



2017 RWAFF Conference

OWNERS STREAM

Welcome to what is now our 14th conference, which we are thrilled to be hosting in Scotland. This year we are once again pleased to be able to bring you a variety of lectures, all chosen carefully to keep you up to date with the latest research and techniques.

We welcome any feedback and any suggestions for next time. We are hugely grateful to our team of Educators today, and as ever, thanks to our sponsor, Burgess Pet Care.

Thanks therefore go to the following people:

Dr Richard Saunders
Dr Livia Benato
Dr Elisabetta Mancinelli
Dr Molly Varga
Dr Nadene Stapleton
Dr Brigitte Lord
Dr Twigs Way

Moreover, of course, huge thanks to all of you for coming along and supporting this event. It would not have been possible otherwise. We hope you have a useful and educational day.

Alan, Emma, Rae, Richard & Ros

Team RWAFF



CONTENTS

<u>Topic</u>	<u>Speaker</u>	<u>Page</u>
BIOGRAPHIES		3&4
CARE OF ELDERLY RABBITS	LIVIA BENATO	5
ABSCESSSES	NADENE STAPLETON	6-23
ANATOMY	ELISABETTA MANCINELLI	24-28
PAIN MANAGEMENT	MOLLY VARGA	29-30
RABBIT GARDENS	TWIGS WAY	31-34
STASIS – CAUSES,DIAGNOSIS & TREATMENT	BRIGITTE LORD	35-38

Richard Saunders BSc (Hons) BVSc MSB CBiol DZooMed (Mammalian) MRCVS

Richard qualified from Liverpool University in 1994, obtained his Certificate in Zoological Medicine in 2001 and his Diploma in Zoological Medicine in 2010.

As many of you will know, Richard has made a huge contribution to improving domestic rabbit health and welfare in too many ways even to count. It is a pleasure to have him as the RWA Vet Advisor. One of Richard's most notable achievements – so notable that it has been recognised with nominations for both a CEVA and a Pet Plan award – is his trailblazing work to bring the RVHD2 vaccine to the UK. Richard worked tirelessly to make this happen and as a result, around 70,000 rabbits have been protected against this fatal disease in the UK already. Richard's contribution to RWA as a vastly knowledgeable and passionate vet is vital and his input helps shape the strategy of the RWA.

Livia Benato

Livia Benato has worked with rabbits and exotic animals since she graduated in 2002. She finished her residency in Rabbit and Exotic Animal Medicine in 2011 at the University of Edinburgh where she also gained her Master by Research on rabbit probiotics. She then worked for one year at Chester Zoo as Veterinary Officer before moving back to Scotland in 2013 where she worked as University Veterinary Clinician at the University of Glasgow. In October 2015, she moved to the South West and started working at CityVets in Exeter as Small Mammal and Exotics Veterinary Associate. In July 2016, Livia also started a PhD on Rabbit pain and stress. Livia is a RCVS and European Recognised Specialist in Small Mammal Medicine.

Elisabetta Mancinelli DVM CertZooMed Dipl.ECZM (small Mammal) MRCVS

Elisabetta graduated with honours from the University of Naples "Federico II", Italy in 2002. Her interest in exotics became clear shortly after her graduation concentrating on a career mainly based on non-conventional animal medicine and surgery. After starting in an exotic only private practice in Italy, Elisabetta then completed an externship program at the 'Angell Animal Memorial Hospital' in Boston (USA) focusing on exotic animal medicine and surgery. In 2007, she moved to the UK where she initially worked in private practice and wildlife charities. With the help of the RWA&F (Rabbit Welfare Association & Fund) Elisabetta started the first European College of Zoological Medicine (ECZM) Residency in Small Mammal Medicine, which she completed at The Royal (Dick) School of Veterinary Studies, Edinburgh. In September 2010, she completed the RCVS Certificate in Zoological Medicine. In 2014, she obtained the ECZM Diploma, Specialty 'Small Mammal'. The ECZM Diploma has only been awarded to veterinary surgeons who have achieved a high level of expertise in their field. However, Elisabetta is the first ever ECZM Diplomat, specialty 'Small Mammal', to have gained this title by examination. Elisabetta has a keen interest and a real passion for small furrries. She regularly writes on 'Rabbiting on', 'Small Furry Pets', and 'The Veterinary Times' as well as lecturing in the UK and abroad.

Molly Varga

Molly graduated from the Royal Veterinary College in 1992. After graduation, she spent the next 4 years working in small animal and exotic medicine in Canada. These varied experiences included working in multicentre urban practice in Toronto and a small exotics practice in rural Ontario. Her caseload included a lot of native wildlife such as racoons, skunks and red-tailed hawks. After returning to the UK in 1996, she has worked in both London and the North West. Molly gained her Certificate in Zoological Medicine in 2001 and her Diploma in Zoological Medicine (Mammalian) in 2007. She is an RCVS Recognised Specialist in Zoo and Wildlife Medicine. She currently runs a first opinion and referral exotics service in a practice at Rutland House in St Helens as well as Manor Vets Edgbaston.

Nadene Stapleton BVSc, MRCVS

Nadene graduated from The University of Melbourne in 2000. Throughout her career, she has had the pleasure of working in various different settings including equine racetrack work, mixed practice and small animal practice. She was a locum vet for the largest collection of Australian native wildlife in the world just fresh out of university, which she admits was a steep learning curve! She has participated in volunteer work in China with bears being rehabilitated from the bile trade and locumed for many years leaving a wake of newly "exotics knowledgeable" colleagues behind her.

She is a self-confessed crazy bunny lady and has been at the Beaumont Animal Hospital since 2009 where she treats exotics of all shapes and sizes but admits she has become known as the "bunny vet" which suits her just fine. She is passionate about improving the lives of animals through education and teaches the new veterinary and vet nursing generations on all things exotic. In addition to two rabbits, she lives with a lizard, a tortoise, parrots, a cat, a fish and one very tolerant magician!

Brigitte Lord BVetMed (Hons) CertZooMed MRCVS

Brigitte, graduated with honours from the Royal Veterinary College, London in 2002. After a period as an exotic animal locum and small animal assistant, she joined the Royal (Dick) Veterinary School, in Edinburgh as a small animal intern. She was appointed the first RWF Rabbit and Zoo animal resident in the UK in 2004, based at Bristol Zoo and University of Bristol. She ran a Rabbit and Exotic Veterinary Referral service in the South West and returned to Edinburgh, R(D)VS in 2008 as a lecturer in Rabbit Medicine and Surgery, the first in Europe. She holds a RCVS certificate in Zoological Medicine. Brigitte was the first resident vet and registrar at Five Sisters Zoo, in 2016 where she developed the vet department. Brigitte is currently working as the RWAF Health Advisor and as a small animal locum.

