Complications can be part of any surgical procedure, and spay and neuter are no different. The beginning of complication management is to know all of the potential complications and their causes. Only then can one make plans to avoid and/or treat the complications. With few exceptions, complications begin or are caused during surgery, but may not become apparent until the postoperative period, sometimes even weeks or months after surgery. This fact makes careful surgical technique all the more important, and the primary avoidance strategy.

OPERATIVE COMPLICATIONS

Hemorrhage

Hemorrhage can be divided into two categories; serious hemorrhage and continuous oozing. The former is usually caused by a failure of ligation, most commonly due to technical errors. The ligature must be 100% reliable in all situations. Measures that will help with this include:

1. Obtain adequate pedicle length
2. Place ligature far enough proximal to be able to cut off the pedicle at least 6 mm distal to the ligature
3. Proper suture size (too small may cut through the pedicle, too large may not enclose tightly enough)
4. Ensure that the second knot throw doesn’t loosen the first throw
5. Don’t rely on inspection/manipulation after ligation (tends to loosen the ligature, creates false sense of security)

The problem of oozing can be technical error in ligation but is more commonly patient related. Bitches in heat or recently in heat may ooze; estrogens may be at least partly responsible. Ingestion of anticoagulant rodenticides, aspirin, and several other drugs may result in bleeding; treatment is based on etiology. Certain breeds (especially Dobermans) are more likely to present with inherited disorders of coagulation (eg, von Willebrand’s disease). History will not always reveal these patients and screening (buccal mucosal bleeding time) should be employed when the index of suspicion for a possible bleeding disorder is high. Blood products should always be available in spay/neuter as in any other primary surgical practice (this can be achieved with blood on hand, or ready access to a donor).

Iatrogenic Ureteral Trauma

Iatrogenic ureteral trauma usually occurs during efforts to deal with a dropped ovarian pedicle, when the ureter is traumatized during attempts to grasp the ovarian artery. Although caused in surgery, this complication may not be apparent until later, when the patient re-presents with uroabdomen if the ureter has a leak, or lumbar pain in the event of ureteral stricture leading to hydroureter and hydronephrosis. In most cases, nephroureterectomy must be performed because the location of ureteral trauma is too proximal for neoureterocystostomy. In the event of a dropped ovarian pedicle, increasing the exposure, and availability of self-retaining retractors, can greatly improve visualization and help reduce the risk of this complication.

POSTOPERATIVE COMPLICATIONS

Dehiscence

Dehiscence most often seen secondary to self-trauma; dehiscence can have catastrophic consequences, although thankfully it usually does not. This complication is frequently (though not always) due to technical error, as a patient will usually leave a comfortable closure alone. Too-tight skin sutures are commonly to blame here; intradermal closure or very loose skin sutures should be used, and any suspect patient sent home in an e-collar, rather than wait for a problem. Sometimes, an otherwise adequate closure is stressed beyond the limits of tissue and/or sutures by an extremely active patient, and minor herniation or even more serious dehiscence can result. While the surgeon cannot control the patient’s behavior at home, good discharge instructions should specify limited activity for 2 weeks or until suture removal. More rarely, incisional dehiscence may result from severe surgical infection or impaired wound healing such as may be seen with Cushing’s disease or diabetes.

Incisional Infections

Of course surgical infections occur for a variety of reasons, some of which are not under the control of the surgeon (the patient that goes home to a filthy, wet environment, for example). Adherence to Halstead’s surgical principles is the best plan for avoidance of incisional infections. This does not necessarily mean gowning and full surgical regalia, however. Attention to the creation of a healthy surgical wound (gentle tissue handling, hemostasis, minimization of dead space, reduction of anesthetic and operative time, and use of only the minimum number of sutures of the smallest possible gauge) should be the focus. Even the areas not under the surgeon’s direct control should still be addressed in the discharge instructions (importance of clean, dry housing).

Reactions to Buried Sutures and/or Surgical Adhesives

These problems are best avoided by minimizing the amount of implanted foreign material. Intradermal sutures should be fine gauge and knots compact (avoid unnecessary use of extra throws) and deeply buried. PDS suture, while not particularly inflammatory, is very long lasting, and poorly buried knots often crop up later as suture granulomas. If a surgical tissue adhesive is
used, it should be restricted to skin only and a minimum amount used.

**Scrotal Swelling and Discoloration**
This is usually caused by oozing from small cutaneous or subcutaneous vessels rather than leakage from the testicular pedicle. Attention to hemostasis and subcutaneous closure, and postoperative exercise restriction (particularly for very active dogs) can help reduce the incidence of this problem. If the scrotum should begin to swell, cold compresses may help reduce the severity of the problem if applied within the first 48 to 72 hours; after that time, warm compresses should be used.

**Postoperative Vaginal Bleeding**
This is a fairly uncommon but potentially quite serious complication. Vaginal bleeding has been noted to begin anywhere from 4 days to 3 weeks after spay. Usually it is mild and self-limiting, but on rare occasion, it will become life threatening. What appears to happen in these cases is that the uterine body ligature erodes through the uterine vessel(s), leading to vaginal bleeding. Any serious vaginal bleed post-spay is an indication for abdominal exploration. The uterine stump is re-excised and double ligated with Miller’s knots. A two-pass uterine ligature (such as one of the modifications of the Miller’s knot) may reduce the risk of this complication when compared with a single-pass ligature.

**Sinus Tracts and Stump Granulomas**
These complications are created during surgery, due to poor aseptic technique, excess remaining stump tissue, or use of nonabsorbable ligature material. Occasionally a uterine stump granuloma can become so large that it causes fecal or urinary obstruction. Sinus tracts can develop with the use of nonabsorbable ligatures or the use of non-surgical ligating materials such as nylon cable ties. Treatment consists of exploration and correction of the cause.

**Ovarian Remnant Syndrome**
Except in the very rare case of accessory ovarian tissue (reported in cats), or exogenous sources of progestins, this condition is an iatrogenic issue. Failure to remove the entire ovary is a technical error and is avoided by obtaining adequate exposure of the ovarian pedicle and checking the removed reproductive tract for two entire ovaries. In the rare developmental anomaly of uterus unicornis, there may still be an ovary on the side lacking the uterine horn. This ovary may be located as far cranially as the diaphragm and is easy to miss if a complete abdominal exploration is not performed. Ovarian remnant(s) may cause signs of estrus beginning as early as 2 weeks to as late as years after ovariohysterectomy.

**Urinary Incontinence**
Urinary sphincter incontinence is a potential physiologic consequence of the loss of estrogens following ovariohysterectomy and may affect as many as 10% to 20% of spayed bitches. This condition, while not a true “complication” of surgery, is still an undesirable outcome and should be discussed with the clients before surgery. More rarely, adhesions may form between the uterine stump and urinary bladder and cause incontinence. The accidental placement of the uterine body ligature around the vagina and a ureter has also been reported to cause ureterovaginal fistula with ensuing incontinence.