Casablanca Kuvasz

Gail S. Dash & Neil Berger

8620 Louise Ave.
Northridge, CA 91325

Kennel now located in Phelan, San Bernardino County
818-77-BWDOG or 818-772-9364

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RECEIVED
FEB 0 1 2008

February 1, 2008

Los Angeles City Council

Dear Council Members,

I'm a resident of Northridge. My husband and I own nearly an acre in one of the few neighborhoods in L.A. City still zoned for horses. We thought the rural neighborhood would be the perfect place to engage in our passion.

Our passion is the preservation of an ancient breed of dog used by the shepherds in Hungary as a protector of the flock. This breed is Kuvasz. We show and train our dogs; we rescue kuvasz from shelters, vet them at our own expense, rehab them and find them new homes. We breed a litter about once every two years.

Was it about ten years ago that the City adopted the Pet over Population ordinance? The license for our intact bitch increased to $100. When we bred her we spent another $100 to obtain the breeders permit. This is a tax we get absolutely no benefit from.

Our puppies have been sold to families outside of Los Angeles, we have collected state sales tax, micro chipped the puppies, and if the dog is not going to be a show dog it must be spayed or neutered at 18 months as a condition of sale.

Under the POP ordinance, you promised a mobile spay/neuter clinic in the communities that had a roaming pit bull problem. You took an officer out of every shelter to put in the field as the POP Officer.

I watched as the POP Officer from the West Valley Shelter pulled up at the house next door where they were selling Golden retriever puppies from an accidental litter. He had no breeders permit. Nor had he done all the tests needed to clear the sire and dam for genetic defects. He offered no support or sales contracts to his buyers. He collected no sales tax. The POP Officer got his address from his ad in the Penny Saver and negotiated the price of the permit he should have had down to $40. He broke the law and paid the City $40 while I obeyed the law and paid $200.

I don't think there was a spay mobile for several more years.

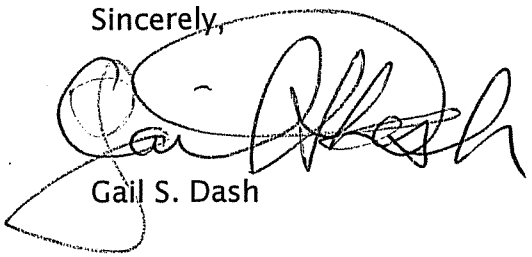
When the move towards more restrictions on responsible breeding started up again last year I began having nightmares that an army of Animal Control officers came to my house and shot my dogs. This is not farfetched if you know the history of the Kuvasz. These dogs were protecting farms in Hungary during WWII and advancing Nazi soldiers killed them all. All except 12 dogs that were guarding warehouses rather than farms. After the war these 12 dogs were taken to the Budapest Zoo to start a breeding program. All the kuvasz in the world today come from those 12 dogs.

So last year, instead of remodeling our home in Northridge, we bought a manufactured home on 2 acres in Phelan in San Bernardino County were you can still get a residential kennel permit.

Our show dogs stay in Phelan and I drive two hours each way to go visit them. We have our retired champions that are spayed and neutered with us in Northridge.

The Pop Ordinance didn't solve the problem and this ordinance won't solve the problem. It will only turn responsible people into law breakers or force us to do ridiculous things like buy property in the desert where our dogs will be safe from a government that seeks to invade our lives.

Sincerely,



Gail S. Dash

"ALWAYS A CLASSIC"
e-mail: gail@casablancakuvasz.com
fax: 818-725-2508
casablancakuvasz.com

LAND USE SERVICES DEPARTMENT

COUNTY OF SAN BERNARDINO
PUBLIC AND SUPPORT
SERVICES GROUP

JULIE RYNERSON ROCK
Director

CODE ENFORCEMENT DIVISION
15456 West Sage Street • Victorville, CA 92392
(760) 843-4337 • Fax (760) 843-4365

APRIL 24, 2007

GAIL S. DASH
DBA: PRIVATE KENNEL -SUP
10330 CAUGHLIN RD
PHELAN, CA 92371

SUBJECT: Private Dog Kennel
LOCATION: **10330 CAUGHLIN RD**
PHELAN, CA 92371

The San Bernardino County Land Use Services Department, Code Enforcement Section has approved your Special Use Permit at the above location for a period of one (1) year.

The permit shall expire one year from the date of issue, and renewal fees must be submitted prior to the expiration date of the permit. As a courtesy, an invoice will be sent prior to the expiration date. A reinspection of the property will be conducted prior to approval of the permit renewal.

Following are the Conditions of Approval of the permit. Those items marked should be particularly adhered to in the use for which this permit is issued.

SPECIAL USE PERMIT FOR A DOG KENNEL
CONDITIONS OF APPROVAL

Your application for a Special Use Permit has been conditionally approved subject to continued compliance with the following conditions:

1. The establishment of the Private Kennel must comply with all provisions of the San Bernardino County Code, Title 3, Division 2, Chapter 3; Commercial Kennels.

2. The keeping of the animals must comply with all County Code requirements, including but not limited to setbacks from property lines and other dwellings.

3. Minimum lot size of two and one half acres with maximum of 15 dogs per parcel permitted.

4. Private kennels shall be inspected by the Department of Environmental Health and Department of Public Health.

5. Noise due to excessive barking of dogs may cause this permit to be revoked.

6. All areas used to maintain the dogs shall be kept clean. Dog droppings shall be picked up at least once a day.

7. All direct and indirect glare from the source shall not cause glare upon adjacent property owners.

8. One sign not to exceed twelve (12) square feet in area stating "Private Kennel" with a twenty four (24) hour emergency phone number must be posted at all entries to the parcel.

9. All permits are to be renewed and kept in good standing.

10. All conditions are continuing conditions and failure to abide by the conditions of this permit may subject the permit to revocation.

Appeal of Conditional of Approval must be submitted to this Department within ten (10) days of receipt of this letter.

SAN BERNARDINO COUNTY LAND USE SERVICES DEPARTMENT
CODE ENFORCEMENT SECTION

ANTHONY MISTRETTA
Code Enforcement Supervisor
Code Enforcement Division
North Desert Region

SAN BERNARDINO COUNTY
LAND USE SERVICES DEPARTMENT
CODE ENFORCEMENT DIVISION

PERMIT
NON-TRANSFERABLE

DBA: PRIVATE KENNEL - SUP/KNL
10330 C AUGHLIN RD
PHELAN, CA
92371

PERMIT #: 154 -CA20070105-SUP
TYPE OF PERMIT: KENNEL
APPLICATION DESCRIPTION: PRIVATE KENNEL - SUP
FEE PAID: $450.00
Issued Date: 04/24/2007
PERMIT EXPIRES: 04/30/2008

This permit may be suspended or revoked by the County Land Use Services Department for cause. This permit is granted on condition that the person named in the permit will comply with the laws, ordinances and regulations that are now or may hereafter be in force by the United States Government, the State of California, the County of San Bernardino, and/or applicable cities pertaining to the above mentioned business. Penalty fees are assessed on permits renewed 30 days after expiration date indicated above, or for failure to obtain new permit in case of transfer of ownership or location. Issuance of this permit does not eliminate the necessity for applicant to obtain any other required permits.

DASH, GAIL S
10330 CAUGHLIN RD
PHELAN, CA 92371

POST IN PUBLIC VIEW

German Shepherd Rescue

417 N. Moss Street · Burbank. CA 91502 (818) 558-7560
26477 Cummings Valley Rd. · Tehachapi, CA 93561 (661) 822-7260
Website: www.gsrescue.org · Email: gsrescue@gsrescue.org

Winter 2007

HOME FOR THE HOLIDAYS

Every adoption is cause for celebration. Lives are transformed. As we look back on 2007, we were able to save many lives thanks to your loyal support. Some of the shepherds needed veterinary care, in some cases even expensive surgery. Others needed a lot of emotional rehabilitation. We took in many seniors. Some of the dogs came from inexcusable situations - some abused, many neglected. These are the lucky ones for they got a second chance with families who will love and appreciate them.

Bandit was bailed out of a shelter by caring neighbors after his own family wouldn't. He's enjoying the good life now with a family who truly loves him!

Bobby wasn't even named before he came to us. His former owner wanted a new puppy instead and had plans to leave Bobby in the local mountains. He's now taken care of by a loving mom and dad who adore him and take him for daily hikes!

Hope was our girl from the Gulf Coast. Read more about her new life below.

Iron spent a long time at the end of a short chain and his now enjoying life with his canine friend and loving mom.

Duke was found starving wandering in the forest. A kind family found him and brought him to us. He's is safe and sound in his forever home with a family who gives him the reassurance he needs in addition to his daily skin medications!

Thelma & Louise were found along a busy highway. They were suffering from severe flea allergies and their pads were worn. They were adopted together and are still very attached to each other.

Sweet Adonis was found in the shelter very emaciated and had open sores all over his body. He recovered completely and recently visited us with his new family and showed off how happy he is now!

Sherlock was left tied to a fence in front of our kennel with obvious signs of neglect. A family came forth and gave him the love he always deserved.

Midnight was saved on her last day at the shelter. That is only a memory now. She also paid us a visit with her new loving family!

When Nero came to us he had been tied to a tree with a short chain ever since he was a pup. He then developed kidney stones. He was successfully treated and went to a loving family who tells us that he enjoys watching TV and has learned to speak for his favorite foods!

Spirit was an 8-mo. old, angry pup when he came to us. He had received intense rough training and it left a lasting impression. His new family understands and loves him. All their patience paid off; he has really blossomed!

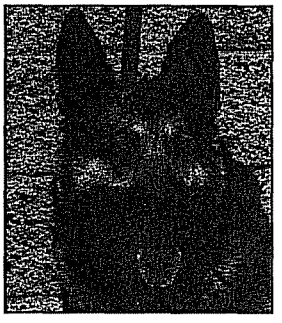
Jake spent a long time at the rescue before he went home with a wonderful family who gives him the exercise and companionship he has craved. He is one happy pup now!

Remember me? I'm Hope- the girl with the funny looking legs. Before I came to German Shepherd Rescue I had a very rough time. I didn't get much to eat when I was little so my legs didn't grow right. Thanks to the folks at German Shepherd Rescue my life has really changed. I have a family now. Yeah!! Here I am with my brother Neptune. I like to play a lot but he prefers to lounge around. I love to play with water. My mom took the other picture of me through the screen. I thought she would get mad at me but she didn't. Dad takes Neptune and me on walks every day. That's so much fun! I'm super happy in my new home. Mom Grace, don't worry about me. I'm taking all my meds. Thank you for all those massages and TLC while you were taking care of me in Tehachapi.

WE WISH UPON A STAR

Here we are featuring six of our longest residents at German Shepherd Rescue. We truly wish for all of these wonderful dogs to be in their forever homes for the holidays.

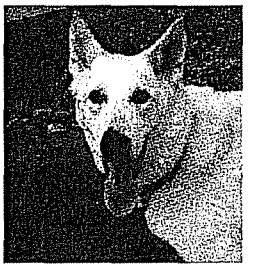
ANGEL is a petite girl who's had a very rough past. Before she came to us, she was tied up at a garage and tormented by children who kicked and hit her. She's trying hard to learn to trust again. She continues to make amazing progress on the leash. She's extremely strong and will need a skilled handler. One of her favorite things to do is to plop down on the grass during her walks. We guess she's never had a yard to play in. She insists on being the only dog. She's been with us too long. She's deserves a family who will love her.



PAIGE is an absolute doll-very affectionate and mellow. She loves people of all ages. She's got a wonderful personality and warms up to people right away. Paige loves to entertain the volunteers by lying upside down in her kennel with her back braced against the wall. She quickly adapts to what you want to do; she's a couch potato when you are, but is ready for a walk at the sound of the leash. She's very easy to walk. Paige is a favorite of our mobile groomer. She is a sweetie.

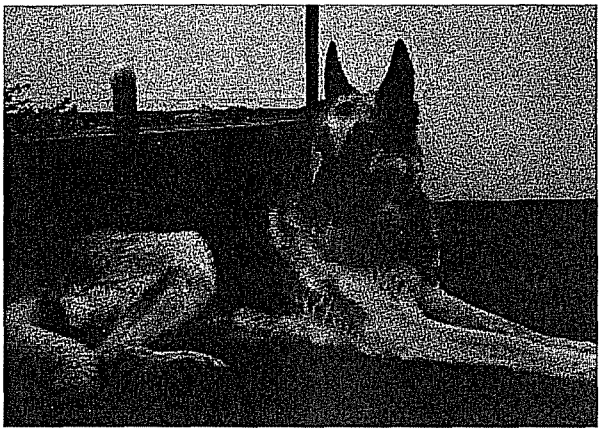
ROLEX has been waiting for a LONG time for a home and we can't understand why. He is Mr. Personality plus. Not only does he look like a teddy bear, but he acts like one as well. Rolex is a handsome guy with a gorgeous thick, red coat. He loves his walks and does well on the leash. He would like to go to a home with older children who would play ball with him. He should be the only dog in his home. He rides well in the car and loves to go on rides. He's a gentle soul but will assert himself if necessary.

OTTO is a gorgeous long-haired boy. He's good with CATS! Loves to go on walks and has great leash manners. He's tough on the outside but gentle on the inside. He will definitely keep strangers away, but he is a total marshmallow with all of our volunteers and those he knows. He's a total charm.



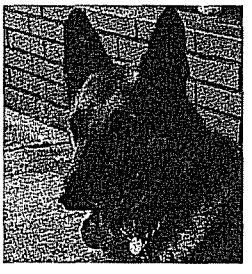
BO, aka "Snow Chief" was rescued from the shelter on his last day. He wasn't on our list that day, but when we saw him, we just couldn't leave this handsome guy behind. He's a middle aged guy with the enthusiasm and energy of a teenager. This boy can really walk and walk and walk. Bo is gentle and has nice manners. He's great with all people and gets along with other dogs. He's lonely and would be a terrific companion to someone who enjoys being active. Jogging anyone?

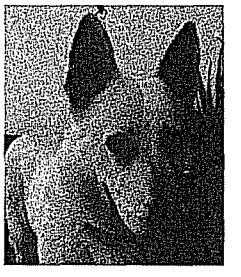
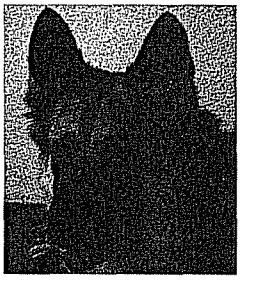
FRANKIE is very playful and easy to walk. Loves to paw at his water bucket and empty it for attention. He's been with us TOO LONG. Someone was very harsh with him in the past, especially around his neck. He's made much progress, but it's not easy to forget the past so, he'd do best in an adult-only home and would do be better as the only dog in the family. Frankie is easy to please and would love nothing more than be at home rolling in the grass of his own backyard.



WE WERE ABLE TO HELP DIANA BECAUSE YOU HAVE CARED ENOUGH TO SUPPORT OUR MISSION - TO SAVE GERMAN SHEPHERDS IN NEED

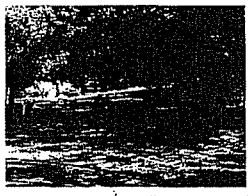
The caller was desperate when she reached us. She was at her workplace a couple of days before, looking out the window when she saw a car drive by, a door opened and a dog was pushed out. The woman couldn't believe what she was witnessing. The dog seemed confused, in shock and seemed injured. That was how a caring lady first saw Diana. Diana is a senior who suffers from severe arthritis. She was too much of a burden for a family she had loved for many years. They just discarded her like an old shoe. But Diana had a guardian angel-someone who was looking out that window, saw her and reached out to help this sweet creature when she most needed help. Diana's rescuer couldn't keep her and she called us. We couldn't turn our back on such a sweetheart. She's on medication for her arthritis and getting a lot of TLC at our Tehachapi Sanctuary. We hope that she will also find her way into someone's heart.





DIETER, PICASSO, , GINA , LADY, CODY, BEAR, BELLA, BRIDGETTE ARE ALSO ANXIOUSLY WAITING FOR THEIR NEW NEW LIVES TO START
WE HOPE IT WILL HAPPEN REALLY SOON.



German Shepherd Rescue has been a no-kill rescue since it was founded 30 years ago. Once we accept a shepherd, we are committed to provide for him for the rest of his life. Since we established our Tehachapi sanctuary, we have been able to take the less adoptable ones - the seniors with aches and pains and those who need extra time to heal. Diana is residing in Tehachapi at this time. Hope and Bobby spent time here as well. These are some of the dear creatures who wouldn't have had a future before. These dogs needed a little extra time to find that special family to find them - and they did. We would like to offer that second chance to more of these wonderful dogs. We need help to expand our facilities in this sanctuary and volunteers to help with the everyday maintenance.

IF YOU LIVE ANYWHERE NEAR OUR
TEHACHAPI LOCATION AND COULD HELP US ,
PLEASE CALL US AT 661-822-7260

WE DEPEND ON YOUR GENEROSITY to continue saving lives. We shelter around 30 shepherds at our Burbank kennel and another 21 in Tehachapi. Our day-to-day expenses to feed and house our dogs are high, but we are often hit with unexpencted vet bills as well. We saved Jessie after vets couldn't figure out what was wrong with him. He was losing weight and his health was deteriorating. After three trips to the doctor, the problem was determined. Jessie's condition and others that need vet care and medication can easily add up to thousands of dollars. Diana's medication costs $140 per month. With you kind support we will be able to take care of more dogs like Jessie, Hope and Diana. Your donation will make this possible.

German Shepherds bond to their people intensely. When they come to us they are often depressed, confused and in poor health. They need to be reassured that they are safe and loved.

A volunteer's reward may be a wet kiss, a wagging tail, a smile in anticipation of a walk. Yes, dogs do smile and express sadness. This is where our volunteers make THE difference. These are the folks who provide that much needed care at German Shepherd Rescue:

Bruce, Ingolf, Jerry and Paulette - they keep our kennel clean- a true labor of love.

***Dennis and Linda Hauge of Stacey Hauge Printing** - they donate printing services and spend many hours at the kennel every week.*

Caroline, Dave, Debi, Diane, Marianne, Robert and Troy who walk, feed, clean, help with adoption interviews and help wherever help is needed.

Many thanks also to Trader Joe's, Natural Balance and Masterfoods (Pedigree) for their generous donations of dog and cat food.

MORE WAYS TO HELP US . . . .

