



A to Z of Rabbits Mini Series

Session One: The Juvenile Rabbit

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What is a Rabbit? Digestive Physiology etc.

Prey animal: rabbits are a prey species unlike most of the other animals we see regularly in small animal practice. This means that some of the strategies they have developed in order to survive in the wild can mean that they present certain challenges as patients. Wild rabbits will either run or hide in order to avoid being eaten, only rarely fronting up to a challenge from a predator. Behaviourally pet rabbits are not materially different to their wild cousins and typically respond in a similar manner to situations they perceive as stressful. Although many owners are well attuned to their rabbits and will notice when subtle changes in behaviour occur, other owners do not notice, meaning rabbits may be presented at an advanced stage of disease or deterioration. This also means that many rabbits are presented at the point at which they are failing to cope with disease, not at the start of a problem. As clinicians it is necessary to remember this and not to interpret the time line of a problem too closely unless there is other clinical evidence to support it.

Hind gut fermenter adapted to a poor nutrient dilute diet: The digestive system of the rabbit is unlike any other mammal, and is a good example of adaptation to a fairly hostile environment, in particular one where food resources can be limited at certain times of year. In the wild rabbits eat leaves and grass. This fibrous diet varies seasonally. The incisor teeth are used for food prehension and the cheek teeth grind this up disrupting cell walls and allowing nutrients to be released. All teeth within the rabbit mouth are open rooted and grow throughout life. The rabbit is dependent on the dentition to initiate digestion, and is also dependent on a fibrous diet to keep the teeth adequately worn down and avoid dental problems. While some amylase is present in the saliva, rabbits are not adapted to a high starch diet and the levels are much lower than other species. The ingesta passes to the stomach, which has a pH of between 1 and 2, and further digestion occurs here in a similar way to other species. The small intestine also functions in a similar way to cats and dogs, and during the passage through, anything within the ingesta that can be absorbed will be. The interesting portion of the gut is the hind gut, which starts at the ileocaecocolic junction. This is a muscular valve-like structure that separates the small intestine from the caecum and colon. Initially ingesta moves from the ileum to the proximal colon. It is here that the non-digestible and digestible particles are separated out. The non-digestible particles are formed into faecal pellets (hard faeces) and these then move to the distal colon and are passed. The digestible particles are sent back to the caecum, using the haustrae. These are sac-like evaginations of the proximal colon that act almost like an elevator and at certain cycles of digestion (controlled by the gut pacemaker or fusus coli), they act retroperistaltically and move digestible particles back into the caecum. The ileocaecocolic valve prevents regurgitation of ingesta back into the ileum. Once in the caecum the bacterial microflora (multibiota) work their magic and break down the digestible fractions of the diet. Once digestion has progressed (and again under the control of the gut pacemaker or fusus coli) the digesta passes into the proximal large intestine and through the fusus coli, is covered in a mucus layer, then passes rapidly through the distal colon and then passes out through the anus, from where it is eaten directly. This process is known as caecotrophy (NOT coprophagy). The caecotrophs then pass into the stomach, where the mucus layer protects them to a degree from the low pH, and once in the small intestine, the digested substrates can be absorbed into the blood stream.

Shift from milk to fibrous diet at weaning: Very young rabbits are dependent on maternal care and survive on milk only for at least the first 10 days of life. During this stage, caecotrophy is not present. As the kits start to interact with their environment once their eyes open between day 7-10, they start to experiment with food items. As weaning progresses, the gut bacteria are established and caecotrophy starts. This period in a rabbits life is critical in terms of establishing a normal multibiota (both digestive and to a degree immune function are reliant upon this). The flora that become established depend on maternal multibionta, maternal diet, and also the dietary items within the environment that the juvenile eats. This time period is also important in determining the juvenile rabbits food preferences.

The First Consult

Where and when bought?: It is sensible to determine the origin of any new pet during the first consult, as this can have an impact on the immediate and longer term health of that animal. This is not an anti-pet shop diatribe, however even with good practice, it can be difficult to avoid disease in larger pet outlets simply because so many individuals are being removed from maternal care, potentially weaned early, are travelling long distances and also being mixed with individuals from other sources.

