

SURGERY BASICS

The information presented here is not designed to be an all-inclusive course on surgery. There are numerous text books and web sites on surgery of small animals. Several are listed in the "References" section of these pages, with specific page citations. It is expected that all volunteers participating in surgery at HSVMA-RAVS clinics are familiar with basic surgical techniques and surgical anatomy.

The objective of this outline is to guide you in some aspects of spay/neuter procedures and general surgery that we feel are particularly important. The specific techniques listed are those that are used in HSVMA-RAVS clinics. All volunteers participating in surgical procedures at HSVMA-RAVS clinics must be familiar with these techniques. It is not that we think these are the only safe and effective approaches. You may have experience or training in other techniques that work quite well. However, in order to standardize teaching it is important that all volunteers know and utilize these specific techniques. Variations may be discussed with the veterinarian in charge at the time of the clinic.

If you plan to participate in surgeries at HSVMA-RAVS clinics you will be responsible for knowing all of the following information (including specifically referenced texts) and having practiced all the listed techniques until you are **proficient**. (This means that you can describe when, where and why it would be appropriate to use a given technique and perform the technique without prompting to a minimal degree of proficiency while wearing surgical gloves and maintaining surgical asepsis.) Surgeons are not born or hatched; they are trained just as one would train to acquire any manual skill; we expect that you will dedicate sufficient time prior to the trip to have the basics down so that you can build your skills from there. You will be tested on this information before you are assigned to clinic duties. If you have difficulty in accessing or learning this information you **MUST** contact Dr. Davis (edavis@ravsmail.org) **PRIOR** to attending the trip.

THE SURGICAL TEAM

Veterinary students assigned to surgery will work directly with a veterinarian on each case, assisting or performing various parts of each procedure as appropriate based on prior experience, preparation and patient status.

RESPONSIBILITIES OF THE SURGICAL TEAM

- Before the procedure, supplies are gathered (pack, suture material, blade, etc), the surgery table is set up and the patient is prepared
- The primary surgeon will perform the bulk of the procedure
- The assistant helps throughout the procedure by holding tissue out of the way, elevating the ovarian pedicle, getting instruments ready etc
- After the procedure, the surgery table must be cleaned and the area prepared for the next procedure, instruments must be washed and the surgical pack wrapped and autoclaved.
- Before the patient leaves the recovery area, the surgeon is responsible for writing a very brief surgery report to note areas of difficulty or complications encountered during the procedure

PRESURGICAL PREPARATION OF THE PATIENT

Hair Removal - Done at induction, before the animal is moved to a surgery table.

- Using a No. 40 clipper blade, the hair is first clipped along the same direction of hair growth, then again against the direction of hair growth. Clippers should be used gently, parallel to the skin.
- Hair is clipped in an area extending at least 10 cm in all directions from the planned incision.
- Loose hair is thoroughly removed with a vacuum before transferring the patient from the induction area to a surgery table.

Positioning

- Before beginning the skin preparation be sure:
 - The patient is stable in dorsal recumbency with the head toward the anesthetic machine and the head is resting comfortably on the table
 - Anesthetic tubing is properly connected and secure
 - Patient is at an optimal position for lighting and instrument access
 - Warming disks are placed if the animal is small or very young. Warming devices should be placed under a towel or other covering and should NEVER be placed in direct contact with the patient as serious burns can result.
- Limbs are tied to help stabilize the patient. In large, deep-chested dogs, it may help to cross the forelimbs, securing each tie-down to the opposite side of the table. Be careful not to over-tighten ties as nerve damage or other complications can result.

Skin Preparation - As soon as the patient is positioned on the table, a thorough skin prep is completed:

- Scrub skin with chlorhexidine scrub from the prep tray.
- Rinse with water containing dilute chlorhexidine solution (pale blue solution).
- Repeat both steps a total of 3 times *after* all gross debris has been removed.
- Begin each scrub in the center of the scrubbed area, over the planned incision site, and scrub in a 'bull's eye' pattern toward the periphery, *never* going back to the center with the same gauze sponge. The skin preparation should be thorough but gentle to avoid unnecessary skin trauma.
- The final application of chlorhexidine solution is allowed to remain on the skin.
- It is important that the skin preparation is started as soon as the animal is on the surgery table to allow for maximum scrub and contact time between antimicrobials and the skin.
- After skin prep is complete, finish securing legs and make final adjustments in lighting.
- Open pack and place blade and suture on sterile field after the patient is positioned and scrubbed.

Preparation of Surgical Team - Both the primary surgeon and assistant must be sterilely gowned and glove for all surgeries except uncomplicated cat castration in which only sterile gloves are needed.