RALPHS - All you have to do is register your card with GSR and we get a donation every time your use your card. Don't forget to reregister if you haven't done so. Just go to ***www.gsrescue.org,*** *click on the Ralphs logo and follow directions. It's easy!*

Whenever you need a search engine, go to GOODSEARCH.COM and type German Shepherd Rescue of Los Angeles.Each time you do it, you will be helping us save more lives.

Through the cash for critters program, we are collecting empty printer cartridges and old cell phones. You can drop them by our kennel or mail them to us. We get money for sending them in for recycling. It's a win-win program. You will be helping the environment and our dogs.

GoodSearch

cash for critters

Ralphs

#9/#39

Currently, exemption F allows EVERY dog or cat to remain UNsterilized as long as the dog or cat has a breeders permit.

However, EVERY dog or cat can get a breeders permit. Thus, as currently drafted, exemption F swallows the rule. Under the current proposed amendment, EVERY dog or cat can remain UNsterilized, simply by purchasing a breeders permit.

The exemptions carefully built into the current draft will have no effect because the exemptions are not in the breeders permit requirements of 53.15.2(c).

SIMPLE SOLUTION (small amendment to EITHER the proposed amendment to 53.15.2(b)(2) OR to existing 53.15.2(c)(3). Picking one of these solutions will make (b) and (c) internally consistent, by having the same exemptions.

[Comment: Changing the amendment to (b) is simpler, and changing the amendment to (b) as suggested will also *reinforce and strengthen the breeders permit requirement*, giving enforcement a needed boost.]

EITHER change proposed amendment to (b): 53.15.2(b)(2):

The following Subdivisions (2) through (8) are proposed as additions to Subsection (b) of Section 53.15.2 of the Los Angeles Municipal Code:

(b) Intact Dogs and Cats:

(2) No person, within the City of Los Angeles, shall own a dog or cat over the age of four months that has not been spayed or neutered, unless valid written documentation is provided to show proof that the animal is exempt from the requirement to be spayed or neutered by reason of one of the following, and is in compliance with Subdivisions (3) and (4) below:

A. The dog or cat is a breed approved by and is registered with a registry or association recognized by the Department through its Commission, whose program and practices are consistent with the humane treatment of animals, and the dog or cat is actively used to show or compete and has competed in at least one legitimate show or sporting competition hosted by, or under the approval of the recognized registry or association within the last two years, or is being trained or groomed to show or compete and is too young to have yet competed, and the dog or cat has a valid breeding permit issued to the owner pursuant to Subsection (c) below. .

B. The dog has earned, or if under three years old, is actively being trained and in the process of earning, an agility, carting, herding, protection, rally, hunting, working, or other title from a registry or association approved by the Department through its Commission, and the dog or cat has a valid breeding permit issued to the owner pursuant to Subsection (c) below.

C. The dog is being, or has been appropriately trained and is actively used in a manner that meets the definition of guide, signal or service dog as set forth in Subdivisions (d), (e), and (f) of Section 365.5 of the Penal Code, or the dog is enrolled in a guide, signal or service dog breeding program administered by a person licensed under Chapter 9.5 (commencing with Section 7200) of Division 3 of the California Business and Professions Code.

D. The dog is appropriately trained or is in the process of being trained and is actively used by law enforcement agencies or the military for law enforcement, military or rescue activities.

E. The owner of the dog or cat provides a letter to the Department from a licensed veterinarian certifying that the animal's health would be best served by spaying after a specified date; or that due to age, poor health, or illness it is unsafe to spay or neuter the animal; or that arrangements have been made to spay or neuter the dog or cat within 60 days after the compliance deadline and the dog or cat is spayed or neutered within that 60-day period. This letter shall include the veterinarian's license number, the date by which the animal may be safely spayed or neutered, and updated periodically as necessary. In addition, if the letter from the licensed veterinarian certifies that arrangements have been made to spay or neuter the dog within 60 days from the date the dog reaches the age of four months, and the dog is spayed or neutered within that 60-day period, the owner shall qualify for the lower license fee and license tax for an altered dog. It shall be the owner's responsibility to comply with the spay/neuter provisions of this chapter, including paying the license fee and license tax.

OR change existing (c): 53.15.2(c)(3):

(3) The Department shall administer an animal breeding permit program to allow the breeding of unaltered dogs and cats consistent with criteria and according to procedures established by the General Manager pursuant to

Section 53.58 of this Code. Under no circumstances shall such a permit be issued:

a. To a person who has been convicted of animal cruelty or neglect, or

b. Unless the permit or renewal applicant meets a spay/neuter exemption requirement set forth in Section 53.15.2(b)(2)A or B.

Long-term risks and benefits of early-age gonadectomy in cats

C. Victor Spain, DVM, PhD; Janet M. Scarlett, DVM, PhD; Katherine A. Houpt, VMD, PhD, DACVB

Objective—To evaluate the long-term risks and benefits of early-age gonadectomy, compared with traditional-age gonadectomy, among cats adopted from a large animal shelter.

Design—Retrospective cohort study.

Animals—1,660 cats.

Procedure—Cats underwent gonadectomy and were adopted from an animal shelter before 1 year of age; follow-up was available for as long as 11 years after surgery (median follow-up time, 3.9 years). Adopters completed a questionnaire about their cats' behavior and medical history. When possible, the cats' veterinary records were reviewed. Statistical analyses were conducted to identify any associations between the occurrence of 47 medical and behavioral conditions and the cats' age at gonadectomy.

Results—Among male cats that underwent early-age gonadectomy (< 5.5 months of age), the occurrence of abscesses, aggression toward veterinarians, sexual behaviors, and urine spraying was decreased, whereas hiding was increased, compared with cats that underwent gonadectomy at an older age. Among male and female cats that underwent early-age gonadectomy, asthma, gingivitis, and hyperactivity were decreased, whereas shyness was increased.

Conclusions and Clinical Relevance—Gonadectomy before 5.5 months of age was not associated with increased rates of death or relinquishment or occurrence of any serious medical or behavioral condition and may provide certain important long-term benefits, especially for male cats. Animal shelters can safely gonadectomize cats at a young age, and veterinarians should consider recommending routine gonadectomy for client-owned cats before the traditional age of 6 to 8 months. (*J Am Vet Med Assoc* 2004;224:372–379)

Euthanasia of healthy cats in animal shelters continues to be a daunting problem in the United States, and the rate is estimated at 4.3 to 15.4 million cats/y.[1] These numbers represent cats that were never adopted from shelters because of insufficient adopters and cats that were adopted but subsequently relinquished back to the shelters, frequently when the cat developed behaviors that were unacceptable to the new owner. Typically, more than half of cats relinquished to shelters are subsequently euthanatized by the shelter, and in some shelters, the rate is > 90%.[2-5]

Many people with humane concerns consider routine early-age gonadectomy of male and female cats as an important step in reducing the number of cats relinquished to shelters for 2 reasons. The procedure enables shelters to gonadectomize all cats before adoption, ensuring that the adopted cats will not breed, thus reducing the number of kittens subsequently relinquished to the shelter. Early-age gonadectomy may also reduce the incidence of certain behavioral problems that lead to relinquishment of adopted cats. The other widely used alternative—neutering contracts in which adopters agree to have the adopted cats gonadectomized some time after adoption—is not effective because many adopters either fail to have the cats gonadectomized or wait until after the cats have already had a litter of kittens before having them gonadectomized.[3,5] Nonsurgical gonadectomy methods may ultimately prove to be a useful alternative to surgical gonadectomy,[6] although those methods are still under development.[7]

To date, studies[8,9] have established safe anesthetic and surgical protocols for early-age gonadectomy and indicate that gonadectomy at 7 weeks of age is associated with more rapid anesthetic recovery and fewer perioperative complications, compared with gonadectomy at 7 months of age.[10] In addition, results of 2 studies indicate no adverse medical consequences of early-age gonadectomy; 1 followed 31 cats until 1 year of age,[11] and another followed 263 cats for a median of 38 months after surgery.[12]

No previous study, however, has followed early-age gonadectomized cats beyond 4.5 years of age, and practicing veterinarians still express concerns about the safety of early-age gonadectomy. In 1 recent survey, for example, 84% of practicing veterinarians perceived risk for at least 1 problem that was associated with gonadectomy before 4 months of age and that was not associated with gonadectomy when performed at an older age, including 29% who thought that early-age gonadectomy increased the risk of at least 1 medical condition later in life.[13] Veterinarians have expressed concerns that early-age gonadectomy may lead to increased risk of many medical and behavioral conditions, including diabetes mellitus, immune deficiencies, obesity, skin disease, and urinary tract obstruction.[14,15]

From the Departments of Population Medicine and Diagnostic Science (Spain, Scarlett) and Clinical Sciences (Houpt), College of Veterinary Medicine, Cornell University, Ithaca, NY 14853. Dr. Spain's present address is the Philadelphia Department of Public Health, Division of Disease Control, 500 S Broad St, Philadelphia, PA 19146.

Supported by a grant from PETsMART Charities, Phoenix, Ariz.

Presented in part at the 139th Annual American Veterinary Medical Association Convention, Nashville, Tenn, July 2002; the Scott Feline Symposium, Ithaca, NY, July 2002; the Tufts Animal Expo, Boston, Mass, September 2002; the American Humane Association Conference, Denver, Colo, September 2002; the Conference for Research Workers in Animal Diseases, St Louis, Mo, November 2002; and the North American Veterinary Conference, Orlando, Fla, January 2003.

The authors thank Siobhan Cully and Dr. John C. Wright for technical assistance.

Address correspondence to Dr. Spain.

The objective of the retrospective cohort study reported here was to compare early-age gonadectomy with gonadectomy at a traditional age in terms of retention in the adoptive household (> 3 months from adoption), overall mortality rate, and incidence of common medical and behavioral conditions via follow-up for as long as 11 years after surgery.

Materials and Methods

Sampling—All cats were selected via the adoption records of the Erie County, New York, Society for the Prevention of Cruelty to Animals (SPCA). This SPCA serves the Buffalo metropolitan area as an animal-control facility and a shelter for animal relinquishment and adoption. Beginning in the mid 1980s, the shelter attempted to gonadectomize all cats before adoption if they weighed at least 0.9 kg (2.0 lb) and were considered healthy by the shelter staff and veterinarians.

To be eligible for the study, cats must have been adopted between July 1989 and November 1998, adopted at between 6 weeks and 12 months of age, and gonadectomized before adoption. If the adoption record indicated that the cat had been returned to the shelter within 3 months after adoption, the cat was not considered eligible because it seemed unlikely that adopters who had their cat a short time would remember enough details about their cat's behavior to participate in the study. Relinquishment information was not always added to the adoption records, so some cats were later determined to be ineligible after we contacted the adopter. A sampling frame of all apparently eligible cats was created. For each calendar year, 100 to 125 cats were randomly sampled from the sampling frame for each of 4 strata: male and female cats gonadectomized before 5.5 months of age and male and female cats gonadectomized at or after 5.5 months of age. If < 100 cats in any stratum qualified for the study, all the eligible cats for that stratum were selected. Random sampling was conducted with commercially available software.[a]

For each selected cat, the adopter's contact information and any information about the cat was transcribed into a computer database. When possible, the previous relinquishment record for each cat was identified and any additional information (eg, reason for relinquishment) was collected. The time of gonadectomy was confirmed by reviewing neuter status on admission to the shelter, SPCA surgery log books, medical treatment records, and records of fees charged for gonadectomy. If a cat had been gonadectomized before admission to the shelter, it was considered eligible only if gonadectomy had been performed at the time of a previous SPCA adoption and the date of gonadectomy could be confirmed (ie, the cat was gonadectomized at the first adoption, relinquished to the shelter, and then adopted a second time.)

Data collection—Between November 1999 and November 2000, the adopters of sampled cats were sent a letter from the SPCA informing them that they might be contacted for this study and giving them the opportunity to contact the SPCA and decline participation. If the adopters failed to decline, they were mailed (within 2 months of the date of the SPCA letter) a packet containing a cover letter describing the purpose of the study and requesting participation, a questionnaire about the adopted cat, a prepaid business-reply envelope, and a list of practicing veterinarians in the Buffalo area from which they could identify their veterinarians. The cover letter and questionnaire met informed consent requirements and were approved by the Cornell University Committee on Human Subjects. The adopters were offered a free 1-year subscription to a newsletter about cats if they participated in the study. Three weeks after the initial mailing, reminder postcards were sent to nonrespondents. After 5 weeks from the initial packet mailing, remaining nonrespondents were sent another packet that was identical to the first but with a modified cover letter that more urgently requested their participation. At that time, attempts were also made to contact the adopter by telephone, and if they were contacted, the questionnaire was completed via telephone by use of a standard script.

If mail to the adopter was returned as undeliverable or if the telephone number was found to be incorrect, telephone directories and Internet databases were consulted to find current contact information for the adopter. If a close, unique match was found for the adopter's name, the contact process was repeated with the new contact information.

The study questionnaire contained 93 questions grouped into 5 sections.[b] The adopters were asked whether the cat was still in the household and, if not, what happened to the cat (section 1); the cat's behaviors and activities and, where appropriate, whether the adopter considered the behavior a serious problem (section 2); the cat's medical history, including the dates of diagnoses for common medical problems, vaccination history, and diet (section 3); demographic information about the adopter's household (section 4); which veterinarians had administered care to the cat and for permission to review the cat's veterinary records (section 5). Because of the uncertainty in pinpointing the exact time of onset of behavioral conditions, only the presence or absence of the behavior during the lifetime of the cat was collected in section 3. The questionnaire booklet was designed by use of published recommendations,[16] and the booklets were printed on recycled paper made from at least 30% postconsumer waste. The questionnaire was pretested on volunteers from Cornell University and pilot-tested on a sample of 60 adopters.

All of the veterinary clinics for which 5 or more adopters gave us authorization to review their cat's records (n = 71) were visited by a veterinary technician or veterinarian. The veterinary records of participating cats were abstracted by use of a standardized form that contained 121 items, including the number of visits to that clinic, the cat's status on the last visit, the cat's vaccination and weight history, and medical and behavioral problems; for each problem reported, the date of first diagnosis and the number of episodes were recorded.[b] When available, specific diagnostic information including laboratory or histopathologic testing was also recorded.

All study personnel were unaware of the cats' ages at gonadectomy when performing telephone interviews, abstracting veterinary records, or entering computerized data.

Outcomes of interest—Forty-seven outcomes were evaluated. The following 25 outcomes were defined by combined information from the questionnaire and veterinary records: overall mortality rate from any cause, aggression towards people, allergic skin disease, arthritis, balanoposthitis, cardiac conditions (any etiology), diabetes mellitus, excessive vocalization, feline asthma, FIV infection, FeLV infection, **feline lower urinary tract disease (FLUTD)**, fractures, hepatic disease (any etiology), hyperactivity, hyperthyroidism, inappropriate elimination and urine spraying, inflammatory bowel disease, neoplasia, pica, pneumonia, psychogenic alopecia, **upper respiratory tract infections (URIs)**, urethral obstruction, and vaginitis. The following 9 outcomes were defined by questions from only the questionnaire: aggression towards other cats, body condition (degree of obesity), hiding frequently, playfulness, relinquishment, scratching furniture or carpets, shyness around strangers, sexual behaviors, and time slept each day. The following 13 outcomes were defined by items from only the veterinary records: abscesses, aggression towards veterinarian or veterinary staff, chronic gastroenteritis, chronic renal failure, eosinophilic inflammatory conditions, **feline infectious peritonitis (FIP)**, fight or bite

wounds, gingivitis, hit by car, lacerations, repeated infections, soft tissue injuries or lameness of undiagnosed cause, and urolithiasis.

For those outcomes based on combined information, the condition was considered present if indicated on either the questionnaire, veterinary record, or both. If indicated on the veterinary record, that date of diagnosis was used. If indicated on only the questionnaire or if the veterinary record was not abstracted, the questionnaire date was used. For analysis of overall mortality and relinquishment rates, all responses including partial responses were used. For all other outcomes, analysis was based on respondents completing most or all of the questionnaire.

Feline lower urinary tract disease was considered present if the cat ever had hematuria, stranguria, pollakiuria, frequent urination of small amounts, or urinary obstruction; if the veterinarian had made a diagnosis of cystitis, FLUTD, or **feline urologic syndrome** (FUS); or if the adopter reported that their veterinarian had prescribed an orally administered medication or special diet for a lower urinary tract sign. Cats whose only clinical sign was urinating outside the litter box were excluded from the analysis for FLUTD. Male cats with urethral obstructions were analyzed alone and also in combination with other cats with FLUTD. For bone fractures, analysis was performed first with all fractures and then with fractures of only long bones (ie, humerus, radius, ulna, femur, tibia, or fibula). Body condition was assessed by asking adopters who still had their cat to compare the cat's present body shape to a series of silhouettes validated by a previous study[17] of feline obesity. Overweight cats (those with a score of 5 or 6 on a 6-point scale) were compared with clinically normal cats (scores of 3 or 4); underweight cats (scores of 1 or 2) were excluded from this analysis. To remove from the analysis cats that may have already had the condition at the time of adoption, cases of URI and heart murmurs were limited to those with onset after 1 year of age. Neoplastic conditions were considered malignant if the veterinarian provided a specific diagnosis, the owner described metastasis, or the cat was euthanatized for the condition. Repeated infection was defined by 2 or more infections of the same body system recorded in the veterinary record. For conditions that may have repeated episodes (eg, URI or FLUTD), only the time until the first occurrence was used.

All instances of aggression towards people were analyzed together and then instances of biting people (after the cat was 1 year old) were analyzed alone. All sexual behavior was evaluated together and then separately by sexual behavior directed towards people, towards other cats, and towards inanimate objects. When evaluating behaviors for which we asked about the presence and severity of the behavior, cats that had the condition at any time (regardless of severity) were compared with those that never had the condition. Cats that had a serious problem with the behavior at any time were compared with those that never had the behavior; cats that had the behavior were excluded if it was not considered a serious problem. A behavioral condition was considered a serious problem if the adopter answered that he or she considered it a serious problem or if the veterinary record indicated that the adopter had sought treatment for the condition.

