A Basic Introduction to Backyard Poultry Medicine – Part 3 of 3: Analgesia, Anaesthesia, and Euthanasia

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As veterinarians, we accept that backyard poultry feels pain.

Anaesthesia and analgesia must be used carefully to alleviate suffering and reduce stress in patients. Backyard poultry are prey species and susceptible to the negative effects of excessive stress. There are numerous procedures (e.g. radiography, blood sample collection) where anaesthesia may be used to simply reduce the stress associated with handling, even though the procedure is not painful.

Requirements for anaesthesia

Anatomical and physiological considerations:
Successful anaesthesia depends on an understanding of avian anatomy, physiology, and pharmacology, with the pulmonary and cardiovascular systems being the most important.

Pulmonary system:

Birds have two distinct functional pulmonary components: those responsible for ventilation (airways, air sacs, thoracic skeleton, and muscles of respiration) and those involved in gaseous exchange (lungs). The opening of the trachea (glottis) is located at the base of the tongue, therefore more rostral than in mammals, and is not protected by an epiglottis. The trachea comprises complete tracheal rings, so cuffed ET tubes should not be used so as to avoid inadvertent tracheal necrosis and stricture formation as a result of excessive cuff inflation.

Sound is produced by the syrinx at the level of the tracheal bifurcation. This means that ventilation can produce sound, and this does not suggest oesophageal intubation as may be suspected in a mammal. The air sacs do not participate in gaseous exchange or accumulate anaesthetic gases. The pulmonary system of a bird is 10 times more efficient than that of a mammal. Birds are thus more sensitive to the effects of inhalational anaesthesia.

Cardiovascular system:

Birds have a four-chambered heart that, compared with a similar-sized mammal, is relatively larger, has a greater stroke volume, a lower heart rate and higher cardiac output.

Acclimatization:

Poultry are often social and confident birds and should be allowed time to acclimatize to the hospital environment before anaesthesia. This allows stress levels to reduce following clinical examination, making subsequent anaesthesia safer and allowing any further signs of disease to become apparent.

Fasting:

The need to withhold food from chickens prior to anaesthesia remains debatable. Arguments against fasting are that birds have a high metabolic rate and will rapidly become hypoglycaemic. However, a chicken with a full crop will also be at risk of regurgitation and aspiration during anaesthesia and recovery. In addition, an empty crop reduces the weight of coelomic viscera on the respiratory system.

A reasonable approach is to withhold food long enough for the upper GIT (especially the crop) to be empty, which is likely to be 2-6 hours unless there is a specific problem affecting motility. Water should be provided until immediately prior to anaesthesia.

General anaesthetic protocols

Inhalation anaesthesia:

For backyard poultry, inhalational anaesthesia is simple, relatively safe, effective, and generally considered the method of choice. Inhaled agents offer several advantages for patient management.

- Rapid induction and recovery, especially when agents with low blood solubility are used (isoflurane and sevoflurane).
- Faster control of anaesthetic depth.
- Improved oxygenation due to the use of oxygen as the carrier gas.
- Recovery that is not dependent on metabolic or excretory pathways, which may be altered or impaired in the diseased bird.

Anaesthetic agents:

Isoflurane: this is currently the most widely used anaesthetic agent in birds. Due to isoflurane having a low blood:gas solubility, it provides rapid induction and recovery. Induction should be carried out at 5% and maintenance at around 1.5-2.5%.

Sevoflurane: this produces dose-related effects similar to isoflurane. It has an even lower solubility which provides quicker induction and recovery. Induction is carried out at 8% and maintenance at around 3-5%.

Halothane: this agent should not be used in birds as it sensitizes the heart to catecholamine-induced arrhythmias which could lead to spontaneous cardiac and respiratory arrest in birds, leaving little hope for successful resuscitation.

Anaesthetic induction:

Induction is simplest via a mask. The bird is wrapped in a towel with its head exposed. The mask is placed over the head of the bird and if required, cotton wool should be placed between the mask and neck to prevent the escape of anaesthetic gas.

Brief pre-oxygenation is recommended (15-20 seconds) and then delivery of the inhalational agent can begin using 5% isoflurane or 8% sevoflurane. Using a modified T-piece would require an oxygen flow rate of approximately 0.8-1.2 l/min/kg bodyweight.

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Endotracheal intubation:

Placement of an ET tube is recommended in all but the shortest procedures. Intubation is straightforward because the glottis lies at the base of the tongue. A 2.0-4.0 mm non-cuffed ET tube is used depending on the size of the bird.

