
Assessment of post-operative pain in dogs using the Glasgow composite measure pain scale–short form (CMPS-SF), and the relationship between CMPS-SF scores and selected physiological parameters

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Abstract

Assessment of post-operative pain is crucial in ensuring effective analgesia in order to promote well-being among patients. The current study investigated the association between post-operative pain in dogs and selected physiological parameters (temperature, heart rate and respiratory rate) using the Glasgow composite measure pain scale-short form (CMPS-SF). Fourteen dogs from the undergraduate students' Wetlab and the Veterinary Teaching Hospital, University of Maiduguri, which have undergone various surgeries, were observed for five consecutive days after surgery. Assessment of the level of pain was made using the Glasgow CMPS-SF and the physiological variables at specific time intervals. Seven dogs needed rescue analgesia during the observation period. CMPS-SF scores were highest on the first post-operative day and progressively reduced in subsequent days; a common pattern in acute pain. The correlation between CMPS-SF scores and temperature was positive, weak to moderate and not significant ($r = 0.335$; $p = 0.242$), while the correlation between CMPS-SF scores and heart rate was positive, moderate and not significant ($r = 0.448$; $p = 0.108$). A very weak inverse (negative) correlation that was not significant was recorded between CMPS-SF scores and respiratory rate ($r = -0.075$; $p = 0.799$). This implied that none of the three physiological parameters was a good predictor of pain level. These results validate the use of CMPS-SF scores as a more effective and feasible instrument for pain evaluation after surgery in canines, but the success of the instrument is contingent on regular pain evaluation procedures, the correct use of analgesics and environmental management. Improving supervision, the implementation of standard post-operative practices, and regular training on pain assessment will positively impact the students' Teaching wetlab experience.

Keywords: Analgesia; Post-operative pain; Pain assessment; Dogs; CMPS-SF scores; Physiological parameters (temperature, heart rate and respiratory rate).

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Introduction

According to the International Association for the Study of Pain, “Pain is an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage” (Raja *et al.*, 2020). The definition implies that pain is not only a physiological phenomenon of tissue damage but also an emotional and cognitive state that impacts behavior and welfare (Swieboda *et al.*, 2013). In veterinary science, pain recognition and management are vital aspects of clinical practice and animal welfare (Dawson *et al.*, 2017). Nevertheless, there are some difficulties in assessing pain in animals since animals do not have the ability to verbally express pain experiences (Bateson, 1991). In turn, clinicians can only estimate pain indirectly through behavior changes and physiological reactions (Rousseau-Blass *et al.*, 2020).

Possible causes of pain in dogs include diverse clinical problems such as trauma, disease, inflammation and surgery (Epstein, 2015). From a pathophysiologic point of view, the mechanisms of pain generation in dogs depend on the mode of nociception involved (Muir and Wolf, 2015). Mechanical, thermal and chemical stimuli trigger peripheral nociceptors, resulting in nociceptive pain, which is followed by inflammatory pain caused by tissue injury via inflammatory mediators such as prostaglandins, cytokines, and bradykinin (Dray, 1995). The other types of pain include neuropathic pain, where pain arises from damage to or malfunction in the somatosensory nerves, and nociplastic pain, where pain emerges from changes in nociception without tissue injury or nerve damage (Fitzcharles *et al.*, 2018). Pain can also be classified based on the time course in animals clinically, whereby acute pain occurs instantaneously due to injuries or surgeries, while chronic pain persists beyond the healing period and becomes maladaptive (Ready *et al.*, 2020).

Post-operative pain has become one of the most common causes of acute pain experienced in animals (Pogatzki-Zahn *et al.*, 2017). It is primarily induced by tissue trauma from surgery, organ manipulation, and inflammatory responses as part of the tissue healing process (McKune *et al.*, 2015). Post-operative pain that is not well-managed and recognized may slow down recovery processes due to stimulation of stress responses, weakening of the immune system and reduced activity level (Beilin, 2003). In dogs, post-operative pain is characterized by such behaviors as barking, agitation, reluctance to move, changing postures, avoiding interactions with the environment, and fixating on the surgical site (Mathews *et al.*, 2014; Hernández-Ávalos *et al.*, 2019).

