Stress, anxiety, fear and frustration in different reptile species: how to reduce these negative emotional states during veterinary procedures

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ABSTRACT: Behavioural responses vary significantly within the Reptile Class when stressed, fearful or frustrated, making it very difficult to observe or measure their emotional state. Reptiles are not commonly seen in general veterinary practice which can mean that suitable accommodation is not always available, and as there is a huge variation in a reptile's ability, or lack of, to signal changes in emotional state, it can be challenging for veterinary nurses to identify and address the stress response. The veterinary practice can reduce negative behavioural responses by managing transportation, sampling and handling methods to improve the patient experience. This article refers to reptile species commonly kept as companion animals in the UK, including snakes, lizards and tortoises, which may be presented for veterinary treatment. It also examines possible routes to the identification of Reptile species as suitable pets, and indeed the suitability of Reptiles as pets at all.

KEYWORDS: Reptiles; reptile stress; frustration; fear; anxiety; sampling and handling; stress reduction

Introduction

When reptiles are presented at the veterinary practice, in order to reduce fear and frustration, stress levels should be minimised by the provision of suitable environmental conditions to suit the individual species. To this end, at the very least the following should be provided:

- **A suitable temperature** - hospitalisation requires provision of a hygienic room or space kept at 20-30 °C. Appropriate basking temperatures and suitable temperature gradients must be provided for each animal (Chitty & Rafferty, 2013)
- **Suitable lighting**
- **Humidity levels** as required
- **Places to hide, seek shelter and retreat**
- **Suitable substrate.**

Suitable temperatures, which are species-specific, are essential for all normal behaviours in reptiles. As ectotherms, they have a very limited ability to compensate for environmental temperatures above or below their Preferred Body Temperature (PBT) (Divers, 1996); they can overheat and die very easily. They require a temperature gradient allowing them to move in and out of warm areas to maintain their PBT which is essential for normal metabolism (including that of drugs).

Suitable lighting to provide adequate levels of light in the required range of wavelength are also essential.

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Danielle is a Clinical Animal Behaviourist based in Greater Manchester. It is Danielle's aim to provide caregivers with an insight into how their animals think and the reasons behind their problematic behaviours. The primary species Danielle works with are dogs however, due to her background in zoology and work within zoological facilities she is happy to see both domestic and non domestic species. Danielle's previous work history includes zoological collections, exotic pet stores and kennels. Danielle is the first and only registered clinical animal behaviourist who has been assessed for reptiles and is both passionate and enthusiastic about reptile welfare. Danielle's MSc thesis focused on the factors affecting the stress of Green Iguanas kept as companion animals and she has a passion for enhancing and improving the welfare of captive reptiles.

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Aquatic and semi-aquatic species will need access to clean water – either fresh or saline.

Although the accommodation may be small in size, and limited by the need to maintain good hygiene, suitable hiding places and retreats can be provided. Ensuring suitability of both resting and sleep sites help keep fear, anxiety, and frustration to a minimum. Many lizard species will sleep in places that are the opposite to their resting areas; often choosing the thin end of a branch as opposed to closer to the trunk (Mohanty et al., 2021). These environmental options need to be provided to ensure adequate rest for the patient, taking into account sterile and disposable items e.g., cardboard tubes and upturned plastic trays that can be easily cleaned.

Procedures should be kept to a minimum in terms of duration. Body position should be maintained in the most natural way possible, as this may be particularly important to a sense of security and well-being. Manipulation and handling e.g. inversion of the reptile may cause significant stress, fear and frustration unless anaesthetised (Figure 1).

The emotional states in reptiles – fear, anxiety, and frustration and their causes within the veterinary context

The complexity of reptile emotions and behaviour is far more advanced than has previously been recognised. These animals may be capable of living in social groups, can have vast home ranges, may show territorial behaviours and are clearly capable of learning (Lambert et al., 2019; Burghardt, 2019.). Their care needs are far more advanced than many owners and practitioners believe. Any limitations to their enclosures can lead to emotional distress, through lack of opportunity to display species-specific behaviours. The need to provide variety of habitat in the physical environment, in order to allow the range of normal behaviours, cannot be emphasised too strongly.

