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ORIGINAL ARTICLE

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Technique description and outcome evaluation of Thoroughbred racehorses following soft palate thermocautery performed under standing sedation

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Abstract

Background: Palatal dysfunction (PD), which encompasses palatal instability (PI) and intermittent dorsal displacement of the soft palate, is the most common performance-limiting upper respiratory tract obstruction in young Thoroughbred racehorses. Soft palate thermocautery (SPT) performed under general anaesthesia is a routinely performed procedure for PD in some countries, but the procedure for and outcome of SPT performed under standing sedation has not been published.

Objectives: (1) To describe a technique for SPT performed under standing sedation; and (2) to assess post-operative performance in horses compared to controls using the Racing Post rating (RPR), British Horseracing Authority official rating (OR), Performance Index and Earnings.

Study design: Retrospective case series.

Methods: Medical records were reviewed for all horses that had SPT performed under standing sedation following topical and local infusion of lidocaine hydrochloride into the rostral soft palate, and that were identified to have PI by overground endoscopy. Two matched controls were identified for each case. The median RPR, OR, Performance Index and Earnings for the three pre-operative and three post-operative races were compared.

Results: No significant differences were identified between the SPT (n = 23) and Control groups (n = 46) for baseline characteristics or outcomes.

Main limitations: Retrospective study design, small sample size.

Conclusions: No significant differences in racing performance were identified between horses that had SPT performed under standing sedation and controls.

KEYWORDS
anaesthesia, endoscopy, equid, equine, respiratory tract, surgery

1 | INTRODUCTION

Palatal dysfunction (PD), encompassing palatal instability (PI) and intermittent dorsal displacement of the soft palate (iDDSP), is the most common performance-limiting dynamic upper respiratory condition diagnosed and treated in racehorses (Barakzai & Hawkes, 2010; Barnett et al., 2015; Davidson, 2015; Davidson & Martin, 2003; Ducharme & Cheetham, 2019; Lane et al., 2006). Palatal dysfunction causes a

turbulence of airflow which can negatively affect the performance of horses at maximum speed (Ducharme & Cheetham, 2019; Morris & Seeherman, 1990; Martin et al., 2000). Although many horses exhibit characteristic clinical signs of PD, dynamic endoscopy (i.e. overground endoscopy [OGE] and high-speed treadmill endoscopy) has become the gold standard for diagnosis as it has been reported that up to 35% of horses are misdiagnosed when either history or resting endoscopy is used alone (Barnett et al., 2015; Davidson, 2015; Lane et al., 2006).

Numerous conservative and surgical treatment options for PD exist, each aiming to address the different proposed mechanisms of the disease and with varying degrees of success (28%–82%) for improved performance (Allen et al., 2012; Barakzai & Dixon, 2005; Ducharme et al., 2003; Dillon et al., 2023; Franklin et al., 2002; Franklin & Allen, 2017; Woodie et al., 2005, 2007). Soft palate thermocautery (SPT) under general anaesthesia is one surgical procedure for the treatment of PD, either alone or in combination with other airway surgeries (Koskinen et al., 2020; Ordidge, 2001). However, to the authors' knowledge, no previous papers have described SPT performed under standing sedation, although the technique has been reported in abstract form (Cassiers & McNally, 2019). Therefore, the objectives of this retrospective study were (1) to describe a technique for SPT performed under standing sedation for horses identified to have PI on OGE and (2) to evaluate the post-operative racing performance for horses that underwent this procedure compared to controls. Our hypotheses were that this surgery would be possible to perform under standing sedation and that horses that underwent SPT under standing sedation would have improved within- and between-group race performance.

2 | MATERIALS AND METHODS

2.1 | Description of the SPT procedure

Standing SPT was performed as follows: The patient was sedated using 0.01 mg/kg intravenous (IV) of detomidine (Dormosedan, Orion Pharma), 0.02 mg/kg IV of butorphanol (Butador, Zoetis) and 0.02 mg/kg IV of diazepam (Diazemuls, Accord Healthcare). Based on clinic's protocol at the time, horses also were administered 1.1 mg/kg IV of flunixin meglumine (Dugnixon, Global Vet Health) and 1 vial (40 flocculation equivalents) of tetanus toxoid vaccine (Equilis Te, Intervet International) intramuscularly.