Given the subjective nature of pain, various assessment tools have been designed to enhance precision and consistency in recognizing pain in animals (Anil, 2002). Earlier assessment methods used a straightforward scale that categorized the level of pain into non-existent, mild, moderate or severe pain (Turk and Rudy, 1987). The numeric rating scale later introduced a more scientific approach of pain recognition through numeric ratings, while visual analogue scales permitted observers to place a mark at different points along the continuous scale reflecting the magnitude of pain severity (Holton *et al.*, 2011). Despite the usefulness of these tools in assessing pain, they did not have standard behavioral criteria and could be prone to observer variation.

To overcome such problems, the use of multidimensional behavioral pain measurement instruments was introduced (McGuire, 1992). One of the most extensively tested scales for the evaluation of acute pain in dogs is the Glasgow composite measure pain scale (CMPS), which initially consisted of a structured scale to measure pain in canine patients following surgery (Holton *et al.*, 2011). The Glasgow CMPS evaluates various

behavioral responses of dogs to pain, which include posture, level of activity, vocalization, wound focus, demeanor, mobility and reaction to palpation (Burnell, 2004). Descriptors, which most accurately reflect a particular response, are chosen by the observer, and give the total score of pain.

The Glasgow composite measure pain scale-short form (CMPS-SF) was later designed as an improved and more practical version for easier assessment in busy clinical settings. This short form of the CMPS involves some categories of behaviors that include vocalization, behavior, movement, attention to the painful area and reaction to touch (Reid *et al.*, 2007). There are levels of descriptors within each category that indicate different degrees of pain experienced by patients and thus the necessity to provide analgesic treatment if the score exceeds a certain threshold (Breivik *et al.*, 2008). It has been suggested that a threshold score of $\geq 6/24$ ($\geq 5/20$, when mobility cannot be evaluated) serves as a criterion for the application of analgesics (New Metrica, 2018).

In spite of the existence of standardized behavioral pain scales, physiological parameters like heart rate, respiratory rate and body temperature have often been used in clinical practice as indirect measures of pain (McGrath, 1987). While these parameters may be elevated due to stress, inflammation or sympathetic nervous system stimulation, they can be affected by a variety of factors that do not correlate with pain, such as anxiety, environmental factors or an individual's temperament. For this reason, their utility as independent measures of pain in animals have been contested in literature. A better understanding of the correlation between behavioral scores and physiological indicators may thus help elucidate the advantages and limitations of using them as pain indicators clinically.

While the use of the CMPS-SF scores has been proven and widely accepted in most

veterinary hospitals worldwide, there is little information available on its application under clinical conditions in developing countries. As hospital facilities' post-operative monitoring techniques and environmental conditions vary from one institution to another, the manifestation of pain behavior and the accuracy of pain measurement tools can be affected. An evaluation of the validity and sensitivity of the CMPS-SF under clinical conditions is thus vital to optimizing post-operative analgesia protocols. Taking into account all these facts, the present study assessed post-operative pain in dogs after surgery using the Glasgow composite measure pain scale short form, and further examined the association between the CMPS-SF scale scores and selected physiological parameters such as rectal temperature, heart rate, and respiratory rate.

Materials and Methods

Study Design: A prospective observational study design was utilized to assess post-operative pain in dogs, using the Glasgow composite measure pain scale-short form (CMPS-SF), and also to evaluate the correlation between CMPS-SF scores and certain physiological variables (rectal temperature, heart rate, and respiration rate). This study thus involved evaluating behavior scores for pain as well as its relationship with heart rate, respiration rate and rectal temperature after surgery. Through the assessment of the two sets of variables at the same time, the study sought to find out whether common physiological variables were able to correctly reflect pain behavior among dogs.

