ELECTIVE SURGERIES IN SMALL MAMMALS

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One of the main reasons for neutering (spay or castration) exotic pet mammals is to control reproduction. However, many of these pets are the only pet in the household and reproduction is not a concern. Medical and behavioral indications are also important factors to consider in making a decision to have a pet neutered. In most species, castration makes male mammals less aggressive both to other animals and to their owners. The urine of many in tact male mammals has a potent odor and is used for territorial marking. The odor and behavior can often be controlled by neutering the animal. In many species, mammary neoplasia is influenced by the presence of estrogen and ovarioectomy can decrease or nearly eliminate the occurrence of mammary cancer. Pyometra and other uterine diseases are effectively prevented by performing OHE (OHE). Because most uterine diseases are influenced by ovarian hormones, ovarioectomy is expected to be nearly as effective at preventing female reproductive diseases as is OHE and recent research supports this.

BASIC PRINCIPLES

When neutering a mammal the goal is to remove the gonads, which are responsible for hormone production. In males, the blood supply to the testicles is ligated prior to transection. It is not necessary to pull the testicle out far from the body risking accidentally tearing the vessels. Once transected (or torn) the vascular pedicle retracts into the abdomen, into the retroperitoneal space as the testicular vessels are branches off the renal vessels. Hemorrhage from these vessels, therefore, occurs in the retroperitoneal space and does not usually get into the scrotum to cause a scrotal hematoma. In adequate control of subcutaneous vessels and vessels within the tunics are the likely causes of scrotal hematomas, not hemorrhage from the testicular vessels. In species with a distinct scrotum, the scrotal skin is usually thinner and more delicate than the inguinal or the prescrotal skin. Therefore, I prefer to make the incision in the thicker inguinal or prescrotal skin if possible to decrease the risk of self-mutilation postoperatively. Closed castration describes removing the testicles along with the tunics without making an incision into the tunics. Open castration describes making an incision into the tunic (open) and removing the testicle, vas deferens, and associated vessels but leaving the incised tunic. In general, the testicles are easier to exteriorize using an open technique as the only attachment to other tissues is at the epididymis. With a closed castration, the external surface of the tunic is attached to the subcutaneous tissues. All of these attachments must be broken down to exteriorize the testicle along with its surrounding tunic potentially causing more trauma. The main advantage to a closed technique is that it ligates the tunic near the inguinal canal minimizing the potential for an inguinal hernia to develop.

In the US, OHE is generally recommended over ovarioectomy alone in order to prevent uterine disease such as pyometra. Yet, most uterine diseases develop because of ovarian hormones. If time and exposure are limited, ovarioectomy should be considered an effective alternative of OHE. As with castration, the goal of surgery is to remove the hormone producing ovaries. It is not necessary to risk tearing the ovarian vessels in an effort to exteriorize the ovary far from the abdominal cavity. You only need to expose the vessels enough to effectively ligate them.

FERRETS
Ovariectomy

In the US most ferrets are spayed at an early age (5–6 weeks) prior to arrival at pet stores. Ferrets are induced ovulators and remain in estrus until they are stimulated to ovulate by breeding or artificial means. A female ferret may remain in estrus for 6 months or more during which time the body’s estrogen levels remain high. This chronic hyperestrogenemia can result in bone marrow suppression and potentially fatal aplastic anemia. Following one month of estrus, female ferrets are considered at risk for developing bone marrow hypoplasia. Clinical signs include lethargy, depression, anorexia, hind limb weakness, pale mucus membranes, and petechial and ecchymotic hemorrhages. Female ferrets in estrus can also develop symmetrical alopecia accompanied by no other clinical signs. CBC reveals a nonregenerative, normocytic anemia. Additionally, a CBC frequently demonstrates the presence of nucleated RBCs, a neutropenia and a thrombocytopenia. Treatment is aimed at reversing the bone marrow suppression and OHE should be performed as soon as the patient is stable. Blood transfusions are indicated in ferrets with a PCV < 30%. Ferrets do not have blood types and there are no reports of transfusion reactions in ferrets; any ferret can donate blood to any other ferret, and a cross match is not needed.

