



Welcome to the 2016 RWF Conference.

## OWNERS STREAM

Welcome to what is now our 14<sup>th</sup> conference. 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 year. We are hugely grateful to our team of Educators today, and as ever, thanks to Burgess Pet Care as our sponsors.

Thanks therefore go to the following people:

Dr Richard Saunders

Dr Elisabetta Mancinelli

Dr Anne McBride

Dr Nadene Stapleton

Dr Jo Hedley

And of course thank you to you for coming along and supporting this event. We hope you have a useful and educational day.

Alan, Emma, Rae, Richard & Ros

RWF Team

Burgess Excel is the UK's No.1 veterinary recommended range of food for rabbits, guinea pigs and chinchillas, specially developed with small animal experts. The Excel Feeding Plan is an easy to follow, 5-a-day guide for complete dental, digestive and emotional health. We are delighted once again to sponsor RWF and their annual conference, and we hope you all have an enjoyable day.



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## **Richard Saunders**

Exotics Species Referral Surgeon

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

Having previously worked in small animal, avian and exotic first opinion practice, Richard is currently the RWA Senior Clinical Training Scholar in Zoo and Rabbit Medicine at Bristol Zoo and Langford, University of Bristol.

Richard has lectured and written articles on rabbits and exotics, co-authored "Notes on Rabbit Internal Medicine" and has a particular interest in chinchillas, rabbits and birds of prey.

## **Elisabetta Mancinelli**

DVM CertZooMed Dipl.ECZM (small Mammal) MRCVS

European Veterinary Specialist in Zoological Medicine (Small Mammals)

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 Diplomate, 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.

**Dr Anne McBride BSc, PhD, FRSA**

Senior Lecturer, Senior Lecturer in Human-Animal Interactions, and Animal Behaviour

Dr Anne McBride holds a BSc (Hons) degree in Psychology awarded by University College London in 1978. She was awarded her Doctorate in animal behaviour (Aspects of Social and Parental Behaviour in the European Rabbit) from the same institution in 1986. In 1992 she obtained a Certificate in Conservation and Ecology from Birkbeck College, London. She is a Fellow of the Royal Society of Arts.

Dr McBride has been a practising animal behaviour therapist since 1987 and was head clinician at the Animal Behaviour Clinic at the University of Southampton which was open from 1999-2009. She is a member of the Association of Pet Behaviour Counsellors and an Honorary Member of the The Canine Training and Behaviour Society (formerly the UK Registry of Canine Behaviourists). She lectures nationally and internationally, on various aspects of animal behaviour and the human-animal bond.

She is a Member of Council of the Companion Animal Welfare Council, an independent advisory body under the chairmanship of Lord Soulsby of Swaffham Prior. She is Chair of the Programme Recognition Committee of the Animal Behaviour and Training Council. She is Deputy Chairperson of PATHWAY - a working party looking at pets and housing issues in the UK, chaired by Roger Gale MP.

She is a patron of the Rabbit Welfare Association.

In 2013 she was awarded an Honorary Membership of the British Veterinary Nursing Association for here contribution to the Veterinary Nursing profession

In 2005 she was made an Honorary member of ASETRA – the Italian Veterinary Behaviour Association.

In 2004 she was made an Honorary member of the UK Registry of Canine Behaviourists.

In 2003 she was made an Honorary Teacher at the University of Bristol Veterinary School.

In 2001 she was awarded an Honorary Fellowship of Myerscough College, University of Central Lancashire for her contribution to the field of pet behaviour.

She was a co-founder of HOPE - the Homeless Owners with Pets project, now subsumed under the wing of the National Canine Defence League. She was a member of the advisory panel for the production of the 'Canine Code for Kids'. She was a member of the executive committee of SCAS (Society for Companion Animal Behaviour Studies) between 1995 –2002, and of British Veterinary Behaviour Association (formerly CABTSG -Companion Animal Behaviour Therapy Study Group), which is affiliated to the British Small Animal Veterinary Association, between 1995 and 2001. She was Honorary Secretary of the Association of Pet Behaviour Counsellors

### **Joanna Hedley BVM&S DZooMed(Reptilian) MRCVS**

Joanna is a Lecturer in Exotic Species and Small Mammal Medicine and Surgery at the Royal Veterinary College in Camden.

Joanna qualified from Royal (Dick) School of Veterinary Studies in 2003 and spent time in mixed, small animal, exotic and wildlife practice before undertaking a residency in Exotic Animal and Wildlife medicine back at R(D)SVS where she obtained her RCVS Diploma in Zoological Medicine.

She is currently a RCVS specialist in Zoological and Wildlife medicine and European specialist in herpetological medicine. She joined the Royal Veterinary College in 2014 as Lecturer in Exotic Species and Small Mammal Medicine and Surgery. She is based at the Royal Veterinary College in Camden, where she leads the exotics clinical service and is developing student teaching of exotic species.

### **Dr Nadene Stapleton**

BVSC, MRCVS

Nadene graduated from the University of Melbourne in 2000 and has had an interesting and diverse career spanning routine farm practice, equine racetrack work and general small animal practice. She has spent time working with Australian Native wildlife and charity work in China with bears before eventually coming to rest at The Royal Veterinary College where she has worked since 2009. She has fostered a passion for the health and welfare of more exotic animals and an enthusiasm for teaching students and colleagues on this subject - or anyone who will stand still for long enough! Her aim is to turn every graduating veterinary student into a 'rabbit vet' whether they want to or not and is well on the path to world domination. A self confessed 'crazy rabbit lady' she has in turn been educated by a series of rabbits including her current two Rue and Elmer and lives in a tiny house with birds, a lizard, fish, tortoise, a cat and a very long suffering magician called John.

