Nuts about Neutering

Surgical tips on desexing rabbits and guinea pigs

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INDICATIONS FOR NEUTERING

Neutering is important for many reasons to both the individual male and female rabbit and guinea pig and their owners.

1. Prevention of unwanted pregnancy
2. Prevention and or reduction of undesirable sexual behaviours, territorial marking (rabbits urine spraying) and aggressive behavior. This also allows for improved litter habits.
3. Social benefit- allows for companionship

Traditionally, desexing of males has been advised to prevent unwanted pregnancies and to reduce aggressive and territorial behaviour. It is equally, if not more important, to spay female rabbits and guinea pigs.

In the male rabbit, urine spraying and territorial marking generally commences around the age of 5-6 months. Often it is reported by owners that the male humans are the target of urine spraying by their free range house rabbits. Castration will decrease urine spraying and improve litter habits (essential for house rabbits). It will decrease aggression towards humans and with hutch mates, and allows for bonded pairs to be kept. It will also result in a reduction of undesirable sexual behaviours and it will decrease the risk of testicular cancer which is often seen at 6-8 years of age. Surgical treatment is recommended.

In the male guinea pig, neutering reduces the risk of faecal impaction between scrotal sacs which is very common in the geriatric male entire.

In the female rabbit, neutering also decreases aggression towards humans and hutch mates. Typically does can be more aggressive than their male counterparts. One of the main reasons for desexing females is that the incidence of uterine adenocarcinoma has been reported to reach 79.1% in female entire rabbits between 5-6 years of age. For this reason, neutering female rabbits is recommended ideally between the ages of 4-9 months old to prevent uterine cancer. The incidence of uterine changes is not affect by breeding status or history, however certain rabbit breeds: the French silver, Havan, Dutch and Tan, are more prone to developing uterine cancer.

Female entire rabbits are also predisposed to developing endometrial polyps/cystic hyperplasia, other uterine neoplasia (adenoma, carcinoma, haemangioma), pyometra and endometritis (with Pasteurella multocida and Staphylococcus aureous isolated commonly), and also pseudopregnancy.

In the female guinea pig, neutering reduces the risk of ovarian cysts and other reproductive disease. Previously unmated female guinea pigs over the age of 9 months should be neutered if there is any possibility of them becoming pregnant. Fusion of the pubic symphysis occurs at 6-9 months of age and dystocia is likely to result if pubic separation is inadequate during parturition.
Uterine adenocarcinoma in the rabbit

Presenting signs:
- behavioural changes
- aggression
- hair pulling
- inappetance
- weight loss
- urine scalding
- haematuria
- serosanguinous vaginal discharge
- respiratory difficulties
- abdominal mass
- sudden death

Uterine adenocarcinoma is the number one differential for any signs of illness in an entire female greater than 3 years of age. Diagnosis is made with an investigation employing abdominal ultrasound, thoracic radiography, and exploratory laparotomy!

Metastatic spread to the lungs, liver, brain, bones and skin is possible and 32% of cases also have mammary gland disease. Uterine neoplasia predisposes does to urinary tract infections.

In a 2010 study of uterine cancer in rabbits, 19% of rabbits that underwent ovariohysterectomy with clear radiographs preop, developed radiographic evidence of spread to the lungs after surgery and 27% of the 29 rabbits with uterine adenocarcinoma survived beyond 22-27 months after surgery.

Ovarian cysts in the guinea pig

Ovarian cysts are very common in reproducing and nonreproducing sows. Serous, follicular and parovarian cysts have been identified in 76% of female guinea pigs between 1.5 and 5 years of age. Cysts have been shown to form in guinea pigs as young as 10 days old and apparently are present in all guinea pigs over the age of 1 year. There is a statistically significant relationship between guinea pig age and cyst prevalence, and age and cyst size i.e. as guinea pigs age they get more and bigger ovarian cysts.

They may occur in one or both ovaries, but they occur most commonly in the right ovary. The ovary may have single or multiple cysts that range in size from 0.5 to 7 cm (average: 3 cm). The cysts are filled with clear liquid, appear to develop spontaneously, and increase in size as the animal ages.

