

## **Preventing and Managing Spay Neuter Complications**

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### **Introductions**

Complications are always a possibility in spay/neuter surgeries. Most complications can be avoided by certain practices. Prevention of complications is always the goal, but when complications occur early recognition and effective management of problems are the keys to ensuring excellent patient care and successful patient recovery. The most common complications are hemorrhage, pain, swelling, and surgical dehiscence.

### **Hemorrhage**

Hemorrhage is perhaps the most common complication of ovariohysterectomy and can occur from many different sources: subcutaneous tissue, rectus abdominis muscle (if you cut muscle fibers), ovarian pedicles, uterine vessels, broad ligament and, unfortunately, from structures that should not even be involved in a spay (spleen, mesentery, bladder). Obviously, prevention of hemorrhage is much better than controlling hemorrhage once it has occurred. To avoid inadvertent trauma to abdominal organs while entering the abdomen of the cat, the puppy and the adult dogs (if you do midline approaches in the adult dog) elevate the linea alba, hold the scalpel parallel to the abdominal wall with the sharp edge of the scalpel blade facing up. Plunge the scalpel into the linea and lift up. This approach avoids any downward movement of the scalpel that could inadvertently cut the spleen, intestines, mesentery or urinary bladder. If you do paramedian approaches in adult canine spays, after separating the fibers of the rectus abdominis muscle elevate the peritoneum before cutting with scissors. Again, this technique prevents inadvertent trauma to abdominal organs.

Splenic lacerations caused by too aggressive abdominal entry or inadvertent trauma with a spay hook can be managed by carefully suturing the splenic capsule using 4-0 absorbable sutures with a taper needle in a simple continuous pattern. The splenic wound is then covered with an absorbable hemostatic sponge. When suturing the capsule, you must take extreme care to prevent making the splenic laceration worse. The splenic capsule is easily torn so you need to be very careful when placing sutures.

Bladder lacerations caused by aggressive abdominal entry can be managed by suturing the bladder wall with 3-0 absorbable sutures in a simple interrupted or simple continuous pattern.

Mesenteric lacerations involving mesenteric vessels are managed by ligating the damaged vessel(s) and suturing the tear in the mesentery with 3-0 or 4-0 absorbable suture in a continuous pattern. If you ligate one or more mesenteric vessels you must try to determine the viability of the involved intestines prior to abdominal closure. Loss of intestinal viability will necessitate an intestinal resection and anastomosis. Generally, if only one mesenteric vessel is involved collateral circulation is sufficient to maintain intestinal viability.

To prevent hemorrhage from the ovarian pedicles in the dog, I recommend a single ligature placed securely. The critical factor here is making sure that the ligature is several millimeters away from any crushing instrument (hemostat or Carmalt). Use a three-clamp technique placing the first hemostat (or Carmalt) most proximally and only closing it 1 click of the ratchet. Place the second hemostat several millimeters distal to the first allowing enough separation that the ligature will crush the pedicle completely when ligating the ovarian vessels. Close the second hemostat two clicks of the ratchet. A third hemostat is placed between the ovary and the uterine horn and closed 3 clicks. The single ligature is controversial, but one tight secure ligature is all that is needed. Ligatures can be tied with a square knot, a surgeon's knot, or a Miller's knot depending on the size of the pedicle and the preference of the surgeon. Of these, the Miller's knot is the most secure. Ovarian pedicles in the cat can be securely "ligated" using the Pedicle tie.

Ligation of the uterine body can best be accomplished with a single Miller's knot placed without placing any hemostatic clamps on the tissue.

If an ovarian pedicle tears, retracting back into the abdominal cavity prior to ligation, you must retrieve and ligate the pedicle. Using the "biological retractors" improves your ability to find the bleeding pedicle. If the right ovarian pedicle is bleeding find the descending duodenum and reflect it to the left exposing the caudal pole of the right kidney and the right ovarian pedicle. If the left ovarian pedicle is bleeding find the descending colon, reflect it to the right exposing the caudal pole of the left kidney and the left ovarian pedicle. The safest way to exteriorize a bleeding ovarian pedicle is to reach in with two fingers, grasp the pedicle and exteriorize it. Once the pedicle is exteriorized you can place two hemostats and ligate in the crushed area of the most proximal hemostat. Remember the ureters are just deep to the ovarian pedicles so reaching into the abdomen and clamping a bleeding ovarian pedicle with a hemostat

can cause injury to, or even result in ligation of, the ureter. With some experience, you don't even have to visualize the ovarian pedicle. You can reach into the abdomen, palpate the caudal pole of the kidney and palpate the ovarian pedicle just caudal to the kidney.

Prevent hemorrhage from the broad ligament by carefully evaluating the size of any vessels in the broad ligament prior to incising or tearing the broad ligament. Any vessels of substantial size should be ligated prior to cutting or tearing the broad ligament.

Ligation of the spermatic cord in the puppy or the cat is performed using a cord tie or figure eight knot in the cord.

Hemorrhage from a castration is generally due to insecure ligatures. The Miller's knot is an excellent knot for the ligation of the spermatic cord in adult dogs. If performing closed castrations, I recommend the placement of one ligature using a Miller's knot on the spermatic cord of the adult dog if the dog weighs under 18 kgs (40 lbs.). In dogs, greater than 18 kgs place a ligature with a Miller's knot proximally and a transfixation ligature distally. Hemorrhage from capillary bleeders in the scrotum can best be managed by: use of a splash block of 9 parts lidocaine and 1 part epinephrine, the use of a cold pack on the incision site during recovery or the placement of a temporary (only about an hour) scrotal wrap. Failure of ligatures on the spermatic cord can result in significant hemorrhage. If caught early enough it is almost always possible to retrieve the spermatic cord before it retracts into the abdomen. Extending your incision, either scrotal or prescrotal, and digital palpation will almost always reveal the spermatic cord. The cord is then retrieved and re-ligated. If hemorrhage occurs after the cord has retracted into the abdomen, diagnosis is much more difficult and correction requires entry in the abdominal cavity for repeat ligation of the cord.

