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Multivariable analysis of chronic pain-related behavioral outcomes following single and multiple long-bone fracture surgery in cats*

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Summary

This prospective clinical study investigated long-term behavioral alterations potentially associated with chronic pain in cats following orthopedic surgery for long-bone fractures and examined whether injury-related or environmental factors independently influenced these outcomes. A total of 120 client-owned cats with radiographically confirmed long-bone fractures were allocated into single-fracture (n = 60) and multiple-fracture (n = 60) groups. Behavioral changes were assessed at postoperative months 3 and 6 using a standardized owner-reported questionnaire. In univariate analyses, cats with multiple fractures exhibited significantly higher behavioral scores at both time points (p < 0.001). Structured caregiver education was associated with lower behavioral scores, particularly at postoperative month 6 (p < 0.001). However, multivariable linear regression analysis identified household size as the only independent predictor of behavioral scores at month 6 (p < 0.001), whereas fracture type and caregiver education did not retain statistical significance after adjustment. Decreased activity and reduced willingness to jump were the most frequently reported behavioral alterations. These findings suggest that environmental context may exert a stronger influence on long-term behavioral expression than injury severity alone. Integration of environmental assessment into postoperative management may therefore be essential for optimizing long-term outcomes in feline orthopedic patients.

Keywords: behavioral changes, cat, chronic pain, orthopedic surgery, environmental context, multivariable analysis

Orthopedic surgery is a fundamental approach for achieving functional recovery in the management of trauma-related fractures and musculoskeletal disorders in cats (3). The short-term outcomes of surgical interventions are generally based on radiographic healing and the evaluation of limb function, but the long-term clinical implications of postoperative chronic pain have been addressed in only a limited number of studies in the literature (5). Pain is a complex experience with sensory, emotional, and behavioral components, and these elements become particularly prominent in chronic pain conditions (11, 15). Chronic pain in cats may manifest through behavioral changes, such as reduced activity, increased tendency to hide, avoidance of social interaction, aggression, alterations in appetite, and decreased grooming behaviors (8, 10, 11). However, the evolutionary status of cats as both predator and prey increases their tendency to mask pain-related clinical signs, making early recognition of chronic pain more difficult (19, 24).

In the current literature, various behavior-based scales and ethograms have been described for the assessment of pain in cats, and these tools have been reported to be clinically useful particularly for the recognition of acute pain (9, 21, 22). In contrast, clinical studies addressing the behavioral manifestations of long-term chronic pain following orthopedic surgery in cats remain limited (24). Factors such as the number of fractures and the extent of trauma, prolonged surgical time, increased soft tissue injury, and postoperative immobilization are considered potential risk elements for the development of chronic pain (2). In this context, it is assumed that cases with multiple fractures may exhibit more pronounced and persistent behavioral

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changes in the postoperative period compared to those with single fractures. However, clinical studies supporting this assumption with empirical data are limited (2, 9). Due to the difficulty of detecting chronic pain in cats through routine clinical examination, owner-reported behavioral observations are gaining increasing importance. Assessments based on owner reports have been described as a reliable and complementary approach for recognizing pain-related behavioral changes in cats. Moreover, it has been suggested that educating caregivers about pain and associated behavioral alterations may enhance the recognition and accurate reporting of such changes (12, 14).

The aim of this study was to evaluate behavioral changes associated with chronic pain that may develop in the postoperative period in cats undergoing orthopedic surgery, to compare single-fracture and multiple-fracture cases, and to assess the potential influence of caregiver-directed pain-management and care instructions, as well as home-environment factors (number of household members), on this process.

Material and methods

Study design and animals. This prospective clinical study was conducted at the Department of Veterinary Surgery, Faculty of Veterinary Medicine, Dicle University. The study population consisted of 120 client-owned cats of various breeds, ages, sexes, and body weights that were presented with a history of trauma and diagnosed with long-bone fractures based on radiographic examination. All cases underwent detailed clinical and orthopedic evaluations upon presentation, and the presence of fractures was confirmed through at least two orthogonal radiographic projections. Fractures involving the femur, tibia, humerus, radius, and ulna were included in the study, whereas fractures affecting the axial skeleton (spine and pelvis) and bones other than long extremities were excluded. Cases with systemic diseases that could independently influence postoperative behavioral assessments and chronic pain outcomes, as well as those that failed to complete the 6-month clinical and behavioral follow-up period, were omitted from the study. Only cases that successfully completed the full 6-month postoperative follow-up were included in the final analyses.