Clinical signs may include:
- Large cystic ovaries are significant space-occupying masses. This can lead to pain-induced inappetence, anorexia, lethargy and secondary gut stasis
- Decreased fertility
- Bilateral symmetrical non-puritic alopecia of the flanks- not proven to be caused by cystic ovaries, but resolves after OHE and hormonal treatments.
- Abdominal mass
- Abdominal distension

Cystic ovaries are often associated with other associated issues such as cystic endometrial hyperplasia, mucometra, endometritis and uterine neoplasia.

Treatment options for ovarian cysts are: ovarioectomy, ovariohysterectomy, percutaneous drainage and hormone treatments (hCG, GnRH).

**REPRODUCTIVE ANATOMY**

**The buck and boar**

Male rabbits (bucks) and guinea pigs (boars) has typical testes and epididymis, however the inguinal canal remains open throughout life. This means that the testicles are free to move from the scrotum into the abdomen through the vaginal process because of a functional cremaster muscle. Both have large epididymal fat pads. In boars, the scrotum is best described as an appendix of the abdominal cavity through a wider inguinal canal. Large seminal vesicles and additional fats in the caudal abdomen of the boar partially occlude the inguinal opening, preventing scrotal herniation of abdominal viscera. With such open inguinal canals one might expect that hernia and intestinal strangulations would be common but this is not so, though bladder hernias have been documented.

Accessory glands include the seminal vesicles, bulbourethral glands, and prostate. Boars also have the coagulating gland. In boars, the seminal vesicles lie ventral to the urethra and extend into the abdomen which could be mistaken for uterine horns. Boars have an os penis bone and two horny styles that project off the penis.

**The doe and sow**

The female rabbit (doe) and the female guinea pig (sow) has typical ovaries, infundibulum and uterine horns, however does are unique in that they have two cervices that lead to each uterine horn. The ovaries are associated with the caudal pole of the kidneys and are embedded in fat. In the adult the ovaries appear as a mass of follicles. The suspensory ligament of the ovary is sufficiently long in the doe to permit easy exteriorization of the ovary, and the oviduct. This is unlike that in the sow where the ovaries are close to the dorsal wall of the abdominal cavity. The oviducts are long and convoluted and enter the long bicornuate uterus of the rabbit which are then connected through the two distinct cervical canals to the large saccular vagina. Unlike the doe, the sow has only one central cervix that separates the uterine body from its short vagina. The vagina is a bright pink and lies dorsal to the urinary bladder. It is quite long in the doe. A single artery and vein run along the entire length of the medial side of each ovary and uterine horn in the broad ligament. The rabbit has only minor anastomoses between the uterine and the ovarian vasculature while in the guinea pig the arteries and veins share many common associations. The suspensory ligaments are long making exteriorisation of the uterus
easy in the rabbit. The mesometrium is a primary storage site for fat in the rabbit and guinea pig, and so early speying is advised. In addition, the uterus and ovarian pedicle of the rabbit are more friable than in the cat or dog, so early spey (before 9 months) is advisable to avoid excess fat. In the mature female, the spey may be a more difficult procedure than initially anticipated.

The guinea pig has the unique presence of a vaginal membrane which seals the vaginal orifice except during estrus, copulation and parturition.

Rabbits have eight mammary glands along the ventral abdomen while guinea pigs have a pair of inguinal mammary glands.

**Determining gender:**

There is very little difference in the anogenital distance between the males and the females. Anterior to the anus is a second opening that conceals the vulva or penis. Slight pressure placed on the round preputial orifice will usually cause the penis to be easily everted in the buck and boar over 2 months of age, and in the female rabbit a triangular vulva with a slitlike orifice will be observed. It is more difficult to determine the gender in immature rabbits.

In buck and boar there are two obvious hairless scrotal pouches which contain large testicles which descend at approximately 10 weeks of age. There is one on either side of the rectal area for the buck.

The boar has anogenital region that looks like a dotted ‘i’; the dotted top is the prepucial opening that encloses the penis. The sow has an anogenital region that looks like a ‘Y’; the arms of the Y are grooves that surround the urethral opening. The straight portion of the Y runs from the vaginal orifice to the anus. The vaginal orifice is closed by a membrane except during oestrus and parturition.