- The primary surgeon should be scrubbing in as the patient is anesthetized and should be prepared to begin draping the animal as soon as the final positioning and patient prep is complete.
- The assistant surgeon will stay with the patient to help as needed with induction, transfer, positioning and prep, then scrub in and join the surgeon.
- HSVMA-RAVS clinics use Avaguard non-rinse hand scrub technique for aseptic preparation of surgeon's hands. This will be demonstrated during clinic orientation.
- If you are unfamiliar with techniques for surgical scrubbing or sterile gowning and gloving, consult a surgery text and practice a few times in before the clinic.

Draping - With the animal positioned and the skin prepared, the animal is ready to be draped:

- Drapes are in the surgery packs and are not fenestrated
- The drape is fenestrated after it is placed on the patient.
- There should be a continuous sterile field from the cranial end of the drape to the instrument tray (which is placed behind the patient).
- On large dogs a second drape may be required to cover chest or feet
- Drapes are placed in one motion and then either used, removed or more drapes added to achieve the desired effect. Once the drape is placed, it should not be repositioned toward the surgical site as this will carry contaminants onto the prepared skin.

BASIC SURGICAL TECHNIQUE

Incision

- Use the “finger tip grip” rather than the “pencil grip” for abdominal skin incisions. This allows for maximum cutting edge contact and pressure, making a straighter incision with less skin trauma.
- Use your free hand to spread skin to afford a smooth surface and tension while cutting.
- Keep the blade perpendicular to the skin and draw it along the line of the planned incision.
- Skin tension and blade pressure should be adequate to smoothly part the skin so that subcutaneous fat appears in the trough of the incision as it is made.
- Try to open the skin in one continuous smooth stroke. Making multiple lacerations traumatizes the skin and results in a jagged incision.

Hemorrhage control

- Female dogs in heat and some male dogs may have more skin hemorrhage than other animals.
- The assistant should be prepared with mosquito forceps and gauze to control hemorrhage that may obscure the surgeon’s view while the incision is made.
- Most ‘bleeders’ will stop with pressure from a gauze sponge. Blot; don’t wipe the tissue, as this disturbs new blood clots.
- With larger skin vessels mosquito clamps may need to be applied. This can only be done when the vessels can be seen. The surgeon holds the skin with thumb forceps. The assistant blots the blood that is obscuring the surgeon’s view. Then the surgeon places a mosquito forcep (“clamp”) on the offending vessel.
- Do not place clamps on large chunks of tissue or on the epidermis. This causes undue trauma and is ineffective at controlling hemorrhage.
- “Clamps” can be removed after several minutes or when hemostasis is achieved.
- Hemorrhage can always be controlled with pressure AND you cannot fix a problem that you can’t see. If you encounter abdominal hemorrhage:
 - **Do** put pressure on the area with gauze
 - **Do** ask for help in finding the problem
 - **Don’t** waste time wandering in the abdomen or trying to do an exploratory unsupervised
 - **Don’t** just hope things will get better on their own
 - **Don’t** panic

OVARIOHYSTERECTOMY TIPS

Locating the linea alba

- Make sure the patient is laying straight on the surgery table in dorsal recumbency. A little extra time making sure that the animal is positioned and stable will make things easier in the long run.
- Palpate the ventral midline. In most animals the aponeurosis of the external abdominal oblique can be palpated. Try to make your skin incision immediately over the linea
- The linea is wider and easiest to locate closer to the umbilicus (at the cranial end of the incision).
- Once the skin has been incised pick up the loose fascia and fat that covers the external rectus sheath with Brown Adson forceps and snip off this tissue with Metzenbaum or Mayo scissors. This will expose the bright white fibers of the external rectus sheath. The linea is at the confluence of these fibers as they travel cranially and medially on the rectus abdominus muscle.
- Removal of subcutaneous fat does not cause any more hemorrhage or ‘dead space’ than blunt dissection, and gives a clearer view of the rectus sheath and linea more efficiently.
- The linea should be located within 2-3 minutes after making a skin incision. If you have been unable to clearly identify this structure, ask for help right away. Failure to incise the linea will make the rest of the procedure more difficult.

Entering the abdomen

- Grasp the linea alba with rat toothed forceps and tent the body wall as much as possible. This is important as the spleen can otherwise be lacerated while entering the abdomen.
- With the cutting surface of the number 10 scalpel blade facing up, use the point of the scalpel to stab through the linea alba. This should be done about 0.5 cm away from the rat-toothed forceps which are holding the linea in a tented position.
- Have a blunt tipped instrument ready to verify that the abdomen has been entered. The assistant should be ready with instruments and anticipate the surgeon's next move.
- Once a small hole has been made through the linea alba into the abdomen, the incision can be extended using either scissors or a guarded scalpel.

