REFINING THE PROCESS

Employing efficient orchiectomy techniques can increase positive outcomes and decrease complications.

Abstract

Surgical sterilization of the male dog and cat is generally achieved by orchiectomy. In addition to sterilization, orchiectomy substantially reduces the incidence of the most common canine prostatic diseases and is often used to modify unwanted behaviors. For decades, the traditional approach for castrating a dog has been a ventral midline prescrotal incision. However, for cats, the scrotal approach is the preferred approach, and is also gaining increased acceptance in dogs. Compared with the prescrotal approach, the scrotal approach is associated with reduced self-trauma and scrotal hematoma risk and shortened surgical times. Both open and closed castration techniques are commonly used; however, the closed technique is associated with significantly fewer complications. Keeping the duration of orchiectomy to a minimum is essential. This review covers techniques to minimize surgery time, including adopting the scrotal approach, creating shorter incisions, using less suture to close these incisions, and adopting efficient gubernaculum disruption and ligation techniques.
The most commonly performed surgical procedures in small animal practices in North America are for reproductive sterilization (spay/neuter).\(^1\) Surgical sterilization of the male dog and cat is commonly accomplished via orchiectomy. In addition to sterilization, orchiectomy substantially reduces the incidence of the most common canine prostatic diseases (benign prostatic hyperplasia and prostatitis), can be used to prevent or manage tumors of the testes, and is often used to modify unwanted behaviors (e.g., roaming, territorial marking, intermale aggression, unwanted sexual behaviors).\(^2\)

**Take-Home Points**

- In addition to sterilization, orchiectomy significantly reduces the incidence of the most common canine prostatic diseases, may be used to prevent or manage tumors of the testes, and is often used to modify unwanted behaviors.
- Compared to the traditional prescrotal approach, the scrotal approach is associated with reduced self-trauma risk, reduced scrotal hematoma risk, shortened surgical times, reduced costs, and elimination of accidental urethral trauma risk.
- The recommended age for castration of cats is younger than 5 months.
- In the authors’ experience, positioning a cat’s hindlimbs in a cranial orientation is advantageous.
- A simple strategy to effectively exteriorize a testicle through a small incision is to orient the testicle so that the caudal pole (near the head of the epididymis) exteriorizes through the incision first. This technique allows for an incision no longer than the testicle is wide.
- After a surgeon has mastered appropriate knot security with binding knots, single-ligature ligation can increase efficiency, lower the cost for suture material used, and decrease the amount of foreign material for the patient’s body to absorb. In the authors’ opinion, a single 2-pass binding knot is sufficient ligation for typical small and medium-size dogs.
- Autoligation can be used for cat, puppy, and very small adult dog castrations.
- For canine scrotal castration, scrotal skin should not be closed as it may increase the risk for self-trauma, discomfort, and postoperative complications. Instead, 1 buried, absorbable simple interrupted or cruciate suture may be placed in the scrotal subcutaneous tissue.
The veterinary medical literature reveals numerous variations in sterilization techniques; this update highlights those that are the most contemporary and clinically relevant. This article features several efficient techniques and other helpful methods that can increase positive outcomes and decrease complications.

**REVIEW OF ORCHIECTOMY TECHNIQUES**

**Prescrotal Approach**

For decades, the traditional approach for castrating a dog has been a ventral midline prescrotal incision. Therefore, this approach is often one of the first surgeries learned by veterinary students, probably giving this technique favored preference in general practice. For this approach, 1 testicle is manually pushed cranially out of the scrotum as far possible into the prescrotal space, where the skin and subcutaneous tissue are incised on the midline to expose the testicle. After exposure, the gubernaculum is often manually broken down with digital pressure and gauze sponges, and the testicle is then removed through ligation and excision. This approach is straightforward and effective.

