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Small Mammal Essentials

Mini Series

Session Three: Common surgical conditions and the equipment you need

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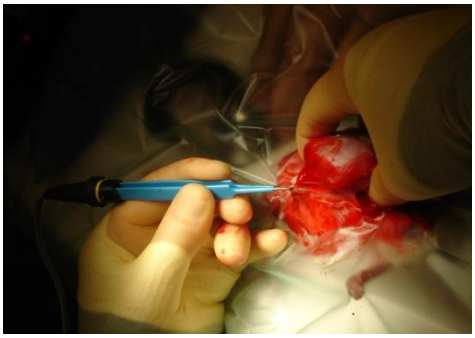

Session 3: Common surgical conditions and the equipment you need.

There are a number of important factors to consider when planning procedures on small patients. Firstly they have a higher metabolic rate and so nutritional and fluid support are critical and the methods which we can use in small mammals have been outlined before.

In addition surgical time must be minimised and blood loss reduced and so a number of important factors are brought into play to maximise the likelihood of success.

Ergonomics of surgery

These patients are small and so they need to be placed within reach of the surgeon. This means that although a standard theatre table (which is hopefully heated and can be moved up and down) is ideal, but the patient can often be placed in the centre at arms length. Ideally tables should be flat with no gaps in them as it can be easy to trap appendages of a small patient. This allows the patient to be positioned directly in front of the surgeon.

Surgical manipulation of the patient can also lead to significant shifting under the surgical drapes. This can lead to the loss of monitoring devices, the secure airway and cause a breach in sterility. Using micropore to secure the patient can help to avoid this, particularly if they are placed close to the edge of the theatre table.

The small size of the patient also means there is poor surgical tolerance of hand tremor and fine motor movements are a necessity. Standing and operating from your shoulders means that hand tremor and fatigue are quick to form and applying pressure to the patient accidentally can be fatal.

Sitting down whilst operating and placing the patient on the table in a similar position to a keyboard used for a computer and resting your wrists to the side of the patient greatly improves dexterity and minimises fatigue. Table and seat height must be adjustable to obtain the optimum position for operating. This should be set up accurately prior to draping. All small mammal procedures should be performed seated wherever possible.

Maintaining core body temperature and a sterile field can be challenging. Firstly the surgical site requires aseptic preparation. It is often impossible to obtain a wide area due to small patient size. Excessive clipping will lead to increased hypothermia. An alternative is to use Micropore to tape the fur around a smaller shaved area to reduce the risk of stray hairs contaminating the surgical field. Surgical preparations can be warmed to body temperature prior to use and the use of surgical spirit minimised.

Using towels, bubble wrap and silver foil on the patients extremities can also reduce heat loss under the drapes. Using clear plastic drapes offers two distinct advantages. Firstly the surgical field and the rest of the patient (monitoring devices, chest excursions) can be seen, but these drapes also provide far better insulation than cloth or paper drapes. They also do not allow wicking of fluids used for lavage or ascites for example and reduce further chilling by evaporative heat loss. It can be expensive to obtain large clear plastic drapes so a simple solution is to use paper drapes towel clamped together around the patient to provide a large sterile area covering the whole theatre table and then an adhesive/clear drape over the patient centrally. Turkey roasting bags (Made of heat resistant nylon) have been used by a number of individuals but they can be difficult to keep in place over the surgical field due to their tackiness.

This allows the sterile surgeon to rest their forearms and wrists to the side of the patient without breaching sterility and improving ergonomics.

Improving visual acuity

Magnification of the surgical field can enable microsurgical techniques to be used. While operating microscopes are often used in ophthalmic surgery exotic animal surgeons are rarely operating in a singular plane, but in a small range (typically 1 – 2 cm depth of field). As a result magnifying surgical loops such as those offered by Surgitel Systems (http://www.surgitel.com) for example offer a small magnification (2.5x) for a greater depth of field. Spatial awareness is important and using the loupes for routine procedures is advised.

Pupillary dilatation markedly improves visual acuity and placing a focal light source onto the surgical field, whilst paradoxically turning off general illumination is an easy way to improve surgical technique. A head torch providing a focal source or a light source attached to the surgical loops enables more accurate placement of the focal beam. These can often be focussed or more diffuse depending on the circumstances.

Anaesthesia of the patient can often be maintained using a focal source (in many cases the theatre lights are used as an uplighter).

Instrumentation

Fine surgical technique requires fine instrumentation. Microsurgical instrumentation offers advantages of counterbalancing, a rolling motion to move the instrument and longer handles. Although microsurgical equipment is lovely to use this is often unnecessary.