Prevention by spaying females at 4 to 6 months of age or within the first two weeks of the first estrus is the best action. A CBC and platelet count should be run on all intact female ferrets prior to OHE to determine if bone marrow suppression has already occurred. OHE in ferrets is analogous to that in cats with the ventral midline incision centered midway between the umbilicus and pubis. The uterus is bicorneate and the suspensory ligaments are loose and easily stretched or broken.

Spayed female ferrets that show clinical signs of estrus are usually affected with adrenal neoplasia and rarely have residual ovarian tissue. Female ferrets that have been spayed but that have residual ovarian tissue will generally present with vulvar swelling and signs of estrus at an earlier age (< 2 years) than ferrets with adrenal tumors (> 2 years). In most ferrets with ovarian tissue, vulvar swelling subsides following the administration of 100 IU of human chorionic gonadotropin, while in ferrets with adrenal disease this hormone has no effect. Though ectopic ovarian tissue...
of incomplete ovariectomy. The incidence of pyometra in ferrets is relatively low. Polyuria and polydypsia are not common in ferrets with pyometra. Hyperestrogenism may occur concurrently underscoring the need for preoperative CBC. In many ferrets, the CBC is normal, but pancytopenia and neutrophilic leukocytosis may be evident. Surgical and postsurgical management of ferrets with pyometra is as with other species including OHE, and appropriate antibiotic and supportive therapy.

Castration and Vasectomy

Most pet ferrets are descented (anal sacculectomy) and castrated at 5 to 6 weeks of age at the breeding facility. However, the surgeon is occasionally presented with an intact male for castration. Intact male ferrets are larger, better muscled, but have a more pungent odor than castrated males. Castration will effectively alter behavior, physical characteristics, and the odor. Because of the problems with breeding females in estrus potentially developing fatal aplastic anemia, in breeding facilities vasectomized males are used to breed female ferrets that they do not want to breed.

The gross male anatomy of ferrets is more similar to that of dogs than of cats; however, most surgeons castrate ferrets using scrotal incisions and techniques similar to those used in cats. While complications with scrotal incisions are not reported, the prescrotal skin is thicker and less fragile, and potentially less sensitive than that of the scrotal skin. Both techniques are acceptable and an open technique or a closed technique can be used – there is no evidence that one method is better.

A vasectomy is best performed through an inguinal skin incision on each side of the prepuce. The spermatic cord is generally palpable and the incision is made directly over the cord. Use blunt dissection to identify the spermatic cord and isolate it within its vaginal tunic. Make a 3- to 5-mm incision in the vaginal tunic. Be careful not to cut the vascular bundle. Separate the vas deferens from the vascular bundle using blunt dissection. The vas deferens typically appears to have cross striations as it zigzags tightly. Use hemostatic clips or ligatures of absorbable monofilament suture to place two sutures roughly 1 cm apart. Cut the segment of vas deferens out from between the ligatures. Suture the incision in the tunic closed using 5-0 monofilament absorbable material leaving the clipped ends of the vas deferens outside the closed tunic. This will help prevent the rare complication of recanalization of the vas. It is recommended that the ferret not be used for breeding for 6 weeks to allow the sperm within the vas to die. I have heard many stories of vasectomies that did not work. I suspect that the vas was not accurately identified. Therefore, I recommend submitting the section of vas for histologic analysis documenting the vas was actually excised.

RABBITS
Ovariohysterectomy

Indications for OHE in rabbits include control of reproduction and uterine adenocarcinoma. There is a high incidence of uterine adenocarcinoma in rabbits over the age of 5 years. Spaying is routinely recommended by most house rabbit practitioners. The uterus of young rabbits is found just dorsal to the bladder, coiled in the caudal abdomen. In older rabbits, the cervices are dorsal to the bladder, but the horns extend laterally more than cranially. The uterus and ovaries are generally easy to exteriorize; however, they are more fragile than those of dogs and cats. The uterus is bicorneate and each horn has its own cervix. There is no uterine body. The mesometrium of rabbits is a site of fat storage. In obese rabbits this can make surgery more challenging as it is often difficult to definitively identify the ovarian and uterine vessels for ligation.