Other than the typical incisional complications (e.g., infection, dehiscence, self-trauma), risks to this approach include scrotal swelling, particularly scrotal hematoma. Moderate to severe scrotal hematoma can have serious associated morbidity and often requires surgical intervention through a scrotal ablation. Although uncommon, another serious complication from this approach is accidental urethral trauma. In younger dogs, a prescrotal incision may increase the likelihood of urethral laceration because the testes have a higher chance of slipping into the inguinal area. Both of these risks can be mitigated by using the scrotal approach.

**Scrotal Approach**

For cats, the scrotal approach (separate incisions for each testicle) has been traditionally used for decades and continues to be the preferred method. Scrotal orchiectomy incisions in sexually mature cats are also recommended because cat testicles may become fixed within the scrotum after sexual maturity. For dogs, the scrotal approach has gained increasing acceptance, especially in high-quality, high-volume spay/neuter (HQHVSN) settings. Compared with the prescrotal approach, the scrotal approach is associated with reduced self-trauma risk, reduced scrotal hematoma risk, reduced surgical times, reduced cost (less suture material, anesthesia, and surgeon time), and elimination of accidental urethral trauma risk. Contraindications for the scrotal approach are moist scrotal dermatitis or other serious scrotal skin conditions.

To perform the scrotal technique, the testicles are first pushed into the scrotum. In the authors’ experience, many adult dog testicles are partially in the prescrotal area at the time surgery begins, presumably due to low operating theater temperatures combined with the use of liquid surgical skin preparation products (e.g., chlorhexidine scrub) on the scrotal skin. After the testicles are manually pushed fully into the scrotum, a skin incision is made in a cranial/caudal direction directly on the median raphe. The subcutaneous tissue is incised on top of each testicle, through the same skin incision, and the testicles are then exteriorized and the castration performed.

Despite clear advantages to the scrotal approach, serosanguineous discharge can be expected 24 to 48 hours postoperatively, which some clients may find objectionable. Postoperative discharge can be minimized by gentle surgical tissue handling, use of postoperative scrotal wrap bandages (if necessary), and vasoconstrictive splash blocks containing diluted epinephrine. Careful communication to clients about the potential for such discharge will help prevent emergency calls.

**Open Versus Closed Techniques**

For dogs and cats, both open and closed castration techniques are commonly used. Historically, evidence to indicate that one technique is superior to the other has been insufficient. The open technique is performed by incising the parietal vaginal tunic and exposing the spermatic cord before ligation; the closed technique involves ligating the spermatic cord with the parietal vaginal tunic intact and enveloping the cord. When the closed technique is used, the gubernaculum and fascia surrounding the spermatic cord must be stripped away or incised to permit adequate testicle exteriorization.

A recently published study objectively evaluated complication risks and surgical efficiency of open versus closed castrations in dogs when traditional...
Age Recommendations

There is no uniform consensus as to the appropriate age for canine orchiectomy patients. Traditionally, dogs have been castrated at or after 6 months of age, but this practice is being re-examined. Recent research has identified differences in response to castration, particularly between large- and small-breed dogs. Several articles have reported increased incidence of orthopedic issues in large-breed dogs castrated before growth plates have fused. There is less evidence that castration at an earlier age predisposes small-breed dogs to orthopedic problems. Several resources cite increased odds for development of nonreproductive tumors in dogs castrated younger than 1 year of age.

However, many of these studies are retrospective, and sources of bias such as longer lifespan of castrated dogs, among others, lead to lack of proof of direct causation. Both AAHA and the AVMA support early-age castration to reduce the numbers of unwanted and homeless animals, citing animal welfare and overpopulation concerns. Shelter professionals certainly advocate for castration of pediatric patients (<6 months of age) as well. In 2019, AAHA revised its Canine Life Stages Guidelines. After a comprehensive analysis of the literature, AAHA recommended castration of owned small-breed dogs before 5 to 6 months of age and large-breed dogs at 9 to 15 months of age. Further research will continue to clarify the risks and benefits of castration at specific ages and in different breeds.