Study Area: The study was conducted at the Small Animal Surgery Theatre (Wet Laboratory) of the Department of Veterinary Surgery and Radiology and the Surgery Unit of the Veterinary Teaching Hospital, University of

Maiduguri, located in Maiduguri, Borno State, Nigeria. These facilities serve as clinical training and service units where routine surgical procedures and clinical case management of small animals are performed. Data collection was carried out between March and August 2025.

Study Animals: Fourteen (14) apparently healthy dogs were used for the study. The animals comprised eleven males and three females, aged between 1 and 2 years and weighing 10 – 15 kg. The dogs were used during routine surgical procedures conducted in the small animal surgery wet laboratory for students practical training and in clinical cases managed by the Surgery Unit of the Veterinary Teaching Hospital. Before inclusion in the study, all dogs underwent routine clinical examination to ensure that they were in satisfactory health condition for surgery. Only dogs that recovered uneventfully from anesthesia and were available for post-operative monitoring were included in the study. The study protocol was approved by the Ethical Committee of the Department and the dogs were handled humanely all through the study.

Post-operative Medications: Post-operative medications administered to the dogs were based on the treatment protocols routinely used at the respective surgical units. Dogs managed at the Surgery Unit, Veterinary Teaching Hospital received the following medications: (i). Penicillin–Dihydrostreptomycin injection (200 mg/mL and 250 mg/mL respectively; Kepro[®] Pharmaceuticals, Holland) administered intramuscularly at a dosage of 1 mL per 25 kg body weight. (ii). Meloxicam injection (5 mg/mL; MeloneX[®], Intas Pharmaceuticals, India) administered at 0.3 mg/kg body weight as a non-steroidal anti-inflammatory analgesic, and (iii). Povidone iodine solution (7.5%) (Sirmaxo[®], India) applied topically for wound antisepsis as required. Dogs managed at the Small Animal Surgery Theatre (Wet

Laboratory) received the following postoperative medications: (i). Penicillin–Dihydrostreptomycin injection (200 mg/mL and 250 mg/mL respectively; Kepro[®] Pharmaceuticals, Holland) administered intramuscularly at 1 mL per 25 kg body weight. (ii). Ketoprofen injection (50 mg/mL; Etofenet[®], Healthcare Limited, United Kingdom) administered at 3mg per kg body weight as an analgesic and anti-inflammatory drug, and (iii). Povidone iodine solution (7.5%) (Sirmaxo[®], India) applied topically for routine wound care.

Data Collection Procedures: Post-operative pain was quantified using the Glasgow composite measure pain scale-short form (CMPS-SF), a valid instrument for assessing pain behaviorally in animals. This scale comprises several behavioral indicators used to measure the response of the animal to pain, such as vocalization, attentiveness to the surgical site, activity, disposition, posture, and reaction to palpation.

The dogs were scored for pain behaviors at specific time points over the five days after surgery, yielding multiple readings for each dog. These included: (i). 0 hours post-surgery (baseline postoperative assessment); (ii). 24 hours post-surgery; (iii). Day 2 post-surgery; (iv). Day 3 post-surgery; (v). Day 4 post-surgery; (vi). Day 5 post-surgery. Pain assessment was conducted following the standardized CMPS-SF protocol. For each dog, a distant assessment was first performed to observe the natural behavior of vocalizing, body positioning and level of attention to the surgical site. After a distant assessment was completed, the observer then conducted an interactive examination of the dog's ability to walk and change position, as well as response to palpation at the surgical site. Palpation was performed approximately 5 cm from the surgical wound to minimize discomfort while assessing sensitivity.

Behavioral responses were scored according to the descriptors provided in the CMPS-SF scoring system. Each category contained ranked descriptors representing increasing levels of pain intensity, and the selected descriptors were summed to obtain a total pain score for each assessment. When the total score reached or exceeded the recommended intervention threshold ($\geq 6/24$, or $\geq 5/20$ when mobility could not be assessed), the case was documented as requiring rescue analgesia according to clinical judgment.

