.008	-
Additional procedures	Yes vs. No	0.8 (0.5–1.3)	-	.436	-
Weight of dog	Per 5 kg	1.0 (0.9–1.04)	1.11 (1.05–1.19)	.486	.001
Adhesive iodine drape used	Yes vs. No	0.8 (0.5–1.1)	-	.134	-
Liposomal bupivacaine administered	Yes vs. No	0.6 (0.2–2.2)	-	.376	-

Abbreviations: CI, confidence interval; TPLO, tibial plateau leveling osteotomy.

TPLO ($p = .004$). The dog's breed and age at the time of TPLO, as well as performance of additional surgical procedures during the same anesthetic event as the TPLO, the intraoperative use of iodine-impregnated adhesive surgical drapes, and local infusion of liposomal bupivacaine during TPLO were not associated with TPLO SSI (Table 4). The dog's sex was not associated with TPLO SSI, but in paired comparisons, male intact dogs were 2.5 times more likely to have an SSI than spayed female dogs (OR 2.5, 95% CI: 0.98–5.7, $p = .199$) and 2.4 times more likely than male neutered dogs (OR 2.4, 95% CI: 0.9–5.5, $p = .199$).

A total of 119 dogs (75.80%) diagnosed with SSI had a culture and sensitivity test performed. Of those cases, 97 (81.51%) had bacterial colony growth identified and 22 (18.49%) had no growth. Of 97 dogs with a positive culture, 54 (55.67%) had multidrug-resistant infections. The most common bacterial isolates from positive cultures are summarized in Table 5.

All dogs were treated with intraoperative antibiotics to be included in this study, most commonly cefazolin (West-Ward Pharmaceutical Corp., Eatontown, New Jersey) ($n = 1409$, 99.09%). Postoperative antibiotics were prescribed following TPLO in 1250 dogs (87.83%). The most common antibiotic prescribed postoperatively was cefpodoxime (Simplicef, Zoetis, Kalamzoo, Michigan) ($n = 1049$, 83.98%). Postoperative antibiotics were shown to be protective against SSI in this study ($p = .008$).

4 | DISCUSSION

In this retrospective study, intraoperative use of the antiseptic lavage solution did not decrease the incidence of TPLO SSI. Instead, a higher number of SSIs were identified in the dogs treated with antiseptic lavage compared to traditionally used saline lavage. Due to these results, we rejected our hypothesis that dogs treated with antiseptic lavage prior to TPLO wound closure would have a cumulative SSI incidence of less than 5%. This was an unexpected finding given reports of the lavage reducing bioburden in human knee surgery.[19–22] However, the antiseptic lavage's efficacy in human patients has been predominantly described during revision procedures with a preexisting SSI rather than as a prophylactic therapy, and the antiseptic lavage is known to be effective, in part, due to its ability to disrupt biofilm, which may limit its efficacy as a prophylactic treatment.[24,25]

Biofilm-based infectious diseases represent up to 80% of all infectious diseases in human patients.[21] The extracellular polymeric substances (EPS) matrix in biofilms

TABLE 5 Bacterial culture results for cases with SSIs after TPLO.

Bacterium isolated	Number of cases (*n*)	Percentage (%)
Methicillin-resistant *Staphylococcus pseudintermedius*	26	16.56
Methicillin-resistant *Staphylococcus spp.* (not MRSP)	20	12.74
Methicillin-resistant organism (not Staphylococcus)		
Xanthomonas spp.	1	0.64
Pseudomonas spp.	3	1.91
Streptococci spp.	1	0.64
Enterococcus spp.	2	1.27
Escherichia coli	1	0.64
Staphylococcus spp.	20	12.74
Streptococcus spp.	7	4.46
Enterococcus spp.	4	2.55
Pseudomonas spp.	3	1.91
Bacillus spp.	1	0.64
Klebsiella spp.	1	0.64
Nocardia spp.	1	0.64
Pasteurella spp.	1	0.64
Escherichia coli	1	0.64
Staphylococcus/E. coli/ Enterococcus spp.[a]	1	0.64
Not available for review	3	1.91
No culture submitted	38	24.20
No growth	22	14.01
Total	157	

Abbreviations: SSIs, surgical site infections; TPLO, tibial plateau leveling osteotomy.
[a]Isolated from the same SSI.

creates a unique barrier that is resistant to most conventional antimicrobial treatments, protecting the bacteria inside. Normal antibiotics that target cell replication cycles will be less effective because the bacteria are slower to proliferate inside the biofilm.[21] The nonantibiotic, antiseptic lavage reduces the bioburden and bacterial count by disrupting the biofilm to expose bacteria to antibiotics, the body's normal defense systems, and removal via lavage.[21] Specific mechanism of action for this product is thought to be from the acetic acid, having an antibacterial effect in its nondissociated form via damage to DNA and proteins via the disruption of proton gradients necessary to intracellular ATP production.[22]

In a human study comparing antiseptic lavage and their efficacy against biofilms, this product was shown to eradicate planktonic bacteria after 1 min of exposure, while requiring 3 min of exposure to target mature biofilms.[20] It also had varied responses based on surface, being most effective against biofilms on porous titanium implants, and was shown to be more effective when pulsed as a jet for mechanical disruption of the biofilm.[20,21] In our study, the antiseptic lavage was pooled for 1 min instead of being administered under pressure, suggesting that results may change based on technique of application, duration, and type of implant. While the study by Hunter et al. demonstrated reduced bioburden and bacterial count within the surgical site after use of surgical lavage,[21] there was also initially increased culturable bacteria, supposedly because bacteria was liberated from the biofilm.

