What is the optimal age for desexing?

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Surgical sterilization of dogs and cats is one of the most frequently employed methods of preventing pet overpopulation\(^1\). In the United States, gonadectomy is one of the most common veterinary procedures performed\(^2\). Its timing is controversial, mainly because it presents a mixture of benefits and adverse effects that depend upon the age at neutering, sex, species and breed\(^3\).

At present, most veterinarians in the United States recommend that elective gonadectomy be performed in dogs and cats at 6 to 9 months of age, however there does not appear to be any scientific evidence to document that this is the optimal age\(^2\). It is argued that to optimise the effectiveness, gonadectomy should be performed prior to the onset of puberty\(^1\).

Several conditions in dogs and cats can be impacted by elective gonadectomy, including neoplasia and orthopaedic diseases\(^2\). Gonadal hormone influences reproductive, skeletal, physical and behavioural development in immature animals\(^1\) and there is a trend to allow bitches and queens to experience an oestrus cycle before surgical sterilization. Knowledge of the benefits and detriments associated with this procedure enables veterinarians to provide appropriate science to clients to make informed decisions and promote animal health\(^2\).

**Mammary neoplasia**

Gonadectomy in dogs and cats significantly reduces the incidence of malignant mammary tumours when compared to their intact counterparts, however the age at which gonadectomy occurs plays an important role. The risk of developing malignant mammary tumours in dogs undergoing gonadectomy prior to the first oestrus is reduced by 99.5% when compared to intact dogs. If performed after the first oestrous and before the second oestrous dogs had a 92% reduction in risk, furthermore if dogs were allowed to have more than two oestrous cycles or are older than 2.5 years the effect is lost\(^4\). This was also reflected in cats. Queens undergoing gonadectomy prior to 6 months of age had a 91% reduction in the risk of malignant mammary tumours when compared to intact cats. If gonadectomy is performed prior to 1 year of age, cats had an 86% reduction in risk, if performed between 12 and 24 months of age had an 11% risk reduction, but after 24 months of age there was no benefit\(^5\).

**External genitalia and the genital tract**

Queens and bitches spayed at 7 weeks or 7 months developed a small and infantile vulva when compared to intact females\(^1\). The incidence of a recessed vulva, perivulvar dermatitis and vaginitis are higher in spayed bitches than in intact bitches and may even have a higher incidence in bitches spayed as a puppy\(^3\). Castration prevents testicular and epididymal disorders, such as neoplasia, torsion of the spermatic cord, orchitis and epididymitis. This is particularly important in male dogs as the testicles are the second most common anatomical sites for cancer development\(^3\). These diseases are very rare in tomcats.

**Urinary incontinence**

The risk of urinary incontinence is low in intact bitches and varies between 3% and 21% in spayed bitches, with signs of incontinence appearing within 3 years of
The risk is influenced by various factors such as body weight and time of spaying. Dogs weighing less than 20 kg have a risk below 10% of becoming incontinent after spaying, whereas in dogs weighing more than 20 kg, the risk is up to 30%. Spaying shortly before puberty seems to reduce the risk by 50%\textsuperscript{3}. In another study, bitches were significantly more likely to develop urinary incontinence when spayed at less than 3 months of age than bitches spayed between 3 months and 1 year of age\textsuperscript{8}.

**Prostate**

The removal of androgens by bilateral orchietomy has a therapeutic effect on diseases such as benign prostate hyperplasia, perineal adenomas and perineal hernias. Moreover, 50% of intact dogs exhibit histological evidence of benign prostatic hyperplasia by 5 years of age\textsuperscript{3}. Furthermore, benign prostatic hyperplasia predisposes dogs to prostatitis, and castration is a suitable treatment for both conditions. Bryan et al, 2007 studied dogs with prostatic cancer and identified an increased risk of neutered dogs to develop prostatic cancer (with an odds ratio of 2.84 for all prostate tumours) and compared to intact dogs with prostatic cancer, neutered dogs were more likely to fall into an older-age category\textsuperscript{7}.

**Hip dysplasia**

The development of hip dysplasia is possibly influenced by gonadectomy. Neutered Boxers, with a mean age of 3 years at neutering, were 1.5 times as likely to develop hip dysplasia than sexually intact dogs\textsuperscript{9}. Age at gonadectomy can also influence the development of hip dysplasia. Puppies that underwent gonadectomy before 5.5 months of age had a 6.7% incidence of hip dysplasia, while those neutered between 5.5 months and 1 year of age had an incidence of 4.7%\textsuperscript{6}. Moreover, in a recent study, Belanger et al, 2017, found that neutering had no effect on the risk of hip dysplasia\textsuperscript{8}.

**Cranial cruciate ligament**

Gonadectomy has an influence on the prevalence of cranial cruciate ligament rupture. The prevalence is most common in neutered males, followed by spayed females, while intact animals have only half of the risk\textsuperscript{9}. No data is provided on the body weight\textsuperscript{3}. This was further supported by Belanger et al, 2017 finding that both males and females were at an increased risk in all gonadectomized dogs.

**Osteosarcoma**

A study comparing 3062 pure-bred dogs with osteosarcoma and 3959 pure-bred dogs without osteosarcoma, revealed a twofold increased risk of osteosarcoma among neutered dogs when compared to intact dogs\textsuperscript{10}. The data did not include the age at gonadectomy, so this study could not evaluate bone sarcoma risk in terms of duration of gonadal hormone exposure\textsuperscript{3}. Cooley et al. 2002 tested the hypothesis that endogenous sex hormones significantly influence bone sarcomagenesis with Rottweiler dogs, a breed known to be at high risk for bone sarcoma. Bone sarcoma was diagnosed in 12.6% of dogs in this cohort overall, with neutered dogs having a twofold increased risk\textsuperscript{11}. Belanger et al, 2017 found that both gonadectomized females and males were at an increased risk of osteosarcoma with an odds ratio of 2.53 and 1.62 respectively.

**References**