Grouping and study groups. The 120 cats included in the study were divided into two main groups according to fracture type. Cases presenting with a single long-bone fracture were classified as the single-fracture group (n = 60), whereas cats with multiple long-bone fractures within the same individual were classified as the multiple-fracture group (n = 60). Prior to discharge, both main groups were further subdivided based on the scope of postoperative caregiver instructions. Accordingly, each group was divided into a detailed and structured information subgroup that included chronic pain management (n = 30) and a routine care subgroup that received standard postoperative recommendations commonly applied in clinical practice (n = 30).

In the subgroups that received detailed information, caregivers were provided with structured instructions prior to discharge regarding home care and rehabilitation strategies aimed at reducing the development of chronic postoperative pain. This information encompassed appropriate activity restriction and controlled mobilization, environmental modifications, adherence to recommended physical support and rehabilitation practices, proper use of analgesic medication and possible adverse effects, as well as the recognition and regular monitoring of behavioral changes associated with pain or discomfort. Previous studies have emphasized that caregiver education plays an important role in the evaluation of long-term postoperative outcomes in cats, particularly given their tendency to mask pain and the fact that chronic pain frequently manifests through behavioral alterations (10, 16, 18).

In the subgroups that received routine postoperative information, caregivers were provided only with standard discharge recommendations and basic care instructions; no additional structured education concerning chronic pain management or rehabilitation was offered. This grouping was intended to evaluate the potential effects of both fracture severity and the scope of postoperative caregiver education on the behavioral changes associated with chronic pain in the postoperative period.

Behavioral assessment and questionnaire application. The evaluation of behavioral changes associated with chronic pain in the postoperative period was performed using a standardized owner-reported behavioral questionnaire. This approach was preferred due to the tendency of cats to mask pain and the fact that chronic pain often manifests through alterations in daily activities and behavioral patterns rather than through clinical examination findings (4, 10). The questionnaire content was developed based on previous studies describing behavioral indicators of acute and chronic pain in cats (6, 16). The primary domains evaluated included general activity level, willingness to move, jumping and climbing behaviors, tendency to hide, social interaction, irritability or aggression, appetite, grooming behavior, and alterations in rest/sleep patterns. For interpretative purposes, questionnaire items were conceptually grouped into three ethogram-based behavioral domains: activity-related behaviors (general activity level, willingness to move, jumping and climbing), social or mood-related behaviors (tendency to hide, social interaction, irritability or aggression), and appetite or self-care-related behaviors (appetite, grooming behavior, and rest/sleep pattern alterations). In the present study, these items were summarized into a composite behavioral score representing the overall burden of chronic pain-related behavioral changes. Each behavioral parameter was rated by the caregiver on a scale from 0 to 10 (0 – no behavioral change; 10 – marked and persistent behavioral change). A total behavioral score was calculated by summing all item scores, and this composite variable was recorded as an indicator of the severity of chronic pain-related behavioral alterations. The behavioral questionnaire was administered at postoperative months 3 and 6 in all cases. Caregivers were instructed to base their assessments on the cat's overall behavioral pattern and observations within the preceding week. This approach was intended to capture long-term behavioral changes potentially associated with chronic pain rather than early postoperative adaptations.

Home environment and owner-related variables. Environmental factors and human–animal interactions have been reported to play an important role in the evaluation of behavioral changes associated with chronic pain in cats. Social density within the home, environmental stimuli, and daily routines may influence stress levels and, in turn, affect the emergence and severity of pain-related behavioral patterns (1, 17, 20). For this reason, home-environment variables were systematically recorded based on caregiver reports. Within this framework, the number of individuals residing in the household was documented for each case. It was considered that the number of household members could modulate behavioral changes associated with chronic pain through effects on social interaction and exposure to environmental stressors. Furthermore, previous studies have emphasized that household size may influence the recognition and reporting of pain-related behavioral alterations in caregiver-based assessments (7, 10). The number of household members was considered as a covariate in the statistical analyses to evaluate its potential influence on behavioral scores. For descriptive analyses, this variable was categorized as 1-2 individuals, 3-4 individuals, and 5 or more individuals. This environmental variable was not used as a primary grouping criterion; rather, it was treated as a secondary factor in analyses evaluating the effects of fracture type and postoperative caregiver education.