The use of fine tip instrumentation (such as used for cat speys or ophthalmic instrumentation) is often adequate, although instruments with slightly longer handles will improve ergonomics. Locking devices can be of limited benefit, as there will always be instrument movement associated with locking and unlocking the instrument, which can lead to tears in friable tissue.

Reducing the size of surgical incisions is also important as this will reduce heat loss but also reduce the time to close the patient.

A series of atraumatic self retaining retractors can be useful, examples include the Heiss or ALM designs. The lone star retractor (https://www.coopersurgical.com) is a popular choice, but care is needed when placing the stays as the needles are sharp and can lead to iatrogenic trauma. Sterilising cotton buds in packs of ten is probably one of the most useful tips. These can be dampened in sterile lavage fluid (all swabs should be to reduce tissue trauma) and then wrung out. These can be used as gentle retractors, for tissue manipulation and to apply haemostasis. The end of a cotton bud holds approximately 0.1mls of fluid (if pre moistened and wrung out) or 0.2mls from dry. Generally wooden q tips have longer handles, but cost more.

Haemostasis

Blood loss is of critical importance and an accurate measurement should be made of any loss during surgery. Using cotton buds can help to keep close track of blood loss. Placing fine suture material using traditional techniques can lead to delays in haemostasis and in some cases it is impossible to place sutures.

One of the commonly used systems in exotic animal surgeries is a stainless steel clip system. One such system widely available in Europe is that offered by Vitalitec Soft Loading System (SLS) clip systems (http://www.surgitech.co.za). These clips circumferentially close on vessels and have grooves to increase grip onto tissue.

Electrosurgery and radiosurgery are other options in common use. Generally bipolar systems are used to control focal points of bleeding, although monopolar systems can be used for cutting tissues. The disadvantage of using a monopolar system is achieving sufficient contact with a small patient and as a result the Ellman radiosurgical units are often preferred (http://www.ellman.com). Other systems such as the ligasure (http://www.medtronic.com/covidien/products/vessel-sealing) are also popular but can be cost prohibitive.

Common surgical procedures

Adrenalectomy

Surgical removal of the left gland is fairly easy. This lies in a large fat pad cranial to the kidney. The right gland is in a fat pad, lies more cranially and is under a lobe of the liver (the caudate lobe). Hemostatic clips are usually required to facilitate removal of the glands. The phrenicoabdominal vein courses over the gland and must be ligated to obtain access. The right gland is closely associated with the caudal vena cava and in aggressive cases can invade the vessel. Ligating clips are required to carefully remove the

gland and can be placed on the vessel wall to partially occlude this vessel. Sterile cotton buds can be used to ensure hemostasis is successful. Cryosurgery has been used to ablate glands as an alternative. Radiosurgical instruments should not be used as thermal damage to the vena cave is possible.

Bilateral disease is present in many cases and many surgeons would prefer to remove the left (or the worst) gland and medically treat the remaining one. Partial removal is another option to reduce the risk of hypoadrenocortism.

Subsequent medical therapy is often used alongside a subtotal adrenalectonmy and desorelin implants are the agent of choice. Monitoring the surgical sites with ultrasound is wise to detect regrowth.

Complications of adrenal gland disease

In males one of the potential complications is prostatic cysts. These can get very large and can lead to stranguria and dysuria as a result. Medical and surgical treatment of the adrenal gland disease may not lead to resolution and surgical therapy is indicated. These can be identified on ultrasound. The fluid contents can be green, viscous with particulate matter. Small cysts can be aspirated at surgery and this may be all that is required. Ablation of the cysts followed by omentalisation (where the omentum is sutured into an incision into the cyst to allow drainage) may have to be performed in severe cases. Secondary infection and abscessation is also seen. Marsupialisation of the cyst to the bladder has also been performed to facilitate long term drainage.

Insulinomas

The ferret pancreas can typically have areas of nodular hyperplasia and as a result ultrasound and even direct visualisation during surgery can be of limited benefit as it is impossible to differentiate nodular hyperplasia from insulinomas based on their surgical appearance. A partial pancretectomy and removal of any nodules are important when performing surgery. Nodules may appear slightly ‘pinker’ than the rest of the tissue. Palpation is important. The main body of the pancreas cannot be removed as the pancreatic ducts exits from here and typically it is the left or the right branch that is removed. Hemostatic clips or monofilament sutures can be used. Nodulectomy can easily be performed using miniature Volkmann spoons. The omentum should be sutured to prevent herniation. Histopathology of any pancreatic tissue removed is important to confirm the diagnosis.

