

NEUTERING OF DOGS AND CATS – DO BENEFITS REALLY OUTWEIGH THE RISKS?



While it might sometimes be convenient for the owners, let's stop pretending it is good for the animals

by Janet Newman

SUMMARY

- Information available to the lay public on spaying and castration (neutering) of dogs and cats contains many one-sided, misleading and even outright untrue claims. Often only the advantages are presented or we learn very little about any of the harmful effects.
- Numerous studies clearly show that neutering can have long-term, irreversible consequences. Among other things, studies have linked it to many types of deadly cancers, orthopedic problems, behavioral disorders, obesity, cognitive disorders, urogenital diseases, hormonal disorders, diabetes and disorders of the immune system.
- Multiple studies also show that aggression, a behavioral disorder that neutering is often recommended for, can actually worsen after the procedure.
- Research shows that neutering does not extend an animal's lifespan as is claimed, but shortens it, and that benefits like reduced risk for certain cancers are outweighed by the harms of the procedure. In fact, some studies suggest that the single most important predictor of good behavioral and health outcomes in dogs is the length of time they have spent in an intact state.
- In recent decades, Western countries witnessed a general trend towards early routine neutering and a corresponding increase in health issues and obesity in pets. But many veterinarians in certain European countries still advise against premature neutering of domestic animals, while the idea of the harmlessness of early neutering was adopted mainly by animal shelters. Animal shelters routinely neuter animals at a very early age, which increases the likelihood that animals will end up unadoptable due to health or behavioral issues.
- Due to the many negative effects that raise serious ethical concerns, sterilization of humans is not performed by removing the gonads, but by much safer procedures of tubal ligation in females and vasectomy in males. These procedures, as well as hysterectomy (removal of the uterus), are also a potential alternative to neutering of domestic animals.

In some countries like Norway, neutering of domestic animals by surgical removal of gonads is illegal and considered mutilation or cruelty.⁽¹⁾⁽²⁾ This is not the case elsewhere, but despite a general trend towards earlier and/or routine neutering in recent decades, many veterinarians in certain European countries still advise against premature neutering and recommend carrying out the procedure after the animal's sex organs have fully developed (in cats and dogs that would be around 6 months of age). However, when it comes to cats, claims that there is no evidence for the harmful effects of early neutering have been gaining ground in recent years. Official recommendations for when to carry out the procedure have been shifting to an increasingly early age (i.e. 3 or 4 months) in some countries, while in other countries the idea of harmlessness of early neutering has so far mainly been promoted by animal shelters, where animals are routinely neutered at a very early age (shelter cats can be neutered already at the age of one and a half months).

In their eagerness to neuter domestic animals as soon as possible, many present the procedure of neutering as so beneficial that one almost wants to rush out to neuter oneself after hearing about it (human overbreeding is supposedly the biggest problem on this planet, right?). But the reality is such that the removal of the ovaries (oophorectomy) in women is proven to be a very harmful procedure with serious lifelong consequences. It causes a rapid decline in important sex hormones – called also “surgical menopause” – and has been associated in numerous studies with premature aging and death,⁽³⁾⁽⁴⁾⁽⁵⁾⁽⁶⁾⁽⁷⁾⁽⁸⁾ cardiovascular disease,⁽⁹⁾⁽¹⁰⁾ cognitive impairment and dementia,⁽⁶⁾⁽¹¹⁾ anxiety and depression,⁽⁶⁾⁽¹²⁾⁽¹³⁾ Parkinson's disease,⁽⁶⁾⁽¹⁴⁾ chronic lung diseases,⁽¹⁵⁾⁽¹⁶⁾ arthritis,⁽¹⁷⁾ osteoporosis,⁽⁷⁾⁽¹⁷⁾ incontinence⁽¹⁸⁾ and so on. The consequences are all the more severe if the ovaries are removed earlier in the reproductive age.⁽³⁾ In 2016, researchers from Mayo Clinic commented on the results of their study:

“Women under 46 who had both ovaries removed experienced a marked increase in eight chronic health conditions, including coronary artery disease, depression, arthritis, chronic obstructive pulmonary disease and osteoporosis ... Removing both ovaries should not be considered ‘an ethically acceptable option’ for women who are not in the high risk group for cancer and it should be discontinued.”⁽¹⁶⁾

As for the castration of the man (removal of the testicles and sometimes also the penis), the procedure has long been considered unethical and, with the exception of a few countries, is not even performed on convicted sex criminals (“... in more recent times we have used different means of expressing man’s inhumanity to man”⁽¹⁹⁾), which is the reason why there are not many studies on adverse effects of castration in humans. However, castration has been associated with sarcopenia, excess body weight, skeletal problems such as osteoporosis and curvature of the spine, gynecomastia (enlarged breasts in men), excessive sweating, loss of body hair, decreased bone calcium, depression, suicidality, emotional lability and apathy. Some of these problems were particularly associated with early castration.⁽²⁰⁾⁽²¹⁾

(Note: Due to the listed negative effects, we do not make humans infertile by removing the gonads, but use the incomparably safer procedures of tubal ligation and vasectomy; these procedures are a potential alternative also for domestic animals – see more on this below.)