## **Rabbit anatomy**

The rabbits kept as pets today originate from European rabbits (*Oryctolagus cuniculus*), which were first kept by the Romans as food animals, and in more recent years have evolved to become a true companion animal. Although a variety of different breeds and colours have been developed since then, the basic anatomical features of the rabbit remain almost exactly the same. Many of these features such as the rabbit's large eyes and ears are adaptations to the lifestyle of a prey animal, with the priorities being to avoid predators, obtain food and reproduce effectively often over a relatively short lifespan. However, understanding the normal anatomy of the pet rabbit can help us detect signs of disease, understand how and why medical problems may occur and how they can be avoided.

### **External anatomy**

As a prey animal, the rabbit is reliant on its senses of excellent vision and hearing to detect any potential threats. The rabbit's eyes are therefore large and positioned at the sides of the head to provide a large visual field of almost 360 degrees. This may vary depending on the head shape of different breeds; those with a wider head shape having a reduced field of vision. In the retina, rod cells are more common than cones giving the rabbit better night vision than colour vision, an advantage for their crepuscular lifestyle. The ears are also large and naturally held upright to catch sound waves. The development of various lop breeds however, has changed the anatomy of the ear resulting in a narrowed often poorly ventilated ear canal.

The rabbit's skin is thin and fragile, but is protected by a dense coat usually made of up two layers; the short undercoat and longer guard hairs. These may vary depending on the breed, for example Angora rabbits have both a very long undercoat and guard hairs, whereas Rex rabbits have very short guard hairs.

### **Internal anatomy**

#### *Teeth*

- The adult rabbit should have a full set of 28 constantly growing teeth; 4 upper incisors (including the peg teeth), 2 lower incisors, 6 upper cheek teeth and 5 lower cheek teeth (premolars and molars). These teeth should naturally sit in alignment so that they wear against each other as the rabbit chews. The rate of tooth eruption should equal the rate of wear in the healthy rabbit fed a natural diet.

#### *Gastrointestinal system*

- The rabbit's gastrointestinal (GI) system is arguably one of the most important body systems for us to understand, both from a medical viewpoint and to ensure that we provide an appropriate diet. Rabbits are hindgut fermenters, similar to some other species such as horses. This means that food is predominantly digested in the hindgut, broken down by microorganisms within the caecum. Food passes through the gastrointestinal system relatively quickly compared to some other species in order to keep the rabbit's weight low. Despite this, the rabbit's GI system makes up to 20% of its body weight. The stomach is large and has a well-developed cardiac sphincter which prevents vomiting. The small intestine is relatively simple but can be ~3m in length. The hindgut is comprised of the very large caecum (where fermentation occurs) which lies either midline or slightly to the right side of the abdomen and the colon (where faecal pellets are produced).

#### *Respiratory system*

- Rabbits are "obligate nasal breathers" meaning that they should only breathe through their nose and open mouth breathing is a last resort. Their soft palate is hooked over the larynx and needs to be disengaged when a rabbit is anaesthetised so that they can be intubated. The thoracic cavity is small and easily compromised by enlargement of the stomach or other causes of abdominal distension.

#### *Heart*

- The rabbit's heart is small, but naturally beats fast at up to 300 beats per minute. However, the coronary circulation is limited so the heart can quickly become compromised if blood vessels become blocked.

#### *Urinary system*

- The anatomy of the rabbit's urinary tract is similar to that of other mammals, despite some functional differences.

#### *Reproductive system*

- Male rabbits have two testes which descend from the abdomen at ~ 10 weeks into the scrotum. The inguinal canal between the abdomen and the scrotum remains open throughout life, allowing testes to be withdrawn into the abdomen when necessary.
- Female rabbits have an unusual reproductive tract comprised of two uterine horns, no uterine body and two cervixes. Large fat reserves are also often associated with this, which can make the procedure of spaying a rabbit more challenging than some other animals.

#### *Musculoskeletal system*

- The rabbit skeleton is very light compared to other animals, with large powerful hind limb muscles allowing them to run fast and evade predators. However, their bones are relatively brittle and the spine in particular may be easily damaged.

