

# **The Euthanasia of Reptiles**

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## **Introduction.**

A feature in a national newspaper<sup>1</sup> at the beginning of 2003 highlighted the problems faced by veterinary surgeons and animal rescue organisations when considering the euthanasia of reptiles. Sadly, it also revealed the ignorance which still exists regarding humane methods of euthanasia for these species; the article stated:

*"Another accepted way of killing an iguana, used by some vets, is to put it in a freezer. 'They close themselves down, and eventually they freeze and die.'"*

This review is written in the sincere hope that not one more iguana will suffer the agonising death described above. There are humane methods of euthanasia for every living thing and if unwanted animals *must* be euthanased – always a lamentable situation – it is absolutely essential that this is carried out decently.

The Royal College of Veterinary Surgeons was approached, and asked for guidance on recommended practices for the euthanasia of reptiles. In a detailed reply, their Professional Conduct Department stated that:

*"...simply putting an iguana into a freezer as a means of euthanasia would be unacceptable, as it causes the formation of crystals in cells which results in pain to the animal. If, however, anaesthesia was administered beforehand, then it would be considered acceptable. However..... the most humane method of euthanasia is the administration of Pentobarbitone intravenously. Administration into a body cavity is also possible, but this takes longer and may therefore be considered less acceptable."*<sup>1</sup>

Why is it difficult to perform euthanasia upon reptiles? To answer this question, and to outline the current methods of euthanasia available, the authors have conducted a review of the literature, and contacted various veterinary organisations and individual experts for their opinions.

## **The Problem of Euthanasia in Reptiles.**

"Euthanasia" means "gentle death" – it may be defined as the humane destruction of an animal with the minimum of pain, fear and distress. This requires a method that either (a) causes immediate, instantaneous death, (b) causes rapid and painless loss of consciousness which is immediately followed by death, or (c) involves anaesthesia, produced by an agent which causes rapid and painless loss of consciousness, followed by death produced by some other means whilst the animal is unconscious.

In the UK, pet owners have come to expect that the end of their animal's life may be peaceful and painfree. They are used to the idea of "putting an animal to sleep", and imagine that this will always involve a painless injection of an anaesthetic agent whereupon their pet will literally fall asleep never to awaken.

When working with wildlife, or in some circumstances when dealing with animals in commercial breeding establishments or the laboratory there are situations – particularly when dealing with non-domesticated animals- in which it may actually be more humane to use other methods of euthanasia to ensure a swift, stress- and pain-free death. Wild animals, for example, may become extremely fearful when handled in order to give an injection; and very small animals may be severely traumatised by the injection itself. A wide variety of methods have been developed for the humane euthanasia of many species. These range from the use of gaseous anaesthetics and injectable drugs to physical methods such as use of a captive bolt pistol or purpose-built laboratory guillotine.<sup>2, 3</sup>

In the case of reptiles, however, there are two specific problems which render many of these methods unsuitable. Firstly, reptiles are ectotherms (so-called "cold-blooded") and their metabolic rate depends upon their body temperature. If a reptile is cooled, or chooses to allow its body temperature to fall, its metabolism slows until it is in a state of torpor. Secondly, reptiles are also very resistant to hypoxia (lack of oxygen) and indeed many species can hold their breath for very long periods and switch to anaerobic respiration. In nature, these two attributes combine to produce very hardy creatures which can virtually shut down their bodily functions in unfavourable circumstances. In captivity, this makes reptiles very resistant to euthanasia.

Evidence suggests that a reptile's resistance to hypoxia is so great that its brain continues to function for long periods without any oxygen supply to the brain at all. This means that in complete contrast to a mammal, a reptile may remain fully conscious and able to experience pain and fear for a considerable time in situations as extreme as decapitation, before death finally occurs. Reports suggest consciousness in a decapitated reptile head may persist for up to an hour in some cases. It is essential that any method chosen for euthanasia of any animal causes an *immediate loss of consciousness*. If the method chosen does not destroy brain function immediately, a reptile *must* be anaesthetised first.

## **Acceptable Methods for Euthanasia of Reptiles**

This article is not intended as a pet owner's guide to the humane way to kill their reptile pet. Before discussing acceptable methods for euthanasia of reptiles, it is vital to stress that with one exception, a qualified veterinary surgeon should carry out these procedures. The one exception – to be described later – is that (in an emergency, for example, when veterinary help is unavailable) the owner of a reptile may legally and humanely kill it by the complete instantaneous destruction of its head, either by a single accurate blow sufficient to completely crush the skull, or by shooting. This is not something to be undertaken lightly. It is an offence under the Protection of Animals Act 1911 to cause unnecessary suffering to an animal. To hit it unsuccessfully on the head would cause suffering, as would putting it into a freezer; and such suffering would be considered unnecessary and therefore could constitute an offence under the terms of the 1911 act.