**REPRODUCTIVE PHYSIOLOGY (in brief)**

Rabbits are induced ovulators and ovulation occurs 10-13 hours after mating. There is no regular estrous cycle but a period of receptivity every 5-6 days, and the ovarian activity is decreased with shorter days in late summer-winter period. In estrous the vulva becomes swollen and reddish purple colour, in anestrus the vulva is narrow and pale pink. The rabbit has a post partum estrus within 24 hours of kindling. The gestation period is 31-32 days (larger litters have shorter gestation periods than small litters). A fetus can be felt by gentle palpation between 12-14 days gestation. Parturition normally takes about 30 minutes, although kits have been reported to be born hours or even days apart. Kits are altricial with sealed eyelids and ear canals and weigh 40-50g. The doe nurses her kits only 1-2 times a day for 3-5 minutes.

Pseudopregnancy can be caused by infertile mating or the presence of a nearby male. It can last for 16-17 days. After this period she may pluck fur from her dewlap or abdomen to make a nest. During pseudopregnancy, the corpus luteum secretes progesterone which causes the uterus and mammary glands to grow.
Guinea pigs are polyestrous with an estrous cycle of 15-17 days. Estrous lasts for 8-11 hours, and the female displays lordosis, elevation of the rump and dilation of the vulva during this period. The vaginal membrane opens for about 2 days and thick mucus discharge can be seen. Ovulation is spontaneous and usually occurs about 10 hours into the cycle. A fertile post partum estrus last 2-10 hours after parturition.

**OPTIMAL TIMING FOR NEUTERING**

Rabbits and guinea pigs may be neutered as soon as they have reached sexual maturity, provided that they are in good health and body condition. Puberty generally occurs at 3-6 months old in rabbits, and 2-3 months old in guinea pigs. Males may be castrated as soon as their testes have descended. It is easier to spay female rabbits when they are less than 9 months old as they tend to have less abdominal fat. It appears that females start to lay down fat in the mesometrium after the age of 6-9 months. Some vets however, advise waiting until the female rabbits are slightly older as the uterus is larger and so easier to locate, and less friable. We recommend to spay at 4-6 months of age.

For obese patients, weight loss is recommended over at least 1-2 months to reduce the anaesthetic risk. This is even more important for obese female rabbits and guinea pigs as they may have abundant adipose tissue around the ovaries, uterine horns and associated ligaments complicating the routine spey procedure. Instruct owners to adjust the diet of the rabbit appropriately and to increase exercise levels to lose weight.

For patients where reproductive disease is suspected (eg uterine neoplasia, cystic ovaries testicular neoplasia), exploratory laparotomy for the females with a view to neuter is recommended if the patient is a good surgical candidate, and thoracic radiographs are negative for gross pulmonary metastasis.

**GENERAL PRINCIPLES WITH SMALL MAMMAL SURGERY**

- Fasting rabbits and guinea pigs is unnecessary prior to an anaesthesia as rabbits have an inability to vomit and a propensity to gastrointestinal stasis. Hay and vegetables supplied by the owners (a greens lunch box) is recommended to be available at all times for the rabbit and guinea pig in hospital both pre operatively and post operatively. They should be encouraged to eat as soon as possible following any procedure.

- Fearful rabbits may have increased catecholamine release which may compromise their anaesthetic safety.

- Rabbits have a reduced ability to deal with acid base imbalances. Rabbits are less able to compensate for acidotic states due to their limited ability to transfer H+ and HCO3 – ions between blood and urine and their glutamine deamination pathways only respond to falling HCO3- concentrations and not decreasing pH.
Rabbits and guinea pigs have a relatively small thorax and large abdomen. Elevating their chest is recommended so that the abdominal organs are not placing pressure on the diaphragm and causing a reduction in tidal volume, especially if placed in dorsal recumbency for a period of time. Bending the surgical table caudally in a slight reverse Trendelenburg position at 10-15 degrees helps to prevent this problem.