## Dr Richard Saunders

### Q&A lecture

1. On a recent webinar, someone referenced a study which showed that male rabbits remain fertile for up to 6 weeks post-castration. This seems a surprisingly long time to me so I'd be really interested to hear a bit more about the study - was all the testicular tissue removed during the castrations, were the findings of significant numbers of sperm or just a few hardcore stragglers? What, if anything, does this study tell us about how long we should be recommending before attempting to bond a recently neutered male to an entire female? Females would normally be spayed but there may be an exceptional circumstance where it's done differently, especially for instance if it was a pair of young siblings and the buck is castrated as soon as he is ready.
2. \*VHD2: update on the latest position (I'm sure this has been asked for by other people!) including progress with importing Filovac and what the vaccination protocol would be with this vaccine.
3. How does biosecurity work at the vets practice? For instance if a rabbit with suspected VHD is brought in to the practice, what sort of steps are taken to contain the disease? What about if a post mortem is required, how is this done minimising the risk to other patients and to prevent spread of diseased tissue?
4. Are there any drugs that can help support kidney function when a rabbit is diagnosed with chronic renal failure?  
I had an elderly (approx. 10 year old ) bunny whose extensive upper jaw abscess had been 'managed' with anti-biotics, pro-biotics & Metacam (plus daily cleaning) for approx. 3 and half years.. When he then started drinking more and weeing outside of his litter tray, blood & urine tests indicated renal failure.  
My vet knew of no drugs that could help: The manufacturers of 'Fortekor' advised against its use in rabbits because of its likely adverse effect on blood pressure (becoming too low, I think).  
I could only encourage my rabbit to drink plenty & try to reduce calcium/protein levels in his food. Taking him off Metacam was not an option as he needed the pain relief. (A 1.9kg rabbit, he had 0.45mg of meloxicam daily).  
Any information gleaned at conference will gladly be passed on to my vet & other rabbit owners I know.
5. What are the latest drug(s) recommended to treat GI stasis, how long should they be used for and is there a role for infacol in this condition.
6. I am a member and have 2 rescue house rabbits and I also have a dog. There has been some research into the possibility of vaccine build up in the body and the necessity to vaccinate every year in dogs, has there been any research/thoughts of the same in rabbits?
7. My vet commented the other day (whilst vaccinating them) that he doubted they would ever get myxi even if I never vaccinated them again, due to the amount of vaccinations they had already had. For me it is certainly not about the cost but purely that I do not want to overdose them and cause any potential problems.  
I realise that for some people it is probably better to educate them to vaccinate regularly rather than possibly check their vaccine levels and vaccinate accordingly as it may leave their rabbit unprotected due to forgetfulness etc.

- 8.** Is there any preventative flea treatment? In particular to prevent Mxyi? Should we routinely worm against EC?
- 9.** At a recent vet check my vet said my 11 year old rabbit's teeth were perfect and really white, but my 2 year olds were good but 'yellow' – why are some white and some yellow? They are fed the same diet. Is it something I should be concerned about?
- 10.** I work at a rescue centre and I wanted to know what is the earliest age at which rabbits can be neutered? I know that Cats Protection have done a lot of research into this with kittens and found no adverse affects of neutering from 9 weeks old and have developed their own anaesthetic protocol for kittens. At the rescue centre we sometimes have rabbit litters born at the centre or come in very young; if we want to rehome these youngsters as mixed sex sibling pairs, the younger we can do that the better the chances of us rehoming them quickly because people like young rabbits, this in turn then frees up space for us to help more rabbits. So is there a minimum recommended age or weight for neutering males and females?

## **Post surgical and Chronic care of Rabbits**

Dr Richard Saunders

When a rabbit (or any animal) leaves the practice, after any treatment, it often has ongoing care needs. And it's possible at this point for them to miss out on some aspects of care, even with the best communication. There are a number of things which need to be discussed at that discharge appointment, and this is even more important if the animal is being sent home by a different member of staff from those who have been involved in his or her care, or being collected by a friend or family member who is not the primary carer.

### **Important points to cover in a discharge appointment:**

These are all things which the vet or vet nurse seeing your pet out should attend to, but it does no harm to mention them here as a belt and braces approach, to avoid missing things out. Veterinary practice staff would generally rather be asked something by you, than have it forgotten!

### **Medication:**

There may be medication to go home with. Make sure you know when the last dose was given. The duration of treatment and how often to give it will be on the label, but it's often unclear whether an afternoon dose has been given, so don't be afraid to ask. You should have the medication itself, and any dosing syringes needed. If giving injections, you may be given a sharps bin for disposal of needles, or a secure box to put syringes and needles in if that is safer than taking them apart. If in doubt about how to give medication, ask to be shown!

In the vast majority of cases, rabbits are sent home on some sort of pain relief, either for post operative control of pain, or as part of the ongoing medication for a painful or inflammatory condition. If your pet has received surgical or dental treatment, or has some other reason to receive pain relief, and this is not part of his or her post operative care plan, I would discuss this with your vet at the earliest opportunity, as it is generally very important for their recovery that they are adequately supplied with pain relief. There may be specific reasons in some cases where this is not supplied, but better to discuss directly at the time than to realise, later, that this has been left out.

Antibiotics are more contentious: there are good reasons for and against the administration of antibiotics in specific cases. If in doubt, discuss with your vet.

### **Food and fluids:**

Rabbits often benefit from post operative supplemental feeding and fluids. This is a big topic in itself, but it's worth asking for some of the supportive care diet that the practice uses, to go home with, in case it is needed later on. As with medication, if unsure, feel free to ask for a demonstration of feeding methods, and make sure you have feeding syringes to go home with.

### **Recheck appointment:**

If possible, make a follow up appointment at this point, so that it doesn't get missed, and so you can make sure it is with someone familiar with your rabbit's case.

### **Questions:**

Especially if your pet is ill, rather than having an elective (planned) surgery, you may have lots of questions. It's easy to forget them all at this point, so write a list to avoid missing any out. This is probably the best time, face to face, to discuss anything with the vet/VN, rather than having to try to get hold of them on a telephone over the next few days. It worth asking them to show you any wounds present so that you know what they should look like, and what to look out for in case you need to seek help about them later.

