

## Notes for Community Practice Surgery (spay/neuter)

The primary goal of the Community Practice surgery rotation is to give you a chance to practice surgery skills.

The two things which are essential to being successful on this rotation are **TEAMWORK** (with classmates, 3<sup>rd</sup> year students, techs, etc.) and **PATIENT CARE**. We are being entrusted with the care and well-being of our patients and we need be sure we deserve that trust. Part of patient care is making sure you are as prepared as you can be when you enter the surgery suite to cut into a live animal.

### Receiving

For our client receiving, you will want to perform a thorough physical exam on the patient. Please be sure to look for deciduous teeth which need to be pulled, umbilical hernias, and locate both testicles - in the case of males- before the client leaves. All of these will require consent and extra money for us to correct at the time of surgery. Be sure to discuss with clients: vaccination status, microchipping, fecals, heartworm or FELV/FIV tests and additional bloodwork where appropriate. We will do a PCV and TP on all animals, but we strongly recommend a CBC and chemistry panel on animals over 4 years of age. Obviously, it is always nice to have more information, but **clients need to be aware of additional costs**. If you have any questions about these procedures or their application to a particular patient, please be sure to ask.

As we are most interested in the reproductive tract, please be sure to ask the client about their reproductive history. Has she ever been in heat? Is there any chance she is pregnant? etc. Also, be sure to explain the surgical procedure we are going to perform, touch on potential complications, what they can expect for after care and make sure you have answered all their questions. Last, but certainly not least, be **SURE to get the CONSENT form signed**.

For Humane Society animals, there is little or no history available. Some shelter patients will arrive with information. It is important to review any information provided. You will not need to get any consent form signed for these animals. Physical exams are critically important in these animals since there is little history available. If you find abnormalities on your physical exams, **BE SURE TO BRING THESE TO THE ATTENTION OF THE CLINICIAN!**

Humane Society animals will need to have a StringSoft record generated when they arrive. If paperwork came with the animals, this paperwork needs to be taken to the front desk to generate a record. If no paperwork accompanied the animals, a list of: **name of shelter, name of animal, breed, sex, birth date, and color** needs to be created and taken to the front desk to generate the record. Obviously, the sooner we can get the information turned in, the sooner we are likely to have records. **Once a record is generated and a complete cage card can be provided for the animal, the invoice from the humane society should remain in the humane society kitchen for the animal's stay so that it is accessible to everyone**. Once the animal leaves, it goes into Dr. Weir's basket in Community Practice.

### Dismissals

Client animals will generally be dismissed the afternoon of the day after surgery. **(Declaw cats will stay two nights after surgery.)** You will need to set up a time for dismissal with the client. Be sure to get a number where you can reach them after surgery since you'll want to let them know how surgery went. Dismissal times are generally best between 1pm and 4pm as we are in surgery in the mornings. It is preferable for the surgeon to perform the dismissal. Obviously, you will want to go over dismissal instructions and medications with the client.

For Humane Society animals, SOAP your patient the morning after surgery. **If you have concerns about your patient, please bring it to the clinician's attention ASAP.**

### Anesthesia

As you probably remember, 3<sup>rd</sup> year students run anesthesia for Community Practice surgery when they are in the clinics. This is generally their first time ever running anesthesia so please try to be as helpful as you can. Keep records for the animals accessible to the 3<sup>rd</sup> year students. Anesthesia requests should have the PCV and TP included on them whenever possible as well as location and weight of animal. Anesthesia requests need to be turned in by **2pm** at the latest. Earlier is always better. If you don't have a StringSoft record by then, turn in an abbreviated request with as much information as you have.

When 3<sup>rd</sup> year students are not in clinics, we will perform our own anesthesia. Usually this means that you will have both a surgery case and an anesthesia case each day. The surgeon is responsible for the anesthesia SOAP on his or her patient and then a colleague will step in and actually run the anesthesia.

## **Canine Ovariohysterectomy**

The area of the abdomen from the xyphoid to the pubis is clipped in the induction room. The contents of the bladder are expressed into a bladder pan. Once inside the surgical suite the abdomen is surgically prepped. Surgical towels (quarter drapes) are placed on four sides and clamped to create a rectangular surgical field. If adhesive quarter drapes are used, towel clamps may not be necessary. The lateral towels should be just inside the nipple lines. The cranial towel should be well **cranial** of the umbilicus, and the caudal towel should be at the level of the pubis. An appropriately sized surgical drape is placed over the towels. If a fenestration needs to be cut in the drape, be sure to palpate for anatomical landmarks to assure the fenestration is cut in the correct spot.

A midline incision is made through the skin with a blade. For dogs that have not had an estrus yet, they should be considered "immature" and the incision should be made closer to the middle third of the abdomen. For mature dogs, the incision should be made

slightly caudal to the umbilicus. For mature, deep-chested breeds, the incision is positioned slightly more caudal as these dogs tend to have longer uterine horns. The length of the incision is determined by the size of the dog, but will usually be 3-5 cm.