Due to their small size and high surface area:volume ratio, rabbits and guinea pigs are prone to hypothermia. Hypothermia prolongs recovery from anaesthesia. Warming (heat packs, heat mats, bear huggers, incubators) from the time of premedication is essential to prevent them from losing too much heat.

Rabbit skin is very thin, fragile and prone to clipper rash. Take care with clipping which is notoriously difficult. Very sharp clean clippers are required and it is essential to work slowly and patiently to remove the hair otherwise skin tears and clipper rash will occur. Delapitory creams have been used to remove hair in rabbits prior to surgery, but are apparently messy and do not give complete hair removal. Plucking has also been recommended by some authors but this also can result in skin trauma.

Don’t use towel clamps to clamp the drape to the rabbit’s skin- as their skin may rip. Instead use one towel clamp on the drape to act as a weight, or double sided tape to hold the drape in place.

Care also is required in abdominal surgery in the rabbit as they are very prone to post-surgical adhesions. Powder free gloves and minimal manipulation of the gastrointestinal tract will minimize adhesions and help prevent gut stasis. Choice of suture material is important to limit tissue reaction and cat gut is not advised because of the caseous reaction which may result. 3/0-5/0 synthetic absorbable monofilament sutures (PDS, monosyn) with swaged on needles are ideal. Adhesion formation potential in rabbits is reduced by use of smaller suture size.

During micturition, urine typically pools into the proximal aspect of the vagina before being voided to the outside. Expressing of the rabbit bladder prior to surgery is not advised. Urine may also move into the vaginal vault if the bladder is expressed prior to surgery, this would cause a greater risk for intraoperative contamination of the abdomen with urine.

Rabbit blood clots quickly. The blood volume of small mammals is approximately 8-10ml/ 100g bw and up to 10% blood lost is considered safe in relatively healthy animals. Remember, loss of >20-25% blood results in hypovolaemic shock.

Close monitoring by a vigilant veterinary staff is essential.

Keep anaesthesia time to a minimum to reduce the anaesthetic risk, and infection risk.

Know your anaesthetic drugs.
Rabbits:
Premedication: Sedation

- Glycopyrrolate 0.02mg/kg SC btw the shoulder blades + Fentanyl 0.025mg/kg IM + Ketamine 5mg/kg IM into the lumber muscles (ensure rabbit is securely restrained in a towel when administrating)
- Take around 10 minutes to take effect
- Lasts 15-20 minutes

Guinea pigs:
Premedication: Sedation

- Glycopyrrolate 0.02mg/kg SC btw the shoulder blades + Midazalam mg/kg IM + Ketamine mg/kg IM into the lumber muscles (ensure guinea pig is securely restrained in a towel when administrating)

Rabbit and Guinea pig Anaesthesia

- Preoxygenation important to prevent hypoxia.
- Face mask induce, and always try to intubate a rabbit- use uncuffed ET tubes. Induce and maintain on Isoflurane 2- 3% Turn down to 1- 1.5% when stitching up.
- Maintain Oxygen flow at 4L
- Depth of anaesthesia monitored via the ear pinch and limb withdrawal reflex.
- Monitor using a pulse oximeter, ECG, blood pressure...

Endotracheal intubation allows airway control, which is just as important in the rabbit as it is in dogs and cats. It is difficult in the rabbit in that the mouth cannot be open wide enough for visualisation of the epiglottis. Thus methods include ‘blind’ intubation, endoscopic intubation. Attempts can be made with the otoscope or laryngoscope to aid visualisation but it is very difficult to pass the ET tube concurrently. An oral examination is advised to ensure there is no food material, debris, oral disease etc that may compromise intubation.

A suitably diameter sized and length uncuffed clear plastic ET tube is selected:
- 2.0mm for rabbits approx 2kg
- 2.5 mm for rabbits approx 2.5kg
- 3.0mm for rabbits >3kg
- Measure the length of the tube required to reach the larynx, avoid endobronchial intubation.

