Analysis on elective claw removal surgery in domestic cats: pathological changes and legislation in contrast with the conceptions of the owners

Análise sobre cirurgia eletiva de remoção de garras em gatos domésticos: mudanças patológicas e legislação em contraste com as concepções dos proprietários

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Raíssa Coutinho de Lucena
Master Student in Veterinary Medicine
Institution: Universidade Federal Rural de Pernambuco (UFRPE)
Address: Rua Dom Manuel de Medeiros, Dois Irmãos, Recife - PE
E-mail: raissaclucena@gmail.com

Leonardo Borges de Lima
Graduate in Veterinary Medicine
Institution: Universidade Federal Rural de Pernambuco (UFRPE)
Address: Rua Dom Manuel de Medeiros, Dois Irmãos, Recife - PE
E-mail: borgesmedvet@hotmail.com

Rebeca Paes Barreto Valdez
Graduate in Veterinary Medicine
Institution: Universidade Federal Rural de Pernambuco (UFRPE)
Address: Rua Dom Manuel de Medeiros, Dois Irmãos, Recife - PE
E-mail: rebecabarretocrato@gmail.com

Maria Vitória dos Santos Lira
Graduate in Veterinary Medicine
Institution: Universidade Federal Rural de Pernambuco (UFRPE)
Address: Rua Dom Manuel de Medeiros, Dois Irmãos, Recife - PE
E-mail: vitorioa_109@hotmail.com

Carlos Henrique Costa de Almeida Junior
Graduate in Veterinary Medicine
Institution: Universidade Federal da Bahia (UFBA)
Address: Avenida Reitor Miguel Calmon, Vale do Canela, Salvador - BA
E-mail: chc.almeida@outlook.com

Maria Clara Breda Dias
Graduate Student in Veterinary Medicine
Institution: Universidade Federal Rural de Pernambuco (UFRPE)
Address: Rua Dom Manuel de Medeiros, Dois Irmãos, Recife - PE
E-mail: clarabreda03@gmail.com
Cats have been gaining space as a preference when choosing a companion animal due to their compatible nature with today's society. However, the growing wave of feline indoor breeding finds a contrast in relation to the need to use claws as a behavioral and physiological mechanism. In this way, surgical techniques aimed at removing this problem have gained ground throughout several countries. Onychectomy and digital flexor tenectomy are two surgical approaches to removing claws or their potential use. Both techniques are elective and unnecessary for maintaining the integrity and health of
the animal. Short- and long-term pathological analysis demonstrated the appearance of alterations, initially with the expression of pain, lameness and behavioral changes. Over time, there is the possibility of developing degenerative joint disease. The constant stress resulting from pain in a chronic process leads to physiological manifestations such as: interstitial cystitis, tumor processes, dermatopathies, oral diseases such as constant stomatitis, coagulopathies, ease of acquiring infectious processes in wounds and neuropathic diabetes. In this way, tutoring a feline implies adapting to its inherent characteristics, including the need to use its claws as a form of expression.

**Keywords:** claws, surgical removal, chronic pain, laws.

**RESUMO**
Gatos vêm ganhando espaço como preferência na escolha de um animal de companhia devido à sua natureza compatível com a sociedade atual. Porém, a crescente onda de criação indoor dos felinos encontra um contraste em relação à necessidade de utilização das garras como mecanismo comportamental e fisiológico. Dessa maneira, técnicas cirúrgicas com objetivo de remover esse problema ganharam espaço ao longo de diversos países. A onicectomia e a tenectomia flexora digital são duas abordagens cirúrgicas para remoção das garras ou do seu potencial de utilização. Ambas as técnicas são eletivas e desnecessárias para a manutenção da integridade e saúde do animal. A análise patológica a curto e longo prazo demonstrou o surgimento de alterações, inicialmente com a expressão da dor, claudicação e mudanças comportamentais. Com o passar do tempo, ocorre a possibilidade do desenvolvimento de doença degenerativa de articulação. O estresse constante decorrente da dor em processo de cronicidade acarreta em manifestações fisiológicas como: cistite intersticial, processos tumorais, dermatopatias, doenças orais como estomatites constantes, coagulopatias, facilidade em adquirir processos infecciosos em ferimentos e diabetes neuropática. Dessa maneira, tutelar um felino implica em adaptar-se às suas características inerentes, incluindo a necessidade de utilizar suas garras como forma de expressão.