Subcutaneous tissues are incised with a blade until body wall is identified. Using your thumb forceps in your non-dominant hand to spread the subcutaneous tissues will help ensure you have adequate visualization. The linea alba is located, if possible, and grasped with thumb forceps and lifted. For dogs, it is not usually possible to visualize the linea. Instead, palpation is used to find the firmer tissue of the linea. Sometimes it may feel like a “valley” between the abdominal muscles. A stab incision is made through the tented portion of the linea alba with the blade. If abdominal contents are visible, insert a grooved director in the abdomen underneath the linea alba being careful not to entrap any abdominal organs. The abdominal wall incision is then extended with the blade using the grooved director as a guide to prevent injuring abdominal contents. If you don’t have a grooved director, closed thumb forceps or a straight clamp can also be used to protect the abdominal contents from the blade.

If muscle tissue is visible after the stab incision, then the linea alba was not incised and blunt dissection of the muscle is performed. You must first use your blade to incise just the rectus sheath on top of the muscle for the length of the incision. Blunt dissection is then used to “split” the muscle fibers along their length in order to create less bleeding than sharp dissection. A finger is inserted into the original stab incision and then directed cranially and caudally in a vigorous manner along the length of the incision. A reasonable amount of downward pressure needs to be used. This should cause the muscle fibers to separate from one another. Once this is done, the peritoneum will be visible. For smaller patients, a clamp may be necessary to bluntly dissect the muscle. Use caution as the tip of the clamp can penetrate the spleen or other abdominal contents if care is not taken. Once the peritoneum is reached, pick up the peritoneum with thumb forceps and make a stab incision. After the stab incision is made, scissors or grooved director and blade should be used to lengthen the peritoneal incision.

Once the abdomen is entered, locate the spleen and be sure it is positioned cranial of where you plan to run the spay hook. It may need to be manipulated digitally to get it out of the way. The spay hook is a helpful tool to find the uterine horn, but it should be used carefully. This is accomplished by holding the spay hook over the incision with the “hook” toward you. Lower the spay hook through the caudal end of the incision into the abdomen by following the body wall on the right side of the animal. (Start on the right side to avoid contact with the spleen.) When you reach the dorsal surface of the abdomen, slide the spay hook toward midline along the dorsal body wall, turn the “hook” 180 degrees and come straight up. If the hook “catches” and won’t come up, DO NOT force it. Let the entrapped tissue fall off and try again. If you pull up a lot of tissue, carefully let the tissues off the hook with your fingers in order to identify each layer as you may indeed have the uterine horn or broad ligament under a loop of gut or piece of omentum. If you don’t pull up the horn, try the same technique again. If you’re having difficulty, be methodical about it as you move from the caudal end of the incision to the

cranial end. If you still can't locate it on the right side, try on the left side. Be sure to retract the spleen cranially with a finger before entering with your spay hook.

In dogs, you will often pull up the broad ligament on the spay hook rather than the uterine horn. The key is to recognize that this is broad ligament and not omentum. The biggest difference between the two is their attachment. The broad ligament is attached dorsally and so will be pulling straight "down". The omentum is generally more filmy or flimsy and is attached cranially in the abdomen. If you retrieve what you think is the broad ligament, you should remove it from the spay hook using your index finger and thumb, manipulate the tissue by rotating it to locate the uterine horn running "through" the tissue.

If you are unable to locate the uterine horn on either side, extend the incision caudally and repeat your attempts with the spay hook. If you are still unable to find either horn, the incision can be extended until the bladder can be located and lifted. The body of the uterus will be located between the bladder and the colon.

When the potential uterine horn is located, palpate cranially to confirm the expected anatomy. The first landmark will be the proper ligament which joins the ovary and the horn. The ovary should be palpated just proximal of the proper ligament. Sometimes there is a lot of fat surrounding the canine ovaries. The ovary is the firm, slightly moveable structure within the fat. You can also follow the horn caudally to locate the uterine bifurcation. Once you have confirmed you have the uterine horn, you must place caudal traction on the proper ligament with your non-dominant hand while you reach into the abdomen with the index finger of your dominant hand to identify the suspensory ligament. The suspensory ligament will be a "fan" of tissue originating from the caudal pole of the kidney and lateral body wall and connecting to the ovary. If you place caudal traction on the proper ligament, you will feel the suspensory as a taut structure stretched between the kidney and the ovary. This is what you must break down in order to get enough exposure to place your ligatures on the ovarian pedicle. The safest way to break the suspensory ligament is to place constant and increasing pressure in a dorso-medial direction on the tightest band. That is, you should be pressing toward the spine and slightly caudal. The reason for this is that the ovarian vessels are originating from the aorta, and if you break the ligament down toward the origin of the vessels, you are less likely to inadvertently rip the vessels from their origin. As you break the suspensory ligament, keep checking to see if you have enough exposure. You will need to be able to place two ligatures at least 1cm from a clamp you will place proximal to the ovary. When you think you have enough exposure, hold the ovary as discreetly as you can between your thumb and finger. Visually assess whether you could place a clamp under the ovary and then ligate at least 1cm below that imaginary clamp. If the stump is very large (big, fat dogs), try for 2cm between clamp and ligations. This distance is important as the clamp you place will be spreading the tissue it holds as you try to bring the tissue together with your ligature. This creates a fight between you and the clamp. The farther you are from the clamp, the less of an effect it will have on your ability to get the ligature tight. This is more of a problem with larger, fatter pedicles.