## **Injection of Anaesthetic Agents**

Sodium pentobarbitone is an effective and humane agent for euthanasia in reptiles<sup>3,4,5,6,7,11</sup>, and in most cases injection of this drug by a veterinary surgeon is easily the method of choice. It produces rapid depression of the central nervous system, leading to loss of consciousness followed by cardiac and respiratory arrest.

Where possible, the intravenous route (injection into a vein) is recommended as it produces the most rapid loss of consciousness. In reptiles, however, this is rarely as instantaneous as it is in mammals. It may take 10 to 15 minutes or more. Intravenous injection is not difficult in larger reptiles such as iguanids, and is possible in much smaller reptiles when carried out by experienced personnel. Where intravenous injection is difficult, in smaller specimens or where the handling and restraint required would cause distress, the intracoelomic route (injection into the body cavity) is preferable although it is much slower to take effect. Ideally, tortoises and turtles should be injected intravenously since following intracoelomic injection, the time to death is considered unacceptably long by some authors<sup>7</sup>; in practice this is not always possible as it may be very difficult to locate a vein, especially in small specimens.

Other injection sites, such as intramuscular (into muscle) or subcutaneous (under the skin), should not be used as they are not effective and may cause pain.

The intracardiac route (injection into the heart) is stated as being particularly painful<sup>4</sup> however many experienced reptile veterinarians regard intracardiac injection as quite acceptable in many species and possibly preferable to coelomic. Intracardiac injection is regarded by some as the best route for any medication – including anaesthetics or antibiotics – in small snakes, and is their first choice for euthanasia in snakes.

Intraosseous routes (injection into the inside of a bone) are also appropriate in many cases since although there is some pain involved in needle placement this would seem to be outweighed for the animal by the speed of onset of anaesthesia (virtually the same as for an intravenous injection) and for the owner, by the speed with which the animal is dead – minutes rather than several hours in some cases where intracoelomic injection is given. Moreover, when a reptile is severely debilitated and its veins are collapsed, making intravenous injection impossible, the intraosseous and intracardiac routes are still reliable.

The recommended dosage of pentobarbitone varies from 60-100mg/kg bodyweight<sup>5</sup> to 200mg/kg body weight<sup>2,7</sup> and in view of the low cost of the drug, there seems no good reason not to select the higher figure for increased certainty of effect. One author recommends giving three or more times the calculated dose<sup>10</sup> or an alternative is to give the calculated dose intravenously or intraosseously plus a massive overdose (2000mg/Kg) injected into the coelom when the client wishes to take the body home immediately or does not wish to have death confirmed by physical destruction of the brain (see later).

Some authors recommend the intramuscular injection of ketamine at 100-200mg/kg as a premedication 10-15 minutes prior to intravenous injection of sodium pentobarbitone<sup>7</sup>, but ketamine should never be used as a sole agent for euthanasia<sup>2</sup>.

Barbiturates other than sodium pentobarbitone may cause pain on injection and are not recommended<sup>5</sup>.

It may be quite difficult to determine exactly when death has occurred following barbiturate administration, and prolonged metabolism in reptiles can lead to the animal remaining anaesthetised for days yet still capable of recovery. This is discussed further under the heading, "Determining whether death has occurred". Use of a physical method of brain destruction to confirm death is strongly advised.<sup>7</sup>

## **Concussion of the Brain by Striking the Cranium**

Concussion involves striking the back of the head with a hard implement or object. Ideally this should only be performed by someone who has been trained to do this properly on recently killed animals. In practice it may be necessary to use this method in an emergency when veterinary assistance is not available (for example, when a reptile is found severely injured with no hope of recovery) and it might be considered by some to be a more

humane method than injection, if performed correctly, for very small reptiles. The purpose is to either kill the animal outright or to immediately render it unconscious. Ideally the blow should be given with such force as to cause immediate and complete cessation of brain activity<sup>3</sup>. If this procedure is performed in an emergency by non-experienced personnel the aim should be to strike the animal with enough force to instantaneously completely crush the head, otherwise the animal will suffer unnecessarily. Failure to kill the animal on the first blow might thus constitute an offence under the Protection of Animals Act 1911. Instantaneous destruction of the head in this way, or by shooting, would be the only acceptable and legal method of euthanasia which could be used by a pet owner themselves. Anything else requires a visit to a vet.