**Palavras-chave:** garras, remoção cirúrgica, dor crônica, leis.

**1 INTRODUCTION**
Domestic cats emerged as direct descendants of the wild African cat (*Felis silvestris* L.) (BRADSHAW et al., 2012). From the jungle to our sofa, its domestication dates back over 9,000 years in Cyprus (FEUERSTEIN & TERKEL, 2008), and these animals have been revered, deified, and mystified by multiple civilizations over the years. There is no evidence indicating that their domestication process was utilitarian. However, hypotheses have emerged to explain the mutualistic character that society has developed with domestic cats, from the predation of crop rodents to potential companion animals, since both cats and humans were getting used to mutual coexistence (BROWN & BRADSHAW, 2014).
Currently, the domestic feline is one of the most popular animals in European households, representing 24% of warded animals (EUROPEAN PET FOOD INDUSTRY FEDERATION, 2017). In Portugal, annually, the search for human-feline interaction grew from 3% to 25% in 2011 (BRADSHAW et al., 2012). In São Paulo, Brazil, Canatto et al. (2012) conducted a demographic study of the feline population and concluded that for every 19.33 São Paulo's citizens, there was one feline guardianship. Thus, domestic cats, with their ease of handling, subtlety in their way of expressing affection, and an incredible adaptation to indoor life, represent a more intimate companion animal, which allows them to strengthen ties with their tutor in the perfect way (BROWN & BRADSHAW, 2014).

The cat has always been an animal whose presence divides opinions regarding its personality. The mysticism that permeates the species is undeniable and has accompanied its presence and domestication throughout history (SERPELL, 2014). Over the years, this love and superstition combination has marked a human-feline relationship of mutual benefit for those who know how to appreciate those (BEAVER, 2003). Aside from love, the domestic cat has always been shrewd enough to be seen as an alternative to pest control in exchange for shelter and food. Kotrschal et al. (2014) point out the vast difference between urban and rural views of the domestic cat. In urban areas, cats finally conquered human affection and gained an important role within the family nucleus.

The accelerated urbanization process, in addition to a decreasing human aversion to cats, brought them into homes, and the routine decision to keep exclusively indoors turned them preferable (MCLEOD et al., 2015). However, the decrease in feline access to external environments did not reduce its genetic, immutable, and species-inherent habits, such as constantly sharpening with claws (FOREMAN-WORSLEY & FARNWORTH, 2019).

Landsberg (1991) indicated that the feline's natural scratching behavior occurs for four purposes: forelimbs elongation, olfactory territorial marking, individual visual marking, and healthy claws maintenance. When scratching a favorable surface, its old claws lose the aged layers, exposing new layers growing underneath (YEON et al., 2001). Although McKeown et al. (1988) state that the scratching process is not essential for this renewal process since the keratinized layers can fall on their own or be removed with the teeth, its removal corresponds to behaviors beyond animal physiology.
Beaver (1980) states that a puppy begins to show scratching behavior at 35 days and discovers the retraction capacity of its claws at four weeks. In addition to external physical factors, scratching is a form of social interaction and communication between cats. Puppies use these moments as integrative social activities, where fun and social approximation can occur. The primary role of the cat's scratching behavior is believed to be for communication, and it is of extreme intraspecific importance (BENNET et al., 2017).

Scratching is also connected to the degree of stress that the animal is subjected to, such as the presence of other animals or changes in the environment (BRADSHAW & HALL, 1999). Naturally, the cat will choose a location whose preferences will determine the frequency and intensity of use in the home (LANDSBERG, 1991). However, the guardians' reaction to the scratching, such as punishment, increases the animal's anxiety and increases the behavior considered inappropriate (BEAVER, 2003). Thus, controversial surgical techniques arise in order to remove the cat claws' potential use. However, the instinct to scratch is so inherent to the animal that they continue to present the claws' gestures of retraction and exposure even after undergoing the surgical removal procedure.

This review aims to establish the morphofunctional consequences of the onychectomy or digital flexor tenectomy procedures in domestic cats and analyze the veterinary discernment on the legislation regarding this practice in different countries. In the end, the search for the tutor's perception concerning the practice is inherent so that alternative forms of claws wear can be implemented.

## 2 AVAILABLE SURGICAL TECHNIQUES

### 2.1 ONYCHECTOMY

Common in the United States and Canada, onychectomy is a surgical procedure whose sole objective is to preserve the material possessions of the animal's guardians. Studies show that 24.4% of cats in the United States have undergone the procedure (PATRONEK, 2001). Onychectomy is characterized by a distal phalanx amputation of each animal's finger with a sterile instrument in the form of a guillotine. The third phalanx disarticulation procedure can be done with a manual scalpel or laser. The articular base with the digital flexor tendon remains connected to the remaining structures (CLARK et al., 2014).
It is an elective technique, unnecessary for the animal's integrity and health maintenance. The laser procedure appears to be the fastest option and presents fewer complications related to animal stress levels (MILLS et al., 2016). However, the long postoperative period has several reported complications, including pain (ROBINSON et al., 2007).