As we will see, the procedure of neutering by removing the gonads has been shown to be harmful in dogs as well, which is not surprising since the biology of humans and dogs is quite similar.⁽²²⁾

Nevertheless, we come across such information everywhere:

“Spaying and neutering pets keeps them healthy and happy. They are at a decreased risk of infection, cancer, and other illnesses and diseases. They are also less likely to display behavioral issues. If your pet isn’t spayed or neutered, keep reading to learn more about the benefits and then contact your veterinarian to schedule an appointment.”⁽²³⁾

“Neutering dogs doesn’t just prevent unwanted pregnancies, though this alone is an excellent reason to get your dog neutered. Neutering your dog also brings with it a whole host of other health and social benefits which can lead to your dog having a longer and happier life.”⁽²⁴⁾

“Spaying a female cat before the first heat helps prevent uterine infections, uterine cancers, and breast cancer. Neutering a male cat eliminates the chances of testicular cancer and lowers the risk of prostate problems. Cats that are spayed and neutered live healthier, longer, and happier lives.”⁽²⁵⁾

As the research described below clearly shows, such claims are at best extremely one-sided and at worst completely untrue. A 2007 systematic review examined more than 50 peer-reviewed studies on long-term consequences of neutering in dogs and concluded:

“One thing is clear – much of the spay/neuter information that is available to the public is unbalanced and contains claims that are exaggerated or unsupported by evidence. Rather than helping to educate pet owners, much of it has contributed to common misunderstandings about the health risks and benefits associated of spay/neuter in dogs.”⁽²⁶⁾

Furthermore, a review of studies done in 2012 explains that the increasing tendency towards routine and early neutering is a trend that came to Europe from the USA, and that the veterinary profession has obvious commercial interests at stake in the practice of routine neutering. The review concludes that routine neutering of companion animals (especially in cases where uncontrolled reproduction is not an issue) is “not morally justified” and that decisions on neutering should be taken on an individual and case-by-case basis.⁽²⁷⁾

We will proceed with a review of studies that examined effects of pet neutering and obtained similar results to the studies done on humans. Such a comprehensive set of studies should serve as a strong warning that these interventions can leave animals with serious long-term, irreversible consequences. The studies cited below may at least partially explain the steep rise in chronic disease in domestic animals,⁽²⁸⁾ and some researchers note that routine early neutering may paradoxically even contribute to increased population of abandoned and unadoptable animals that animal shelters complain about.

CANCER

GLOSSARY

Hemangiosarcoma – A very aggressive, rapidly spreading form of cancer, common in dogs and rare in cats

Lymphoma – One of the most common forms of cancer in dogs and cats; treatment that slows down the progression of the disease is available, but is not curative

Mast cell tumor – The most common skin tumor in dogs and the second most common skin tumor in cats

Osteosarcoma – A very aggressive form of cancer common in large breed dogs

Prostate cancer – A relatively rare type of cancer in dogs, extremely rare in cats

Urinary bladder transitional cell carcinoma – The most common type of cancer of the urinary tract in dogs, very aggressive and difficult to treat

An association between neutering of dogs and an increase of a number of serious cancers has been shown in many studies (the most frequently mentioned are lymphoma, hemangiosarcoma, mast cell tumors, transitional cell carcinoma, prostate cancer and osteosarcoma), some of which are listed below.

Although neutering of dogs has long been recommended as a preventive measure against prostate cancer, science has shown in recent decades that the practice is unsound, as prostate cancer was shown to be significantly more common and more aggressive in castrated dogs as compared to intact dogs⁽²⁹⁾⁽³⁰⁾⁽³¹⁾⁽³²⁾. One of the studies found a four-fold increased risk of prostate cancer,⁽³³⁾ while another found an eight-fold increased risk of prostate transitional cell carcinoma (one of the most aggressive forms of prostate cancer) in neutered dogs.⁽²⁹⁾

Prostate cancer is extremely rare in cats, yet several case studies describe this type of cancer in neutered cats, indicating that neutering can increase the risk of prostate cancer in cats as well.⁽³⁴⁾⁽³⁵⁾⁽³⁶⁾⁽³⁷⁾

Belanger et al. (2017) from the University of California (UC Davis) found an increased risk of hemangiosarcoma, lymphoma, mast cell tumors and osteosarcoma in neutered dogs of both sexes.⁽³⁸⁾

Villamil et al. (2009) examined more than one million dogs and found a significantly increased risk of lymphoma in spayed female dogs,⁽³⁹⁾ while some older studies (one of which also looked at more than one million dogs) showed an increased risk of lymphoma both in spayed female and castrated male dogs.⁽⁴⁰⁾ In a more recent study Bennet et al. (2018) found an approximately three-fold increased risk of lymphoma in spayed female and castrated male dogs.⁽⁴¹⁾

In a large study of neutered dogs, Grüntzig et al. (2016) reported an increased risk of lymphoma and mast cell tumors in both sexes, an increased risk of hemangiosarcoma and melanocytic tumors in females and an increased risk of adenocarcinoma and osteosarcoma in males.⁽⁴²⁾

In 2008, the Vizsla Club of America Welfare Foundation sponsored a study of Hungarian Vizsla dogs. The most common problems in this breed are cancer and behavioral disorders, and the most common cause of death is cancer (specifically hemangiosarcoma and lymphoma). The most common types of cancer are mast cell tumors, hemangiosarcoma and lymphoma; researchers found that these types of cancer, as well as behavioral disorders, were more common in neutered Hungarian Vizsla dogs.⁽⁶⁴⁾

Zink et al. (2014) also studied Hungarian Vizsla breed and found an increased risk of mast cell tumors, lymphoma, hemangiosarcoma and other cancers in neutered dogs. Cancer was 6.5 times more common in spayed female dogs and 3.6 times more common in castrated male dogs as compared to intact animals. The earlier the neutering was done, the earlier the dogs were diagnosed with cancer.⁽⁴³⁾

Bryan et al. (2007) found that urinary bladder transitional cell carcinoma is more than three times more common in neutered dogs as compared to intact dogs.⁽²⁹⁾ Several other studies also found an association between neutering and this type of cancer.⁽⁴⁴⁾⁽⁴⁵⁾⁽⁴⁶⁾ Another study found a two-fold increased risk of all types of lower urinary tract cancer in neutered dogs.⁽⁴⁷⁾

