Should You Spay or Neuter?

The Benefits and Health Risks of Fixing Your Pet

Tag Words: Spay, Neuter, Health Risks, Health Benefits, Osteosarcoma, Mammary Tumors, Hemangiosarcoma, Pyometra, and Cranial Cruciate Ligament (CCL)

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Summary (KJ)

One of the problems today within the topic of pet health is spay and neuter. More times than none pet owners are told spay and neuter your pet it’s the best option for them because of pet overpopulation, behavioral problems, and the opportunity for your pet to live a longer, healthier life. Yet if you dive a little deeper you will find that there are associated risks with subjecting your companion to such a procedure. Complications such as bone deformations, urinary incontinence, and even sickness like cancer. With the information often difficult to find we found that compiling the lesser known risks into a table which listed information such as breed, sex, age, and health, would aid pet owners in making a decision on whether to fix their pet. In addition to creating a table we put together an informative video which provides owners with facts and knowledge on the issues associated with a spay and neuter procedure.

Video Link (OL)

Spay or Neuter: http://www.youtube.com/watch?v=c153foqDcLg

The Issue: Fixing your Pet

Introduction (KJ)

In our current day and age it seems to be that overpopulation is a trend that is ever increasing. The overpopulation I refer to is not of humans, but of animals. Our companion animals are left homeless, running the streets, and often left for dead because of the irresponsibility and carelessness of owners. Spaying and neutering our pets is often the best option to alleviate the number of unwanted and unexpected animals on the street however, there are two sides to every story. Every pet owner should not feel obligated to spay or neuter their companions due to it apparently being the right thing to do. For example if you had a female Siamese cat a little less than a year old should you choose to spay it? The final decision would ultimately be up to you however, you should know that this breed is predisposed to developing mammary carcinoma if you choose not to spay or if you decide to spay at a later age (maxshouse.com). Or what if you had a male breed of terrier that often marks areas of your house, what should be done about that? Normally with this breed one is advised to neuter to stop this type of behavior but again you should know that neutering, if done later than earlier, will cause this behavior to most likely continue if not make it an extremely difficult habit to break (toybreeds.com). On the other hand it is vital to mention, adopted pets, if not previously fixed, should most likely be spayed or neutered. The reasoning behind this is you simply do not know the animals genetic background,
disease could run in the litter, cancer perhaps, or some type of genetic disorder, like diabetes. You should never risk a slip up with an adopted animal, so it is in an owners’ best interest to take a trip to the veterinarian to discuss a future procedure.

Information, although often biased, is available therefore owners should be encouraged by their veterinarians to seek all information, for and against fixing your pet. Pet owners should make a well informed, educated decision on the future of their new pet and know the risks and benefits of such a procedure, based on the breed, age, sex, and health. Although, with continued research it seems that health and breed are becoming a more important factor as opposed to age and sex. Age, we are now finding, may not be as important as we think when it comes to younger animals however, there are still increased risks that should be noted when dealing with geriatric pets. The thing that veterinarians tend to pay attention to is the health of the pet, the weight and overall body condition of these animals(Kraft). Also breed is another determining factor, as there are certain dogs and cats that may have doubled risks due to fixing or deciding not to. As you read further the information provided will help you make an educated and informed decision on whether to spay or neuter your new companion.

Benefits of Spaying and Neutering (KJ)
The first topic that will be discussed are the benefits of neutering and spaying your pet. Neutering is done in males and it is the process of having the testicles removed, while spaying, which is done in females, is the process of removing the uterus and ovaries. There are options such as, a vasectomy for the male companions which, leaves the spermatic artery intact but still sterilizes the male. The problem with this is that most of the behaviors that neutering claims to get rid of will still remain due to testosterone levels being the same in the body (hdw-inc.com). With these options available let us go into discussing the benefits of neutering and spaying our canine companions first.

Canines
Often the benefits are the more obvious aspects of having this procedure, making it seem a very likely decision. Having a dog neutered will keep him from accidently impregnating a female dog in heat if he was to escape an owner’s watchful eye, thus preventing another homeless puppy. Also another thing that should be taken into consideration is that intact males tend to be more aggressive, not a very desirable trait (aspca.org).

Neutering will increase the lifespan, and decrease the incidence of testicular cancer and/or prostate disease as well as perianal fistulas ( Sanborn 2007). Perhaps one of the best things is that neutering should reduce territorial behavior, such as marking the house and dominance behavior such as mounting. The next question would be when you should decide, if you do, to go through with this procedure. Most veterinarians would say that the optimal time for this is as soon as possible, meaning before they reach a year of age. Often the younger the dog the easier the procedure and the quicker the healing time, however we shall discuss the issue with age in greater detail as the paper progresses. For now we should know that pet owners are often advised to neuter their male dogs before six months of age and at least before they reach one year (Campbell&Eldridge 2005).

