

# Recognition and behavioral assessment of acute pain in cats: literature review

## *Reconhecimento e avaliação comportamental da dor aguda em gatos: revisão de literatura*

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### Abstract

Although pain is considered the 4th vital sign and one of the most frequently observed clinical signs in domestic animals' clinical practice, its treatment is still inadequate despite significant improvement in the last few years. Acute post-operative pain has aroused great interest due to its potential risk of developing into chronic pain, and if not treated properly, it might worsen the recovery and the patient's quality of life. Cats are one of the least studied species of domestic animals regarding pain recognition and control. Some of the difficulties lie in pain assessment and perception. The consensus published in February 2016 about behavioral signs of pain in cats considered some signs to be reliable and sensitive for the assessment of pain in this species in many different clinical conditions, however it still states that more studies will be necessary in order to evaluate its clinical validity and applicability, especially considering the various pain intensities. As an attempt to quantify pain intensity in cats, several types of traditional subjective scales and others that facilitate pain assessment by combining the observation of spontaneous behavioral signals of pain and qualitative response to palpation of surgical wound are used as tools. It is necessary to use specific scales for each type of pain and for each specific animal species so to minimize the subjectivity and the partiality of the observers, reducing bias and improving efficacy, thus leading to a better patient care.

**Keywords:** Analgesia. Pain Scale. Acute Pain. Cat.

### Resumo

Embora a dor seja considerada o quarto sinal vital e uma das manifestações mais comumente encontradas na prática médica veterinária dos animais domésticos, seu tratamento ainda é inadequado. A dor aguda pós-operatória tem suscitado grande interesse por seu potencial risco de cronificação caso não adequadamente tratada, podendo piorar a recuperação e a qualidade de vida do paciente. O gato é uma das espécies domésticas menos estudadas no que diz respeito ao reconhecimento e controle da dor, e algumas das dificuldades residem na avaliação e na percepção da dor. O consenso sobre os sinais comportamentais da dor nesta espécie publicado em fevereiro de 2016 considerou alguns sinais como confiáveis e sensíveis para a avaliação da dor em gatos, em toda uma gama de diferentes condições clínicas, porém afirma a necessidade da realização de estudos que analisem a sua validade e aplicabilidade clínica, especialmente em relação a diferentes intensidades de dor. Na tentativa de se quantificar a dor são utilizados vários tipos de escalas subjetivas tradicionais e outras que facilitam a avaliação da efetividade da analgesia, a partir da observação de sinais comportamentais espontâneos indicativos de dor, combinada a uma resposta qualitativa à palpação da ferida cirúrgica. Faz-se necessária a utilização de escalas específicas para o tipo de dor (aguda ou crônica) e para a espécie, de modo a minimizar a subjetividade e a parcialidade dos observadores e possibilitando uma melhor assistência ao paciente.

**Palavras-chave:** Analgesia. Escalas de Dor. Dor aguda. Gato.

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### Introduction

Post-operative acute pain has aroused great interest due to its potential risk of developing into chronic pain if not treated properly, which worsens the recovery and quality of life of the patient (PERGOLIZZI JUNIOR et al., 2014). Pain management is one of the most important steps of the perioperative period and has direct impact on quality

of recovery. It is known that pain triggers responses in the organism that might be undesirable for the patient, as it is associated with metabolic, immune, and neuroendocrine alterations (BEILIN et al., 2003). These alterations result from stress, tissue injuries, and the anesthesia itself involved in the perioperative period. For this reason, adequate postoperative analgesia is essential for faster recovery, thus decreasing morbidity and mortality (XU; BRENNAN, 2011).

Although pain is considered to be the 4<sup>th</sup> vital sign (HELLYER et al., 2007) and one of the clinical signs most frequently found in veterinary medical practice of domestic animals, its treatment, despite having been significantly improved in the last few years, is still inadequate (ROBERTSON; LASCELLES, 2010). This could be due to the difficulty in recognizing pain signals in dogs and cats (INGWERSEN et al., 2012) and resulting from fear of side effects related to traditional analgesics and lack of pharmaceutical products with market authorization (labelled) for this species (ROBERTSON; TAYLOR, 2004).