Surgical procedure and pain management. All orthopedic procedures were performed under individualized anesthesia protocols tailored to each patient's general clinical status, age, body weight, and concurrent traumatic findings. The selection and dosing of anesthetic agents were determined on a case-by-case basis according to the routine clinical protocols of the Department of Veterinary Surgery at Dicle University. Surgical technique selection was based on fracture location, type, and stability requirements. Internal fixation methods appropriate for femoral, tibial, humeral, radial, and ulnar fractures were employed. All surgeries were carried out under aseptic conditions by the same clinical team.

A multimodal analgesic strategy was adopted for perioperative and postoperative pain management in all cases. Analgesic protocols were adjusted during the postoperative period according to clinical status, pain-associated findings, and recovery progression. Particular attention was given to maintaining adequate postoperative pain control and ensuring consistency in fundamental analgesic approaches across cases. To this end, postoperative acute pain assessments were performed using the Glasgow Feline Composite Measure Pain Scale (CMPS-Feline), with the aim of managing pain effectively and minimizing potential group differences related to acute postoperative discomfort (13). Since the aim of this study was not to compare specific analgesic protocols, perioperative pain-management practices were not treated as an independent variable in the statistical analyses. Nonetheless, acceptable postoperative pain control was targeted in all cases, and clinical follow-up was maintained accordingly (Fig. 1).

Statistical analysis. Statistical analyses were performed using IBM SPSS Statistics for Windows, Version 25.0 (IBM Corp., Armonk, NY, USA). The distributional characteristics of continuous variables were assessed by visual methods (histograms and Q–Q plots) and analytical tests (Shapiro-Wilk test). Normally distributed data were presented as mean ± standard deviation. Total behavioral scores associated with chronic pain were analyzed separately at postoperative months 3 and 6. Comparisons between the single-fracture

Fig. 1. Representative images obtained for the assessment of postoperative pain using the Glasgow Feline Composite Measure Pain Scale (CMPS-Feline)

and multiple-fracture groups were performed independently for each time point. When the assumption of homogeneity of variances was violated, between-group comparisons were conducted using Welch's t-test.

To evaluate the effect of postoperative caregiver education on behavioral scores, groups receiving detailed pain-management instructions were compared with groups receiving routine postoperative care instructions at each time point separately. Independent samples t-tests were used for these comparisons. To assess the clinical relevance of between-group differences, effect sizes were calculated using Cohen's d coefficient. Cohen's d values of 0.2, 0.5, and ≥ 0.8 were interpreted as small, medium, and large effect sizes, respectively.

A multivariable linear regression analysis was performed to evaluate independent factors influencing total behavioral scores at postoperative month 6. Fracture type, postoperative caregiver education approach, and the number of household members were simultaneously included in the regression model. Age, sex, and body weight were initially evaluated in univariable analyses. However, as none showed a significant association with the 6-month behavioral score, they were not retained in the final multivariable model. Model results were reported with β coefficients, 95% confidence intervals, and exact p-values. A significance threshold of $p < 0.05$ was adopted for all statistical analyses. A post-hoc power analysis was performed using the G*Power software (version 3.1.9.7) to determine whether the sample size was sufficient for multivariable linear regression with three predictors. Assuming a medium effect size ($f^2 = 0.15$) and an alpha level of 0.05, a total sample size of 120 cases yielded a statistical power of 0.93 ($1-\beta = 0.93$). Therefore, the study sample was considered adequate to detect clinically meaningful associations in the regression model.

Results and discussion

A total of 120 client-owned cats were included in the final analysis, comprising 60 cases with a single long-bone fracture and 60 cases with multiple long-bone fractures. No statistically significant differences were observed between the two fracture groups in terms of age, sex distribution, body weight, or household size ($p > 0.05$), indicating baseline comparability between groups.

At postoperative month 3, the total chronic pain-related behavioral score was significantly higher in the multiple-fracture group compared to the single-fracture group (6.31 ± 1.69 vs. 4.28 ± 1.61; p = 0.0004; Cohen's d = 1.22). Similarly, at postoperative month 6, behavioral scores remained significantly elevated in cats with multiple fractures (6.88 ± 2.12 vs. 4.47 ± 2.74; p = 0.0002; Cohen's d = 1.01) (Tab. 1, Fig. 2-3).