Contagious disease is very difficult to control under these circumstances. Individuals purchased from breeders may not have the same risk of communicable disease, however the potential for this is not zero. Diseases related to a closed breeding/gene pool may be more of an issue, however there are now many responsible breeders making sound stock available. In general terms those owners that have sought out a breeder have considered keeping a rabbit in more depth.

How is it being kept?: Gone are the days when rabbits were simply kept in a hutch at the bottom of the garden as a child's pet. The Rabbit Welfare Association's 'A Hutch is not Enough' campaign has highlighted the needs of rabbits in terms of the space in which they live. In the wild rabbits are territorial and have home ranges the size of several football pitches. A small hutch that does not allow for them to display normal behaviour ie hopping, stretching out and standing on the hind legs is clearly not enough. The guidelines advocated by the RSPCA are for a minimum size of accommodation (for a 2.5kg rabbit) of 6x2x2 feet indoors with an outdoor run of 6x2x2 feet outside. But essentially the bigger the area provided the better. Many rabbits are now kept in accommodation that is a converted garden shed: allowing for open hutches to act like bedrooms, and for hide boxes and food resources to be provided. Outdoor accommodation is limited only by space and imagination, with many owners devoting a good portion of their garden to the rabbits. House rabbits are also gaining in popularity, with many owners choosing to devote a whole room to this, and often letting their rabbits have the run of the house if they are at home. Because rabbits can easily be litter trained they make quiet but responsive house pets and this is at the root of many owners seeking more advanced care for these animals.

What is being fed?: Diet is critical to the health and wellbeing of pet rabbits. Getting an idea of what is being offered will allow you to assess the advice that has already been given and make suitable alterations as necessary. Rapid changes in diet can be detrimental, particularly to young rabbits, so a period of 10-14 days should be scheduled for any changes. Many breeders do not advocate giving any green stuff to young rabbits to avoid diarrhoea/loose faeces at the stressful times of weaning and moving to a new home. In the wild juvenile rabbits would have access to whatever vegetation was available during that season, so there is no physical reason not to give vegetables, however if a young rabbit has not had access to greenery previously it is sensible to advise it is added in very slowly and preferably only one thing at a time switching every few days so it is easy to see what is and isn't tolerated.

Discussion of vaccination, worming and neutering: The initial consult will very often be when the vaccinations are given as long as the individual is well. Because neither myxomatosis nor rabbit haemorrhagic disease (VHD, Rabbit calici virus) require direct rabbit to rabbit contact for spread, then in most cases I recommend vaccination. Control of biting flies during the summer (these can spread myxomatosis) and the awareness that contaminated hay or other fomites can spread RHD are valuable things to mention to the owner. No vaccine is 100% protective. Occasionally small thread like worms may be seen in the faeces of healthy rabbits, particularly juveniles. These are likely to be *Passalurus ambiguus* and as such are thought to be normal commensals. In very young animals a heavy burden of these worms can cause a physical obstruction of the gut, but this is rare, and these individuals will be thin, poor-doers. In cases like this worming may be justified. However for normal healthy rabbits without clinical signs routine worming is not required because there are currently no pathogenic intestinal nematodes that affect rabbits present in the UK. BUT NB this may well change now that moving animals within the EU in particular has become easier. Medications authorised for worming under the small animal exemption scheme are available, however the active ingredient fenbendazole is not benign in rabbits, so the advice would be to check for a worm burden using a lab that is familiar with rabbits and to treat in response to these results if there is a problem.

Physical examination

TPR First!!: Always complete the pulse, respiration and temperature (if being done) evaluations before completing the rest of the physical examination. As a prey animal once adrenaline is released all these clinically significant parameters can be altered. In some individuals that are difficult to handle it may be sensible to avoid taking a rectal temperature unless it is essential because of the risk of rectal tearing. Should a temperature be necessary then the rabbit should be safely restrained by a trained member of staff and not the owner.