When adequate exposure is obtained, a crile clamp should be placed just underneath the ovary. The ovary of dogs is encased in a bursa and may be surrounded by a significant amount of fat. You need to palpate the extent of the ovary itself by palpating through the bursa for the firm structure within. This is the ovary. Holding the ovary with your non-dominant hand and using your thumb and index finger to delineate the extent of ovary, use the closed point of a crile clamp to poke through a **clear** “window” in the tissue (broad ligament) below the ovary and the uterine horn. You need to be caudal to the ovarian vessels, but as close to them as possible. Open the clamp to enlarge your “window”, clamp across the ovarian pedicle at the cranial or proximal extent of the ovary. This marks the boundary for tissue that must be removed since all the ovary must be excised. Using a Carmalt clamp and the same “window” in the broad ligament, clamp across the ovarian pedicle as close to the body wall as possible. You should have at least 1cm between the two clamps. More space is better! Using appropriate suture, place an encircling type ligature below the Carmalt clamp. Before you really tighten the suture, remove the Carmalt clamp and allow the suture to slide into the “crush” created by the clamp. Check to be sure that nothing is entrapped in the ligature, and tighten. Use 3-4 square knots (6-8 throws) for all ligatures. You will want to place a second ligature around the pedicle. If you place a transfixing ligature, it needs to be distal to the encircling ligature but still be able to maintain a minimum of 1cm from the crile clamp. If this is not possible, it is better to place another encircling type ligature proximal of your first ligature in order to maintain adequate distance from the clamp. Once the two ligatures are placed, grasp some tissue from your future stump- between your ligatures and the clamp- with a mosquito hemostat. This will allow you to visualize your stump after it is cut. Cut the ovarian pedicle with your blade just below your crile clamp but above the mosquito hemostat. Observe the stump for bleeding. Be sure to release the tension on the stump by holding it down in the abdominal cavity to fully assess any potential bleeding. By retracting the edges of the incision, you should be able to observe the stump in its tension-free state. You may clamp the other side of the stump with a second clamp and release the first clamp in order to be sure potential bleeders were not occluded with the original clamp. Once satisfied that the stump is not bleeding, release the clamp and allow the stump to return to the abdomen.

For smaller dogs, you may choose not to use a Carmalt or “crushing” clamp. In that case, a mosquito or crile clamp is placed proximal to the ovary as described above, but no Carmalt is placed. The ligatures still need to be placed at least 1cm proximal to the crile or mosquito clamp.

In order to remove the broad ligament, follow the horn back to the uterine body. Visualize the uterine vessels running on each lateral side of the uterine body. Make a “window” in a clear spot of the broad ligament that is close to the uterine vessel at the level of the uterine body. Place one encircling ligature through the window and around the broad ligament on the first side. Amputate the broad ligament above the ligature taking care not to incise the uterine vessel that is running along the uterine horn. Allow the ligated broad ligament to return to the abdomen once you have checked it for bleeding. After ligating the broad ligament, follow the uterine horn digitally to the other

ovary and repeat the procedures for clamping, ligating, and transecting the ovarian pedicle.

When both ovaries have been removed and both sides of the broad ligament ligated, the uterine body must be ligated. Two transfixing ligatures starting from each side of the uterine body work well for this. Start the first ligature by passing the suture needle through the uterine body toward one side or the other. Pass the suture around what's left of the broad ligament and the associated uterine vessel. Tighten the ligature and tie one square knot (2 throws) to secure it. Pass the ends of suture around all the tissue and after tightening securely, place 3 square knots (6 throws). Repeat the process for the second transfixing ligature, but start on the other side of the uterine body. This gives you two transfixing ligatures as well as isolating the uterine vessels. Clamp across the uterine body at least 1cm above the two ligatures. Attach a mosquito hemostat to the uterine body tissue cranial to the ligatures and transect the uterine body below the clamp. In assessing the uterine stump for bleeding, it is important the uterine vessels on the lateral surfaces of the uterine body not be occluded with the mosquito hemostat. (i.e. Grasp tissue from the center of the uterine body not the sides.)

Before closing, check the abdomen for bleeding. Retracting the edges of the incision should allow visualization of the abdomen. Gently pressing the abdomen from each side should cause any blood to "well" up. For very large or deep-chested dogs, a gauze sponge attached to sponge forceps may be run along the body wall to the dorsal surface of the abdomen to check for bleeding. When you are satisfied that all is well, begin closing.

For body wall closure, use simple interrupted sutures until the clinician has approved the use of simple continuous closure. Using a monofilament suture, be sure to take at least 5mm bites in the rectus sheath or linea alba. Try not to entrap muscle as it won't hold and will only cause tissue necrosis. To convince yourself that you have rectus sheath, grasp the suture ends on either side of the incision and pull upward as if you were attempting to lift the dog off the table. If you feel any slippage, you do not have rectus sheath. You need at least 6 square, secure throws on either end of the suture line. Space your sutures no more than 5mm apart. Test your suture line continuously as you close. It is critical that we get the body wall securely closed, so take your time and utilize your thumb forceps to confirm that the ventral rectus sheath is being incorporated. If the ventral rectus sheath is everted with the thumb forceps, either muscle or the peritoneum coming up to join the rectus sheath should be observed. Once you have finished the body wall closure, a final test is to put digital tension firmly and directly on the suture line to test its integrity.