Currently, consensus for feline orchiectomy is more uniform. A consensus document developed by the Veterinary Task Force on Feline Sterilization (bit.ly/aafprecs), which recommends that cats be castrated before 5 months of age, has been endorsed by the AVMA, AAHA, the American Association of Feline Practitioners, the Association of Shelter Veterinarians, many veterinary associations, and numerous humane groups. The Association of Shelter Veterinarians’ 2016 Veterinary Medical Care Guidelines for Spay-Neuter Programs recommends castrating owned cats at 4 months of age, after they have received the full vaccination series. With respect to cats awaiting adoption in shelters or rescues, the guidelines state that “neutering is best performed prior to adoption (as early as 6 weeks of age).” Castration of cats before 5 months of age is easy and safe and has not been shown to create any medical, orthopedic, or behavioral problems.

Efficient Orchiectomy Techniques

Use of efficient surgical techniques benefits the patient and the veterinary business alike. In human and veterinary medicine, increased surgical times have been associated with increased risk for anesthetic complications and surgical wound infections.

Decreased surgical times should lead to faster recovery and return to function for the patient. Therefore, keeping duration of surgery and anesthesia to a minimum is imperative. Techniques to minimize surgery time include adopting the scrotal approach, creating shorter incisions, adopting efficient gubernaculum disruption and ligation techniques, and using less suture to close incisions.

Patient Positioning

Orchiectomy is typically performed with the patient in dorsal recumbency. Traditionally, dogs’ hindlimbs are secured by pulling them as far caudally as possible. One large paper drape can be used to cover the patient and instrument stand, and a small fenestration, just large enough for the scrotum to be forced into view, can be cut into the drape. For puppy and cat castrations, draping is not necessary if care is taken to avoid gross contamination during the surgical procedure. However, drapes can be used at the discretion of the surgeon. For cats, in the authors’ experience (approximately 20 000 combined surgeries), positioning the patient’s hindlimbs in a cranial orientation is advantageous. There are several ways to accomplish this positioning, but a simple device created from bending aluminum splint rods enables efficient placement and ease of surgical preparation of the
patient and disinfection of the aluminum rod (FIGURE 2). This position improves efficiency by reducing preoperative surgical preparation time and increasing exposure to surgical anatomy to facilitate the scrotal approach. For puppies, simply placing them in a relaxed, dorsal recumbency position provides the best exposure for orchiectomy (FIGURES 1E AND 1F).

Initial Surgical Approach
For an orchiectomy in cats, puppies, and dogs, most incisions should be no longer than the width of 1 testicle. Short scrotal incisions are associated with decreased surgical times, less suture needed for closure (for surgeons using suture reels), and decreased postoperative complications.\(^8,9,27\) Whether to orient the orchiectomy incisions horizontally (FIGURE 3A) or vertically (FIGURE 3B) in cats is under debate, but the authors recommend that regardless which direction is chosen, the testicles should always be held such that the incision is directed away from the surgeon’s fingers. In puppies, a single midline vertical incision is recommended (FIGURE 4).

For a scrotal orchiectomy of an adult dog, the testicles must first be pushed from their dorsal position (FIGURE 5A) caudally into the scrotum, where a small skin incision is made in a cranial/caudal direction.
directly on the median raphe (FIGURES 5B AND 5C). Each testicle is individually moved into the skin incision, and the subcutaneous tissue and spermatic fascia are incised on top of each testicle (FIGURES 5D AND 5E). Next, a simple strategy for effectively exteriorizing a testicle through a small incision is to orient the testicle so that the caudal pole (near the head of the epididymis) exteriorizes through the incision first (FIGURES 5F AND 5G). This technique allows the incision to be no longer than the testicle is wide. After the testicle is initially exteriorized, the gubernaculum and fascia associated with the spermatic cord must be released to permit complete exteriorization, especially for the closed technique. Manual stripping, blunt, and sharp dissection techniques can be used to release this tissue. The traditional approach for disrupting these structures has been to manually strip the tissue. In small dogs, puppies, and cats, this task is easily accomplished. However, older and larger dogs have significantly stronger gubernacular and spermatic fascial tissue, and the authors recommend sharp transection of this tissue with a scalpel blade or Metzenbaum scissors in mature dogs. This sharp transection technique can significantly increase efficiency and, depending on surgeon hand strength, may be the only way to disrupt the tissue. Although