2.2 DIGITAL FLEXOR TENECTOMY

The tendon transection related to the deep digital flexor muscle is a surgical approach that inhibits the claws' extension without removing it (YEON et al., 2001). The incision occurs on the first digit ventral surface, and a prior dissection is performed to remove a 0.5cm portion of the deep digital flexor tendon. It has the same purpose as the onychectomy, i.e., removing the claws' potential use but aiming for a simpler postoperative period with a reduced chance of long-term pain.

3 MORPHOFUNCTIONAL CONSEQUENCES

3.1 SHORT AND LONG TERM PATHOLOGICAL ANALYSIS

Several studies report pain expression in cats that have undergone surgical approaches of claw removal (CLOUTIER et al., 2005; HOLMBERG & BRISSON, 2006; CURCIO et al., 2006). Tobias (1994) indicates that, in the short term, it is possible to observe hemorrhage due to the paws' use as support, edema, and possible local infection, lameness due to pain, and drastic changes in the animal's behavior. Pollari and Bennett (1996) report that 53% of the animals undergo the removal technique combined with ovariosalpingohysterectomy or bilateral orchiectomy, increasing the potential risk of postoperative complications.

Anatomically, claws are epidermis' modifications covering the nail bed and nail process. It is formed by two parts: the keratin cuticle, which surrounds the nail bed, and the horn, which protects the nail process. The claw grows from the root of the keratin cuticle (CLARK et al., 2014). A common long-term complication of these surgeries is claw regrowth, which occurs at a rate of up to 15.4% depending on the method used to remove the phalanx (JANKOWSKI et al., 1998; CLARK et al., 2014). Martell-Moral (2017) used radiographs to infer that 63% of the animals had residual fragments of the third phalanx, even after performing a complete onychectomy, and four animals had new externally visible claws growth.
In the long term, problems following surgery are reported, such as chronic back pain and uninterrupted lameness. Clark et al. (2014) also reported that 42.3% of the cats experienced pain when handled in the paws. The use of neural blockers with systematic analgesia as a multimodal anesthetic for cats undergoing onychectomy is the most used standard surgical procedure. However, Curcio (2006) indicated that this anesthetic protocol does not reduce postoperative discomfort. Thus, after the removal procedure, the animal experiences pain when it wakes up from anesthesia and continues chronically, affecting its posture, walking, and stretching.

The third phalanx removal forces the animal to support its body weight using only the remaining cartilaginous interphalangeal tissue and the second phalanx. This inevitable and unnatural effort can develop exertional arthritis and chronic pain where the skeletal muscles exert high digital pressure. The lack of support is also responsible for lameness, fear of walking, and persistent pain in the spinal region.

Pain is a multifactorial mechanism that results in functional, affective, and behavioral changes (ROBERTSON, 2005). Several previously uncorrelated clinical conditions arise when it reaches chronicity due to a body's constant physiological stress. In cats, beyond the degenerative joint disease development or feline arthritis, the animal can present, in the long term, interstitial cystitis, tumoral processes, dermatopathies, oral diseases such as constant stomatitis, coagulopathies, increasing of infectious processes in wounds, and neuropathic diabetes (COSTIGAN & WOOLF, 2009; ROBERTSON, 2005). In 1993, a study demonstrated that animals undergoing onychectomy increased adrenergic concentrations, significantly increasing norepinephrine, which, in excess, is related to pain mechanisms (LIN et al., 1993).

3.2 BEHAVIORAL DEVIATIONS

Onychectomy creates unnecessary behavioral problems because it means removing an anatomical portion of great value to a predator. Without claws, cats have increased biting behavior as a defense and replacement mechanism. Aggressive behavior and excessive licking are also reported. Many cats express pain with a behavioral change or inadequacy in keeping the litter box clean. Tutors report that the animals began to experience difficulty keeping the environment clean due to periuria and an intense aversion to limb palpation (KOGAN et al., 2016).
Yeon et al. (2001) reported that 78% of the cats kept the scratch instinct and body stretch even after complete recovery from claw removal. However, even after some studies indicating changes in the behavioral patterns, some veterinarians do not see the association of the practice with long-term personality changes (KOGAN et al., 2016). Morgan and Houpt (1989) analyzed the onychectomy influence in cats according to the guardians' perception. The only reported categorical difference was the increase in table and balcony jumping in animals after the procedure. A previous telephone survey on the same theme confirms this same result of a strong appeal to the jump towards higher surfaces (BENNET et al., 2017).