This method is approved by the Home Office for amphibians and reptiles in the laboratory, weighing up to 1kg, provided that if death is not caused by the first blow, ie. the reptile is only stunned, the brain must be destroyed before the return of consciousness, either by a further blow or by some other method such as pithing.

The Home Office Code of Practice highlights the importance of ensuring destruction of the brain following concussion and states:

*"In the case of amphibians, reptiles and fishes, if the brain is not destroyed by the initial blow, there must be no delay in destroying the brain by a penetrating probe or by a blow sufficient to cause a severe brain contusion with fracture of the cranial bones, or disposal through a macerator."*<sup>4</sup>

### **Shooting by Captive Bolt Pistol or Firearm**

Euthanasia of large reptiles such as crocodilians may be performed humanely by those with expertise, using captive bolt pistols or firearms. However, shooting which does not immediately lead to cessation of brain function could cause the animal to suffer unnecessarily. The location for the entry point of the bolt or bullet is critical, and line drawings of the heads of various species indicating these locations are available<sup>9</sup>. The animal must be properly restrained to ensure the first shot is the only one necessary; the bolt must go through the brain, or the animal may only be stunned. Death must be ensured by destruction of the brain.

In the case of shooting with a firearm such as a heavy calibre rifle or shotgun, the operator must have considerable skill since the bullet must penetrate the brain through the two brain cases found in many reptiles.<sup>3</sup>

### **The Euthanasia of Reptile Embryos**

Reptiles are highly developed at birth and the Home Office Code of Practice notes that special care must be taken when euthanasing reptile eggs, since the developing embryo may be well advanced and, like newly hatched reptiles, resistant to chilling and hypoxia. It is suggested that death of a larger embryo close to the time of hatching should be ensured by use of an injectable agent (such as sodium pentobarbitone) given by the intracoelomic route.. For smaller embryos immersion in the agent is described (presumably by injecting it into the egg) and disruption of the egg by opening the shell and tearing the membranes is also considered effective and humane.<sup>4</sup>

## **Methods of Killing that are NOT acceptable for Euthanasia of Reptiles.**

### **1. Hypothermia and Freezing**

Because ectotherms become progressively inactive with lowering of body temperature, it has been assumed in the past that cooling them prior to euthanasia would not only facilitate handling, but would anaesthetise them. Reptiles immobilised in this way were then placed in a domestic freezer and killed by subsequent freezing. This method of euthanasia is not acceptable in the light of modern knowledge. Although decreasing temperature decreases metabolic rate and decreases response to stimuli, it is not known how it affects pain perception - impulses in various nerve bundles are affected differently by temperature and some authors feel that pain neurons are less cold-affected than motor neurons. Most published guidelines on euthanasia now include statements to the effect that although cooling ectotherms produces torpor, it does not reduce their ability to feel pain<sup>2,3,5</sup>, and indeed it may prolong suffering since a lowered metabolic rate would delay the onset of unconsciousness due to hypoxia. Humans dying from hypothermia are said to experience numbness, even euphoria; but this is believed to be due to endorphin production by the mammalian, endothermic brain; there seems to be no evidence for this in reptiles. A conscious reptile placed in a freezer would experience a very painful death. Destruction of its skin and eyes due to ice crystal formation within the cells, causing intense pain, would occur long before the brain had become chilled enough to cause loss of consciousness, especially in the case of a large reptile such as an iguana, whose brain would take a considerable time to chill. Even inducing hypothermia for facilitating the handling of reptiles is now considered inappropriate and inhumane by many authorities<sup>5</sup>, and freezing in a domestic freezer should not be accepted as a method of euthanasia for any unanaesthetised animal of any species.

The Euthanasia Working Party (EWP) report published in Laboratory Animals (International Journal of Laboratory Animal Science and Welfare)<sup>3</sup> on the recommendations for euthanasia of experimental animals states that hypothermia *"..will make the animal torpid but will not raise the pain threshold. The formation of ice crystals within the body tissues is likely to be extremely painful. Hypothermia is not acceptable for euthanasia."* This is a comment typical of many found throughout the literature.