De la Riva et al. (2013) found three times more cases of lymphoma (lymphosarcoma) in early-castrated Golden Retrievers than in intact male dogs. Around 10% of castrated dogs developed this form of cancer. Not a single case of mast cell tumor was found in intact females, while almost 6% of late-sterilized females had this form of cancer. The researchers wrote:

“In contrast to the rather strong evidence for neutering males and/or females as a risk factor for osteosarcoma, hemangiosarcoma, lymphosarcoma, mast cell tumor, and prostate cancer, evidence for neutering as protection against a dog acquiring one or more cancers is weak ... Because neutering can be expected to disrupt the normal physiological developmental role of gonadal hormones on multiple organ systems, one can envision the occurrence of disease syndromes ... to possibly be affected by neutering as a function of gender and the age at which neutering is performed.”⁽⁴⁸⁾

White et al. (2011) found that spayed female dogs had a four-fold increased risk of developing a mast cell tumor as compared to intact dogs. The risk was also slightly increased in castrated males.⁽⁴⁹⁾

Ware and Hooper (1999) found a larger than four-fold increase in the risk of cardiac tumors and a larger than five-fold increase in the risk of cardiac hemangiosarcoma in spayed female dogs.⁽⁵⁰⁾

Prymak et al. (1988) found a twice increased risk of hemangiosarcoma of the spleen in spayed female dogs.⁽⁵¹⁾ The association between neutering and hemangiosarcoma was also found by Robinson et al. (2020).⁽⁵²⁾

Hart et al. (2014) found an increased risk of one or more types of cancer (lymphosarcoma, hemangiosarcoma, mast cell tumor and mammary cancer) in neutered Golden Retrievers and Labradors of both sexes. In Golden Retrievers the risk was particularly pronounced, as neutered dogs had a three- to four-fold increased risk of at least one type of cancer.⁽⁵³⁾

In a recent study, Hart et al. (2020) studied many other breeds and for some breeds (Australian Shepherd, Bernese Mountain Dog, Border Collie, Boston Terrier, German Boxer, Cocker Spaniel, Collie, Doberman, Irish Wolfhound and Shih Tzu) found an increased risk of cancer in neutered or early-neutered animals.⁽⁵⁴⁾

Cooley et al. (2002) found a three- to four-fold increased risk of bone sarcoma in neutered Rottweilers (as many as 25% of neutered dogs developed this type of cancer during their lifetime). They also measured the time that the dogs spent exposed to sex hormones and found that the earlier the dog was neutered, the higher was the risk of developing bone sarcoma.⁽⁵⁵⁾ Ru et al. (1998) also found a doubling of the risk of osteosarcoma (a type of bone sarcoma) in neutered dogs.⁽⁵⁶⁾

BEHAVIORAL DISORDERS

According to a 2018 US study,⁽⁵⁷⁾ problematic behavior is the leading cause of admitting dogs to shelters and the main reason for dogs being unadoptable. Neutering is often recommended for reducing aggression in animals, but many recent studies show that such recommendations are unfounded.

In a well-designed 2018 study (examining more than 6000 dogs and measuring the length of time the dog spent in a neutered state) McGreevy et al. found that inappropriate behavior related to fear and aggression was more common in (early) neutered dogs. Only two unwanted behaviors (urine marking and barking when the dog was alone) were more common in intact dogs, while 26 mostly unwanted behaviors were more common in dogs that were neutered early. This means, to quote the authors, that “for some dogs, partial or complete denial of puberty may reduce indoor urine-marking but have many other undesirable consequences.”

The authors also noted the following:

“The beneficial effects of gonadectomy are underpinned by the need to reduce the number of unwanted companion animals. Thousands of dogs are euthanased in shelters and pounds annually in many developed countries. However, shelters are inundated by dogs that are most commonly surrendered because they display undesirable behaviours. So the current findings present the paradox that castration may reduce the numbers of unwanted dogs but may also increase the likelihood of problem behaviours that reduce the appeal of the castrated dogs and make them more vulnerable to being surrendered.”⁽⁵⁷⁾

The above findings are supported by numerous other studies:

- Salman et al. (2010) found that the neuter status is more common in dogs and cats abandoned by their owners for behavioral reasons.⁽⁵⁸⁾ The association between problematic behavior and neutering of cats has also been confirmed by other studies.⁽⁵⁹⁾
- Spain et al. (2004) found a higher risk of shyness in the presence of strangers in early-neutered cats (< 5.5 months of age), and a higher risk of frequent hiding in neutered cats. In male cats, hiding was associated with an increased likelihood of being abandoned by their owner.⁽⁶⁰⁾
- Kaufmann et al. (2017) found a link between castration of dogs and unstable behavior in stressful situations, which can lead to insecurity and aggression.⁽⁶¹⁾
- Balogh et al. (2018) have done a study on the Labrador breed and concluded: “Owners of spayed dogs described more frequent or more intense fear reaction in their animals in response to loud noises, unfamiliar objects approaching on or near the sidewalk, or if they were approached by unknown dogs barking, growling or jumping ... In contrast to popular belief, gonadectomy did not inevitably result in a behaviourally more stable dog.”⁽⁶²⁾
- Garde et al. (2016) studied a population of free-living male dogs and found that castrated dogs showed no decrease in sexual activity and aggression 6 months after the surgery.⁽⁶³⁾
- Zink et al. (2014) found an increased risk of behavioral disorders (fear of storms, separation anxiety, fear of noises, fear of gunfire, timidity, excitability, submissive urination, aggression, hyperactivity and fear biting) in early neutered Hungarian Vizslas. The earlier the neutering was done, the earlier the dogs were diagnosed with a behavioral disorder.⁽⁴³⁾ Neutering was also linked to behavioral disorders in an older study on Vizslas.⁽⁶⁴⁾
- Zink et al. confirmed their findings in a 2023 study. They took into account the length of time each dog was exposed to sex hormones and found that the shorter the duration of exposure, the bigger the risk of both problematic and nuisance behaviors. They found no difference in marking or mounting between neutered and intact male dogs.⁽¹⁴⁷⁾
- Kim et al. (2006) showed that a few months after the surgery spayed German Shepherd females became more reactive when meeting a stranger walking an unfamiliar dog. They wrote: “[V]eterinary practitioners should