For subcutaneous closure, start at the cranial end. Place the first knot deep in the SQ and leave a suture "tag" to tie off your intradermal line. To get the first knot to be deep, take the first bite "deep to superficial" and the second bite "superficial to deep". 4 square throws are sufficient for the subcutaneous tissues and dermis. Use a simple continuous pattern to close the subcutaneous tissues. For dogs with extensive subcutaneous tissues, take multiple small bites on either side of the incision in order to create a purse-string

effect and gather the tissues together. When the caudal end of the incision is reached, the intradermal pattern is started. Be sure that both of the first intradermal stitches start at the very caudal end of the incision in the dermis. The intradermal closure is a continuous horizontal mattress pattern. The key to a successful intradermal closure is to take small bites and to “backtrack” half the distance as you move from one side of the incision to the other. It is also important to make sure that you are in the dermis. Think about splitting the skin edge with your suture needle. Continually check to be sure you are in the dermis by placing cranial traction on the suture and try to spread the skin edges apart. If you see gapping, you are too deep and need to be more superficial. Also check to be sure you are not inadvertently exiting the skin. At the cranial end of the intradermal line, the last intradermal stitch needs to be a vertical stitch which dives “deep”. This will allow both ends of the suture to be “deep” and result in more successful knot burying. Tie to the subcutaneous tag that was left with 4 square throws. Cut the “tag” end of the suture. Now direct the needle into the incision just cranial to the knot and come out in the skin cranial to the incision. While pinching the cranial end of the incision with your fingers, put firm, steady cranial traction on the suture end. This should cause the knot to “bury” in the SQ.

Check the integrity of your intradermal closure by trying to spread the incision open. If it opens, skin sutures will need to be placed to augment the intradermal closure. Cruciate sutures are nice because they are easier to remove when the time comes. Remember that skin sutures should be loose enough to allow a clamp to slide easily between skin and suture. This will leave room for post-operative swelling.

### **Feline Ovariohysterectomy**

The feline OHE is performed similar to the canine OHE with the following exceptions. While the technique is basically the same, the feline OHE requires a more delicate touch. Tissues WILL tear if too much tension is applied to them!

The OHE incision in cats is always made in the middle third of the abdomen. For entering the abdomen, cats will usually have a more visible linea alba than dogs. Once inside the abdomen, you will often have more trouble with omentum and falsiform fat entangling the spay hook. Digitally retracting the omentum cranially while the spay hook is used can be helpful.

The ovaries of cats are not encased in a bursa and there is very little associated fat as compared to the dog. This allows clear visualization of the ovary and often of the ovarian vessels. The suspensory ligament is usually very minimal, so stretching rather than tearing is generally all that is necessary. To stretch the suspensory, apply caudal traction on the proper ligament just like in the dog, but for cats, you can usually stretch the suspensory from outside of the abdomen. Palpate through the skin for the suspensory ligament and then apply straight downward pressure to gain the necessary ovarian exposure. As with the dog, check often to see if adequate exposure has been achieved.

Once the ovary clears the edge of the incision, you usually have enough exposure in a cat. The suspensory ligament will continue stretching as you work on your ligations.

Since there is very little tissue surrounding the ovarian vessels, it is not necessary to “crush” the ovarian stump with a clamp. This may result in tearing the vessels! Therefore, only one clamp is placed just below the ovary. Usually a mosquito clamp is used proximal to the ovary. Since the ovary can be visualized, it is not necessary to palpate the ovary. The mosquito can be placed across the ovarian pedicle at the proximal tip of the ovary through visualization. The encircling ligature is then placed a **minimum** of 1 cm proximal of the mosquito clamp. In cats, it is usually not possible to place a transfixing ligature as there is very little tissue surrounding the ovarian vessels. If the encircling ligature is well placed, often only one ligature is used. If the cat was pregnant or has very large vessels, a second encircling ligature may be performed. It is critical that these ligatures be placed well below the clamp as cat tissue tends to retract when cut and it is very possible for your ligatures to slip off if there is not adequate tissue above them.

In cats, there may be some broad ligament to tear, but it is very minimal as compared to the broad ligament of dogs. Usually the round ligament is all that needs to be cut. Identify the uterine vessels running lateral to the uterine body before cutting the broad ligament as it is easy to tear them inadvertently. The uterine stump is generally ligated similar to the dog. For small kittens, we may use encircling ligatures as transfixing ligatures can sometimes tear these delicate tissues.

The closure in cats is similar to that in the dogs with a few exceptions. The subcutaneous tissues are not well attached, so there should be very little or no subcutaneous tissues incorporated in the body wall closure. Be sure to lift the rectus sheath with thumb forceps when taking suture bites in order to be well clear of the abdominal contents. The subcutaneous sutures can be spaced widely apart in the cat- usually 1-2cm apart. The intradermal closure is similar to the dog, but, of course, the cat dermis is very thin. It is very distinct though and should provide a lot of resistance to the suture needle as you enter and exit.