Age at gonadectomy was either evaluated on a continuous scale (from 1.4 to 12 months) or categorized into 3 groups. When categorized, group 1 included cats gonadectomized before 3.5 months of age. This is the age at which many shelters routinely neuter cats but at which few practicing veterinarians neuter cats.[13] Group 2 included cats between 3.5 and 5.5 months of age. At this age, most cats have completed their initial vaccination series and could be gonadectomized in veterinary practice if the veterinarian's main consideration for choosing the age of gonadectomy was the cat's vaccination status. Group 3 included cats gonadectomized at or after 5.5 months of age. This is the most common age for gonadectomy and is accepted by most practicing veterinarians.[13]

Statistical methods—The goal of the multivariable analyses was to determine whether age at gonadectomy was related to the occurrence of the outcomes, while controlling for the effect of any potentially confounding variables. Most behavioral outcomes were dichotomous without time-to-event information and were analyzed with unconditional logistic regression.[18] For most medical conditions, the analysis was conducted with time-to-event data (ie, time from adoption until diagnosis of the condition or end of follow-up) by use of multivariable survival analysis (Cox proportional hazards model).[19] For survival analysis, the cats' age was used as the time scale (instead of the usual scale, follow-up time) to control for the effect of age as a potential confounder.[20,21] All multivariable analyses were conducted with commercially available software.[c]

Before beginning the analysis, we determined for each outcome if age at gonadectomy on a continuous scale from 1.4 to 12 months had a linear relationship with the log-odds (for logistic regression) or with the log-hazard (for survival analysis) by use of the methods of Hosmer and Lemeshow.[22] If the relationship was linear, age at gonadectomy was used on a continuous scale. If it was not close to linear, the 3 age categories were used for analysis. In addition, for each outcome with time-to-event data, incidence densities were calculated by use of commercially available software.[d]

For all outcomes, the following variables were considered in multivariable models as possible confounders with age at gonadectomy: sex, long- or short-haired coat, owner surrender or stray on admission to the shelter, whether the cat was kept in the shelter for > 5 days before adoption, outdoor status after adoption (outdoor cats defined as going outside unsupervised for mean time of ≥ 2 h/d during any part of the year), and presence of another cat in the household. When relevant to the outcome, eating mostly or only dry cat food, relinquishment for a behavioral problem (on shelter admission), and onychectomy (declawing) before adoption were also considered in each model. Declawing performed after adoption was not used because it could not always be determined whether the surgery was performed before or after onset of the behavior.

For logistic regression and survival analysis, the multivariable models were selected by use of backward elimination via the methods of Kleinbaum.[23] The potential confounders in each model were subjectively ordered (a priori) by expected biological relevance to the particular outcome.[24] During the model-selection process, these variables were removed 1 at a time beginning with the least biologically relevant. If 1 of these variables was associated with the outcome but did not act as a confounder for age at gonadectomy, it was not retained in the model. Age at gonadectomy was always the last variable to be removed from the model. When age at gonadectomy was categorized, the indicator variables for groups 1 and 2 were removed simultaneously and evaluated for significance. For outcomes with 10 to 50 cases, the number of variables in the initial model was restricted by use of the guidelines of Hosmer and Lemeshow.[19] For outcomes with < 10 cases, age at gonadectomy was collapsed to 2 categories (< 5.5 months and ≥ 5.5 months) and its association with the outcome was evaluated by use of the Fisher exact test without multivariable models.[25]

The interaction between the cat's sex and age at gonadectomy was evaluated for each outcome. If this interaction was significant at $P \leq 0.1$, the model-building process was repeated separately for male and female cats. For all analyses, values of $P \leq 0.05$ were considered significant when evaluating age at gonadectomy. The fit of the final logistic

regression models was evaluated by use of guidelines of Stokes et al.[18] For survival analysis models, the proportional hazards assumption was assessed by use of the guidelines of Allison.[21]

For comparisons that did not require multivariable modeling, the χ^2 test was used for categoric variables and the Student *t* test was used for normally distributed continuous data.[26]

When assessing whether associations between age at gonadectomy and the outcomes were likely to represent a cause-and-effect relationship, 4 criteria were considered and included significance of association, consistency of the results with other studies (if any), presence (or absence) of a plausible biological mechanism, and degree of certainty that the outcomes occurred after gonadectomy and were not likely to be already present at the time of adoption and surgery.[27]

Results

Of the 3,172 sampled cat adoptions, no current contact information could be found for 1,121 (35.3%) adopters. Another 175 cats (5.5%) were subsequently determined to be ineligible (in most instances, either because the adopter kept the cat for < 3 months or the cat's age was incorrectly listed on the adoption record). Of the 1,876 remaining eligible cats for which we believed we had the adopters' correct contact information, 1,579 (84.2%) adopters completed the questionnaire and another 81 (4.3%) provided partial information about their cat. Of the 1,039 cats for which the adopters provided authorization to review veterinary records, 853 (82.0%) records were successfully located.

Among the adopters for whom we believed we had correct contact information, the 1,660 cats of responders (partial and complete) did not differ significantly from those of nonresponders by age at gonadectomy, sex, proportion that were strays, or proportion that were originally relinquished for a behavioral problem (all comparisons, $P > 0.2$). The nonresponders, however, had a longer time from adoption until contact time (difference between means, 128 days; $P = 0.06$); that is, earlier adopters were less likely to respond to the survey than more recent adopters. Approximately half of the cats of responding adopters were male; cats that were gonadectomized at ≥ 5.5 months of age were more likely to have been stray than those gonadectomized before 5.5 months of age (**Table 1**).

Median follow-up time from adoption until either questionnaire completion or the cat's death or relinquishment was 3.9 years (range, 0.25 to 11.7 years). Median age at end of follow-up was 4.4 years (range, 0.5 to 12.3 years), and 119 cats had follow-up past 10 years of age.

A significant relationship with age at gonadectomy was found for 3 medical and 5 behavioral conditions (**Table 2 and 3**). In addition, sexual behavior among male cats was the only outcome for which the *P* value was from > 0.05 to 0.09 (ie, near significant). None of the potential confounding variables evaluated remained in the final models for any of these 9 outcomes. The interaction between sex and age at gonadectomy was significant for abscesses, aggression towards veterinarians, hiding frequently, sexual behaviors, and shyness around strangers. In other words, for these 5 outcomes, age at gonadectomy had a different

Table 1—Characteristics of 1,660 cats (No. [%] with characteristic) adopted from a humane shelter in a study of long-term risks and benefits of early-age gonadectomy

Characteristic	Age at gonadectomy (mo)		
	< 3.5 (n = 703)	3.5–< 5.5 (284)	≥ 5.5 (673)
Sex			
Female	361 (51.4)	129 (45.4)	369 (54.8)
Male	342 (48.7)	155 (54.6)	304 (45.2)
Status on shelter admission[a]			
Owner surrender or impoundment	482 (70.2)	171 (61.7)	337 (51.1)
Stray	205 (29.8)	106 (38.3)	323 (48.9)

[a]Information missing for certain cats.

Table 2—Medical conditions associated with age at gonadectomy in 1,579 cats

Condition	Age at gonadectomy (mo)	Incidence density[a]	Hazard ratio[b]	95% CI	Overall *P* value
Abscesses[c]	< 3.5	0.88	0.53[d]	0.18–1.60	0.05
	3.5–< 5.5	0.26	0.08	0.01–0.71	
	≥ 5.5	1.26	1.0	NA	
Feline asthma	Continuous	0.14	0.77[e]	0.58–0.93	0.01
Gingivitis	< 3.5	2.12	0.67	0.43–1.05	0.02
	3.5–< 5.5	1.61	0.45	0.24–0.87	
	≥ 5.5	3.24	1.0	NA	

[a]Incidence density/100 cat years at risk. [b]Hazard ratio adjusted for cat's age at time of disease onset. [c]For male cats only. [d]Interaction between age at gonadectomy and follow-up time was significant; therefore, hazard ratios for abscesses were valid only near beginning of follow-up period. [e]Hazard ratio/1-month decrease in age at gonadectomy.
95% CI = 95% Confidence interval for the hazard ratio. NA = Not applicable (referent category).

Table 3—Behavioral conditions associated with age at gonadectomy in 1,579 cats

Behavior	Age at gonadectomy (mo)	Cats with behavior (%)	Odds ratio	95% CI	Overall *P* value
Aggression towards veterinarians[a]	Continuous	2.5	0.77[b]	0.63–0.98	0.03
Hiding frequently[a,c]	Continuous	14.5	1.11[b]	1.02–1.20	0.01
Hyperactivity[c]	< 3.5	16.0	0.67	0.51–0.90	0.01
	3.5–< 5.5	14.4	0.60	0.40–0.89	
	≥ 5.5	22.1	1.0	NA	
Sexual behaviors[a,c]	Continuous	12.2	0.93[b]	0.86–1.01	0.09
Shyness around strangers[c]	Continuous	56.3	1.04[b]	1.00–1.09	0.03
Urine spraying[a]	Continuous	2.1	0.79[b]	0.64–0.97	0.02

[a]Male cats only. [b]Odds ratio/1-month decrease in age at gonadectomy. [c]Not significant ($P > 0.05$) when considered a serious problem.
See Table 2 for remainder of key.

risk for males than for females. In analyses stratified by sex, these 5 outcomes were significantly associated with age at gonadectomy for males but not for females.

An **odds ratio (OR)** or **hazards ratio (HR)** < 1.0 indicated that the condition decreased with early-age gonadectomy, and an OR or HR > 1.0 indicated that the condition increased with early-age gonadectomy. For conditions analyzed with age at gonadectomy categorized, the HR or OR in the tables can be interpreted as an estimate of the relative risk of developing the condition for that age group, compared with cats gonadectomized from ≥ 5.5 to 12 months of age. With hyperactivity, for example, the OR for group 1 was 0.67, meaning that the cats gonadectomized before 3.5 months of age were 0.67 times as likely as cats gonadectomized after 5.5 months of age to have hyperactivity (Table 3). It could also be stated that cats gonadectomized after 5.5 months of age were 1.49 (the reciprocal of 0.67) times as likely to have hyperactivity as those gonadectomized before 3.5 months of age. For those conditions analyzed with age at gonadectomy on a continuous scale, the OR or HR can be interpreted as the change in risk for each month earlier that the cat was gonadectomized. For hiding frequently among males cats, the OR of 1.11 can be interpreted as the following: each month earlier that the cat was gonadectomized, the risk of hiding frequently increased by approximately 11% (Table 3). To compare cats gonadectomized at 4 months with those gonadectomized at 7 months of age, the OR (1.11) is raised to the third power (3 months difference); therefore, cats gonadectomized at 4 months of age would be approximately 1.36 times as likely to frequently hide as cats gonadectomized at 7 months of age.

The incidence densities can be converted to cumulative incidences by use of the following formula: $1 - \exp[-t(ID/100)]$, where t is the number of years of follow-up for each cat, ID is the incidence density/100 cat-years (Table 2), and exp is the inverse of the natural logarithm.[28] For example, to estimate the proportion of cats gonadectomized before 3.5 months of age that would be expected to develop gingivitis during a 12-year life span, $1 - \exp[-12(2.12/100)] = 0.22$; thus, approximately 22% of cats gonadectomized before 3.5 months of age would be expected to develop gingivitis during the first 12 years of life. For cats gonadectomized at ≥ 5.5 months of age, 32% would develop gingivitis during this same period ($1 - \exp[-12(3.24/100)] = 0.32$). Use of this formula assumes that the risk of disease is constant throughout the cats' lives and that there are no competing risks (ie, no other diseases cause them to die during the time of observation).

Medical outcomes—Among all cats, gonadectomy before 5.5 months of age was associated with significantly reduced incidence of feline asthma and gingivitis, compared with gonadectomy from ≥ 5.5 to 12 months of age. Early-age gonadectomy was also associated with lower incidence of abscesses among males, but the interaction between the group gonadectomized before 3.5 months and follow-up time was close to significant ($P = 0.08$). The coefficient for this interaction was positive, indicating that the protective effect of gonadectomy before 3.5 months diminished with time. After 5 to 6 years of follow-up, there were no longer any meaningful differences between groups in terms of risk of abscesses. These 3 medical conditions were not associated with an increased risk of euthanasia or relinquishment.

When all neoplastic conditions were evaluated, it initially appeared that the early-age gonadectomized cats were at lower risk ($P = 0.03$), but this outcome included many vague conditions reported by the owners as tumors that may have been cysts, abscesses, and other non-neoplastic conditions. When only malignant conditions were evaluated, there was no longer a significant association.

Behavioral outcomes—Gonadectomy before 5.5 months of age was associated with decreased occurrence of hyperactivity and increased occurrence of shyness around strangers. Among male cats (but not female cats), early-age gonadectomy was also associated with reduced occurrence of aggression towards veterinarians, sexual behaviors, and urine spraying but an increased risk of hiding frequently. For 4 of these behavioral outcomes (hiding frequently, hyperactivity, sexual behaviors, and shyness), we also assessed whether the adopter considered the behavior a serious problem. When analysis was restricted to cats with a serious problem, the conditions were no longer significantly associated with age at gonadectomy. Of these 6 behavioral conditions associated with age at gonadectomy, only hiding among males was associated with increased rate of relinquishment. Of the male cats reported to frequently hide, 11% were relinquished, compared with 4% relinquished among those not reported to frequently hide.

When the outcome of scratching furniture was initially evaluated, it appeared that early-age gonadectomy had a significant ($P < 0.01$) protective effect. Cats with early-age gonadectomy, however, were also more likely to be declawed, and some of these cats were not declawed until after the onset of the behavioral problem, so it was not possible to clearly determine in our study whether early-age gonadectomy alone would have been protective. Among the 827 cats that were never declawed, age at gonadectomy was not associated with frequency of scratching furniture.

Outcomes not related to age at gonadectomy—No association was found between age at gonadectomy and occurrence of the condition for the 38 other outcomes studied, including overall mortality rate, relinquishment rate, obesity, FLUTD, and urethral obstruction of male cats. Twelve of these conditions were very rare in our study (< 10 cats with the condition), including arthritis, balanoposthitis, chronic gastroenteritis, chronic renal failure, diabetes mellitus, FeLV infection, FIP, FIV infection, long-bone fractures, pneumonia, urolithiasis, and vaginitis. Therefore, the statistical power for finding any subtle difference between groups for these outcomes was low. Nevertheless, the risk of any gonadectomized cat developing these conditions before the age of 12 years, regardless of age at gonadectomy, appears to be low. For a condition with 10 cases, the highest possible

upper 95% confidence limit for a 12-year lifetime cumulative incidence was 2.5% (ie, < 2.5% of cats would likely develop these conditions during a 12-year lifespan).

Discussion

For most of the medical and behavioral conditions evaluated in this study, no association was found between frequency of the outcome and age at gonadectomy. This was true even for many conditions speculated to be associated with age at gonadectomy, such as urethral obstruction of male cats, physeal fractures, body condition, diabetes mellitus, and immune deficiency. Many practicing veterinarians delay castrating male cats because of concerns about urinary obstruction.[13] Other studies[11,29-31] have found mixed results on anatomic differences of the penis that might result from early-age gonadectomy, and 1 long-term investigation[12] found a decreased rate of FLUTD among cats gonadectomized before 24 weeks of age. On the basis of these results and the lack of association found in our study, it would appear that even if early-age gonadectomy results in anatomic differences in the penis, these changes do not lead to an increase in the incidence of FLUTD or urinary obstruction. Therefore, concerns about these conditions should not be used as a reason to delay castration of male cats.

Age at gonadectomy was not associated with the frequency of long-bone fractures in our study. One other study[32] did find a small delay in closure of the proximal radial physis among early-age gonadectomized female cats, but if physeal closure is delayed, our results suggest that the delay does not result in more long-bone fractures. Furthermore, long-bone fractures in our study were rare overall, suggesting that physeal fractures are not a common problem for gonadectomized cats in general.

Cats in our study that were gonadectomized before 5.5 months of age were not significantly more likely than cats gonadectomized at ≥ 5.5 months of age to have any conditions that might be associated with long-term immune suppression, including URI with onset after 1 year of age, FeLV infection, FIV infection, FIP, or repeated infections of the same body system. On the contrary, the early-age gonadectomized cats had lower incidence of gingivitis, a condition that is often associated with immune suppression.[33,34]

No association was found between age at gonadectomy and prevalence of obesity in our investigation, a finding consistent with other studies[11,12,35] on body condition. The incidence of diabetes mellitus was similarly not related to age at gonadectomy, and to our knowledge, only 1 other study[12] of early-age gonadectomy in cats could have detected cases of diabetes mellitus and that study reported no cases of the condition among any cats. As with long-bone fractures, diabetes mellitus appears to have low incidence in all gonadectomized cats, at least in the first 10 years of life.

Feline asthma and gingivitis had lower incidences among early-age gonadectomized cats than late-age gonadectomized cats in our study. Age at gonadectomy, neuter status, and sex have not been detected as a risk factor for these conditions in cats.[33,34,36-38] Studies[39,40] in other species, however, indicate that exposure to androgens during key stages of development can permanently transform immune function. Therefore, it is possible that reduction in the incidence of these inflammatory conditions (asthma and gingivitis) is attributable to reduced concentrations of androgens among early-age gonadectomized kittens during immune development. It is also possible that the association is attributable to differences in some unmeasured confounding variable (eg, difference in geographic location between groups that might lead to exposure to different types of allergens that could exacerbate feline asthma) or a type-I error (ie, by chance, the sampled late-age gonadectomized cats were the ones that developed feline asthma or gingivitis).

It would seem reasonable that the lower rate of abscesses among early-age gonadectomized male cats in our study could be attributable to decreased intercat aggression among prepubertally gonadectomized cats. In our study, however, the early-age gonadectomized cats were not less likely than the late-age gonadectomized cats to fight with other cats or have other intercat aggression as reported by the adopters, so this mechanism may not explain the association. Regardless of the biological mechanism involved (if any), the significant interaction between rate of abscesses and follow-up time suggests that early-age and late-gonadectomized male cats become more alike in the rate of abscess development as they age.

Shyness was increased among all early-age gonadectomized cats, and hiding was increased among early-age gonadectomized male cats, but to our knowledge, these behaviors were not previously suspected of being associated with age at gonadectomy. Because these are behaviors that may appear after a stressful event (eg, adoption) and later resolve,[41] we cannot fully determine whether these behaviors were long-term effects of early-age gonadectomy or simply behaviors associated with being adopted at a young age. Castrating male cats (regardless of age) reduces aggression and urine spraying,[11,42,43] so it was not surprising that early-age castration was associated with decreased occurrence of these behaviors in male cats. Although aggression towards veterinarians was decreased in early-age gonadectomized male cats in our study, the frequency of other forms of aggression was not associated with age at gonadectomy. The decreased hyperactivity in early-age gonadectomized cats may be related to the decrease in heat production and resulting decrease in energy levels seen with gonadectomy in general[35]; that study found no difference in heat production between gonadectomy at 7 weeks versus 7 months of age, although the sample size was probably too small to detect subtle differences between groups.