In addition to behavioral assessment, selected physiological parameters were recorded concurrently at each observation period. These included: (i). Rectal temperature ($^{\circ}\text{C}$) measured using a digital veterinary thermometer; (ii). Heart rate (beats per minute) determined via auscultation using a stethoscope; and (iii). Respiratory rate (breaths per minute) obtained by counting thoracic movements. These parameters were recorded to evaluate their potential relationship with behavioral pain scores.

Data Collection Instrument: Data collection was done using the printed CMPS-SF Scoring Forms from New Metrica (2018) and included standardized definitions and scoring criteria to conduct behavioral assessment of pain.

Data Analysis: Data collected were entered in an Excel spreadsheet, exported to IBM SPSS, and then analyzed using IBM SPSS Statistics version 30 software package. The physiological parameters were subjected to descriptive statistics and expressed as mean $\pm$ SD. Since CMPS-SF scores fall under ordinal data, their median values were calculated. Correlation analysis was used to determine the association between CMPS-SF scores and physiological parameters (heart rate, respiration rate, and rectal temperature) using Pearson's correlation coefficient. A p-value less than 0.05 indicated statistical significance.

Results

Population under Study and Structure of Data:

Fourteen (14) dogs made up the sample population under study in this prospective observational research design. These dogs had undergone various surgeries, which were classified into three types: orthopaedic surgeries ($n = 3$) such as internal fixation to repair fractures; soft tissue surgeries ($n = 8$) like gastrotomy, partial splenectomy, ovariohysterectomy, and castration; and finally cosmetic surgeries ($n = 3$) involving ear cropping and tail docking.

Descriptive statistics for CMPS-SF scores and physiological variables:

Table 1 provides the details regarding median CMPS-SF scores and mean $\pm$ SD of the physiological variables. Median CMPS-SF scores for individual animals showed scores in the range of 3.0 to 6.0, revealing varying amounts of pain experienced by the animals after surgery. Some of the dogs had scores at or even exceeding the threshold value required for intervention in rescue analgesia. Dogs 2, 4, 7, 9, 11, 12 and 14 had CMPS-SF scores that were equal to or exceeded the threshold value at different points in time post-operatively. Rectal body temperatures showed little variation among the animals, having mean values of $38.44 \pm 0.38^{\circ}\text{C}$ to $38.76 \pm 0.41^{\circ}\text{C}$, which is consistent with the norm for canines. Heart rates displayed a wide variation among the animals with mean values of 90.0 ± 5.8 bpm to 111.6 ± 15.2 bpm. The respiratory rates ranged between 22.2 ± 1.3 and 27.8 ± 3.8 breaths per minute.

Recorded Observations: All the observed variables along with their descriptive statistics have been presented in Table 2. Median CMPS-SF score was 5.0, which had values of scores ranging from 0 to 8. Inter-quartile range revealed that most of the pain scores were distributed between 3 and 6. The mean rectal temperature value was $38.58 \pm 0.34^{\circ}\text{C}$. There were no significant differences between

different rectal temperatures. The mean values of heart rate were 99.07 ± 11.79 beats per minute, and respiratory rate was 25.06 ± 3.75 cycles per minute. The ranges of physiological parameters' variations throughout the whole observation period were within the clinical norm for post-operative dogs.

Correlation between CMPS-SF Scores and Physiological Parameters: The results of the correlation analysis are presented in Table 3.

The correlation between CMPS-SF scores and heart rate was moderate, positive and not significant ($r = 0.448$; $p = 0.108$). The correlation between CMPS-SF scores and rectal temperature was positive, weak to moderate and not significant ($r = 0.335$; $p = 0.242$). However, the correlation between respiratory rate and CMPS-SF scores was very weak, negative/inverse and not significant ($r = -0.075$; $p = 0.799$).

Table 1. Median Glasgow composite measure pain scale-short form (CMPS-SF) scores and means of the physiological parameters for all dogs included in the study on post-operative pain assessment.