inform owners that a bitch may become more reactive after spaying either because they have lost the calming effects of progesterone or because elevated gonadotropins stimulate release of adrenal androgens.”⁽⁶⁵⁾

- O’Farrell and Peachey (1990) measured a higher incidence of dominance aggression towards family members in spayed female dogs.⁽⁶⁶⁾
- In dogs that were neutered early (before 5.5 months of age) Spain et al. (2004) found a higher frequency of noise phobia, aggression towards family members, barking or growling at visitors and excessive barking that bothered household members.⁽⁶⁷⁾
- Bamberger and Houdt (2006) found that Animal Behavior Clinic at Cornell University had a higher proportion of neutered dogs than Cornell University Hospital for Animals, a clinic that did not specialize in behavioral disorders.⁽⁶⁸⁾
- Reisner et al. (2005) studied several types of problematic behavior in dogs and confirmed more frequent owner-directed aggression (in several contexts) in neutered dogs. In addition, neutered animals bit more often, and spayed females were more aggressive towards unfamiliar adults who approached them.⁽⁶⁹⁾
- Duffy and Serpell (2006) studied thousands of dogs of various breeds and concluded: “The results of the study suggest that spayed female dogs tend to be more aggressive toward their owners and to strangers than intact females, but that these effects of spaying on behavior appear to be highly breed-specific. Contrary to popular belief, the study found little evidence that castration was an effective treatment for aggressive behavior in male dogs, and may exacerbate other behavioral problems.” Among the problems that have been linked to neutering are fear of touch, sensitivity to touch, frequency of begging for and stealing food, aggression towards people and other dogs, rolling in feces, eating feces, excessive barking etc.⁽⁷⁰⁾
- Farhoody et al. (2018) examined a large number of dogs of different breeds and concluded: “This large, comprehensive study of the relationships between gonadectomy and aggressive behavior in dogs demonstrates that when the many factors affecting aggressive behavior are considered, there is no evidence that gonadectomy at any age alters aggressive behavior toward familiar people or dogs, and there is only a minimal increase in aggression toward strangers. Given the increasing evidence of significant negative health effects of gonadectomy, there is an urgent need to systematically examine other means of preventing unwanted procreation, such as vasectomy and hysterectomy.”⁽⁷¹⁾

After reviewing several major studies, Farhoody et al. (2018) noted the following:

“It is worth noting that every prospective, controlled study that examined the effects of gonadectomy on the aggressive behavior of dogs demonstrated either no change in aggressive behavior or an increase in aggressive behavior after gonadectomy.”

The number of studies that have shown an increase in behavioral disorders after neutering is alarming and it is not unreasonable to ask to what extent these interventions actually help in reducing the population of unwanted domestic animals, especially in cases where reproduction of intact animals can be controlled to large extent. The situation is not as clear-cut as it may seem, as “empirical studies show no effects of desexing on population control in companion and shelter dogs despite desexing being consistently recommended in the literature.”⁽⁷²⁾ Dr. Kersti Seksel, an Australian veterinarian who specializes in animal behavior, believes that neutering is not the way to solve the problem of unwanted pets. Unwanted pet populations were increasing despite early age neutering being done in certain countries for over 20 years. She emphasizes that problematic behavior is one of the most common reasons for surrendering an animal to a shelter and that “[i]t’s not about whether we neuter or not, it’s the behaviour of the animal that actually decides whether it stays in the home.”⁽⁷³⁾

The findings of The No-Kill Advocacy Center should be mentioned here as well. They [have claimed for many years](#) that the alleged “pet overpopulation” in the US is a myth used to justify the fact that shelters euthanize a large number of “unadoptable” animals annually.⁽⁷⁴⁾

OBESITY

Obesity in domestic animals is extremely common and has increased dramatically in recent decades. The latest studies from the US show that as many as 60% of cats and 56% of dogs are overweight or obese.⁽⁷⁵⁾

Due to changes in metabolism and increased food intake, neutered dogs and cats are more commonly overweight than intact animals.⁽⁷⁶⁾ Increased food intake occurs within a few days after neutering; one of the studies found that 7 weeks after castration, adult male cats ate an average of 78% more food than before,⁽⁷⁷⁾ and in studies on dogs, this percentage was around 20%.⁽⁷⁶⁾

In cats, neutering was confirmed in several studies as one of the main risk factors for developing obesity. In an urban cat population, Allan et al. (2000) found that 31% of neutered animals were obese, while not a single intact cat was obese.⁽⁷⁸⁾ Other studies show that neutered cats have more than three times the risk of obesity, are less active and have a reduced metabolism as compared to intact animals.⁽⁷⁹⁾⁽⁸⁰⁾⁽⁸¹⁾ Hormonal changes (increased leptin, prolactin and insulin growth factor I) were measured in male cats after castration, which indicates significant changes in metabolism.⁽⁸²⁾

