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Tortoises, turtles and terrapins. The approach to common clinical presentations in practice Mini Series

Session One: Husbandry, clinical history taking, clinical assessment and hospitalisation of chelonians

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Session one – 'Husbandry, clinical history taking, clinical assessment and hospitalisation of chelonians'

The most commonly seen tortoises in the veterinary practice will be of the genus *Testudo*. These are the Mediterranean tortoises. There are four species commonly seen. The Spur Thighed tortoises have a great variation in size and colour but do share some common features.

Firstly they all have a flexible hinge on their plastron. Spurs are located on their thighs and are infact osteoderms. They can be large or small depending on the country of origin. There is no tubercule on their tail. Smaller and lighter colour individuals may well come from hotter climates and so caution is advised as these animals should not be hibernated. Larger darker individuals are more likely to hibernate.

The Hermanns tortoise does not have a plastron hinge or spurs on their thighs. They do however have a tubercule on the end of the tail (more prominent in males). They tend to be light in colouration and have distinct black bands on their plastron. They all hibernate.

Horsefield tortoises are probably the most common species seen currently. This is because they do not need a CITES permit as the other Mediterranean species do. These have no plastron hinge, but small spurs and tubercles are present. They are slightly smaller and lighter in colouration. They all hibernate.

Marginated tortoises are the least commonly seen of the four. They are very ornate and have a lateral flare of their carapace. They lack spurs and tubercles. They also hibernate.

All of the above species come from more temperate regions and as a result their husbandry is similar and will be discussed together.

There are other species being seen that come from different habitats, these can still be imported and these do not hibernate. The first group come from South Africa and inhabit Savannah and so are used to less succulent food compared to the Mediterranean species. These should be fed more fibrous food with a greater emphasis on grass and sun dried hay.

Sulcatas or African Spurred Tortoises. When can reach 100kgs when fully grown. These have spurs on their thighs, no tubercle, no hinge and a light grown in colouration. Leopard tortoises can reach up to 30 kgs, they also have leg spurs, no tubercle but are highly patterned with yellow skin.

Red footed tortoises are found in the rainforest and will also feed on fallen fruits, fungi and occasionally even carrion. 10% of the diet as a maximum should be fruit sources such as tomato, grapes, blackberries, mushrooms and peppers. Their need for UV-b light is less compared to the arid diurnal species. They have red marks on their legs and a dark brown and orange shell. Their skin is dark. They have no spurs, tubercules or hinges.

Semi aquatic species such as the south East Asian box turtles or American box turtles are becoming increasingly popular. These are usually taking omnivorous or carnivorous diets and should be provided with an environment similar to the red footed tortoises (higher humidity) and a pool similar to that required by aquatic species.

Aquatic species can be seen quite frequently and although their husbandry is much more complex (and your ability to house them as long term patients will be limited) it is essential you are able to identify common species and know about their husbandry. Essentially two species will be seen commonly, these are the Red eared terrapin and the yellow bellied terrapin. These are originally from America, but have become invasive pest species in many countries.

Many aquatic turtles require a large volume of filtered and heated water. External filtration systems used for fish are acceptable, but filters within the tank will be disrupted. Monitoring water quality is important and measuring ammonia, nitrite, nitrate and pH on a regular basis should be performed. A 10 – 20 % water change should be performed regularly. The water should be heated to 24^0C with a guarded water heater. A haul out area with a basking lamp providing a temperature of 35^0C and a UV-b source is required. The turtle should be allowed to dry completely at least once a day or shell

infection is possible. Many species start out primarily carnivorous but become more omnivorous as they become older.

It is best to keep a solitary tortoise, if a group is required then no more than 5 individuals of the same species and sex can be kept, being introduced after no less than 6 months quarantine.

Determining gender is important as a large number of reproductive diseases can be seen. Gender determination is relatively easy in adult individuals.

In terrestrial chelonians the males have a longer tail with a caudally placed vent (termination of cloaca), usually beyond the edge of the carapace. Their plastron may be concave.

The females have a shorter tail with a more proximally located vent, before the edge of the carapace.

Both genders have a cloacal organ although this is more prominent in males.

American Box turtles have different iris colours. The males have a red iris and the females is more orange.