### **Dehiscence**

Perhaps the most devastating complication of an ovariectomy, short of terminal hemorrhage, is an abdominal wound dehiscence. Management of an abdominal dehiscence, if caught in time, involves cleaning the exposed abdominal contents, repairing any damaged tissue, thorough lavage of the abdominal cavity, secure closure of the abdominal wall and skin and administration of antibiotics.

Prevention of abdominal dehiscence is a far better option than treatment of such. The critical elements for a secure abdominal closure are apposition of the edges of the holding layer, the ventral rectus fascia, and the skin in a manner that maintain blood supply and minimize self-trauma. The mistakes that are most likely to result in dehiscence are insecure knots, suturing body wall on one side of the incision to subcutaneous tissue on the opposite side, taking bites in the body wall that are too small and placing sutures too tightly in the body wall. To prevent these, make sure that knots are true square or surgeon's knots. When tying, apply even tension to both the long and short strands of the suture and avoid any upward tension. Uneven or upward tension can easily turn a square knot into a slipknot. To ensure that you are opposing the linea alba or the rectus fascia you must have good exposure. Undermining slightly on either side of the linea alba on entry (in ventral abdominal midline spays) will give you clear visualization of the holding layers on both sides of the abdominal wall incision. Clean exposure of the rectus fascia (if you do paramedian entries into the abdomen) provides good visualization of the fascia as you close the body wall. Bites in the body wall, or rectus fascia, should be no less than 3 mm on both sides of the incision (I actually prefer them to be at least 5 mm on both sides).

A common mistake made in abdominal wall closure is placing the abdominal sutures too tightly. There is a real difference between ligating and suturing. Sutures tied too tightly, especially sutures that incorporate some of the rectus muscle compromise blood supply to the very tissue you want to heal, create increased pain and increased tendency for self-trauma. With increased self-trauma, there is an increased chance of wound dehiscence. Sutures should appose wound edges without strangulating tissue. A good technique is to place the first throw of the knot with only enough tension to appose the wound edges. The second throw should have the same amount of tension. This creates tissue apposition without compromising blood flow. The next four throws (depending on the suture material) should be pulled tightly creating a secure knot.

### **Ovarian Remnant**

An ovarian remnant occurs when ovarian tissue is left in the abdomen after an ovariectomy. To prevent ovarian remnants, make sure you have fully exteriorized the ovaries. Cutting the suspensory ligament, proper placement of the incision site, and positioning the animals with the front legs reflected along the side of the thoracic wall all assist in getting good exposure of the ovary. When placing hemostats (or carmalts) on the ovarian pedicle either fully visualize the ovary or have a thumb and index finger on the ovary so you can feel where the ovary ends and avoid clamping the ovary with your surgical instruments.

Always examine the transected tissue to make sure you have not transected the ovary leaving ovarian tissue with the pedicle.

If an ovarian remnant occurs you must surgically remove it. Performing the surgery while the animal is in heat will make locating the remnant easier. Use of the “biological retractors” for exposure and grasping with fingers are the best methods to expose and exteriorize the ovarian pedicles and find the ovarian remnant. Once the remnant is exteriorized, place two clamps proximal to the remnant, and ligate in the crushed area of the most proximal clamp.

### **Seromas**

A seroma is a collect of serosanguinous fluid generally in a subcutaneous pocket and is the result of excessive tissue trauma, excessive undermining of skin, and/or failure to adequately close dead space. Prevention is a matter of minimizing tissue trauma, minimizing undermining and effectively closing dead space.

Seromas are self-limiting and may or may not be treated. Drainage with placement of a belly wrap can be used. Or the seroma can simply be left to resolve on its own. The most difficult aspect of management of a seroma may be differentiating it from an abdominal wall dehiscence.

### **Pain**

The appropriate use of and suggested protocols for perioperative analgesia could be seminar all by itself. Suffice it to say, that perioperative analgesia is required in all surgeries. There are, however, several principles of surgery that can be used to minimize postoperative pain, and therefore reduce the amount of and duration of administration of analgesics. The use of small incisions and very gentle tissue handling resulting in minimal tissue trauma, both reduce postoperative pain. I believe that cutting the ovarian suspensory ligaments as opposed to tearing them also reduces postoperative pain, but research hasn't demonstrated that (yet). But perhaps the most critical technique in either creating or minimizing postoperative pain in suturing. Too often surgeons fail to recognize the difference between suturing and ligating. Many surgeons place wide bites of tissue on both sides of the body wall and then when they tie the suture they pull so tightly that they crush the tissue that is being sutured. The key principle to remember is that when ligating you are attempting to stop blood flow, when suturing you must ensure that blood flow continues. When ligating you want to crush the tissue, when suturing you simply want to appose tissue edges without crushing.

### **Conclusions**

Complications will occur. Prevention is always better than management. Meticulous tissue handling, secure ligatures, secure body wall closures and minimizing dead space will all help to minimize complications. But when complications occur, don't panic. Just work your way through the complication in a careful and logical approach.

### **Note**

All videos demonstrated during this presentation can be viewed or downloaded from:

<http://mymedia.msstate.edu/outputset.php?id=25524>