The equipment used to perform the procedure is shown in Figure 1. A dental mouth gag (McPherson Full Mouth Speculum; Figure 1a) was placed, and the horse's head was maintained at a suitable height on a headstand (Figure 1b). Using a headlight (Figure 1c) for the illumination of the oral cavity, 60 mL of lidocaine hydrochloride (LidoBel, Bela-Pharm GmbH & Co. KG) was applied topically to the visible portion of the soft palate, the tongue and the cheeks, using a 60-mL syringe and insemination pipette (Infusion pipette 25" Flex Tip, MAI Animal Health). Next, 20 mL of lidocaine hydrochloride was injected submucosally using a butterfly catheter (Winged catheter 21 g x 0.75", Nipro

FIGURE 1 Equipment used for thermocautery of the soft palate of horses performed under standing sedation: (a) dental mouth gag, (b) headstand, (c) headlight, (d) three curved L-shaped iron instruments, (e) gas burner and (f) vacuum.

Corporation) in an inverse U shape on the ventral surface of the soft palate to create a series of blebs (Figure 2). The head was removed from the headstand allowing excess saliva and local aesthetic to run out.

The remainder of the procedure was performed similarly to that already described under general anaesthesia (Barakzai, Boden et al., 2009; Dillon et al., 2023; Ordidge, 2001), with one notable difference: The horse's head was positioned on a headstand at a suitable height to allow visualization as far caudally as possible along the ventral aspect of the soft palate. Briefly, three custom-made, curved iron instruments (50 cm in length; Figure 1d) were used to cauterize the anaesthetized portion of the soft palate. The distal ends of the iron instruments were heated until glowing red using a gas burner (Figure 1e) before being firmly applied serially, for 2–3 s, to the oral aspect of the soft palate beginning at the most caudal visible portion of the soft palate and working rostrally to the interface with the hard palate (Figure 2). This caudal to rostral direction is used as the horse may be more likely to swallow and move the tongue at the end of the procedure as the sedation was wearing off, making a placement of the iron instruments in the caudal area and visualization more difficult. An industrial vacuum cleaner (Figure 1f) was used to evacuate smoke and improve visualization. Earplugs were used in horses that demonstrated signs of restlessness to decrease the possible reaction of the horse to the vacuum noise during the procedure.

Horses were muzzled post-procedure for two hours. Post-operative medication consisted of 4.4 mg/kg PO q 12 h of phenylbutazone

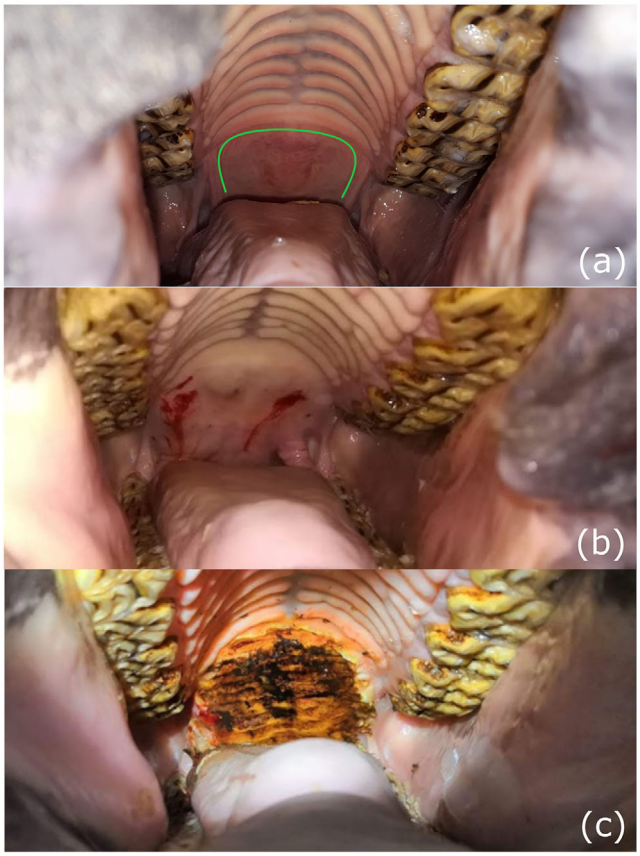

FIGURE 2 (a) Normal appearance of a soft palate when the horse's mouth is open with a gag in place. The green line is the submucosally injected point for the 20 mL of lidocaine performed in an inverse U shape on the rostral aspect of the soft palate. (b) Appearance of the soft palate after local anaesthesia is injected (60 mL of lidocaine hydrochloride). (c) Appearance of the soft palate several minutes after thermocautery has been performed.

