

Surgical neutering and nonsurgical alternatives

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Overpopulation of unwanted or stray cats and dogs continues to be a problem not only in North America, but in other countries of the world. It has been reported that more than 27 million dogs and cats are impounded annually in the United States alone.¹ Although the figures vary, an estimated 5.4 to 9.1 million dogs and 5.7 to 9.5 million cats were euthanatized in animal shelters in the United States in 1990.² It is important to recognize that although this problem is primarily one of unwanted or stray animals, some cats can be included in the classification of "pet overpopulation." The term "pet" connotes that a human being has assumed ownership and responsibility for the animal. However, that does not mean that the pet owner is a responsible individual, nor does it mean that he or she has not contributed to the overpopulation of unwanted or stray cats. A survey of 500 pet-owning households in Massachusetts revealed that 73 and 87% of all dogs and cats, respectively, had been neutered. Of interest was that 20% of these neutered animals had been allowed to reproduce before they were sterilized.² In addition, the numerous cats that are abandoned or euthanatized for such undesirable characteristics as behavioral problems may be a component of "pet overpopulation." Not only should pet owners assume responsibility for their pets, but the practicing veterinarian must assume responsibility to counsel clients on responsible pet ownership, including behavioral modification and the advantages and risks of neutering.

As parents, we want our children to experience the "miracle of birth" as it relates to the family pet. However, if 1 litter is allowed to be born, the effects on animal overpopulation can be overwhelming. If 2 cats produce 8 kittens/y, production of 174,760 cats in 7 years could potentially result.²

Prevention of Pregnancy

Any method of prevention of pregnancy in cats must be affordable, reliable, safe, and convenient.² Methods for neutering cats can be divided into the categories surgical and nonsurgical. Nonsurgical methods or alternatives to neutering in female cats include oral administration of megestrol acetate, parental administration of

steroid hormones, induction of pseudopregnancy, administration of gonadotropin-releasing hormone agonists and antagonists, zona pellucida vaccines, and tissue-specific cytotoxins. Nonsurgical methods of neutering in male cats include steroid-hormone suppression of reproductive function and injection of chemical sterilants into the testes.³

Surgical methods of neutering in female cats include ovariectomy (OHE), tubal ligation, ovariectomy, salpingectomy, or subtotal hysterectomy. Surgical methods of neutering male cats include castration (bilateral orchidectomy) and vasectomy.

Nonsurgical alternatives—By definition, "neuter" refers to desexing an animal or rendering it sterile.⁴ It is also defined as a spayed or castrated animal.⁵ To this end, the only nonsurgical methods of neutering would be the use of agents that permanently render the cat sterile. These agents would include chemical sterilants, cytotoxins, and vaccines.^{2,3} Other methods of nonsurgical prevention of pregnancy require continuous administration of medication/treatment that does not render the cat permanently incapable of reproduction and requires responsible pet ownership.

Chemical sterilization—Chemical sterilants for injection into the testis and/or epididymis of dogs have been developed. Except for neutralized zinc arginine, chemical sterilants have not been developed or evaluated in cats.³ Injection of chemical sterilants into the testes, ductus deferens, or epididymides results in permanent azoospermia, alteration in the physical composition of the testes, and alteration of testosterone production. If a chemical sterilant is injected into the testes, androgen production is reduced, thus ameliorating androgen-dependent disorders such as prostatic disease, behavioral problems (urine marking, mounting, aggression toward other males, and fighting), and gonadal disease. If these agents are injected into the ductus deferens or epididymides, azoospermia may result, but androgen-dependent disorders may still develop.^{2,3}

Chemical sterilants that have been evaluated in dogs include chlorhexidine gluconate, with or without dimethyl sulfoxide (DMSO); ethylcellulose in DMSO and formalin; chlorhexidine in ethylcellulose; zinc tannate; zinc arginine; and acrylic hydrogel N-50 and N-90 dissolved in DMSO. Aqueous solutions of chlorhexidine