Anaesthetic maintenance:

Following induction and ET intubation, anaesthesia can be maintained with isoflurane at 1.5-2.5% or sevoflurane at 3-5% delivered in 100% oxygen. Anaesthetic depth would need to be altered depending on the stimulus present. Observation and monitoring of breathing, withdrawal reflexes and corneal reflexes are the minimum requirements to ensure adjustments to the anaesthetic depth are made timeously. In dorsal recumbency, the weight of the abdominal viscera compresses the caudal air sacs and can significantly decrease ventilation. Thus, birds should be kept in lateral or sternal recumbency.

Body temperature:

Due to their extensive air sac system and high metabolic rate, birds are prone to excessive heat loss under anaesthesia. Normal core body temperature is 39-42°C and monitoring should be undertaken to avoid hypo- or hyperthermia (temperatures exceeding 46°C will lead to death)

Fluid therapy:

Fluid therapy is very important during anaesthesia. Fluids should be warmed prior to administration. This should be given at a rate of 10ml/kg/h, usually with a 10ml/kg bolus at the start.

Injectable anaesthesia:

The main limitation of injectable anaesthetic protocols is the inability to modify the effects once administered. Although most drugs can be administered intramuscularly or intravenously, the latter is more reliable, and a lower total dose can be used. See the table below:

Drug	Dose	Route of administration	Comments/Uses
Atipamezole	5x the mg dose of medetomidine	i/m	Antagonises sedative effects of medetomidine
Diazepam	0.5-1.0 mg/kg	i/m, i/v	Premed; sedation; seizure control
Ketamine	20-40 mg/kg	i/m	Not for use as sole agent; insufficient analgesia, prolonged (3h) excitation on recovery
Ketamine + Diazepam	75mg/kg (K) + 2.5mg/kg (D)	i/m, i/v	D given i/v followed by K 5-10 min later i/m. Recovery in 90-100 minutes
Ketamine + Medetomidine	3-10mg/kg (K) + 0.1-0.2mg/kg (M)	i/m	Short-term; can be antagonised
Ketamine + Xylazine	10-25mg/kg (K) + 1-2mg/kg (X)	i/m, i/v	Recumbency within 6 minutes; good surgical anaesthesia; can be antagonised
Medetomidine	0.25mg-0.34mg/kg	oral	Used for sedation; the speed of onset is 6-10 minutes
Midazolam	0.1-2mg/kg	i/m, i/v, intranasal	Premed at lower doses, sedation at higher doses. Shorter acting than diazepam
Propofol	5-10mg/kg	i/v	Intubation and ventilation with oxygen are recommended. Can be maintained with 0.5mg/kg/min CRI
Yohimbine	0.2-2mg/kg	i/m	Antagonises xylazine

Monitoring

Reflexes, breathing rate, heart rate and manual assessment of pulses and the basic requirements to assess anaesthetic depth.

Pedal reflex: A short sharp pinch to the toe will elicit a withdrawal response. This will be present at light anaesthetic depth but lost at surgical anaesthesia.

Corneal reflex: Touching a cotton bud to the surface of the cornea should cause the nictitating membrane to sweep across the eye. The slower the reflex, the deeper the plane of anaesthesia. If absent, the patient is likely too deep.

Feather pluck: This is very painful to a chicken and the absence of movement when a body contour feather is plucked usually indicates surgical anaesthesia.

Recovery

Once inhalational anaesthesia is discontinued, poultry should remain on oxygen until reflexes start to reappear. At this point, the ET tube should be removed, and the bird wrapped in a towel. As the bird regains consciousness and begins to move voluntarily, it can be placed in a warm, dimly lit environment, still wrapped in the towel. The bird should be placed in sternal recumbency, and observations should continue until the patient is able to wriggle from the towel and stand normally. Keeping poultry wrapped in a towel during recovery prevents excessive wing flapping and self-trauma whilst they are still disoriented.

Local anaesthesia

The use of local anaesthesia is controversial in birds as the safety margins appear to be small. Regional infiltration with a line block is the most commonly used method. The skin and subcutaneous space in birds are thin, so a small gauge needle is used. Lidocaine (without adrenaline) and bupivacaine are most commonly used, but neither the time to effect nor duration of action have been demonstrated in birds. Lidocaine is used at 2-3 mg/kg and commercially available preparations may need to be diluted. The safety index is low with doses of 4mg/kg causing seizures and death. Bupivacaine is used at 2mg/kg.

