Pain in birds: a review for veterinary nurses

Aneesa Malik MSc RVN Cert VNES Cert VNECC and **Adina Valentine** RVN C&GCertVNES, VNCertECC, Clinical Coach

Vets Now Exotics, 10 Berkshire House, County Business Park, Shrivenham Road, Swindon, Wiltshire SN1 2NR, UK; The Blue Cross Animal Hospital, Coco Markus House, Nelson Street, Grimsby DN327SH, UK

ABSTRACT: Pain assessment and management in animals is still a new and growing field of research. Although it is still early days for pain research in birds, this article aims to provide information on the pain behaviours known so far, and describes current analgesic drugs and doses.

Keywords: pain; birds; pain assessment; analgesia

Introduction

There is a need to develop valid and reliable techniques for the assessment of pain (Weary, Niel, Flower, & Fraser, 2006), because it is difficult to say if we have effectively treated something if we cannot measure it before and after therapy (Paul-Murphy, 2006).

As avian pain assessment and management is still in the early stages, it is very likely that our avian patients in practice are still undertreated for pain (Hawkins, 2006, Kubiak, 2016a).

The reasons why pain often goes untreated have been discussed previously. Briefly, practitioners can overestimate the risk of potential side effects, worry about masking symptoms, and the cost to the owner. Unfortunately, practitioners subconsciously assign a "moral status"

Blackbird with cat bite injuries and thoracic puncture. Note the hunched appearance typical of this condition. Photo courtesy of Vale Wildlife Hospital.

Aneesa Malik MSc RVN Cert VNES Cert VNECC

Aneesa has worked in first-opinion practice, emergency, referral and for the RSPCA. She went on to pursue an interest in animal welfare science, particularly pain assessment and management. Her focus is the factors that affect very different pain management regimes in our veterinary patients.
Email: aneesa.vn@gmail.com

Adina Valentine RVN C&GCertVNES, VNCertECC, Clinical Coach

Adina started working in private practice in 2004 dealing with exotic species; once qualified as an RVN she started travelling abroad, working for animal welfare charities across the UK and Asia.

Adina is a committee member for the Association of Zoo and Exotic Veterinary Nurses (AZEVN), a clinical coach to student veterinary nurses and is currently studying towards a Diploma in Animal Ethics and Welfare.

Adina works for the Blue Cross Animal Hospital in North East Lincolnshire.
Email: adina.rvn@googlemail.com

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Injury visible with some blood loss. *Photo courtesy of Vale Wildlife Hospital*

This is the same patient, with an air sac visible due to thoracic puncture. This presentation, along with the cat bite injury, would have been very painful to the bird and would warrant analgesia. *Photo Courtesy of Vale Wildlife Hospital*

to a patient that decides whether the animal is *worth* analgesia – for example, is it a wild pigeon or an expensive owned falcon?

In addition, the benefit of analgesia to the welfare of the patient can be underestimated (see Bradbury, cited in White, 2016). Whether a practitioner acknowledges animal pain and their tendency to act on it depends on their level of empathy, which varies for many personal, societal and cultural reasons. Finally, without knowing the normal behaviour of a species, an observer will find it extremely difficult to detect abnormal behaviour, especially in prey species (Paul-Murphy & Hawkins, 2015).

Pain is described by people as "one of the most negative experiences possible" (Mellor & Bayvel, 2011). Pain has both physical and emotional effects. We are also aware that pain is a debilitating factor in healing. Relief of pain in birds has demonstrated a quicker return to recovery (Paul-Murphy, 2006 unpublished data; Forbes, 1999).

The pain experience is considered analogous to that of mammals (Kubiak, 2016a; Machin, 2005). Therefore, pain is a significant factor in any medical condition or traumatic injury that may be painful to us, despite the differences in expressive pain behaviours between birds and mammals.