When the effect of caregiver education was evaluated, cats whose owners received structured postoperative pain-management information demonstrated significantly lower behavioral scores compared to those receiving routine discharge recommendations. At postoperative month 3, behavioral scores were 4.62 ± 1.79 in the education group and 5.91 ± 1.85 in the non-education group (p = 0.018; Cohen's d = 0.71). This difference became more pronounced at postoperative month 6 (3.92 ± 2.14 vs. 7.48 ± 2.08; p < 0.0001; Cohen's d = 1.68) (Tab. 2). These findings indicate that both fracture multiplicity and caregiver education were significantly associated with behavioral scores in unadjusted comparisons.

To determine independent predictors of long-term behavioral outcomes, variables demonstrating significant

Tab. 1. Chronic pain-related behavioral scores at months 3 and 6 according to fracture type

Fracture type	3-month behavioral score	6-month behavioral score
Single fracture (n = 60)	4.28 ± 1.61	4.47 ± 2.74
Multiple fractures (n = 60)	6.31 ± 1.69	6.88 ± 2.12
p-value	0.0004	0.0002
Cohen's d	1.22	1.01

Explanations: Values are presented as mean ± standard deviation. Between-group comparisons were performed separately for each time point using Welch's t-test. Cohen's d indicates effect size.

Tab. 2. Effect of owner education on chronic pain-related behavioral scores at months 3 and 6

Owner education status	3-month behavioral score	6-month behavioral score
Education provided (n = 60)	4.62 ± 1.79	3.92 ± 2.14
No education provided (n = 60)	5.91 ± 1.85	7.48 ± 2.08
p-value	0.018	< 0.0001
Cohen's d	0.71	1.68

Explanations: Values are presented as mean ± standard deviation. Between-group comparisons were performed using independent-samples t-tests. Cohen's d represents effect size.

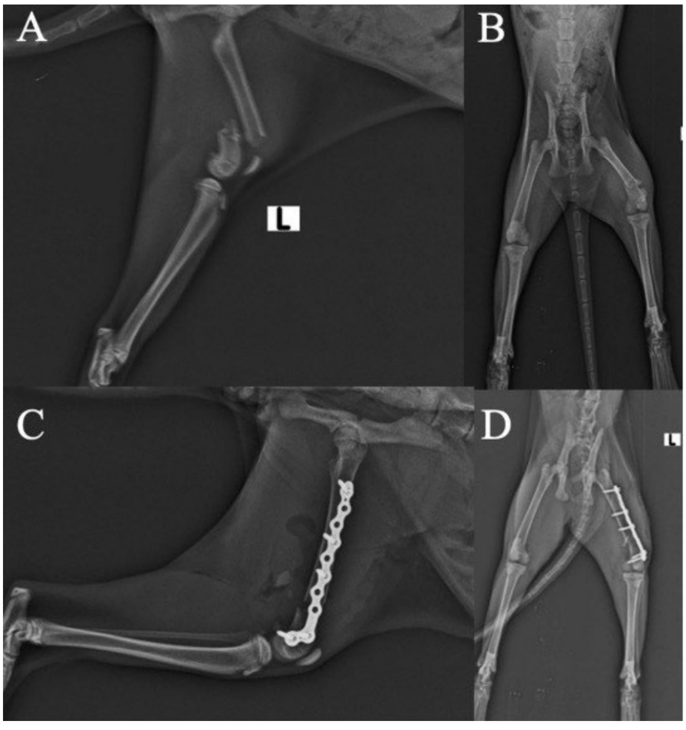

Fig. 2. Radiographic images of a case with a single long-bone fracture. A. Preoperative mediolateral (M/L) radiographic image B. Preoperative ventrodorsal (V/D) radiographic image C. Postoperative mediolateral (M/L) radiographic image D. Postoperative ventrodorsal (V/D) radiographic image