4 VETERINARIANS' PERCEPTIONS

There is no consensus in veterinary medicine about the performance of aesthetic procedures with a high potential for long-term complications. In Europe, many veterinarians consider both removal techniques an act of abuse that should be illegal (MERTENS & SCHAR, 2014). In places where the practice is frequent, it is still seen as unusual and unacceptable by the vast majority. Cats without claws have enormous disadvantages in activities inherent to the species, such as hunting, climbing, dominance demonstration, and various feline social relationships (FRAZIER, 1981; HERIOT, 1980).

In Canada, where the practice is legal, some professionals choose not to perform the technique because they consider it unethical (KOGAN et al., 2016). Alternatively, Swiderski (2002) encourages environmental change and the use of behavioral modification techniques. There are non-invasive and temporary methods, such as plastic covers fixed in the keratin sheath. The lack of consensus in the medical community regarding short-term physical consequences, behavioral impact, and effects on feline well-being divides the veterinary community, particularly concerning peridomicile and shelter-dwelling cats.

However, several veterinarians disagree with the dehumanization aspect and consider onychectomy an alternative to euthanasia or abandonment when the cat has behavioral issues (FOX, 1974). McKeown et al. (1988) state that the most significant advantage is the permanent solution to the animal's destructive behavior. For Sis (1971), surgery has only advantages and does not condone evidence of chronic postoperative pain.
Kogan et al. (2016) found, through an online survey among veterinarians with an active license in Ontario, that 91.2% had already performed onychectomy/tenectomy, with 75.8% being the leading surgeon during the technique. Twenty-five percent of professionals responsible for the removal believe that the postoperative period brings pain in both the short and long term. Many believe that the procedure is a form of mutilation but an alternative to euthanasia for cats with persistent behavioral problems.

5 TUTORS' PERCEPTIONS

Landsberg (1996) surveyed the tutor's preference on the average age for performing the removal. Seventy percent of the cats had undergone surgery between six and 12 months of age, and 69% had undergone the sterilization procedure in the same anesthetic protocol, increasing the chances of postoperative complications. Also, according to the author, some animals were already donated without claws due to the early approach (two months).

The feline tutors give multiple reasons for submitting the animal to the surgical procedure for the claws removal. However, the primary justification is damage to furniture by the act of scratching. Twenty-nine percent of tutors feel uncomfortable with the possibility of injury when playing or affective touching. There is also a concern for other animals and the need for imposing discipline through the punishment of cats that do not meet the owner's behavioral expectations. Four percent of guardians answered that they would never keep indoor cats if claws were kept.

For these animals' owners and people who share the same thinking, the benefits are extreme, such decrease in furniture damage and accidental scratches, and more safety for children and other animals. Owners feel less anxious about the animals, and discipline/punishment is rarely necessary.

Although the scratching instinct remains, the effect desired by the guardians is reached, while the animals' is not. Landsberg (1996) reports better results in the tutor-animal connection, improving the relationship that possibly previously did not exist. In their survey, four percent of tutors reported dissatisfaction, considering the procedure negative, feeling dissatisfied and guilty for submitting the cat to a surgical approach.

In an analysis performed by Gerard et al. (2016) looking for the connection between clawless cats and the typical felines' cleanliness maintenance, it was found that 28.6% of 120 in their sample number misused the litter box as behavioral change. Yeon
(2001) evaluated 98 tutors whose animals underwent onychectomy or digital flexor tenectomy. Before surgery, 49% were afraid of injury when playing, 90% justified the interest in keeping an indoor routine, and 78% were induced by the medical community or people in their social life. At the behavioral level, 78% remained with the typical scratching movement and the rate and intensity of bites, which used to be little or non-existent, increased exponentially. Sixty-seven percent of the animals that underwent onychectomy presented pain expression, and 69.2% decreased their activity level immediately after surgery.

However, after a study with 103 shelter-dwelling cats, Fritscher & Ha (2016) supported the non-association between animals without claws and increased biting behavior as a defense mechanism. The behavior may be rarer in shelters due to the number of animals in the same space. Rather than adopting typical aggressive territorial behavior, cats in shelters tend to practice a peaceful individual strategy in response to stress (CARLSTEAD et al., 1993). Regarding how long the animal stays in the shelter, there was a subtle difference between whole animals and animals without claws.