We use the blind technique:
1. The rabbit is placed in sternal recumbency following induction with iso face mask, with the surgical nurse providing flow-by oxygen.
2. Use xylocaine jelly 2% to lubricate the ET tube and also provide topical local anaesthesia to reduce laryngospasm.
3. Support the head in extension with the left hand.
4. Gently advance the ET tube, held in the right hand, in the diastema towards the larynx. As the ET tube comes into contact with the larynx a small amount
of resistance may be felt. Withdraw slightly and hold the ET tube in this area and observe the rabbit’s breathing pattern- all the while listening and watching for condensation in the ET tube. An absence of breath sounds may either indicate apnoea or that the tube has been advanced into the oesophagus.

5. Attempt gentle advancement of the ET tube at inhalation through the larynx. Sometimes a mild axial twist of the tube may facilitate intubation. Avoid laryngotrauma with overzealous attempts. Work with the rabbit and observe mucous membrane colouring. Abort if the rabbit become cyanotic with apnoea, and provide oxygenation. Abort if the rabbit becomes light iso and oxygen via face mask for a couple of minutes and then reattempt.

6. If attempts are unsuccessful, try altering the angle of the head extension. I try to extend the head so that the larynx and trachea are almost horizontally aligned, while Narelle extends the head so that the larynx and trachea are almost vertically aligned.

7. Successful intubation often leads to the rabbit coughing mildly.

8. Once intubated advance the tube sufficiently so that the end of the tube lies just forward of the nostril to minimise dead space.

9. The ET tube can be held in place using Transpore tape encircling the end of the ET tube and then passed around the back of the rabbits’s head under the ears (avoid the eyes and whiskers)

Intubation is especially difficult in the guinea pig because the fusion of the soft palate to the base of the tongue creates only a small opening called the palatal ostium. This makes intubation difficult. Using an otoscope cone or endoscope to enhance visualization of the larynx is recommended especially in the guinea pig to avoid trauma to the palatal ostium. Use of a laryngoscope is possible in a larger rabbit, otherwise, blind intubation is employed. Use an uncuffed 1.0-2.5 mm internal diameter endotracheal tube in guinea pigs and rabbits less than 3 kgs. Placing the rabbit in sternal recumbency, extend the head with one hand so that the trachea is perpendicular to the surface of the table. Then advance the endotracheal tube into the trachea. A stylet (eg 5 or 8 F polypropylene urinary catheter) can be placed into the trachea as a guide and allowing the advancement of the endotracheal tube.

Surgical preparation
During surgical preparation of the surgical site, the over use of alcohols should be avoided. The alcohol clean should be done using a wipe. Excessive skin scrubbing should also be avoided.
Recommended surgical preparation protocol:
- Chlorhexidine scrub
- Chlorhexidine/Alcohol solution
- Chlorhexidine/Alcohol spray

**ORCHIECTOMY (CASTRATION)**

There are 3 approaches used for orchiectomy in rabbits and guinea pigs: scrotal, prescrotal, and abdominal. For the scrotal and prescrotal approaches, 3 different surgical techniques can be performed: closed, open with closure of the inguinal ring,
and open without closure of the inguinal ring and with preservation of the epididymal fat pad.

Remember, rabbits and guinea pigs have open inguinal canals throughout life, thus, an open castration has a theoretic risk of inguinal herniation.

**Advantages and disadvantages of the different techniques to castration**

<table>
<thead>
<tr>
<th>Open and Closed Prescrotal Techniques</th>
<th>Open and Closed Scrotal Techniques</th>
<th>Abdominal approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher closure of the inguinal ring</td>
<td>Difficult to ligate the cranial vaginal tunic</td>
<td>Difficult to close the inguinal ring</td>
</tr>
<tr>
<td>Clipping of the scrotum is not required</td>
<td>Clipping of the scrotum is difficult</td>
<td>Essential for a cryptorchid (intra-abdominal testicle)</td>
</tr>
<tr>
<td>Superior sterile preparation, and decrease wound infection risk</td>
<td>Increase surgical wound infection risk</td>
<td>Superior sterile preparation</td>
</tr>
<tr>
<td>Increased surgical time</td>
<td>Decreased surgical time</td>
<td>Increased surgical time</td>
</tr>
<tr>
<td></td>
<td></td>
<td>More invasive procedure</td>
</tr>
</tbody>
</table>