Interim results of a study on Golden Retrievers linked obesity mostly to early sterilization. In animals neutered before one year of age, the risk of obesity was increased two times as compared to intact animals. For every additional year that a dog stayed intact, the risk of obesity decreased by 70%. The study also found that obese neutered animals had a 300% increased risk of non-traumatic chronic orthopedic injury.⁽⁸³⁾

Being overweight is associated with a whole series of health problems and increased mortality in dogs (and humans). For example, obese dogs have a higher risk of Cushing's syndrome, torn ligaments, hypothyroidism, urinary tract disease, oral disease, diabetes, pancreatitis, hip dysplasia, and cancer.⁽⁸⁴⁾⁽⁸⁵⁾

Given the high percentage of obese dogs and cats in the US where early neutering is routinely performed, it is obvious that the advice for preventing obesity with diet and exercise is unsuccessful in practice.

HORMONAL DISORDERS

Sundburg et al. (2016) found a higher risk of hypothyroidism (reduced thyroid function) and Addison's disease in spayed female dogs and castrated male dogs.⁽⁸⁶⁾

The link between neutering and hypothyroidism was also found previously by Milne and Hayes (1981)⁽⁸⁷⁾ and a 1994 study that found neutered dogs had a three-fold higher risk of hypothyroidism as compared to intact dogs.⁽⁸⁸⁾ The most common clinical signs were obesity, alopecia (significant loss of hair on certain body areas), skin problems, fatigue and weakness.

Belanger et al. (2017) found a higher risk of Cushing's syndrome in spayed female and castrated male dogs.⁽³⁸⁾

DIABETES

Cai et al. (2019) found that the castration of American Eskimo dogs, and even more so the spaying of females of this breed, is strongly associated with later development of diabetes, while earlier studies have shown an association between diabetes and castration in dogs of various breeds.⁽⁸⁹⁾⁽⁹⁰⁾⁽⁹¹⁾

Studies in cats have shown that cats have up to a 9-fold increased risk of diabetes after neutering.⁽⁹²⁾⁽⁹⁰⁾⁽⁹³⁾

IMMUNE SYSTEM DISORDERS

Sundburg et al. (2016) found a higher frequency of atopic dermatitis, autoimmune hemolytic anemia, immune thrombocytopenia and chronic inflammatory bowel disease in spayed female and castrated male dogs. Spayed females also had a higher risk of systemic lupus erythematosus.⁽⁸⁶⁾

Other studies found an association between dog neutering and the autoimmune disease myasthenia gravis⁽⁹⁴⁾⁽⁹⁵⁾ and acute pancreatitis.⁽⁹⁶⁾⁽⁹⁷⁾

A link between removal of the ovaries and autoimmune diseases has also been found in studies done on mice.⁽¹⁴⁵⁾⁽¹⁴⁶⁾

ORTHOPEDIC PROBLEMS

The development of the animal's skeleton is regulated by sex hormones, which signal the closure of the growth (epiphyseal) plate in long bones.⁽⁹⁸⁾⁽⁹⁹⁾ Neutering prior to the completion of growth plate closure results in elongated bones and deformed joints,⁽¹⁰⁰⁾ which can lead to a variety of problems.

Duerr et al.(2007) found an association between early neutering and development of excessive tibial plateau angle in large breed dogs with cranial cruciate ligament disease.⁽¹⁰¹⁾

Many studies have shown that early castration of cats leads to delayed closure of the growth (epiphyseal) plate; in neutered cats with this problem, spontaneous femoral capital physeal fractures have been recorded.⁽⁹⁹⁾

Witsberger et al. (2008) found that castrated male dogs had an increased risk of hip dysplasia, while castrated males and spayed females had twice the risk of cranial cruciate ligament deficiency as compared to intact dogs.⁽¹⁰²⁾ Spain et al. (2004) confirmed the association between hip dysplasia and early neutering.⁽⁶⁷⁾ Hagen et al. (2005) found that 6 months after the procedure, neutered German Boxers had a 1.5 times increased risk of developing hip dysplasia as compared to intact dogs.⁽¹⁰³⁾

Belanger et al. (2017) found a higher risk of ruptured anterior cruciate ligament in castrated male and spayed female dogs. Spayed females also had a higher risk of intervertebral disc disease.⁽³⁸⁾

De la Riva et al. (2013) studied Golden Retrievers and found that males neutered early had twice the risk of hip dysplasia as compared to intact males. While not a single case of anterior cruciate ligament tear was found in intact dogs, as many as 5% of castrated males and 8% of spayed females had this problem.⁽⁴⁸⁾

Hart et al. (2014) found a doubled incidence of joint problems in Labradors neutered before 6 months of age. Neutering turned out even more detrimental for Golden Retrievers, where the incidence was increased by 4 to 5 times in dogs neutered before 6 months of age. (In intact dogs, the incidence was around 5%).⁽⁵³⁾

Hart et al. (2016) also examined German Shepherds and found that dogs neutered before one year of age had a significantly increased risk of joint problems (increased from 7% to 21% in males and from 5% to 16% in females).⁽¹⁰⁴⁾

In a recent study, Hart et al. (2020) studied many other breeds and again found an increased risk of joint problems in (early) neutered animals.⁽⁵⁴⁾

Patellar luxation, one of the most common orthopedic problems in dogs that can lead to lameness, osteoarthritis and pain, was more than twice as common in neutered dogs in one study (O'Neill et al., 2016),⁽¹⁰⁵⁾ while in another study (Vidoni et al., 2006) the same problem was three times more common in neutered dogs.⁽¹⁰⁶⁾