(Equipalazone, Dechra Limited) administered for 3 days post-procedure. Patients were either discharged on the same day or the next day after the procedure. No ridden exercise for 1 week was advised (the horse could be turned out or allowed to walk on a mechanical walker), followed by 1 week of walking and trotting exercise under saddle, with gentle canters allowed on the third week. Normal exercise resumed in the fourth week. Use of a crossed noseband and tongue tie for any fast exercise and racing was advised.

2.2 | Retrospective analysis

Medical records were reviewed to identify all Thoroughbred racehorses that had undergone SPT performed under standing sedation as described before at a single private practice between October 2015 and October 2018. Horses with PI were identified on the basis of history, clinical signs and endoscopic examination at rest and during exercise (OGE). Horses were excluded if any other airway pathology was detected (e.g. epiglottic entrapment, recurrent laryngeal neuropathy, vocal cord collapse, medial or ventral deviation of the aryepiglottic folds and pharyngeal collapse), if they had undergone previous airway surgery, or if the horse did not race at least three times before and after the surgery.

For each SPT group case, two age-, sex- and race type-matched Thoroughbred racehorse controls were selected at random from the first race in which the SPT group horse ran post-operatively (Control group). If matched controls could not be identified in the first post-operative race, they were selected from (1) the second post-operative race or (2) the third pre-operative race. Horses in the Control group were required to have raced on six occasions (i.e. three 'pre' races and three 'post' races). If an age-, sex- and race type-matched control could not be identified from any of these three races, a horse that was 1 year older or younger in the first post-operative race was chosen. For each horse in the SPT group and matched controls, signalment, date of surgery and race data were recorded. Figure 3 provides a flow diagram illustrating the enrolment of horses in the SPT and Control groups. Race types were classified as flat (flat, stakes and all-weather) or national hunt (hurdle, chase, national hunt and point-to-point). For all cases and controls, tongue tie use and race data were obtained from the Racing Post Database (Racing Post 2020), including the Racing Post Rating (RPR), British Horseracing Authority Official Rating (OR), Performance Index and Earnings for the three races before and three races after the procedure (Racing Post 2020; Reardon et al., 2008; Woodie et al., 2005). For the purposes of the study, success of the surgery was defined as improvement in performance following the procedure for the following four performance measurements (RPR, OR, Performance Index and Earnings). The median for each of these four measurements for the last three pre-operative races was compared to the median for the first three post-operative races.

2.3 | Statistical analysis

All data analysis was performed using commercial statistical software (SPSS version 28.0, IBM Corporation). Normality of the data was tested using Shapiro–Wilk tests. As none of the key variables followed a normal distribution, baseline characteristics of the horses were compared between the SPT and Control groups using Chi-square tests (for categorical variables) or Mann Whitney–*U* tests (for continuous variables). Horses' success was assessed by four performance measures: (1) RPR, (2) OR, (3) Performance Index and (4) Earnings. Kruskal–Wallis tests were used to compare between-group differences in RPR, OR, Performance Index and Earnings using the difference between the median of the last three races before and median of the first three races after surgery. Data for horses in the Control group were collected using the procedure date of the matched horse in the SPT group to determine the three pre- and post-operative races for comparison. In addition to between-group comparisons, within-group differences in RPR, OR, Performance Index and Earnings for both groups were analysed using Wilcoxon Signed Rank tests. For all analyses, a p-value <0.05 was considered statistically significant.