**Prescrotal Open with Closure of the inguinal ring**

The benefits of this technique include a higher closure of the inguinal canal and that this allows for more effective patient preparation. Clipping, scrubbing and draping is easier, which helps reduce the post operative incisional infections, especially in guinea pigs. As the surgical wound is situated closer to the abdomen it has less risk of faecal contamination than the scrotal approach. This is important as a guinea pig sits and walks low to the ground, and there is often debris retained within the boar’s periscrotal pouch, or impaction of the rectal pouch. In addition, clipping of the scrotum is not required which is great as the skin of the rabbit scrotum is extremely thin and friable. In the authors’ opinion, this technique is better tolerated by the lapine and cavy patient than the scrotal approach in regards to post-operative pain and suture irritation. A disadvantage is that this is slightly longer procedure then an open scrotal approach.

The buck/boar is placed in dorsal recumbancy. An area about 4 cm by 4 cm is clipped cranial to the scrotal sacs. An adhesive dressing can be used to minimize stray hairs in the surgical field, alternatively a border of double sided tape works well and this can also be sterilized and placed whilst in surgery to keep the drape in place.

If the buck/boar is too lightly anaesthetized they can retract their testicles into the abdominal cavity. Deepening the level of anesthetic and gentle abdominal pressure will allow the testicles to return to the scrotal sacs.

In this technique...

- The vaginal tunics are approached each in turn through a single ventral midline incision located cranial to the scrotum. In the guinea pig, prescrotal
incision separately over each cranial scrotal region on either side of the body of the penis is preferred by some.

- The vaginal tunic is bluntly dissected and isolated with a hemostat or ligature is placed around the cranial portion.
- The vaginal tunic is then incised caudal to the ligature and the spermatic cord may be grasped, and with gentle traction the testicle and epididymis exposed.
- Once the connective tissue adjuring the tail of the epididymus to the gubernaculum is broken down, then reverse the everted hemiscrotal sac.
- Place a double ligature is around the spermatic vessels. The testicle can now be removed.
- In order to prevent post-operative herniation, the vaginal tunic should be circumferentially ligated as far cranially as possible, incorporating the spermatic vessels.
- This is then repeated on the opposite side.
- The skin is then closed with subcutaneous sutures and then intradermal sutures 4.0 PDS ending with a small amount of tissue glue topically.

An alternative technique to close the inguinal ring is with a transfixing suture of the inguinal ring. This can decrease surgical time. When the epididymal fat pad is preserved, there are references that do not recommend closure of the inguinal ring.

**Open and Closed Scrotal Approach**

The scrotal approach requires the scrotum to be surgically clipped and prepared. Care needs to be taken to minimize cuts and clipper rash as this will increase the likelihood of the rabbit licking and chewing at the surgery site. The advantage of the scrotal approach is that it is a quicker surgical procedure.

In this technique...

- Two separate skin incisions are made over the left and right testes respectively.
- In the case of the open technique, the vaginal tunic is opened to permit extraction of the testicle and ligation of the spermatic cord. The tunic can then also dissected and ligated as far cranial as possible.
- In the closed technique, the testicle and associated spermatic cord are dissected free from the scrotum and removed as one. Again the vaginal tunic is ligated, incorporating the spermatic vessels.
- The skin need not be closed in either procedure.

The main problems with these techniques are the difficulty of cranial vaginal tunic ligation and the requirement to clip the scrotum. This increases the incidence of
trauma and subsequent infection. If the skin wound is closed there is often a buildup of fluid in the scrotal sac which can act as a nidus for infection.

**Abdominal Approach**

The abdominal approach is rarely utilized as it is a more invasive surgery and longer surgery. It is also more difficult to close the inguinal ring then in more traditional approaches. It is useful in the case of cryptorchidism. This condition is rare in the rabbit and often once they are anaesthetized and relax the testicle will descend more easily into the scrotal sac.