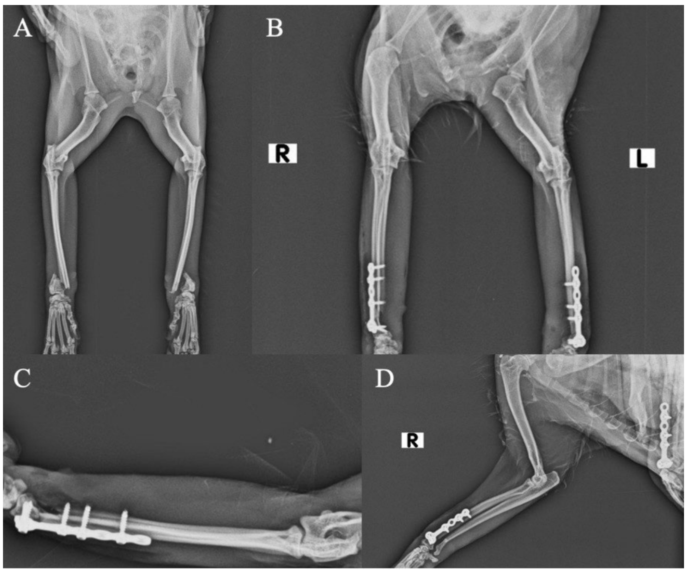

Fig. 3. Radiographic images of a case with multiple long-bone fractures. A. Preoperative anteroposterior (A/P) radiographic image B. Postoperative anteroposterior (A/P) radiographic image C. Mediolateral (M/L) radiographic image of the left limb D. Mediolateral (M/L) radiographic image of the right limb

associations in univariate analyses were entered into a multivariable linear regression model. The dependent variable was the total behavioral score at postoperative month 6.

In the adjusted model, the number of household members emerged as the only statistically significant independent predictor of behavioral scores (β = −0.90; 95% CI: −1.21 to −0.59; p < 0.0001). In contrast, fracture type (β = 0.18; p = 0.214) and caregiver education (β = −0.22; p = 0.143) did not retain statistical significance after controlling for environmental context (Tab. 3).

Tab. 3. Multivariable linear regression analysis of factors associated with 6-month behavioral scores

Variable	β coefficient	95% CI	p-value
Fracture type (multiple)	0.18	–0.11 to 0.47	0.214
Owner education (provided)	–0.22	–0.51 to 0.08	0.143
Number of people in the household	–0.90	–1.21 to –0.59	< 0.0001

Explanations: A multivariable linear regression model was used. The dependent variable was the total chronic pain-related behavioral score at postoperative month 6. CI: confidence interval.

This finding indicates that although fracture multiplicity and educational intervention were associated with behavioral scores in univariate comparisons, environmental context – represented by household size – was the sole independent factor influencing long-term behavioral alterations at postoperative month 6.

The most frequently reported behavioral changes included a decreased activity level and reduced willingness to jump. These alterations were more prevalent in cats with multiple fractures in unadjusted comparisons. When the evaluated items were interpreted according to behavioral domains, activity-related alterations appeared to represent the most persistent behavioral changes during follow-up. Social and mood-related behaviors showed more variable patterns among individuals, whereas appetite and grooming changes were reported less consistently. Although lower frequencies were observed in the education subgroups, persistent behavioral changes were still reported at postoperative month 6, indicating incomplete behavioral normalization in a subset of cases (Fig. 4).

The present prospective clinical study evaluated behavioral alterations potentially associated with chronic pain in cats following orthopedic surgery for long-bone fractures. The principal finding of this study is that the number of household members emerged as the only independent predictor of behavioral scores at postoperative month 6 in the multivariable regression model. Although fracture type and caregiver education were significantly associated with behavioral scores in unadjusted analyses, these variables did not retain statistical significance after controlling for environmental context. This finding suggests that long-term behavioral outcomes following orthopedic trauma may be influenced not only by injury severity, but also by environmental and social factors within the home. Household size was selected as a pragmatic and easily measurable proxy for environmental social context. Although this variable does not capture all aspects of the home environment, it may reflect the level of social interaction and environmental stimulation experienced by the animal.