Twigs Way

An early fascination with all things historic led to a degree in archaeology and time spent in England, Europe, South America and the Near East. Settling back into academia she completed a PhD in Cambridge on medieval to eighteenth century parkland and was promptly mistaken for a garden historian. It was in this guise that Twigs started to design courses on garden history for the University of Cambridge whilst also carrying out research on landscapes for private clients. As the study and protection of designed landscapes gradually gained greater recognition, Twigs became involved in creation of restoration and management plans for gardens and parklands, she now carries out consultancy work for a range of clients, including Natural England and Historic England on conservation and parkland management plants. Twigs is unique in combining a career in gardens with a dedication to rabbit rescue! She has over thirty rabbits at home including hand raised orphans and abandoned or unwanted rabbits who for whatever reason have failed to find a place in more formal rabbit rescues. She has also worked with Wood Green Animal Shelter to teach staff on forage foods for a variety of animals. In 2014 she published 'Foraging Foods for Rabbits' for the Rabbit Welfare Association and 2017 will see the publication of an accompanying book 'Gardening for Rabbits'

Caring for elderly rabbits

Livia Benato DVM MScR CertZooMed Dip ECZM (Small Mammals) MRCVS

Nowadays, rabbits live longer than they did a few years ago with an average lifespan of 8-10 years. The oldest rabbit recorded by the Guinness World Records[®] was 16 years old. Several aspects of rabbit management have improved over the years. A pet rabbit's diet is now richer in fibres and nutrients: we have gradually changed from cereal mix to a more balanced diet with *ad libitum* hay and pelleted food. Many studies have also proved that rabbits need large and spacious accommodations and a companion to be able to have a healthier and more interesting life. Furthermore, rabbit medicine has progressed over the years, and vets have a better knowledge of how to treat the most common problems and how to reduce the risks under general anaesthesia. As a consequence, pet rabbits are better cared for and they live longer. A rabbit is considered senior from the age of 5 years and their metabolism changes with age. Similarly, to other companion animals like cats and dogs, older rabbits become less independent and more prone to develop chronic health issues that, if overlooked, can affect their life quality. The general approach to the pet rabbit should take in consideration these changes. The diet should continue to be rich in fibre but less rich in proteins to prevent kidney problems. The outdoor accommodation should be well insulated and waterproofed while ramps and rugs should be added indoors to improve the mobility of those more stiff older rabbits. An owner should spend more time grooming the rabbit, especially around the perineal area, and check the ears, the teeth and the body condition (BCS) on a regular basis. Vaccination should be continued throughout the rabbit's life, and regular health checks should be performed by a vet in order to pick up diseases at an early stage, ensuring that the animal is comfortable and well treated at all the times. For example, osteoarthritis is a common presentation in elderly rabbits and affects especially the back and the hind legs. It develops gradually over time and, in the early stages, only subtle changes in the rabbit's behaviour such as changes in the toileting habits can be noticed. With the progression of the disease obvious signs of pain and discomfort can be present. Early diagnosis and an adequate medical and supportive treatment can alleviate the problem, ensuring nevertheless a long and happy life.

Beaumont Sainsbury Animal Hospital

Royal Veterinary College
Camden



Dr Nadene Stapleton

Consultant in Exotic Animal Medicine and Surgery



Many of the images used in this presentation are from:

Surgical Management of Ear Diseases in Rabbits Rebecca Csomos, DVM, PhD,
Georgia Bosscher, DVM, Christoph Mans, Dr med vet, DACZM, , Robert Hardie,
DVM, DACVS, DECVS

Clinical Technique: Treatment of Periapical Infections in Pet Rabbits and
Rodents Vittorio Capello, DVM

The Progressive Syndrome of Acquired Dental Disease in Rabbits Frances
Harcourt-Brown, BVSc, FRCVS, RCVS recognized Specialist in Rabbit Medicine
and Surgery



WARNING

Graphic Content

(And a smattering of random cute stuff to balance it out)



Rabbit Abscesses

- Anatomy/physiology
- Types of abscesses and their causes dental/fight wounds/ear abscesses
- Investigation
- Treatment options
- Complications
- Prevention
- Questions



Rabbit abscesses – what's all the fuss about?

Abscesses are common in cats and rabbits why are they so difficult to treat in rabbits?

1.LIMITED CHOICE OF ANTIBIOTICS

- Gut microflora
- P-L-A-C-E rule

2.THICK CAPSULE

- Less systemic signs
- Hard for antibiotics to penetrate
- Unlikely to burst then heal like cats

3.THICK (often sterile) PUS

4.HIDE SIGNS OF ILLNESS



Fight Wound Abscesses

- Usually occur on body
- History of a fight
- Often a wound or scab evident
- Easier to deal with than most abscesses



Fight Wound Abscess: Investigations

Usually diagnosed from
history / physical
examination/location

Fine needle aspirate

Sometimes difficult because
of thick pus (use large
needle)



Fight Wound Abscess: Treatment Options

SURGERY

- Antibiotics cannot always resolve
- Complete removal
- Lancing less likely to be successful



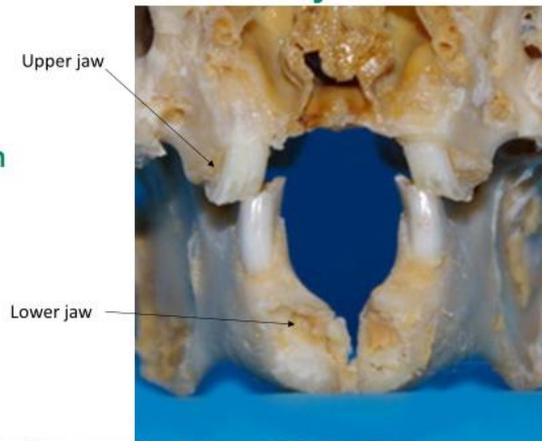
Dental Abscesses



Anatomy: dental anatomy

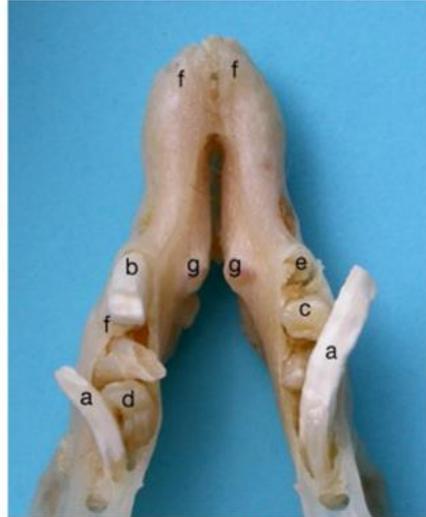
Continuously growing teeth
Movement of jaw depends on
type of food eaten

- Chomping (carrots)
- Grinding (hay and grass)



Normal xrays
and photos







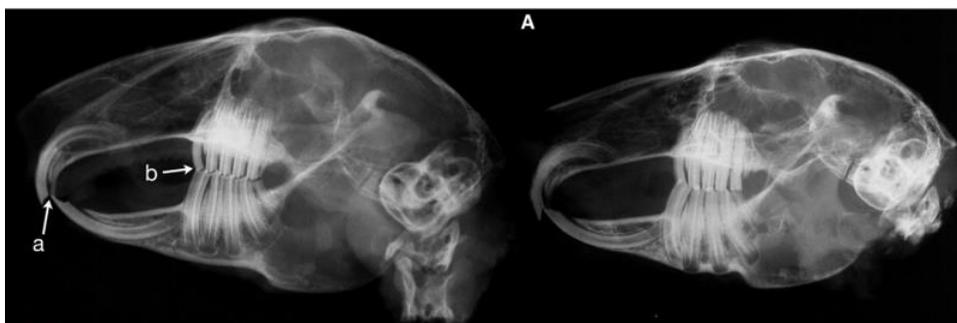
Dental Abscesses: Causes

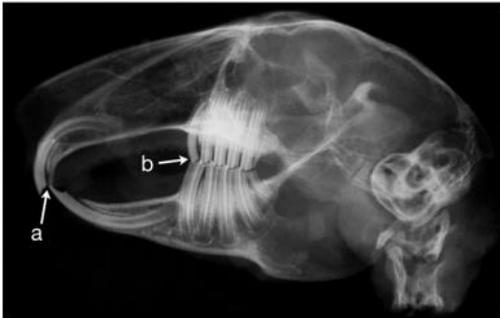
- Incorrect diet
- Calcium/Vit D imbalance
- Selective feeding
- Overgrown teeth
- Root elongation
- Trauma
- Genetics



Dental Abscesses: Investigations

- Anaesthesia!!
- Oral exam
- Endoscope
- Xray
- CT scan
- Culture and sensitivity





Dental Abscesses: Treatment

- Lancing
- Complete removal not possible
- Clean and close
- PMMA beads
- MARSUPIALISATION