FIGURE 2. Various sizes of bent aluminum splint rods used to position a cat's hindlimbs in a cranial direction, creating ideal positioning to perform orchiectomy. Note that the leg bars have deeper valleys than those used for ovariohysterectomy.

FIGURE 3. Finger positions and incisional direction for (A) horizontal and (B) vertical incisions for orchiectomy in cats.

FIGURE 4. Vertical midline incision for orchiectomy in puppies.
FIGURE 5. Initial approach for a scrotal orchiectomy. (A) Biological position of testicles dorsally in the scrotum. (B) Manual positioning of testicles as caudally in the scrotum as possible and location of a small initial incision. (C) Small scrotal midline incision. (D) After initial incision, surgeon moves 1 testicle into view of skin incision and (E) begins incising subcutaneous tissue. (F AND G) After the subcutaneous tissue is incised over 1 testicle, the testicle is oriented to where the caudal pole advances out of the scrotum first, maintaining the smallest possible incision.

FIGURE 6. Sharp transection of spermatic fascial tissue and gubernaculum to create efficient release of spermatic cord. (A AND B) Elevation of the testicle, exposing the gubernaculum and spermatic fascia on the concave portion of the testicle. (C) Metzenbaum scissors making sharp circumferential transection of the tissue around the spermatic cord through the window that was just created in the fascia.
traditional belief in regard to surgery is that manual tearing of a structure with very small vessels causes vasospasm and, therefore, can potentially decrease hemorrhage, in the authors’ opinion, specifically related to sharply incising gubernaculum and spermatic fascia, we have not observed, nor is there a concern for, bleeding using this method. To accomplish sharp transection of the gubernaculum and spermatic fascia, the surgeon should hold the testicle in the nondominant hand, after which there are several options. One technique involves using a scalpel blade to “score” the gubernaculum and spermatic fascia circumferentially around the spermatic cord proximal to the testicle, thereby weakening the tissue enough so the surgeon can then easily digitally strip the fascial tissue away. An alternate technique involves Metzenbaum scissors. The testicle is elevated, exposing the gubernaculum and spermatic fascia on the concave portion of the testicle (FIGURES 6A AND 6B). Next, through the window that was just created in the fascia, the tissue is sharply transected away in a circumferential fashion around the spermatic cord (FIGURE 6C). If the gubernaculum and fascia do not immediately release, gentle manual stripping motions with gauze sponges and minimal force will complete the task.

Ligatures

Conventionally, ligation of the spermatic cord of dogs and cats involves multiple encircling ligatures with square or surgeon’s knots or a combination of encircling and transfixation knots. However, recent publications have demonstrated the excellence of 2-pass binding knots. After a surgeon has mastered appropriate knot security with these binding knots, single-ligature ligation can increase efficiency, lower the cost for suture material used, and decrease the amount of foreign material the patient’s body must absorb postoperatively. In the authors’ opinion, using 2-0 monofilament polydioxanone and a single 2-pass binding knot such as the modified Miller’s knot (strangle knot) is sufficient ligation for typical small and medium-size dogs (FIGURE 7A). At the surgeon’s discretion, a second 2-pass binding or transfixation ligature may be placed in large dogs (FIGURE 7B). When a 2- or 3-clamp technique is used for spermatic cord ligation, transecting the spermatic cord between the most distal clamp and testicle before ligation may allow for more efficient ligature placement.