Because some behavioral conditions decreased with early-age gonadectomy but others increased, the natural question that follows is this: which of these conditions is most likely to cause a problem for the adopter or even to cause the adopter to request euthanasia for the cat or relinquish the cat back to the shelter? In other studies, house soiling is the most commonly reported behavioral reason for owners requesting euthanasia of their cats,[44] for relinquishment to shelters (43%),[45] and

for owners to seek consultation with a behaviorist.[46,47] Although urine spraying among male cats represents only a portion of all house-soiling problems, any reduction in the occurrence of this behavior through early-age castration could be important in reducing relinquishments and euthanasia requests.

Frequent hiding was associated with an increased relinquishment rate among male cats in our study. Hiding and shyness have not specifically been reported as reasons for relinquishment in other studies, although being unfriendly was reported as a reason for 5% of cats relinquished for behavioral reasons.[45] If hiding and shyness are truly long-lasting and not just related to the periadoption period and if the cats with these behaviors are perceived as being unfriendly, then early-age gonadectomy may carry a small risk of relinquishment for these cats, supporting the finding among our study cats.

In another study,[2] hyperactivity was reported by only 1% of owners relinquishing cats for any reason, so changes in this behavior would have a relatively small impact on the number of cats relinquished. Because being too mellow was reported as a problem even less frequently,[2] reducing hyperactivity through early-age gonadectomy would not appear to be associated with important risks. Aggression specifically directed towards veterinarians or veterinary staff has not been reported as a common reason for relinquishment,[2] although it is likely that veterinarians would be happy to find measures that might reduce aggression directed towards them.

Our study provided several improvements over previous studies of early-age gonadectomy, including a much larger sample size, longer follow-up times, and verification of medical and behavioral conditions with veterinary records for a large portion of the cats. These improvements permitted examination of the relationship between age at gonadectomy and some uncommon conditions for which previous studies lacked statistical power. Nevertheless, as with any epidemiologic study, certain biases are possible. Because of the retrospective data collection, for example, it was not possible to collect veterinary information for some cats that died early in life and for whom the veterinary records were subsequently destroyed. Also, because behavioral diagnoses were not commonly recorded in veterinary records, assessment of many behavioral outcomes was exclusively based on the adopters' perceptions and memories. The cats of adopters for whom we found no contact information could have been different in some way from the cats of contacted adopters. We would not expect, however, that the health or behavior of these cats was associated with the likelihood that the adopter changed his/her address or phone number. It is also possible that the adopters of cats that died early in life or were relinquished early in life were less inclined to respond to the study, although the relatively high response rate probably minimized the effect of this type of nonresponse bias.

For extremely rare conditions, our study did not have the statistical power to detect any subtle difference between groups. For an outcome with 10 cases, for example, the statistical power for detecting an HR of 2.0 would have been only 20%. The HR would have had to be at least 3.4 to have a statistical power of more than 50%.[20] Our study could not have detected any conditions with peak onset after 10 to 11 years of age. For these conditions with late-age onset, however, it becomes difficult to find plausible biological mechanisms that would support a cause-and-effect relationship between gonadectomy at an early age and development of the outcome after 10 to 11 years of life. Similarly, this study could not have detected conditions that would have led to relinquishment, euthanasia, or death within the first 3 months after surgery.

With approximately 50 comparisons made in the analyses for this study, some of the significant results were likely attributable to type-I errors. In other words, the sampled cats in an age group could have been the ones that developed some outcomes at higher rates by chance alone. With a significance level of 0.05, 2 to 3 of the comparisons are expected to be significant by chance alone, with a 92% chance of at least 1 type-I error.[48] If a more conservative value of $P = 0.01$ was used, only 3 outcomes were still associated with age at gonadectomy (ie, feline asthma, hiding frequently, and hyperactivity).

[a]Microsoft Excel 97, Microsoft Corp, Redmond, Wash.
[b]The study questionnaire and veterinary abstract form are available from the first author.
[c]PROC LOGISTIC and PROC PHREG, SAS, version 8.02, SAS Institute Inc, Cary, NC.
[d]Stata, version 7.0, Stata Corp, College Station, Tex.

References

1. Nassar R, Talboy J, Moulton C. *Animal shelter reporting study.* Englewood, Colo: American Humane Association, 1992.
2. Salman MD, New JC, Scarlett JM, et al. Human and animal factors related to the relinquishment of dogs and cats in 12 selected animal shelters in the United States. *J Appl Anim Welf Sci* 1998;1:207–226.
3. Manning AM, Rowan AN. Companion animal demographics and sterilization status: results from a survey in four Massachusetts towns. *Anthrozoos* 1992;5:192–201.
4. National shelter census results revealed. *J Am Vet Med Assoc* 1997;210:160–161.
5. Alexander SA, Shane SM. Characteristics of animals adopted from an animal control center whose owners complied with a spaying/neutering program. *J Am Vet Med Assoc* 1994;205:472–476.
6. Carter CN. Pet population control: another decade without solutions? *J Am Vet Med Assoc* 1990;197:192–195.
7. Olson PN. Historical, ethical, and political issues involving pet overpopulation, in *Proceedings*. Int Symp Nonsurgical Methods Pet Popul Control 2002;11–17.
8. Aronsohn MG, Faggella AM. Surgical techniques for neutering 6- to 14-week-old kittens. *J Am Vet Med Assoc* 1993;202:53–55.
9. Faggella AM, Aronsohn MG. Anesthetic techniques for neutering 6- to 14-week-old kittens. *J Am Vet Med Assoc* 1993;202:56–62.
10. Howe LM. Short-term results and complications of prepubertal gonadectomy in cats and dogs. *J Am Vet Med Assoc* 1997;211:57–62.
11. Stubbs WP, Bloomberg MS, Scruggs SL, et al. Effects of prepubertal gonadectomy on physical and behavioral development in cats. *J Am Vet Med Assoc* 1996;209:1864–1870.
12. Howe LM, Slater MR, Boothe HW, et al. Long-term outcome of gonadectomy performed at an early age or traditional age in cats. *J Am Vet Med Assoc* 2000;217:1661–1665.
13. Spain CV, Scarlett JM, Cully SM. When to neuter dogs and cats: a survey of New York state veterinarians' practices and beliefs. *J Am Anim Hosp Assoc* 2002;38:482–488.
14. Johnston L. Opposes early-age neutering (lett). *J Am Vet Med Assoc* 1993;202:1041–1042.

15. Dowling S. Opposition to prepubertal gonadectomies in cats [lett]. *J Am Vet Med Assoc* 1997;210:321.

16. Dillman DA. *Mail and internet surveys: the tailored design method.* 2nd ed. New York: John Wiley & Sons, 2000;79–159.

17. Scarlett JM, Donoghue S. Associations between body condition and disease in cats. *J Am Vet Med Assoc* 1998;212:1725–1731.

18. Stokes ME, Davis CS, Koch GG. *Categorical data analysis using the SAS system.* Cary, NC: SAS Institute Inc, 1995;163–214.

19. Hosmer DW, Lemeshow S. *Applied survival analysis.* New York: John Wiley & Sons, 1999;87–112.

20. Therneau TM, Grambsch PM. *Modeling survival data: extending the Cox model.* New York: Springer-Verlag Inc, 2000;39–78.

21. Allison PD. *Survival analysis using the SAS system: a practical guide.* Cary, NC: SAS Institute Inc, 1995;111–184.

22. Hosmer DW, Lemeshow S. *Applied survival analysis.* New York: John Wiley & Sons, 1999;158–195.

23. Kleinbaum DG, Kupper LL, Morgenstern H. *Epidemiologic research: principles and quantitative methods.* New York: Van Nostrand Reinhold, 1982;448–456.

24. Allen DM, Cady FB. Model selection with many explanatory variables. In: *Analyzing experimental data by regression.* Belmont, Calif: Lifetime Learning Publications, 1982;247–259.

25. Stokes ME, Davis CS, Koch GG. *Categorical data analysis using the SAS system.* Cary, NC: SAS Institute Inc, 1995;19–36.

26. Ott RL. *An introduction to statistical methods and data analysis.* 4th ed. Belmont, Calif: Duxbury Press, 1993;195–418.

27. Rothman KJ, Greenland S. Causation and causal inference. In: Rothman KJ, Greenland S, eds. *Modern epidemiology.* 2nd ed. Philadelphia: Lippincott-Raven, 1998;7–28.

28. Rothman KJ, Greenland S. Measure of disease frequency. In: Rothman KJ, Greenland S, eds. *Modern epidemiology.* 2nd ed. Philadelphia: Lippincott-Raven, 1998;29–46.

29. Herron MA. A potential consequence of prepuberal feline castration. *Feline Pract* 1971;Sep–Oct:17–19.

30. Root MV, Johnston SD, Johnston GR, et al. The effect of prepuberal and postpuberal gonadectomy on penile extrusion and urethral diameter in the domestic cat. *Vet Radiol Ultrasound* 1996;37:363–366.

31. Herron MA. The effect of prepubertal castration on the penile urethra of the cat. *J Am Vet Med Assoc* 1972;160:208–211.

32. Root MV, Johnston SD, Olson PN. The effect of prepuberal and postpuberal gonadectomy on radial physeal closure in male and female domestic cats. *Vet Radiol Ultrasound* 1997;38:42–47.

33. Pedersen NC. Inflammatory oral cavity diseases of the cat. *Vet Clin North Am Small Anim Pract* 1992;22:1323–1345.

34. Diehl K, Rosychuk RA. Feline gingivitis-stomatitis-pharyngitis. *Vet Clin North Am Small Anim Pract* 1993;23:139–153.

35. Root MV, Johnston SD, Olson PN. Effect of prepuberal and postpuberal gonadectomy on heat production measured by indirect calorimetry in male and female domestic cats. *Am J Vet Res* 1996;57:371–374.

36. Corcoran BM, Foster DJ, Luis-Fuentes V. Feline asthma syndrome: a retrospective study of clinical presentation in 29 cats. *J Small Anim Pract* 1995;36:481–488.

37. Corcoran BM, Foster DJ, Luis-Fuentes V. Feline asthma syndrome. *Vet Q* 1995;17:S15–S16.

38. Padrid P. Feline asthma: diagnosis and treatment. *Vet Clin North Am Small Anim Pract* 2000;30:1279–1293.

39. Martin JT. Sexual dimorphism in immune function: the role of prenatal exposure to androgens and estrogens. *Eur J Pharmacol* 2000;405:251–261.

40. Cutolo M, Seriolo B, Villagio B, et al. Androgens and estrogens modulate the immune and inflammatory responses in rheumatoid arthritis. *Ann N Y Acad Sci* 2002;966:131–142.

41. Houpt KA. *Domestic animal behavior for veterinarians and animal scientists.* 3rd ed. Ames, Iowa: Iowa State University Press, 1998.

42. Hart BL, Barrett RE. Effects of castration on fighting, roaming, and urine spraying in adult male cats. *J Am Vet Med Assoc* 1973;163:290–292.

43. Hart BL, Cooper L. Factors relating to urine spraying and fighting in prepubertally gonadectomized cats. *J Am Vet Med Assoc* 1984;184:1255–1258.

44. Kass PH, New JC, Scarlett JM, et al. Understanding companion animal surplus in the United States: relinquishment of nonadoptables to animal shelters for euthanasia. *J Appl Anim Welf Sci* 2001;4:237–248.

45. Salman MD, Hutchison JM, Ruch-Gallie R, et al. Behavioral reasons for relinquishment of dogs and cats to 12 shelters. *J Appl Anim Welf Sci* 2000;3:93–106.

46. Beaver BV. Housesoiling by cats: a retrospective study of 120 cases. *J Am Anim Hosp Assoc* 1989;25:631–637.

47. Olm DD, Houpt KA. Feline house-soiling problems. *Appl Anim Behav Sci* 1988;20:335–345.

48. Ott RL. *An introduction to statistical methods and data analysis.* Belmont, Calif: Duxbury Press, 1993;767–1038.

Long-term outcome of gonadectomy performed at an early age or traditional age in dogs

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Objective—To determine long-term results and complications of gonadectomy performed at an early age (prepubertal) or at the traditional age in dogs.

Design—Cohort study.

Animals—269 dogs from animal shelters.

Procedure—Dogs that underwent gonadectomy were allotted to 2 groups on the basis of estimated age at surgery (traditional age, ≥ 24 weeks old; prepubertal, < 24 weeks old). Adoptive owner information was obtained from shelter records, and telephone interviews were conducted with owners to determine physical or behavioral problems observed in the dogs since adoption. Follow-up information was obtained from attending veterinarians for dogs with complex problems or when owners were uncertain regarding the exact nature of their dog's problem.

Results—Prepubertal gonadectomy did not result in an increased incidence of behavioral problems or problems associated with any body system, compared with traditional-age gonadectomy, during a median follow-up period of 48 months after gonadectomy. Rate of retention in the original adoptive household was the same for dogs that underwent prepubertal gonadectomy as those that underwent traditional-age gonadectomy. Infectious diseases, however, were more common in dogs that underwent prepubertal gonadectomy.

Conclusions and Clinical Implications—With the exception of infectious diseases, prepubertal gonadectomy may be safely performed in dogs without concern for increased incidence of physical or behavioral problems during at least a 4-year period after gonadectomy. (*J Am Vet Med Assoc* 2001;218: 217–221)

Millions of dogs and cats are euthanized annually in US animal shelters.[1] Many animal adoption agencies now require mandatory neutering of all companion animals after adoption; however, owner compliance with these programs is estimated to be < 60%.[2,3] As a method of increasing population control effectiveness, many of these groups, as well as many veterinarians, have promoted prepubertal gonadectomy, which is neutering well before the onset of puberty and prior to adoption.[4-11] In 1993, the AVMA House of Delegates approved Resolution 6, which supported the concept of prepubertal gonadectomy in an effort to stem the overpopulation problem in dogs and cats.[12] Despite the passage of this resolution, acceptance of prepubertal gonadectomy by veterinarians has been slow, in part because of concerns about anesthesia, potential postoperative behavioral abnormalities, musculoskeletal disorders (including hip dysplasia), urinary incontinence in female dogs, and obesity.[13-18] On a short-term basis (7 days), prepubertal gonadectomy has been shown to be safe and did not result in increased morbidity or mortality in dogs, compared with traditional-age gonadectomy.[4] Results of other studies also support the belief that increased morbidity or mortality are not associated with the early age procedure on a short-term basis[6-10]; however, to the authors' knowledge, no long-term studies with large numbers of animals and reference (or control) populations have been reported.

Objectives of the study reported here were to determine long-term results and complications of gonadectomy performed at an early age (prepubertal) or at the traditional age in dogs.

Materials and Methods

Dogs and surgical technique—All dogs were from 2 humane organizations and underwent ovariohysterectomy or castration in association with the fourth-year surgical teaching program at Texas A&M University. These dogs constituted the study group in a previous report in which dog care before and after surgery was described.[4] Shelter 1 accepted only owner-surrendered animals, had a long holding period, and did not euthanatize animals after they entered the shelter. Shelter 2 performed animal control in the region, had a short holding period, and euthanatized animals that were not adopted within a stated period. Dogs were placed in 2 groups on the basis of age, which was estimated on the basis of dentition,[19] size, breed, weight, or date of birth (when available). Group-1 (traditional-age) dogs were ≥ 24 weeks of age, and group-2 (prepubertal) dogs were < 24 weeks of age.

Ovariohysterectomies and castrations were performed on group-1 dogs by use of accepted techniques, using a single or triple-clamp method (depending on preference of student or clinician). Ovariohysterectomies in group-2 dogs were performed in similar fashion to those in group-1 dogs (using a single-clamp method) with the exception of incision location. Incision location in group-2 dogs was nearer the middle third of the distance from the umbilicus to the cranial brim of the pelvis. In male puppies, the entire scrotal and prescrotal areas were prepared for surgery, and the puppies were castrated through a single midline scrotal or prescrotal incision, using the closed castration technique. Castration incisions were closed in an intradermal pattern by use of 1 or 2 simple interrupted sutures in which knots were buried.

Study design—Client information was recorded from the humane organization records for each dog that was adopted. Adoptive owners were contacted by telephone no earlier than 41 months (range, 41 to 64 months) after surgery and asked questions from a standardized questionnaire[a] to

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evaluate rates of infectious diseases and retention in the original adoptive household, physical status of all body systems, and behavioral status of the dog. If an owner gave a specific name and description (including treatment) for a medical condition for which their dog had been treated by a veterinarian, which was consistent with the clinical signs the dog had at that time, the dog's veterinarian was not contacted. Attending veterinarians were contacted to clarify complex problems or those not adequately described by the owner. Internet resources were used to attempt to locate telephone numbers and addresses for those individuals who had moved since adopting their pet.

Problems were classified by severity (major or minor) and type (eg, trauma-induced). Major problems were those that resulted in mortality, prolonged (≥ 2 weeks) morbidity, surgery, or prolonged (≥ 2 weeks) or recurrent medical treatment. Additionally, behavioral problems that resulted in, or could potentially result in, alterations to the dog's environmental status (ie, removal of dog from the household or from inside the house) were considered major problems. Examples of major problems included parvoviral enteritis, chronic skin disorders, and behavioral problems that resulted in removal from the household or to the outdoors. Minor problems were those that did not result in surgery or death, including single episodes that resolved with short-term (< 2 weeks) treatment. Examples of minor problems included mild lameness that resolved without treatment, single episodes of upper respiratory tract infection, and behavioral problems that did not jeopardize the dog's standing in the household. Trauma-induced problems included vehicular accidents, dog fights, snake bites, gunshot wounds, and poisonings. Dogs that died, ran away, were returned to the shelter, or were placed in a new home within 1 month of adoption were not included in the subsequent analysis except to list problems that led to death or removal from the household.

Statistical programs[b,c] were used for all analyses. Frequencies of responses to all objectives were summarized by use of proportions and 95% confidence intervals. Summaries for each body system and frequencies of the most commonly cited problems were described similarly. Mantel-Haenszel χ^2 analysis was used to compare frequencies of problems between group-2 and group-1 dogs, stratified by shelter. When differences were detected between shelters for a certain variable, the 2-tailed Fisher exact test was used to determine significance. Follow-up times were examined by use of the unpaired Student *t*-test and Mann-Whitney test. Differences were considered significant at $P \leq 0.05$.