Male terrapins have large front claws which are used in display to the females (and very often to the owners as well).

Clinical history taking

It is important to cover the main points of care for captive chelonians and this essentially means there are five avenues of questioning that can be applied to all species.

It is important with captive tortoises to allow daily and seasonal light patterns appropriate to their natural cycle. All of the chelonians you will commonly encounter will need UV-b lighting to enable vitamin D synthesis. UV-b light can be either from the sun or from an artificial source.

It is important to realise that many heliothermic tortoises exposed to high levels of natural UV-b would never have the physiological need or evolutionary pressure to develop a system for absorbing oral vitamin D or for storing its metabolites; this has been shown in some species.

There are four bulb types in common use the fluorescent tubes which need to be close to the tortoises (30 cm) and changed regularly, the compact bulbs which provide UV over a small area or the mercury vapour and metal halide bulbs which provide a focal heat source as well.

Many marketed lights fall well short of recommended levels. UV-b light diminishes with distance from the light source. It is filtered by glass and plastic. It also diminishes over usage despite still giving out light. UV-b light should be combined with a heat source to enable vitamin D production. UV fluorescent tubes can be placed by the basking area to provide a UV-a/UV-b source. The suggested distance is less than 30 cm. However in practice many bulbs need to be within 15 cm. The best style of lights marketed is the self ballasted mercury vapour lights. The light source should be on a time switch and be on for 9 -15 hours a day (depending on the season). Residue builds up behind the glass of the bulbs and the UV-b output slowly reduces, so regular replacement is essential.

Chelonians are *ectothermic*. This means they rely on an external heat source to maintain their body temperature. This is achieved from radiant heat primarily but also from conduction from surfaces with a high thermal inertia.

When providing basking sites always place a roof slate or rock under the site to retain the heat to allow the tortoise to warm up quickly. Another heat source is required to raise the enclosure temperature to the lower end of their activity range. This can be a heat mat, tubular heater, heat tape, ceramic bulb or a radiator elevating the temperature of the whole room. I recommend that these sources are thermostatically controlled and include a night time drop in temperature.

The basking site during the day should be from a spot bulb (two side by side for larger animals). The bulb can be directed either onto a focal area or more diffusely depending on the species. These can be can be combined with UV-b sources. Some designs such as the mercury vapour or metal halide

lamps provide heat and UV-b together. Otherwise a UV-b fitment should be placed close to the heat source so the tortoise gets heat and UV-b concurrently.

Species that do not require high UV levels can have a ceramic spot bulb with a low intensity UV fluorescent tube positioned near the heat source. Hot spot temperatures should be 30 – 50^{0}C depending on species. Cold end temperatures should be around 27^{0}C. Overnight temperatures should be 21^{0}C.

One of the main problems with captive care is inadequate temperature provision for some or all of the time. Many primary heat sources are unable to maintain an overnight temperature when the room temperature falls. Basking site use may also be limited due to intra or interspecific competition. At colder temperatures a tortoise will reduce its heart rate and vasoconstrict its periphery in order to retain heat. They will bury into the substrate which has a degree of thermal inertia and will also retain heat. In order to heat up the tortoise will bask and turn itself to maximise sun exposure. In captivity, overheating is possible due to being placed next to a glass window or an excessively hot basking lamp. Underfloor heating can lead to focal burns on the animals ventrum. Naturally when high temperatures are present a tortoise will seek shelter and bury into substrate. In the captive situation this brings them into closer proximity with the heat source, the substrate will insulate the tortoise and reduce heat loss. Heat sources can get very hot on their surface so it is important that these are shielded from the occupants of the enclosure or kept out of the way. Problems can be seen if heat sources are too powerful for the enclosure leading to overheating of the occupants or provide insufficient heat, this is particularly evident in the winter months.

Tortoises use about 2 – 5% of the energy of a comparably sized mammal. They are adapted to live in marginal habitats. Energy conservation is what it is all about and a tortoises life is geared towards getting metabolically active (which costs energy) but then is able to forage and obtain food (which provides an energy source). This food source will be scarce and the cost of obtaining it against the benefits (energetically speaking) need to be considered.