### **Canine and Feline Ovariectomy**

The ovariectomy procedure varies little from the ovariohysterectomy procedure, but it may offer some benefits. Usually a smaller incision can be utilized which often results in decreased surgical time due to a decrease in time spent closing the incision. Also, for the ovariectomies, there is generally no need to work around the bladder which likely translates into less risk of accidentally damaging a ureter.

The ovariectomy incision is usually placed slightly more cranial than the OHE incision. For dogs, it is generally 1-3cm caudal of the umbilicus, but this will vary depending on the size and maturity level of the dog. For cats, it's usually 1 cm caudal of the umbilicus.



The incision length for dogs is generally about 3cm. The incision length for cats is generally about 1cm.

The procedure up to and including the ligation of the ovarian pedicle is performed the same as an OHE. Once the ovarian pedicle is transected, the horn is ligated. Find the proper ligament and ligate the horn, broad ligament, and uterine vessel about 1 cm away from the proper ligament. Once ligations are complete, the horn is transected about 1 cm above the ligatures which should be through the proper ligament. You can ligate the horn anywhere you want, as long as it is at least 1 cm away from the proper ligament. Some reasons you might want to ligate farther down the horn would be: a cyst or other pathology that you want to ensure is removed, or if the horn becomes discolored and edematous due to our handling. In the dog, if the horn is ligated farther from the proper ligament, the broad ligament may need to be ligated separately. This is done similar to the OHE broad ligament ligation.

Once the horn is ligated, transected, and checked, the horn may be followed caudally to see if the bifurcation can be reached and the second horn retrieved. If this is not possible, release the first horn and use the spay hook to retrieve the second horn.

Closure is accomplished the same as an OHE.

### **Complications for OHE and OVE:**

The complications can be many and varied, especially if good surgical technique is not followed, but the most common complications are outlined below.

**Dropping a bleeding stump:** This will happen to every surgeon at some time. The main thing to remember is **STAY CALM!** Extend the incision to allow better visualization. If you do not have IV fluids going, have someone insert a catheter and get them running. The ovarian stumps are going to retract to the area just behind the kidney. If a ligature is on the stump, you can often palpate the stump and retrieve it digitally. If there is no ligature, you will need to move the abdominal contents away in order to find the bleeding stump. For the right side, the duodenum can be located and used to “pack off” the intestines to gain access to the area caudal to the kidney. For the left side, the mesocolon may be used in the same way.

Once you have access to the region where the bleeding stump should be, it is simply a matter of locating the bleeder. What you must **NOT** do is reach into a pool of blood with a clamp and try to clamp something which you cannot see. Remember, there are important structures in this area- especially ureters!!!! It's usually safest to retrieve tissues digitally. Only clamp when you are sure that the stump has been separated from other tissues and structures. Once clamped, the stump is ligated.

**Post-operative bleeding:** Sometimes bleeding will occur from the incision, other times you may suspect that abdominal bleeding is occurring. Bleeding from the incision can often be the result of subcutaneous or muscle bleeders and not cause for great concern.

Assessing the patient's attitude and mucous membrane color is important in determining the level of concern. A PCV and total protein should be performed on any patient which is not recovering appropriately. Remember that the PCV will not drop acutely, but it can be used as a comparison. It is rarely necessary to take a spay patient back to surgery for an abdominal bleed. Spay patients in which an abdominal bleed is suspected should be placed on IV fluids and the abdomen wrapped. They should be monitored closely and kept quiet. If their clinical picture continues to decline or depending on the circumstances, additional surgery may need to be performed.

**Herniation:** A hernia will occur if the abdominal wall suture line fails. This can be due to knot failure or failure of the surgeon to identify the rectus sheath or take appropriate bites of the rectus sheath at closure. If the abdominal wall sutures fail before the subcutaneous tissues and skin have healed, there is risk of abdominal contents coming through the incision. Obviously, this is an emergency situation. An abdominal bandage should be placed to prevent evisceration, and the patient should be taken back to surgery as soon as possible. If the subcutaneous tissues and skin have healed, the hernia will be apparent upon palpation. When a hernia such as this is discovered, the patient should be scheduled for surgery soon, but it is not an emergency. There is potential for intestines to become entrapped and strangulated so it is not advisable to wait too long.

**Seroma:** Seromas may occur if the "dead space" in the subcutaneous tissues is not closed appropriately. These usually resolve without intervention. It can be difficult to differentiate a hernia and a seroma. Sometimes waiting a few days to see if it resolves can help you decide which of the two it is.

**Suture Reaction:** This is a fairly common complication. It is more common with the braided sutures than the monofilament sutures. The swelling must be thoroughly palpated to differentiate it from a hernia. In its mildest form, it is a slight, firm swelling along the suture line. In its worst form, it is a very large swelling with serous drainage. If any drainage is occurring, antibiotics may be helpful to prevent secondary bacterial infection. Suture reactions usually occur about 1-2 weeks after surgery and may take 4-12 weeks to completely resolve depending on the type of suture used.