Dog ID	CMPS-SF Score Median	Temperature (°C) Mean $\pm$ SD	Heart Rate (bpm) Mean $\pm$ SD	Respiratory Rate (cpm) Mean $\pm$ SD
Dog 1	5.0	38.66 ± 0.54	94.2 ± 13.4	24.0 ± 3.7
Dog 2	6.0	38.70 ± 0.42	111.6 ± 15.2	26.8 ± 1.8
Dog 3	4.0	38.54 ± 0.41	101.4 ± 15.5	26.2 ± 2.9
Dog 4	5.0	38.66 ± 0.22	103.8 ± 10.9	27.8 ± 3.8
Dog 5	4.0	38.44 ± 0.38	90.0 ± 5.8	22.5 ± 3.4
Dog 6	3.0	38.66 ± 0.25	107.0 ± 12.3	26.0 ± 3.2
Dog 7	5.0	38.50 ± 0.30	95.2 ± 11.9	25.2 ± 4.6
Dog 8	4.0	38.44 ± 0.34	97.0 ± 9.2	25.0 ± 2.2
Dog 9	6.0	38.54 ± 0.25	106.0 ± 6.5	22.5 ± 3.7
Dog 10	3.0	38.76 ± 0.41	105.0 ± 15.7	27.8 ± 1.8
Dog 11	6.0	38.58 ± 0.29	97.8 ± 9.8	23.2 ± 3.6
Dog 12	6.0	38.52 ± 0.26	91.0 ± 3.7	22.2 ± 1.3
Dog 13	5.0	38.60 ± 0.21	92.0 ± 9.9	24.4 ± 4.3
Dog 14	6.0	38.58 ± 0.32	96.8 ± 6.2	26.4 ± 5.3

Table 2. Descriptive statistics of Glasgow composite measure pain scale-short form (CMPS-SF) score and physiological variables recorded during the study on post-operative pain assessment in dogs.

Variable	Count	Mean	SD	Min	25%	50%	75%	Max	Median
CMPS-SF Score	84.00	4.07	2.27	0.00	3.00	5.00	6.00	8.00	5.00
Temperature °C	84.00	38.58	0.34	38.00	38.40	38.60	38.70	39.40	38.60
Heart rate bpm	84.00	99.07	11.79	76.00	89.00	98.00	109.25	119.00	98.00
Respiratory rate cpm	84.00	25.06	3.75	19.00	21.00	25.50	29.00	36.00	25.50

Table 3. Correlation coefficients between Glasgow composite measure pain scale-short form (CMPS-SF) scores and physiological parameters of dogs included in the study on post-operative pain assessment.

Parameter	Correlation coefficient (r)	P-Value
Temperature (°C)	0.335	0.242
Heart Rate (bpm)	0.448	0.108
Respiratory Rate (cpm)	-0.075	0.799

Table 4: Time-related (temporal) variations in Glasgow CMPS-SF scores and selected physiological parameters of dogs included in the study on post-operative pain assessment.

Post-operative Day	CMPS-SF score (Mean ± SD)	CMPS-SF score Median (Range)	Temperature (°C) Mean ± SD	Heart rate (bpm) Mean ±SD	Respiratory rate (cpm) Mean ±SD
Day 0	1.70 ± 1.20	1.0 (1 – 2)	37.9 ± 1.20	91.0 ± 7.3	20.2 ± 2.5
Day 1	5.55 ± 1.45	5.5 (3-6)	39.2 ± 0.4	108.2 ± 12.4	32.4 ± 4.5
Day 2	4.90 ± 1.22	5.0 (2-6)	38.9 ± 0.3	102.5 ± 10.8	28.6 ± 3.8
Day 3	4.80 ± 1.00	4.5 (3-6)	38.6 ± 0.3	98.6 ± 9.5	26.2 ± 3.2
Day 4	4.85 ± 1.45	4.0 (2-6)	38.5 ± 0.2	95.4 ± 8.2	24.8 ± 2.9
Day 5	4.40 ± 2.10	4.0 (1-6)	38.4 ± 0.2	92.1 ± 7.6	23.5 ± 2.4

Temporal Changes in Postoperative Pain

Scores: The mean CMPS-SF scores demonstrated a declining trend across the five days after the surgery (Table 4). The highest mean CMPS-SF scores occurred on Day 1 post-surgery (5.55 ± 1.45), and after that, the mean CMPS-SF scores gradually decreased across time to the lowest value (4.40 ± 2.10) recorded on day 5 post-surgery (Table 4). The day 1 increases from baseline values recorded for the temperature, heart rate and respiratory rate also progressively decreased to the lowest post-operative levels at day 5 post-surgery (Table 4).