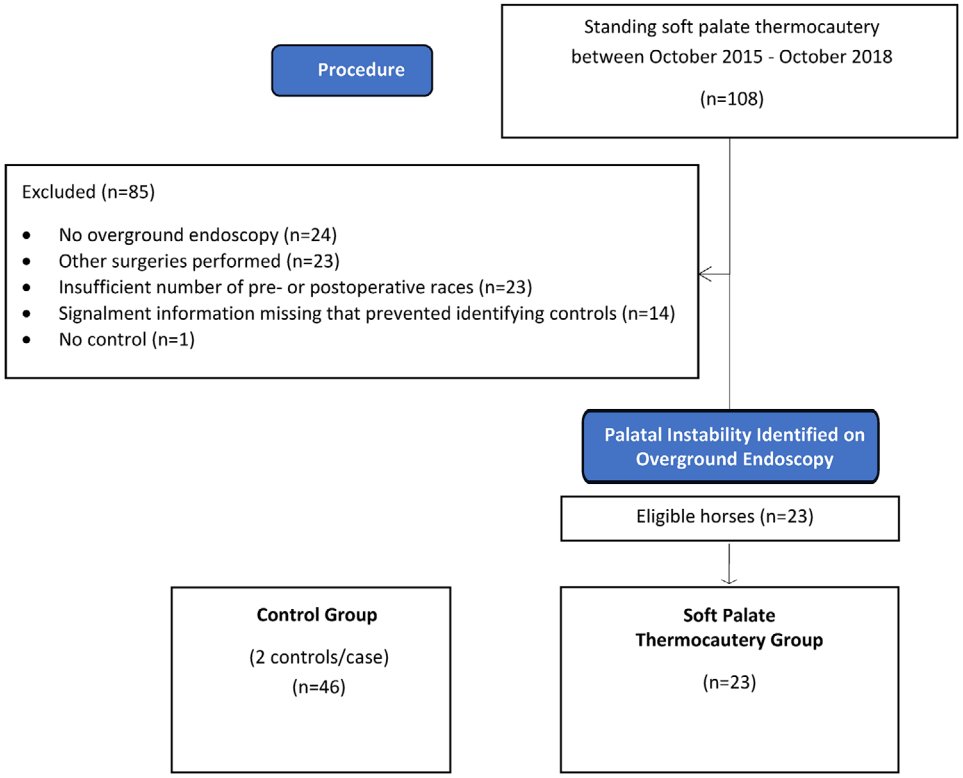

FIGURE 3 Flow diagram illustrates the enrolment of horses in this retrospective study, reasons for exclusion and number of eligible horses in the Soft Palate Thermocautery and Control groups.

3 | RESULTS

Between October 2015 and October 2018, 108 Thoroughbred racehorses with PD underwent SPT performed under standing sedation. Eighty-five of these horses were excluded, and 23 horses met the study inclusion criteria (Figure 3). All 23 horses had PI identified on OGE. Forty-six control horses were age-, sex- and race-type matched to these 23 horses in the SPT group. No significant differences were identified between the two groups in age, sex, racing type or any of the five performance indices (Table 1). Tongue tie use was not significantly different between the SPT and Control groups at the third ($p = 0.22$) or second ($p = 0.31$) pre-operative races, but tongue tie use was significantly more common in the SPT group in the first pre-operative race ($p = 0.04$). Additionally, tongue tie use was more prevalent in the SPT group than in the Control group across all three post-operative races ($p = 0.04$, $p < 0.001$, $p = 0.007$).

No significant differences were identified between groups in the proportion of horses that met the definition of success (i.e. improvement in post- compared to pre-procedure performance when using RPR ($p = 0.17$), OR ($p = 0.08$), Performance Index ($p = 0.86$) or Earnings ($p = 0.49$; Table 2). There were also no significant between-group differences (Table 3) or within-group differences (data not shown) observed for the change in median RPR, OR, Performance Index or Earnings (Table 3).

4 | DISCUSSION

This study described a technique for SPT performed under standing sedation for horses with PI. SPT is thought to be beneficial for PD by scarring the distal aspect of the soft palate to decrease its compliance. The exact mechanism is unknown (Ducharme & Cheetham, 2019; Lane et al., 2006), although a change in compliance has been described with other palate procedures, such as sclerotherapy and laser cautery (Ducharme & Cheetham, 2019; Jean et al., 2011).