### **Canine Closed Castration**

The inguinal area from just cranial of the scrotum to 2-3cm cranial of the prepuce is clipped. Only the long hairs of the scrotum are clipped as the scrotal skin is very sensitive and very prone to "razor burn". The pre-scrotal area is prepped as usual with the ventral surface of the scrotum being prepped very delicately. Three surgical towels are placed to create a triangular surgical field just cranial to the scrotum. The scrotum and opening of the prepuce should be toweled **out**. (For small puppies, the scrotum may be toweled in as it is difficult to palpate tiny testes through the towels. If this is the case,

the scrotum will need to be clipped as well.) Towel clamps are placed well lateral to the scrotum at the base of the triangle, and **well away from the penis** at the apex of the triangle. If adhesive quarter drapes are used, towel clamps do not need to be placed. A surgical drape is then placed over the quarter drapes. If there is no pre-cut fenestration, a fenestration will need to be cut using Mayo scissors. Be sure to palpate for anatomical landmarks prior to cutting the fenestration so it will be placed correctly.

A testicle is palpated through the drape and towels and pinched forward with the thumb and index finger of your dominant hand. It should appear under the skin in the pre-scrotal region of the surgical field. When it is maximally manipulated cranially, grasp the testicle through the skin with your non-dominant thumb and index finger to prevent it from returning to the scrotum. Use your blade to make a midline skin incision over the cranial half of the testicle. The hair growth pattern in the pre-scrotal skin will guide you to the midline. Once the skin is incised, gently incise the subcutaneous tissues and fascia overlaying the testicle to the level of the testicular tunic. The tunic will appear bright white. If you maintain slight upward pressure on the testicle, it will begin to “pop” out of the incision when you have freed the subcutaneous tissues and fascia adequately.

Once the testicle can be removed from the incision, grasp the skin edges at the caudal end of the incision with the thumb and index finger of your dominant hand and grasp the testicle in your non-dominant hand. Pull caudally with your dominant hand and cranially with your non-dominant hand to tear the scrotal ligament. For many dogs, the scrotal ligament will tear with this technique. If you have a dog with a very strong scrotal ligament, you may need to cut the ligament with scissors. If you need to cut it, take care to stay close to the testicle to prevent cutting the inverted scrotum.

Once the testicle is freed from the scrotal ligament, you should have several centimeters of exposure between the bottom of the testicle and the pre-scrotal incision. Remove as much fascia and associated fat from around the tunic as possible using a sponge to wipe the fibrous tissues away. Using a crile or mosquito clamp, depending on the size of the animal, clamp across the cord a few centimeters above the incision. You should be able to identify the vessels (pampiniform plexus), the vas deferens, and the cremaster muscle within the tunic. Try to keep these structures lined up as you place the clamp across them.

Using suture on a needle, pass the needle through the tunic between the vas deferens and the cremaster muscle. (You should be at least 1 cm below the clamp you placed.) Tie a square knot (two throws) around the vas deferens and pampiniform. Take the ends of the suture around the whole cord and tie 6-8 throws. You now have a transfixing ligature with isolation of the vessels. Put an additional encircling type ligature below your transfixing ligature. Attach a mosquito hemostat to the vas deferens and amputate your stump below the clamp. There should be at least a centimeter of tissue remaining above your ligatures. By placing a holding clamp on the vas deferens, you can be sure that you are not occluding any potential bleeders with your clamp. Be sure to take the tension off the stump before you satisfy yourself that it is not bleeding. Once you are satisfied, push the stump back through its subcutaneous “hole” and release your clamp.

Repeat this technique for the other side. For the second testicle, you will not need to incise skin, but you will still need to incise subcutaneous tissue and fascia down to the level of the tunic.

If you accidentally incise the tunic and the testicle extrudes from it, you can usually still “save” your closed castration by digitally raising the tunic toward the testicle and then clamping across all the tissue directly under the testicle. You’ll still need to break down the scrotal ligament, but it can usually be done below the clamp without too much difficulty. Once the scrotal ligament and fascia are stripped away, the tunic and structures within it should look just the same when viewed proximal to the clamp. Ligations proceed as described above.

Once both testicles are removed, you are ready to close the subcutaneous tissue and skin. Using the suture on a cutting needle, start at the cranial end of the incision and begin your subcutaneous closure. Be sure your initial knot is deep in the SQ as this will be what “pulls” your final knot down and allows it to “bury”. Starting with your first stitch “deep to superficial” and your second stitch “superficial to deep” will help the knot bury. Two square knots (four throws) are sufficient for SQ closure. Don’t forget to leave a suture “tag” which you will use to tie off your intradermal line. The SQ is generally closed in a simple continuous pattern. To accomplish this, take a small bite on one side of the incision from superficial to deep and a bite on the opposite side of the incision from deep to superficial. Take care not to bite into the penis. If you see any subcutaneous bleeders, try to place your suture line to incorporate them as this will help control post-operative bleeding. Be sure to tighten your suture line as you work in order to bring the incision together and put pressure on the subcutaneous bleeders which may occur. When you reach the caudal end of the incision, you can move directly into the intradermal closure. This is a horizontal mattress pattern. It is important to stay very superficial with this line in order to get an effective seal of the incision. Think about “splitting the skin edge” with your needle as you take your bites. For canine castrations and other thin-skinned areas, smaller bites (smaller progressions forward) will get you a more cosmetic and effective closure. Leaving the incision line slightly loose (i.e. don’t pull your suture line tight) will help you with the final intradermal stitch. The final stitch needs to end “deep” so that it can be tied to the “deep” tag we left from the subcutaneous knot. This will be a vertical stitch starting just deep to the dermis and directed down as deep as possible in the subcutaneous tissues – watch out for the penis! Tighten up the intradermal line and then tie to the subcutaneous “tag” that was left. Since both ends being tied together are “deep”, the knot should want to be “deep”. Four square throws are sufficient for this. Cut the “tag” end close to the knot. Direct your needle into the incision right next to your knot and exit the skin well cranial of your incision. Using cranial traction on your suture and caudal traction on your skin edges, “tunnel” your knot into the subcutaneous tissues and cut the suture close to the skin.

