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## Aggressive behavior in cats exposed to trauma

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**ABSTRACT:** Aggressive behavior is an important behavioral problem in cats. This issue can occur as a reaction when there is disease or pain in a normal cat. The aetiology of the aggressive behavior is beyond disease and pain. The aim of this study is to evaluate the behavior changes of cats exposed to trauma using behavior scoring system and demeanour scoring system. This study is consisted of 135 cats of different breeds, ages and genders with high rise syndrome and traffic accidents. These cats were given a detailed clinical and radiological examination. Demeanour scoring system, behavior tests, and visual analog scale were used to identify behavior changes and pain in cats. The findings from this study showed that cats exposed to trauma may experience behavioral changes or aggression, and this may result from pain or stress from trauma.

**Keywords:** Aggressive behavior, Behavioral changes, Cats, Trauma

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## INTRODUCTION

Aggressive behavior, which remains a current subject in cats, is a complex phenomenon that depends on genetics and many different environmental factors (Penar and Klocek, 2018). Among the factors that lead to aggressive behavior, biochemical and physiological processes, psychological factors including tendency and mood, emotional reactions, motor actions and vegetative reactions, and environmental factors such as false socialization, hostile environment or irresponsible animal owners are very important (Penar and Klocek, 2018). Aggressive behavior is defined as “attacks, attack attempts or attack threats” and this definition does not necessarily include the desire to harm aggressive behavior (O’Hearem 2009; Penar and Klocek, 2018). Behavioral issues of cats include drawing furniture, aggressive behavior, anxiety, overstimulation, and exaggerated vocalization. Both passive and active aggressive behavior is a more common problem (Strickler and Shull, 2014; Penar and Klocek, 2018).

Aggressive behavior can occur as a reaction when there is disease or pain in a normal cat (Camps et al., 2015). If a cat is suffering, the normal touch of its owner can be very disturbing, and the animal can instinctively respond with aggressive behavior (Camps et al., 2015). Aggressive behavior also disappears if the underlying cause is removed or the disease is cured (Penar and Klocek, 2018). On the contrary, in some cases, aggressive behavior or aggressive response of the animal is not always disappearing, cat not as tolerant any longer for manipulation due to bad experience.

Behavior scoring system has been developed for domestic cats to evaluate their responses to stress, as the Zeiler et al., (2014) aimed at detecting a change in behavior in healthy cats undergoing short-term hospitalization. Recent advances in pain scoring that Mills et al., (2020) investigated the correlation between behavior problems and painful processes, have been recorded in cats and dogs. However, the nature of the cat (the individual temperament or friendly, confident, shy, protective or wild) is not taken into account when describing the type of aggressive response. Any cat that is not friendly and does not feel confident could incorrectly be classified as suffering. Increased stress worsens the perception of pain, and recovery is delayed in healthy cats (Zeiler et al., 2014). Stress may not be the source of pain, but all stress factors can alter behavior. Therefore, it is important to determine

an effective behavior scoring system, the individual temperament of the cat and changes in daily behavior in the home context or in hospitalization. It will be more sensitive to detect pain by adding individual temperament and behavior to pain scoring systems.

The visual analog scale (VAS) consists of a 100 mm line labeled “no pain in one end” and “extreme pain” in the other, and the pain indicating the line is scored by the blind author (Tan and Yayla, 2018; Yayla et al., 2019).

High Rise Syndrome (HRS) is a term used to describe cats falling from two or higher floors, resulting in injury or less often death (Vnuk et al., 2004).

The aim of this study is to evaluate the behavior changes of cats exposed to trauma using behavior scoring system and demeanour scoring system.

## MATERIALS AND METHODS

The study was conducted on cats following approval by the Animal Research Local Ethics Committee of Dicle University (Dicle Universty-HADYEK, E--020-73418).

### *Study animals*

Permission was obtained from the owners and clinical protocol was recorded before starting the study.