### **Discharge sheet:**

This isn't just a make-work piece of paper, it's a useful document to help pass on information about your pet. It should contain details of what medications he or she is on, when they are due, any wound care required, details of follow up appointments, and contact numbers for an out of hours service in case there are questions or problems later than night.

### **Post-surgical care:**

**Pain relief:**

As above, pain relief is a vital part of a rabbit's care around the time of surgery, dentistry or any other painful condition. Individual animals react differently to pain, and to medication, and it's possible that your pet may need to have an initial pain relief plan changed depending on his/her response. Discuss with your vet what signs you should look out for that would suggest additional pain relief were needed, such as tooth grinding ("hard" tooth grinding rather than the quieter happy grinding noise that rabbits may make when relaxed), pressing their bellies on the ground, hunching up, excessive thirst, not moving, lethargy, not eating, chewing a painful part of their body, or just "looking unhappy": don't dismiss your awareness of your rabbit's normal body language! Conversely, sedation can result from high doses of opioid pain relief agents, and if you feel they are "out of it", contact your vet to discuss changing the dose, rather than just stopping it.

**Feeding and water intake:**

Observe how much (and what) your rabbit is eating. Appetite is a vital guide to your rabbit's recovery, and lack of food intake will slow your rabbit's recovery as well as leading to GI stasis, which could be fatal. Note what he or she is eating, keep a record, and discuss with your vet if you are concerned. Don't be afraid to contact your vet: they would rather hear from you the day after surgery if things aren't quite right, than at a post operative check 3 days later when things may be too late to turn around. If you are having trouble getting food into them, let the practice know.

Water intake may be too low, but can also be too high, which can indicate pain. Keep a record of this, and let your practice know if you have concerns.

These things can be difficult to monitor if your rabbit is back in with companion(s). It's generally better to be back with their bonded friends, but extra diligence, or some separate feeding, may be helpful to ensure the patient is missing out.

**Faeces/urine:**

Keeping an eye on what comes out the other end is just as important. Again, it can be difficult if in with companions, but if possible keep them together. Faeces may have a temporary reduction in output after anaesthesia and surgery and a period of not eating, but should return to normal output soon. If this is not the case, let your practice know. Note approximate amount, and details of shape and size. Lack of urine can indicate failing kidneys, so observe litter trays, and other areas, as temporary loss of litter training may occur through stress or inability to use a tray if uncomfortable.

**Nursing:**

Whilst this includes medicating, feeding and fluids, it also includes less tangible things like keeping your rabbit quiet, clean, comfortable, and with or without companionship as appropriate. You, as the owner, are probably best placed to make that latter decision, but generally speaking, if your rabbit is cleared to come home, they are best back with any companions, with good observation to ensure not being treated boisterously or aggressively, and to ensure they are eating OK. No animal likes being dirty, and so good nursing, including using bedding described later (under "Chronic Care", can help to keep them clean and dry and comfortable.

**Weighing:**

A useful back up to ensure they are eating enough, is to weight the rabbit daily, at the same time each day. While their weight may occasionally take a dip for a day, this hopefully just reflects emptying of the bladder, and the general weight trend should be upwards if recovering well from surgery (unless weight loss is planned, which would be best carried out in stable, good health). Small bathroom, or large kitchen scales, are accurate and relatively inexpensive now.

**Wound care:**

Follow your vet's specific instructions on wound care, sutures, and bandages etc. In general, we aim not to place sutures in rabbits that can be removed by the animal. The ends of sutures are typically placed ("buried") under the skin to avoid chewing them and opening wounds. Check the wound daily for this, and for any swelling, discharge or chewing or licking. There may be a sticky wound dressing, but many vets prefer not to draw the rabbit's attention to the area, and leave it uncovered. Bandages should be checked daily as they can become tight around a limb, and may shrink if they get wet. If you have any concerns speak to your vet. Collars, aka the "cone of shame", are rarely used in rabbits as they put them off eating and prevent

normal grooming and caecotrophy. If they are used, extra grooming and cleaning may be helpful, and ensuring they eat is important. Don't place a cone on a rabbit yourself as anything other than a very short term safety measure, and discuss it with your vet asap if you need to.

#### **Exercise:**

I've known rabbits, excited by being home, and evidently pain free, decide to run and jump and binky, and pop sutures. It's possible that your vet doesn't realise, seeing a quite bunny in his or her surgery, that your rabbit is an athlete at home, so it's a good idea to ask what exercise restriction, if any, is needed after a particular surgery.

#### **Chronic care:**

There are a few things in this below, which are relevant to the immediate post-surgical period, and vice versa. I've tried not to be too repetitive, and only address some differences where they occur.

#### **Pain relief:**

Long term pain relief may be a bit different to immediate short term post surgical pain relief. It is more likely to be reliant on drugs given by mouth, more likely to use NSAIDS (non-steroidal anti-inflammatory drugs, eg meloxicam <Metacam/Loxicom>) than opioids, and may use lower doses. So, for example, your post-op pet may be on opioid painkillers at the surgery, and possibly after they go home, and might get a high dose of liquid oral meloxicam at home for a few days. Whereas long term, they may be on lower doses of meloxicam, and possibly more unusual drugs such as tramadol, if meloxicam isn't enough.

Long term, it may also be worth trying cartilage support supplements such as glucosamine:chondroitin. There's little if any evidence for their efficacy, but they appear safe in rabbits at the suggested dose rates.