Note on incision placement: Spay incisions are generally made midway between the umbilicus and pubis. In dogs the incision is made somewhat more cranial than in cats. It is CRITICAL that the umbilicus is clearly identified prior to choosing the incision site. Surgical patients must be clipped all the way to the xiphoid to insure that this important landmark can always be identified.

Note on incision size: While exposure of the ovaries, uterus, and cervix are important to a successful surgery, larger incisions do have a "down side". The longer the incision the greater the tissue damage (pain), the greater the likelihood of complications (dehiscence and wound infection), and the greater the surgery time (longer anesthesia and more opportunity for organisms to gain access to the abdomen). More experienced surgeons are able to make an incision further caudally. This allows a smaller the incision. If the incision does not allow adequate exposure, it can always be extended. A good rule of thumb for beginning surgeons is to start with an incision of about 2.5 finger widths in length for cats and small dogs. For medium-sized dogs use 3.5 finger widths and 4 finger widths for large dogs (60 lbs+).

Suture sizes and applications: All HSVMA-RAVS clinics use polidioxinone (Ethicon trade name PDS) or poliglecaparone (Ethicon trade name Monocryl) monofilament absorbable sutures with a swaged needle. The following table gives suture sizes used in various procedures.

	2-10 lbs	11- 20 lbs	20 – 40 lbs	40 lbs +
Dog Spay	2-0 (3-0 pediatric) 3-0 skin	2-0 linea alba 2-0 or 3-0 skin	2-0 linea alba 2-0 or 3-0 skin	0 linea alba 2-0 or 3-0 skin
Dog Neuter	3-0	3-0	2-0	2-0
Cat Spay	3-0 linea alba and skin			

Suture handling – The following techniques all have applications in soft tissue surgery and must be mastered before participating in surgical procedures at HSVMA-RAVS clinics. You should practice each technique until you can complete it without looking at your hands. First use a piece of string to "figure out" the sequence of hand motions required to tie the knot. Then use outdated suture, string or fishing line to develop skill and speed. You do not need to have a surgery lab to learn these. You DO need to practice. Practicing in distracting situations, such as while watching TV, is a good idea. We are serious about expecting students to be proficient and you will be tested!

These are knots you should be proficient at before participating in surgery:

- Square knot – basic knot for all ligatures and suturing
- Surgeon's knot – for knots being tied under tension
- Instrument tie – use of needle holders
- One handed tie or Two handed tie – you should be able to do at least one of these

These additional knots will be demonstrated at orientation:

- Instrument /hand tie – handy for working with monofilament suture with 'memory'
- Miller's knot – handy knot for ligatures under tension and in difficult to reach places

See *References*: Fossum-Common Suture Techniques – Page 49-59

Suture patterns – Suture patterns are more difficult to practice in vitro, as it is hard to reproduce the feel and texture of skin and other tissues. However, you should know and practice the following patterns on cloth, banana skin, cadaver skin or a suture practice model until you are comfortable with the steps in completing the pattern. You will be responsible for knowing:

- Simple Interrupted
- Simple Continuous
- Cruciate
- Ford Interlocking
- Horizontal OR vertical intradermal (subcuticular)

See References: Fossum - Common Suture Techniques: Pg. 49-59

Application of patterns:

Body wall closure – Proper body wall closure is essential to prevent dehiscence. The suture must be anchored in the external rectus sheath approximately 4-10 mm from the edge of the incision. Knots should be tied carefully, with 6 “throws”. The final “throw” should be ‘cinched’ tightly to prevent untying.

- Simple continuous body wall closure – Most commonly used to close linea and body wall. This pattern creates a good “seal”, has greater bursting strength than interrupted patterns, and is faster to complete. There is no evidence that it results in greater complications than interrupted patterns. Knots must be tied securely and tension must be repeatedly checked during suturing or gapping of the incision will result.
- Interrupted body wall closure – This can be done as simple interrupted or cruciate pattern. Sutures should be placed 5-10 mm apart.
- Important: Do not include fat or muscle in body wall closure. The external rectus sheath is the holding layer in all ventral body wall closures and it is imperative that this tissue layer is clearly visualized when closing.