Head: in my opinion the examination of the head and skull is a crucial part of the clinical examination. First check the face and head for symmetry. Both mass lesions and facial palsy can alter this and may well be clinically significant. Next consider the range of normal jaw movement and manipulate the mandible gently through its range and decide whether this is normal or not. If it is not normal, then why is this? Then palpate the whole head, paying attention to the ventral edge of the mandible and the zygomatic arches (where the apices of the reserve crowns of the teeth are likely to erupt). Feel the line of the nasal bone compared with the ventral mandible: a line drawn down the nasal bone should meet a line drawn on the ventral edge of the mandible at a point in front of the rabbit's nose. If these lines are approaching parallel, then the rabbit's cheek teeth are long and are holding the mouth more open than normal. Look at the incisors by lifting and separating the upper lips: is the occlusal surface horizontal or is it slanted? If it is slanted, this suggests that the rabbit is favouring one side of the mouth for chewing meaning that there is an area of pain or dysfunction present. Are the incisors a normal length? If not then again it is likely that the cheek teeth are overlong. Examine the oral cavity using an otoscope. Whilst the view can be limited and should not be looked upon as a thorough examination, it can give a good idea of some of the pathology that is going on inside the mouth. Both eyes should be examined for discharge, as well as the anterior and posterior segments of the globe being examined with an ophthalmoscope. The rabbit retina is very different from the cat and dogs, and the optic disk is found just below the median line of the globe. The retina usually appears pinkish grey. Always check that the eyes retropulse normally and symmetrically: lesions behind the eye, dental disease and mass lesions in the anterior thorax can affect this. Ears should be checked for obvious disease and mites, as well as with an otoscope. Many rabbits will have evidence of a build-up of wax inside the ears, this may be a sign of failure or inability to groom rather than ear disease proper.

Chest: the rabbit's thoracic cavity is significantly smaller than the more familiar species meaning that the lung space is correspondingly smaller as is the area of auscultation. The dorsal lungs only extend to the 9/10 rib. Anterior to the heart the thymus which remains large throughout life, can impede auscultation. Using an appropriately sized stethoscope can be very helpful as small subtle areas of change can be missed using the normal sized bell/diaphragm. It is also worth remembering that rabbits are diaphragmatic breathers and do not use the intercostal muscles for breathing at all, so any restriction of the chest during restraint or auscultation can be detrimental particularly if there is parenchymal lung disease. Many rabbits when scared exhibit paradoxical breathing: this is where there is rapid shallow breathing, the rate of which approaches the heart rate. It is an adaptation for running away from predation. This is normal. Deep rapid breathing is not normal and requires investigation. The heart can be auscultated near the sternal border from under the front leg, from approximately ribs 3 to 5. Heart rate may be very rapid, 250-300 not being abnormal. Although it can be difficult, try and listen for abnormal rhythms and murmurs and definitely check that there are no pulse deficits. If any abnormality is detected then an ECG or ultrasound scan of the heart may be warranted.

Abdo: palpation and auscultation must both be performed on the abdomen. Generally it is sensible to auscult both sides of the abdomen for at least 30-60 seconds to check for gut sounds. These should be low level and regular, loud tinkling sounds are abnormal. Some rabbits in the consulting room will now have obvious gut sounds simply because they are nervous. If there is no consistent history, then they may just be nervous and not in gut stasis. Abdominal palpation is also important and generally most rabbits are relaxed about this. It is unusual to have a tense abdomen or areas of pain: these are abnormal. Remember that the caecum in a normal rabbit should feel relatively full most of the time, and this structure can be felt on both sides of the abdomen. Hard portions of gut, are abnormal and should be investigated. In most animals the liver is under the ribs and is difficult to easily feel, however both kidneys should be palpable. In older unsprayed females it is often possible to palpate the uterus particularly if it is enlarged. The bladder is also palpable, but generally is not tense.