MARSUPIALISATION

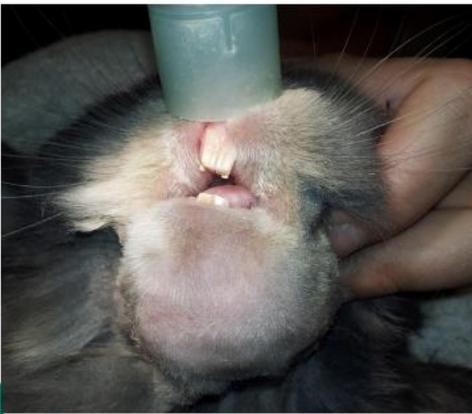
- Treatment of choice in most cases
- Success depends on:
 1. Ability to remove focus of infection (TEETH/BONES/SOFT TISSUE)
 2. Post operative care

IS A **LOT** OF WORK FOR OWNERS POST OPERATIVELY
(seems) WELL TOLERATED BY RABBITS



Complications

- Osteomyelitis – bone infection
- Jaw fractures
- Recurrence
- Gut stasis
- Anorexia

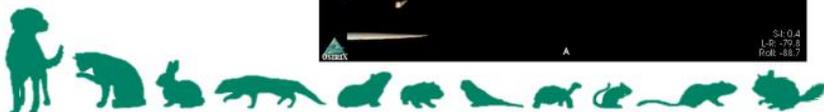






Importance of advanced imaging – CT scans

- Gives the veterinarian a better idea of the complexity of the structures involved
- Helps plan surgery
- Gives a better idea of prognosis





Prevention of dental disease/abscesses

1. Try and give all rabbits outside time in a predator proof area. Access to sunlight (not filtered through a window) helps maintain good calcium and vitamin D balance.
2. Try and feed a *minimum* of a ball of hay the same size as the rabbit every day – make sure they eat it!
3. Reduce adult rabbits ration of pellets to encourage hay eating average 2kg rabbit give one dessert spoon full a day (if you must)
4. Encourage grass eating wherever possible
5. Regular dental check ups = early intervention

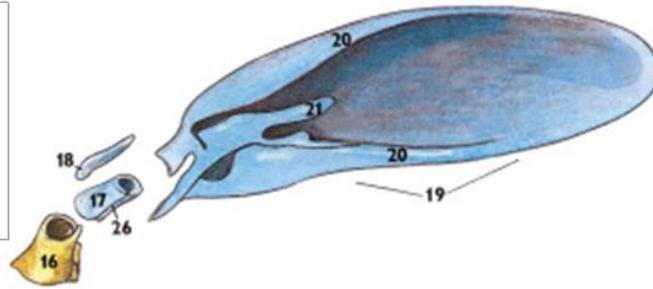


Ear base Abscesses



Anatomy: ear anatomy

- 16. Boney part of ear canal
- 17. Annular cartilage
- 18. Scutiform cartilage
- 19. Auricular cartilage
- 20. Helix
- 21. tragus



Ear Base Abscesses

- Lop rabbits - caused by the lopping of the ear
- Wax trapped
- Weak spot
- Hard to identify
- Often show no clinical signs
- Show no signs of pain
- "Tip of the iceberg"

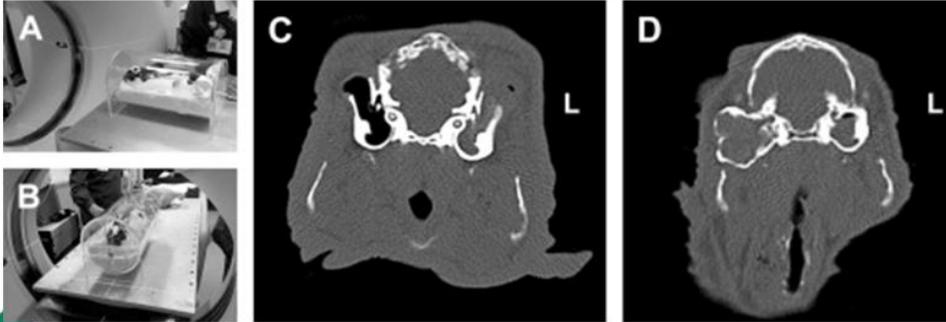


Ear Base Abscess: Investigations

- Palpation
- Ear exam
- X ray
- CT scan



CT Scan



Ear Base Abscesses: Treatment Options

Antibiotics?

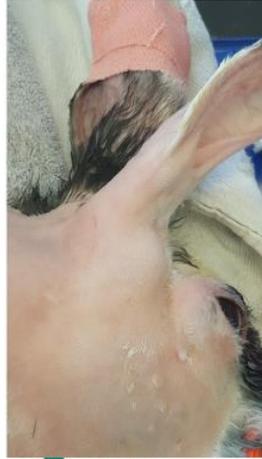
Ear drops

Ear flushing

Surgery

Prevention



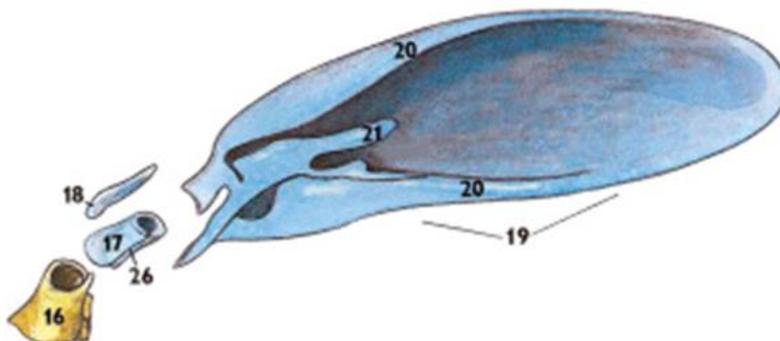


surgery

Surgery best chance of success
in most cases
Not possible in every case
Involves the removal of most of
the ear canal

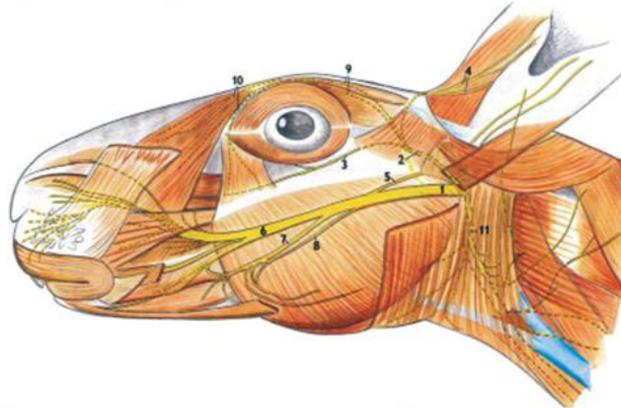


Ear canal ablation



Surgery: Complications

- Bleeding
- Auriculo palpebral nerve paralysis
- Eye problems
- Balance problems



Palliative Care Options

- Surgery not always possible
- Quality of life
- Hard to assess pain
- Pain relief
- Antibiotics – Penicillin?



Prevention

- Ear Cleaning??
- Responsible breeding practices



Questions?



Anatomy of pet rabbits

**Elisabetta Mancinelli DVM CertZooMed ECZM Dipl (Small Mammal Medicine and Surgery)
European Veterinary Specialist in Zoological Medicine (Small Mammal Medicine and Surgery)
Recognised RCVS Specialist in Zoo and Wildlife Medicine**

HEAD

Skull

Skull, ear and body conformation vary widely between the different rabbit breeds. Breed selection, especially in true dwarf rabbits, often leads to abnormal skull proportions and/or abnormal anatomical relationship between upper (maxilla) and lower (mandibula) jaw. An abnormally long lower jaw relative to the length of the upper jaw is a common inherited trait which leads initially to edge-to-edge apposition of the incisors and blunting of their chisel edges. Later the lower incisors protrude more compared to the upper ones.