## **Complications of castration:**

**Dropping a bleeding stump:** If a stump is dropped before ligation or is bleeding after ligation, it must be retrieved. If it can't be retrieved before it retracts into the abdomen, a paramedian incision should be made next to the prepuce and the stump should be retrieved in the abdomen. **CARE MUST BE TAKEN TO AVOID PUNCTURING OR INCISING THE BLADDER!**

**Post operative abdominal bleeding:** A patient which is not recovering well or has pale mucous membranes should be suspected of having an abdominal bleed. Since canine castrations can bleed significantly in a short period of time, it is generally recommended that exploratory surgery be performed to ligate the vessels if post-operative abdominal bleeding is detected. Ultrasound of the abdomen usually provides a definitive diagnosis.

**Scrotal Hematoma:** A scrotal hematoma can occur whenever there is excessive subcutaneous bleeding. Ensuring cranial placement of the incision helps significantly in avoiding hematomas. Good subcutaneous closure and pressure applied to the incision to control any post operative bleeding will decrease the occurrence of scrotal hematomas. Some scrotal swelling post operatively is expected, but the scrotum should not be larger than it was pre-operatively. If a scrotal hematoma does occur, it can usually be managed conservatively. The patient will need an E-collar to prevent further trauma to the area. Pain medications are usually necessary. Systemic antibiotics should be used if the incision is pulled apart by the edema. The patient should be kept as quiet as possible. If the scrotal hematoma does not begin to resolve within a few days or if the patient is uncooperative, a scrotal ablation surgery may be performed.

**Infection:** Infections are usually caused by patients licking the incision site. This should be prevented with an E-collar or other restrictive device. **The incidence of post-operative licking can be greatly reduced by careful clipping and prepping of the surgical site. This is a very sensitive area and rough clipping and prepping will irritate the area and cause the patient to begin licking.** If clipper burns or prepping irritation are noticed after surgery, an antibiotic/steroid cream applied to the area in recovery can help alleviate the discomfort. Patients with infections should be placed on systemic antibiotics and may need the scrotum lanced to allow drainage.

## **Feline Closed Castration**

Surgeons scrub and glove but do not gown for this procedure.

The hair over the scrotum and around its base is plucked or clipped and surgically prepped. A circular drape is placed over the scrotum. A testicle is grasped with the thumb and index finger of the non dominant hand on either side of the testicle and the scrotal skin over the testicle is incised with a blade to the level of the tunic. Once the incision is large enough, the testicle is "popped" out. Using a gauze sponge wrapped around the cord at the base of the testicle, the scrotal skin and fascia is "stripped" from the tunic toward the cat. This will need to be done vigorously for adult cats, delicately

for kittens. Try to accomplish this with one “wipe” and then just steady pressure pushing the cat away as you pull the testicle toward you. You will usually feel a distinct tear or release. Once 2-3 centimeters of cord is visible, a mosquito hemostat is used to tie an overhand knot in the cord. The testicle is cut off with a blade right next to the clamp, and the loop of cord is slipped off the end of the hemostat finishing the knot. The knot is then tightened- first with the thumb and index finger pushing the knot cranially toward the cat, then with the thumb and index finger stabilizing the knot while the clamp is directed firmly in all directions. Once the knot is sufficiently tight, the stump is returned to the scrotum. Lifting the cut edges of the scrotum with your fingers causes the stump to retract through the incision.

The process is repeated for the other testicle.

**Complications:** Considering the lack of sterility of most cat castrations, there are surprisingly few complications.

**Dropped Vessel:** The vessels of cats recoil when ripped. This often causes them to stop bleeding on their own. It is rarely necessary to open the abdomen and retrieve a dropped bleeder. The cat should be kept quiet, monitored closely, and placed on IV fluids if necessary.

**Post Operative Bleeding:** Bleeding observed in the cage after surgery is usually from the scrotal skin. This is generally a problem with large, older males. Pressure applied to the scrotum in recovery will decrease the incidence.

**Infection:** Infection is rarely a problem, but if it occurs, it should be treated with systemic antibiotics.

**Protrusion of tissue from healed incision site:** This can occur if tissue is left protruding from the incision after the stump has been released. After castration, the edges of the scrotum should be lifted to allow the tissues to retreat inside. If any tissue does not retreat inside the scrotum, it should be removed. Once the incision has healed around a protruding piece of tissue, the incision must be re-opened and the devitalized tissue amputated.