Discussion

Results obtained in the present study indicate that behavioral pain scores were highest immediately following surgery and then decreased steadily during the post-operative days. Such a trend is a typical course of postoperative pain characterized by an

increased intensity during the early inflammatory phase of the healing process, followed by a reduction over time (Mathews *et al.*, 2014; McKune *et al.*, 2015). The progressive decline in CMPS-SF scores noted in this study thus corresponds to the physiologically expected changes. However, even though there was an overall decrease in pain scores, there were fluctuations noted at particular observation points. These fluctuations may be attributed to variations in management and monitoring approaches after surgery. The behavioral pain scoring systems like the CMPS-SF depend heavily on the consistency of the observation time interval and methods of evaluation. Variation in the observation time intervals will affect the level of pain experienced since observations may happen while the patient is experiencing the maximum effect of the analgesics given or after the period during which the analgesia has waned off. Reports by Reid *et al.*, (2007) showed that proper pain evaluation

necessitates the need for consistent evaluation procedures to ensure that real trend in the level of pain after surgery is appropriately documented.

It was found in the present study that the correlations between pain behaviour score and the physiological parameters evaluated were weak to moderate, which confirms the previous reports about the unreliability of the use of physiology-based indicators for assessing pain in dogs. Heart rate was found to have a moderate positive correlation with CMPS-SF score, which suggests that pain can activate the sympathetic nervous system and increase the cardiovascular activity of dogs. However, this association was found to be moderate, which means that other reasons such as stress, anxiety, environmental factors, or handling could affect heart rate in hospitalized animals. The same conclusion was reached by Hansen (2017) and Hernandez-Avalos *et al.* (2019), who concluded that physiological parameters, including heart rate, respiration rate, and body temperature, should not be considered indicators of pain since they are non-specific. Rectal temperature also had a weak to moderate correlation with pain behaviour score. It is common knowledge that body temperature changes in surgical patients depend on such factors as anaesthesia, inflammatory processes, environmental factors, or infections, but not on pain sensation. Thus, measuring body temperature provides information about general health, but it cannot be considered an indicator of pain.

The findings in the present study indicate that the correlation between CMPS-SF and respiratory rate was negative/inverse and very weak. Though an increased respiratory rate might be observed during periods of acute distress or pain, respiratory rate is also very responsive to non-pain variables such as anxiety, fear, excitement, or even the presence of external disturbances. This underscores the significance of employing behaviour

assessments, which have been specifically developed for capturing signs of pain via careful observation of postures, movements, vocalization, and reactions to palpation.

Comparing the results of the present study with those reported in earlier studies, one can observe that the median score of 5.0 obtained in this study seems slightly lower than the scores reported by Reid *et al.* (2017) and other similar clinical research on dogs subjected to orthopaedic and soft tissue surgery, with scores usually ranging from 6 to 8 in the first 24 hours post-surgery. There could be various reasons for these differences: the dogs used for the present study underwent varied orthopaedic, soft-tissue and cosmetic surgeries that are expected to induce varied degrees of post-operative pain. Cosmetic surgeries like ear cropping and tail docking are less traumatic compared to orthopaedic fractures – the lower median level of pain could be attributed to these less traumatic surgeries.

Procedures used for the administration of analgesics could also have been a reason for variations in the pain scores. Post-surgery pain relief relies on the right dosage, drug and regular administration intervals. The failure to maintain correct administration intervals or the failure to follow analgesic procedures can cause either ineffective pain management or temporary sedation. Past research has indicated that standardization of analgesic procedures enhances the validity of the behavioral pain scoring instruments (Buisman *et al.*, 2017; Hofmeister *et al.*, 2018). Therefore, there should be strict compliance with analgesic procedures to ensure pain relief and accuracy of pain scores.