In studies on English Beagles, neutering led to accelerated trabecular bone remodeling, and after 6 months, signs of osteoporosis (similar to bone loss that occurs in menopausal women) were visible.⁽¹⁰⁷⁾ Researchers also found bone loss in the spinal cord.⁽¹⁰⁸⁾

UROGENITAL DISORDERS

Urinary incontinence is very common in spayed female dogs and can occur soon or with a delay of several years after surgery. The incidence in various studies was shown to be between 4% and 30% in spayed females⁽⁷⁶⁾⁽¹⁰⁹⁾⁽¹¹⁰⁾⁽¹¹¹⁾ and only 0.3% in intact females.⁽¹¹²⁾ Several studies have shown that clinical signs of incontinence were more pronounced after early spaying.⁽⁶⁷⁾⁽¹¹⁰⁾⁽¹¹²⁾

Seguin et al. (2003) found that long-term and recurrent urinary tract infections were 3 to 4 times more common in spayed as compared to intact female dogs.⁽¹¹³⁾ Similar results were also obtained by Ling et al. (1998)⁽¹¹⁴⁾

Lekcharoensuk et al. (2001) studied diseases of the lower urinary tract in cats and found that castrated male cats had a higher risk of almost all types of diseases they studied, while spayed female cats had a higher risk of urinary stones, urinary tract infections and urinary tract cancers.⁽¹¹⁵⁾

A study of more than two million dogs found that urinary stones (urine crystals, kidney stones, and bladder stones) were three times more common in neutered animals.⁽¹¹⁶⁾

COGNITIVE DISORDERS / DEMENTIA

In 2017, Italian scientists (Mongillo et al.) concluded: “In spite of the frequency with which dogs’ gonadectomy is advised in most western countries, its consequences on cognitive abilities remain virtually unknown.” To remedy that issue, they designed a study that would help determine the relationship between ovary removal and cognitive function in female dogs. Their results showed that intact females learned faster and were more accurate and successful in a task related to learning and memory.⁽¹¹⁷⁾

A study from the USA (Hart, 2001) showed that sexually intact male dogs were significantly less likely than neutered dogs to progress from mild cognitive impairment to severe cognitive impairment. Symptoms included disorientation, changes in social interaction with people, loss of house training and changes in the sleep-wake cycle.⁽¹¹⁸⁾ Neilson et al. (2001) have similarly found that intact dogs had a slower progression of decline in cognitive function.⁽¹¹⁹⁾

Scandurra et al. (2019), in a study on Labradors and Golden Retrievers, confirmed a detrimental effect of spaying on dogs’ socio-cognitive functions related to the responsiveness to human pointing gestures.⁽¹²⁰⁾

The results of the above studies are very similar to the results of studies done on women who have had their uterus and/or ovaries removed,⁽¹²¹⁾ as well as to results of studies done on rats.⁽¹²⁰⁾

LIFESPAN

Proponents of neutering often claim that the procedure will extend an animal's lifespan. Given that a procedure increases the risk of all kinds of diseases, we should immediately be suspicious of such claims, so let's take a look at what the scientific literature says about this. Waters et al. (2009)⁽¹²²⁾ studied Rottweilers and showed a strong correlation between female lifespan and the length of time their ovarian function was preserved. In other words, the earlier the dog was spayed, the shorter was her lifespan. The researchers emphasized that similar results were found in studies done on women who had their ovaries removed.⁽¹²³⁾

However, the results of their methodologically well-designed study do not match the results of certain older studies that have shown longer lifespans in neutered dogs, so Waters et al. tried to find out what could explain the discrepancy. In 2011 they repeated their above-mentioned study, but this time used the methodology applied in other studies that did not measure the length of time the animal had spent in an intact state (the inadequate methodology only divided the animals according to the status of neutered/intact at death, which would be similar to studying the effects of smoking and only recording smoking status at death, completely disregarding how many years the person actually spent smoking). The result of this experiment is, in my opinion, one of the best demonstrations of how misleading statistics can be. To sum up, researchers used the exact same data set twice. In the first study they used an appropriate methodology which showed that intact females live longer, while in the second study they used an inadequate methodology of previous studies and got the result that intact females lived shorter lives.

Waters et al. concluded that the methodology used in other studies “... introduces misclassification bias that can generate misleading assumptions regarding the lifelong health consequences of ovariohysterectomy.” Translated into simple language, studies that have shown a link between neutering and longevity were inadequately designed, which means that the claims that neutering will extend an animal’s lifespan are scientifically unsupported.⁽¹²²⁾

Kengeri et al. (2013) repeated the Waters’ study on Rottweilers a few years later and once again found that the longer the function of the ovaries was preserved, the longer the animal lived.⁽¹²⁴⁾

Two recent studies confirmed earlier findings that the bodies and brains of dogs benefit from maximum exposure to the sex hormones. Zlotnick et al. (2019) found that service dogs that were neutered before 7 months of age stopped working for health reasons twice as often as dogs that were neutered later.⁽¹²⁵⁾ In their most recent study, Zink et al. (2023) similarly discovered that the single most important predictor of good behavioral and health outcomes in dogs is

the length of time their bodies are exposed to sex hormones. Dogs who were neutered wound up with more health problems — including orthopedic disorders, increased cancer risk, endocrine system abnormalities, increased likelihood of obesity, behavioral disorders — and shorter lifespans than intact dogs and dogs who received hysterectomies or vasectomies.⁽¹⁴⁷⁾

What is it that could explain poorly designed studies showing a link between neutering and longer lifespan (or better health)? The scientific literature provides several good explanations for this.⁽⁷²⁾ One of them is that people who do not neuter domestic animals are more likely to come from lower class backgrounds and have a harder time affording quality food and good care for their animals. It is clear that their animals will on average have a shorter lifespan and more health problems, which means that the statistics are fundamentally biased towards underestimating the harmful effects of neutering. Another explanation is that the group of neutered animals is on average older, since the animals placed in this group had to already spend some time being alive before they were neutered.