Moving along to our females, the benefits of spaying a female dog are more numerous than neutering your male. As said with neutering, spaying the female will decrease the possibility of having a litter of puppies that could likely end up as shelter dogs, in the hands of the wrong
owner, or roaming the streets. This could offer your female dog a longer life, since spaying reduces the risk of uterine infections like pyometra, mammary tumors, breast cancer, cervical, uterine, and ovarian tumors and lastly perianal fistulas (Sanborn 2007). There would be no heat (estrus) cycle therefore no males would be attracted to her and this would get rid of pregnancy complications such as, spotting and pseudo-pregnancies. Moving along to the age factor, with females it seems to be a bit easier. The rule, the sooner the better, still applies however; with females they should be spayed before going into their first heat, to reduce the risk of future complications such as mammary tumors and/or cancer (Martinez 2009).

As we end our discussion of the benefits of spaying and neutering dogs we now introduce our feline companions. Most of the common issues that were mentioned with dogs hold true for cats but in the interest of the reader all information is useful. So we will begin with the benefits of neutering male cats.

Felines
Spraying is a major issue with male cats and although it is the same with male dogs, there is a difference in the odor and the male cat has a more distinct smell which is rather difficult and near impossible to get rid of. The next is cats are rather promiscuous, so an intact male can mate with as many females as he wants and impregnate them because female cats are induced ovulators, they must copulate to become pregnant. Therefore neutering a male cat will definitely decrease any possibilities of accidental litters. Again aggression is reduced if not eliminated with neutered male cats; this is important if you have an outdoor cat because it will likely defend its territory and engage in fighting. Neutering reduces the already limited chances of testicular cancer and tumors, as well as feline AIDS, feline leukemia, and rabies. Also, chances of an enlarged prostate are greatly reduced (Knowblet-Aman 2011). The question of age comes into question again and it is often recommended to neuter your male by six months, due to the fact that this is the age they began to spray and again of course younger animals tend to recover better.

Last on our list is a female cat. Female cat will benefit greatly from being spayed because spaying will prevent them from having unwanted litters from many male cats. In other words a female can become pregnant by different male cats simultaneously due to them being induced ovulators. An intact female will copulate with one male and become impregnated and move onto another and male become impregnated by that one as well. This gives an unsprayed female cat the chance to have up to three or four different kittens all from different males, often without homes. As mentioned previously, spaying a cat will reduce roaming outside and also eliminates female spraying. It reduces pregnancy complications and caesarian sections during birth, due to a larger than normal litter, and pseudo-pregnancies which tend to increase in incidence with age. Spaying reduces mammary tumors, uterine, cervical, and ovarian cancer, a risk that also tends to increase with age in intact female cats especially specific breeds of cat such as, domestic short hair cats and Siamese cats. These breeds tend to have a double or triple risk in developing mammary tumors if not spayed (maxshouse.com). It is suggested that a female cat be spayed before puberty or her first heat because spaying after greatly increases the risk of malignant mammary tumors, which is the most common and often most deadly cancer in cats.

To conclude the benefits of spaying and neutering your feline friends, there seems to be little to no information on the risks of fixing your cat. It is almost safe to say that spaying and neutering your cat is the best option. Although any type of procedure will come with risks, the benefits of having this procedure on a cat will definitely outweigh the risks in the long run. In the long run your feline will have a long healthy life due to the decision to spay and/or neuter.
After discussing the benefits, most may be inclined to be very for fixing your furry friend however there are always two sides to everything, and this topic is not excluded. Although there seem to be numerous reasons to spay and neuter your pets, sometimes due to age, health, breed or sex these options may not always be the best choice. There are instances in which health risks outweigh the benefits and neutering or spaying is something you may want to decide against completely. In the next section we will discuss side effects of neutering and spaying in dogs, since there was little to no information on the risks of fixing cats. Here is the information which isn’t easily found but should be, in order for pet owners to make a proper decision.

Health Risks Associated with Spay and Neuter (OL)
In the United States, pets’ owners are often suggested to have their dogs or cats neutered or spayed for healthy reason. It has been agreed by many veterinaries and owners that pets will live longer and healthier after having castration. Recently, experts found out several serious canine diseases were more easily to be developed in early castrated pets than sexually intact pets. Bone cancer, abnormal bone growth, prostate cancer, cranial cruciate ligament disorder, hip dysplasia and obesity are the most common disease that have been associated with early castration.

Having pets in the family is becoming more and more popular in the United States. According to “American Pet Products Manufacturers Association 2009-2010 National Pet Owners Survey” done by the Humane Society of The United States, in our country, about 77.5 million families own dogs and 93.6 families own cats. 39% of the households own at least one dog, while 33% of the households own at least one cat. There are a large portion of owners own two or more dogs and cats in the same time1. As pets have become a very important part in the human life, the health of pets attracts much attention by their owners. Whether the pets should have gonadectomy or not becomes a hot debate in the society.