**FIGURE 7.** Ligation. (A) Single encircling ligature created by using an appropriate binding knot (e.g., modified Miller’s knot) (for small to medium-size dogs). (B) Double ligation (for large dogs with thick spermatic cords).
FIGURE 8. Proper technique for creating autoligatures (cord ties) in cat and puppy orchiectomies. (A) Testicle held in the nondominant hand and gently pulled along with spermatic cord toward the surgeon while simultaneously the dominant hand holds a curved hemostat with the palm down and curved tip up. (B) Hemostat crossed over the spermatic cord with the curved tip passed under and behind the spermatic cord (from the nondominant hand toward the dominant hand). (C) Hemostat closed with the tip facing away from surgeon, then directed above the spermatic cord as the hemostat is rotated counterclockwise (clockwise for left-handed surgeons). (D) Hemostat opened and used to clamp the spermatic cord. (E) Spermatic cord transected between the hemostat and the testicle. (F) Tissue tag remains. (G AND H) Tissue around the hemostat is gently pulled over the tip of the hemostat with a gauze sponge, creating a secure knot.
hand to grasp a curved hemostat with their palm down and curved tip up (FIGURE 8A). Next, the hemostat is crossed over the spermatic cord and the curved tip of the hemostat is passed under and behind the spermatic cord (from the nondominant hand toward the dominant hand) (FIGURE 8B). The hemostat should be closed with the tip of the hemostat facing away from the surgeon. The tip of the hemostat is then directed above the spermatic cord as the hemostat is rotated counterclockwise (FIGURE 8C) (or clockwise for left-handed surgeons). Next, the hemostat is opened and used to clamp the spermatic cord (FIGURE 8D). The spermatic cord is transected between the hemostat and the testicle, leaving a tissue tag (FIGURES 8E AND 8F), and the tissue circled around the hemostat is gently pulled over the tip of the hemostat with a gauze sponge (FIGURE 8G), creating a secure knot (FIGURE 8H). Last, the knot should be pulled significantly tight before the hemostat is released.30-32

Closure
Prescrotal incisions for dogs should always be closed by appropriate tissue apposition with buried absorbable suture. For routine prescrotal orchiectomy of a dog, a substantial portion of surgical time is spent closing the incision. Surgical textbooks suggest performing a 2- or 3-layer closure for the deep fascial, subcutaneous, and cutaneous layers. For scrotal castration of a dog, however, the closure should not be complete. Closure

![FIGURE 9. Closure of an adult dog scrotal orchiectomy incision. (A) Only subcutaneous tissue is sutured from the deep to superficial plane on the surgeon’s side to begin burying the knot. (B) Only the subcutaneous tissue on the side away from the surgeon is sutured in a superficial–deep direction. The surgeon is isolating the median raphe with thumb forceps, which will be incorporated into the buried simple interrupted suture. (C) Subcutaneous tissue apposition with 1 buried simple interrupted suture. (D) The scrotal skin is back into apposition, despite not having any suture placed in the dermal layer. No surgical glue is placed; it is left to heal by second intention.](image-url)
of the scrotal skin may increase risk for self-trauma, discomfort, and postoperative complications; therefore, dermal tissue should never be sutured in scrotal incisions.

Instead, 1 buried simple interrupted or cruciate suture (FIGURES 9A AND 9B) at the discretion of the surgeon. To ensure a buried knot, the median raphe should be included in this suture as either the very first or the very last pass (FIGURE 9C). The scrotal skin should naturally relax into apposition, even without suture being placed in the scrotal dermal tissue plane (FIGURE 9D). Scrotal incisions in pediatric patients should not be closed with suture; however, at the discretion of the surgeon, a small amount of tissue glue may be used to close the skin. In cats, scrotal skin incisions should always be left open to heal by second intention and prevent abscess formation.

SUMMARY

Orchiectomy is one of the most commonly performed surgical procedures in veterinary medicine. Considering the many different techniques available, an awareness and use of efficient surgical techniques should prove beneficial for the patient, surgeon, and veterinary business alike. TVP

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