The only mention of refrigeration in the Home Office Code of Practice for the Humane Killing of Animals<sup>4</sup> is for small foetal, larval and embryonic forms of animal and even so, reptile eggs and embryos are specifically

*excluded* from this method because of their resistance to chilling and hypoxia. In the laboratory situation dropping into liquid nitrogen at minus 196°C – a very extreme form of freezing, far removed from a domestic freezer- may be acceptable for animals of less than 40g bodyweight (i.e. less than 1cm in diameter) as liquid nitrogen would freeze an entire body of that size instantaneously.<sup>10</sup>

## **2. Decapitation**

This procedure involves the severing of the neck of the animal, close to the head, using a sharp instrument such as a guillotine, ideally with a single very swift cut. It has traditionally been a method of choice for killing fish, birds, amphibians, reptiles and small mammals. However, there has been debate for over 20 years regarding the length of time taken for a decapitated head to lose consciousness, and it is now regarded as unsuitable for all but mammals<sup>2</sup>. As previously described, reptiles may remain conscious for up to an hour after decapitation; clearly this is far from humane as a direct method of killing a reptile.

Nevertheless, it has been described in the EWP report<sup>2</sup> as an acceptable method for killing a reptile made unconscious by other methods such as stunning, although there is some confusion in the literature even so. The authors of this report themselves go on to say that stunning must always be followed by destruction of the brain (which does not immediately follow decapitation). The AMVA<sup>5</sup> state that decapitation is acceptable without prior stunning, but must be immediately followed by pithing – a method of brain destruction by inserting a needle into the base of the brain. Pithing is a technique which requires some skill. The EWP report states that pithing should only be carried out on animals first rendered unconscious by stunning or anaesthesia. Logically one must conclude that to kill a reptile humanely by decapitation, one must first stun it, then decapitate it and then pith it. There are less unpleasant methods.

## **3. Inhalation of Anaesthetic Agents and Carbon Dioxide**

Breath-holding greatly prolongs the time taken to euthanase a reptile using inhalant anaesthetics and gases such as carbon dioxide, making their use problematical. Lizards and snakes do not in general hold their breath as readily as chelonians but even so, it may take 30 to 100 minutes for a small lizard or snake to become anaesthetised for surgery, indicating a considerable ability to resist inhalation. Evidence has shown that in some reptiles, resistance to hypoxia can last up to 27 hours<sup>5</sup>. It has occasionally been suggested that pet owners and hobbyists might attempt to euthanase reptiles using carbon dioxide from dry ice or fire extinguishers. Such methods would be extremely unlikely to deliver a controllable or sufficient concentration of gas for a humane euthanasia, particularly given the time scale needed for the procedure. In any case euthanasia with carbon dioxide is not considered an acceptable method for reptiles by many authors<sup>3,4</sup>.

## **4. Other Unacceptable Methods**

Drowning is inhumane for any species<sup>2,5</sup>, and reptiles are particularly resistant to it. There are reports of terrestrial tortoises which have fallen into ponds and spent several hours at least submerged without ill effect other than chilling, and some species, especially terrapins, may be able to spend months in hibernation underwater - although there is some evidence that they have some gaseous exchange in this case over their cloacal mucous membranes. Incidentally, removal *from* water is also regarded as an inhumane way to kill amphibians with gills (including tadpoles)<sup>2</sup>.

Hyperthermia – raising the temperature above the critical temperature of the species- has been suggested as a method of euthanasia for some ectotherms, but this is likely to cause extreme distress prior to death. Likewise dropping an animal into boiling water causes intense pain and a slow death<sup>2</sup>.

Exsanguination (cutting of major blood vessels) following stunning is considered unacceptable for reptiles, although it is widely used for mammals. The reason for this is that since reptiles are so resistant to anoxia, consciousness may return before exsanguination has caused death<sup>2</sup>.

Cervical Dislocation –the dislocation of the neck –as approved for small rodents, rabbits and birds is not appropriate for reptiles owing to the resistance of the reptile brain to hypoxia. Crocodiles, for example, have been shown to remain conscious for nearly two hours after spinal cord severance<sup>8</sup>.

## **Determining whether death has occurred**

Since reptiles are so resistant to euthanasia, it can be surprisingly difficult to determine whether a reptile is actually dead. This fact is not widely known to the public; pet owners, for example, might expect their vet to be able to say at once whether the reptile that has just been “put to sleep” has “gone”. It is important that an expert should be on hand to assist in the euthanasia and to verify its success.<sup>6</sup> Close to death, vital signs may be virtually absent; but a slow recovery from what turns out to have been merely deep anaesthesia, following a failed attempt at euthanasia, is a very unacceptable event.