Anatomical features include:

- Skull morphology typical of true herbivores: the mouth is long, with a narrow opening. Incisors and cheek teeth are separated by a gap with no teeth called diastema. There are no canine teeth. The rabbit temporo-mandibular joint (the joint connecting the jawbone to the skull on either side) is dorsal to the dental occlusal plane. This skull morphology, typical of a true herbivore, is similar to that of larger species such as horses, cattle, sheep and goats.
- Maximum gape 20°-25° degrees . This coupled with the long diastema can make inspection of the oral cavity relatively difficult in rabbits
- Narrow lower jaw and wider upper jaw
- Each tooth on the lower jaw occludes with two teeth on the upper jaw
- Upper and lower teeth come into occlusion on one side at a time during chewing

Teeth

Rabbits also have a teeth arrangement typical of true herbivores with continually growing incisors and cheek teeth. The rate of tooth growth varies and can be influenced by age, pregnancy and diet. When the lower jaw is at rest, the mandibular (lower) incisors teeth occlude between the first and second (peg teeth) maxillary(upper) incisors teeth, and the cheek teeth are slightly separated. Cheek teeth then come into direct contact only during chewing.

Rabbits have:

- 2 sets of teeth (deciduous and permanent)
- No roots – teeth are continuously growing and erupting
- 28 teeth of which:
 - ✓ 2 upper incisors
 - ✓ 2 “peg teeth”
 - ✓ 2 lower incisors
 - ✓ 22 Cheek teeth
- Horizontal occlusal plane

The naso-lacrimal duct

- It starts at the nasolacrimal punctum in the ventral eyelid at the corner of the eye
- It has 2 sharp diversions and narrowing close to molar and incisor tooth roots
- The distal opening is within the nostril

Chewing activity

The function of incisors teeth is to cut plant material and reduce the size of larger food items. The food is then introduced into the mouth with the lips and moved by the tongue towards the cheek teeth, where food is ground and crushed.

In particular:

- Four basic combined movements occur during chewing activity
- Chewing is performed by one arcade at a time while the other is slightly separated
- The complete chewing cycle is repeated twice per second
- 120 jaw movements occur per minute during mastication

- Teeth are worn during normal chewing activity
- The degree of lateral movements of the jaw partially depends on the type of food consumed:
- ✓ Hay and natural fibrous food produce wide lateral and reduced vertical movements
- ✓ Concentrated pellets or grains produce reduced lateral and more extensive vertical movements

Nose

In rabbits:

- The nose is very sensitive and the sense of smell is acute
- The nostril twitches at a rate of 20-150 twitches per minute but is still when the rabbit is totally relaxed
- Any impediment to clear air flow through the nostrils can lead to marked respiratory issues
- It is easy for infection to pass up to the ear or down to the trachea leading to pneumonia
- The incisor and premolar roots are closely connected to the nasal cavities
- Minimal bone separates the teeth from the nasal passages
- Dental pathology can be linked to nasal pathology

Ears

Rabbits have long funnel like ears. The pinna (outer visible part of the ear) is freely movable and capable of independent action.

The ears in rabbits:

- Lops have a different ear anatomy compared to straight eared rabbits and this may predispose them to otitis
- Highly vascular
- They are used to lose heat as they cannot sweat or pant
- They could be a suspensory system for the head
- The vessels of the ear margins can be used for:
 - Catheter placement
 - Pulse oximeter probe placement (to check for oxygen concentration in the blood)
 - Blood pressure measurement
 - Arterial blood gas analysis

Eyes

- Large cornea occupies 25-30% of the globe
- Prominent and laterally located eyes
- Wide visual field of 360°
- The retina has a horizontal area of high fotoreceptor density to allow the rabbit to concentrate on all points of the horizon
- Poor accommodation
- Good nocturnal vision
- Rabbits blink 10-12 times per hour
- Third eyelid passively covers 2/3 of the cornea
- The third eyelid is associated with the lacrimal gland

CHEST

Lower respiratory tract

- Thorax small in contrast to the large abdomen
- Thymus (is a gland that remains large even into adult life) and lies ventral to the heart and extends forward into the thoracic inlet
- Lungs divided into cranial, middle and caudal lung lobes. The left cranial lung lobe is much smaller than the right due to the presence of the heart.
- Diaphragm for breathing

Heart

- Relatively small
- Heart rate 180-250 bpm

- Heart between rib 2 and 5

ABDOMEN

Gastro-intestinal (GI) tract

- Monogastric (a monogastric organism has a simple single-chambered stomach, compared with a ruminant organism, like a cow, goat, or sheep, which has a four-chambered complex stomach. Examples of monogastric animals include omnivores such as humans, rats, dogs and pigs, carnivores such as cats), true herbivores, hindgut fermenters
- Adapted for efficient digestion of fibrous food without having to store large volumes within the body (prey species)
- Rely on microbial fermentation of food in the caecum to obtain nutrients
- GI tract content up to 10-20% of body weight and contains 80% of all food undergoing digestion
- The gastro-intestinal tract includes:
 - ✓ Stomach
 - ✓ Duodenum, jejunum, ileum: small intestine
 - ✓ Caecum, colon, rectum: large intestine
- Stomach + caecum contents: 5% to 19% (average 10%) of the rabbit's total body weight
- Small intestine: 12% of the total volume of the GI tract
- High metabolic rate with a fast feed transit time (19 hours)

Stomach and duodenum

- J – shaped, thin walled, poorly distensible, no intrinsic motility
- The stomach always contains food, fluid and some hair due to the normal grooming activity of the rabbit. However, large hair impaction (hair balls or trichobezoars) may be indication of dehydration or lack of gastric motility.
- Rabbits are unable to vomit
- The duodenum starts 1 cm from the pylorus at an acute angle
- Digestion and absorption of nutrients in stomach and small intestine is similar to other species

Ileum

- The ileum ends into a portion called *sacculus rotundus* that forms a T-junction between ileum, caecum and colon. The *sacculus rotundus* is very unique to rabbits.
- At the entrance of the *sacculus rotundus* there is a valve (ileocolic valve) which narrows the diameter of the small intestine. The ileocolic valve controls movement of food from the ileum into the *sacculus rotundus* and into the caecum.

Caecum

The rabbit's hindgut consists of a large caecum (the rabbit caecum is the largest of all animals, relative to size, with 10 times the capacity of the stomach and containing 40% of the intestinal content), where food is fermented and of the proximal colon, which mechanically separates the high and low fibre particles. The high fibre particles are eliminated fast while the nutrient rich particles are sent back to the caecum to be made into caecothrophes.

- The caecum is thin walled, folds onto itself 3 times, forming a coiled spiral on the right side of the abdomen. It ends into a blind-ended, thick walled tube called vermiform appendix
- Contains large numbers of microorganisms that produce substances called volatile fatty acids which provide 40% of the energy for the rabbit
- Gut microflora also provide 15-25% of the rabbit's protein requirements. Unlike many other herbivores, the main caecal microorganisms in the rabbit are not *Lactobacillus* (e.g. as in cows), but *Bacteroides*.

Colon

- The *fusus coli* is a portion of the colon which is unique to lagomorphs, including rabbits, and forms a natural division between two distinct sections of the colon. For this reason the terms proximal and distal colon are often used. The *fusus coli* acts as an "intestinal pacemaker" for

colonic motility, controls the passage of food into the distal colon and the contractions necessary for excreting the two types of pellets.