The above-mentioned findings are also supported by the fact that the health of domestic animals is getting worse year by year,⁽²⁸⁾ and that according to the data of a [study](#) conducted by The Kennel Club the life expectancy of dogs in the US (a country that is extremely aggressive in its approach to neutering) declined by around 10% in just ten years.

DANGERS OF SURGERY

Young animals (<4-5 months) with a lower ability to thermoregulate, a lower ability to metabolize and excrete anesthetics and painkillers, and a predisposition to hypoglycemia are especially sensitive to neuter surgery.⁽⁸⁶⁾⁽¹²⁶⁾

Cats have a higher risk of death during surgery than dogs due to intubation problems and cardiomyopathies. Hypothermia during the administration of anesthesia further contributes to a higher risk.⁽¹²⁷⁾⁽¹²⁸⁾⁽¹²⁹⁾ The most common complications of anesthesia are cardiac arrhythmia, gastric dilatation and excessive dosing of drugs.⁽¹³⁰⁾

In a study of 142 dogs, the incidence of complications that occurred during ovariohysterectomy (the surgery for ovary and uterus removal) was 6.3%, while the incidence of complications that occurred after the surgery was higher, namely 14.2%.⁽¹³¹⁾ The complications were mostly mild. The recorded mortality rate due to anesthesia-related complications during surgery was between 0.1% and 0.2% in healthy and 0.5% to 2% in sick dogs and cats in one research review.⁽¹²⁸⁾

Other complications (some of which can be long-term) that can occur in cats and dogs due to an improperly performed procedure are ovarian remnant syndrome, kidney dysfunction, uterine stump pyometra and urinary incontinence.⁽¹³²⁾⁽¹³³⁾

ADVERSE EVENTS AFTER VACCINATION

In a retrospective cohort study Moore et al. (2005) showed that spayed female dogs had a 30% higher risk and castrated male dogs had a 27% higher risk of adverse events after vaccination as compared to intact dogs. Possible side effects of vaccination include anaphylactic shock, allergic reactions, itching, cardiac arrest, circulatory shock and sudden death.⁽¹³⁴⁾ In 2007, an increased risk of adverse events after vaccine administration was also found in a study on neutered cats.⁽¹³⁵⁾

MAMMARY TUMORS, PYOMETRA AND TESTICULAR CANCER

We are often told that neutering prevents the occurrence of certain health problems, such as mammary tumors and infection of the uterus (pyometra) in female and testicular cancer in male animals. It is true that some studies have shown a lower incidence of mammary tumors and pyometra in neutered animals, but upon closer examination of research the picture becomes murky at best.

Beauvais et al. from the Royal Veterinary College in the UK have done a systematic review of studies in 2012. They concluded that the evidence for (early) neutering preventing the occurrence of mammary tumors is “weak and not a sound basis for firm recommendations.”⁽¹³⁶⁾ They describe serious flaws in studies that have shown a link between neutering and mammary tumors. To give just one example, most of these studies did not take into account the fact that

intact animals are often exposed to synthetic hormones (contraception) that have been shown to cause mammary tumors, and this error alone, according to the authors, “has the potential to explain a large proportion of the association between neutering and mammary neoplasia.”

Furthermore, even if neutering did in fact decrease the risk of mammary cancer, the decreased risk would have to outweigh the numerous negative effects of the surgery. Waters et al. (2017) showed in a well-designed study that while it is true that Rottweiler females that spent most of their lives spayed had a lower incidence of pyometra and mammary tumors, they nevertheless died earlier than intact Rottweiler females. Intact females had on average a 33% lower mortality rate and lived 17 months longer than spayed females, despite the fact that compared to other breeds Rottweilers have a very high incidence of mammary tumors and pyometra. Researchers concluded:

“These findings fail to support the notion that a strategy, such as elective ovariectomy, implemented to reduce the incidence of mammary carcinoma and pyometra will beneficially impact overall longevity. It follows that future efforts to find and implement effective longevity-promoting interventions should look beyond reducing the incidence of a particular disease to considering trade-offs.”⁽¹³⁷⁾

Zink et al. (2014) have also found that mammary tumors in Hungarian Vizsla females were few in comparison to other, common types of cancer in this breed, the incidence of which was significantly higher in neutered animals.⁽⁴³⁾

Studies on women who had their ovaries removed also showed similar results. The incidence of breast and ovarian cancer is said to be lower in these women, but due to numerous other problems they die earlier than women who still have their ovaries.⁽¹²³⁾

Castrated males are supposed to not be able to get testicular cancer (which is actually not quite true; cases of castrated dogs and cats in which testicular cancer developed are described in the literature⁽¹³⁸⁾⁽¹³⁹⁾). Testicular cancer in dogs appears relatively late (on average at ten years of age), mostly responds well to therapy and does not spread to other organs.⁽²⁶⁾ One study found that the vast majority of testicular cancers found in dog biopsies and autopsies were benign (not dangerous) and only rarely metastasized to other organs.⁽¹⁴⁰⁾ In cats, testicular cancer is extremely rare and only a few cases are described in the literature.