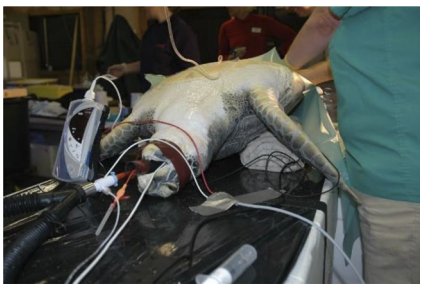

Figure 1. Green Turtle (*Chelonia mydas*) Dorsal recumbency during surgery - Photograph Nic Masters

For many reptiles, their failure to show normal behaviours would be the clearest indicator of stress or fear, together with physical condition and health (Highfield, 1996). However, establishing that sort of base line data, for emotional states in reptiles has not been carried out for reptilian species. In addition, at the veterinary practice, normal behaviour is unlikely to be seen, due to the effects of transportation and handling, combined with the proximity to humans. Stimuli such as vibrations within the environment e.g., due to footfall and equipment noises are likely to be fear-inducing as they are so far from the normal environmental experiences. These non-domesticated species will not have had the opportunity to habituate to any of these stimuli (Figure 2).

A recent literature review looking into reptile sentience by Lambert et al. (2019) found "at least eight different aspects of sentience in the scientific literature; anxiety, distress, excitement, fear, frustration, pain, stress, and suffering. Furthermore, they also referred to four studies that explored and found evidence of "anxiety, emotion and pleasure in reptiles." This provides us with further evidence to support the complexity of the needs of many Reptile species. These needs should be taken into consideration when they are presented at the veterinary practise for examination and treatment.

Behavioural responses from a variety of reptiles when anxious, stressed, fearful or frustrated

Reptiles have scaly skin; they cannot show facial expressions due to the fixed scales of the head; many also have limited limb movements; many do not vocalise to any significant extent. All of which make expressions of relaxation or pleasure, distress fear, frustration or pain difficult to identify. It is therefore very difficult to determine emotional responses from reptiles, unlike other groups, such as mammals where facial expression, body language, vocalisations to name but few, are all employed as indicators of emotional state.

Figure 2. Green Iguana (*Iguana iguana*) Presenting at the practice, these can grow up to 2 metres in length.

Fearful behaviours in lizards can be displayed as a passive or active response. During the former the individual may remain stationary, clasping onto a branch is common in many lizard species such as Anoles or Geckos. "Balling" is seen in many snake species, Other squamate species will posture defensively when threatened, often raising their heads, back and tail, bobbing their heads and opening of a dewlap if present. If posturing does not work, they may whip with their tails or strike with their mouth open whilst hissing.

Identifying fearful behaviours is not easy in Chelonians, but when tortoises withdraw into their shell and will not protrude their head or legs, it is a clear indication that their environment has become alarming to them (McArthur, et al., 2004). Sudden forced ejection of large volumes of urine is commonly seen on handling or during transportation as an indication of high levels of stress and fear. In the authors experience, this is also common in many other reptile species as is defaecation e.g., during transportation, for similar reasons.

Identifying happy, or at least comfortable, relaxed reptiles, has largely not been researched or defined in meaningful ways. Criteria for the assessment of these emotional states, which must surely be part of the scientific definitions for the opposite emotional states, including fear and frustration, have yet to be defined in these animals. For example, categorisation of reptile vocalisations as a means of expressing emotional state has yet to be done in any definitive work. Despite this there is evidence from a recent study by Kabelik (2021) that some lizards do possess similar brain physiology, with regards to stress and corticotropin-releasing factor distribution, as compared to mammals, and birds. Therefore, their lack of ability to demonstrate stress related behaviours, by no means implies a lack of a physiological or emotional response.