Painful conditions in pet birds

Pet birds often present with problems such as respiratory, gastrointestinal (GI) or reproductive disease. Infectious or external environmental agents are often a cause. Full history-taking, husbandry information and thorough diagnostic work-ups in these cases are essential to determine and treat the underlying problem, and analgesia is often important in the treatment. Husbandry-related issues are frequent. Egg-binding, GI or respiratory conditions caused by inappropriate diet or environment and feather-destructive behaviour are all conditions that have potential to cause some discomfort or pain.

It is important to attempt to understand the normal behaviour of the individual as well as the species. Questioning the owner

Progression of condition. *Photo courtesy of Vale Wildlife Hospital.*

Young collared dove with cat injuries to back, right leg and tail feathers. Large feathers pulled out are extremely painful. This bird was started on a course of meloxicam, antibiotics and wound flushes. Initially it was not eating therefore required crop feeding. *Photo courtesy of Vale Wildlife Hospital*

will help a great deal with this. Observant owners, vets, animal care staff and nurses will be able to pick up on behavioural changes associated with pain (Hawkins & Paul-Murphy, 2011). If a pet bird is hospitalised, finding out from the owners their level of sociability and preferences for human contact or enrichment will help speed their recovery.

Painful conditions in wild birds

The avian patients that we as veterinary nurses probably see the most are cat-caught wild birds and road traffic accidents. Figures estimate that 55 million wild birds are brought home by cats every year in the UK (RSPB data) – and these are just birds brought home, not killed or injured, or accounting for subsequent deaths from failed nests if a parent bird was taken. This is probably a major underestimation.

Wild birds often present to us with traumatic injuries, such as bone fractures, head traumas or bite wounds.

It is very difficult for us to detect pain in wild birds. Birds are often prey species and will act as such: a debilitated bird in the wild will do its utmost to appear healthy to avoid predation, or ensure its territory is not encroached on. Likewise, avian predator species will also do everything they can to appear normal. We should be mindful of this during initial examination, and ensure that our approach to observation is adequate: this may mean we have to observe the hospitalised bird from a distance initially, rather than directly observing them.

It goes without saying that normal nursing care as for any bird, such as the provision of a clean, warm, dry, quiet cage away from predators, with appropriate and suitably positioned perches, a comfortable bed, easily accessible provisions and quiet, gentle and efficient handling will go a long way in increasing patient comfort (Machin, 2014).

Buzzard with a right wing fracture *(courtesy of Adina Valentine)*

Same buzzard post surgery to place an external fixator *(courtesy of Adina Valentine)*