The study material consisted of 135 cats of different breeds, ages and genders with high rise syndrome and traffic accidents between 2019 and 2020 at Dicle University Faculty of Veterinary Medicine, Department of Surgery. These cats were given a detailed clinical and radiological examination. In addition to neurological and orthopedic evaluation, major trauma protocol was applied in all cases. In addition, all cats in the study were injected with Tranexamic acid (Transamin® 5% ampoule, Teva, IV) and Methylprednisolone (Prednol L® 20 mg, Mustafa Nevzat, IM) for a possible internal bleeding, spinal cord injury and shock picture that may develop. Fluid support was provided for (0.9% NS, 0.09% NaCl®, Baxter, IV). Then the evaluation of the cats was carried out as follows.

### *Usage and evaluation of scales*

In previous studies, “Demeanour scoring system (DSS)” used by Zeiler et al. (2014) and “behavior test (Owner-assigned response scores)” used by Vaisanen et al. (2007) were used to identify behavior changes in cats included in the study. In addition, visual analog

scale (VAS) was used to evaluate the pain (Merola and Mills, 2015; Yayla et al., 2019).

DSS consisted of 8 multiple choice questions (5 hands-off and 3 hands-on questions) to describe the cat's movement. Each question was given a score of 0 to 5 depending on the option selected, and the total DSS score is the simple sum of the answers to all questions (Table 1). Owner-assigned response scoring, which is a behavior test, consisted of two parts as previously described (Vaisanen et al., 2007). The first part consisted of a list of 10 individual aspects of cat behavior. This included overall level of activity, time spent sleeping, playfulness, aggressive behavior (as table 1), closeness (ie, the cat's desire to be in close proximity to a person), willingness to stay on the lap, attention seeking, withdrawal or hiding, vocalization (other sounds other than purring or hissing), purring, and appetite. This scoring was as follows; significantly increased (+2), increased to some extent (+1), no change (0), decreased to some degree (-1) and clearly decreased (-2). The second part consists of 9 statements about the behavior that the owners are asked to indicate the degree of observation about the time it takes to be brought to the hospital after trauma. Cats move differently than normal, have a lower posture than normal, have a different attitude than normal, sleep in different positions than normal, sleep in dif-

ferent places than usual, restless than normal, scary than normal, vocalize differently than normal and respond differently than normal. The answers received were clearly yes (+2), to some extent yes (+1) and no (0).

The VAS consisted of a 100 mm line labeled "no pain at one end" and the other "extreme pain", and the perceived pain intensity indicating the line was marked by blind writer.

While scoring, one researcher person (first author) met with the patient owners (Table 1, DSS score) and each cat was evaluated by this person (first author) immediately after trauma.

For the cats included in the study, it was recorded that age, gender, breed, whether they had undergone surgery before. In addition, the cat's position in the family (0 = only one animal; 100 = full member of the family), and now anxiety or degree of distress (0 = not at all stressed; 100 = extremely stressed) were noted. Also, cats with aggressive behavior in their history towards humans and veterinary clinics were not included in the study. All these evaluations were made by a single person (SY) immediately after the trauma. Subsequent follow-up continued for a week, either by phone or face to face.

**Table 1.** The total range of total scores obtainable (0 to 25) divided into the five different demeanour categories (from Zeiler et al., 2014).

Total Score	Category	Definition of category and note on possible link with pain scoring systems
0	Friendly and confident	Cat is "loveable" with attention seeking. Will approach handler for human-cat interaction. The pain score may be considered true as these cats are assumed to be able to reflect their true demeanour.
1-8	Friendly and shy	Cat is friendly and "loveable" when handled but will not seek interaction with human. These cats may mask pain and thus the score obtained in the pain score may be lower than the true pain experienced.
9-18	Withdrawn and protective	Cat remains ridged and appears "uneasy" when handled. Handler does not feel in danger of being attacked by cat during handling. These cats may mask pain very well. The pain score may be lower than the true pain experienced.
19-24	Withdrawn and aggressive	Cat is ridged or frozen and may demonstrate pawing, biting, or clawing when handled. May or may not be associated with growling. Handler feels in danger of being hurt when handling this cat. These cats may mask their pain very well. The pain score may be lower than the true pain experienced.
25	Overtly aggressive	Handler at risk of being injured when handling this cat. Cat makes aggressive gestures including hissing, growling, pawing, clawing and rapid aggressive movement towards handling attempts. These cats are a challenge to handle and evaluate correctly. This makes pain scoring a challenge or perhaps even impossible.