Physiological changes can be used in pain assessment. Signs as tachypnea, tachycardia, hypertension, mydriasis, and salivation might be indicative of pain in cats (ROBERTSON, 2008). Moreover, variations in biochemical indicators (adrenaline, noradrenaline, cortisol, and  $\beta$ -endorphins) are also indicative of pain (OLIVEIRA et al., 2011), however they can be influenced by other factors, such as stress (SMITH et al., 1996).

Pain assessment tools that include behavior observation and the interaction with the animal (pain scales) are subjective, yet reliable in a clinical context (BRONDANI et al., 2011). Therefore, knowing the normal behavior of the species and the individual under evaluation is crucial (ROBERTSON, 2008). There are several pain scales currently available for the evaluation of pain in feline practice. They differ in level of simplicity and reliability, and in the context in which they should be employed.

This review reports the definition and the consequences of untreated pain, general painful signs, peculiarities of the feline behavior, and recent tools (pain scales) developed for the assessment of acute pain in cats. Chronic pain assessment and the treatment of pain are beyond the scope of this review.

## Pain

Pain is defined by the International Association for the Study of Pain (IASP) as an unpleasant sensory and emotional experience associated with actual or potential tissue damage (TASK FORCE ON TAXONOMY OF THE

INTERNATIONAL ASSOCIATION FOR THE STUDY OF PAIN, 1994). Nowadays, pain is considered a physiologic parameter, as well as temperature, pulse, and respiration and the effective pain management should be an essential component of companion animal medicine (EPSTEIN et al., 2015).

The difficulty in adequate recognition of painful signals in dogs and cats has led to a philosophical shift based on the concept of "treating predictable pain" (INGWERSEN et al., 2012); thus prophylactic analgesia was established, which consists in an attempt to abolish or attenuate postoperative pain and avoid or limit its subacute or even chronic phases by blocking or reducing alterations associated with peripheral and central sensitization (ROBES, 2006).

Pain intensity depends directly on the stimulus that generates the wound, and its treatment varies according to its nature and type. Acute pain is one of the main consequences of trauma and its repercussions are potentially harmful to the organism (BEILIN et al., 2003) that is associated with undesirable effects such as discomfort, prolonged recovery, and long-term sequels, such as the development of neuropathic pain (LEDOWSKI et al., 2012). Along with physiological alterations used as parameters for pain assessment, pain triggers a sympathetic response to stress, increasing levels of stress hormones like cortisol, catecholamines, glucagon, and cytokines, which are important inflammatory mediators released by the immune system. Consequently, there is an increase in basal metabolic rate, cardiac work, peripheral vascular resistance, and myocardial oxygen consumption. There is also an impairment of respiratory function that can cause pulmonary complications like atelectasis, pneumonia, and even coagulation disorders, which may lead to thromboembolism (SAKATA, 2001).

In order to avoid or reduce the alterations caused by acute pain, opioid and non-opioid analgesics are commonly used, including the nonsteroidal anti-inflammatory drugs (NSAIDs) and the simple analgesics, as well as adjuvant analgesics and complementary therapies, such as physiotherapy and acupuncture (MATHEWS et al., 2014).

## Pain recognition

Cats are one of the least studied species of domestic animals regarding pain recognition and its treatment (AL-GIZAWIY; RUDÉ, 2004). Over the last few years, concern about this issue has increased most likely in response to studies reporting that pain in cats had been

inadequately treated when compared with other animal species (DOHOO; DOHOO, 1996; WATSON et al., 1996; CAPNER et al., 1999; JOUBERT, 2001).