#### **Ancillary treatments:**

I have no idea whether a range of alternative therapies may help, and I think it comes down a lot to the individual rabbit whether other things help or hinder, but it may be worth looking into both complementary alternative therapies, and adjunctive therapies such as hydrotherapy, massage, etc, to make your rabbit as comfortable as possible. Some rabbits benefit immensely from personal contact and regular attention, whereas for some, it may add to their stress. It's like handfeeding: closely bonded rabbits may be encouraged to eat by a patient familiar human sitting next to them, whereas some may eat better by themselves.

#### **Companionship:**

Generally, companionship is incredibly helpful, both mentally, for support and to maintain important social bonds and needs, but also physically: grooming by a companion can help keep a debilitated rabbit clean, remove mats from his or her coat, and in the case of blocked tear ducts, reduce the risk of sore skin under the eyes, by gently grooming discharge away.

#### **Substrate and furniture:**

I know people who have significantly altered their pets surroundings to customise them for a particular condition. Slippery floors can be very difficult for animals with mobility problems to cross, and that might mean that they stay in one room, and miss out on food, water and companionship. Ladders or jumps may be impossible for a mobility impaired rabbit to manage, and so shallow, wide ramps with good footing are much preferred.

Low sided litter trays to make it easy to get in and out are helpful in avoiding accidents.

Thick soft bedding, whether it is clean soft hay or "Vetbed" type products, helps avoid pressure sores, and keeps urine away from the skin in incontinent rabbits.

Chronic conditions can slowly sneak up on us: it's worth keeping an eye out for a slow decline in mobility, caused by stiffness, pain, or both, and addressing it. The first sign might be not getting up onto a favourite vantage point, so do tell your vet about any unexpected changes of behaviour which could have a physical cause and can be managed.

## **Encephalitozoon cuniculi (ECUN) infection in domestic rabbits**

Elisabetta Mancinelli DVM CertZooMed ECZM Dipl (Small Mammal)

European and RCVS Veterinary Specialist in Zoological Medicine (Small Mammal)

Encephalitozoon cuniculi (Ecu) is a parasite commonly encountered in domestic rabbits. The resultant infection is called Encephalitozoonosis.

### **What is it?**

Ecu is a tiny protozoan organism that belongs to the phylum Microsporidia which comprises over 1,200 species of ubiquitous, spore-forming, parasites that can infect almost all animal phyla. Three different Ecu strains have been identified. The only rabbit strain is Strain I whereas Strain II and III have been isolated from rodents, dogs and humans respectively. Ecu primarily infects rabbits but infection can be seen in other mammals (including sheep, goats, cows, horses, dogs, cats, monkeys, guinea pigs, foxes, exotic carnivores and pigs) as well as in birds and snakes. It is frequently encountered in farm and laboratory rabbits but it is thought to be rare in the wild rabbit population. A recent study demonstrated evidence of exposure in 52% of normal healthy pet rabbits. However, exposure does not mean disease as not all the exposed rabbits will develop clinical signs.

### **Can it be transmitted to humans?**

The infection caused by Ecu is considered a zoonosis as it is possible for this organism to be transmitted to humans. However, human infection only occurs in immunocompromised patients. The zoonotic risk is considered minimal in healthy individuals observing basic hygienic rules and so far there have been no reported cases of confirmed direct transmission from an infected domestic rabbit to a human. It has been postulated that human infections are mainly of environmental origin via contaminated water sources or from other infected humans. Individuals who are immune suppressed (e.g. organ transplant recipient, HIV patients, people on immune suppressive medication) should avoid contact with infected animal and seek doctor advice for any concern. However, at present, it is still not clear which animal species play a major role as reservoir of infection.

### **Transmission**

The parasite is spread via spores (sort of resistant eggs) that are shed in the urine of infected rabbits. Unborn kits may be infected from their mothers, via the placenta during pregnancy. Young and adult rabbits may contract it from an infected mother or, at any age, from a cage mate by ingesting the spores present in urine contaminated food or water. Inhalation of spores may also occur. Other routes of infection are possible but not proven to occur naturally. When a rabbit is first infected the parasite is absorbed via the intestine, carried into the blood circulation and distributed around the body where

different type of cells can get attacked by the spores and infected. Inside the host cells, spores multiply and mature, eventually causing rupture of the cell and release of other spores, which can then infect other cells. Rupture of these host cells is associated with an inflammatory response. The main target organs are those with a high blood flow, such as the brain, the kidneys, and the eye but other organs may also be involved including liver, lungs and heart. In these organs the parasite's damage can cause chronic inflammation and typical lesions called granulomas. When the infection overwhelms the rabbit's immune system, clinical signs eventually manifest. It is not completely understood why many rabbits will develop signs of disease whilst others won't. It is well possible that many factors may be involved in the development of clinical disease. The rabbit's immune system certainly plays a major role as well as the route of infection and the strain of parasite involved. These contribute to the fact that not necessarily all the infected rabbits will show clinical signs of disease: carriers and asymptomatic infections are extremely common but immune suppressed and diseased rabbits are more likely to show symptoms associated with Ecu infection.

## **Symptoms**

Clinical disease may be serious, such that some rabbits either do not survive or are left with lifelong signs.