Following expression of the bladder, the rabbit is placed in dorsal recumbency and prepared for surgery. A 2- to 3-cm incision is made starting midways between the umbilicus and pubis extending caudally. The cecum and bladder may be directly under the linea alba and it is recommended that the body wall be elevated from the abdominal structures prior to making the initial incision. The uterus is usually visible dorsal to (under) the cranial pole of the bladder. One uterine horn is lifted through the incision using atrumatic forceps. It is best to avoid using a spay hook as such an instrument can perforate the cecum leading to disastrous consequences. Once the uterine horn has been elevated through the incision it is traced to the ovary, which is loosely attached to the dorsal body wall by a long fat filled mesovarium. The ovary is usually visualized as a fine tubular structure, which literally encircles the ovary. A clamp may be placed between the ovary and the uterine horn to allow traction to be applied to the ovary. The ovarian ligament need not be broken down. There are many vessels, which supply the ovary within the fat of the mesovarium. An opening is created by blunt dissection through the fat of the mesovarium and ligature is passed around the portion of the mesovarian containing the vessels supplying the ovary. As the suture is tightened it will cut through the fat, but will ligate the blood vessels. This procedure is repeated on the contralateral side and the fat filled broad ligament of the uterus may be broken down by gentle blunt dissection with the surgeon’s fingers. Any large vessels or any hemorrhage from vessels within the broken ligament may be controlled by ligation or hemostatic clips. Following dissection of both uterine horns the uterus may be ligated on either the cranial or the caudal side of the cervix. Because of reports of fatal hemorrhage from cervical and uterine stump aneurysms, it is preferred to ligate through the cranial vaginal vault, caudal to the cervixes. The uterine vessels lay on each side of the uterus several millimeters from the uterus. It is best to ligate these vessels individually and place a transfixation ligature around the uterus prior to transection. Closure is routine with body wall, subcutaneous tissue, and skin being closed as separate layers.
Castration

Indications for castration in rabbits include decreasing the odor of the urine, marking behavior, and male rabbit aggression and territoriality. The testes of rabbits move freely between the abdomen and the scrotum through the function of a well-developed cremaster muscle. The inguinal canal is open in rabbits; however, the intestine does not herniate because of the large epididymal fat pad which fills the inguinal canal when the testes are within the scrotum and the inguinal fat pads within the abdomen. The proper ligament of the testis which attaches the tunica vaginalis to the scrotum is quite strong in rabbits.

With the rabbit in dorsal recumbency the fur around the cranial scrotum and penis, as well as along the inner thighs is carefully clipped and prepared for aseptic surgery. There are three commonly used for castration of rabbits: closed, open with closure of the inguinal ring, and open with preservation of the epididymal fat pad. The initial incision may either be scrotal or prescrotal. A prescrotal incision potentially allows the surgeon to remove both testicles through one incision. Alternatively a 1- to 1.5-cm incision is made through the scrotum longitudinally on each side of the midline about midway along the length of the scrotum. For a closed castration, the tunic is grasped and the testicle is removed from the scrotum with the tunic intact. The tunic is tightly adhered to the end of the scrotum by the proper ligament of the testis. This ligament must be broken down to allow exteriorization of the testicle. Traction is applied to the testicle and dry gauze is used to strip the facial attachments allowing the narrow portion of the cord to be exteriorized. Once the testicle has been exteriorized adequately the cord is ligated using a 2 or 3 clamp technique.

A second technique involves performing an open castration and closing the inguinal ring. The incision is made as described above and the vaginal tunic is incised to allow exteriorization of the testicle, spermatic cord, and vascular supply. The spermatic cord is double ligated and the testicle is removed. The vascular pedicle is traced cranial and the inguinal canal is identified. A single interrupted suture is placed across the inguinal canal being careful not to compress the blood vessels passing through the canal. A third technique involves an open castration being careful to remove only the testicle and leaving the epididymal fat pad intact. The fat pad will then prevent herniation of intestine through the inguinal ring. With any of these techniques the incisions may be left open to heal by second intention or may be sutured closed using either an intradermal pattern, tissue adhesive such as Nexaban, or skin staples.