There is a risk of insulin release and a pancreatitis after surgery and many surgeons prefer to give some glucose saline during recovery and dexamethasone as well (which also helps prevent a hypoglycaemic episode).

Splenectomy

Enlargement of the spleen is a frequent finding on clinical examination of ferrets and is usually benign extramedullary haematopoiesis. However other conditions can occur and include lymphoma, abscessation, haematoma. Splenectomy can be performed using hemostatic clips or monofilament suture material. These should be placed close to the spleen to reduce the risk of damage to the pancreas or stomach.

Ovariectomy

Is commonly performed in the laboratory setting but is equally importance clinically to prevent mammary tumours in rats and cystic ovarian disease in guinea pigs. This is usually performed on 12 week old animals. The surgical approach is the same for both species. A bilateral surgical approach is taken with the animal in ventral recumbancy with the thorax elevated. The surgical entry point to the body cavity is a 5 mm behind the last rib and 5mm lateral to the vertebral column. The distance is larger in juvenile guinea pigs (1cm). This entry point is typically caudal to the kidney and dorsal to any of the gastrointestinal tract. The incision size is up to 1 cm in length and is generally vertical in orientation. Forceps can be used to gently ease out periovarian fat and then the proximal oviduct and ovary are easily identified. Monofilament suture material or ligating clips can be used to remove the ovary. PDS is used to close the body wall. The process is repeated on the other side and the surgical wounds can be closed with tissue glue.

Ovariohysterectomy

If reproductive pathology is suspected or confirmed on ultrasound then an ovariohysterectomy should be performed. A ventral midline incision is made from the pubis to the umbilicus. Rodents have a periovarian fatpad that can be manipulated and will avoid damaging the ovaries and implant remnant ovarian tissue. Haemostatic clips may aid in the ligation of ovarian and uterine vessels. In guinea pigs and chinchillas it can be difficult to visualise the ovarian pedicles due to fat and the ovaries have a very short mesometrium caudal to the kidneys making it difficult to exteriorise them.

Castration

Rodents have open inguinal canals and retract the testicles. If the testicles are not visible in the scrotum push gently on the abdomen caudally until they appear. A bilateral scrotal incision is the most common approach. The closed technique leaving the tunica intact is preferred. A transfixing or circumferential ligature is placed around the spermatic cord. If the tunica is incised (open castration) ensure the inguinal canal is closed after ligating the blood vessels of the spermatic cord. The fat pad is closely associated with testis and will need to be removed if an open castration is performed as it is friable and difficult to reposition.

Mastectomy

Mammary gland neoplasia is common in rats. They majority tend to be benign (Fibroadenomas) but they rapidly in size. In mice and gerbils they tend to malignant. An incision is made over the mass and it dissected loose from surrounding tissue. Larger blood vessels are ligated and the smaller vessels can be clamped briefly. Try to minimise any ‘dead space’ is created to reduce seroma formation. The wound is closed with subcuticular sutures. Mammary gland tissue is extensive in rats and mice extending even to shoulders and flank making complete mastectomy impossible.

Ventral Scent Gland Removal in Gerbils

A common surgical procedure in gerbils is removal of the ventral scent gland. This is a simple procedure. The entire gland should be excised using a circumferential incision with a wide margin into normal skin. Haemostasis is important to prevent excessive blood loss. Closure using continuous subcuticular absorbable monofilament sutures is the preferred method.

Cystotomy

In guinea pigs urinary tract stones are common. These can occur in the renal pelvis, in the ureters, the bladder and in the urethra. Uroliths are usually of calcium carbonate and readily visible on radiography. Clinical signs are anorexia, depression, pain, urine staining/scalding, weight loss, anuria, and dysuria.

A clinical examination may reveal a full firm bladder if urethral obstruction has occurred. Typically obstruction occurs in males where the urethra narrows. In females the urethra progressively narrows so obstruction is less likely. A typical presentation is for the stone to become stuck at the point of exit from the urethra leading to marked discomfort. In these cases incising the distal urethra allows the urolith to be removed. Thankfully they can usually still urinate around the stone and rarely block.

Uroliths in the bladder can rarely be palpated. Enlarged kidneys may be detected if hydronephrosis has occurred secondary to obstruction. Plain radiography will usually reveal the discrete uroliths. It is common to detect calcium carbonate crystals or radiodense ‘sand’ in the bladder on radiography as an incidental finding. When performing a cystotomy it is not uncommon for the stone to roll caudally down the urethra. In these cases elevating the pelvis can aid visualisation or Volkmann spoons or forceps used to retrieve the stone. In males retrograde flushing with a catheter in the urethra can help. In females the urethra is sufficiently large for a solid crop tube to be passed to push stones cranially.