Changes in physiological parameters such as heart rate, respiratory rate, and blood pressure, as well as the biochemical indicators (adrenaline, noradrenaline, cortisol, and  $\beta$ -endorphins) can be used as objective parameters in pain evaluation; however, they might be influenced by a number of factors other than pain (SMITH et al., 1996). Previous studies reported an increase in cortisol levels compared to baseline preoperative values (MÖLLENHOFF et al., 2005) and in cats with higher pain scores and requiring rescue analgesia (EVANGELISTA et al., 2014). However, in another study differences in physiological parameters including cortisol and  $\beta$ -endorphins were not observed between cats that had undergone surgery and control cats (that had not) (CAMBRIDGE et al., 2000). These parameters change significantly in response to changes of environmental conditions and to stress resulting from manipulation, and they also vary according to the individual's behavior (HELLYER et al., 2007). The observation of spontaneous behaviors indicative of pain combined with the qualitative assessment of response to interaction and palpation of surgical wound facilitates the evaluation of painful states and analgesic effect (BLEY et al., 2004).

A consensus published in February 2016 regarding behavioral signs of pain in cats considered some signals to be reliable and sensitive to assess pain in this species in many different clinical conditions. However, it is clear that more studies are necessary, especially regarding its clinical validity and applicability, considering the various levels of pain. The following signs were considered: difficulty to jump, abnormal gait, reluctance to move, reaction to palpation, withdraw/hiding, absence/reduction of grooming, playing/hunting less, appetite/feed-intake decrease, overall activity/movement decrease, less rubbing towards people, changes in general mood and temperament, hunched-up posture, changes in weight, licking or biting a particular body region or damaged area, lowered head posture, blepharospasm, change in form of feeding behavior, avoiding bright areas/photophobia, growling, groaning, and eyes half closed or closed. These behaviors were considered enough to infer pain, that is, if this signs are present the subject is in pain, but their absence does not exclude the presence of pain. Together with two other behaviors (straining to urinate and tail flicking) also considered reliable, but disagreeing on the

intensity of pain, these signs cover both the sensorial and emotional aspects of pain (MEROLA; MILLS, 2016).

According to the Guidelines for Recognition, Assessment and Treatment of Pain by World Small Animal Veterinary Association in 2014 (MATHEWS et al., 2014), behavioral alterations associated with acute pain in cats are: reduced activity, loss of appetite, quietness, hiding, hissing and growling (vocalization), excessive licking of a specific area of the body (usually involving surgical wounds), guarding behavior, cessation of grooming, tail flicking, and aggression. These guidelines add that changes in facial expression and posture might be pain indicators. These changes can be furrowed brow, orbital squeezing (squinted eyes), hanging head and hunched position, and/or a tense abdomen following abdominal surgery. Cats in severe pain are usually depressed, immobile, and silent. They will appear tense and distant from their environment (LAMONT, 2002).

These behaviors were reported in previous studies and were included in pain scales (BRONDANI et al., 2012; REID et al., 2017), however, some of them might reflect solely changes in cats' mood and not in the painful state. This proves the importance of the context, environment, and acclimation in feline pain assessment. Besides that, other factors such as age, underlying diseases, level of pain, type and duration of the surgical procedure or trauma, and individual variability must be considered.

There is currently no unique pain assessment tool that has been shown to be valid in a universal range of situations in cats. It is known that no single objective or subjective assessment strategy, such as physiological parameters, interpretation of behaviors, pathology or estimates of pain by others is considered sufficient by itself, therefore the use of scales capable of assessing several aspects (or dimensions) of pain is preferred.