Gender determination

Male vs female: determination of the gender of rabbits can prove troublesome particularly in very young individuals. In males it is usually possible to extrude the penis even if the testicles are not yet descended. The genitourinary aperture in this case is round and not slit-like. Because the inguinal ring remains open, testicles can be retracted after they have descended but in this case, the scrotal sac will still be present and obvious. Females tend to have a slit like genitourinary aperture, which is closer to the anus than it is in the male.

Vaccination

Authorised products in UK: there is one authorised product in the UK for the vaccination of rabbits: Nobivac Myxo RHD. This is a combined vaccine giving cover from both myxomatosis and rabbit haemorrhagic disease for a period of one year. The vaccination can be given from 5 weeks of age, and is generally associated with very few side effects, although a low grade fever and a small lump at the injection site have been reported. Because of the manner of spread of myxomatosis and RHD, unless there are exceptional circumstances (eg significant immunocompromise, chemotherapy etc) then all rabbits, even those kept indoors, should be vaccinated.

Myxomatosis (a member of the poxvirus family) is highly contagious and often fatal virus that can be spread both by direct contact, and vectors such as rabbit fleas and biting flies. The outbreaks tend to be seasonal and dependent of weather are at their peak in late summer. Clinical signs include swelling of the eyelids and ear pinnae, progressing to facial swelling severe lethargy and death. Rabbits with myxomatosis appear and feel very unwell.

RHD is a calici virus and is almost universally fatal in animals over 6-10 weeks of age. Animals younger than this are immune, and whilst can become infected, usually develop a protective response and are then resistant for life. The typical clinical picture for RHD is a dead rabbit perhaps with a haemorrhagic nasal discharge. Occasionally rabbits are found acutely dead without any premonitory signs and diagnosis is reliant on histopathology +/-PCR. Very occasionally a rabbit may be presented obviously unwell with no other relevant clinical history, and these animals often die rapidly despite aggressive treatment.

RHDV2

Worming

Authorised products: there are several products authorised under the SAES for worming rabbits. As previously stated there are no pathogenic nematodes of rabbits found in the UK, so unless there is a clinical indication, preferably with clinicopathological results to support it, routine worming of healthy rabbits is not required.

Issues surrounding movement of animals from Europe may lead to pathogenic worms being introduced into the UK and practitioners must be aware of this potential. *Obeliscoides cuniculi* is found in wild and pet rabbits in the USA, and other parts of the world, so could be a potential future hazard.

What is a suitable diet?

Hay: ideally the basis of all rabbit diets should be fresh clean, non-dusty hay and lots of it! The phytates and fibre in hay support good dental wear and the long stem fibre promotes gut motility. It is easily accessible and cheap as well as ideal. Introducing young rabbits to hay from day 10 when their eyes open is the best way to ensure they are happy eating this. Hay can be presented in bowls, hay racks or as bedding, however soiling can magnify any infection in the environment and lead to issues with coccidiosis and *E.cuniculi*. Most rabbits should eat a bundle of hay that is approximately the size of their body every day.

Pellets: there are several brands of pelleted food available for rabbits that have been formulated with longevity and not growth as their primary focus. Many brands now also have age appropriate formulations as well as different sized pellets. Giving a small amount of a good quality pelleted food every day will remove any concerns about nutritional deficiency within the diet. Because pelleted food is homogenous, there is no possibility of selective feeding. Adult rabbits need approximately 25g/kg of pellets daily however growing rabbits benefit from having a slightly larger amount until puberty and neutering.

Vegetables/fresh food: all rabbits should be offered a variety of fresh foods every day. As mentioned previously some rabbits will not have been offered fresh foods at all prior to purchase so it is necessary to introduce these slowly and carefully to avoid diarrhoea. Generally offering a small amount of one thing daily for a few days then switching to a different vegetable is safe (by a small amount I mean a teaspoonful initially but gradually increasing over a period of a couple of weeks). Should any evidence of diarrhoea occur then the food item should be withdrawn and the rabbit offered just hay and water with a small amount of pellets until this is resolved. Owners should be advised to seek veterinary care urgently in the case of diarrhoea. Once the rabbit appears normal the process can begin again perhaps with a different food item. Eventually an adult rabbit should be eating a bunch of fresh leafy greens approximately the size of its head every day.