Typically, SPT is performed under general anaesthesia (Barakzai et al., 2009; Koskinen et al., 2020; Ordidge, 2001; Reardon et al., 2008). Standing procedures are preferred in equine veterinary medicine as they remove the risk associated with general anaesthesia. Despite advancements in equine anaesthesia, horses are still significantly more prone to anaesthetic fatality (0.9%–1.9%, depending on the population) (Deutsch & Taylor, 2022) compared to humans (0.0004%–0.07%) (Haller et al., 2011; Hopster, 2018; Laurenza et al., 2020) or dogs (0.17%–0.05%) (Franklin et al., 2002; Shoop-Worrall et al., 2022). SPT can be performed under standing sedation by administering topical and submucosal local anaesthetic to the area of interest. Four nerves innervate the soft palate, including the pharyngeal branch of the vagus nerve (Holcombe et al., 1998), hypoglossal nerve (Cheetham et al., 2009; Hawkes et al., 2010), the mandibular branch of the trigeminal nerve (Ducharme & Cheetham, 2019) and the first cervical nerve (Genton

TABLE 1 Baseline signalment and race information on 23 Thoroughbred racehorses that had palatal instability identified on overground endoscopy and that had soft palate thermocautery (SPT) performed under standing sedation and 46 controls.

	SPT group	Control Group	*p*-Value
n	23	46	—
Age (years)	6 (2–11)	5 (2–11)	0.78
Sex			0.99
Geldings	16 (70%)	32 (70%)	
Mares	7 (30%)	14 (30%)	
Race type			0.98
National hunt	14 (61%)	29 (63%)	
Flat	4 (17%)	8 (17%)	
Both	5 (22%)	9 (20%)	
Time to first race after surgery (days)	49 (21–400)	—	—
Racing post rating (median of three pre-operative races)	85 (0–121)[a]	79 (15–142)	0.60
British Horse Authority Rating (median of three pre-operative races)	83 (0–121)	75 (0–140)	0.28
Performance index	0.7 (0–2)	0.3 (0–2)	0.98
Earnings (Euros)	440 (0–106,800)	1315 (0–62,700)	0.99

Note: Data are presented as median (range) or frequency (%).

TABLE 2 Comparison of success rate for 23 Thoroughbred racehorses that had palatal instability identified on overground endoscopy and that had soft palate thermocautery (SPT) performed under standing sedation and 46 controls.

	SPT group	Control Group	*p*-Value
n	23	46	—
Improvement in Racing Post Rating	10 (44%)	28 (61%)	0.17
Improvement in British Horse Authority Official rating	5 (22%)	20 (44%)	0.08
Performance Index	8 (35%)	17 (37%)	0.86
Earnings	9 (39%)	22 (48%)	0.49

Note: Data are presented as frequency (%). For the purposes of the study, the success of the surgery was defined as improvement in performance following the procedure (i.e. comparison of the median of the first three postoperative races to the median of the last three pre-operative races) for the five performance measurements: Racing Post Rating, British Horse Authority Official Rating, Performance Index and Earnings.

et al., 2021). The technique described in the current study does not specifically desensitize those nerves but addresses the specific area that will be sensitive due to the procedure. The SPT procedure is easier and faster to perform, in our experience, and desensitization is sufficient when the iron instruments are applied in a caudal to rostral direction. The procedure takes less than 30 min, with the horses muzzled post-procedure for 2 h to prevent accidental tongue lacerations or choking. The procedure was successfully performed in 23 horses under standing sedation, confirming the first hypothesis that this surgery could be performed under standing sedation.

The study's second objective was to evaluate the post-operative racing performance of horses that underwent this procedure compared to controls. The success rate of SPT performed under standing sedation in the current study (22%–57%) is similar to the success rates reported by the previous studies of SPT performed under general anaesthesia, which has ranged from 28% to 59% (Barakzai et al., 2009; Franklin et al., 2009; Reardon et al., 2008). However, in the current study, the success rate was not significantly different between horses that had the surgery and controls (37%–61%). Additionally, in the current study, our definition of success was based on that of Reardon et al. (2008) for RPR, so it is difficult to compare to other studies that used different definitions of success. The modest success rates of our study and previous studies contrast with a success rate of 72% reported in a study by Ordidge (2001). However, that study used subjective measurements of performance (assessment by trainer questionnaire of decreased respiratory noise and increased performance) to define success. The challenges of the varied performance measures for racehorses emphasize the importance of establishing a unified definition of racing success that could be consistently used in future interventional research.

Other measures of post-operative performance were consistent with the lack of difference in success rate between horses that underwent SPT and controls. There also were no significant between-group or within-group differences in RPR, OR, Performance Index or Earnings when comparing the SPT and Control groups. These findings are similar to the findings of a study that identified no significant difference in pre- and post-operative RPR for horses with iDDSP that underwent SPT under general anaesthesia compared to controls (Reardon et al., 2008).