Fig. 4. Clinical images showing behavioral findings consistent with persistent habitual behavior changes, aggressive behaviors, and cautious weight-bearing/protective posture in a case during the postoperative period

Chronic pain is increasingly recognized as a multidimensional condition influenced by biological, psychological, and environmental variables (11, 15). In feline patients, behavioral expression represents one of the most reliable indicators of pain due to the species' well-documented tendency to mask overt clinical signs (10, 19). The independent association between household size and behavioral scores observed in the present study supports the concept that environmental complexity may modulate the behavioral manifestation of chronic pain. Previous research has demonstrated that social density, environmental unpredictability, and exposure to stressors may alter behavioral responses and welfare status in domestic cats (1, 17, 20). A large household size may reflect heightened environmental stimulation, variability in human–animal interactions, or elevated stress levels, all of which could influence both pain perception and caregiver interpretation of behavioral changes.

Experimental and clinical pain research has established that stress-related neurobiological mechanisms may amplify nociceptive processing and contribute to central sensitization (15, 23). Therefore, the association between household size and behavioral scores may represent a multifactorial interaction involving stress modulation, altered coping mechanisms, and variability in owner observation patterns. Additionally, larger households may lead to inconsistencies in daily routines or differences in the perception and reporting of subtle behavioral alterations, further contributing to variability in caregiver-based assessments (7, 10).

In contrast, although cats with multiple fractures demonstrated significantly higher behavioral scores at both postoperative time points in univariate comparisons, fracture type did not remain an independent predictor in the multivariable model. This suggests that the apparent effect of fracture severity may partially overlap with or be mediated by environmental factors. Previous studies have suggested that increased trauma burden and soft-tissue injury may predispose individuals to persistent nociceptive input and central sensitization (5, 23). However, the current findings indicate that once environmental context is taken into account, fracture multiplicity alone may not independently determine long-term behavioral expression.

Similarly, caregiver-directed postoperative education was associated with lower behavioral scores in unadjusted comparisons, particularly at postoperative month 6, indicating a potentially beneficial role of structured pain-management information. Caregiver awareness has been reported to improve recognition of pain-related behaviors and adherence to postoperative recommendations (9, 16). Nevertheless, the absence of independent significance in the regression model suggests that educational intervention alone may not fully mitigate environmental influences or other unmeasured factors contributing to chronic behavioral alterations.

The persistence of decreased activity and reduced willingness to jump, particularly in multiple-fracture cases, aligns with previous descriptions of chronic musculoskeletal pain manifestations in cats (4, 8). Behavioral adaptations may persist beyond radiographic healing due to neuroplastic changes associated with central sensitization (23). These findings emphasize that radiographic union does not necessarily equate to a complete functional or behavioral recovery.

Several limitations should be acknowledged. Behavioral assessment relied exclusively on caregiver-reported questionnaires, which may introduce reporting bias and inter-observer variability. Although owner-based instruments are widely accepted for assessing chronic pain in cats (10, 16), the absence of objective measures, such as accelerometry, gait analysis, or activity monitoring, limits causal interpretation. Furthermore, environmental complexity was represented solely by household size, which may not fully capture other relevant factors, such as the presence of other animals, spatial resources, or environmental enrichment.

Despite these limitations, this study contributes clinically relevant evidence suggesting that long-term behavioral outcomes following orthopedic surgery in cats are influenced by environmental context in addition to injury-related factors. The findings support the incorporation of environmental assessment and caregiver education into postoperative pain-management strategies. In addition, outdoor access status and major changes in the home environment during follow-up were not systematically recorded and may have influenced behavioral expression in some cases.

In conclusion, long-term behavioral alterations following orthopedic surgery for long-bone fractures in cats were independently associated with the number of household members, highlighting the importance of environmental context in the expression of chronic pain-related behaviors. Although fracture severity and caregiver education influenced behavioral scores in unadjusted analyses, they did not remain independent predictors in multivariable modeling. These results underscore the necessity of integrating environmental, behavioral, and caregiver-related considerations into the long-term evaluation and management of feline orthopedic patients.