The difficulties for reptiles, as non-domesticated species, in displaying fearful or frustrated behaviours towards humans

Many large lizards such as Iguanas, Monitors and Tegus will raise their backs and arch in a defensive curve when threatened, ready to whip with their tail or bite. When handled,

many lizard species will open their mouth as a threat gesture, particularly chameleons. More docile lizards like Bearded Dragons and Crested Geckos can often be handled more easily, however, they too will posture when threatened. Those with dewlaps will extend them, and often bob their heads as a warning gesture.

Withdrawal is seen during stressful experiences in Chelonians, often requiring anaesthesia to carry out any procedures, even palpation, because the animal can completely close into the shell giving no access to head or limbs at all, for purposes of examination or sampling. Surgical interventions may be extensive requiring long-term recuperation (Figure 3).

The escape response is high in many reptiles and is often displayed through interactions with boundaries. To help reduce this, reptiles at the veterinary practice should be provided with enclosures away from other patients, especially predators. Observation of movement within their eyeline, should be prevented to reduce arousal and stress. Hides should be made available in both the high and low temperature range, plastic covers over enclosures are needed to reduce internal reflections and to assist in provision of appropriate levels of UV lighting and heat. Too high temperatures may also result in hypermobility, accompanied by open mouth gasping and gular fluttering.

Sedation or anaesthesia may be required in order to fully examine some species safely e.g. dangerous snapping turtles; venomous snakes or lizards; very large marine turtles or large or giant land tortoises; large lizards and iguanas which have the capacity to use their limbs, head, mouth or tail as a means of causing injury to humans (Figure 4).

Reducing fear and frustration – environmentally, through husbandry and management in captivity

Provision of a suitable environment as previously discussed, particularly in relation to temperature, lighting, substrate and humidity, is key for reptiles to stay healthy and well – the first steps in avoiding stress, anxiety and frustration. In captivity, the overall aim is to create an environment as similar to that found in the wild situation. This will then allow the animal to make suitable choices in order to maintain homeostasis and therefore good health (Chitty & Raftery, 2013; McArthur et al., 2004). Environmental enrichment is also essential in the provision of a captive environment which thus allows most normal behaviours to be shown. This would include provision of a variety of substrates, shelters, vegetation, platforms, branches and basking sites as well as water sources appropriate to the individual and its natural habitat. Opportunities to feed (and hunt if appropriate) on a suitable quantity, of a suitable diet is essential.

In order to reduce fear and frustration offering choice and control in their enclosure can be greatly beneficial (Kish, 2018). This can be achieved by utilising all 3D space within the enclosure, so the individual is able to move around and thermoregulate naturally. This allows them to take advantage of the micro-climates created by such a set-up, providing there are opportunities to hide and bask in warm and cold areas of the enclosure to maintain PBT.

Sampling and handling approaches which may reduce anxiety, fear and frustration

Reptiles will undergo transportation, handling, examination (e.g., palpation or inversion) and possibly invasive techniques during a trip to the veterinary practice, the effects of which are likely to be stressful leading to fear-driven behaviours. Transportation requires use of heat pads or hot water bottles to maintain PBT and to reduce stress; however, owners should be aware of the potential danger of burns due to lack of control of the temperature. A range of 24-30°C would be appropriate (Chitty & Raftery, 2013).

Fazio et al. (2014) found that in a study of 23 healthy juveniles (*Testudo hermanni)* cortisol levels were greatly increased, compared to basal values, for more than four weeks after handling and a short transportation experience. Their conclusions support the hypothesis that cortisol may be mediating the effects of handling and transport stress in this species.

More recently, techniques have been developed for the sampling of cortisol levels from faecal samples which totally remove the stressful handling required for blood sampling (Carbajal et al., 2019).