Neurological signs are certainly the most common symptoms associated with this infection in domestic rabbits. Depending on which structure, between the brain and the spinal cord, is affected, neurological disease may result in changes in behaviour, seizures, paresis or paralysis of one or both hind legs (hind limb weakness to complete loss of function), neck spasm, head tilt (torticollis), urinary incontinence, loss of balance, rolling, swaying at rest. Rabbits suffering from renal disease may present with non specific symptoms such as drinking and/or urinating excessively, loss of litter training, incontinence, urine scalding, reduced appetite, weakness, depression and weight loss. If the foetus becomes infected whilst in-utero (in the womb) the parasite can infect the eye and, as a result, cataracts (clouding of the crystalline lens in the eye), uveitis (inflammation involving the interior part of the eye), hypopion (white patches visible in the eye) or even blindness may develop.

The impact that the different clinical presentations of Ecu infection can have on the quality of life of positive rabbits varies depending on whether neurological, renal or ocular disorders are present, alone or in combination. Generally neurological disorders seem to affect less the general condition of rabbits when compared to those affected by renal disease. In a study, renal failure was a reason for euthanasia in the majority of cases compared to a survival rate of 50% of rabbits showing only neurological signs.

It is extremely important to rule out other possible diseases that may cause the same clinical signs as, in many cases, multiple diseases may be present at the same time. For example, other causes of head tilt and neurological disease in rabbits should be considered such as ear infections, trauma, congenital abnormalities, parasites and toxicities. For this reason, a definitive diagnosis cannot be achieved simply on the basis of the symptoms observed.

## Diagnosis

A correct and prompt diagnosis in vivo would be important for a more targeted therapy, a more accurate prognosis and would allow consideration of possible zoonotic risks. However, diagnosing an active infection in a domestic rabbit can be challenging. There is not one single test which could tell in a definitive way whether the symptoms observed are due to *Ecun* infection only. That's why, when a rabbit is presented with clinical signs compatible with this infection, a series of tests are usually recommended. Furthermore, a full neurological examination should always be performed in all cases presented with neurological difficulties. A thorough examination can be difficult to perform in rabbits and careful interpretation of results is mandatory because rabbits are prey species, and they tend to react differently from dogs and cats in a stressful situation.

The gold standard for diagnosing *Ecun* infection is a specific blood test that can be performed to detect antibodies to *E. cuniculi* in the blood. The test is called ELISA and a positive result (detection of antibodies in the blood) is referred to as a "positive titer". Unfortunately, a positive result is not always straightforward. In many cases, a high level of antibodies in the blood, in a rabbit with symptoms compatible with *Ecun* infection, is sufficient to start the specific treatment for it. However, when the level of antibodies is moderate to low, this may not be sufficient to warrant a treatment as many rabbits can still carry this parasite without symptoms and it is therefore possible that they may be affected by another disease mimicking *Ecun* infection. Further investigations would be required in these cases (e.g. bloods, urine analysis, x-rays, ultrasound, CT, MRI and/or other specific tests).

A negative result usually rules out *Ecun*. However, it is possible that the sample is taken very early in the course of the infection (the rabbit has not had the time to mount an immune response to the parasite and has not yet produced antibodies) or that the immune system of the rabbit is too weak to produce antibodies. In these cases, we have a false negative result and the test is inconclusive. However, in some instances a second blood test can be carried out at least 4 weeks apart from the initial one to check for rising antibody titer which would indicate an active infection.

We need to consider though that antibody levels can persist for years even in rabbits with no clinical signs and that there is considerable individual variation in the immune response in each patient (for example some rabbits have persistently high antibody levels for a long time or even for life, others become negative after 8 weeks only). Furthermore, a positive serology test may be strong evidence of infection but does not correlate with clinical signs of disease (high antibodies level do not mean more severe disease). Secondly, antibody production does not result in a protective response or immunity for the patient (antibodies do not protect against reinfection).

More recently, other tests have been developed which may help achieve a clearer diagnosis. For example, a test called PCR (Polymerase Chain Reaction) has been developed for detection of spores in samples of lens content from diseased eyes (very sensitive and specific test) or from tissue samples (especially kidney) collected by laparoscopy (key hole surgery) or at post mortem (during a necropsy). However, these tests are strongly reliant on the stage of infection, the spore burden within the patient,

and spore excretion in the urine (which is intermittent) therefore may not be very useful in practice. Many other tests have been investigated some of which may prove useful in adjunct to serology to obtain a more precise diagnosis. Some of these tests will be discussed during the talk. Unfortunately post mortem examination is often the only reliable way of testing for this parasite which may cause typical lesions in the brain and kidneys.

## **Treatment**

Treatment is aimed at reducing inflammation using anti-inflammatory drugs and stopping spore formation and proliferation using benzimidazole drugs (such as fenbendazole). A study has shown that a 28 days course of fenbendazole can eradicate *E. cuniculi*. Killing the parasite, though, does not reverse the chronic changes that have already taken place in many organs. Many rabbits, despite treatment, may not get any better because the parasite may have already induced irreversible brain inflammation or kidney damage. However, it is important to consider that animals seem to have less difficulty adjusting to loss of mobility than humans do. Rabbits who manifest the clinical disease may therefore stabilise with time and still be able to live comfortably for a prolonged period of time.