Table 1. Table of pain studies in birds

Procedure	Type of bird	Type of pain	Behaviours	Test/outcome	Reference
Healed keel bone fracture (egg-laying industry) Broiler (meat chicken) industry	Chicken	Chronic	Decreased mobility, decreased confidence in mobility	Increased time to jump down from perch Increased time to reach food reward in runway tests Decreased used of perch Butorphanol group showed less time to jump down from perch compared to saline group	Nasr, Murrell, Wilkins, and Nicol (2012), Nasr, Nicol and Murrell (2012), Nasr, Nicol, Wilkins, and Murrell (2015) and McGeown, Danbury, Waterman-Pearson, and Kestin (1999)
Healed keel bone fractures (egg-laying industry)	Chicken	Acute/chronic	Conditioned place preference to area associated with analgesia	Birds with keel bone fractures preferred environment where they had experienced butorphanol	Nasr et al. (2013)
Femoral osteotomy	Pigeon	Acute	• Decreased time spent on perch • Abnormal limb position • Uneven weight-bearing • Slower return to pre-surgical behaviour	Pigeons with 2 mg/kg meloxicam treatment showed improved weight-bearing, and lowered subjective overall pain score compared to control group and 0.5 mg/kg meloxicam group	Desmarchelier et al. (2012) and Desmarchelier, Troncy, Fitzgerald and Lair (2012)
Electric shock	African Grey	Acute	• Lifting affected limb • Flinching or flapping wings	Butorphanol (but not buprenorphine) increased threshold to react to electric shock in half of the tested birds	Paul-Murphy, Brunson, and Miletic (1999)
Thermal stimulus	Amazon parrots, American kestrels	Acute	Decreased time to withdraw from noxious stimuli	Birds given tramadol took longer to withdraw foot from thermal stimulus compared to control	Sanchez-Migallon Guzman et al. (2012) and Guzman, Drazenovich, Olsen, Willits, and Paul-Murphy (2014)
Noxious stimulus under anaesthetic	Ducks	Acute	• Increased heart rate • Increased respiratory rate • Decreased latency to move under anaesthetic when noxious stimuli applied	Birds given ketoprofen had an increased latency to move under anaesthetic and lower heart rates when a noxious stimulus was applied (see paper for specific details)	Machin and Livingston (2002)
Degenerative joint disease (turkey farming)	Turkeys	Chronic	• Decreased weight bearing • Decreased activity	Butorphanol increased weight-bearing	Buchwalder and Huber-Eicher (2005)
Beak amputation to prevent feather plucking (poultry farming)	Chicken	Acute/chronic	• Vigorous escape attempts • Jumping, flapping, calling • Increased heart rate and blood pressure • Progresses to passive/tonic immobility (learned helplessness) • Reduced pecking • Reduced feed and water intake initially • Increased inactivity	Chronic long-term pain behaviours alongside neuroma development at the stump site	Gentle (1992)
Lameness (meat chicken/"broiler" farming	Chickens	Chronic	• Reduced mobility • Analgesia self-selection • More time spent lying down, less time spent walking • More time spent lying down to eat rather than standing • Less visits to feeding trough, but spending more time eating at each visit • Lying with one leg extended at right angles to body • Less time spent preening	Danbury, Weeks, Waterman-Pearson, Kestin, and Chambers (2000) looked at analgesia self-selection. Lame birds consumed more carprofen feed than sound birds. Gait scores improve with analgesia self-selection. As lameness severity increases, more drugged feed is consumed. Weeks, Danbury, Davies, Hunt, and Kestin (2000) looked at gait scores and activity budget of broilers.	Danbury et al. (2000) and Weeks et al. (2000)
Induced arthritis (intra-articular injection of sodium urate) (mimic leg problems in meat chicken/broiler farming)	Chicken	Acute	Lying with affected limb outstretched Lifting the leg Decreased standing, increased sitting Decreased oral behaviours Increased one-legged stand	Hocking et al., 1997 showed that 3 mg total dose of intra articular bupivacaine restored the behavioural profile of the induced arthritis chickens to that of control group. Hocking, Robertson, and Gentle (2005) showed that the optimal doses determined for carprofen, ketoprofen and flunixin in painful birds caused: • Increased standing • Decreased resting • Increased oral behaviours • Decreased one-legged standing	Hocking et al. (1997) and Hocking et al. (2005)
Slaughter	Chicken	Acute/chronic	• Wing flapping • Vocalisation • Attempting to straighten up • Fear and escape response • Increased plasma corticosterone ("stress-related" hormone)	Shackling upside down prior to stunning is painful	Debut et al. (2005), www.gov.uk/government/publications/fawc-advice-on-linco-gas-stunning-system-for-poultry; Wathes (2009), Gentle and Tilston (2000); and Gentle, Tilston, and McKeegan (2001)