Results

Follow-up information was obtained on 269 of 635 (42%) dogs that underwent gonadectomy and were adopted during the study period. The remaining dogs were lost to follow-up and were not included in the study. An additional 580 dogs underwent gonadectomy during the study period, but these dogs were not adopted or shelter records for them could not be located, so they were not included in the study. Owner contact was attempted at least 3 times during a period of several days.

There were 154 (57%) dogs with follow-up data from shelter 1 and 115 (43%) dogs from shelter 2. Shelter 1 had 52 group-1 dogs and 102 group-2 dogs; 89 (58%) dogs were female and 65 (42%) dogs were male. Shelter 2 had 42 group-1 dogs and 73 group-2 dogs; 64 (56%) dogs were female and 51 (44%) dogs were male. When shelters were combined, there were 94 dogs in group 1 and 175 dogs in group 2; 153 dogs were female and 116 dogs were male. A difference was not detected between shelters for distribution of age groups or sex among groups.

Group-1 dogs were significantly older than group-2 dogs at the time of gonadectomy surgery (group 1, 70.8 ± 59.3 weeks [median, 52 weeks; range, 24 to 280 weeks]; group 2, 11.2 ± 4.2 weeks [median, 10 weeks; range, 6 to 22 weeks]; $P = 0.0001$).

Mean and median follow-up times (length of time from gonadectomy to owner contact, or death or loss of dog) did not differ between shelters (shelter 1, 39.6 ± 19.6 months [median, 48 months; range, < 1 to 63 months]; shelter 2, 37.2 ± 20.7 months [median, 47 months; range, < 1 to 64 months]). Follow-up times did not differ between age groups (group 1, 40.4 ± 20.5 months [median, 50 months; range, < 1 to 63 months]; group 2, 37.6 ± 19.8 months [median, 47 months; range, < 1 to 64 months]).

Difference was not detected between age groups for incidence of dogs being returned to a shelter or placed in another home or in the number of dogs alive or dead at time of owner contact. Overall, 35 (13%) dogs were returned to a shelter and 16 dogs (6.0%) had been given to a new owner. Of the 51 dogs returned to the shelter or placed in new homes, 27 were relocated because of animal-associated problems (destructive, aggressive, or miscellaneous behavioral or medical problems), and 24 were relocated because of owner-associated problems. The majority of dogs (n = 174; [65%]) were still alive at follow-up, although several dogs had died (31 [11%]) or run away (13 [5%]). Approximately equal numbers of dogs in both age groups died from traumatic incidents (vehicular, gun, or miscellaneous trauma) or medical causes (parvoviral enteritis, behavioral, or miscellaneous medical problems), and there was no difference between age groups in incidence of traumatic or medical deaths.

Owners reported that 197 (73%) dogs (group 1, n = 73 [78%]; group 2, 124 [71%]) developed a problem after adoption. When classified by severity and type, 107 (40%) dogs (group 1, n = 43 [46%]; group 2, 64 [37%]) had a major medical or surgical problem, 69 (26%) dogs (group 1, 24 [26%]; group 2, 45 [26%]) had a minor problem, and 21 (8%) dogs (group 1, 6 [6%]; group 2, 15 [9%]) had ≥ 1 traumatic incident. More dogs had 1 problem (group 1, n = 40 [43%]; group 2, 66 [38%]) than 2 to 3 problems (group 1, 30 [32%]; group 2, 55 [31%]) or ≥ 4 problems (group 1, 3 [3%]; group 2, 3 [2%]). Significant differences in overall incidence of problems, problem severity, or number of problems were not detected between age groups.

Infectious diseases affected 23 (9%) dogs; parvoviral enteritis was reported in 14 (5%) dogs and infections of the upper portion of the respiratory tract were reported in 9 (4%) dogs. Group-2 dogs had higher incidence of infectious diseases, compared with group-1 dogs ($P = 0.04$), which was attributable to the greater incidence of parvoviral enteritis seen in that group ($P = 0.01$). Shelter 1 had significantly ($P = 0.008$) higher incidence of parvoviral enteritis in group-2 dogs, compared with group-1 dogs. A difference between age groups was not reported for incidence of infections of the upper portion of the respiratory tract.

The most common problems reported in dogs of both groups were behavioral in nature. Overall, 92 (34%) dogs (group 1, n = 36 [38%]; group 2, 56 [32%]) had at least 1 behavioral problem; aggressive (20 [7%]) and destructive behaviors (8 [3%]) were most common. Inappropriate elimination, including submissive urination (n = 5 [2%]) and housebreaking problems (3 [1%]), was observed infrequently. Miscellaneous behavioral problems (n = 65 [24%]) included excessive barking and digging, separation anxiety, jumping, and inability to get along with other animals. A difference between age groups was not detected in incidence of overall or specific behavioral problems.

Integumentary problems were reported in 80 (30%) dogs; nonspecific skin allergies and dermatitis were most common (n = 39 [15%]). Other integumentary problems included ear problems (n = 29 [11%]), masses (8 [3%]), mange (5 [2%]), and miscellaneous skin problems (9 [3%]). A difference between age groups was not reported for overall incidence or incidence of specific integumentary system problems.

Musculoskeletal problems were seen in 21 (8%) dogs. Mild hip dysplasia that did not require surgical management or prolonged medical management was reported in 6 dogs, whereas 1 dog had more severe hip dysplasia that required long-term intermittent medical management. Other musculoskeletal problems included undiagnosed lameness (n = 6 [2%]) and miscellaneous disorders (8 [3%]). A difference between age groups was not reported for overall incidence of musculoskeletal system problems or incidence of hip dysplasia.

Twelve (5%) dogs had gastrointestinal tract problems. Most problems were minor and consisted of intermittent vomiting, diarrhea, or both. One dog had dental disease, diarrhea of parasitic origin, and salivary mucocele. Intermittent vomiting or diarrhea generally developed long after adoption and thus were not likely associated with shelter-related infectious disease outbreaks. Group-1 dogs had more gastrointestinal tract problems than did group-2 dogs ($P = 0.001$); this finding was attributed to a high incidence of gastrointestinal tract problems in group-1 dogs from shelter 1 ($P = 0.001$).

Urinary problems were identified in 6 (2%) dogs. Three dogs developed urinary incontinence; 2 of these dogs were in group 1, and 1 was in group 2. Of the 2 group-1 dogs, 1 dog presumably had estrogen-responsive urinary incontinence, whereas the other dog developed long-term incontinence after anesthesia and a dental cleaning procedure (urinary tract infection could not be identified). The group-2 dog developed incontinence after ovariohysterectomy. This dog was mildly incontinent for 2 months, did not require medical treatment, and has not had a recurrence of this problem. Two dogs had single episodes of cystitis, whereas 1 dog had a single episode of azotemia of unknown cause. A difference was not detected between age groups for incidence of problems associated with the urinary system.

Neurologic, cardiopulmonary, and reproductive problems also were identified. Significant differences were not detected between age groups for problems that involved any of these body systems. Neurologic problems were reported in 7 (3%) dogs, including seizures (n = 4 [2%]) and intervertebral disc problems (3 [1%]). Five (2%) dogs had heartworm disease. Reproductive problems were reported in 3 (1%) dogs, including 2 dogs (1 dog from each group) with single episodes of vaginitis and 1 dog with mammary neoplasia.

Miscellaneous problems (often traumatic in nature) were reported in 43 (16%) dogs, including vehicular accidents (n = 7 [3%]), lacerations (4 [2%]), poisonous snake bites (7 [3%]), bite wounds (4 [2%]), gunshot injuries (2 [1%]), and others. A difference was not detected between age groups for incidence of miscellaneous problems.

A difference was not detected between age groups for owner perception of their dog's body weight. Most (82%) owners judged their dog's body weight to be ideal, whereas 18% felt their dogs were overweight.

Discussion

Little scientific data exists to support recommendations regarding timing of gonadectomy in dogs. However, many veterinarians remain resistant to prepubertal gonadectomy because of concerns about short- and long-term outcomes.[13-18] Many of these concerns have proven unfounded in short-term studies,[4,6-9] but controlled long-term studies have been lacking.

This study examined dogs from a shelter environment that underwent either early or traditional age gonadectomy approximately 4 years after surgery. Problems that may occur later in a dog's life, such as neoplasia or degenerative joint disease, were beyond the scope of this study; however, problems in this shelter population related to retention rates in households, behavioral characteristics, and non-age-related problems associated with numerous body systems were evaluated.

Prepubertal gonadectomy was not associated with higher return rate or increased rate of placement in another home after adoption, compared with traditional-age gonadectomy. Behavioral problems and unpreparedness for pet ownership by adoptive owners were the most common reasons cited for return of dogs to shelters or placement in new homes.

Although most (73%) dogs developed a problem after adoption, dogs that underwent prepubertal gonadectomy had similar outcome to dogs that underwent traditional-age gonadectomy, except for infectious diseases. More dogs had major problems than had minor or traumatic problems. Most dogs had 1 to 3 problems, whereas few dogs had ≥ 4 problems.

Parvoviral enteritis was the most commonly reported infectious disease and was reported exclusively in dogs that underwent prepubertal gonadectomy. Parvoviral enteritis is common in puppies from shelter environments, but uncommon in older dogs. The potential influence of anesthesia and surgery on the incidence of parvoviral enteritis in puppies that underwent gonadectomy could not be determined in our study, because comparisons with puppies that did not undergo gonadectomy were not performed.

Interestingly, most puppies that developed parvoviral enteritis were adopted from the shelter with long holding periods, rather than from the shelter with short holding periods. This may reflect the euthanasia policy of each shelter; the shelter with the long holding periods attempted treatment of animals with infectious diseases, which may have caused increased risk of exposure for other puppies in the shelter. This is in contrast to the other shelter, which euthanatizes dogs of a certain age group (and doesn't permit adoption of that age group) during infectious disease outbreaks.

Concerns that prepubertal gonadectomy would result in increased incidence of musculoskeletal disorders or hip dysplasia[2,6] were not supported by results of the study reported here. It has been speculated that the increased length of time that growth plates remain open and the subsequent increased long bone growth (and decreased muscle mass, in absence of testosterone) seen in dogs neutered at an early age might predispose these dogs to hip dysplasia or angular limb deformities.[2,6] Hip dysplasia was diagnosed infrequently in dogs in our study, and of those that were affected, most dogs did not require medical or surgical treatment. No difference was seen between age groups in the incidence of hip dysplasia. Angular limb deformities were not observed in dogs in our study.

Gastrointestinal tract problems were reported more commonly in dogs that had undergone traditional-age gonadectomy. Most problems were minor and consisted of mild vomiting, diarrhea, or both. Cause of this increased incidence was undetermined, but may reflect unidentified dietary or environmental differences between age groups and shelters.

It has been suggested that prepubertal gonadectomy may result in increased incidence of urinary incontinence in female dogs, because of the lack of estrogenic influence on the urinary tract.[2,15,18] Results of our study indicate that female dogs that undergo prepubertal gonadectomy are not more likely to develop urinary incontinence than are dogs that undergo traditional age-gonadectomy, during the first 4 years after gonadectomy. Only 3 dogs in our study developed incontinence. Interestingly, only 1 dog (traditional-age gonadectomy) had a history consistent with estrogen-responsive urinary incontinence.

Prepubertal gonadectomy was not associated with problems associated with integumentary, neurologic, cardiopulmonary, or reproductive systems. Dermatitis and ear problems were the most common integumentary problems, reflecting common types of skin problems encountered in routine veterinary practice. Neurologic problems seen in our study also reflected commonly encountered neurologic problems and included seizures and intervertebral disc disease. All dogs with cardiopulmonary disorders had heartworm disease. Not surprisingly, problems associated with the reproductive system were uncommon. Although concern has been expressed that prepubertal gonadectomy would result in increased incidence of vaginitis,[14,15] results of our study do not support such a concern, because only 1 dog in each age group was affected. In both of these dogs, vaginitis responded to short-term antimicrobial treatment and did not recur.

Miscellaneous problems were often traumatic in nature. Prepubertal gonadectomy was not associated with incidence of miscellaneous problems. The high incidence of injuries in free-roaming dogs emphasizes the health benefits of maintaining dogs in confined environments.

Most owners assessed their dog's body weight as ideal. Prepubertal gonadectomy was not associated with obesity as perceived by the owner; however, owner perception of a pet's body weight may often be suspect.

Prepubertal gonadectomy can be safely performed without any increased risk of problems or complications during anesthesia, surgery, and the first week after surgery.[4] Results of the study reported here indicate that prepubertal gonadectomy is not associated with increased problems associated with behavior or any body system, compared with traditional-age gonadectomy, during the first 4 years after surgery. Dogs that underwent prepubertal gonadectomy in our study were more likely to develop infectious diseases, particularly parvoviral enteritis. We did not determine whether prepubertal gonadectomy was associated with increased incidence of infectious diseases, compared with that observed in shelter puppies that did not undergo gonadectomy. Rate of retention in the original adoptive household in dogs that underwent prepubertal gonadectomy was similar to that of dogs that underwent traditional-age gonadectomy. Lastly, after adoption, no difference was observed in outcome related to physical or behavioral problems between a shelter with long holding periods and one with short holding periods.

[a]Available from first author upon request.
[b]BMDP, Version 7.0, BMDP Statistical Software Inc, Los Angeles, Calif.
[c]Statistix, Version 4.1, Analytical Software, Tallahassee, Fla.

References

1. Nassar R, Talboy J, Moulton C. *Animal shelter reporting study 1990.* Englewood, Colo: American Humane Association, 1992;5.

2. Stubbs WP, Bloomberg MS. Implications of early neutering in the dog and cat. *Semin Vet Med Surg (Small Anim)* 1995;10:8–10.

3. Eno M, Fekety S. Early-age spay/neuter: a growing concensus. *Shelter Sense* 1993;Nov:1–7.

4. Howe LM. Short-term results and complications of prepubertal gonadectomy in cats and dogs. *J Am Vet Med Assoc* 1997;211:57–62.

5. Lieberman LL. A case for neutering pups and kittens at two months of age. *J Am Vet Med Assoc* 1987;191:518–521.

6. 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.

7. Faggella AM, Aronsohn MG. Evaluation of anesthetic protocols for neutering 6- to 14-week-old pups. *J Am Vet Med Assoc* 1994;205:308–314.

8. Faggella AM, Aronsohn MG. Anesthetic techniques for neutering 6- to 14-week-old kittens. *J Am Vet Med Assoc* 1993;202:56–62.

9. Aronsohn MG, Faggella AM. Surgical techniques for neutering 6- to 14-week-old kittens. *J Am Vet Med Assoc* 1993;202:53–55.

10. Theran P. Early-age neutering of dogs and cats. *J Am Vet Med Assoc* 1993;202:914–917.
11. Salmeri KR, Olson PN, Bloomberg MS. Elective gonadectomy in dogs: a review. *J Am Vet Med Assoc* 1991;198:1183–1192.
12. Kahler S. Spaying/neutering comes of age. *J Am Vet Med Assoc* 1993;203:591–593.
13. Romatowski J. Early-age neutering, an "uncontrolled experiment" (lett). *J Am Vet Med Assoc* 1993;203:1523.
14. Johnston L. Opposes early-age neutering (lett). *J Am Vet Med Assoc* 1993;202:1041.
15. Chalifoux A, Fanjoy P, Niemi G, et al. Early spay-neutering of dogs and cats (lett). *Can Vet J* 1981;22:381.
16. Joshua JO. The spaying of bitches. *Vet Rec* 1965;77:642–647.
17. Jorgoe JA, Serpell JA. Optimum time for neutering (lett). *Vet Rec* 1988;122:447.
18. Jackson EKM. Contraception in the dog and cat. *Br Vet J* 1984;140:132–137.
19. Dorn A. Introduction to veterinary dentistry. In: Slatter DH, ed. *Textbook of small animal surgery.* 2nd ed. Philadelphia: WB Saunders Co, 1993;2310–2315.

Correction: Long-term outcome of gonadectomy performed at an early age or at traditional age in cats

In "Long-term outcome of gonadectomy performed at an early age or at traditional age in cats" (*JAVMA*, Vol 217, pp 1661-1665), the first sentence in the seventh complete paragraph on page 1664 should read, "Most behavioral problems were minor in nature; however, several cats were judged to have major behavioral problems, including destructive behavior (damaging furniture, carpet, or walls) and inappropriate elimination (spraying or other inappropriate urination)."

Dear LA City Council Members:

Definitions: *Ovariohysterectomy*=spay=removing ovaries and uterus of a female pet; *castration*=removal of the testicles of a male pet; and *gonadectomy* refers to either spay or castration. A *neuter* can refer to a male or female, although often it is synomous with castration. *Prepubertal* refers to a pet that has not yet become fertile, usually before 6 mos. Of age.

In the early 1900's, elective ovariohysterectomies were performed at 3-6 mos. of age, and castrations were done when pets were as young as 4 wks. Over time the recommended age for sterilization of small animals increased to 6-9 mos. of age. Despite the advances in anesthetics and surgical techniques, many people still cling to the belief that dogs and cats need to wait until they are six to nine months to be sterilized. It is estimated that 5.4 to 9.1 millions of dogs and 5.7 to 9.5 millions of cats were euthanized by humane organizations in 1990. In a survey of dog and cat owning US households, it was found that 56 % of 154 canine litters and 68% of 317 feline litters were unplanned. Animal owners are clueless about knowing that their female dogs were in heat--this was the most common reason for the unplanned litters. Up to 57% of female dog owners didn't know their dogs cycle in heat twice yearly. Up to 83% of cat owners did not know that the queens are seasonally poyestrus (meaning they cycle often during the seasons of increased daylight). Also, up to 61% of dog and cat owners were not certain, or truly believed that their pet would be better if it had a litter before it was spayed.

I am distributing two studies done by prominent board-certified veterinary surgeons. The study involving dogs (269 dogs from animal shelters), in 2 groups, those sterilized under 6 mos. old and those done after 6 mos. old) showed that "Prepubertal gonadectomy did not result in an increased incidence of behavioral problems or problems associated with any body system, compared with traditional age gonadectomy, during a median follow-up period of 48 mos. after gonadectomy." A similar study on 263 shelter cats by the same authors came to the conclusion that "Compared with traditional age gonadectomy, prepubertal gonadectomy did not result in an increased incidence of

infectious disease, behavioral problems, or problems associated with any body system during a median follow-up period of 37 mos."

