



## Early-age neutering in dogs and cats: advantages and disadvantages

*Castração precoce em cães e gatos: vantagens e desvantagens*

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### Abstract

Prepubertal gonadectomy is defined as the surgical sterilization of immature male and female animals aging from 6-to-14 weeks, and it is a less invasive, less traumatic surgery when performed prior to puberty than in adult animals. In dogs, growth plate closure is delayed when surgery is performed prior to puberty, but the delay is significantly longer when neutering is done at 7 weeks as compared to 7 months. External genitalia do not develop fully: penile and preputial immaturity and decreased radiodensity of the os penis are frequently observed. Vulvar development is also often insufficient in bitches gonadectomised at 7 weeks. Heat production is 28% lower in neutered compared to intact cats. A decrease in urethral diameter has been observed in neutered female but not male cats. Effects of prepubertal gonadectomy on behaviour vary depending on species and sex. In general, excitability and degree of activity are increased in males and females gonadectomised at 7 weeks or 7 months, and when surgery is done at 7 weeks animals are found to be more excitable if compared to those gonadectomised at 7 months. Incidence of urinary incontinence in the canine population may increase significantly when gonadectomy is done prior to 3 months of age. The most important anesthetic and surgical considerations concern fasting, the use of a warm environment, the use of short-acting inducing drugs, of volatile anesthesia. Prepubertal neutering is probably an acceptable technique for dogs and cats, although it carries some (minor) risks which should be explained in details whenever using it for client-owned animals.

**Keywords:** ovariohysterectomy, spaying, gonadectomy, prepubertal.

### Introduction

Prepubertal gonadectomy is defined as the surgical sterilization of immature male and female animals aging from 6-to-14 weeks and has been used to control pet over-population in United States since the second half of the last century. Apart from ensuring that the animal will never be able to reproduce after puberty, gonadectomy is also a less invasive, less traumatic surgery when performed prior to puberty than in adult animals. When trying to deal with the pet overpopulation problem, neutering puppies and kittens prior to adoption is regarded as an important asset in order to avoid unwanted pregnancies when owners do not comply with the neutering contract which is normally signed or agreed upon at the time of adoption. However, performing a surgical procedure in very young animals poses some constraints and risks, and may be characterized by side effects which may not be present (or may not be as serious) when gonadectomy is performed at an older age. The following is a brief discussion of advantages and disadvantages of early-age neutering in dogs and cats.

### Physical changes

In dogs, growth plate closure is delayed when surgery is performed prior to puberty, but the delay is significantly longer when neutering is done at 7 weeks as compared to 7 months. The rate of growth is unaffected but both radius and ulna become longer regardless of the age at neutering. Food intake is not affected nor is weight gain or back-fat depth during the first 15 months or until the age of 18 months when comparing 7 week- to 7 month-neutered puppies, but weight gain later in life has been reported in non-working bitches. Although it is well known that neutering predisposes (non-working) dogs to develop obesity, the time at which gonadectomy is performed in these animals probably does not affect the clinical manifestation of this problem. External genitalia do not develop fully: penile and preputial immaturity and decreased radiodensity of the os penis are frequently observed (which rarely if ever constitute a problem). Vulvar development may be insufficient in bitches gonadectomised at 7 weeks. However, the incidence of infolding of vulvar lips leading to perivulvar dermatitis and chronic vaginitis is not different when compared to bitches neutered at 7 months. In cats neutered at 7 weeks or 7 months of age physal closure is delayed 5 to 7 months resulting in a 10% longer size of long bones when comparing neutered to intact cats. Fractures of open physes have been reported in neutered cats at 12-16 months of age. Also, when penile extrusion was attempted at the age of 22 months, it could be done in all intact cats, in only 60 % of cats neutered at 7 months and in none of the cats neutered at 7 weeks. Heat production is 28% lower in neutered compared to intact cats, which means that castrated cats require 28% less caloric intake when compared to intact animals. No decrease in urethral diameter (and therefore



no increased risk of lower urinary tract disease) has been observed in neutered male cats (regardless of age at neutering) compared to the intact population, with no difference in urethral closure pressure in neutered vs intact female cats, while there was a significant decrease in the diameter of the pre-pelvic urethras in queens neutered at 7 weeks. Glucose metabolism (glucose half life, peak serum insulin concentrations, peak insulin response following intravenous glucose administration) was not altered in neutered (regardless of age at neutering) compared to intact cats when evaluated at 6, 12, 18 months of age, while at 24 months of age neutered male cats had a significantly later peak serum insulin response when compared to intact cats.

### **Behavior**

Effects of prepubertal gonadectomy on behaviour vary depending on species and sex. In dogs increased aggressiveness and barking towards family members and strangers, increased fear of noise, increased sexual behaviour but decreased separation anxiety and decreased urination at home have been observed. In general, excitability and degree of activity are increased in males and females gonadectomised at 7 weeks or 7 months, and when surgery is done at 7 weeks animals are found to be more excitable if compared to those gonadectomised at 7 months. However, inappropriate behaviors as reasons for relinquishment have not been reported in dogs neutered at an early age when compared to those neutered as adults, and in Labrador/Golden Retriever crosses raised as guide dogs for the blind, neutering at 7 weeks or 7 months does not affect the degree of training success. No effect of early age neutering on playfulness, excitement or frequency of vocalization has been reported in cats. In cats castrated prior to 5 months of age there is a decrease in activity and an increase of shyness towards strangers.