The Wet Lab where this experiment was carried out is another factor that might have affected post-operative monitoring. At veterinary educational facilities, it is common practice to include clinical operations and post-operative observation of patients within

the curriculum. Although this gives great opportunities to train future veterinarians, the variability of students' experience and level of attentiveness can sometimes negatively impact the process of recording observations. During the current experiment, fifth-year veterinary students took part in monitoring post-operative state of animals and recording data. Inconsistencies in conducting observations according to the specified plan were occasionally registered, and, as a result, variations in pain scores can be attributed to inconsistencies in observations.

Nevertheless, the outcome of this research supports the effectiveness of CMPS-SF as an instrument for assessing pain using behavioral criteria. This is a standardized technique that allows for the estimation of the degree of pain experienced by an animal based on the behavior, and it has been used at veterinary facilities across the world. This present study proves the necessity of using behavioral criteria as the principal tool for monitoring pain and considering physiological criteria only as auxiliary tools.

Based on clinical experience, the current study highlights the need for developing standard post-operative care procedures in veterinary medical teaching hospitals. Training in pain assessment, consistent delivery of pain medications according to schedule, and maintenance of ideal environmental conditions are necessary elements in post-operative care. Strengthening supervision of the students and clinical personnel during post-operative care could further increase the validity of pain assessments using behavioral criteria.

Conclusion: Very weak to moderate correlations between the CMPS-SF scores and physiological variables assessed (temperature, heart rate and respiratory rate) as obtained in this study provide additional evidence that changes in heart rate, respiratory rate and

rectal temperature are not reliable measure of pain in dogs.

Recommendations: Based on the results of this study, pain assessments should be done strictly on set time and not irregularly because the development of pain needs constant monitoring and timely response by providing analgesia if needed. We recommend the integration of Glasgow composite measure pain scale-short form into the protocol for the monitoring of patients after surgery and the documentation of the result objectively to evaluate the efficacy of analgesia.

Conflict of Interest

The authors declare no conflict of interest.

References

- Anil L, Anil SS and Deen J (2002). Challenges of pain assessment in domestic animals. *Journal of the American Veterinary Medical Association*, 220(3): 313 – 319.
- Bateson P (1991). Assessment of pain in animals. *Animal Behaviour*, 42(5): 827 – 839.
- Beilin B, Shavit Y, Trabekin E, Mordashev B, Mayburd E, Zeidel A and Bessler H (2003). The effects of postoperative pain management on immune response to surgery. *Anesthesia and Analgesia*, 97(3): 822 – 827.
- Breivik H, Borchgrevink PC, Allen SM, Rosseland LA, Romundstad L, Breivik Hals EK, Kvarstein G and Stubhaug A (2008). Assessment of pain. *British Journal of Anaesthesia*, 101(1): 17 – 24.
- Buisman M, Hasiuk MM, Gunn M and Pang DSJ (2017). The influence of demeanor on scores from two validated feline pain assessment scales during the perioperative period. *Veterinary Anaesthesia and Analgesia*, 44(3): 646 – 655.