Pentobarbitone is an anaesthetic drug; it is not a poison *per se*. If it is only absorbed very slowly, in insufficient quantity to cause death, it is quite possible that the living body will very slowly break it down until consciousness returns. In effect, the reptile might simply be anaesthetized for several days (large snakes often take days to recover completely from normal anaesthesia) or even months. Survival for such long periods is not so remarkable

when one considers that a tortoise may well normally hibernate for three months or more. This is why it is important for the drug to be given in sufficient quantity, by an effective route, to a reptile at its optimum body temperature to ensure relatively rapid absorption of the drug and hence optimum effect.

The Animals (Scientific Procedures) Act 1986 states that “an animal shall be regarded as continuing to live until the permanent cessation of the circulation or the destruction of its brain.”

#### Problems with ascertaining that the circulation has ceased.

Detecting heartbeat is particularly difficult in reptiles. In most reptile species the heartbeat cannot be heard with a stethoscope. Doppler ultrasonographic monitoring or ECG monitoring can be used.

Even so, the reptile heart may beat so slowly (especially when cold – down to once every few minutes in hibernating tortoises or in animals that have been deeply anaesthetized) that it might be assumed to have stopped.

Conversely it may continue to beat for a long time after the destruction of the brain; hence without sectioning the heart and great vessels, a procedure recommended by the Home Office<sup>4</sup>, it is difficult to be certain that the circulation has ceased.

#### Problems with ascertaining that the brain has stopped functioning.

Destruction of the brain does not just refer to physical destruction. Permanent brain death follows the correct dosage of anaesthetic agents used for euthanasia, as well as from anoxia. However, it is very difficult to tell when a reptile brain is dead, unless it has indeed been physically destroyed.

In mammals, loss of reflexes such as the blink response to touching the cornea may be used to test for brain function - loss of reflexes may indicate deep anaesthesia or death. In reptiles the situation is even less clear cut. Snakes do not possess eyelids and so cannot blink, in any case; but other reflexes and body movements in response to stimuli may continue for some time after brain destruction, owing to the comparatively greater role played by the spinal cord in the control of bodily function. On the other hand, loss of almost all reflexes is normal in a surgically anaesthetized animal – most reptiles do not breathe spontaneously under general anaesthetic. Complete flaccid (open) loss of laryngeal movements is a reasonable indicator of very deep anaesthesia or death in reptiles.

A *combination* of prolonged absence of a heartbeat and complete cessation of all signs of reflex activity is usually considered a fairly reliable indicator of death; but as we have seen, it is difficult to distinguish between very deep anaesthesia and death.

Rigor mortis is a reliable indicator of death, but the time taken for this to develop varies depending on the size of animal, its physiological state and the temperature of the environment. Following death, the muscles usually relax completely, then stiffen as rigor mortis sets in, and then relax again as it is lost after up to 48 hours.

Those involved with a reptilian euthanasia, particularly pet owners, need to be informed in an appropriate and sensitive manner as to what will happen. They need to know that it may be necessary to wait some time for definite signs of death (such as the onset of rigor mortis) if it is unacceptable for the vet to carry out an additional procedure such as a final pithing (destruction of the brain with a surgical tool), crushing of the skull, opening of the heart or freezing of the carcass “to make sure”, as may be done in a research or commercial establishment.

#### A final act of brain destruction following a lethal dose of anaesthetic agent.

**Freezing of the carcass** after a lethal dose of anaesthetic has been given by injection and *only* when the reptile is, if not certifiably dead, then at least extremely deeply unconscious, may be considered as an acceptable ‘final act’ of brain destruction<sup>11</sup>. However it is vital that the brain is completely frozen right through, to ensure total brain death. This would mean that the carcass would need to remain in a standard freezer for at least 24 hours.

**Pithing** can be easily carried out in pet reptiles without crushing the skull and is markedly underused as a ‘final act’ of brain destruction. A dental scaler can easily be introduced through the roof of the mouth, entering the cranial vault and destroying the brain structure without leaving outward cosmetic signs on the animal. It might well be that the pet owner to whom the facts have been explained in a sensitive manner will feel able to request this ‘final act’, knowing that it will always complete the euthanasia and confirm, with no room for doubt, that the animal will never suffer again.

When the euthanasia in question is that of a companion animal, time taken to ensure that a truly humane death has occurred is not time wasted. Once an owner knows what to expect, it is likely that he or she will be appreciative of the care taken, rather than dismayed that the procedure has taken so long or been in any way gruesome.

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Please note: the legislation cited refers to that in force in the United Kingdom at the time of writing (2004).

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