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digluconate have been injected into cats, but results were inconsistent. The aforementioned chemical agents have not developed into promising methods of chemical sterilization because of inconsistent results and unsatisfactory tissue reactions.²

A chemical sterilant that holds promise for use in dogs and cats is zinc gluconate neutralized by arginine. Injection of this chemical into the testes of epididymides induces sterility, without interfering with development of male secondary sex characteristics. The mode of action is attributable to the zinc arginine causing atrophy of the seminiferous tubules, scar tissue formation, and atrophy of the rete testis and coils of the head and body of the epididymis, resulting in failure of production and maturation of spermatazoa. The increased concentration of zinc ion in the testis inhibits division and replication of germinal cells and causes fragmentation of the cell membrane and nucleus. Extensive research trials have been completed in dogs and cats.⁶ Presently, the FDA Center for Veterinary Medicine is reviewing the results of the research trials and evaluating proposed clinical trials in dogs.

Zona pellucida vaccines are being evaluated in cats. Perhaps if such a vaccine was given before puberty, it would render a cat's ovaries permanently nonfunctional. Tissue-specific cytotoxins may achieve permanent sterilization in cats and dogs, but these agents have not been fully developed.²

Surgical alternatives—Surgical sterilization of cats, whether pre- or postpubertal, is the most reliable and commonly used method of rendering cats incapable of reproducing. The anesthetic and surgical techniques for OHE and castration in prepubertal and mature cats have been well documented.⁷⁻¹⁰ The advantages of surgical sterilization include not only the obvious one of rendering the cat incapable of reproducing, but also include a decrease in the incidence of androgen- and estrogen-dependent medical disorders and of other reproductive diseases or conditions related to the reproduction organs.³

Ovariohysterectomy—Ovariohysterectomy or spay is an important contraceptive technique in cats because they are polyestrous induced ovulators, and thus may have fertile estrous cycles year-round.³ Complications of spaying in cats are similar to those described for dogs, but less well documented, and include anesthetic complications, wound dehiscence, incisional infections, adverse reaction to suture materials, hemorrhage, incomplete removal of ovaries and uterus (ovarian remnant syndrome), accidental ligation of a ureter, and granulomas of uterine or ovarian stumps.^{9,10} The benefits of OHE to the cat are decreased risk of mammary neoplasia, prevention of pyometra, and decrease in urine marking.^{3,11}

Bilateral orchidectomy—The advantages of bilateral orchidectomy in male cats include a decrease in reproductive behavior (age-dependent), aggressive behavior, roaming, and urine marking. Other beneficial aspects include a decrease in risk of testicular cancer, orchitis, and disease of secondary sex organs.¹¹ Postoperative com-

plications include anesthetic risks, avulsion of ureters, hemorrhage, scrotal bruising and swelling, and infection at the surgery site.^{9,10} A common misconception is that castrated male cats gain weight and become lethargic. Weight gain and lethargy are probably related to dietary habits and decrease in activity (eg, roaming behavior).¹¹ A potential disadvantage of castration is retention of the adhesions that are present between the penis and prepuce during pre- and postnatal development, but this has not been documented as an important cause of preputial inflammation or infection.¹²⁻¹⁵

A very common misconception is the theory that castration, especially at an early age, predisposes male cats to urethral obstruction. There is excellent scientific evidence that the incidence of urethral obstruction or lower urinary tract disorders is not related to castration in cats.¹²⁻¹⁷

Early-age Neutering

It stands to reason that if neutering cats is the most reliable method to avoid unwanted pregnancies and thus avoid contributing to the overpopulation of stray or unwanted cats, neutering the cat before it reaches sexual maturity would be more effective.^{2,18,19} This philosophy is especially important for animal shelters, because owner compliance with neutering programs is often less than 60%.¹⁵ Thus, it would be ideal to release for adoption only cats that were neutered, and thus maintain 100% compliance.