If not given appropriate lighting or diet then nutritional secondary hyperthyroidism (NSHP) may result. In tortoises beak deformities and scutes that are pliable under pressure are well recognised signs of NSHP. Carapacial deviations due to the pull of musculature can also be evident in the caudal midline. With continued growth this can lead to the appearance that the shell is too small for the tortoise's body. Abnormal plastrocarapacial bridge growth has also been reported as an ongoing sign of NSHP. Other signs that may be encountered include gastrointestinal tract stasis, cloacal organ prolapse and posterior paresis. In severe cases fractures can be seen. Reproductive problems can also be seen in females.

Calcium is absorbed from the intestine primarily by active transport, which is initiated by 1, 25-dihydroxyvitamin D. In order to prevent hypocalcaemia sources of vitamin D pre cursors are required in the diet along with exposure to UV-b light (315nm – 290nm) to synthesise metabolically active vitamin D. This can be achieved by exposure to sunlight or to artificial UV-b light.

In the absence of UV-b light, then vitamin D itself will be required in the diet. These two mechanisms have varying importance across the species with basking species being more reliant on UV-b sources and non-basking species being able to utilise dietary vitamin D alone.

Provitamin D (7-dehydrocholesterol) is converted by UV-b to previtamin D and then undergoes further transformation to vitamin D in the skin, which is crucially temperature dependant. There have been no reports of vitamin D toxicity through exposure to sunlight.

The vitamin D is bound to D-Binding protein (DBP) and then enters the circulation where it is transported to the liver and is converted to 25-hydroxyvitamin D. This step is quick and largely unregulated, so blood levels are variable and depend on the rate of production from dietary precursors and/or UV-b exposure.

From here it is transported to the kidney where it receives its final transformation to 1, 25-dihydroxyvitamin D, which is the metabolically active form. This step is much slower, subject to

product feedback control and is tightly controlled by blood ionised calcium, PTH and phosphorous levels.

The calcium requirements of reptiles vary during growth and reproduction (in females) and it is in these individuals that signs of NSHP are commonly seen.

The environment should be as large as possible and complex in its nature. Provision of hides and logs, substrates for burying and a water source are mandatory. Tortoises will not perceive a glass barrier and can do significant damage to their rostrum as a result. A fibreglass, plastic or melamine enclosure provides visual security and can be modified to suit the needs of any individual tortoise. On the whole an open topped 'tortoise table' is best as this allows for a high level of ventilation, but consideration must be given to a suitable bedding area which can hold its temperature overnight.

The substrate needs to be appropriate to avoid ingestion with subsequent impaction and straining. If a natural substrate is preferred then soil (irradiated/baked) or leaf litter are suitable. Newspaper/Astroturf/Alfalfa bedding/Rabbit pellets/Newspaper based cat litter or dense carpet tiles are suitable artificial substrates. Newspaper is a good substrate as it allows faecal and urinary output to be monitored.

Relative humidity is important and requirements will vary based on an animal's physiological state. Younger animals require higher levels. I feel it is important to provide captive tortoises with a choice of RH both in warm and cold environments.

HOUSING TORTOISES OUTSIDE

A tortoise should not roam free in the garden, as this will enable potential trauma from birds, dogs, lawnmowers or fires to occur. Escape is also a hazard, as is hibernating or digging and not being found until the spring (leading to both frost and rodent damage). The best method is to house the tortoise in a purpose built run with an attached house. Tortoises can dig and so it is a good idea to use blocks sunk down well into the ground (30 cm around the side of the run on a deep concrete base). The floor of the run can consist of soil but an area of concrete can assist wearing down nails and provide an area that does not get water logged. It is important that the area chosen has good drainage. It may also be wise to lay fine netting under the soil in the run at the level of the base of the sides. Care must be taken to ensure there is no chance of self-trauma due to the design of the run.

Within the run grass and weeds can be grown to provide food and cover. Rocks and logs can be used to vary the environment and provide areas for sheltering from the sun. Incorporating a cold frame in a sunny area of the run is also useful as this gives a quick hot spot that the tortoises can utilise to heat up quickly. Water can be provided in a shallow bowl or concrete pool. The run must be covered to prevent trauma and reduce the risk of theft. It is important to realise that glass or plastic unless specifically labelled will filter out any useful UV-b radiation.