- The distal colon is 80-100 cm long and runs from the cecum to the rectum

Caecothrophy

- Caecothrophy refers to the consumption of caecal pellets. It starts between 2-3 weeks of age when the kits start to eat solids
- Excretion of faeces follows a roughly 24 hour cycle. Wild rabbits tend to produce caecothrophes during the day, while they are sleeping in their burrow. Pet rabbits tend to produce hard pellets 4 hours post feeding and caecothrophes 8 hours post feeding, which tends to be at night
- Caecothrophes are ingested directly and swallowed without mastication
- Their ingestion is a reflex arch and not a voluntary act
- Caecothrophes are essential to the rabbit health as their ingestion provides: short chain fatty acids (9-15% energy daily requirement), microbial protein containing essential aminoacids (15-25% daily requirement), Vit B and K, sodium, potassium, nitrogen (up to 30% of the total intake of rabbits), enzymes, water but also bacteria, yeasts and protozoa

Liver

- Divided into 6 lobes
- Anorexia in rabbits can lead rapidly to fatal "fatty liver disease"

Motility of the GI tract

The control and co-ordination of normal GI motility is highly complex and influenced by many factors:

1. DIET: fibre stimulates it, excess carbohydrate in the diet inhibits motility
2. STRESS: adverse effects on motility
3. HORMONES

Reproductive tract

Female

- The ovaries are elongated and located more caudally compared to dogs and cats
- The oviducts are very long and coiled
- The uterus is duplex, being separate along its length and forming two cervixes, uniting only to form a long and flaccid vagina
- There is a ligament to either side of the uterus called mesometrium which is a site of fat storage
- The urethra (opening of the urinary tract that brings the urine from the bladder to the outside) opens into the vagina

Male

- The male has a rounded penis which can be easily extruded in rabbits over 2 months old. On either side there are 2 hairless and blind inguinal sacs, which contain scent glands. The testes descend at about 10 weeks and the hairless scrotal sacs can be seen in front of the penis

Reproduction

- No oestrus cycle but sexual receptivity every 4-6 days
- Sexual maturity: 3.5-6 months
- Pregnancy: 30-33 days
- 3-12 kits per pregnancy up to 8 times per year
- Youngs are born with eye and ears closed, and with no fur
- Lactation: 3-5 min once or twice daily
- Kits stay in the nest for 2-3 weeks
- Female receptive 48 hours post partum
- At 3 weeks: starts ingestion of small amounts (5%) of solid food
- At 20°-21°days: eating hay and caecothrophy

Urinary tract

Water intake

- The average water intake for a rabbit is 120 ml/kg/day so a 2 kg rabbit will drink as much as a 10 kg dog per day. The amount of water drunk will depend on ambient temperature and composition and quantity of food (rabbits fed on lots of fresh greens will drink less while if on a dry and high fibre diet water intake will increase to moisten the food in transit).
- Rabbits prefer drinking from open dishes

Kidneys

- More primitive than other mammals
- Less able to concentrate their urine
- The urine is a major route for calcium excretion and that's why it is normally cream coloured and thick. However, colour can vary from yellow to red as plant pigments (e.g. alfalfa, the tropical legume *Leucaena*, beet, carrots, spinach, cabbage, radish, turnip, mustard, cauliflower and broccoli) can be excreted in the urine and can be confused with blood.

PAIN MANAGEMENT IN RABBITS

Molly Varga

Behaviour patterns that protect rabbits in the wild make it difficult for owners and veterinary staff to recognise signs of pain. Once pain recognised, the disease process causing it has often progressed further than would have in other species. This means that the rabbit does not care if vulnerability recognised. This presents certain challenges within the clinical environment in terms of nursing and veterinary assessment. Means that careful observation is mandatory for both owners and veterinary staff. Failure to recognise pain results in a reduction in welfare of the patient and so does failure to provide adequate analgesia for the level of pain expected. Equally, failure to address concurrent problems that impact the use of suitable analgesic or anti-inflammatory medications also results in a longer term reduction in welfare.

Pain leads to stress. Stress is mediated by adrenal hormones such as adrenaline and cortisol. Acute stress leads to adrenaline production and chronic stress to cortisol production. Each hormone has physiological consequences for the rabbit including: acute death, induction of cardiomyopathy, oliguria, anorexia, increased gastric acidity leading to ulceration, gut stasis, and immunosuppression. Owners may notice increased respiratory rate and possibly increased heart rate. Other changes that may be noted by veterinary staff include: reduced or absent gut sounds, elevation or depression of core temperature and blood pressure elevation. NB these are prey animals so how you maintain them in hospital and how/when/in which order these parameters are measured matters.

- **Definitions**
 - Analgesia: Absence of pain in response to stimulation, which would normally be painful.
 - Hyperalgesia: An increased response to a stimulus, which is normally painful.
 - Nociceptor: A receptor preferentially sensitive to a noxious (painful) stimulus or to a stimulus, which would become noxious if prolonged.
 - Noxious stimulus: A noxious stimulus is one, which is damaging to normal tissues.
 - Pain threshold: The least experience of pain, which a subject can recognize.
 - Pain tolerance: The greatest experience of pain a subject can tolerate.
 - Neurogenic pain: Pain initiated or caused by a primary lesion or dysfunction or temporary perturbation in the peripheral nervous system.
 - Neuropathic pain: Pain initiated or caused by a primary lesion or dysfunction in the nervous system.
 - Wind-up pain: An increase in perceived pain intensity over time, when a given stimulus is repeatedly applied. Lasts for a short period of time, however can lead to 'long term potentiation' and become part of a chronic pain state.
 -
- Owners with rabbits that are in pain, or failing to cope with painful conditions may notice various alterations in behaviour. Lack of alertness/reduced mentation/lack of interest in surroundings, hiding, shifting/throwing themselves around/unable to get comfortable,

sitting in a hunched position, failure to use/move certain parts of the body and head pressing (this is really serious and indicates severe pain).

A lot of these signs are noted fairly late on in the pain/disease course. Perhaps more subtle signs are needed in order to recognise pain earlier.

Pain Scoring (Keating et al, 2012)

- Using the 5 facial action units and scoring these from 0 (not present) to 2 (obviously present)
- Orbital tightening: A normal rabbits eyes will be widely open and the rabbit will be aware of and interested in its environment. A painful rabbit will often partially or fully close its eyes and in cases of severe pain the eyeballs appear to be withdrawn into the head.
- Cheek flattening: A normal rabbits cheeks will be relaxed and the whiskers will protrude giving information about the environment. A painful rabbit will suck in its cheeks making the whiskers lie flat across the face, and giving the face an angular, pinched appearance.
- Nose shape: A normal rabbits nose is constantly twitching and the nostril slits (nares) are around 30 degrees from the horizontal. When a rabbit is painful the nostril slits are drawn upwards bringing them closer to a vertical position.
- Whisker position: A normal rabbits whiskers will stick outwards from the face, however these will be pulled in and flattened towards the cheek when a rabbit is painful.
- Ear position: Except in the case of lops, a rabbits ears are usually perpendicular to the head. Where a rabbit is painful the ears are pulled back to eventually become flattened towards the back and the sides of the body.
- PAIN SCORING is more than just a grimace scale. It encompasses behavioural, postural, grimace, clinical parameters and vocal cues in order to assess pain. The cues need to be validated and repeatable and whilst scoring systems exist for cats and dogs, there is no validated system for rabbits.
-
- Once pain is recognised and the cause has been diagnosed, your vet may choose from a variety of pain killers to manage your rabbit so that he or she is comfortable. Drug options include: Opiates (morphine, methadone, fentanyl, buprenorphine), tramadol, gabapentin, occasionally ketamine, and medetomidine (these are often used as sedatives as well), non-steroidal anti-inflammatories (eg metacam), and paracetamol. Other treatment modalities can also be helpful, for example: Acupuncture, Physiotherapy, Transcutaneous electrical nerve stimulation (TENS) and K laser. For most rabbits a pain management approach that uses more than one pain control method gives the best results, and allows each drug to be given at a lower dose, thereby reducing the risks of side effects. In every case, pain must be managed effectively even if the risk of side effects is present, and the welfare of the rabbit should be best promoted.

GARDENING FOR RABBITS

(Based on the book *Gardening for Rabbits* newly published by RAAF)

Talk by Twigs Way

INTRODUCTION

Creating a flower garden full of rabbit-edible plants and rabbit-friendly design features can be fun for you and your rabbit, however it is not always easy and there are a myriad of questions that people often ask me: How do they go about designing a garden? What about paths and fences? Which plants are safe and which are not? How do you protect the flowers from the rabbits and the rabbits from the flowers? This talk tries to answer some of these questions so that you and your rabbits can enjoy your garden in harmony.