Puberty may occur between 4 and 21 months of age in female cats and between 8 to 10 months in males.¹³⁻¹⁵ Although neutering is one of the oldest surgical procedures described in domestic animals,²⁰ there is very little information in the literature that establishes the ideal age at which to neuter a cat. Most veterinarians were instructed during training that the optimal age to neuter cats was 5 to 8 months. A search of the literature reveals that early in this century, cats, dogs, and other domestic farm animals were neutered at 4 weeks to 6 months of age.¹³

Although there is now evidence that neutering cats and dogs at less than 4 months of age is a safe and effective procedure, veterinarians, pet owners, and shelter personnel still question such a practice.^{7,10,12,14-15} Many concerns over early-age or prepubertal neutering of cats included risks of neonatal anesthesia, stunted growth, obesity, perivulvar dermatitis, vaginitis, urinary incontinence, endocrine and dermatologic abnormalities, behavioral changes, immunocompetence, and urethral obstruction. Some of these conditions are related to neutering, but there is no evidence in the literature to substantiate claims that early-age neutering increases the risk of these conditions developing. On the contrary, recent studies involving early-age neutering in cats and dogs have revealed that such problems are not related to early-age neutering.^{11-13,15}

A study was conducted by Salmeri and coworkers at the University of Florida, relative to early-age neutering of dogs.¹² As a follow-up to this study, a similar investigation was performed in domestic cats. Thirty-one do-

mestic cats were studied to determine the effect of prepubertal gonadectomy on skeletal maturation and growth, body weight, body fat, secondary sex characteristics, and behavioral development. Thirty-one kittens from 7 litters were randomly allotted to 3 groups. The 11 kittens in group 1 were neutered at 7 weeks of age, and in group 2, at 7 months of age. The 9 cats in group 3 were kept sexually intact, and were neutered following completion of the study. Anesthetic and surgical techniques for neutering cats less than 4 months of age were very similar to those already described.^{7,10,21} Technical advantages of early-age neutering included decreased operative time, improved visibility of intra-abdominal structures, and rapid recovery from anesthesia.

The results early-age neutering of cats were similar to those in dogs.^{12,14,15} Closure of the distal radial physis was significantly delayed in neutered cats in groups 1 and 2 compared with that in sexually intact control cats in group 3. There was no significant difference in maturation of the distal radial physis between female and male cats of any age group. Although physeal closure was delayed in groups 1 and 2, there was no significant difference in mature length of the radius among any of the treatment groups. Male cats in all groups had significantly longer radii than their female counterparts did.

Body weights of cats in groups 1 and 2 did not differ significantly. However, group-2 cats were significantly heavier than the intact cats group 3. All male cats were heavier than their respective female counterparts. Fat measurements in group-1 and -2 cats were significantly greater than in group-3 cats. There were no differences in body fat between male and female cats.

Secondary sex characteristics of group-1 and -2 cats were underdeveloped. The penile spines in group-2 male cats were atrophied, and in group-1 cats were completely absent, compared with those of group-3 cats. The vulva in group-1 and -2 females appeared smaller than in group-3 females.

Four urinary tract variables were measured in each treatment group, to include maximal urethral pressure, maximal urethral closure pressure, functional urethral pressure length, and diameter of the urethra (male cats only). No significant differences were noticed among any of the treatment groups, relative to these variables.

There were very few behavioral differences between the 3 treatment groups for the variables measured, which included activity level, excitement, frequency of vocalization, affection, and intraspecies aggression. The sexually intact group of cats (group 3) displayed significantly greater intraspecies aggression and less affection toward a human observer than did neutered cats.