In a routine TPLO, there should not be an active infection to target, and the antiseptic lavage is utilized in a prophylactic manner for any sources of contamination or break in sterile technique that occurred during the surgery. While this product may be effective at reducing bioburden at the time of surgery, it does not have residual properties to prevent future SSIs. Thus, a different result may be obtained if this product was used against active SSIs such as when implants are being removed or during treatment of a deep SSI where implants are being maintained.

The TPLO procedure has an increased risk of SSI compared to other clean orthopedic procedures, though the cause of this disparity is unknown and believed to be multifactorial.[2] The finding that increasing weight of the dog correlates with increased risk of TPLO SSI is consistent with previous literature,[1,3] but the correlation between increased TPLO SSI risk and single session bilateral TPLO in this study's population contradicts findings reported by Montano et al.[26] Since single session bilateral TPLO is not widely performed, it is possible that either the surgeon(s) performing the single session bilateral TPLOs practiced in hospital settings with generally higher TPLO SSI rates, or the risk associated with different surgeons was increased due to the inherent risk of TPLO SSI following single session bilateral TPLO. Further prospective studies may be indicated to determine if there is an increased risk of infection with single-session bilateral TPLOs.

In this study, there was also a correlation between the surgeon performing the TPLO and risk of TPLO SSI, though many variables relating to the surgeon were not assessed as outlined in the limitation section, limiting what conclusions can be extrapolated from this data. Antimicrobial stewardship protocols aim to limit

inappropriate use of antibiotics while promoting optimal outcomes for patients. Routine, prophylactic postoperative antibiotic use poses a "one health" challenge by increasing the risk of development of multidrug resistant bacteria.[1,2,9] Unfortunately, the impact of routine, prophylactic antibiotic prescription on TPLO SSI is ambiguous and conflicting in the veterinary literature with the use of prophylactic antibiotics being reported to lower TPLO SSI risk[1–3,5,6,9,10,12–17] and have no effect on TPLO SSI risk.[1,2,14,17] Due to these conflicting data and the importance of antimicrobial stewardship, alternative antimicrobial practices are needed to reduce TPLO SSI rates. The antiseptic lavage reported in this study did not lower the incidence of SSI. There is a recent report of a povidone-iodine intraoperative lavage used in total hip arthroplasty that may serve as an additional avenue of investigation for efficacy in lowering SSIs in TPLOs.[27] That lavage may be a more appropriate option for prophylactic therapy, and a study evaluating its efficacy in TPLO cases may present a nonantibiotic solution for reduction in TPLO SSIs.

This study had several limitations. As a retrospective study, the data gathered is reliant on the accuracy and completeness of medical records. Bias and confounders cannot be controlled due to a lack of randomization and masking protocols, and therefore causality is difficult to impossible to determine. To achieve an adequate sample size, data were pooled from multiple institutions. Many variables cannot be standardized across different hospitals, such as surgeon differences (reports of breaks in aseptic technique, intraoperative contamination, tissue handling style, glove type, implant selection, infection reporting, potential carriers of MRSP), intraoperative and postoperative TPLO protocol differences. Because this was a retrospective study involving multiple surgeons, there was no way to know what guided the decision behind which dogs received antiseptic lavage versus saline. While some surgeons may have utilized the antiseptic lavage in every case, others may have reserved its use for patients at higher risk of SSI, resulting in bias toward patient selection.

Additionally, diagnosis of surgical site infection in this study followed the guidelines of the CDC.[23] The CDC's definition does not require a positive bacterial culture for diagnosis of SSI if other specific factors, including inflammation of the surgical wound site, are met. However, clinician variability in interpretation of the CDC definition, especially when dogs are assessed by nonsurgeon clinicians, may have led to diagnosis of SSI in dogs without a true TPLO SSI. However, most dogs suspected of having TPLO SSI (75.8%) did receive culture and sensitivity testing performed by a veterinary diagnostic laboratory and were diagnosed by a surgeon.

In conclusion, the antiseptic lavage solution evaluated in this study was ineffective at reducing TPLO SSIs; however, a prospective, randomized evaluation of this product may further guide the efficacy of preclosure antiseptic lavage in TPLO patients or in a population where biofilm is suspected. Due to the frequency of TPLO procedures, the increased SSI risk profile following TPLO, and the detrimental one-health impacts of poor antimicrobial stewardship practices, further studies to identify effective methods of reducing TPLO SSI risk are warranted.

AUTHOR CONTRIBUTIONS

Sanders BD, DVM: Provided contributions to the conception and design of the work, acquisition, analysis, and interpretation of data for the study; drafting and revising the work. Kruse MA, DVM, DACVS and McDonald-Lynch M, DVM, DACVS: Provided substantial contributions to the study conception and design, data acquisition and interpretation, critical manuscript revision, and final approval of the version to be published. All authors provided a critical review of the manuscript and endorse the final version. All authors agree to be accountable for all aspects of the work as described by the ICMJE.

ACKNOWLEDGMENTS

The authors thank Deborah Keys, PhD for her assistance in performing statistical analysis for this project and Steven W. Frederick, LVT, VTS (Surgery) for his critical editorial work of the manuscript.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest related to this report.

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How to cite this article: Sanders BD, McDonald-Lynch M, Kruse MA. Influence of antiseptic lavage during tibial plateau leveling osteotomies on surgical site infection in 1422 dogs. *Veterinary Surgery*. 2024;53(1):167-174. doi:10.1111/vsu.14050