### **Side effects**

Physal (also known as Salter-Harris) fractures have occasionally been reported in mature cats with still open physes due to early age neutering. Salter-Harris fractures are a potential complication when prepubertal gonadectomy is performed, but appear to be as an extremely rare condition in both dogs and cats.

Obesity is reported as a common side effect of neutering. No difference in food intake, weight gain or back-fat depth were reported for the first 15 months following neutering when a total of 32 neutered and intact dogs were compared. However, larger studies indicate that, irrespective of age at surgery, spayed female dogs are about twice as likely to become obese as intact animals. It appears that in working bitches there is no increase in body weight following neutering; however, in this study the observation period was limited to 55 weeks, therefore more research is needed to clarify the role of regular exercise in the development of obesity in neutered bitches. The risk for obesity does not change in animals gonadectomized prepuberally. It is unknown whether there is a predisposition to obesity, but if this is the case gonadectomy seems to have the same stimulus regardless of age. Obesity is also a side effect of neutering in cats, as intact animals have a lower weight and a lower fat thickness than cats neutered at 7 weeks or 7 months. The resting metabolic rate is lower and body condition scores are higher in gonadectomised (irrespective of age at neutering) compared to intact cats.

Adrenal tumors may occur in certain strains of mice gonadectomised at birth, and are also a concern in neutered ferrets but no such lesion has ever been reported in dogs or cats following neutering.

Urinary incontinence (UI) is a common sequel of spaying in bitches, with the interval between spaying and diagnosis of incontinence varying from days to months or even years. Incidence of UI in the normal canine population varies from 0.3 to 2.0%, while it increases to 5-10% in the spayed bitches population. In a long-term study on risks and benefits of early age neutering in dogs, the incidence of UI was reported to increase in bitches neutered prior to 3 months of age when compared to that of bitches neutered after 3 months, therefore the age of 3 months was indicated as a threshold after which female puppies could be safely neutered. However, many authors think that going through puberty may have a beneficial effect as it allows the reproductive system to reach its final stage of growth thereby perhaps limiting the incidence of side effects such as UI as well as those due to insufficient growth of external genitalia.

### **Anesthetic and surgical issues for early-age patients**

Early age patients should be in healthy conditions and normally hydrated before anesthesia and surgery. Also, proper immunization for the most common infectious diseases should have been previously performed. Although vaccination should be a prerequisite, vaccination failures may occur and death of immunized young dogs/cats entering a veterinary facility for castration purposes has been reported during the 7-day period following surgery. From a surgical point of view, neutering at a very early age is a very simple and quick, low-risk procedure. The incidence of short-term post-surgical complications is lower in young ( $\leq 12$  weeks of age) than in young adult ( $\geq 24$  weeks of age) animals and most of the complications are minor problems such as swelling of the abdominal suture. The following guidelines should be followed when performing surgical procedures in very young animals:



- In order to avoid hypoglycaemia fasting prior to surgery should not be longer than 1 hour; also, eating should be allowed as soon as the patient is able to stand
- The use of heating pads and a warm environment during and after surgery is recommended in order to avoid hypothermia which occurs very commonly in young patients; hypothermia prolongs recovery time and slows the metabolism of anesthetic drugs
- Controlling post-operative pain is fundamental to help return to normality thereby stimulating appetite. Anti-inflammatory drugs are known to cause physal cartilage damage following chronic use, but they may not be harmful following (although there is no information about side effects due to single treatments)
- The opioid petidine provides analgesia and sedation without causing bradycardia; petidine must be given exclusively IM because it releases histamine causing pain when given IV
- Avoid bradycardia-inducing drugs (such as alpha-agonists like medetomidine)
- Avoid long-acting drugs (such as acepromazine or tiletamine-zolazepam) as they prolong recovery time
- Use short-acting drugs for induction of anesthesia (such as propofol or alfaxalone) to avoid drug residues during the recovery phase
- Benzodiazepine can be used to increase sedation (thanks to its cardiovascular sparing effect)
- If possible use only volatile anesthesia during surgery
- Atropine or glycopyrrolate are not advised as they decrease respiratory secretions by reducing the serous component thereby potentially causing the development of dangerous mucous plugs.
- Buprenorphine can be associated as a single shot as it gives a long analgesic effect without CVS depression
- The association ketamine-midazolam can be safely used in kittens as it stimulates the central nervous system without causing any depression of the cardio-respiratory function

### Conclusions

Prepubertal neutering is probably an acceptable technique for dogs and cats when it is performed at a shelter. Health risks are minimal and there are advantages due to the lower incidence of side effects when compared to performing it in adult animals. However, the choice of neutering a very young ( $\leq 3$  months) pet should be thoroughly discussed with the owner carefully highlighting advantages and disadvantages. Despite a lack of scientific base, the option of delaying neutering bitches until after the first heat should be considered because of the potential beneficial effects on the development of the reproductive system

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