Subcutaneous closure

- This layer is closed to decrease ‘dead space’ which can result in seroma formation and does not have significant “holding power”. It is not necessary in animals with minimal subcutaneous tissue, such as pediatrics.
- May be closed in a simple continuous, simple interrupted or cruciate pattern.
- We recommend that short incisions (< 6 cm) be closed with a cruciate or simple continuous pattern. Longer subcutaneous closures should be closed with simple continuous.
- Subcutaneous knots should be paced so that the knots are ‘buried’. This is easily achieved by starting the stitch next to the body wall (deep), exiting the fascia closer to the skin (superficial), then reversing the sequence on the other side of the incision (i.e.: superficial to deep). This leaves the free ends of the suture material below the subcutaneous fascia when the knot is tied and the knot ends up being covered. Subcutaneous sutures must not stick up through the skin closure, regardless of which skin closure technique is used.

See References: Fossum -Common Suture Techniques: Pg. 49-59

- Suture patterns for closure of the abdominal wall: Pg. 327-330

Skin closure - This is the layer that most novice surgeons have the most difficulty with. While we generally close skin with buried or intradermal sutures, making it unnecessary to remove the skin sutures after healing, there is nothing wrong with placing exposed simple interrupted, cruciate, or (in some cases) Ford interlocking sutures in the skin. If a buried pattern is to be used, the knots beginning and ending the pattern MUST be completely hidden by the overlying skin and the wound edges must be firmly opposed. Once you have mastered basic knot tying and suture patterns your biggest challenge will be burying knots on your skin patterns, practice this as much as possible. While we do use tissue glue, this compound is designed only to seal skin and is not a substitute for good suture technique.

See References: Fossum-Common Suture Techniques: Pg 49-59

Please refer to the following texts for the specifics on spay and neuter surgeries.

With minor variations HSVMA-RAVS clinics use the techniques outlined in Fossum's Small Animal Surgery text.

REFERENCES:

1. Bojrab, Joseph M. Current Techniques in Small Animal Surgery, fourth edition, Williams and Wilkins, Baltimore, 1998. SF991.C87 1997. ISBN 0-683-00890-0
Ovariohysterectomy: Pages 489-49
Suture patterns for closure of the abdominal wall: Pages 327-330
2. Fossum, Theresa Welch. Small Animal Surgery, Second edition, Mosby, St. Louis, 2002. SF911.F67 2002. ISBN 0323012388
 - a. Common Suture Techniques - Pages 49-59
 - b. Ovariohysterectomy and Orchiectomy : Pages 616 – 622. (Note: We use closed canine castration techniques and the "figure 8" knot for feline castration.)
 - c. Celiotomy of the dog and cat: Pages 255- 258. (Note: Though you will not be expected to do an abdominal exploration as described in Table 20-2, it is worth knowing this material. You will not be tested on it.)

Please read and learn these selections. You will be tested and we WILL expect you to know this material and have practiced the techniques.

COMMON MISTAKES IN SURGERY PRACTICE AND HOW TO AVOID THEM

- Proper grip of needle driver and thumb forceps . . . see above references and never allow yourself to practice with poor technique.
- Always clamp your needle fully in the driver.
- Always pull and check the tension of your closure pattern with every throw, especially on the linea, which should be firmly opposed but not crushed.
- Avoid excessive use of sponges to check for bleeding in the abdomen, abrasion of the peritoneal surface by surgical gauze is painful and creates adhesions.
- Procedures like finding the linea, entering the abdomen, breaking down the suspensory or removing the broad ligament require you to be concise and definitive in your manipulations. If you have done 3 maneuvers and not accomplished your objective - stop and get help. Trauma and complications result from multiple small or misplaced maneuvers.

GENERAL SURGERY REMINDERS

- Patient welfare ALWAYS comes first.
- Procedures will be assigned based on experience and skill level. You will not be asked to do anything for which you are unprepared and you will be well supervised. However, it is your responsibility to ask for assistance when needed and to honestly tell a veterinarian when you feel you are in "over your head".
- You are allowed a certain amount of surgical time. Think about what you want to work on. If it is decided student time is up, it is up, no matter where you are in the procedure.
- A good surgeon practices ahead of time and has a series of plans already in mind if things do not go as planned. You should run through the steps of a procedure repeatedly until you know exactly what to do next. Then start mentally practicing what you would do if something went wrong.
- Practice knot tying and suture patterns until they are spinal reflexes. When you have gotten to the point where you can tie knots without looking at your hands, you still need to tie about 500 more.
- You will have lots of supervision, and we will be right there to help and teach. However, you will get much more out of the trip and be allowed to do more if you have practiced ahead of time. Those who have prepared get a lot of responsibility and will learn much more. Those who have not practiced will spend a lot of time watching others. It is unethical to do surgery on a live animal without having done all the practice one can possibly do on a phantom.