What are we trying to achieve? With the diet we are trying to achieve healthy growth and longevity not rapid growth for production. We are looking to make certain there is adequate potential for good dental wear as well as sufficient fibre to stimulate normal gut motility.

Changing the diet

Why can/does this cause problems?: Changing the diet can lead to loose faeces, uneaten caecotrophs and potentially diarrhoea. This is because the ability of the bacteria within the caecum to digest the diet, is dependent on the diet eaten, so if the diet alters the digestion alters until the bacterial profile changes, meaning that osmotic diarrhoea can occur, and because the taste of the caecotrophs alters, these may remain uneaten.

Why are we worried about the microbiota? The bacterial colony within the gut is vitally important to the health of the individual rabbit. Preserving gut function is the prime directive of rabbit medicine, and in order to do this we must look after the bacteria that it contains. By making dietary changes slowly, offering appropriate food items, being cautious about oral antibiotic usage and considering offering pre and pro-biotics when appropriate this can be protected.

So how do we achieve a safe change?: the best way to achieve this is to make alterations slowly, to allow the minimum of disruption to digestion and to allow a shift in the profile of the gut bacteria to complement the new diet. A period of 10-14 days is ideal for making significant dietary alterations.

Socialisation and bonding

Overview of how rabbits live in wild: Rabbits live in social groups usually of a male, breeding females and associated young. There is a strict social hierarchy and strong social bond. Rabbits are also territorial and range areas that can be larger than several football pitches.

Ability to display normal behaviours: it is recommended to keep two rabbits together within a home situation to allow them to display social behaviours. Whilst lone rabbits can appear to thrive, they need to be able to interact with other 'companions' whether these are human, a stuffed animal or another species ie a guinea pig. However; guinea pig rabbit pairings are not recommended because the guinea pigs can be bullied, and rabbits also carry Bordetella in their nasopharynxes as a normal commensal, which can lead to severe pneumonia in guinea pigs.

Why keep two and not more? Because rabbits are hierarchical and territorial it can be very difficult to keep them in stable groups within the home situation. A pair of rabbits can exist together once bonded without regular struggles for dominance, this is much more difficult with a group. Equally providing enough resources for a larger group becomes a significant space issue. Each rabbit should have its own food/water/hide/bedding resources plus one extra to allow movement between resource points.

Basic bonding: The idea is to initially get the two rabbits intending to be bonded used to each other's scent. Most people achieve this by placing bedding from each rabbit in the others bed. This is done daily. The rabbits are kept in adjacent areas ideally with a wire mesh divide separating them. Once the rabbits are starting to interact through the wire and ideally lying down next to each other on each side of the divider and attempting to groom each other, then they can be introduced in a neutral area under supervision for a short period of time. If fighting occurs then the rabbits should be separated. If they are calm but not interacting then leave them in the same area for a short period of time. If everything goes well then the time they are allowed to spend together can be increased daily. Once they are grooming each other and laying down beside each other, they can be left for short periods on their own. These time periods can then increase until eventually the rabbits can be left in the same environment overnight. Remember that there must be one of each resource (food/water/bedding/toys/hide boxes) PLUS one for each rabbit.

Stress bonding: this is a method of bonding that relies on rabbits that are stressed in a controlled environment finding comfort in each other. The commonest way this is done, is to put two rabbits into a carrier and either take them on a car ride or put the carrier containing the rabbits on/near a working washing machine. The loud but regular noise and motion creates a degree of predictable stress that can lead to the rabbits mutually grooming and finding comfort in each other. Once the rabbits start to mutually groom then the regular bonding can proceed as before.