For a long time, in traditional, it has been admitted that the spayed female pets have less changes to obtain uterine infections and breast cancer while testicular cancer could be also prevented in neutered male pets; and therefore, pets will live longer and healthier. Also, neutered male pets will not roam away from home. They put more their attention and behave better to their families. Female pets will not suffer heat during their breeding seasons as well. Moreover, gonadectomy is a effective method to control the overpopulation of pets2.

Many veterinarians agree that six months should be the perfect time for pets to have gonadectomy3. Dr. Deanna Kraft, DVM, uses her experience to argue that it is the health and weight factor, not age, that determine whether the pet should be had neutering or spaying or not. She claims that the six month rule was not based on scientific theory, but chosen arbitrarily. Dr. Kraft found out it would be also safe to perform sterilization to young kittens and puppies as long as the pets are in good health, weighing as least two pounds and the surgery protocol is correct3. Recently, experts began questioning if pets should have early sterilization or not. The researchers found out several serious canine diseases were more easily to be developed in sterilized pets than intact pets.

Bone Cancer
The scientists in the Department of Veterinary Clinical Sciences and Veterinary Pathobiology, Purdue University, have found out the significant influence of bone tumor by gonadectomy. In their experiment, 683 Rottweiler dogs in the North America area were chosen to obtain experimental data. The results showed that the neutered males and spayed females which had
gonadectomy in their early age (before one year old) were more likely to develop bone sarcoma than sexually intact ones. Those sterilized pets had about one in four lifetime risk for bone tumor\(^4\). The research group suggested that endogenous sex hormones would be the significant factor which influences the development of bone cancer. In this study, 683 Rottweiler dogs were split into four major groups, intact male, castrated male, intact female and spayed female. It has been investigated that the castrated male had the highest possibility to develop bone sarcoma than other groups. Thus, it could be proved that gonadal hormone exposure was a significant risk factor for the development of bone sarcoma\(^4\). To date, the mechanism of how sex hormones have effects on promoting bone sarcoma is still not definite. However, it is mostly understood as the endogenous sex hormones could have the ability to inhibit the transformation of osteoblasts by serving as a prodifferentiation agent\(^4\), or removing one of the cancer's primary impetuses\(^5\).

<table>
<thead>
<tr>
<th>Neuter Status</th>
<th>Dogs with bone sarcoma</th>
<th>Dogs without bone sarcoma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intact</td>
<td>10</td>
<td>120</td>
</tr>
<tr>
<td>Castrated</td>
<td>25</td>
<td>139</td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intact</td>
<td>5</td>
<td>64</td>
</tr>
<tr>
<td>Castrated</td>
<td>46</td>
<td>274</td>
</tr>
<tr>
<td>Total</td>
<td>86</td>
<td>597</td>
</tr>
</tbody>
</table>

Table 1. Bone sarcoma distribution in 683 Rottweiler dogs

Abnormal Bone Growth and Development
The study from Purdue University, USA and University of Turin, Italy indicated that dogs which had sterilization too early or before puberty would grow taller than normal dogs or the ones which were sterilized after puberty\(^5\). It is believed that the estrogen produced in puberty is the significant factor to control the bone growth plates. Growth hormone (GH) and insulin-like growth factor 1 (IGF-1) are agreed as the two major factors involved in bone growth. The concentration changes of sex hormones, both androgen and estrogen, have impacts on the secretion of GH and IGF-1, which will have great effects on the bone formation. A study has shown that estrogen stimulates the secretion of GH, while testosterone is also able to stimulate the secretion of GH by converting itself into estrogen\(^17\). Bone formation takes place at the growth plate at where estrogen plays a critical role. It can prevent in aromatase gene and ER-\(\alpha\) gene from mutation. As the estrogen-producing organs are removed when dogs are still immature, it slowed the closure of growth plates which resulting to the continuously growing of bones. These abnormally growing bones cause the abnormal bone structure inside the dogs; and finally develop as irregular body proportions\(^5\).

Prostate Cancer
Previous studies found that the risk of obtaining mammary cancer would be reduced in about 90% if dogs and cats were spayed before one year old\(^6\). Similarly, the risk of prostatic cancer would be also reduced in male dogs and cats as gonadectomy were done in the early age\(^7\). Nevertheless, the research done by Dr. Robert Padley and Dr. E. Teske suggested that the risk of developing prostate cancer in sterilized dogs and cats appeared to be higher than intact dogs\(^8,9\).