Analgesia

To be able to assess pain, or the efficacy of analgesia, the clinician must have a good understanding of normal behaviour for the bird and remember that, as a prey species, they will often effectively mask signs of pain or illness until very severe. Common analgesic drugs used in chickens are listed in the table below:

Euthanasia

Drug	Dose	Route of administration	Comments/uses
Buprenorphine	0.01-0.05mg/kg q8-12h	i/m	There are doubts about its efficacy
Butorphanol	0.2-0.4mg/kg q12h	i/m	Dose evaluated in chickens; other spp require 0.5-2mg/kg q4-6h
Carprofen	1-4mg/kg	i/m, s/c	Lower doses are effective for short periods. Dosing interval is not established.
Flunixin	1.1mg/kg i/v, 3mg/kg i/m	i/v, i/m	Once off, potential nephrotoxicity.
Ketoprofen	2-12mg/kg	i/m	Higher doses last for 12h in chickens. Other spp known to have died at 5mg/kg
Meloxicam	0.2-2mg/kg q12-24h	i/m, oral	Used by the author at 1mg/kg q24h
Morphine	10-20mg/kg	i/m	Limited data on chickens. Effective at this dose in quail.
Tramadol	5-11mg/kg	oral	Limited data

Although the veterinary surgeon is unlikely to be involved other than for welfare purposes, it is essential that they are able to advise their clients on all aspects of humane killing. Many veterinarians will prefer to euthanise poultry in a clinical setting using chemical techniques; however, the food-producing origins of poultry mean that several mechanical techniques are available (beyond the scope of this article). Pentobarbital should be administered intravenously. This may be preceded by injectable sedatives or gaseous anaesthesia to minimize stress and facilitate handling. In addition to this, the occipital sinus provides a very effective site for the administration of pentobarbital. Once the depression between the occiput and atlas is located, a hypodermic needle is placed in the midline at this point and advanced 2-3mm before commencing barbiturate injection. Once the bird loses consciousness, the needle may be advanced into the brainstem for further barbiturate administration. This technique typically avoids the leg and wing flapping associated with many avian euthanasia techniques.

References:

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QUESTION 1

Compared to that of mammals, the avian heart:

a. Is smaller compared to a similar-sized mammal
b. Has a greater stroke volume
c. Has a lower cardiac output
d. Has a faster heart rate
e. Is 3-chambered

QUESTION 2

Why are birds more sensitive to the effects of inhalational anaesthesia?

a. They have multiple air sacs that act as bellows
b. They have a syrinx in the trachea
c. The respiratory system is 10x more effective than that of mammals
d. The trachea contains complete tracheal rings
e. Their smaller size

QUESTION 3

With regards to fasting a bird prior to anaesthesia:

a. Food may be withheld for a few hours to ensure an empty crop
b. An empty crop puts less pressure on the respiratory system
c. Water should not be withheld
d. A full crop may cause regurgitation and aspiration
e. All of the above

QUESTION 4

Inhaled anaesthetic agents offer several advantages in birds. Which of the following is true?

a. Rapid induction and recovery
b. Faster control of anaesthetic depth
c. Improved oxygenation
d. Recovery is not dependent on metabolic or excretory pathways
e. All of the above

QUESTION 5

Which of the following is false?

a. Induction with Isoflurane should be carried out at 5%
b. Maintenance with Isoflurane should be at around 3-5%
c. Induction with Sevoflurane is carried out at 8%
d. Maintenance with Sevoflurane should be at around 3-5%
e. Using a modified T-piece would require an oxygen flow rate of approximately 0.8-1.2 l/min/kg body weight

QUESTION 6

What is the preferred route of administration for medetomidine?

a. Oral
b. Subcutaneous
c. Intravenous
d. Intramuscular
e. Inhaled

QUESTION 7

Regarding propofol, which of the following is true?

a. The dose is 10-20mg/kg
b. Route of administration is intramuscular
c. Intubation and ventilation with oxygen are recommended
d. Can be maintained with 5mg/kg/min CRI
e. Should be administered over the needle

QUESTION 8

Which of the following should be used to monitor anaesthesia?

a. Pulses
b. Temperature
c. Respiratory rate
d. Reflexes
e. All of the above

QUESTION 9

Regarding anaesthetic recovery, which of the following is true?

a. Once inhalational anaesthesia is discontinued, poultry can be extubated
b. Birds should be placed under a bright light after extubation
c. The cage can be maintained at room temperature
d. The bird should be placed in sternal recumbency
e. Keeping poultry wrapped in a towel restricts respiratory movements

QUESTION 10

What is the recommended dose of meloxicam?

a. 0.01-0.05mg/kg q8-12h
b. 0.2-0.4mg/kg q12h
c. 1-4mg/kg
d. 0.2-2mg/kg q12-24h
e. 5-11mg/kg

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