### **Feline pain scoring tools**

According to the WSAVA Guidelines (MATHEWS et al., 2014), important factors that must be taken into account when assessing pain are: type, anatomical localization and duration of the surgery (when dealing with postoperative pain), as well as environment, individual variation, age, and clinical condition of the cats. Knowing the cat's normal behavior or routine is essential to detect alterations, such as the absence of normal behaviors, like rubbing and climbing the litter box, and the presence of new behaviors, like changing the temperament from friendly to aggressive or fearful, thus providing us alert

signs. First, the cat must be observed from a distance and then there must be interaction with the cat and wound palpation, aiming to thoroughly assess pain (Figures 1 and 2). Some cats might show subtle behavioral signals, especially in the presence of humans or other animals or under stressful situations. If sleeping, they should not

be awakened to assess pain, as resting and sleeping are good signs of comfort. However, it should be ensured that the cat is showing a normal posture (relaxed, curled up). Comfortable cats show relaxed facial expressions, posture, and movements after a well succeeded analgesic therapy (MATHEWS et al., 2014).

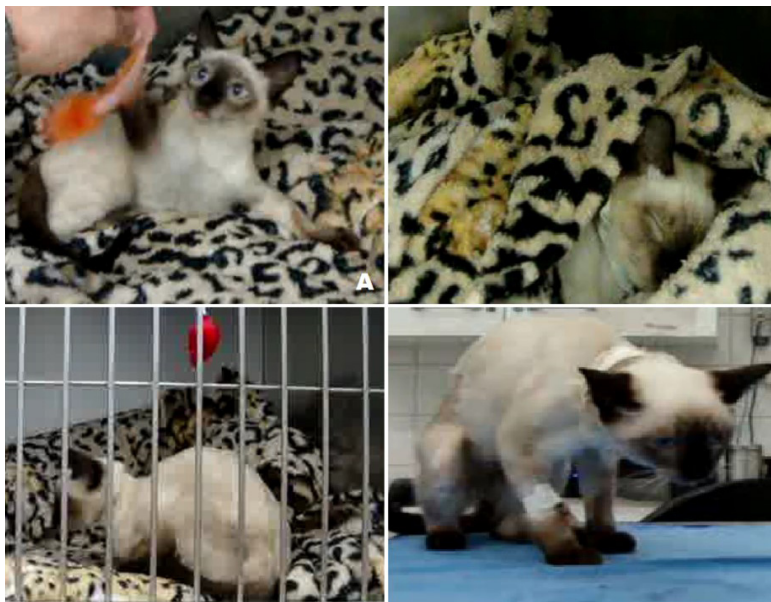


Figure 1 – Illustrations of normal postures and facial expressions and those that may be indicative of pain. (A) Cat showing normal/playful behavior before undergoing surgical procedure (elective ovariohysterectomy); (B) Sleeping, relaxed two hours after the procedure; (C) and (D) hunched posture and facial expression indicative of pain four hours after the procedure, requiring rescue analgesia – HOVET/USP – 2016



Figure 2 – Illustration of pain signals in a cat after interaction with observer and surgical wound palpation. (A) Normal posture and facial expression two hours after elective ovariohysterectomy; (B) Normal response to palpation of surgical wound two hours after the surgical procedure; (C) Facial expression indicative of pain and painful reaction to surgical wound palpation four hours after the procedure, requiring rescue analgesia; (D) Animal exhibiting normal behavior after adequate pain management – HOVET/USP – 2016

The widespread use of pain scales requires testing the validity (effectiveness with which a pain scale actually measures pain), sensitivity, and reliability (the error associated with a scale, the internal consistency, and intra- and inter-rater reliability) (STREINER; NORMAN, 2008).

To standardize the assessment and quantification of acute pain, different types of subjective scales were developed, such as the Simple Descriptive Scale (SDS), the Numerical Rating Scale (NRS), and the Visual Analogue Scales (VAS) (ROBERTSON, 2008), which are general pain scales also used for dogs. These scales have been proved reliable in comparing both one patient's pain intensity over time and the pain intensity among groups receiving different treatments. Nevertheless, they are not species-specific (TASK FORCE ON TAXONOMY OF THE INTERNATIONAL ASSOCIATION FOR THE STUDY OF PAIN, 1994). A variation of the VAS is the Dynamic Interactive Visual Analogue Scales (DIVAS), which includes physical interaction with the patient in addition to the observation of behavioral alterations and the assessment of physiological parameters (EPSTEIN et al., 2015).