**Table 2.** Distribution of patients evaluated and scoring scale

Cause of trauma		DSS					Total
		1 (0)	2 (1-8)	3 (9-18)	4 (19-24)	5 (25)	
High rise (n=110)	Medical treatment	12	8	6	3	3	32
	Surgery	35	21	14	7	1*	78
Traffic accident (n=25)	Medical treatment	2	2	1	1	1	7
	Surgery	7	5	3	1	2	18
Total		56	36	24	12	7*	135

\*shows statistically different in each row,  $P < 0.05$

**Table 3.** Scores consist of two part for the extent of change in various behaviors

Part I	clearly decreased (-2)	decreased to some extent (-1)	no change (0)	increased to some extent (1)	clearly increased (2)
Overall level of activity	41	32	21	5	1*
Time spent sleeping	4*	14	21	29	32
Playfulness	1*	6	14	35	44
Aggressive behavior	0*	0	92	3	5
Closeness	0*	5	18	35	42
Willingness to stay in the lap	2*	8	57	23	10
Attention seeking	10	14	31	25	20
Withdrawal or hiding	8	15	42	24	11
Purring	25	23	35	12	5*
Appetite	17	26	24	23	10

\*shows statistically different in each row,  $P < 0.05$

Part II	no change (0)	changed to some extent (1)	clearly changed (2)
Way of movement	15	35	55
Posture (lowered)	40	32	28
Demeanor	32	37	31
Sleep (position)	41	30	29
Restlessness (increased)	65	27	8*
Fearfulness (increased)	60	24	16
Vocalization	65	21	14
Response to touch	55	27	18

\*shows statistically different in each row,  $P < 0.05$

### Treatment protocol

Operations such as orthopedic surgery and palatotomy were performed under general anesthesia (2-3 mg/kg Xylazin (Rompun®, Bayer 20 mg/ml/im, 10-20 mg/kg dose Ketamine (Ketaso®I, Interhas, 100 mg/ml/im) in cats. Postoperative analgesia management (meloxicam (Metacam® 20mg / ml IV) was performed for 3 days. Also, other cats that did not undergo surgery received medical treatment for wound or soft tissue damage.

Data on the post-treatment period of all animals undergoing surgery and receiving medical treatment were not included in the study, since standardization cannot be achieved.

Behavioral tests were performed after trauma and operative situations were not included.

### Statistical analysis

Statistical analysis of the data was performed using the Minitab-17 software package. All data from the study were considered nonparametric, and for calculations, the sign test of median was used with  $P < 0.05$  was accepted as significant.

### RESULTS

It was determined that the cases included in the study were cats with 81.48% high rise syndrome and 18.52% affected by traffic accident. Sixty-three (46.66%) of the cases were male and 72 (53.34%)



were female. The cases were distributed between 1 and 8 years in terms of age. Body weights of the patients varied between 0.8 kg and 4.5 kg. There was no statistically significant difference in body weight, age and gender.

Distribution of patients evaluated and scoring scale (Table 2) and scores of change in various behaviors (Table 3) are summarized in tables.

According to DSS, aggressive behavior was observed in 7 of all cases at the time of arrival to the clinic and this was found statistically significant ( $P < 0.05$ ). In addition, 4 of these 7 affected cats did not have any orthopedic disorders (such as osteosynthesis, vertebral stabilization) or other conditions requiring surgical treatment (such as cleft palate, hernia, tissue loss wounds). It was learned that these cats returned to condition before trauma on the 3rd day during hospitalization or after discharge (Table 2). However, a significant behavioral change was not observed in 56 cats who received medical treatment (14) and undergoing surgery (42) (Table 2).

In the behavioral change scale results, a statistically significant difference was observed, especially in terms of aggressivity, similar to DSS (Table 3).

There was no significant difference between high rise (mean 35, min 0- max 89) and traffic accidents (mean 42, min 0- max 95) in cats evaluated with VAS. There was a significant difference between those who undergoing surgery (mean 38, min 0- max 85) and those who received medical treatment (mean 41, min 0- max 90). In addition, the VAS score (mean 75, min 60- max 95) of 7 patients with 5th grade in DSS was higher than the others.