**Rabbit Ovariohysteriovaginectomy (Spey)**

- A ventral midline incision is made caudal to the umbilicus. The linea alba is visualized and careful incision is made ensuring you do not accidentally penetrate the thin-walled caecum, which lies at the ventral midline. A large incision (3-5cm long) should be made to minimize traction on the reproductive tract as it is particularly friable.
- The uterus is exteriorized (large and pink in adults, surprisingly small in immature females). Generally a spey hook or forceps are rarely required to locate the uterine horns. It may be difficult to visualise structures due to the large amount of fat surrounding the ovary. The ovarian artery is located within the large amounts of fat in the broad ligament and tends to approach the ovary from a more caudal direction. Dissection can be difficult and patience is often required due to the large fat pad. Haemostats are useful to blunt dissect through the fat. Always double ligate the ovarian artery using 3.0 or 4.0 PDS or a single firmly secured haemoclip. It is important to ensure the removal of the fallopian tube which is long in the rabbit.
- The uterine artery and vein are located within the broad ligament, often imbedded within the fatty tissue. These vessels tend to be large in mature rabbits and often double ligation with 3.0 PDS or a haemoclip are required for haemostasis.
- In younger animals a ligature around the vaginal body can incorporate these vessels.
- Place two pairs of haemostats caudal to the cervix in the vaginal body. Double transfixing ligatures should be placed in the proximal 1/3 – 1/2 of the vaginal vault. At this location there is no danger of accidently incorporating the ureters and caudal vesicular artery that supplies the bladder wall. It is important to oversew the vaginal stump in a continuous pattern if the vagina diameter is larger than 1cm to prevent urine leakage into the abdominal cavity.
- Alternatively, some surgeons place the ligature on the uterine side of the cervix, although this is more secure it does leave a small amount of residual uterus and with it a risk of uterine neoplasia developing in the future.
- A three layer closure is the normal technique employed by the authors. Simple interrupted suture pattern is used in the abdominal rectus muscular sheath. This is followed by simple continuous closure in the subcutaneous layer with 4.0 PDS, and then simple continuous closure in the intradermal layer with 4.0 PDS. A small amount of skin glue can be placed at the end in the intradermal layer to approximate the skin edges.
Ovariectomy versus ovariohysterectomy/ovariohysteriovaginectomy

Ovariectomy is often proposed for young rabbits due to the friability of the rest of the reproductive tract. Theoretically removing just the ovaries does leave the remaining uterus susceptible to infection and neoplasia.

While some may view this as a debatable subject as with other species, the current overwhelming evidence of uterine disease in entire female rabbits cannot be ignored. There is currently no published data on reduction of reproductive disease post ovariectomy in rabbits, and based on this the authors prefer ovariohysterectomy. Most older female entire rabbits we see already display pathological changes in the uterus, and as previously mentioned is a main differential for a clinically ill rabbit presenting with an abdominal mass or haematuria or gastrointestinal stasis.

GUINEA PIG OVARIECTOMY: Flank approach

In the guinea pig, the lateral flank approach is a good alternative to the traditional ventral midline approach for elective ovariectomy or ovariohysterectomy. ovariohysterectomy in the guinea pig can be challenging due to certain anatomic features, such as long and thin uterine horns, fragile salpinges and the exceptionally short ovarian suspensorv ligament. Contraindications for the lateral flank approach include suspected or diagnosed ovarian and/or uterine disease, though some vets have found this approach to be helpful to treat ovarian cysts if the cysts is small or has been previously drained.

The guinea pig is placed in ventral recumbency and the lumbar flank areas are clipped and prepared for aseptic surgery. A single dorsal midline incision may be made or, alternatively, a transverse incision can be made on each side. Through the dorsal midline incision, the skin may be shifted from one side to the other to gain access to each ovary. Following skin incision, blunt dissection is used caudal to the last rib at approximately the level of the third lumbar vertebra through the muscles of the body wall into the peritoneal cavity. The ovary is located within the fat at the caudal pole of the kidney and it is carefully exteriorized. No ligation is generally required as hemorrhage is generally minimal, however, a hemostatic clip or ligature may be placed on each ovarian pedicle. The muscle is apposed with 4-0 or 6-0 synthetic, absorbable suture material and the skin is closed in a routine manner.

Guinea Pig Ovariohysterectomy

The spey in a guinea pig is approached through a ventral midline incision (1-2 inches) is made from the umbilicus to 1/2- 1/3 of the way to the pubic bones. The incision is made in the uterine body cranial to the cervix similar to in the dog and cat.

