

Safe Anaesthesia of Large Crocodiles



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In far north Queensland we really care about our crocodiles...



Australian crocodiles



- **Freshwater crocodile**
(*Crocodylus johnstoni*)

Rarely larger than 2 metres

Shy, communal

Restricted to freshwater systems
of northern Australia



- **Estuarine crocodile**
(*C. porosus*)

Males up to 5metres +

Estuaries, fresh and salt water

Takes large prey, including man

Territorial aggression in males,
and females guarding nests

Crocodile anatomy



- Brief overview
- Skeleton
- Skin structure
- Osteoderms

Reasons for restraining crocodiles



- Staff training & safety
- Transport
- Relocation



- Field research
- Minor procedures
- Blood collection



- Veterinary examination
- Diagnostic procedures





- Major or invasive surgery

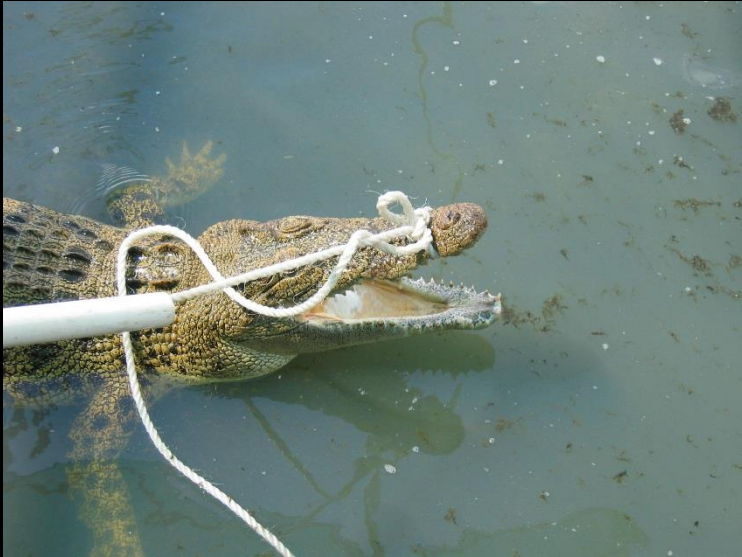


Options for physical restraint



Snout roping

- Snout roping is effective for simple restraint and release



Manual restraint

- Physical restraint can restrict effective aerobic respiration
- Effective restraint for non-invasive procedures only



Restraint on board



- Helpful during transport
- Good restraint when personnel are limited



Restraint in trap



Key objectives of chemical restraint



- To provide safe restraint for crocodile and handlers
- To ensure best welfare practices are carried out when handling large crocodiles

To safely immobilise large crocodiles it is critical to...



- Know the right drug for the right occasion, what is too much, what is not quite enough....and,

To have lots of time and patience...



Preparation for a restraint

- Plan
- Sufficient experienced staff
- Sufficient trainees/others
- Safety briefing
- Vet on site if required
- Team briefing (if you work with the team regularly presumably there is mutual respect; those you don't work with regularly fall into one of two categories- either those who think vets know everything and look to the vet to make the right decisions; or those who think vets know nothing and are reluctant to follow vet direction if it differs from their own opinion. Find out which group first!!)



Equipment



Noose



Ropes and
sacks



Duct tape
Gag
Other

Team leader



Environmental conditions



Room to move;
Ground conditions;
Temp & humidity

Personal safety



Safe access to the animal
Safety for the animal

Physiological considerations



- Solar heated; thermoregulation through physiological and behavioural means

Physiological considerations...



- Low metabolic rate reduces oxygen requirement to tissues which enables cessation of respiration for an hour or more while still supplying the brain with sufficient oxygen
- Brief periods of activity cause increased metabolic rate and are usually anaerobic. Elevated lactic acid levels cause the animal to tire easily

Physiological considerations...

- Aerobic respiration occurs in a similar manner to mammals, using intercostal muscles and pseudodiaphragm (unlike most reptiles)
- Palatal valve closes to seal airway during submersion



Physiological considerations

- Four-chambered heart as in mammals and birds
- Right and left aorta present and functional
- Foramen of Panizza connects right and left atria enabling shunting of blood from right heart to left aorta during periods of hypoxia



Limitations of chemical restraint



■ Various agents have been used in crocodiles at their preferred body temperature but outside the preferred temperature range, drug dose and effect are highly variable and frequently unpredictable.

Drug choices for different scenarios

- Sedation- midazolam, diazepam
- Muscle relaxation- medetomidine
- Immobilisation- midazolam/pancuronium
- Maintenance- isoflurane
- IV (smaller)- alfaxan, propofol
- Reversal- atipamezole, flumezanil, neostigmine

Reversal agents

- Reversal agents are effective at preferred body temperature. Below this, they appear to behave very unreliably and should not be relied upon
- Atipamezole reverses medetomidine at PBT
- Neostigmine reverses pancuronium at PBT



Immobilising your target

- Common IM sites include limbs and tail but not all sites give ideal results
- Injection using rope or trap restraint and using hand or pole syringe



IM administration sites

- IM injection is more effective if given in cranial $\frac{1}{2}$ of body although traditionally large crocs are injected caudally. This may account for variability in results of chemical restraint



IV administration site



- Dorsal occipital venous sinus

Management of immobilisation



Management of large crocodile anaesthesia can be very hands on!