DESIGN:

Preparing to Garden: Questions, Questions, Questions

There are many things to take into consideration when planning your rabbit garden and it is as well to have a think about these before setting out to the garden centre with a list of desirable plants and a hopeful rabbit waiting back home.

Gardening for Whom? Will the garden be just for you and your friends or will your rabbits (and their friends) have full free range as well?

Why are you Gardening? Are you only going to grow plants which are useful for feeding to rabbits or are you wanting primarily to produce a lovely looking garden which just has a few plants edible by rabbits?

What Sort of Style do you Like? Formal or informal? and what sort of style is your rabbit accommodation? and of course

How Much Time will you have for gardening?

Once you have decided how the garden will be used and shared by you and your rabbits you can start designing your garden and its plants with more confidence in deciding on how much room to devote to flowers or vegetables, where to put fences and what to make them from, and how to integrate rabbit friendly features

Basic Layout and Design

Consider each garden feature in turn and decide whether you and your rabbit feel it will suit your garden and of so where it should be located: Ponds, Pergolas, Seats, Raised Beds, Lawns Window Boxes , Flower Beds, Rabbit play areas, and vegetable and herb areas all need to be accounted for in any plan, along with measures to protect those plants which might be overwhelmingly attractive to even the most restrained of rabbits (and who has ever met one of those!). Memorial Gardens also need to be carefully thought about carefully to ensure happy memories are kept alive and a range of plants and memorial stones or statues can be considered and space made for them - or maybe a simple wild meadow area?

Lawns

The centre piece of any rabbit garden. Whether already in existence complete with lovely edible weeds, or needing to be laid with turf or seeded, the lawn serves as play space, breakfast, dinner, lunch and digging area. Getting the lawn to bunny ratio right is vital for any bunny garden as is avoiding unnecessary chemicals.

Protection!

Whether you are trying to prevent your flowers and trees being munched before their time or your beloved pet lurching on a toxic foxglove, a range of temporary or permanent protections can be used including upturned hanging basket frames, tree protector spirals, wire mesh, trellis fencing, old 'runs' reborn with the plants on the inside and bunny outside, or parts of the excellent runaround system. Think more about penning in the plants and letting the bunny out!

A word about Compost: Poo, wee, and discarded hay make an ideal compost - add rain water, cold tea . . . and time. And I do mean rabbit poo!!

and **Chemicals** . . . just don't. No really - never.

THE MOST COMMON QUESTION! Is it Poisonous?

Many garden plants will have some toxin within some part of them as a protective mechanism or 'incidental' to their chemical make up but unless fed solely and constantly on these rabbits will not be affected by the vast majority of these. The toxins help to protect the plant from being constantly grazed or their roots or seeds eaten.

What do Toxins Do?

In fact although they are all known commonly as 'poisons', different toxins work in very different ways - and very few of them cause almost instant death (exceptions are largely those that affect the heart or nervous system such as foxglove, yew, or lily of the valley). Many toxins will cause small amounts of damage that may build up over months or years - leading to chronic changes in organs such as the kidney or liver or brain - and ultimately cause organ failure.

If a Plant is 'Toxic' is it all Toxic?

Although some plants have toxins in every part of them others only have toxins in the seed, or the fruit, or the root, or only at certain times of year. For example, this means that you do not have to panic if you see your rabbit eating a leaf of a plant like honeysuckle where the leaves and flowers are edible but the berries contain toxins.

The following commonly grown garden plants are the most toxic to animals and should be avoided in a rabbit garden.

Aconites, Aliums, Arums, Azalea, Bluebell bulbs, Celandine, Cherry Laurel, Cineraria, Colchicum (autumn crocus), Cyclamen (indoor and outdoor), Daffodil bulbs, Daphne, Day Lilies (Hemerocallis), Delphiniums, Euonymus, Foxgloves (Digitalis), Helenium, Hellebores (mainly the roots), Honeysuckle (berries), Hyacinths (including the small Grape Hyacinth and Bluebells), Hydrangea, Ivy berries (nibbling leaves is fine), Laburnum, Laurel, Lily of the Valley, Lobelia (except the bedding lobelia Lobelia erinus), Love-in-a-Mist (Nigella damascena), Lupins, Monkshood (Aconitum), Nicotinia (annual bedding plants), Oleander, Periwinkle (Vinca major and V. Minor), Peony (roots), Primroses, Privet, Rhododendron, Robinia pseudoaccacia, Solomon's Seal, Sweet Pea (Lathyrus odoratus), Tulip bulbs, Wisteria, Yew (Taxus sp.), Zantedeschia (calla lily) .

In the vegetable garden Rhubarb leaves, Potato leaves and Tomato leaves are toxic as are the onion family in some instances depending on the rabbit).

So WHAT PLANTS CAN I PLANT?

The following sections list the 'top' garden plants which you and your rabbit can enjoy together. They are predominantly plants that are rabbit edible, and some can also be dried for eating out of season. The main list is divided into seasons and includes annuals, perennials, shrubs, etc but there are also separate sections for herbs, hedging plants and trees.

Spring Has Sprung!

This is the most difficult of seasons in the rabbit garden. Small nibbly shoots tempt a rabbit bored with dried forage and desperate for a tender morsel of fresh growth. Plants are largely limited to bulb plants such as daffodils, snowdrops, and tulips, which contain toxins in the bulbs.

Try planting: Brunnera macrophylla, Erythronium, Forget me Not, Hardy Geranium, Ground Elder, Lamium (garden dead nettle), Pulmonaria, Wallflowers.

Supplement with Hedges of hawthorn and sloe which will start to show small nibbly leaves!

Window boxes can be used to enliven rabbit housing with gaily coloured pelargoniums or herbs and a fresh coat of garden paint will cheer up housing that has taken a bit of a battering over winter.

Summer in an English Garden!

Unless you have totally misjudged the ratio of rabbits to garden area, or failed to take preventative measures in early spring, any garden should be able to put forth a glorious selection of flowers in summer. Annuals are at their best in summer, whether you have sown them yourself in pots in the greenhouse, or direct in beds once the soil had warmed up, or purchased them from the garden centre.

Top Plants for a Bunny Garden in Summer include:

Alchemilla mollis, Aubretia, Carnations, English Marigold, Hop, Hyssop, Hardy Geranium, Iris (they won't eat them!), Hollyhock, Mint, Nepeta (Catnip), Lambs ears (Stachys Byzantina), Pelargonium, Pinks, Roses, roses and more roses, Salvias, Snap Dragons, Snow in Summer), Strawberry plants, Sweet Peas (watch for the seed heads and remove), Thyme, Verbena, Vines, Zinnias.

Autumns Fruitful Harvest;

Autumn is the season for making the most of late flowering perennials. Many traditional English autumn perennials are the 'thugs' of the garden world, using wandering roots so establish new colonies which thrive by smothering more delicate early season plants. Often tall, as they have invested all their growing in the earlier part of the year, many have stalks that can be cut down complete with leaves for drying for rabbit forage. Yellows, reds and mauves dominate this time of year, even for many of the annuals, and daisy shaped flowers. Annuals sown earlier in the year, or bought on impulse at the garden centre, will also see you through until the first frost. Vines and hops will also provide good foraging material for drying later in the year.

Top Autumnal Plants in the Flower Border include:

Buddleia, Echinacea, Fuschia, Golden Rod, Hop, Lavatera (Tree Mallow), Michaelmas daisy, Nasturtium, Vine.

Winter

Once the frosts and rain set in and the cheerful nasturtiums and echinacea have admitted defeat it is time to turn to the evergreens. Garden designers like to promote plants that can give 'structure and interest' to the garden in the darkest months, such as clipped box hedging or box balls and cones, yew hedging, arches of winter jasmine and well shaped rosemary bushes. For the rabbit gardener this ideal

can be taxing as many of the evergreens are toxic (box and yew for example) whilst anything not toxic will be eaten as forage becomes increasingly sparse. Grass is a firm favourite and ivy may be nibbled, along with winter flower pansies and rosemary but stored forage is the best bet and bunnies may like to stay out of the snow!