While the spey is similar to the rabbit, it is more difficult for several reasons. As previously described, the reproductive tract is much more friable, especially the infundibulum and oviduct. The ovary is frequently surrounded by fat and may be difficult to see. The short ovarian suspensorv ligament makes it difficult to elevate the ovary away from the kidney. The gastrointestinal tract: large caecum, delicate
small intestines often get in the way. It is important not to nick the caecum or incorporating small intestines in ligatures. The gastrointestinal tract often needs to be moved to the side to allow access to the ovaries, so soak laparotomy sponges in warm sterile saline to keep the organs moist and protected.

**Closing the surgical incision**

In most routine procedures simple continuous intradermal and/or subcuticular sutures with 4/0-5/0 synthetic absorbable monofilament, are preferred in rabbits and guinea pigs because external skin sutures are often chewed and the use of Elizabethan collars is not recommended. The most important thing is that the stitches are secure but not too tight. Tight stitches and bunching of the skin will be a source of irritation to the rabbit.

Tissue glue is a useful addition to skin sutures. If using tissue glues then a small amount should be placed using the scalpel blade as a guider while opening the wound, attempting to place the glue between the edges of the incision rather than on the skin itself. Do not use large amounts of tissue glue as rabbits may chew on it.

External skin sutures are often chewed and many rabbits appear to find them irritating. Skin staples are not routinely used in rabbits as they can very effectively remove these as well. Ongoing issues are often encountered when skin wounds are ‘resutured’ with both infection and constant damage by the rabbit.

Elizabethan collars should not be placed on rabbits or guinea pigs post surgery. Not only does an Elizabethan collar increase their stress levels, and predisposing to the development of gastrointestinal stasis, it also restricts them from consuming their caecotrophs. Caecotrophy is an important component of the rabbits’ fiber digestion system and restricting this behaviour can result in gastrointestinal stasis. Utilizing these different skin closure techniques and maximizing pain relief prevents wound trauma.

**POST OPERATIVE CARE**

The recovery phase post operative is the most dangerous period. Constant monitoring by a vigilant nurse is required. Oxygenation until the rabbit can lift its head aids recovery and prevents hypoxia. Often rabbits become hypothermic during the general anaesthesia, and recovery in a warm environment eg incubator until rectal temperature of 37 degrees is obtained.

Warmed subcutaneous fluid (0.9%NaCl) 20ml/kg is administered post operatively to maintain hydration over the post operative period when it may not eat.

Post operative Analgesia:
- Meloxicam 0.5mg/kg SC provides analgesia for 24 hours.
- Buprenorphine 0.03mg/kg SC may also be used every 8 hours in hospital for additional pain relief.
Often meloxicam oral syrup is prescribed at a dose of 0.3mg/kg after feeding once daily for 3-5 days.

Offer hay and veggies to the conscious rabbit and guinea pig as soon as possible, and monitor for appetite. If anorexia is observed, commence nutritional support through syringe feeding Oxbow critical care. Review analgesia, as pain and stress of the surgical procedure can lead to the development of gastrointestinal stasis.

**Home Care Advice**

It is recommended to keep the rabbit and guinea pig confined inside in a warm draft free and quiet environment for 5-7 days after the surgery. This allows for the owner to monitor the patient’s appetite and defaecation and for pain. An example of a suitable environment is the laundry with no opportunities for the rabbit/guinea pig to jump up on to different levels, and a hay tray provided with clean towels as bedding to monitor for any bleeding. Increased activity, especially jumping and climbing, can increase the amount of scrotal swelling observed in the male. Although this is often seen to be increased in scrotal techniques compared to prescrotal surgery, significant swelling can be common in older, larger or active males.

It is best for owners to have on hand a packet of Oxbow Critical Care for supportive nutritional therapy if required in the post operative period. While companionship with a bonded friend reduces stress, neutered bucks should be separated from intact females for 5 weeks after neutering, as live sperm may still be present in the vas deferens and testosterone levels drop slowly.

Post operative recheck should be scheduled at 2-4 days to monitor the surgical wound.
REFERENCES


11. www.vin.com