This study had a number of limitations that are important to consider. Because of the retrospective design of the study, not all data on age, sex and race type required for identification of matched controls were available, which required excluding 14 horses (Figure 3). The timepoints between races and the surgery were not consistent. In addition, the study excluded horses that had the procedure performed without definitive diagnosis by dynamic endoscopy (24 horses) which made only a relatively small number of cases available for analysis. There was large variability made detecting of small differences between groups, if present, difficult (i.e. a Type II error). Even in horses that had a diagnosis of PI by OGE, it is impossible to definitively prove that these horses did not progress to iDDSP, given the limitations of a single OGE. Therefore, some of these horses may have had iDDSP, making the SPT group more heterogeneous than planned.

Following the procedure, trainers were advised to use tongue ties for any fast exercise and racing. At that time, it was believed that immobilizing the tongue hinders its ability to retract, which, in turn, prevents the downward movement of the larynx given the connection through the thyrohyoid bone (Dugdale & Greenwood, 1993). This recommendation itself may have affected outcomes as one study

TABLE 3 Comparison of the difference between the median of last three races pre-operative races and median of the first three post-operative races for 23 horses that had soft palate thermocautery (SPT) performed under standing sedation and 46 matched controls.

	SPT group	Control Group	*p*-Value
n	23	46	—
Change in Racing Post Rating	0 (−96 to +50)	3 (−141 to +104)	0.31
British Horse Authority Official Rating	−2 (−121 to +123)	0 (−110 to +113)	0.06
Performance Index	0 (−1 to +2)	0 (−2 to +2)	0.60
Earnings (Euros)	0 (−106,800 to +17,835)	0 (−62,400 to +23,195)	0.70

reported a 33% success rate for tongue ties in a study of six racehorses (Franklin & Allen, 2017). Another study showed a significant earnings improvement (53%–61%) after the first use of a tongue tie, with even higher percentages of improvement when used persistently (3–5 times consecutively had a 69.4%–76.9% improvement) (Barakzai, Finnegan et al., 2009). However, a more recent study evaluating dynamic airway obstruction found that tongue ties did not significantly influence laryngeal width or area, and that iDDSP was observed more often with the use of tongue ties (Barton et al., 2022). Therefore, our recommendations in the SPT group may have introduced a negative bias on racing performance since tongue tie use was more common in the SPT group than in the Control group in all three post-operative races.

Finally, all of the outcome parameters used to measure success of the procedure in the current study (i.e. RPR, OR, Performance Index and Earnings) were proxy measures. Racing performance can be affected by a wide range of other variables, including weather conditions; track conditions; and owner, trainer, jockey and training factors (Reardon et al., 2008). Post-operative dynamic endoscopy to directly determine the success of the procedure in correcting PD would have been ideal to use rather than the proxy measures and could be considered in future studies assessing the outcomes of soft palate procedures. It is widely acknowledged that pre- and post-intervention dynamic endoscopy is the gold-standard for the assessment of the efficacy of interventions, although there are still limitations to single examinations (McCluskie et al., 2009; McGivney et al., 2019; Sandnes et al., 2019). Unfortunately, post-operative dynamic endoscopy was not routinely performed at the time so, due to the retrospective nature of our study, the evaluation of this valuable information was not possible.

Despite these limitations, this study found that SPT performed under standing sedation was a feasible technique that can avoid risks associated with general anaesthesia. Nevertheless, there were no differences in success between horses that had the procedure and controls on the basis of a comparison of pre- to post-operative racing performance. In light of these results, continued use of this procedure remains questionable.

AUTHOR CONTRIBUTIONS

Hypothesis generation and experimental design: Violette Cassiers and Turlough McNally. *Organizing and conducting the experiments*: Violette Cassiers. *Interpreting and analysing the results*: Violette Cassiers and Turlough McNally. *Writing and revising the manuscript*: Violette Cassiers and Turlough McNally.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

FUNDING INFORMATION

None.

ETHICS STATEMENT

Research ethics committee oversight not required by this journal: retrospective study of clinical records.

INFORMED CONSENT

Explicit owner consent for animals' inclusion in the study was not stated.

OPEN RESEARCH

Descriptive clinical study based on retrospective review of clinical records.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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PEER REVIEW

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