Other scales combine the observation of spontaneous behavioral signs of pain and the qualitative response to palpation of surgical wound. One example is the Colorado State University Feline Acute Pain Scale. It presents scores that vary from zero to four based on behavior, attitude, and response to palpation in the postoperative period: score zero means that the animal is comfortable, happy, and does not react to wound palpation, representing minimal pain, while score four is attributed when the animal is vocalizing, reluctant to move, might be aggressive and even biting. The recommendation is that scores greater than or equal to two indicate moderate to severe pain and require rescue analgesia (HELLYER et al., 2006). This tool has been used for many years in feline practice, however its validity has not been tested.

The UNESP-Botucatu multidimensional composite pain scale for assessing postoperative pain in cats (31) was developed and validated for postoperative abdominal pain related to ovariohysterectomy. This scale presents ten items: posture, comfort, activity, attitude, miscellaneous behaviors, reaction to palpation of the surgical wound, reaction to palpation of the abdomen/flank, arterial blood pressure, appetite, and vocalization. The items are distributed in four dimensions or subscales: psychomotor change, protection of painful area, physiological parameters,

and vocal expression of pain. The multidimensional structure of the scale allows each aspect to be examined separately if a more meticulous evaluation is required. Furthermore, it allows the omission of certain subscales in case there is some technical difficulty in its evaluation (BRONDANI et al., 2012; BRONDANI et al., 2013). The final score reflecting the global assessment of pain intensity is obtained by the sum of the points given in all items and ranges from zero (absence of arbitrary pain) to thirty (maximum pain). The final scores classify pain as mild (0 – 8 points), moderate (9 – 21 points), and severe (22 – 30 points). Based on these scores, establishment of analgesic therapy (or reassessment of pain) should be considered for scores greater than or equal to eight, and is strongly recommended for scores greater than or equal to ten points. Nevertheless, analgesic therapy should also be instituted in case of scores lower than eight if clinical judgement indicates it (BRONDANI et al., 2013). This was the first validated pain scale for cats, however, some limitations to its use were reported regarding the influence of demeanor and anesthetic protocol including ketamine as confounding factors changing the pain scores (BUISMAN et al., 2016; BUISMAN et al., 2017).

The Glasgow Feline Composite Measure Pain Scale (CMPS – Feline) (CALVO et al., 2014) is a simple tool and its updated version (REID et al., 2017) was the first valid instrument to relate the psychometric analysis of clinical acute pain in cats also using facial expressions. Facial expressions of acute pain in cats were described by Holden et al. (2014) and incorporated into the new version of the CMPS-Feline (30). CPMS-Feline evaluates acute pain in seven behavioral categories: vocalization, activity/posture, attention to wound, caricature observation (ears and muzzle), response to manipulation/stroking, response to palpation of wound, and general behavior. Scores are attributed to each category and the maximum final score is twenty. Observers must consider analgesic intervention if the final score is greater than or equal to five (REID et al., 2017).

Correlation between the UNESP-Botucatu and the CMPS-Feline has been reported in one study (38). The results showed strong association between tools, but outcome for rescue analgesia would differ when using each of scales. Other factors that might influence the assessment of pain using scales are related to cultural and language differences, as well as observer's level of experience (BENITO et al., 2015; DOODNAUGHT et al., 2016).

The subjective nature of pain assessment and the difficulty in recognizing behavioral clues that might be indicative of painful states, especially in a hospital environment, are some of the inherent limitations of pain scales. Nevertheless, the advantages of using a pain scale include the awareness of the staff to the presence of pain in the clinical setting, implementation of standard procedures and guide attitudes towards pain, allowing the consistent assessment and monitoring the animal's response to analgesic administration (BORTOLAMI; LOVE, 2015). Choosing one scale over another depends on the familiarity with the tool, the animal's features and whether it is feasible in routine practice.

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