Few studies have evaluated the use of corticosteroids as anti-inflammatory agents in the treatment of *E. cuniculi* infection in pet rabbits. Results strongly discourage their use to treat *E. cuniculi*-mediated inflammation because of their suspected potential interference with fenbendazole efficacy and their strong immune-suppressive effect (in animals which potentially may already have a compromised immune system). These effects are of great concern as they may promote persistence and shedding of *E. cuniculi*. Lastly, rabbits are notoriously a corticosteroid-sensitive species and toxic changes have been reported in many organs even after short corticosteroid use. Systemic non-steroidal anti-inflammatory drugs, such as meloxicam, may be safely used for a short period of time as an alternative to treat inflammation. However, non-steroidal anti-inflammatory drug therapy should also be used cautiously in animals that have concurrent renal disease (especially considering the kidney is a target organ for *E. cuniculi*-associated inflammation).

Broad spectrum antibiotics may be prescribed to cover against risks of secondary bacterial infections. Supportive care is of utmost importance as many rabbits will be presented lethargic and anorexic. Sometimes with severe neurological signs sedation might be required.

Eye disease may be initially cured with eye drops. In particular cases, cataract surgery might be performed but if the disease is severe the eye may need to be removed.

## **Is routine treatment required?**

Whilst this remains an area of active debate and research, there are unfortunately very different opinions on this matter. Some advise routine treatment 2-4 times a year to reduce the risk of *E. cuniculi* developing into clinical disease. However, others feel that this is ineffective and pointless because the rabbit becomes immediately susceptible to the infection as soon as the treatment is stopped.

Furthermore, side effects are rare but possible and have been reported in rabbits. Further studies would be required to clarify whether these regular treatments are useful or not.

### **Can disease be prevented?**

*Encephalitozoon cuniculi* is widespread amongst many mammalian species including rabbits. This explains how difficult it is to prevent establishment of infection. Creating *E. cuniculi* free colonies is possible but time consuming and expensive. Some feasible measure to reduce the likelihood of infection, especially in a group situation, may include observation of basic hygienic rules (e.g. during shows/studs observe rigid hygiene rules and avoid urine contact between rabbits), appropriate disinfection of environment, food bowls and water containers, reduction of the risk of urine contamination (e.g. lifting the food bowls off the floor), housing rabbits in separate hutches to reduce the risk of urine dropping onto lower cages and avoid contact with wild rabbits and rodents that might be potential source of infection. Setting up '*E. cuniculi* free' colonies or households of rabbits can be done by treating all rabbits in the household with 28 days fenbendazole (being careful not to over dose). Simultaneously, the accommodation should be carefully cleaned and disinfected. Any subsequent new rabbits joining the group, should be treated prior to mixing. Whilst theoretically rabbits could become reinfected from rodents, foxes and other wild animals, the current view is that the risk is minimal.

### **Is there new research out there?**

More recent research has attempted reclassification of microsporidia (including *Ecun*) as fungi rather than protozoa. As the microsporidia spores may retain fungal elements, research focused on finding drugs that could target various components of the microsporidian spore and laboratory studies have been carried out to evaluate the susceptibility of the parasite to different drugs. The author is not aware of any in vivo studies carried out on rabbits at present. Many of these drugs may be effective in vitro but may have serious side effects on live animals, therefore further research is necessary before we can think of changing our protocols.

### **Conclusions**

There are an estimated 1.3-3 million pet rabbits in UK and over 50% are likely to have been exposed to *E. cuniculi*. Increased awareness is important so that clinical cases may be identified and treated at an early stage. Hopefully over the next few years more definitive recommendations will emerge. In the meantime, if your bunny shows suspicious clinical signs do have him/her blood tested. X-rays, urine test, CT or other exams may aid ruling out the presence of other diseases that might cause the same symptoms. At any point, the most important thing to keep in mind is your rabbit's welfare and quality of life. If a rabbit has head tilt but is eating, drinking and otherwise happy then he/she is probably coping with his/her situation and managing well. On the contrary, if a rabbit is unable to move, rolling and unable to keep his/her balance, unresponsive to the medical treatment and progressively deteriorating and being miserable, then you should consider whether he/she has an acceptable quality of life.

## **Behaviour: Fear and Problems.**

Dr Anne McBride

This lecture will briefly present some relevant research findings from various studies, including surveys involving veterinary professionals and the general public regarding how rabbits are managed, the types of behaviour problems they present, and some of the approaches taken to resolve such issues. This will form the basis to look more closely at fear: an emotion that frequently underlies problem behaviour.

### Further Reading

- Buseth M.E. and Saunders, R.A. (2015) Rabbit behaviour, health and care Wallingford UK: CABI
- Clinchy, M., Sheriff, M. J., & Zanette, L. Y. (2013). Predator-induced stress and the ecology of fear. *Functional Ecology*, 27(1), 56-65.
- Gray, J. A. (1987). *The psychology of fear and stress* (Vol. 5). CUP Archive.
- McBride, A. (2000) *Why does my rabbit...?* Souvenir Press Ltd, London, UK
- McBride, E.A. (2013) Help! They are taking me to the vets! *Rabbiting On*, Winter 2013 pg 7-9 (Journal of the Rabbit Welfare Association).
- McBride EA and Magnus E in press *Understanding the behaviour of small animals: rabbit and rodent behaviour*. In Casey R and Heath S (eds) *Companion animal behaviour problems: Prevention and management of behaviour problems in veterinary practice* CABI: Wallingford, UK

# Beaumont Sainsbury Animal Hospital

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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
- 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?