HERB GARDENS

Almost all herbs are by definition edible, although rabbits will tend to avoid those with spiky or evergreen leaves or very strong essential oils (such as rosemary). Other herbs such as coriander and mint are firm rabbit favourites. Some herbs are thuggish perennials, such as mint and lemon balm and will romp away happily in the garden, whilst others whose original homeland was Italy or Greece are rather less reliable. Thyme, hyssop, helichrysum, lemon verbena, and even oregano or marjoram may simply 'disappear' after a very harsh winter or become disfigured with cold scorched leaves. Plant in pots on shelves, raised beds (very raised!), or in traditional sinks - but beware invaders! Replace every few years, as they get 'leggy' (the plants not the rabbits). Or oftener if needs be - like every 10 minutes. Some rabbits do not like the strongly scented yellow flowering 'Curry Plant' (*Helichrysum italicum*) and it has even been used to ward off cats from gardens. However I would not claim that more adventurous eaters would not demolish it.

HEDGING PLANTS

With the easy availability of modern fence panels, and the smaller size of many urban gardens, hedging has fallen out of fashion. However for the rabbit garden hedging is a very valuable source of forage, as well as providing hiding spaces, shade and shelter. Hedges are also incredibly important for garden birds and wildlife such as hedgehogs and mice who make find insects and berries amongst the leaves at the base. No hedge will stop a rabbit getting through though, so best to use in combination with wire mesh and trellis fence behind.

Edible and Safe Hedges: Beech (except the beech mast), Blackthorn, Hawthorn, Hazel, Hornbeam, Lavender, Rose,

Hedges which are not edible by rabbits include: Box (*Buxus*) (toxic), Cherry Laurel (toxic), Holly (*Ilex aquifolium*), Laurel (toxic), Leylandii, Photinia, Privet (*Ligustrum* sp.), Pyracanthus (although they will nibble the leaves and berries seemingly to no ill effect), Yew (*Taxus*) (very toxic),

TREES

A small group of trees or even a single tree gives an element of 'vertical design' in a garden, making one look up to the sky above. For a rabbit it provides shelter from weather and also shelter from large birds that the rabbit may feel are a threat. Many trees can also be used for fodder, even quite substantial branches as well as the leaves and twigs and fruits.

The top trees for planting are of course those that also have edible fruits, but do bear in mind the role of gravity and restrain yourself from planting an apple or pear tree which will produce large fruits within a rabbit run. Or if you do then use netting in the summer and autumn to catch windfalls. Rabbits have fragile skulls and little grasp of Newtonian theory or Health and Safety!

Bunny Favourite Edible Trees include: Apple, Crab Apple, Hazel, Pear, Quince, Weeping Willow. Trees which are not edible by rabbits include: Most evergreens as the leaves are indigestible and may cause stasis; most fruit trees with 'stones' such as cherries, plums etc, Mulberry (*Morus*) which has toxic leaves and tons of large rich berries which can cause issues (although this is beloved of tortoises) ; Plums, Yew (toxic)

Stasis – Causes, diagnosis and treatments

By Dr Brigitte Lord BVetMed(Hons), CertZooMed, MRCVS

Stasis and ileus

Rabbits are often present to the vets with a history of lack of defaecation. Anorexia is a common clinical sign seen with this presentation. This is a non-specific sign of a sick rabbit. The challenge is to identify the cause, diagnose the secondary pathogenesis, stabilize and then treat these cases. Stasis is primarily an acquired disorder of decreased motility. Generalized ileus is a common continuation of this condition and may arise from mechanical obstruction or from defective propulsion.

Causes of stasis:

Mechanical obstruction:	Defective propulsion: (muscle or nerve defect)
dehydrated impacted ingesta	anorexia
foreign bodies	high-carbohydrate/low-fiber diet
infiltrative lesions	dehydration
post-surgical adhesions	post-surgical adhesions
	lack of exercise
	toxin ingestion (lead)
	pain
	Environmental stress (extremes of temperatures or humidity)
	emotional stress (predators, dominant rabbit, change routine, transport,

Anorexia and chronic dehydration are both causal factors and consequences of gastric stasis and ileus. Systemic dehydration leads to gut content dehydration and impaction of normal stomach contents, which includes loose hair lattices or trichobezoars.

Diagnosis

The history and clinical findings, of a firm, dough-like stomach on palpation, allow a presumptive diagnosis of stasis and ileus and are suggestive of non-obstructive disease. Non-obstructive disease is best managed medically and obstructive disease is best managed surgically.

Signs of non-obstructive stasis and obstructive stasis:

Clinical finding	Non-obstructive	Obstructive
Attitude	Bright and alert	May initially appear bright, but rapidly becomes depressed
Appetite	Gradually reducing appetite	Acute anorexia
Faecal volume and size of droppings	Gradually reducing size and amount of droppings	Acute history of no faeces

Although, advanced cases do not permit differentiation between obstructive and non-obstructive stasis and ileus. Plain radiography in early cases reveals a mass of hair and food, appearing similar to normal ingesta. As the impaction in the stomach and occasionally caecum develops, a gas halo is often seen around the compacted material. A definitive diagnosis can only be made on exploratory laparoscopy or laparotomy, however this is a high-risk procedure in these already metabolically unstable rabbits.

Treatment and prognosis

Aggressive medical management is required to prevent further deterioration and death. Hepatic lipidosis is a common complication and cause of death in rabbits, with prolonged stasis.

Rehydration, of both the patient and stomach contents, with both oral and intravenous fluids may be required depending on the severity.

Analgesics, such as partial or full opioids in the first instance, and then once rehydrated, NSAIDs are also appropriate.

Prokinetics are required to stimulate GI motility. The prokinetic effects of metoclopramide are not as potent as ranitidine and are limited to the proximal GI tract. Ranitidine has equal prokinetic effects to cisapride and antacid actions. Ranitidine has synergistic effects when used with metoclopramide.

Domperidone has been found to be very effective at stimulating contractions in the large intestines of rabbits and can be a good alternative in cases that poorly respond to ranitidine or metoclopramide.

Nutritional support to reverse energy balance and stimulate motility can be achieved by syringe feeding commercially available high fibre recovery diets e.g., Critical Care for Herbivores (Oxbow Petlife International Ltd., Bury St. Edmunds, Suffolk, UK), or pureed leafy vegetables and grass, four-five times a day. A wide variety of fresh vegetation should be offered daily, to encourage the rabbit to eat. Nasogastric tubes are easily placed in a conscious calm or weak rabbit, in a similar manner to that used in a cat. Radiography is always recommended to ensure the tube is in the correct position. Some rabbits will tolerate the tube with-out an Elizabethan collar, which will enable eating, caecotrophy and is less stressful. Blended and strained food can then be fed, flushing with 5ml of water before and after feeding will keep the tube patent. Nasogastric tubes can be left in place for several days. Prophylactic antibiotics is recommended to help prevent rhinitis, which may develop if nasal tissue was traumatized. Rehydration is likely to be more beneficial than liquid paraffin, papain enzyme, pineapple juice and bromelin, which may cause dysbiosis. Due to the tight cardiac sphincter it is debatable how effective simethicone or dimethicone would be at dispersing gastric gas.

Gastric obstruction

Ingested objects such as matted hair, carpet, plastic or rubber, can pass down the esophagus and become a gastric or intestinal foreign body. The pylorus is a common site of obstruction and material or objects lodged in this area can cause gastric outflow obstruction.

The rabbit patient with gastric obstruction may be asymptomatic or have anorexia initially until an acute abdomen and hypovolaemic shock rapidly develops (24-48 hours). Death often occurs within 24-48 hours. Liver lobe torsion is the main differential diagnosis of the acute abdomen in a rabbit.