RODENTS

There are three basic groups of rodents – myomorph (mouse-like), sciurumorph (squirrel-like), and hystrichomorph (guinea pig-like). Anatomically, the hystrichomorphs (which includes guinea pigs and chinchillas) are unique. The males do not have a distinct scrotum and the testicles are located in the inguinal region on each side of the penis.

Ovariohysterectomy

Indications for OHE in rodents include to prevent uterine and ovarian disease, and potentially, behavior alteration. The ovaries are located at the caudal pole of the kidneys within a rather large fat pad. The uterus is not coiled and as caudally located as in rabbits. As in rabbits, the suspensory ligaments are long and it is easy to exteriorize the ovaries. There is a single artery and vein which run medial to the ovaries and extend along the uterus following the uterine horns to the uterine body.

The patient is placed in dorsal recumbency and prepared for aseptic surgery. A 1- to 2-cm incision is made midway between the umbilicus and pubis. The uterine horns are identified dorsal to the apex of the bladder. One horn is grasped and exteriorized through the incision. The horn is traced cranial to the ovary. The oviduct circles cranially around the ovary. The procedure continues as described for rabbits. Rodents do have a single cervix and a uterine body. It is recommended that the uterus be ligated cranial to the cervix in order to prevent urine leakage. Care must be taken to avoid damaging the urinary bladder. Closure is routine.

In small rodents it is possible to remove the ovary without removing the uterus through a lumbar approach. This procedure is routinely performed in research facilities. The patient is placed in ventral recumbency and the lumbar and flank areas and clipped are prepared for aseptic surgery. A single dorsal midline incision may be made or a transverse incision can be made on each side. Through the dorsal midline incision, the skin may be shifted from one side to the other to gain access to each ovary. Following skin incision, blunt dissection is used caudal to the last rib at approximately the level of the third lumbar vertebra through the muscles of the body wall into the peritoneal cavity. The ovary is located within the fat pad at the caudal pole of the kidney and removed. No ligation is required and hemorrhage is generally minimal; however, placing a hemostatic clip or single ligature is recommended. The muscle is apposed with 4-0 or 6-0 synthetic, absorbable suture material and the skin is closed in a routine manner.

Orchidectomy

Castration is mainly used to control reproduction in the pet rodent. It is easier to perform than OHE and is associated with less morbidity and mortality. It may also be indicated to help control urine odor and marking behaviors, decrease aggression, and for medical reasons such as tumors. The testicles of rodents are rather large and descend in the first week or two of life. The inguinal canals remain open and a functional cremaster muscle allows the testicle to migrate into and out of the abdominal cavity. As described in rabbits, rodents also have a large epididymal fat pad which prevents intestinal herniation. The large seminal vesicles also partially occlude the internal inguinal ring preventing herniation.

Castration of guinea pigs and chinchillas performed using a technique similar to that described in rabbits. Some surgeons feel that guinea pigs are more likely to...
herniate the seminal vesicles through the inguinal ring and recommend closure of the inguinal ring to prevent this. These hystrichomorph rodents also seem to be more prone to the development of incisional infections than other species. The reason for this is undetermined. Because of this, proper aseptic technique, gentle tissue handling, and the use of perioperative antibiotics are recommended. A clean substrate must be used and cleaned on a regular basis postoperatively. Fortunately, most of these (unlike other abscesses in rodents) respond to local debridement and systemic antibiotics.

In other rodents (scirumorph and myomorph), following routine clipping and surgical preparation of the scrotum a single, transverse or midline 1-cm incision is made at the distal (caudal) tip of the scrotum. The incision is extended through the tunic on each side of midline to allow exteriorization of each testicle. Caudal retraction is applied exposing the spermatic cord. The proper ligament of the testis is broken to free the tunic and scrotum from the testicle. The cord is double ligated and transected distal to the ligatures. The tunic may be closed using a 4-0 to 6-0 synthetic, absorbable material. The skin incision may be left open to heal by second intention or may be closed using a tissue adhesive or staples. Generally, sexual activity should cease after 1 to 2 weeks. In rodents that have had sexual experiences pre-castration, mounting and intromission persists following castration.