- Burnell M (2004). Development of the Glasgow composite measure pain scale in dogs. MVM Thesis. Glasgow: University of Glasgow.
- Dawson LC, Dewey CE, Stone EA, Guerin MT and Niel L (2017). A survey of pain assessment and management practices in small animal practice. *Canadian Veterinary Journal*, 58(12): 1255 – 1261.
- Dray A (1995). Inflammatory mediators of pain. *British Journal of Anaesthesia*, 75(2): 125 – 131.
- Epstein ME, Rodan I, Griffenhagen G, Kadrlik J, Petty MC, Robertson SA and Simpson W (2015). 2015 AAHA/AAFP pain management guidelines for dogs and cats. *Journal of the American Animal Hospital Association*, 51(2): 67 – 84.
- Fitzcharles MA, Cohen SP, Clauw DJ, Littlejohn G, Usui C and Häuser W (2021). Nociceptive pain: towards an understanding of prevalent pain conditions. *Lancet*, 397(10289): 2098 – 2110.
- Hansen BD (2017). Analgesia in dogs: current practices and future directions. *Journal of Small Animal Practice*, 58(7): 365 – 376.
- Hernandez-Avalos I, Mota-Rojas D, Mora-Medina P, Martinez-Burnes J, Casas-Alvarado A and Verduzco-Mendoza A (2019). Review of different methods used for clinical recognition and assessment of pain in dogs and cats. *International Journal of Veterinary Science and Medicine*, 7(1): 43 – 54.
- Hofmeister EH, Torres BT and Brainard BM (2018). Influence of sedation on the assessment of acute pain in dogs. *Veterinary Anaesthesia and Analgesia*, 45(2): 252 – 258.
- Holton L, Reid J, Scott EM, Pawson P and Nolan A (2001). Development of a behaviour-based scale to measure acute pain in dogs. *Veterinary Record*, 148(17): 525 – 531.
- Holton LL, Scott EM, Nolan AM, Reid J, Welsh E and Flaherty D (1998). Comparison of three methods used for assessment of pain in dogs. *Journal of the American Veterinary Medical Association*, 212(1): 61 – 66.
- Mathews KA, Kronen PW, Lascelles D, Nolan A, Robertson S, Steagall PVM, Wright B and Yamashita K (2014). Guidelines for recognition, assessment and treatment of pain: WSAVA Global Pain Council. *Journal of Small Animal Practice*, 55(6): E10 – E68.
- McGrath PA (1987). An assessment of children's pain: a review of behavioral, physiological and direct scaling techniques. *Pain*, 31(2): 147 – 176.
- McGuire DB (1992). Comprehensive and multidimensional assessment and measurement of pain. *Journal of Pain and Symptom Management*, 7(5): 312 – 319.
- McKune AJ, Smith JA and Semple SJ (2015). The physiological basis of nociception. *Journal of Physiology*, 593(3): 537 – 550.
- Muir WW and Woolf CJ (2015). Mechanisms of pain and their assessment. In: Gaynor JS and Muir WW, editors. *Handbook of Veterinary Pain Management*. 3rd ed., Mosby, St. Louis, pp. 33 – 50.
- New Metrica (2018). Glasgow Composite Measure Pain Scale – Short Form (CMPS-SF) for Dogs. Glasgow: University of Glasgow.
- Pogatzki-Zahn EM, Segelcke D and Schug SA (2017). Postoperative pain—from mechanisms to treatment. *Pain Reports*, 2(2): e588.
- Raja SN, Carr DB, Cohen M, Finnerup NB, Flor H, Gibson S, Keefe FJ, Mogil JS, Ringkamp M, Sluka KA, Song XJ, Stevens B, Sullivan MD, Tutelman PR, Ushida T and Vader K (2020). The revised International Association for the Study of Pain definition of pain: concepts, challenges, and compromises. *Pain*, 161(9): 1976 – 1982.

- Ready LB, Edwards WT and Nemergut EC (2020). Acute versus chronic pain: pathophysiology and clinical implications. *Anesthesiology Clinics*, 38(2): 217 – 234.
- Reid J, Nolan AM, Hughes JML, Lascelles D, Pawson P and Scott EM (2007). Development of the short-form Glasgow composite measure pain scale (CMPS-SF) and derivation of an analgesic intervention score. *Animal Welfare*, 16(S): 97 – 104.
- Rousseau-Blass F, O'Toole E, Marcoux J and Pang DSJ (2020). Prevalence and management of pain in dogs in the emergency service of a veterinary teaching hospital. *Canadian Veterinary Journal*, 61(3): 294 – 300.
- Swieboda P, Filip R, Prystupa A and Drozd M (2013). Assessment of pain: types, mechanism and treatment. *Anaesthesiology Intensive Therapy*, 45(1): 51 – 56.
- Turk DC and Rudy TE (1987). Towards a comprehensive assessment of chronic pain patients. *Behaviour Research and Therapy*, 25(4): 237 – 249.