Endothelin (ET) change is the main cause of the increasing risk of developing prostatic cancer\(^8\). ET-1, ET-2 and ET-3 are three members in the ET system. It is known that ET\(_A\) is the receptor for both ET-1 and ET-2, while ET\(_B\) is the receptor for ET-3\(^10\). A study shows that ET-1 and
ET\textsubscript{A} level are increased in prostate cancer patients. Thus, experts consider ET-1 promote the formation of prostate cancer\textsuperscript{11}. In Padley’s study, six male beagle dogs were used to examine the relationship between ET system and neutered dogs. Among the six dogs, three of which were castrated and the others were intact. His experimental result showed that there was a higher level of ET-1 and ET-3 in castrated dogs than intact dogs. Moreover, he also found a significant increasing of binding between ET-1 and ET\textsubscript{A} in castrated dogs. It was proposed that androgen was depleted after sterilization. As a result, the ET receptor system was upregulated. This upregulation of ET system, therefore, was considered help the survival of prostate cancer cells when the prostate cancer became androgen−refractory\textsuperscript{11}.

Dr. Teske studied the relationship between castrated dogs and prostate cancer by analyzing benign prostatic hyperplasia(BPH) in both castrated and intact dogs\textsuperscript{9}. BPH was found more in castrated dogs than intact dogs. The sterilization of dogs results to the decreasing of epithelial cells which are androgen dependent and the increasing of basal cells which are androgen independent. These basal cells are thought to be the possible places where prostate cancer arises from\textsuperscript{9}. Therefore, with the increasing number of basal cells in castrated dogs, the chance of developing prostate cancer is also increased in castrated dogs compared with intact dogs.

**Obesity**

Obesity is also one of the issues resulted from early-age neutering in dogs and cats. Previous research found out castrated cats experienced higher risk to become obese and develop diabetes mellitus than intact cats\textsuperscript{12}, loss of estrogen contributed to the decreasing in leptin concentration which further caused the increasing food intake\textsuperscript{13}. There was a hypothesis that hormones were a kind of biochemical which involved in glucose and fat metabolism. After castration, the change of hormone level affected the amount of food intake of dogs and cats. More food was needed to supply their increased energy requirement\textsuperscript{14}. It was also reported that becoming less active contributed as another reason for gaining weight in castrated dogs\textsuperscript{15}. Some researchers explained that castration would also change the concentration of gonadotropin-releasing hormone(GnRH) which is a kind of pituitary hormones in the body. Increasing of GnRH in the body leads to a shift from catabolism to anabolism in the body\textsuperscript{16}. Thus, it is believed that fats are more easily to be formed rather than decomposed in castrated dogs and cats than sexual intact ones.

**Cranial Cruciate Ligament(CCL) Rupture**

Cranial Cruciate Ligament Rupture is “the tearing of an important ligament in the stifle joint (knee), resulting in partial or complete joint instability, pain, and lameness”\textsuperscript{17}. Dr. Slauterbeck reported that the prevalence of CCL rupture in castrated dogs were higher than intact ones\textsuperscript{18}. Figure 1 is the result from his experiment. CCL in neutered dogs is about twice as many as in intact male dogs, and CCL in spayed dogs is about 1.5 times the amount of intact females. As mentioned before, sex hormones play a critical role in bone formation. Since the lacking of sex hormones, neutered or spayed dogs will keep growing and appear to be taller and bigger than the same aged species. Such continuous growing leads to an abnormal body structure which develop irregular angle at stifle position. Moreover, lower leg below stifle would become heavier as the body of dog keeps growing. This change gives more stresses on the cranial cruciate ligament and finally would develop to CCL\textsuperscript{18}. 
Hip Dysplasia

Hip dysplasia is also higher of early castrated dogs or cats than intact dogs or cats. It is reported that dogs have castration before they were 5 and half months old would have 1.5 times higher in chance to suffer hip dysplasia compared to the same species which have their castration after 5 and half month old. It is also the abnormal growth issue that leads to this problem.

In general, neutering and spaying have brought up a lot of health issues to dogs and cats. Pets’ owners should evaluate the benefits and risks before giving their pets surgery.

Conclusion (KJ)
After researching information that is available the best option is to educate yourself as previously stated. There are many veterinarians who are willing to go through with a procedure, stating the vast benefits and maybe mentioning a slight risk or two however, a pet owner should be informed on all the risks. Many owners who have breeds that are predisposed to certain disorders don’t know that their purebred dog is at a higher risk of developing a disease than a mixed breed or rather, certain breeds of dogs, which are already prone to an array of problems (bloat, orthopedic disorders, tumors, etc.), may develop more disorders if spayed or neutered too soon, too late, or not at all. The conclusive answer is not a simple yes or no, but to make the decision based on the information you have gathered for your pet. Becoming educated is the right answer for yourself and your companion.
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