6 LEGISLATION AND ETHICS: AN AMBIGUOUS COMBINATION

It is estimated that around 28 countries have already banned onychectomy or digital flexor tenectomy practices and consider it a crime against animal welfare/nature (KOGAN et al., 2016). In 2005, a section about animal cruelty was added to the US Penal Code. The American Association of Veterinary Medicine (AVMA) made a detailed pronouncement in 2005 regarding onychectomy (KOGAN et al., 2016). The practice is no longer completely justifiable. For AVMA, it is necessary to instruct tutors about other alternatives and that the behavior is considered normal and inherent to the species. However, the onychectomy continues to be performed to avoid animal abandonment, and the decisions must respect the dialogue between tutor-veterinarian. The American Association of Feline Practices recognized in 2002 that the medical procedure is unnecessary and, there is a risk of postoperative complications even in low occurrence (GRIER & PETERSON, 2005).

In Canada, in 1988, the Human Practices Committee of the Canadian Veterinary Medical Association (CVMA) announced that veterinarians who performed and advised the onychectomy practice should report the possible occurrence of changes in the animal's behavior after surgery (CANADIAN VETERINARY MEDICAL ASSOCIATION,
Landsberg (1991) conducted a survey that revealed that 4% of cat owners in Canada are unwilling to keep the animal if they have not had a previous onychectomy. Veterinary doctors in Ontario say that several animals would lose their homes due to abandonment if the practice were banned in Canada, representing an average of 40,000 cats per year living on the streets due to the maintenance of their claws.

Meanwhile, in Brazil, the Federal Council of Veterinary Medicine (CFMV) guarantees the prohibition of aesthetic surgeries that impede the expression of the species' natural behavior by Resolution Nº877, 2008. According to the resolution, it is reaffirmed the veterinarian obligation of promoting animal welfare. The legislation, associated with the actions of several non-governmental organizations in favor of animal rights, gains strength and allows effective inspection implementation (CFMV, 2013).

However, Pereira (2017) conducted an experiment in 50 cats submitted to onychectomy and sterilization using meloxicam as an analgesic strategy. In Brasília, Andrade (2016) conducted a survey on sarcoma applied to felines and observed 13 listed animals undergoing "convenience onychectomy" within its sample group of followed-up surgical cases. The practice is known, widespread, and accepted among veterinarians who are adept at elective aesthetic procedures. Torres (2017) demonstrated the extreme need to create a program to publicize these procedures to inform the population about the harm involving elective aesthetic procedures.

**7 CONSCIOUS ALTERNATIVES TO ONYCHECTOMY**

**7.1 SCRATCHER AS THE MAIN PART**

Guarding an animal is taking on a role whose patience must be linked to motivating love. Kittens need training and attention to become compliant adults without the characteristic behavior considered destructive by some guardians. Raising indoor cats needs adaptation to the cats’ natural scratching and climbing behavior. Scratchers offer a great alternative to avoid damages to the furniture and keep the animal's impulses. Landsberg (1991) reports the need for initial confinement in an environment free from hazards and potential losses.

The scratcher should become the main piece of the room, encouraging the inherent feline curiosity. Often training is unnecessary once cats are intuitive and territorial animals about the objects they take for themselves. Some animals may need more than one piece distributed around the area they circulate (DUNBAR & BOHNENKAMP,
Positive reinforcement can be used when the animal is reluctant to use a piece. Toys or snacks may be means of making the scratcher attractive to use. Landsberg (1991) points out the sensory and olfactory use when rubbing like the animal's paws on the scraper to make the scraper appealing in the future.

7.2 REGARDING CLAWS AND COMBINED TUTOR-ANIMAL EFFORT

In addition, regularly trimmed claws or the use of protective covers to the keratin cuticle is indicated (MILLS et al., 2016). Some cats scratch their guardians due to personality or response to some disapproved actions. It can be avoided if the cats are socialized correctly and handled in abundance while juveniles (Vitale et al., 2019). Intimate contact with humans makes the cat less aggressive and more susceptible to affection and risk-free play.

An Italian study indicated that sexually whole animals present a greater willingness to scratch surfaces when the house lacks a specific surface for this end (FEUERSTEIN & TERKEL, 2008). Thus, it is interesting to spread the sterilization practice, not only for population control but also to control unwanted behavior.

8 CONCLUSION

Besides being painful and causing physical and behavioral sequelae in domestic cats, the technical-surgical procedure of onychectomy or tenectomy has been prohibited by law in Brazil since 2008. Thus, veterinarians must assume the duty of following the law and not contributing to the performance of this technique, of which the consequences go against the patient's life quality. Under the aura of professional illegality, procedures remain routine. Furthermore, the professionals must always seek the best alternatives aiming the animal welfare with the felines' tutors so that they do not lose their natural expression characteristics. Thus, it is observed that effective societal action is essential to develop public policies aimed at preserving animal welfare.
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