It must be stressed that this method is controversial and obviously stressful for the rabbits concerned. Opinion is divided as to whether it is justifiable. Some people feel that a single short period of stress that results in a long term bond is worth it in welfare terms however other argue that the initial stress is unacceptable. It must be remembered that stress bonding should never be a repeated intervention.

Why does a bond go wrong? Bonds that are established can go wrong for many reasons, and the first port of call is to make certain that both rabbits are healthy and pain free. Then a consideration of the circumstances is warranted: are there enough resources? Is there any obvious area where competition for resources is causing an issue? What season is it? Males that have been bonded and neutered can still be affected hormonally by increasing day length leading to disruption of the bond. This is why neutered female/neutered male pairings are advocated. My opinion is that the pairing between individual rabbits of whatever gender can work as long as the individuals are well matched temperamentally. Once the bond has broken, then another attempt at bonding can be made although sometimes this is not successful.

Re-bonding: this needs to progress in a similar way to initial bonding although is generally carried out after a cooling off period during which any injuries caused during the trauma of the bond breaking are treated and healed, and any other underlying clinical conditions are addressed. At this stage it may be sensible to consider neutering if this has not already been carried out, however neutering often does not achieve the desired effect alone, and behavioural training must be undertaken. Even neutered rabbits respond behaviourally to increased daylight particularly if neutering has been undertaken recently. Equally neutering one of a pair also often doesn't work and can result in injury to the more submissive animal, so in welfare terms it is unacceptable.

Litter training

How and why? Rabbits are naturally clean animals and are easy to litter train. Usually rabbits will use the corners of their 'bedroom' environment as a latrine, so placing litter trays in the established latrine area often works. With new rabbits where latrine areas are not established, placing litter trays each corner of the environment, is the simplest way of achieving litter training. Using hay in the litter trays is controversial. Rabbits will often nibble on hay whilst using the latrine areas, so placing hay in the litter tray can reinforce the training. However diseases such as coccidiosis and encephalitozoonosis are spread by oral intake of infective matter (either from urine or faeces) so encouraging animals to eat from potentially infected hay is a concern.

What does it mean if this goes wrong?? In general terms loss of litter training is usually referable to a clinical or psychological issue. Perception of predation can cause this, should the litter tray be moved out of the corner, or a new animal introduced into the environment. Equally issues surrounding pain and poor mobility can also be at fault. Increased drinking, pain on urination or central nervous disease caused by encephalitozoonosis are also possible culprits. Therefore loss of litter training warrants careful evaluation of the environment as well as clinical evaluation of the individual rabbit.

Neutering: when and how?

Age at neutering: Rabbits should be neutered around the time of puberty preferentially, however this varies between breed: the smaller breeds tend to become sexually mature younger than the larger ones (4m vs 6-8m) and males are mature earlier than females. Neutering prior to puberty has no known clinical sequelae however in females it is technically more difficult as the uterus is tiny and can be very difficult to find. As long as the rabbit is large enough to intubate and mature enough to withstand surgery then I am happy to neuter.

Castration: This can be done either trans-scrotally or through a pre-scrotal incision. Ideally castration should be performed closed, however in older males this can prove difficult so it must either be performed open, with the inguinal ring being sutured shut afterwards, or semi-closed where the testicle is prolapsed through an incision in the tunica, however a transfixion ligature is placed through both the spermatic cord and tunica that has been loosened further down to allow the testicle to be removed without too much tissue trauma. This effectively seals the inguinal ring without the need for additional suture placement. The skin can be closed using loose sutures or skin glue.

Ovariohysterectomy: this is done via a midline abdominal approach and the primary issues encountered are: the ability to find/identify the uterus in pre-pubertal females (I have found dorsiflexing the bladder is usually successful) or finding significant amounts of fat in the broad ligament making haemostasis a challenge. Because excessive bleeding can lead to significant post-surgical adhesions and potentially long term gut stasis issues, haemostasis must be excellent. There are often large vessels within the broad ligament that do not originate either at the ovarian pedicle or the uterine pedicle so these must be tied off separately.