Diagnosis

Clinical signs are usually indicative, but gastric obstructions can rarely be detected on abdominal palpation alone and there is a high risk of trauma to the distended stomach and friable liver (secondary to hepatic lipidosis). Plain and contrast radiography can be difficult to interpret due to the normal presence of ingesta always in the stomach and caecum and recirculation of barium if coprophagia occurs. There may be a large amount of fluid in a stomach that is obstructed at the pylorus. In most cases exploratory laparotomy is required for diagnosis.

Treatment and Prognosis

Aggressive treatment is essential in this life threatening condition. Stabilization of the rabbit prior to gastrotomy is essential to optimize a successful outcome. Analgesia, shock doses of intravenous or intraosseous crystalloid solution and systemic broad-spectrum antibiotics should be administered. Prokinetics are contraindicated with an obstructive condition prior to surgery, but are useful postoperatively to stimulate gastrointestinal motility. Gastric decompression via nasogastric or orogastric tube should always be attempted. Where possible serum electrolyte concentrations and acid-base status should be evaluated, acidosis and ketosis may be present. Systolic arterial blood pressure should be measured using the same technique as for a cat, the reference for the

systolic pressure in a rabbit is 92.7-135 mmHg. Following the same principles as used in cats and dogs, fluid therapy has been used to correct hypovolaemia in rabbits. Rabbits have an unnecessary reputation for being difficult to anaesthetise. Careful attention to all aspects of perioperative care, addressing stress and underlying respiratory disease will optimize safety and success.

Good principles of anaesthesia:

- Excellent perioperative care.
- Select suitable agents for the individual patient.
- Ensure the airway can be maintained and IPPV (intermittent positive pressure ventilation) can be given in an emergency.
- Ensure intravenous access is available for intraoperative fluid therapy and emergency drug administration.
- Increase fluid therapy to 10 ml/kg/hr during anaesthesia.

The selection of a suitable anaesthetic regime for a critically ill patient is vital. The use of alpha2-adrenoceptor agonists is contraindicated in these cases.

One suggested regime is:

Premedication: Opioid analgesia. Midazolam 0.2-0.5 mg/kg s.c., i.m. or i.v. to effect (0.7 mg/kg mean dose).

Then either chamber induction with sevoflurane or isoflurane, with pre-oxygenation. Otherwise Ketamine i.v. to effect (mean dose 10 mg/kg) can be given for a faster smooth induction. Ketamine can be diluted in 5 ml saline to ensure slow IV injection. The rabbit should be pre-oxygenated prior to intubation with a 2-3.5 mm endotracheal tube using the blind or visual technique. Lidocaine spray of the glottis, may reduce laryngeal spasm. The use of local anaesthetic agents will reduce the amount of general anaesthesia doses required, therefore reducing the side effects of these agents. Local analgesics are a very useful and can provide good postoperative analgesia. Bupivacaine (1mg/kg) and lidocaine (1mg/kg) when used in combination provide rapid onset and long duration of local anaesthesia and analgesia. The maximum dose of Bupivacaine is 2 mg/kg and lidocaine is 10 mg/kg. These can be injected as ring block into the midline skin and abdominal muscle. During surgery the rabbit can be given a top up of morphine 2 mg/kg i.v. or i.m., unless a partial opioid was used in the premed.

Reversal at the end of the surgery: In an emergency fully reverse opioids with IV naloxone 10-100 µg/kg. Continue analgesia post op. Fluanisone has sedative properties in rabbits and so may not be as useful at reversal of midazolam in rabbits.

Rabbits can be challenging surgical patients but the chance of a successful outcome can be maximized by ensuring:

- Good knowledge of regional anatomy.
- Adequate patient preparation.
- Suitable instrumentation.
- Steps are taken to minimize pain, fear and stress experienced by the patient.

The basic principles of veterinary surgery described for other domestic species are applicable to rabbits. Surgical techniques and considerations, however, may need to be modified to account for the unique anatomy, physiology and behaviour of rabbits. To perform a gastrotomy in a rabbit a standard midline incision should be made, care must be taken as the abdominal muscles and linea alba are very thin. The abdomen should be fully explored. The stomach should be partially exteriorized and the abdomen should be packed adequately to prevent contamination. Stay sutures should be placed at the proposed incision site. An incision should be made in non-vascular site along the greater curvature or between the greater and lesser curvatures of the stomach. The foreign material should be visualized and removed. Closure is similar to that in other species. One layer of a simple continuous suture pattern followed by an inverting pattern. Only absorbable synthetic monofilament suture material should be used in rabbit surgery as they are very prone to adhesions. The linea alba should be closed

using a continuous or interrupted suture pattern, The skin should be closed with a simple continuous subcuticular pattern.

Post-surgical adhesions have been minimized with NSAIDS post operatively. Then continue support as for ileus. Prognosis is guarded to poor as most rabbits have severe hepatic lipidosis, acidosis, ketosis and severe gastric ulceration. Severe gastric ulceration could progress to perforation with subsequent peritonitis. Perforation carries a grave prognosis. Aggressive and early treatment will improve rate of recovery.

Intestinal ileus and obstruction

Caecal stasis is primarily an acquired disorder of decreased motility. Generalized ileus is a common continuation of this condition and may arise from mechanical obstruction or from defective propulsion, as seen with gastric stasis. Small or large intestinal obstruction has been reported in rabbits, where the small intestine was most commonly affected. Foreign bodies were most commonly found in the small intestine and included locust bean seeds from mixed muesli-type rations, carpet fibre and pellets of compressed hair. Post-surgical adhesions, inguinal hernia and a tapeworm cyst caused strangulating obstructions of both the small and large intestines. Neoplasia was found to cause an obstruction in all areas of the gastrointestinal tract.

Diagnosis

The history and clinical findings, of a firm, dough-like or gas-filled caecum on palpation, allow a presumptive diagnosis of caecal stasis and ileus. Differentiation between non-obstructive and obstructive ileus can usually be based on the clinical appearance of the rabbit and response to treatment, although advanced non-obstructive disease may be more challenging to interpret. Radiography is indicated if obstructive disease is suspected and dilation of the region proximal to the obstruction is diagnostic and an emergency laparotomy should be carried out. Serial radiographs may be useful in some cases to confirm a suspicion. In advanced cases of ileus the stomach often contains some ingesta, but large and small intestines are gas filled.

Treatment and Prognosis

Treatment of caecal stasis necessitates aggressive medical management to prevent further deterioration and death. Rehydration, analgesia, prokinetics and nutritional support with a high fibre diet is vital in these cases as described in gastric stasis. If obstructive disease is suspected or diagnosed on radiography then an exploratory laparotomy is indicated. Care must be taken in the perioperative period of these critical patients. The anaesthesia protocol described for gastrotomy procedures is recommended. A routine laparotomy incision should be made as described for a gastrotomy and the entire GIT should be explored. The area of the affected bowel should be exteriorized and the abdomen should be packed adequately to prevent contamination. An assistant's fingers or atraumatic forceps (sterilised bobbi pins can work well) should be used to prevent ingesta contaminating the surgical field. Ideally an incision should be made in a healthy portion of intestines and then the foreign body milked into the incision. For firmly attached obstructions an incision should be made just next to the lesion. The foreign body should be removed or in the case of a neoplasm an enterectomy and histopathology could be considered. If no intestine is removed then the incision is closed with a simple interrupted pattern using synthetic absorbable monofilament suture. If the incision was made into the caecum a second layer of an inverting suture technique should be carried out. Care must be taken to use a small needle to prevent leakage of caecal contents or tearing through this very thin walled structure. Omentum can be tacked around the incision site. The abdomen is closed as previously described for the gastrotomy. The Perioperative mortality rate can be high in rabbits with obstructions, but with excellent perioperative care a good outcome can be achieved. The prognosis is grave for rabbits with an obstructing neoplasm and euthanasia should be considered.