## DISCUSSION

Behavioral scores have been defined to evaluate behavior changes in cats against various stressors (Zeiler et al., 2014). DSS and owner-assigned response scoring have been recently used by different authors, and their results have been reported (Zeiler et al., 2014; Vaisanen et al., 2007). In our study, we aimed to evaluate the behavior changes of cats exposed to trauma by using these two tests and VAS.

Recently, many scales related to pain in cats and dogs have been described, and many of them have been used especially in the assessment of postoperative pain (Tan and Yayla, 2018; Yayla et al., 2019). However, in these pain tests or scales, many situations

related to cat's behavior are not considered. Some behaviors such as the habitus and friendly, confident, shy, protective and wild behaviors are important in cats. Increased stress aggravates pain and delays recovery. Stress factors may not cause pain, but they do cause a change in behavior. Therefore, an effective behavior scoring system should consider the cat's individual temperament and be able to monitor daily behavioral changes. If individual temperament and behavior are included in pain scoring systems, it may be more sensitive in detecting pain (Brondani et al., 2011; Gaynor and Muir, 2009; Zeiler et al., 2014). In our study, while VAS was used as pain score, DSS and owner-assigned response scoring were used together in terms of behavioral changes. Three different scales covering both animal behavior and pain issues were evaluated together.

Feline behavioral experts have shown the types of aggressive behavior as aggressive behavior caused by lack of socialization, play aggressive behavior, aggressive behavior associated with petting, redirected aggressive behavior, pain-associated aggressive behavior, predatory behavior and inter-cat aggressive behavior (Tuzio et al., 2004). It is also important to understand normal behavior in cats as stated in the guide. Besides, knowing normal social behavior and communication can prevent aggressive behavior (Tuzio et al., 2004).

The aggressive behavior of felines is a complex issue (Penar and Klocek, 2018). Aggressive behavior can occur in cats due to many different causes. Hunger, thirst, pain, all sorts of disappointment, as well as fear, are among the causes (Beata, 2001). The cause may not always be pain or a disease, and this cause is sometimes difficult to determine (Camps et al., 2015). In our study, trauma stress was considered as the cause of aggressive behavior and therefore this study was conducted on cats exposed to trauma. As a source of trauma, cats with traffic accident and high-rise syndrome were chosen. Aggressive behavior appeared in only 7 of 135 cats. Pain management and medical treatment were performed in 4 of 7 cats. Therefore, we do not think that aggressive behavior in cats exposed to trauma is related to the severity of trauma. In addition, the cat's aggressive behavior or predisposition to aggressive behavior or other individual characteristics may be more important than trauma stress.

Another important issue in controlling post-traumatic pain or aggressive behavior change is the patient's home care and the relationship with the owner

(Camps et al., 2015). The cat's attitude towards the owner at home or its relationship with other animals should be evaluated. Post-traumatic cats can be normal at home while very aggressive in the veterinary clinic. On the contrary, if conditions such as nutrition or wound care cannot be achieved when aggressive movements are observed at home, this should not be neglected. On comforting measures, the owner of the cat should be warned or recommended. Scoring should be done to evaluate pain and effective pain management should be applied. According to the results obtained in our study, it was seen that 5/7 of the cats who had aggressive behavior were calmer at home, only when they became aggressive in the clinic. The other two cats were observed to be aggressive towards their owners, but these cats returned to normal when their treatment was completed.

Understanding aggressive behavior in cats is a very different matter. Communication with the cat is important both for the examination of the cat without any damage and for the veterinarian to prevent damage and for the simple interventions. Cat owners also worry that their cats are suffering from pain. There-

fore, it is necessary to deal with aggressive behavior in cats. Owners of cats as well as veterinarians should be aware of the types and causes of aggressive behavior in cats. It should be thoroughly evaluated in terms of aggressive behavior or behavior change.

## CONCLUSION

As a result, it should be known that cats exposed to trauma may experience pain, even if there is no orthopedic disorder or surgical treatment, and that pain or trauma stress can cause behavioral changes. In addition, we think that the behavioral categories in Table 1 should be known and taken into account in the treatment process.

An interesting finding was that only 7 out of 135 cats displayed aggressive behavior according to the behavioral scores we used. It is also noteworthy that the remaining cats did not change despite their potential to exhibit aggressive behavior.

## CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

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