Procedures should be kept to a minimum in terms of duration. Body position should be maintained as natural as possible as this may be particularly important to a sense of security and well-being. Manipulation and handling e.g. inversion of the reptile, may cause significant fear and frustration. The limbs, or at least two of them, should remain in contact with a hard surface as a simple way to reduce fear and frustration in lizards and tortoises, as this may prevent the animal struggling to regain purchase on the ground.

To minimise this, stationing and target training can be used to teach individuals to place themselves onto weighing scales, or to follow a target stick out of their enclosure or into a travel container.

Handling and restraint should be kept to a minimum, and the animal maintained at a suitable temperature during procedures. Hands-off practices should be utilised where possible within the veterinary environment to reduce stress. Such practices may include feeding stations within the enclosures to build a 'target area'. This can then be utilised as an area for weighing rather than removing the individual from the enclosure, or as a removable platform for species less likely to jump as it can provide them with a surface to grip onto. Simple target training, allowing the individual to follow the target can be useful for handling, as opposed to grabbing from the enclosure (Figure 5).

Diagnosis and treatment may well require invasive techniques. Endoscopy, blood analysis, and biopsy are all commonly used techniques, all of which may induce fear and/or frustration, due to the physical presence of humans; the manipulation and handling involved; the discomfort created by the unusual body positioning. Ultrasound and radiography have the advantage of being non-invasive and are often possible without sedation.

Figure 3. Spay of Spur-thighed tortoise (*Testudo graeca*) – Photograph William Lewis.

Figure 4. Intubation of a boa constrictor.

Stomach tubing can be very stressful for Chelonians but may be preferred to the anaesthesia risks associated with an oesophagostomy tube according to Chitty and Raftery (2013). However, use of an oesophagostomy tube instead of repeated handling and manipulation of the head and limbs for gavage tubing is arguably much less stressful to the tortoise, prevents iatrogenic damage from tubing, reduces risks of regurgitation/aspiration and may result in much better outcomes (Figure 6 and 7).

Figure 5. Veiled Chameleon (*Chamaeleo calyptratus*) in practice – shows inability to stand on a flat surface. Providing a branch can help provide full visual access without stress.

Figure 6. Stomach-tubing a spur-thighed tortoise (*Testudo graeca*).

Figure 7. Horsfield's Tortoise (*Testudo horsfieldii*) with pharyngostomy tube fitted – Photograph William Lewis.

Figure 8. Operating room for a spur thighed tortoise.

Conclusions

Treatment effects will inevitably be stressful, and should be reduced by provision of a suitable environment to suit each species, including suitable basking arrangements and providing shelter and hiding opportunities. This represents a significant challenge for veterinary staff and may require investment by veterinary practices if the health and welfare of the reptile is to be effectively met while being cared for. Many reptile species have displayed behavioural flexibility and the ability to learn simple tasks, most recently seen in skinks. Szabo et al. (2021) provides more evidence that these animals can be trained to help improve their husbandry and welfare, providing an avenue for further research into these areas.

We have a duty of care under the Animal Welfare Act (2006) to ensure the animals in our care are free from pain, suffering, injury or disease as set out by the five freedoms. This can be a particular challenge in the case of non-domesticated species such as reptiles, coming into contact with a number of humans in the veterinary situation. Their suitability as pets is a moral and ethical dilemma, not least because of the difficulty in giving appropriate veterinary treatment when required. As non-domesticated species, all reptiles are particularly susceptible to stress and fear simply from the presence of humans (Figure 8).

Toland et al. (2020) suggest that an improved alternative way of legislating to protect exotic pets being traded and kept, would be for governments to "positively list" that is to allow "only the keeping of animals that meet certain scientifically proven criteria as suitable in respect of species, environmental, and public health and safety protections." Currently the approach is one of "negative listing" which involves restricting or banning problematic species, but it is not based on any useful criteria in terms of public or environmental health, or indeed welfare issues. Underestimating the emotional lives of reptiles is contrary to the recent scientific evidence and leads us along a path which history has shown to have a very likely detrimental effect on welfare, not least because it allows us to disregard the welfare needs of these animals.

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