Inside accommodation can either be an adapted garden shed or a small greenhouse. Green houses do have the advantage of heating up well but do not provide warmth overnight and so a dry shed is probably the best option. A small entrance and exit hole can be created; this must be designed so it can be closed off. Using plastic strips over the hole will reduce drafts at tortoise level. The shed should have both a heat lamp and UV-a/UV-b lighting, depending on how long it is intended to be used for. It is possible with a floor pen indoors that no additional lighting or heating will be required. However this will place some requirement on the tortoises being brought back in on colder nights and on short days. Night time temperatures should be in the region of 21^0C. The basking area should get up to 40^0C during the day, although thermostatic control is probably not required. Having the lighting on a time switch is advisable. Substrate should consist of vinyl or newspaper and should be cleaned regularly to reduce bacterial or parasitic burdens.

PROVIDING WATER

Tortoises usually drink by submerging their entire head underwater and can take water in via their nose or mouth or even suck fluid into the cloaca/bladder/colon and from there it can be absorbed. In a sense bathing allows dialysis of the tortoise via the bladder. Water should be presented in a shallow bowl with easy access into it. Twice a week the tortoise should be bathed in a cat litter tray of warm water. There should be sufficient water for the tortoise to be able to lower its head and suck up the water via its nose. This water should be 25^0C temperature. Warm water bathing also serves as a stimulus for voiding urates and faecal material. The passing of urine is a sign that the tortoise has rehydrated itself. Weighing the tortoise both before and after a bath is a good way of assessing the degree of rehydration that has occurred.

Tortoises are designed to conserve water. Protein breakdown and excretion of nitrogenous waste is one of the major factors influencing the amount of water lost. As a result tortoises are able to modify the protein breakdown products they utilise. Ammonia and Urea require a lot of fluid and this if fine where fresh water is plentiful. However species where fresh water is limited (such as terrestrial species or marine species) use uric acid. This forms insoluble urate salts in the bladder which exert no osmotic effect. The bladder amongst other sites is used as a water storage facility. As the tortoise dehydrates it uses water from the bladder to maintain its circulatory volume. In order to draw water into the circulation the tortoise must maintain an osmotic gradient.

Urea is a rapidly diffusible solute that can be excreted when water is available again. Blood electrolytes and urea can be used to detect subclinical blood concentration in a tortoise. As the bladder contents are involved too checking the specific gravity of the urine, its pH and its rate of production also allow an assessment of the tortoise's water balance.

FEEDING CAPTIVE TORTOISES

Presentation of food is important as aquatic species may only feed whilst in water. Any uneaten food should be removed and discarded to reduce the risk of autoinfection with parasites due to faecal contamination. Anorexia is a common presenting problem. Many cases are directly related to husbandry. A variety of food sources should be offered. Mediterranean tortoises are vegetarian. The use of a variety of plants, leafy greens, and other organic vegetables should comprise the entire dietary intake. Vegetables such as kale, spinach, broccoli, iceberg lettuce, romaine lettuce, cabbage, bok choi, turnip greens, endive, mange tout, spring greens, brussel sprouts, carrots (grated) can be offered. Naturally grown weeds such as dandelion, grass, sow thistle, plantains, chickweed, milk thistles, sedum, honeysuckle, nasturtium flowers, hibiscus flowers or wild pansy are an exceptionally good food sources and would be far preferable to supermarket goods. I would not recommend feeding any commercially available pelleted tortoise diets. Savannah species require grass and hay as 40% of their dietary input. Rainforest floor species will accept a variety of fruit items and mushrooms. Some owners also feed pinkie mice to these species. Box turtles are omnivorous and will relish livefood. Items such as woodlice, millipedes and earthworms are far better than commercially available livefood.

Calcium is an important component of the diet. For adult tortoises with access to a variety of vegetation and vegetable matter then daily supplementation with a multivitamin powder such as 'Arkvits' is advised. Younger individuals would benefit from 'Nutrobal' which has higher levels of calcium and vitamin D_3. These should be dusted on every feed.