Ovariectomy/laparoscopic surgery: The use of laparoscopic surgery is increasing in other species and there is interest in using this for rabbits. The instrumentation required for most rabbits is smaller than that required for dogs, and there is a cost implication to this. The speed of laparoscopic neutering in many cases is not much faster than the traditional method in rabbits. The verrus needles and ports should ideally be placed surgically and not blindly in rabbits to avoid damage to the delicate thin walled guts. Any rabbit undergoing laparoscopic surgery must be intubated (a supraglottic airway device will not be suitable) and preferably positioned so that the chest is elevated. Remember that rabbits are diaphragmatic breathers, so once the abdominal cavity is pressurised to allow visualisation of anatomical structures, then breathing will possibly be compromised. Equally the drying of the tissue during insufflation has been implicated in post-surgical adhesion formation. Perhaps the biggest issue surrounding laparoscopic surgery is the question of ovariectomy vs ovariohysterectomy. Current thinking suggests that pre-pubertal ovariectomy is not a problem but ovariectomy where there may be preclinical uterine changes is contraindicated: in these cases the uterus should be removed. In post-pubertal individuals it can be difficult to tell if there are any uterine changes visually, so those undergoing ovariectomy only should be monitored carefully for subsequent uterine changes.

Anaesthesia, analgesia, perioperative care

Rabbit friendly hospital: the key to good outcomes for rabbit patients is the provision of a suitable hospital environment. This needs to consider where rabbits are kept (away from predators, but in an area where they can be easily monitored without causing undue stress). Ideally bonded companions should accompany the patient as long as the hospital situation is not unduly stressful. Provision of hide boxes within the hospital cages as well as suitable food resources is mandatory.

Pre-op bloods: blood samples are easy to obtain and there is no reason why rabbit patients should not benefit from the same pre-operative care as other species. Checking parameters such as PCV, BUN, creatinine and AST will give an idea of how well the patient will withstand the planned intervention, particularly if this is an elective procedure.

Drugs: there is one authorised injectable anaesthetic agent for rabbits in the UK and that is the fentanyl/fluanisone combination "Hypnorm". This can be combined with a benzodiazepine to provide a surgical plane of anaesthesia. Other combinations include medetomidine/ketamine/opioid and medetomidine/opioid/benzodiazepine. The best combination is the one that you are most familiar and confident with. The reader is referred to the BSAVA Formulary or Carpenters Exotic Animal Formulary for doses.

Monitoring: Capnography and pulse oximetry are now regularly used and provide good information, however a good nurse watching attentively is irreplaceable. Heart rate and rhythm and therefore cardiac output can be significantly affected by some of the anaesthetic agents commonly used. Contrary to popular belief rabbits are not dangerous to anaesthetise, they just need to be properly assessed, stabilised and monitored.

Fluids: all rabbits should receive some form of fluid supplementation if they are undergoing anaesthesia. The fluid rate is similar to that in other species: 2-4ml/kg/hour. This can be given intravenously if an infusion pump or syringe driver is available, or can be given subcutaneously fairly effectively as long as the rabbit is otherwise well. Because rabbit skin is very loosely attached to the subcutaneous tissues (one reason they are used in surgical research into skin flaps) fluid given subcutaneously disperses easily and does not cause as much discomfort as in other species. It also is effectively taken up into the blood stream. Intraperitoneal fluids can also be given, however it is easy to damage the delicate viscera using this route and if substantial volumes are given, the increase in intra-abdominal pressure can impede breathing.

Prokinetics or not?? The use of pro-kinetics routinely in surgical cases is controversial. My preference is to make certain that adequate pain relief has been provided, fluid therapy has been given and that support feeding is established early if the rabbit is not seen eating promptly after surgery. Should there be reduced gut sounds, and a definite lack of appetite then prokinetics can be used safely at this time, however they should not be used to mask any failings particularly in terms of analgesia.