Another journal article which I copied for you states "Among male cats that underwent early age gonadectomy (under 5.5 mos. of age), the occurrence of abscesses, aggression toward veterinarians, sexual behaviors, and urine spraying was reduced."

The 4th article I have provided to you-- by Dr. Scarlett-- asserts "there are no scientific studies indicating that 6 months of age is optimal for neutering, and numerous studies document the safety of early age neutering. In light of this, veterinarians are beginning to schedule neutering at the end of puppy and kitten vaccination series (approx. 4 to 4.5 mos. of age). when animals are fully immunized but before they reach puberty. This approach lessens the likelihood that clients forget or their pets escape and have litters before they are neutered and has good potential to reduce relinquishments."

Gonadectomy has many benefits besides population control, and my associates will present some information on the role that sterilization has in preventing mammary tumors and uterine infections, preventing and treating non-cancerous prostate disease in the male dog, and preventing pain and suffering.

Thank you for your consideration!

Steven Feldman, DVM
Chief Veterinarian
Los Angeles Animal Services

Long-term outcome of gonadectomy performed at an early age or traditional age in cats

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Theresa W. Fossum, DVM, PhD, DACVS; Angela C. Spann, BS; W. Scott Wilkie, BS

Objective—To determine long-term results and complications of gonadectomy performed at an early age (prepubertal) or at the traditional age in cats.

Design—Cohort study.

Animals—263 cats from animal shelters.

Procedure—Cats that underwent gonadectomy were allotted to 2 groups on the basis of estimated age at surgery (traditional age, ≥ 24 weeks old; prepubertal, < 24 weeks old). Adoptive owner information was obtained from shelter records, and telephone interviews were conducted with owners to determine physical or behavioral problems observed in the cats after adoption. Follow-up information was obtained from attending veterinarians for cats with complex problems or when owners were uncertain regarding the exact nature of their cat's problem.

Results—Compared with traditional-age gonadectomy, prepubertal gonadectomy did not result in an increased incidence of infectious disease, behavioral problems, or problems associated with any body system during a median follow-up period of 37 months. Additionally, the rate of retention in the original adoptive household was the same for cats that underwent prepubertal gonadectomy as those that underwent traditional-age gonadectomy.

Conclusions and Clinical Relevance—Prepubertal gonadectomy may be performed safely in cats without concern for increased incidence of physical or behavioral problems for at least a 3-year period after gonadectomy. (*J Am Vet Med Assoc* 2000;217: 1661–1665)

Pet overpopulation continues to be a serious problem in the United States. In 1990 it was estimated that approximately 11 to 19 million animals were euthanatized in US animal shelters.[1] Additionally, many unwanted animals die from exposure, starvation, or trauma each year.[2] Although many humane organizations now require mandatory neutering of all companion animals after adoption, owner compliance with these programs is estimated to be < 60%.[3,4] To increase the effectiveness of population control measures, many humane organizations and veterinarians have promoted prepubertal gonadectomy (neutering well before the onset of puberty and prior to adoption).[5-12] Prepubertal gonadectomy of humane shelter animals may result in nearly 100% neutering compliance rates, fewer returned animals, and improved staff morale.[3]

In 1993, the AVMA House of Delegates approved Resolution 6, which stated: "Resolved, that AVMA supports the concept of early (8 to 16 weeks of age) ovariohysterectomies/gonadectomies in dogs and cats in an effort to stem the overpopulation problem in these species."[13] Despite the passage of this resolution, acceptance of prepubertal gonadectomy by veterinarians has been slow, in part, because of concerns about anesthesia, urethral obstruction in male cats, potential behavioral abnormalities, and obesity.[14-20] Short-term results (7 days) and complications of prepubertal gonadectomy in nearly 2,000 cats and dogs have been reported.[5] In that study, animals were allocated into 3 groups on the basis of estimated age: < 12 weeks old (prepubertal), 12 to 23 weeks old (prepubertal), and ≥ 24 weeks old (traditional age). Prepubertal gonadectomy did not result in increased short-term morbidity or mortality in cats, compared with traditional-age gonadectomy. Prepubertal gonadectomy in cats was concluded to be safe. Results of other clinical and experimental studies also do not indicate that increased morbidity or mortality is associated with prepubertal gonadectomy on a short-term basis[6-8,10,12]; however, to the authors' knowledge, long-term studies with large numbers of animals and reference (or control) populations have not been reported.

Objectives of the long-term study of animal shelter cats reported here were to compare effects of prepubertal and traditional-age gonadectomy on incidence of infectious diseases, retention in the original adoptive household, and long-term differences in physical, behavioral, and health-related problems. Findings were also compared between cats in a limited-admission shelter and those in a shelter with a short holding period.

Materials and Methods

Cats—Cats included in the study were from 2 humane organizations and underwent ovariohysterectomy and castration in association with the fourth-year surgical teaching program at Texas A&M University during the first 28 months (July 1994 through October 1996) that a prepubertal gonadectomy program was in operation. Shelter 1 accepted only owner-surrendered animals, had a long holding period, and did not euthanatize animals after they had entered the shelter. Shelter 2 performed animal control in the region, had a short holding period, and euthanatized animals that were not adopted within a stated period of time. These

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cats formed the study group in a previous report.[5] Cats were allocated into 2 groups on the basis of age, which was estimated by evaluation of dentition,[21] size, body weight, and date of birth (when available). Group-1 (traditional-age) cats were ≥ 24 weeks of age, and group-2 (prepubertal) cats were < 24 weeks of age.

Study design—Client information was recorded from the humane organization records for each cat that was adopted. Owners were contacted by telephone no earlier than 30 months after surgery (range, 30 to 58 months). At least 5 attempts were made at various times during the day, evening, and weekends to contact owners for which addresses or phone numbers could be located. Owners were asked questions from a standardized questionnaire[a] to evaluate cats for incidence of infectious diseases, retention in the original adoptive household, physical status of all body systems, and behavioral status. If an owner gave a specific name and description (including treatment) of a medical condition for which their cat had been treated by a veterinarian that were consistent with the clinical signs the cat had at that time, the cat's veterinarian was not contacted. The attending veterinarian was contacted to clarify complex problems or those not adequately described by the owner. Internet resources were used to attempt to locate telephone numbers and addresses for those individuals who had moved since adopting their pet.

Problems were classified by severity (major or minor) and type (eg, trauma-induced). Major problems were those that resulted in mortality, prolonged (≥ 2 weeks) morbidity, surgery, or prolonged (≥ 2 weeks) or recurrent medical treatment. Additionally, behavioral problems that resulted in, or could potentially result in, alterations to the cat's physical or environmental status (eg, onychectomy or removal from the household or to the outdoors, respectively) were considered major problems. Examples of major problems included destructive behavior resulting in onychectomy, inappropriate elimination resulting in return to the shelter or placement of the cat outdoors or in another home, and liver problems. If urinary tract disease was identified as contributing to inappropriate urination (ie, cats ceased inappropriate urination when the urinary tract disease was treated), the problem was classified as a urinary system problem rather than a behavioral problem. Minor problems were those that did not result in surgery or death, including single episodes that resolved with short-term (< 2 weeks) treatment. Examples of minor problems included shyness, skin allergies, single episodes of infection of the upper portions of the respiratory tract or cystitis, and behavioral problems that did not jeopardize the cat's standing in the household. Cats with signs of urinary tract infection were treated with antimicrobials (in addition to dietary modifications) without urinalysis or bacteriologic culture of urine. Because bacterial infection could not be confirmed, all urinary tract infections reported by owners and veterinarians were listed as cystitis to reflect the fact that cystitis may be aseptic. Traumatic problems resulted from traumatic incidents or poisoning and included vehicular accidents and injuries from fighting, being struck by an automobile engine fan, and gunshot. Cats that died, did not return home, or were returned to the shelter within 1 month of adoption were not included in the subsequent analysis other than to list the problems that led to death or removal from the household.

Statistical analyses—Statistical programs were used for all analyses.[b,c] Distribution of responses to survey questions were described by use of proportions and 95% confidence intervals. Summaries for each body system and incidence of the most commonly cited health problems were described similarly. Mantel-Haenszel χ^2 analysis was used to compare incidence of health problems between prepubertal and traditional age groups stratified by shelter. When differences were detected between shelters for a certain variable, the 2-tailed Fisher exact test was used to determine significance. Differences were considered significant at $P \leq 0.05$.

Results

Follow-up information was obtained for 263 of 693 (38%) cats that underwent gonadectomy and were adopted during the study period. The remainder of these cats were lost to follow-up and were not included in the study. An additional 214 cats underwent gonadectomy during the study period but were not adopted and were not included in the study. Internet resources were useful in locating 7 (3%) individuals who had moved since adopting their cat. Five owners declined to participate in the study.

There were 75 cats in group 1 and 188 cats in group 2. Mean ± SD age of cats at the time of gonadectomy was greater ($P < 0.001$) for group-1 cats than for group-2 cats (group 1, 56.8 ± 53.1 weeks [median, 51 weeks; range, 24 to 390 weeks]; group 2, 10.5 ± 3.7 weeks [median, 9 weeks; range, 6 to 22 weeks]).

There were 155 (59%) cats with follow-up data from shelter 1 and 108 (41%) cats from shelter 2. Shelter 1 had 31 group-1 and 124 group-2 cats; 85 (55%) cats were female and 70 (45%) were male. Shelter 2 had 44 group-1 cats and 64 group-2 cats; 70 (65%) cats were female, and 38 (35%) were male. When shelters were combined, 75 cats were in group 1, and 188 cats were in group 2; 155 cats were female, and 108 were male. Distribution of sexes between groups was not different between shelters.

Mean and median follow-up times (length of time from gonadectomy to owner contact or death or loss of cat) did not differ between shelters (shelter 1, 38 ± 8.6 months [median, 38 months]; shelter 2, 36.8 ± 8.9 months [median, 37 months]). Mean and median follow-up times did not differ between groups when shelter data were combined (group 1, 38.3 ± 10.2 months [median, 39 months]; group 2, 37.1 ± 8.0 months [median, 36 months]).

Differences were not detected between age groups for incidence of cats being returned to a shelter; overall, 7 (3%) cats were returned to a shelter. Two cats were returned to a shelter because of owner allergies, 2 because of inappropriate elimination, 1 because of aggression, 1 because of FeLV infection, and 1 because

of fleas. Most cats (n = 228; 87%) were still alive at follow-up, although several cats had died or been euthanatized (20; 7%) or failed to return home (8; 3%). Of the cats that were no longer alive, 5 were involved in vehicular accidents, 3 died from infectious diseases, 2 from poisonings, 5 from miscellaneous traumatic incidents, 1 from pulmonary mycosis, and 4 from unidentified causes. A difference was not detected between age groups in the number of cats alive or dead at time of owner contact. More cats in both age groups died from traumatic incidents than from medical causes, and a difference in incidence of traumatic or medical deaths was not detected between age groups.

Overall, owners assessed 181 (69%) cats as having experienced a problem since adoption (group 1, n = 58 [77%]; group 2, 123 [65%]). When classified by severity and type, 71 (27%) cats (group 1, 27 [36%]; group 2, 44 [23%]) had a major medical or surgical problem, 74 (28%) cats (group 1, 23 [31%]; group 2, 51 [27%]) had a minor problem, and 36 (14%) cats (group 1, 8 [11%]; group 2, 28 cats [15%]) had a traumatic incident or failed to return home. Most cats had only 1 problem (group 1, n = 35 [47%]; group 2, 81 [43%]). Several cats from both groups had 2 or 3 problems (group 1, n = 21 [28%]; group 2, 41 [22%]), whereas few cats had 4 or more problems (group 1, 2 [3%]; group 2, 1 [0.5%]). A difference was not detected in overall incidence of problems between age groups. A difference was not detected between age groups for problem severity or type or number of problems.

Infectious diseases affected 21 (8.0%) cats; infections of the upper portions of the respiratory tract were seen in 12 (5%) cats. Miscellaneous infectious diseases also were reported in 3% of cats and included feline leukemia (n = 3), feline immunodeficiency virus infection (1), viral enteritis (3), feline infectious peritonitis (1), and diarrhea caused by spirochetes (1). Differences between age groups were not detected for incidence of infectious diseases, infections of the upper portions of the respiratory tract, or miscellaneous infectious diseases.

The most common problems reported in cats of both groups were behavioral in nature. Overall, 75 (29%) cats (group 1, n = 26 [35%]; group 2, 49 [26%]) had at least 1 behavioral problem, with the most common major problems being destructive behavior (23) and inappropriate elimination (17). Miscellaneous behavioral problems were also reported, including aggression toward people (n = 9), shyness (19), psychogenic alopecia (4), fighting (3), fear of outdoors or people (3), nervousness (3), pica (1), and psychotic behavior (1). Differences between age groups were not detected in the incidence of overall behavioral problems, destructive behavior, inappropriate elimination, or other miscellaneous behavioral problems.

Problems associated with the urinary system were reported in 17 (7%) cats, with cystitis being most common (n = 11 [4%]). Overall (combined shelter data), group-1 cats had more urinary system problems than group-2 cats ($P = 0.004$). Older cats at shelter 2 had more urinary problems overall ($P = 0.003$) and cystitis ($P = 0.041$) than did younger cats. Similar age differences for these variables were not detected in cats at shelter 1. Cystitis was reported commonly in cats of both sexes. Group 1 had 4 female and 3 male cats with cystitis, and group 2 had 2 cats of each sex with cystitis. Differences between age groups were not detected for the incidence of obstruction or other miscellaneous urinary tract problems. Only 2 of 38 (5%) male cats in group 1 had obstructive episodes, whereas 0 of 70 (0%) group-2 cats had an obstructive episode. One obstructive episode was reported in a cat neutered at 1 year of age, whereas 3 episodes were reported in a cat neutered at 6 months of age. Miscellaneous urinary tract problems included urinary calculi (n = 3) and renal failure (1).

Problems were also identified in the integumentary, gastrointestinal, musculoskeletal, and cardiopulmonary systems. Differences between age groups were not detected in any of these body systems. Skin problems were reported in 42 (16%) cats but were usually minor and included ear mite infections (n = 20), ear infections from causes other than ear mites (4), aural hematoma (1), minor skin allergies (10), anal sac impaction (2), abscess (1), *Cuterebra* sp infection (1), benign skin tumor (1), localized ringworm infection (1), and minor hair loss (1). Gastrointestinal tract problems were reported in 21 (8%) cats, whereas 8 (3%) cats had musculoskeletal problems, and 8 (3%) cats had cardiopulmonary problems. Gastrointestinal tract problems included diarrhea (n = 5), vomiting (4), regurgitation (3), liver problems (4), dental calculus (3), gingivitis (1), and megaesophagus (1). Most gastrointestinal tract problems were minor in nature; however, liver problems (n = 4), chronic vomiting (1), chronic regurgitation (1), megaesophagus (1), and recurrent dental calculus (1) were considered major. Musculoskeletal problems were generally minor and consisted of transient lameness (n = 5) for which a diagnosis was not achieved. Major musculoskeletal problems included fractures (n = 2), and recurrent patellar luxation (1). Cardiopulmonary problems included heartworm disease (n = 2), asthma (2), and others (4). Neither neurologic nor reproductive problems were reported.

Other miscellaneous problems were reported in 57 (22%) cats, and many were caused by traumatic incidents (n = 43), poisonings (3), or miscellaneous medical problems (11). Miscellaneous traumatic incidents included vehicular accidents (n = 9), injuries from fights with other animals (11), corneal scratches (3), gunshot injuries (2), injuries from automobile engine fans (2), traumatic tail amputation (2), cranial trauma after falling through the slats in a fence (1), and others (13). Other miscellaneous medical problems were reported, including parasite infestations (n = 3), facial twitch (1), vaccine reaction (1), systemic mycosis (1), infection associated with neutering (1), diabetes mellitus (1), and others (3).

A difference between age groups was not detected in owner perception of their cat's body weight. Most owners (84%) judged their cat's body weight to be ideal, whereas 14% believed their cats were overweight, and 2% believed their cats were underweight.

Discussion

Pet overpopulation continues to be a substantial problem in the United States. Because all methods of pet birth control involve veterinarians, they play a crit-

ical role in battling pet overpopulation. Although many methods of pet birth control have been examined, gonadectomy remains the mainstay.

Although there are few scientific reports to support recommendations regarding the ideal time to neuter cats, many veterinarians remain resistant to prepubertal gonadectomy in companion animals. Concerns include potential for surgical and anesthetic complications, stunted growth, vaginitis, perivulvar dermatitis, urethral obstruction in male cats, urinary incontinence, impaired immunocompetence, obesity, and dermatologic, endocrine, cardiac, and behavioral abnormalities.[14-20] Many of these concerns have been proven unfounded by results of short-term studies, but controlled long-term studies have been lacking.

Our study was designed to provide long-term information regarding all body systems and behavioral characteristics in shelter cats that underwent prepubertal gonadectomy, compared with shelter cats that underwent gonadectomy at a traditional age. Although 3 years (follow-up time for cats in our study) certainly does not reflect the typical lifespan of a cat, it does permit evaluation of a substantial portion of a cat's life. Certain problems that may develop later in a cat's life, such as neoplasia, were beyond the scope of this study; however, problems related to infectious diseases, retention rates in households, behavioral characteristics, and non–age-related problems associated with numerous body systems, including the urinary system, were evaluated.

Follow-up was obtained in a moderate number (38%) of cats that underwent surgery during the study period. Although a higher follow-up rate was desirable, many adoptive owners could not be located or contacted.

Prepubertal gonadectomy did not affect retention rate in the original adoptive household or result in an increased rate of return to a shelter after adoption, compared with traditional-age gonadectomy. Of the 7 cats returned to a shelter, 4 were returned because of animal-associated problems, and 3 were returned because of owner-associated problems. Inappropriate elimination (n = 2) and owner allergies (2) were the most common reasons cited for returning cats to shelters.

In our study, both gonadectomy groups had similar rates, type, and severity of problems. Although most (69%) cats developed a problem after adoption, outcome for cats that underwent prepubertal gonadectomy was similar to that of cats that underwent gonadectomy at a traditional age.