CLINICAL EXAMINATION

Whilst taking an account of the husbandry time should be taken to observe the tortoise presented to you. Assess its general demeanour, activity and respiration prior to handling or stressing the tortoise. Disposable gloves should be worn when handling any tortoise. This is to prevent the risk of disease transmission between the reptile and yourself, and to reduce the risk of you being a vector for disease between different tortoises. Handling of chelonians should be performed with care. There are just a few points worth noting. Some species such as Box turtles, Hinge Backed tortoises and Asian Box

turtles are capable of closing off sections of their body off from the outside world due to hinges within the shell. This can lead to trapped fingers and intense pain! Larger stronger species can also trap fingers due to forcible limb or head retraction. It is important to ensure fingers are not trapped, grasping and extending an appendage will ensure no hinge is shut. Snapping turtles and soft shelled turtles can (and will) bite with some force and providing them with something to latch onto is helpful in control. They can extend their heads a long way out! Other species can bite and many terrapins get quite cross. It is unusual for most of the terrestrial chelonia to bite unless you are inflicting pain or distress. Cases that are recalcitrant should be sedated for a full clinical examination. This should be systematically performed in every case seen. A healthy tortoise will have bright open eyes and be active. There should be no nasal or, in most cases ocular discharges (Red footed tortoises normally have an ocular discharge). Some may be resistant and retract into their carapace. Time must be given for these animals to relax. Active animals should walk or run with their plastron raised off the floor. It is impossible to make an accurate judgement on a cold hypothermic tortoise. Respiration should be observed. There is usually a small amount of forelimb movement with no undue exertion or respiratory noise. Increased yawning, face rubbing, effort, noises such as squeaks can all indicate underlying respiratory disease. A closer examination of the head, limbs and shell should follow. The tortoise should give a perception of strength when extremities are being examined. Check the eyes, nares, beak and ear drums for any abnormalities. Beak overgrowths are a common presentation and can be carefully burred back. Middle ear abscesses are also common leading to distension of the ear drums. The mouth should be opened and the choana, tongue and glottis examined. If possible the glottis should be observed when the tortoise exhales to check for discharges. The heart can be assessed using a Doppler probe placed at the thoracic inlet. The skin should be examined for any wounds, burns, scarring, swellings, dysecdysis or external parasites. In tortoises these are limited to ticks in imported specimens. The shell should be examined for compressibility, loose scutes, discharges, fractures, reddening. The coelomic cavity can be palpated via the pre femoral fossa in front of the hind legs. Tipping the tortoise towards the examiner can allow eggs and bladder stones to fall onto your finger and ballottement can confirm their presence. In larger tortoises examination of the cloaca is possible.

A weight should be taken at every time the tortoise is examined and should be performed twice daily while hospitalised. Weighing a tortoise after bathing can also provide useful clinical information.

HOSPITALISATION

The essential aspects of chelonian husbandry have been covered already. These need to be modified slightly within the clinic. The aim of the hospital environment is not to create a wonderful setup for captive maintenance, but to provide for the tortoise's basic needs in an easy to clean disinfectable environment with minimal risk of disease transmission.

Plastic open topped vivaria serve this purpose well. A clamp lamp directed over the side to provide a basking area and UV- b light should be provided. The box can remain empty or newspaper can be used. This allows faecal and urine output to be monitored and collected for analysis. Water does not need to be provided but instead the tortoise can be taken out and bathed in a cat litter tray twice a day while the tank is being cleaned out. Electrolytes can be added to the bath to encourage rehydration.

Overnight the basking lamp should be turned off. The room temperature should be kept at 21^0C. The basking temperature can be monitored by a thermometer.

Larger animals or those requiring more specialised accommodation can be difficult to house appropriately in the clinic. Larger enclosures and more potent heat sources will be required. Rainforest species or semi aquatic species will fair better in an enclosed vivarium with a more even distribution of heat and higher humidity. This can be achieved by simply placing a cat litter tray of damp substrate within the tank. Many sick aquatic species may be too ill to swim (or you may wish to 'dry dock' them) and so short term housing is possible. Longer term hospitalisation should allow for swimming facilities and larger plastic bins or containers may have to be utilised.

Zoonotic diseases can be transmitted from tortoises. All individuals handling them should wear disposable gloves. Most chelonians shed *Salmonella sp* and/or *Campylobacter sp*.