### **Feline Declaw (Onychectomy)**

The correctly performed feline declaw involves complete removal of P3. Leaving any portion of P3 risks regrowth of claw and long-term discomfort for the cat.

A tourniquet is placed on the forearm distal to the elbow to avoid injuring brachial plexus nerves. The tourniquet should be in place no longer than 20 minutes. The hair is not clipped as it is impossible to do an adequate job. The feet are prepped with alcohol. The surgeon scrubs and gloves but does not gown for this procedure.

The amputation of P3 may be performed by either the dissection technique or the nail clipper (Resco) technique. Either is acceptable. The dissection technique takes longer to become proficient at and has a greater risk of lacerating the pad skin, but is unlikely to leave fragments of P3. The Resco technique is faster for inexperienced surgeons and with care taken to inspect the amputation site, there is little risk of leaving a fragment of P3.

For the dissection technique, the nail is grasped with fingers or Allis tissue forceps and a blade (#12) is used to cut along the joint space from dorsal to ventral. The skin, collateral ligaments, deep digital flexor tendon are incised. Care must be taken to follow the ventral surface of the flexor process cranially to prevent incising the skin of the pad. The pad can be accidentally incised quite easily as the blade slices through the flexor tendon and then slips straight down and incises the pad resulting in a painful and slow-healing wound.

The Resco technique is performed quickly and easily with a little practice. The Resco trimmers are positioned over the claw so that the curved handle is toward the cat. This allows visualization of the cutting blade. The loop of the Resco is placed in the dorsal joint space by flexing the claw. Once this achieved, close the blade gently on the ventral surface of the claw and pull the claw upward. The idea is to get the blade of the Resco to fall into the ventral joint space while the blade retracts the skin of the pad caudally and ventrally off the flexor process. When the blade drops into the ventral joint space, an obvious indentation in the skin should be visible. Once the Resco is in position, close the blade completely to amputate. With the blade closed, tear any remaining soft tissue free. Be sure to tear in a distal direction. If a small amount of skin does not get cut, use a blade to excise it and free the claw.

Once the claw has been removed, spread the skin edges and inspect the incision. The smooth end of P2 should be readily visible. Just ventral to P2, the cut end of the flexor is visible when the pad skin is retracted. A mosquito hemostat should be run along the edge of the tendon to “feel” for bony fragments of P3. If fragments are found, grasp them with the mosquito hemostat and either tear them free or dissect them out with a blade. For large cats cautery may be used on the incisions to control bleeding once the tourniquet is loosened.

A pressure bandage is applied to each paw before the tourniquet is removed. A non-stick pad is placed across the end of the foot after making sure the edges of the incisions are covering the ends of bone. Cast padding is then applied to hold the pad in place and provide padding. The cast padding is spiraled up the leg to just below the elbow. The bandage should be laid as flat as possible and should be tightest at the paw and slightly looser as it moves up the leg. This is a pressure bandage so we would like pressure! Vet wrap is placed over the cast padding with firm pressure- greatest at the paw and slightly less as you move up the leg. The Vet wrap is firmly anchored to the hair with tape once surgical gloves have been removed. It is important that the bandages be secure

as they may be severely tested in recovery, and the cat will be much less cooperative once it is awake!

The pressure bandages should stay in place for a minimum of 6 hours. If the bandages are removed and the cat is still bleeding, the bandages must be replaced. Ideally, the bandages will be removed the following morning. The cat should be observed for bleeding at least 15 minutes following the removal of the bandages.

Clients should be advised to replace the litter in the box with shredded newspaper, newspaper pellets, or sawdust pellets for one week. It is also a good idea to advise confinement to a small, easily cleaned area (such as a bathroom) for a day or two since there may be some mild bleeding.

#### Complications:

Considering the crudeness of the declaw procedure, it is surprising but true that most cats heal uneventfully. Some possible complications are outlined below:

**Persistent Bleeding:** Most cats will not require a pressure bandage beyond the first night after surgery. If the bandages are removed and bleeding occurs, the bandages should be replaced for another day. Using cautery for large cats will help prevent this from occurring.

**Persistent Pain:** Owners should be advised that some pain is expected for up to 6 weeks after surgery. This will be more obvious in large cats. If a cat shows persistent lameness in one paw or is tender in both paws beyond 6 weeks and the incisions appear to be well-healed, a radiograph should be taken to look for fragments of P3.

**Accidental amputation of P2 or part of P2:** While we would prefer to amputate just P3, the partial or complete amputation of P2 should not cause a problem. If part of P2 is amputated, be sure there are no sharp fragments on the cut edge. The Resco trimmers can be used to remove sharp fragments if present.

**Protrusion of P2 from the incision:** If there is inadequate skin to cover the end of P2 at the time of the surgery, then part or all of P2 must be amputated to allow the skin incision to close. If the cat is excessively active or licks excessively after the surgery, the skin edges may open and allow P2 to become exposed. This is evident upon examination of the paw. If this occurs, then P2, or at least the exposed edges of P2, must be excised and the skin edges should be apposed with skin sutures to prevent it from happening again. Systemic antibiotics should be administered.

**Infection:** Infections should be treated with systemic antibiotics.