At the completion of the project, the intact cats in group 3 were neutered at 12 months of age. An identification microchip was implanted subcutaneously in each cat in all 3 treatment groups. The cats were placed with

private owners in 1992. Follow-up questionnaires and physical examinations were completed on all of the cats that were able to be located in 1993, 1994, and 1995. These long-term follow-up evaluations have identified no adverse effects previously thought to be related to prepubertal gonadectomy. It was concluded that neutering at 7 weeks and 7 months of age had similar effects on physical and behavioral development in domestic cats.

Prepubertal gonadectomy in cats is a safe and effective means of controlling the feline population in animal control and private veterinary practice environments. The advantages of early-age neutering far outweigh the risks. However, there is still a need to further document the long-term effects of early-age neutering.

References

1. Crenshaw WE, Carter CN. Should dogs in animal shelters be neutered early? *Vet Med* 1995;90:756-760.
2. Olson PN, Johnston SD. New developments in small animal population control. *J Am Vet Med Assoc* 1993;202:904-909.
3. Concannon PW, Meyers-Wallen VN. Current and proposed methods for contraception and termination of pregnancy in dogs and cats. *J Am Vet Med Assoc* 1991;198:1214-1225.
4. Blood DC, Studert VP. In: Carling RCJ, ed. *Baillière's comprehensive veterinary dictionary*. Philadelphia: Baillière Tindall, 1988;622.
5. *Webster's ninth new collegiate dictionary*. Springfield, Mass: Merriam-Webster Inc, 1989;795.
6. Fahim MS, Wang M, Sutar FM, et al. Fertility control for overpopulation of pets, in *Proceedings*. 1st European Congr FECAVA and CNVSPA 1994.
7. Aronsohn MG, Fragella AM. Surgical techniques for neutering 6- to 14-week-old kittens. *J Am Vet Med Assoc* 1993;202:53-55.
8. Crane SW. Orchidectomy of descended and retained testes in the dog and cat. *Current techniques in small animal surgery*. 3rd ed. Philadelphia: Lea & Febiger, 1990;416-422.
9. Fingland RB. Uterus. In: Bojrab MJ, ed. *Current techniques in small animal surgery*. 3rd ed. Philadelphia: Lea & Febiger, 1990;398-404.
10. Hosgood G. Surgical and anesthetic management of puppies and kittens. *Compend Contin Educ Pract Vet* 1992;14:345-359.
11. Johnston SD. Questions and answers on effects of surgically neutering dogs and cat. *J Am Vet Med Assoc* 1991;198:1206-1214.
12. Salmeri KR, Bloomberg MS, Scruggs SL, et al. Gonadectomy in immature dogs: effects on skeletal, physical and behavioral development. *J Am Vet Med Assoc* 1991;198:1193-1203.
13. Salmeri KR, Olson PN, Bloomberg MS. Elective gonadectomy in dogs: a review. *J Am Vet Med Assoc* 1991;198:1183-1192.
14. Stubbs WP, Salmeri KR, Bloomberg MS. Early neutering in the dog and cat. In: Kirk RW, Bonagura JD, eds. *Current veterinary therapy XII*. Philadelphia: WB Saunders, 1995;1037-1040.
15. Stubbs WP, Bloomberg MS. Implications of early neutering in the dog and cat. *Semin Vet Med Surg* 1995;10:8-12.
16. Herron MA. A potential consequence of prepubertal feline castration. *Feline Pract* 1971;1:17-19.
17. Herron MA. The effect of prepubertal castration on the penile urethra of the cat. *J Am Vet Med Assoc* 1972;160:208-211.
18. Lieberman LL. Advantages of early spaying and neutering (lett). *J Am Vet Med Assoc* 1982;181:420,422,434.
19. Lieberman LL. A case for neutering pups and kittens at two months of age. *J Am Vet Med Assoc* 1987;191:518-521.
20. White GR, ed. *Animal castration*. 2nd ed. Chicago: Alex Eger, 1935;1-222.
21. Theron P. Early-age neutering of dogs and cats. *J Am Vet Med Assoc* 1993;202:914-917.