- Limited choice of antibiotics
- Thick capsule
- Thick pus
- Unlikely to burst then heal
- Hard for antibiotics to penetrate
- Hide signs of illness



## Fight Wound Abscesses

- Usually occur on body
- History of a fight
- Often a wound or scab evident



## Fight Wound Abscess: Investigations

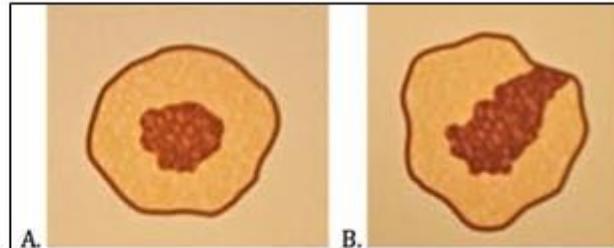
Fine needle aspirate



## Fight Wound Abscess: Treatment Options

### SURGERY

- Complete removal
- Treat it like it is a tumour



## Fight Wound Abscess: Complications

Sometimes unable to remove whole thing

Antibiotic resistance



# Dental Abscesses



# Anatomy: dental anatomy

- Continuously growing teeth  
Movement of jaw depends on  
type of food eaten
- Chomping
  - Grinding







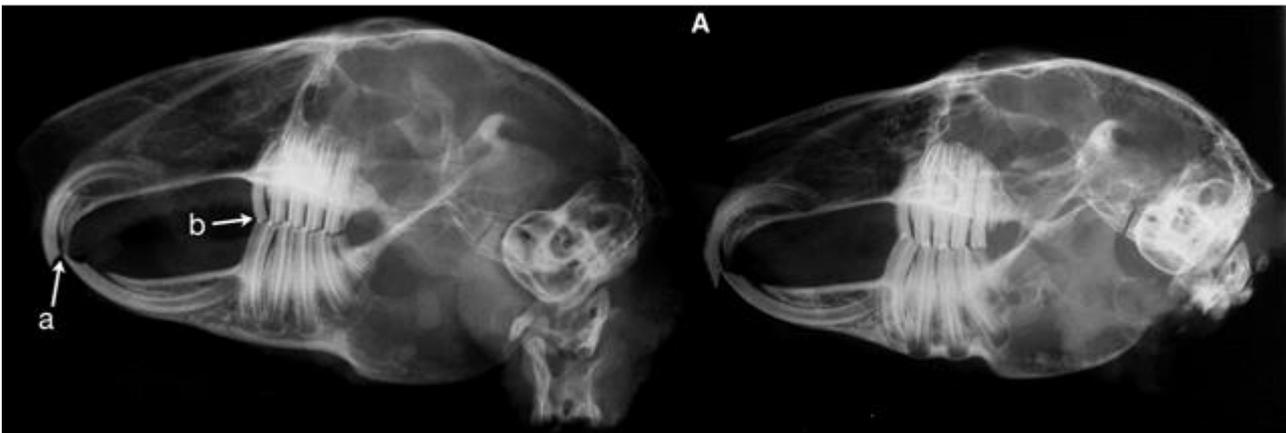
## Dental Abscesses: Investigations

- Anaesthesia
- Oral exam
- Endoscope
- Xray
- CT scan



## Dental Abscesses: Causes

- Incorrect diet
- Calcium/Vit D imbalance
- Selective feeding
- Overtgrown teeth
- Root elongation



## Dental Abscesses: Treatment

- Lancing
- Complete removal
- Clean and close
- PMMA beads
- Marsupialisation



## Complications

- Osteomyelitis – bone infection
- fracture
- Recurrence
- Gut stasis
- anorexia









# Ear base Abscesses



## Ear Base Abscess: Investigations

- Palpation
- Otoscopic exam
- Xray
- CT scan



## Ear Base Abscesses

Caused by the lopping of the ear

Wax trapped

Weak spot

Hard to identify

Often show no clinical signs

Intensely painful

“Tip of the iceber”



## Ear Base Abscesses: Treatment Options

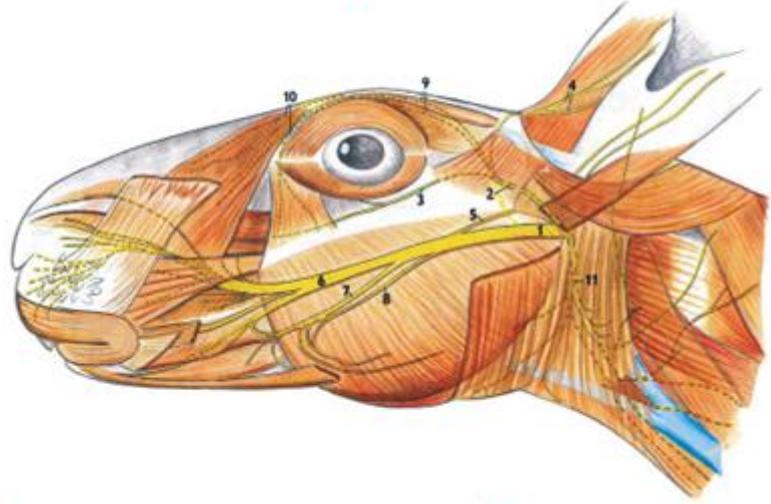
Ear flushing

Surgery



## Ear Base Abscesses: Complications

Bleeding  
Facial nerve paralysis  
Eye problems  
Balance problems



## Questions?