In cats, mammary tumors are the third most common form of cancer, however, one recent study from Sweden showed that the annual incidence was (only) around 2/1000, while data for northern Italy showed it to be less than 0.8/1000.⁽¹⁴¹⁾⁽¹⁴²⁾ For dogs, the data for northern Italy show that the annual incidence of mammary tumors is 2.5/1000.⁽¹⁴³⁾

INFECTIOUS DISEASES

Finally, we are told that neutering will prevent the spread of infectious diseases contracted via mingling and sexual behavior. But studies have shown that feral cats (that are mostly unneutered, live in cat colonies and in theory should have a much higher rate of infectious diseases) often have similar or even lower rates of feline leukemia virus (FeLV) and feline immunodeficiency virus (FIV) as owned cats.⁽¹⁴⁸⁾⁽¹⁴⁹⁾ A study from Brazil found a FeLV rate of only 0,3% (one of the lowest rates ever measured in any cat population) in free-roaming, unowned cats in São Paulo, where one would expect infectious disease rates to be very high,⁽¹⁵⁰⁾ while a Finnish study found a FeLV rate of just 1% in free-roaming cats in Helsinki area.⁽¹⁵¹⁾ It turns out that even intact feral cats are not necessarily “a breeding ground for disease” and that there are probably other factors (i.e. dirty or crowded conditions with a shortage of quality food) that contribute to increased rates of disease seen in some places.

Indeed that is what FeLV might be all about. According to official data, up to 40% of FeLV-positive cats overcome the infection and remain healthy, so there are obviously other factors involved that determine the health of an animal. If these factors (like quality food, avoiding toxic chemicals, safe shelter etc.) are provided, infections like FeLV should not present a problem. It is also funny how animal activists have claimed for years that keeping a cat indoors will prevent them from catching FeLV, but now it is increasingly being claimed that cats that live outside (even in feral colonies) do not live in close enough proximity to each other to spread the virus.⁽¹⁵²⁾ So, is it better to keep a cat indoors or outdoors?

As for feline immunodeficiency virus (FIV, also called “cat HIV”), it has been shown in numerous studies that FIV-positive cats live just as long as FIV-negative cats,⁽¹⁵³⁾⁽¹⁵⁴⁾⁽¹⁵⁵⁾⁽¹⁵⁶⁾⁽¹⁵⁷⁾ so I don’t know why so much emphasis is still being placed on this more or less insignificant marker. Well, actually I do know why – because if FIV’s insignificance, as well as the fact that it is not even transmissible between cats in normal circumstances,⁽¹⁵⁸⁾⁽¹⁵⁹⁾⁽¹⁶⁰⁾ were to be freely admitted, many people would suddenly appear very foolish for killing countless FIV-positive cats just because they were positive and for no other reason.

People should also know that tests for these diseases are so unreliable that recommendations are now being given to the shelters to discontinue routinely testing all cats for FeLV and FIV. According to one source, if you test 1000 cats for FeLV in a population with a prevalence of 3%, 17 out of the 47 cats that test positive do not actually have FeLV, which means that over 36% of positive results are actually false positives.⁽¹⁶¹⁾ But it gets worse, with many test kits obviously being appallingly inaccurate. In one study, the VetScan Rapid test was only 85.7% specific, which translates to only 3 true positives per 17 positive test results, or in other words, over 82% of positive results being false positives.⁽¹⁶²⁾ One can only wonder how many cats were needlessly killed because of a false positive result.

To sum up, the risk of infectious diseases in cats has been exaggerated (to put it mildly) and neutering, by making an animal more hypothyroid and otherwise unhealthy, should increase, not decrease the risk of complications that can arise not only from vaccination, but also from infections.

CONCLUSION

Given the long list of studies showing harm, it is clear that the practice of neutering, as currently performed on domestic animals, is far from a benign, let alone a beneficial intervention. In fact, common sense should tell us that removing organs crucial for the production of vital hormones is probably not a good idea. And while it is true that we have less data on cats, it is unlikely that the biological response of cats would differ radically from that of dogs and other studied mammals. One problem is that the incidence of many diseases is far lower in cats than in dogs, which means that a larger number of animals needs to be studied in order for a study to get a statistically significant result. I noticed that some studies showing no harmful effects of neutering in cats only looked at a small number of animals, which means that they are probably not relevant.

The situation becomes all the more curious when we learn that there are alternatives to the current practice of neutering as a method of preventing reproduction. In the research available, [vasectomy and hysterectomy \(removal of the uterus while the ovaries are kept intact\)](#) are mentioned as viable options several times, while some mention [tubal ligation \(cutting or blocking the fallopian tubes\)](#) as the safest method for sterilizing females. All these interventions preserve the hormone-producing ovaries, while vasectomy and tubal ligation preserve all sex organs, so it is not at all surprising that these two methods are used to sterilize humans. It is hard to believe that these interventions are only rarely performed on domestic animals.

The first study to examine health effects of gonad-sparing sterilization procedures was done in 2023. It found that dogs given a vasectomy or a hysterectomy indeed had much better health outcomes than the dogs subjected to a standard neuter procedure. Authors concluded that “dogs might benefit from these alternative surgeries, with respect to general health and experience better behavior outcomes, compared to undergoing traditional spay-neuter surgery.”⁽¹⁴⁷⁾

Because of the overwhelming amount of new evidence, the situation has already improved somewhat in Western countries. For example, veterinarians now often recommend delaying neutering dogs of large breeds (where studies have shown a deleterious effect on skeletal development most clearly) for some months. But we still have a long way to go, so let's conclude with the words of Dr. Jamie Mulcahy, a small animal practitioner from Australia:

“Now my attitude has changed a lot. My thinking is that cats and dogs have had their gonads for millions of years. In the last 100 or so, we have been removing them en masse. In hindsight, it is strange to think that we as a collective of veterinary scientists never considered that this action might have unintended consequences.”⁽¹⁴⁴⁾

It is strange indeed. Let’s hope that this review helps the society move further in the right direction.

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