References

1. *Amat M., Camps T., Manteca X.*: Stress in owned cats: behavioural changes and welfare implications. J. Feline Med. Surg. 2016, 18 (8), 577-586.
2. *Aoyama N., Izumi M., Morimoto T., et al.*: A novel rat model to study postsurgical pain after joint replacement surgery. J. Pain Res. 2022, 15, 2911-2918.
3. *Bain M.*: Surgical and behavioral relationships with welfare. Front. Vet. Sci. 2020, 7, 519.
4. *Benito J., Depuy V., Hardie E., et al.*: Reliability and discriminatory testing of a client-based metrology instrument, feline musculoskeletal pain index (FMPI) for the evaluation of degenerative joint disease-associated pain in cats. Vet. J. 2013, 196 (3), 368-373.
5. *Erwin E. R., Ray K. S., Han S.*: The hidden impact of orthopedic surgeries: Examining the psychological consequences. J. Clin. Orthop. Trauma. 2023, 47, 102313.
6. *Evangelista M. C., Watanabe R., Leung V. S., et al.*: Facial expressions of pain in cats: the development and validation of a feline grimace scale. Sci. Rep. 2019, 9 (1), 19128.
7. *Lascelles B. D., Sheilah A. R.*: DJD-associated pain in cats: what can we do to promote patient comfort? J. Feline Med. Surg. 2010, 12 (3), 200-212.
8. *Marangoni S., Beatty J., Steagall P. V.*: An ethogram of acute pain behaviors in cats based on expert consensus. PLoS One. 2023, 18 (9), e0292224.
9. *Mathews K., Kronen P. W., Lascelles D., et al.*: Guidelines for recognition, assessment and treatment of pain. J. Small Anim. Pract. 2014, 55 (6), E10-E68.
10. *Merola I., Mills D. S.*: Systematic review of the behavioural assessment of pain in cats. J. Feline Med. Surg. 2016, 18 (2), 60-76.
11. *Monteiro B. P., Lascelles B. D. X., Murrell J., et al.*: 2022 WSAVA guidelines for the recognition, assessment and treatment of pain. J. Small Anim. Pract. 2023, 64 (4), 177-254.
12. *Mosegaard S. B., Stilling M., Hansen T. B.*: Pain catastrophizing scale as a predictor of low postoperative satisfaction after hand surgery. J. Orthop. 2020, 21, 245-248.
13. *Nicholls D., Merchant-Walsh M., Dunne J., et al.*: Use of mechanical thresholds in a model of feline clinical acute pain and their correlation with the Glasgow feline composite measure pain scale scores. J. Feline Med. Surg. 2022, 24 (6), 517-523.
14. *Overall K. L., Rodan I., Beaver B. V., et al.*: Feline behavior guidelines from the American Association of Feline Practitioners. J. Am. Vet. Med. Assoc. 2005, 227 (1), 70-84.
15. *Raja S. N., Carr D. B., Cohen M., et al.*: The revised International Association for the Study of Pain definition of pain: concepts, challenges, and compromises. Pain 2020, 161 (9), 1976-1982.
16. *Reid J., Nolan A. M., Scott E. M.*: Measuring pain in dogs and cats using structured behavioural observation. Vet. J. 2018, 236, 72-79.
17. *Rochlitz I.*: A review of the housing requirements of domestic cats (Felis silvestris catus) kept in the home. Appl. Anim. Behav. Sci. 2005, 93 (1-2), 97-109.
18. *Sparkes A. H., Heiene R., Lascelles B. D. X., et al.*: ISFM and AAFP consensus guidelines: long-term use of NSAIDs in cats. J. Feline Med. Surg. 2010, 12 (7), 521-538.
19. *Steagall P. V., Monteiro B. P.*: Acute pain in cats: recent advances in clinical assessment. J. Feline Med. Surg. 2019, 21 (1), 25-34.
20. *Stella J., Croney C., Buffington T.*: Effects of stressors on the behavior and physiology of domestic cats. Appl. Anim. Behav. Sci. 2013, 143 (2-4), 157-163.
21. *Taylor P. M., Kirby J. J., Robinson C., et al.*: A prospective multi-centre clinical trial to compare buprenorphine and butorphanol for postoperative analgesia in cats. J. Feline Med. Surg. 2010, 12 (4), 247-255.
22. *Wilson D. V., Pascoe P. J.*: Pain and analgesia following onychectomy in cats: a systematic review. Vet. Anaesth. Analg. 2016, 43 (1), 5-17.
23. *Woolf C. J.*: Central sensitization: implications for the diagnosis and treatment of pain. Pain 2011, 152 (3), S2-S15.
24. *Yayla S., Altan S., Kanay B. E., et al.*: Aggressive behavior in cats exposed to trauma. J. Hell. Vet. Med. Soc. 2022, 73 (1), 3875-3880.

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