Infections that involved the upper portions of the respiratory tract were the most commonly reported infectious disease; however, prepubertal gonadectomy did not result in an increased incidence of infectious diseases after adoption, compared with traditional-age gonadectomy. Infections of the upper portions of the respiratory tract in cats from shelters are common and may result in return of the cat to the shelter or owner dissatisfaction. Most adoptive cat owners in our study whose pets developed infectious diseases kept their cat and obtained veterinary care.

Most behavioral problems were minor in nature; however, 5 cats were judged to have major behavioral problems, including destructive behavior (damaging furniture, carpet, or walls) and inappropriate elimination (spraying or other inappropriate urination). Many of these behavioral problems resulted in onychectomy, or change to an outdoor environment, which probably put cats at further risk for injury or illness. Prepubertal gonadectomy did not result in increased behavioral problems, compared with those observed after traditional-age gonadectomy.

Concerns that prepubertal gonadectomy would result in increased incidence of feline **idiopathic lower urinary tract disease** (ILUD) and potential urethral obstruction in male cats were not supported by results of our study. Cats that were neutered at the traditional age appeared to be at increased risk for urinary tract problems (including cystitis), as indicated by a highly significant difference between age groups in shelter-2 cats. Reasons for this increased risk of urinary tract problems were not determined; however, unidentified differences in environments or diets may have played a role. Results of experimental and clinical studies implicate calicivirus, feline syncytia-forming virus, and a gamma herpesvirus (bovine herpesvirus 4) as potential causes of ILUD in some cats.[22] If a virus is involved in ILUD, removal of reproductive hormones via gonadectomy before puberty could possibly affect viral manifestation in some way and account for differences between age groups in incidence of urinary problems. Finally, gonadectomy at an early age may result in some other unidentified protective effect on the urinary tract. Although the increased incidence of urinary tract problems in cats that were neutered at the traditional age remains unexplained, concerns regarding increased incidence of urethral obstruction in male cats that were neutered before puberty are unfounded within 3 years of surgery. Only 2 male cats developed urethral obstruction, and both cats were in the traditional-age gonadectomy group. None of the 70 males that underwent prepubertal neutering had obstructive episodes. Because ILUD is most commonly recognized in young to middle-aged adult cats,[23] studies of longer duration are unlikely to yield different results.

Prepubertal gonadectomy did not affect problems associated with integumentary, gastrointestinal, musculoskeletal, or cardiopulmonary systems. Ear problems accounted for most integumentary problems; ear mite infestation was most common. Most musculoskeletal disorders involved mild lameness that was self-limiting and of undetermined cause. Miscellaneous cardiopulmonary disorders were seen, including 2 cats with heartworm disease.

Miscellaneous problems were often traumatic in nature. Prepubertal gonadectomy had no effect on the incidence of miscellaneous problems. The high incidence of injuries received by cats while outdoors emphasizes the health benefits of maintaining cats in completely indoor environments.

Most cat owners assessed their cat's body weight as ideal. Prepuberal gonadectomy had no effect on obesity (as perceived by the owner); however, owner perception of a pet's body weight may often be suspect. Additionally, perception of body weight gives no information regarding attaining or exceeding genetic size or weight potential.

Prepubertal gonadectomy can be safely performed

without increased risk of problems or complications during anesthesia, surgery, and the first week after surgery.[5] Results of our study indicate that prepubertal gonadectomy does not result in increased problems associated with behavior or any body system, compared with traditional-age gonadectomy, for as long as 3 years after surgery. Results of our study also suggest that prepubertal gonadectomy may result in some unidentified protective effect on the urinary tract, compared with traditional-age gonadectomy in some cats. Furthermore, increased incidence of infectious diseases or a difference in the rate of retention in the original adoptive household in cats that underwent prepubertal gonadectomy was not detected. Finally, differences between cats obtained from shelters with long holding periods, and cats obtained from shelters with short holding periods are not expected for outcomes related to physical or behavioral problems of cats that undergo prepubertal gonadectomy.

[a]Survey available on request from authors.
[b]BMDP, version 7.0, BMDP Statistical Software Inc, Los Angeles, Calif.
[c]Statistix, version 4.1, Analytical Software, Tallahassee, Fla.

References

1. Nassar R, Talboy J, Moulton C. *Animal shelter reporting study 1990*. Englewood, Colo: American Humane Association, 1992;5.
2. Sturla K. Role of breeding regulation laws in solving the dog and cat overpopulation problem. *J Am Vet Med Assoc* 1993;202:928–932.
3. Eno M, Fekety S. Early-age spay/neuter: a growing concensus. *Shelter Sense* 1993;Nov:1–7.
4. Stubbs WP, Bloomberg MS. Implications of early neutering in the dog and cat. *Semin Vet Med Surg (Small Anim)* 1995;10:8–10.
5. Howe LM. Short-term results and complications of prepubertal gonadectomy in cats and dogs. *J Am Vet Med Assoc* 1997;211:57–62.
6. Faggella AM, Aronsohn MG. Evaluation of anesthetic protocols for neutering 6- to 14-week-old pups. *J Am Vet Med Assoc* 1994;205:308–314.
7. Faggella AM, Aronsohn MG. Anesthetic techniques for neutering 6- to 14-week-old kittens. *J Am Vet Med Assoc* 1993;202:56–62.
8. 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.
9. Lieberman LL. A case for neutering pups and kittens at two months of age. *J Am Vet Med Assoc* 1987;191:518–521.
10. Aronsohn MG, Faggella AM. Surgical techniques for neutering 6- to 14-week-old kittens. *J Am Vet Med Assoc* 1993;202:53–55.
11. Salmeri KR, Olson PN, Bloomberg MS. Elective gonadectomy in dogs: a review. *J Am Vet Med Assoc* 1991;198:1183–1192.
12. Theran P. Early-age neutering of dogs and cats. *J Am Vet Med Assoc* 1993;202:914–917.
13. Kahler S. Spaying/neutering comes of age. *J Am Vet Med Assoc* 1993;203:591–593.
14. Chalifoux A, Fanjoy P, Niemi G, et al. Early spay-neutering of dogs and cats (lett). *Can Vet J* 1981;22:381.
15. Johnston L. Opposes early-age neutering (lett). *J Am Vet Med Assoc* 1993;203:1523.
16. Romatowski J. Early-age neutering, an "uncontrolled experiment" (lett). *J Am Vet Med Assoc* 1993;203:1523.
17. Joshua JO. The spaying of bitches. *Vet Rec* 1965;77:642–647.
18. Jackson EKM. Contraception in the dog and cat. *Br Vet J* 1984;140:132–137.
19. Jagoe JA, Serpell JA. Optimum time for neutering (lett). *Vet Rec* 1988;122:447.
20. Root MV, Johnston SK, Olson PN. Effect of prepubertal and postpubertal gonadectomy on heat production measured by indirect calorimetry in male or female domestic cats. *Am J Vet Res* 1996;57:371–374.
21. Dorn A. Introduction to veterinary dentistry. In: Slatter D, ed. *Textbook of small animal surgery*. 2nd ed. Philadelphia: WB Saunders Co, 1993;2310–2315.
22. Kalkstein TS, Kruger JM, Osborne CA. Feline idiopathic lower urinary tract disease. Part II. Potential causes. *Compend Contin Educ Pract Vet* 1999;21:148–154.
23. Kalkstein TS, Kruger JM, Osborne CA. Feline idiopathic lower urinary tract disease. Part I. Clinical manifestations. *Compend Contin Educ Prac Vet* 1999;21:15–26.

Exploring the Bond

The role of veterinary practitioners in reducing dog and cat relinquishments and euthanasias

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Estimates vary regarding the number of dogs and cats euthanatized each year in the United States.[1,2] Regardless of the source of the estimates, however, all agree that the numbers are in the millions. Even after removing animals that are unlikely to make good pets or those that are surrendered because of old age or illness, millions of healthy animals are euthanatized because they are homeless. The problem has been called pet overpopulation, suggesting that if only feline and canine birthrates were further reduced, the problem would disappear. Many, including shelter veterinarians and managers, have disputed this, pointing out that puppies and often kittens are not the predominant age group being euthanatized, but rather adolescent and older animals that have been in homes but are no longer wanted by their original owners.[3,4] They have emphasized that addressing pet fertility alone will not stop euthanasia of adoptable animals.[5]

Numerous authors and researchers in the veterinary and humane communities have emphasized the contributions that behavioral problems, ignorance of basic husbandry, and differential attitudes toward cats have on pet overpopulation. These reasons beg veterinary intervention, because veterinarians counsel pet owners on a daily basis and have what sociologists call Aesculapian authority, which is the authority that accompanies the knowledge to heal in human cultures.[6] Veterinarians have an opportunity to intervene, because people relinquishing pets to shelters are often veterinary clients. Seventy percent of dogs and 50% of cats (excluding litters) had been taken to veterinarians at least once during the year preceding their relinquishment to shelters.[a] The genesis and maintenance of a strong bond between humans and pets are of paramount importance to veterinarians for ethical and economic reasons and for mitigation of pet euthanasias for lack of sufficient homes.[6,7]

Recent studies underscore the complexity of the issues and situations that lead people to relinquish pets and their litters to animal shelters.[8-15] Whereas the shelters represented in these studies are not scientifically representative of all animal shelters in the country, they provide badly needed quantitative estimates of the reasons for relinquishment and the risks associated with various factors. The results are consistent with and extend observations of many people working in companion animal welfare.[16] For example, data now confirm that most animals entering shelters nationwide are not puppies and kittens. Although puppies and kittens continue to be euthanatized nationwide and veterinary efforts to promote neutering must continue, in a recent study[12] of 12 animal shelters across the country, puppies accounted for 29% and kittens for 47% of dog and cat relinquishments, respectively. Not surprisingly, these young animals are presented to shelters predominantly because the owners now perceive they have too many animals and have been unable to find homes for these offspring. Dogs and cats 6 to 24 months old accounted for the single largest percentage of dogs relinquished (31%) and the second largest percentage of cats relinquished (20%).[12] These data reemphasize the need for continuing efforts at neutering but also underscore the need for veterinarians to understand the characteristics of all surrendered animals and the reasons they were relinquished. Understanding the reasons leading to dissolution of the human-animal bond can lead to early identification and treatment of potential problems (before the decision to relinquish is made) and ultimately may lead to improved veterinary care, increased veterinary income, and fewer deaths from euthanasia. The purpose of this report is to identify specific activities and programs that practicing veterinarians can adopt that may strengthen the human-animal bond and reduce pet surplus in the United States. These recommendations are derived from the most current research findings related to this topic.

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Undesirable Behaviors

Counseling clients about pet behaviors perceived as problems by owners and continuing the emphasis on neutering are probably the most effective means by which veterinarians can influence the number of dogs and cats surrendered to animal shelters today. Behavioral problems are the leading cause of relin-

quishment of dogs and the second most common reason for relinquishment of cats (excluding litters).[11] Forty percent of dogs and approximately 28% of cats were surrendered with 1 or more behavioral problems cited by owners among the 5 reasons they could provide for relinquishing their pet. These figures probably underestimate the importance of behavior as many owners may be reluctant to report behavioral problems for fear of pet euthanasia following surrender.[11]

Behavioral problems are best prevented. If that is not possible, then many can be successfully treated or modified. These recent data help focus attention on the leading behavioral causes for relinquishment and indicate those that should be of high priority for veterinarians working to establish and preserve the bond between client and pet.

Inappropriate elimination—Resolving the cause of inappropriate elimination is of highest priority for both dogs and cats, because this behavior leads the list of individual behavioral reasons for relinquishment of both species.[11] Not surprisingly, in studies comparing behaviors of animals relinquished with behaviors among animals retained in their homes, frequent inappropriate elimination substantially increased the risk for relinquishment for both dogs and cats.[12-14] Because definitions of frequency of the behavior vary, direct comparisons between studies are difficult, but dogs and cats urinating at least weekly in the home were approximately 2 to 4 times and 2 to 6 times, respectively, more likely to be relinquished to a shelter, compared with animals occasionally or never displaying these behaviors.[12-14] Also, owners who were aware that prescription drugs were available to modify inappropriate elimination were only half as likely to relinquish a cat as those unaware of such drugs.[17]

Veterinarians are trained to distinguish medical from behavioral causes of inappropriate elimination. Most medically related elimination problems are probably accurately diagnosed and successfully treated, but behavioral causes remain a challenge. Nonmedically related inappropriate elimination by animals has a wide variety of causes, and taking a careful history is essential to an accurate diagnosis and effective treatment.

Clients with new puppies must be given good information regarding house training, and their success must be monitored. In a study conducted in 12 animal shelters nationwide, 31.8% of people surrendering dogs believed that, "It is helpful to rub the dog's nose in its mess when it soils in the house," and an additional 11.4% were not sure.[12] Among people with veterinary contact within the past year, a slightly higher percentage were better informed, but there was much room for improvement. Veterinarians cannot assume that new pet owners (whether first-time or former owners) are knowledgeable about and capable of successful housebreaking. The fact that almost half of pet owners who relinquished their dogs believed or were unsure that dogs should have their noses rubbed in their excrement underscores the need for education among dog owners. During puppy and kitten vaccination series, veterinarians should inquire repeatedly about the success of house-training efforts. Problems can be identified early and sound advice (eg, prepared handouts) provided to clients that may not seek assistance otherwise.

Urinating outside the litter box is more common among cats in multicat households than in single cat households.[18] When asked whether cats minded the presence of other cats in the household, 35.5% of people relinquishing cats did not know or were unaware that multiple cats could affect elimination behavior.[12] In light of the increasing percentage of multiple-cat households (up from 42.2 to 52.0% from 1991 to 1996)[19] and the lack of understanding regarding the potential effects of multiple cat ownership (particularly on elimination behaviors), making clients aware of the risks is important. Proactively inquiring about whether cat owners intend to acquire additional cats and providing good information to assist the decision-making process seem likely to prevent some relinquishments for this reason.

In a 1996 study of risk factors for relinquishment, dogs with inappropriate elimination on a weekly basis had a 7-fold lower risk of relinquishment if they had veterinary care at least 2 times yearly, compared with similar dogs receiving veterinary care less than once a year.[13] This was true after adjustment for neuter status, household income, dog's age, length of ownership, and owner's attachment to the pet. Presumably, veterinary contact included assistance with behavioral problems, as dogs receiving regular veterinary care were less likely to have behavioral problems. Despite this association between veterinary care and reduction in risk of surrender, only 25% of dog owners reported routine veterinary behavioral advice.[13] Clearly, veterinarians need to identify and successfully treat behavioral problems.

In contrast to dogs, the frequency of veterinary care and risk of relinquishment for inappropriate elimination in cats was not associated after controlling for neuter, indoor/outdoor and declaw status, cat's age, and length of ownership in the same study.[14] Given the importance of inappropriate elimination as a cause of the dissolution of the human-animal bond, the veterinary team (defined as practitioners, technicians, office staff, veterinary college faculty, and students) must become proficient at helping owners prevent and resolve this problem.

Aggressive behaviors—Excluding litters, approximately 10% of dogs were surrendered to 12 shelters in part because of aggressive behaviors toward people, and 8% were surrendered because of aggression toward other animals.[8] Among dogs surrendered for aggressive behaviors (growling, snarling, baring teeth, and biting), 69% had bitten at least 1 person.[a] Among surrendered cats, fewer cats (5%) than dogs were relinquished in part for aggression toward people, and about the same proportion of cats as dogs (7%) were relinquished for aggression toward other animals. Among cats surrendered for aggressive behaviors toward humans, 71% had bitten people.[a]

Previous estimates of the frequency of canine aggression have been restricted to dogs presented to veterinarians for behavior evaluation. Among these dogs, 40% were presented for aggression, and 54 to

67% of these cases involved aggression to humans.[20] Recent data from a national sample of more than 3,000 dog-owning households reported that approximately 16% of households had dogs that had growled, snapped, or attempted to bite people at least some of the time during the preceding month.[12] For 2 studies in which aggressive behaviors were compared between animals surrendered to shelters and those retained in their homes, dogs displaying aggression toward people on at least a weekly basis or "most of the time" were a minimum of 1.5 times more likely to be surrendered, compared with those lacking signs of aggression.[12,13] These data, coupled with dog bite statistics indicating that between 0.5 and 4.7 million people, mostly children, are bitten in the United States each year,[21] stress the importance of identifying and treating aggressive tendencies early.

Aggression toward people was somewhat less common among cat-owning households (13.2%) and was not associated with relinquishment in 1 study.[12] In contrast, Patronek et al[14] found that cats with daily aggressive behaviors toward people were almost 4 times more likely to be relinquished, whereas those with less frequent aggressive behaviors were not. Veterinary contact within the past year was associated with a dramatically reduced risk for relinquishment for dogs (but not cats) with aggression toward people.[13,14]

Dogs with daily signs of aggression toward other pets were 3 times more likely to be taken to a shelter in 1 study[13] but not in another.[12] Aggressive behavior in cats toward other animals was not associated with risk of relinquishment.[14] Veterinary contact similarly reduced risk of relinquishment of dogs with this behavior, but not of cats.[13,14]

Other problem behaviors—Other behaviors reported by people surrendering dogs (excluding litters) were destructiveness outdoors (5.5% of all dogs relinquished), escaping (5.5%), disobedience (4.4%), and being too active (3.8%).[a] Unwanted chewing or other destructiveness in the house on a daily basis or "most of the time" was consistently associated with enhanced likelihood of relinquishment (with risks being 2 to 3 times greater than those for dogs rarely or never exhibiting these behaviors). Similarly, overactive dogs were approximately 3 times more likely to be relinquished, compared with those rarely or never considered overactive.[12,13]

The top individual behavioral reasons not associated with aggression or inappropriate elimination for relinquishment of cats (excluding litters) were destructiveness in the house (3.3% of all cats relinquished), not being friendly (1.8%), disobedience (1.2%), demanding too much attention (1.1%), and being too active (1.1%).[a] When compared with animals retained in their homes, cats with inappropriate scratching or other destructive behavior on a daily basis were approximately 2 times more likely to be relinquished, compared to cats never exhibiting the behavior.[12,14] Cats perceived to be overactive by their owners most or all of the time were more than 2 times more likely to be relinquished.[12]

Providing appropriate guidance to owners regarding the management of these behaviors, particularly before the decision to relinquish is made, will undoubtedly help some people retain their pets. In a recent survey of veterinarians nationwide regarding their attitudes toward and practices involving behavioral education and consultation, a small proportion of veterinarians routinely actively identified and treated behavioral problems.[22] Veterinarians were most likely to routinely discuss behavior during new puppy or kitten visits (52 to 65% discussed behavior), least likely to discuss it during annual check-ups (approx 15% discussed behavior), and moderately likely to discuss it during new adult pet visits (25% discussed behavior). Less than a third felt routinely confident of their ability to treat common behavioral problems. Perhaps even more disturbing, only 11.1% of veterinarians strongly agreed that it was the veterinarian's responsibility, rather than a client's, to initiate discussion about behavioral problems. These estimates leave much room for improvement. Many relinquishments are fraught with guilt and regret[15] or complicated by stressful life events,[9] and relinquishment is a last resort.[15] Often people simply do not know that or how behavioral problems can be modified or resolved. Asking specifically about problem behaviors may uncover behavioral problems that clients were reluctant to mention or that they may not realize can be modified; once identified, appropriate interventions can be recommended.