Common infectious diseases of juvenile rabbits

Pasturella: *P.multocida* is a common nasopharyngeal commensal in rabbits and often does not cause any clinical disease. However there are strains with varying pathogenicity and equally stress or immunosuppression can lead to an outbreak. Pasturella can be spread by direct contact, air droplet formation (from respiratory discharges), through sexual contact, vertically from the dam and injected through bite wounds. The clinical signs are often dependent on the method of transmission and are not restricted to 'snuffles'. SO although respiratory disease is a common outcome, abscesses, orchitis, pyometra etc can also be seen. Treatment involves an assessment of the underlying immune status and stress factors as well as antibiotic treatment in response to culture and sensitivity results. Often long term treatment is required, or even surgical treatment in the case of abscess formation.

Coccidiosis: Infection with various species of *Eimeria* is common in young rabbits particularly where overcrowding and poor hygiene are risk factors. Different strains of *Eimeria* have different areas of predilection as well as varying pathogenicities. Many cause diarrhoea, and this can be fatal in some cases, but is usually associated with high morbidity particularly if overcrowding and poor hygiene are factors. One species of *Eimeria*, *E.steidae* causes liver dysfunction, poor growth, ascites and is commonly fatal. The life cycle of this parasite particularly the migration after oral intake, is poorly understood. When getting faecal evaluations done it is important to get the species of eimerian found identified so that suitable treatments and prognosis can be given.

Encephalitozoonosis: rabbits under around 12 weeks of age are thought to be resistant to encephalitozoonosis due to the presence of maternal antibody. Juvenile rabbits that have been infected in utero may show clinical signs related to phaeoclastic uveitis even at an early age. Once over 12 weeks of age rabbits are susceptible to infection, however clinical signs may not become evident for at least 35 days and are often noted much longer after initial infection. EC is spread through oral intake of spores shed in the urine and to a lesser extent the faeces of relatively recently infected/reinfected animals. Stress can also play a significant role in determining whether an animal sheds a lot of spores or shows clinical signs because it has a significant detrimental effect on immunocompetence. Clinical signs often reported as being referable to EC include head tilt, seizures and renal disease however cardiac disease as well as lung damage have occasionally been reported. Because a positive EC titre does not confirm that clinical signs noted are due to EC, these animals should be fully evaluated for the other differentials prior to initiating treatment.

Toxoplasmosis: another potential cause of neurological signs in rabbits is Toxoplasmosis. In my experience this is not as common as EC, and is most often seen in rabbits kept outdoors. Infection is via ingestion of infective spores from cat faeces (ie cat faeces that have been evacuated usually 48hrs prior to ingestion to allow spore ripening) so is in general restricted either to outdoor rabbits or those that share house space with a cat. *Toxoplasma* can cause a variety of potential neurological signs in rabbits and is difficult to treat. A titre will confirm exposure and clinical suspicion. Fluoroquinolones are suitable treatments for rabbits, however clindamycin is contraindicated.

External parasites: fleas, lice and mites are all commonly noted particularly in juvenile animals. Identification of the parasite is essential, as is evaluation of the environment and other issues surrounding infestation such as poor hygiene, poor grooming and presence of female hormones (in the case of rabbit fleas). There are now authorised products available for the treatment and control of ectoparasites in rabbits, and these should be employed in addition to specific controls/treatments for the issues surrounding the infestation.

Flystrike: The colonisation of areas of wet/soiled/necrotic tissue with fly larvae or maggots is relatively common although not restricted to juvenile rabbits. Control/removal of the maggots is key, as is pain relief and antibiotics. Even with comprehensive treatment these animals can still become septicemic. In warm weather flystrike can occur within hours, and become fatal rapidly.

Owners should be encouraged to check their rabbits daily for this, and owners as well as their veterinary surgeons are encouraged to diagnose and treat the underlying causes of wet/soiled or damaged tissue in order to avoid this condition. There is an authorised product available for the prevention of flystrike in rabbits and this should be considered as part of routine preventive care in outdoor rabbits, however this doesn't mean the underlying cause of any issues shouldn't be determined.