And you need to be really good friends with your assistants!!



Progression of immobilisation



- Reflexes and responses disappear from head to tail
- Deep pain response in limbs/tail unreliable
- Ocular reflexes unreliable
- “Poke” response
- Prayer

Other responses monitored

- Ocular responses- not reliable on their own
- “Poke” test
- Monitoring a constellation of signs is important in determining depth of anaesthesia



Monitoring respiration



- Observation of nostrils closing and opening

Palatal valve relaxation



- Occurs with profound immobilisation or deep general anaesthesia
- Animal may require intubation
- Closure of valve equates to voluntary airway protection

Respiratory management



- Intubation if not breathing regularly at least 2 medium breaths per minute (if safe to do so)
- First place an appropriate sized strong gag in mouth at oblique angle (depending on whether you are right or left handed) and tape securely in place using duct tape

Intubation



- If palatal valve still closed (take care!!) depress it with hand or firm rod and visualise tracheal opening
- Using a hand to guide tube, intubate using a long size 10-18 tube depending on size of animal. Tape tube to upper jaw if possible

Maintenance of respiration



- Intubation if not breathing regularly at least 2 medium breaths per minute (if safe to do so)
- Gaseous anaesthesia isoflurane at 2-2.5% maintenance

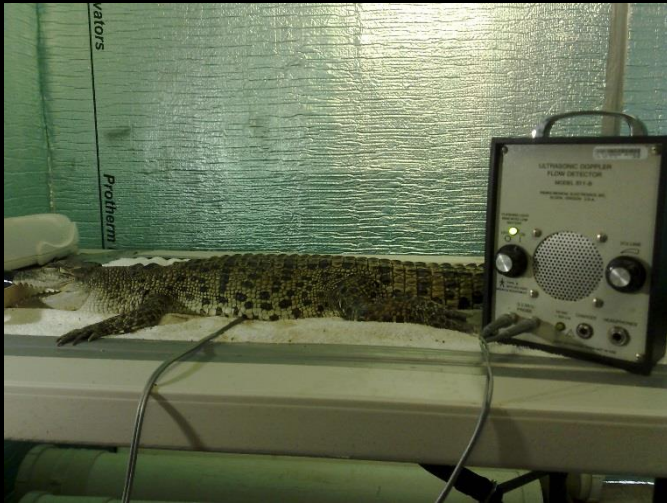
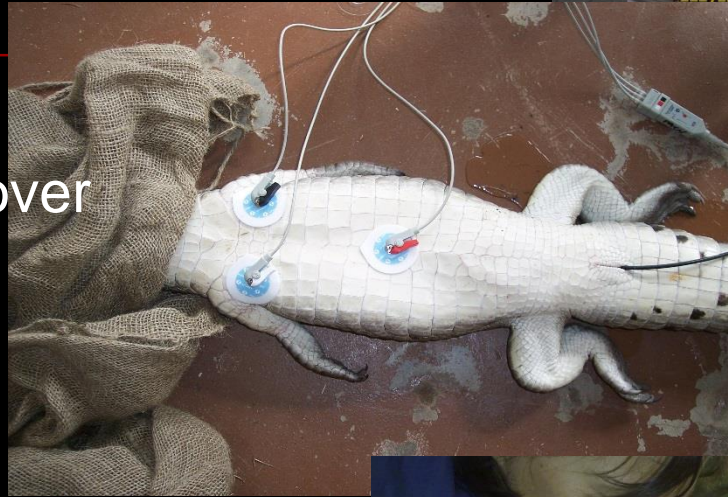
Monitoring heart rate and rhythm

- Position of heart by counting scale lines
- Auscultation via stethoscope externally difficult or impossible in animals over 2-2.5m



Monitoring ...

- Auscultation almost impossible in animals over 2m;
- ECG , Doppler, BP



Temperature monitoring



- Large crocodiles have a limited capacity to maintain body temperature but cannot generate heat
- As temperature drops, drug absorption and metabolism change

Blood collection



- Only one practical site in large crocodiles-
Dorsal occipital venous sinus
- Reptile blood should be collected in tubes containing lithium heparin

Recovery



- Ventilate with room air
- Extubate only when gagging and breathing 4bpm deep voluntary breaths
- Reflexes and responses return from tail to head
- Legs are adducted as animal lightens

Recovery...

- Never leave the animal until it is protecting its airway, it is very responsive, and is voluntarily breathing and walking
- Restrict access to water as long as possible/practical



Summary

- Preparation
- Briefing of personnel
- Team leadership
- Drugs for all occasions
- Environmental considerations
- Safety precautions
- Post immobilisation monitoring for days not minutes or hours