As explained previously, Patronek et al[13] found that dogs with 1 or more yearly veterinary visits were associated with lowered risk of relinquishment for many common behavioral problems, compared with dogs having < 1 annual visit. These data indicate that veterinarians can assist owners in resolving behavioral problems, strengthen human-animal bonds, and reduce the likelihood of relinquishment. The introduction of drugs to address behavioral problems (eg, submissive urination in dogs) holds promise for increasing the veterinarian's arsenal against behavioral problems. In contrast to dogs, the annual number of veterinary visits for cats was not associated with reduced risk of relinquishment.[14] The reasons for the lack of an association between veterinary visits and risk of relinquishment of cats are not clear. It may be that owners or veterinarians are less likely to mention or inquire about behavioral problems in cats, treatment attempts are less successful, or that there are other explanations. If veterinarians actively seek to prevent, identify, and treat objectionable behaviors in cats, it seems likely that risks for relinquishment could be reduced in cats as well.

Pet owners should turn first to veterinarians for health and behavioral problems in their pets. Humane groups are increasing efforts to help pet owners and reduce relinquishments for behavioral reasons. Some shelters already support behavior hotlines. Veterinarians must also be effective in dealing with these problems.

Obedience training—Obedience training was also strongly protective against relinquishment of dogs in the Patronek et al study,[13] and the data indicate, if

implemented more widely, training could reduce relinquishments. Only a small fraction (approximately 6.5%) of surrendered dogs had been to obedience classes or privately trained by a professional,[a] indicating that this is an area where substantial progress is possible if clients can be convinced of its importance and be directed to reputable trainers.

Neutering

Although puppies (and often kittens) are no longer the primary age group being euthanatized in many shelters, neutering (spaying and castration) must continue to be a priority in reducing the number of young animals surrendered and euthanatized. The reductions in numbers of dogs and cats being euthanatized in shelters during the last 20 years[1,3,23] and the high proportion of veterinary clients with neutered pets[24] reflect the efforts of veterinarians and humane groups to persuade owners to neuter their pets. Yet enough animals remain intact to perpetuate euthanasia of adolescent and older animals that may be adopted if puppies and kittens were less available. Among those 5 months of age or older and owned at least 1 month (to allow for neutering), 49.5% of female and 39.1% of male dogs and 52.8% of female and 61.7% of male cats relinquished were neutered in the 12-shelter study.[10,11] Among those having seen a veterinarian at least once during the year preceding surrender, a substantially higher proportion were neutered (56% of female and 44% of male dogs and 72% of female and 76% of male cats).[a] Veterinarians clearly influence neutering decisions, but there is room for further improvement.

Neutered dogs and cats have one half to one third the risk of relinquishment, compared with sexually intact animals.[13,14] This is probably at least partially attributable to the reduction in management problems (eg, unwanted estrous cycles) and objectionable sex hormone-associated behaviors (eg, urine marking, aggression) in neutered animals. Clients must be told that neutering has many benefits including reducing undesirable behaviors, reducing risk of mammary and testicular cancers and prostatic disease, reducing numbers of unwanted puppies and kittens, and enhancing the ease of care of these animals.

Misinformation among dog and cat owners regarding estrous cycles and the desirability of having a litter before ovariohysterectomy is common. Approximately 37% of people relinquishing dogs did not know that dogs generally come into heat twice a year, and even more disturbing, almost 80% of cat relinquishers didn't know that cats were seasonally polyestrous. Between 50 and 60% of people giving up their dogs or cats believed or were unsure that female dogs or cats would be better off after having 1 litter before spaying. These percentages were almost identical among owners who had visited a veterinarian within the past year and those that had not.[a] Veterinarians cannot assume that pet owners are well informed about basic dog or cat husbandry and must actively combat myths surrounding reproduction in companion animals. Owners must be told that there is no evidence suggesting that females make better pets after experiencing a heat or having a litter, and similarly, practitioners must emphasize the health and behavioral benefits of male castrations (especially in dogs) to get more males neutered. More research regarding cultural, religious, and other beliefs that influence decisions to castrate must be conducted to facilitate these recommendations.[7]

Neutering dogs and cats before the first estrous cycle promises to reduce the number of puppies and kittens and also reduce sex hormone-related behavioral problems among adult animals presented to shelters. An increasing number of shelters are neutering all dogs and cats before adoption, because traditional neutering contracts at adoption have low compliance.[25] A 1991[26] study of a small sample of pet owners in 3 Massachusetts towns revealed that the mean lifetime number of litters of neutered and intact dogs and cats was the same, indicating that neutered animals had litters before their surgery. Results of other surveys of owned cats indicate that although most owned cats are neutered (> 60%),[12] 15 to 20% have litters before being neutered.[26] This presents a powerful argument for prepubertal neutering of clients' animals. There are no scientific studies indicating that 6 months of age is optimal for neutering, and numerous studies document the safety of early-age neutering.[27-32] In light of this, veterinarians are beginning to schedule neutering at the end of puppy and kitten vaccination series (approx 4 to 4.5 months of age) when animals are fully immunized but before they reach puberty. This approach lessens the likelihood that clients forget or their pets escape and have litters before they are neutered and has good potential to reduce relinquishments.

Other Factors Associated with Relinquishment

Recent studies also highlight other subgroups of people and animals associated with relinquishment. For example, mixed-breed dogs and cats and those acquired at no or low cost are at higher risk of relinquishment.[12-14] Despite this fact, approximately 30% of relinquished dogs (excluding litters) were purebred, and 7.2% had been acquired for $200 or more.[8] Among cats the comparable figures were 6% purebred and 1.7% costing $200 or more. Some of these animals are probably not truly purebred, but veterinarians should not assume that clients with purebred or expensive animals have established strong bonds with their animals. Similarly, educational achievement and income level have been associated with relinquishment. In one study, people with a high school education or greater were 1.4 to 1.9 times as likely to surrender their pets than people with less education,[12] whereas in a second study, people with less than a high school education were about twice as likely to surrender their pets, compared with people with a postgraduate degree.[13,14] Despite the conflicting results, a substantial proportion of individuals with high and low educational achievement relinquished pets in both studies.

Patronek et al[13,14] also examined income and found that risk of surrender increased with decreasing income. Yet, in this study and the study involving 12 shelters nationwide, almost a quarter or more of people bringing animals to shelters had annual incomes of $40,000 or more.[12-14]

Other Veterinary Efforts

Veterinarians must look for opportunities to influence the development and maintenance of strong bonds between people and their pets. Helping prospective new owners evaluate their lifestyle and circumstances carefully and evaluate whether and what type of pet they should select, for example, will enhance the likelihood that a lasting bond will be formed. Helping people choose a pet (eg, breed, age, gender, size) that is appropriate for their circumstances and lifestyle is an activity that will increase the likelihood of a happy and long-term client. Even the person who is persuaded to postpone pet ownership until after the birth of a child or until after they get their new job is likely to be a happier long-term client. Veterinarians can and have adopted creative approaches to address these needs. For example, practices can offer puppy socialization or obedience classes or sessions on how to select the best pet. This will extend the services offered by their clinics and may reduce needless euthanasia. These classes can and are being offered by staff members as well as veterinarians. These efforts help reduce pet relinquishments and potentially bring clients to, and keep clients at, the practice.

Similarly, educating breeders who are clients in the practice about adequately counseling prospective adopters who seek purebred dogs will enhance the probability that a good match will be made between people and their pets. In light of the high proportion of animals acquired from friends, providing advice to clients with pregnant animals and litters on how to counsel people adopting their puppies and kittens could be a productive investment in reducing pet euthanasias. Many other creative approaches that will enhance client attachment to their pets and reduce the probability of relinquishment are possible.

Length of ownership is a powerful determinant of whether a dog or cat will be relinquished. In studies[12-14] comparing relinquished with retained animals, both dogs and cats owned for < 1 year were at highest risk of relinquishment. In the New et al study,[12] where length of ownership was examined within the < 1 year category, the bond between owner and pet was most fragile among animals owned < 6 months. These data emphasize the importance of the initial veterinary exam for new pet owners (including juvenile and older animals). Spending time with clients during the first visit and discussing basic animal husbandry, techniques for house training, the importance of basic obedience training, and stressing veterinary availability for answering medical and behavioral problems can potentially prevent many misconceptions about pets and problems with pet behavior and can strengthen human-animal bonds. This personal attention does not have to be the exclusive domain of the veterinarian. Instead, such attention to prevention of behavior problems can be a duty of well-trained staff. Such duties can often add a dimension to their daily activities that many find rewarding and enjoyable and can lead to good clients for the practice.

The attitudes of some veterinarians toward animal shelters must change. Criticizing the local shelter, for example, because shelter cats have a higher frequency of upper respiratory tract infections is unhelpful to the shelter, its animals, and to prospective owners who may acquire wonderful companions from the shelter. Respiratory disease in cats housed in shelters is impossible to eliminate, regardless of control efforts, because of the nature of the viruses involved. Instead of criticizing the shelter, veterinarians (either individually or collectively as a organization) can assist the shelter to minimize disease. Working with shelters, explaining the nature of these illnesses to clients, and treating these usually mild self-limiting infections will result in healthier pets and can save lives. Discouraging people from seeking animals from shelters condemns many healthy and mildly ill animals to death simply because there are not enough homes.

Not all relinquishments to shelters are the result of excess births or an unsuccessful bond. Some owners bring pets to shelters for euthanasia for reasons similar to those of animals presented to veterinarians for euthanasia. Owners of 24% of dogs and 17% of cats requested euthanasia at the time of surrender in 1 study.[33] Their reasons were predominantly old age and illness and, to a lesser extent, behavioral problems. Relinquishments to sources other than animal shelters have not been discussed in this report, because little data regarding them exist, and because many (eg, placement in a new home) are in the best interest of the animal. Presumably, many of the reasons leading to surrender to shelters also pertain to other relinquishments (eg, release near farms, along highways) that threaten an animal's welfare, but more research is needed in this area.

Enhanced training regarding the identification and treatment of behavioral problems, prepuberal neutering, shelter medicine, and strategies to address the problem of euthanasia of millions of healthy adoptable pets must be further incorporated into our veterinary curricula. Not all veterinary colleges, for example, have veterinary behaviorists, and fewer have incorporated behavioral training into their core curricula. Similarly, not all colleges provide instruction in prepuberal gonadectomy.[34] Veterinary students require this training to meet the needs of their clients and to preserve the health of the animals they take an oath to protect.

Veterinary practitioners and their staff can enhance the quality of the bond between clients and their pets and thereby can reduce the numbers of relinquishments and euthanasias of healthy adoptable dogs and cats at animal shelters. Recent data highlight the most common causes of surrender and suggest specific means by which veterinarians can further reduce relinquishments and euthanasias. More clients must recognize that veterinarians can help them with behavioral problems, and accurate diagnosis and treatment of causes of inappropriate elimination, aggression, and destructiveness promise to enhance the likelihood that owners and pets will remain together.

Continued emphasis on neutering of pets, with special emphasis on prepuberal animals, will reduce the number of litters that arise accidentally before owners bring their animals for neutering. Similarly, neutering before puberty can reduce undesirable sex

hormone-associated behaviors that frequently lead to relinquishment. Veterinarians and their staff must actively combat myths regarding dog and cat husbandry, such as those surrounding the desirability of having a litter before neutering or regarding housebreaking in dogs.

Encouraging the veterinary team to spend extra time with clients during initial visits and to actively identify problems can provide opportunities to prevent problems or modify behaviors before they become well established in the pet. Such activities create good clients, increase income, and reduce animal relinquishments and euthanasias.

[a]Scarlett JM, Salman MD, New JG, et al. Regional shelter study, College of Veterinary Medicine, Cornell University, Ithaca, NY, 1998.

References

1. Nassar R, Talboy J, Moulton C. *Animal shelter reporting study, 1990.* Englewood, Colo: American Humane Association, 1992.
2. Patronek GJ, Glickman LT. Development of a model for estimating the size and dynamics of the pet dog population. *Anthrozoos* 1994:7:25–41.
3. Olson PN, Moulton C. Pet (dog and cat) overpopulation in the United States. *J Reprod Fertil Suppl* 1993;47:433–438.
4. Arkow P. Animal control laws and enforcement. *J Am Vet Med Assoc* 1991;198:1164–1172.
5. Olson PN, Moulton C, Nett TM, et al. Pet overpopulation: a challenge for companion animal veterinarians in the 1990s. *J Am Vet Med Assoc* 1991;198:1151–1152.
6. Rollin BE. Social ethics, veterinary medicine, and the pet overpopulation problem. *J Am Vet Med Assoc* 1991;198:1153–1156.
7. MacKay CA. Animal welfare forum: overpopulation of unwanted dogs and cats. Veterinary practitioners role in pet overpopulation. *J Am Vet Med Assoc* 1993;202:918–932.
8. Salman MD, New JG, Scarlett JM, et al. Human and animal factors related to the relinquishment of dogs and cats in 12 selected animal shelters in the United States. *J Appl Anim Welfare Sci* 1998;1:207–226.
9. Scarlett JM, Salman MD, New JC, et al. Reasons for relinquishment of companion animals in U.S. animal shelters: selected health and personal issues. *J Appl Anim Welfare Sci* 1999;2:41–57.
10. New JC, Salman MD, Scarlett JM, et al. Moving: characteristics of dogs and cats and those relinquishing them to 12 U.S. animal shelters. *J Appl Anim Welfare Sci* 1999;2:83–96.
11. Salman MD, Hutchinson J, Ruch-Gallie R, et al. Behavioral reasons for relinquishment dogs and cats to 12 shelters. *J Appl Anim Welfare Sci* 2000;3:93–106.
12. New JG, Salman MD, Scarlett JM, et al. Shelter relinquishment: characteristics of shelter-relinquished animals and their owners compared with animals and their owners in U.S. pet-owning households. *J Appl Anim Welfare Sci* 2000;3:179–201.
13. Patronek GJ, Glickman LT, Beck AM, et al. Risk factors for relinquishment of dogs to an animal shelter. *J Am Vet Med Assoc* 1996;209:572–581.
14. Patronek GJ, Glickman LT, Beck AM, et al. Risk factors for relinquishment of cats to an animal shelter. *J Am Vet Med Assoc* 1996;209:582–588.
15. DiGiacomo N, Arluke A, Patronek G. Surrendering pets to shelters: the relinquisher's perspective. *Anthrozoos* 1998;11:41–51.
16. Fennell LA. Beyond overpopulation: a comment on Zawistowski et al and Salman et al. *J Appl Anim Welfare Sci* 1999;2: 217–228.
17. Kass PH, Hart LA, Scarlett JM, et al. Determinants of relinquishment to animal shelters in Sacramento County California: a case-control study, in *Proceedings.* 9th Int Symp Vet Epi Econ, 2000.
18. Askew HR. *Treatment of behavioral problems in dogs and cats.* Oxford, England: Blackwell Science, 1996;286–287.
19. Center for Information Management. *US pet ownership and demographics sourcebook.* Schaumburg, Ill: American Veterinary Medical Association, 1997.
20. Beaver BV. *Canine behavior: a guide for veterinarians.* Philadelphia: WB Saunders Co, 1999;155.
21. Weiss HB, Friedman DI, Coben JH. Incidence of dog bite injuries treated in emergency departments. *JAMA* 1998;279:51–53.
22. Patronek GJ, Dodman NH. Attitudes, procedures, and delivery of behavior services by veterinarians in small animal practice. *J Am Vet Med Assoc* 1999;215:1606–1611.
23. Zawistowski S, Morris J, Salman MD, et al. Population dynamics, overpopulation and the welfare of companion animals: new insights on old and new data. *J Appl Anim Welf Sci* 1998;3: 193–206.
24. Scarlett JM, Donaghue S, Saidla J, et al. Overweight cats: prevalence and risk factors. *Int J Obes Relat Metab Disord* 1994;18:522–528.
25. Moulton C. Early spay/neuter: risks and benefits for shelters. *Am Humane Shoptalk* 1990;7:1–6.
26. Manning AM, Rowan AN. Companion animal demographics and sterilization status: results from a survey in four Massachusetts towns. *Anthrozoos* 1992;5:192–201.
27. Faggella AM, Aronsohn MG. Evaluation of anesthetic protocols for neutering 6- to 14-week-old pups. *J Am Vet Med Assoc* 1994;205:308–314.
28. Faggella AM, Aronsohn MG. Anesthetic techniques for neutering 6-to 14-week-old kittens. *J Am Vet Med Assoc* 1993;202:56–62.
29. Howe LM. Short-term results and complications of prepuberal gonadectomy in cats and dogs. *J Am Vet Med Assoc* 1997;211: 57–62.
30. 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.
31. Stubbs WP, Bloomberg MS, Scruggs SL, et al. Effects of prepuberal gonadectomy on physical and behavioral development in cats. *J Am Vet Med Assoc* 1996;209:1864–1871.
32. Wright JC. Early-age neutering and behavior in household kittens. In: *Convention notes of the 135th annual convention of the American Veterinary Medical Association.* Schaumburg, Ill: American Veterinary Medical Association, 1998;829–830.
33. Kass PH, New JC, Scarlett JM, et al. The importance of relinquishment of non-adoptable pets to animal shelters for euthanasia in understanding pet surplus in the United States. *J Appl Anim Welfare Sci* 2001;4:237–248.
34. Root Kustritz MV, Johnston SD, Lieberman LL. Availability of training for prepuberal gonadectomy at North American veterinary colleges. *J Am Vet Med Assoc* 2000;216:1566–1567.