Table 2. Basic analgesia doses in birds

Drug	Dose ranges	Route	Frequency (hours)	Type of bird used for research	Reference	Notes
Butorphanol	0.5–6 mg/kg	IM, IV	Q1 – 6 h	Most species	Carpenter and Marion (2013) Paul-Murphy and Hawkins (2015) Meredith (2015)	Currently most common opioid in use See formulary for more species-specific doses In raptors, doses > 1 mg/kg can cause recumbency Smaller doses have been studied in ratites
Buprenorphine	0.25–0.5 mg/kg	IM IM	Q2 – 5 h Q8 – 12 h	Pigeons Chickens	Girling (2013) Carpenter and Marion (2013) Paul-Murphy and Hawkins (2015) Meredith (2015)	See formulary for more species-specific doses Doses of 0.6 mg/kg have been studied in American Kestrel, with good absorption and bioavailability, with potential to last 6–9 h (Gustavsen et al., 2014). Further research is needed
Fentanyl	0.2 mg/kg or 0.15/0.2–0.5 µg/kg/min	SC CRI		Cockatoos Red-tailed hawks	Carpenter and Marion (2013) Paul-Murphy and Hawkins (2015)	Insufficient research Some analgesia, hyperactivity in the first 15–30 min in some birds. Reduced isofluorane MAC by 31–55% without a significant effect on other measurable parameters
Morphine	2.5–3 mg/kg 10–20 mg/kg	SC, IM IM	Q4 h	Galliformes Japanese Quail	Carpenter and Marion (2013)	Insufficient research Anti-nociceptive effect on foot withdrawal and pressure tests. No effect on locomotion, eating or drinking
Tramadol	5–11 mg/kg	IV, PO	Q12 h	Peafowl Bald eagles Red-tailed hawks Hispaniolan Amazon parrots	Paul-Murphy and Hawkins (2015) Girling (2013) Carpenter and Marion (2013) Meredith (2015)	See formulary for species-specific doses Tramadol has been tested at 30mg/kg Q6h in Amazon parrots.
Gabapentin	10–11 mg/kg	PO	Q12 – 24 h	Little corella Prairie falcon	Carpenter and Marion (2013) Meredith (2015)	
Lidocaine	< 4 mg/kg	Nerve block/local anaesthesia			Girling (2013), Meredith (2015) Paul-Murphy and Hawkins (2015) Carpenter and Marion (2013)	Dilute at least 1:10 Do not use preparations with adrenaline See formulary for species-specific doses Care with toxicity
Bupivicaine	2–8 mg/kg	Local infusion2 mg/kg SC2–8 mg/kg perineurally		Chicken, duck	Girling (2013), Meredith (2015) Carpenter and Marion (2013)	Can mix 1:1 with dimethylsulfoxide for topical application Care with toxicity Variable efficacy
Carprofen	1–10 mg/kg	PO, IM, IV	Q12 – 24 h	Most species, including raptors	Carpenter and Marion (2013) Girling (2013) Paul-Murphy and Hawkins (2015) Meredith (2015)	See formulary for species-specific doses Doses of 30 mg/kg have been successful in chickens with induced arthritis
Meloxicam	0.1–2 mg/kg	IM, PO, IV	Q12 – 24 h		Meredith (2015) Girling (2013) Carpenter and Marion (2013) Paul-Murphy and Hawkins (2015)	See formulary for species-specific doses and notes
Piroxicam	0.5–1 mg/kg	PO	Q12 h	Psittacines	Carpenter and Marion (2013) Meredith (2015) Paul-Murphy and Hawkins (2015)	See formulary for species-specific doses and study details
Ketoprofen	1–12 mg/kg	IM, IV, SC, PO	Q8 – 24 h	Raptors, waterfowl, Japanese quail, budgerigars, chickens	Carpenter and Marion (2013) Paul-Murphy and Hawkins (2015) Meredith (2015)	See formulary for species-specific doses and study details
Celecoxib	10 mg/kg	PO	Q24 h × 6 –24 weeks	Psittacines, for pro-ventricular dilatation disease	Carpenter and Marion (2013)	

Other agents used in conjunction with analgesia, such as ketamine, midazolam or similar drugs which are adjunctive, anxiolytic or used as pre-medication or sedation have not been included in this table due to space constraints, but can be found easily using the sources described.

Research so far in brachial plexus blockades has been variable/inconclusive. Further research is needed in other local anaesthetic techniques (e.g. epidurals, etc.). There has, however, been a successful report of a sciatic femoral nerve blockade.

Tawny owl with a superficial corneal ulcer. Eye ulcers often warrant systemic as well as topical analgesia *(courtesy of Adina Valentine)*

In pet birds and wild birds, treatments such as fluid therapy, injections or crop feeding should be grouped together as far as possible to avoid repeated interruption and handling and to minimise stress.

Painful conditions in farmed birds

In terms of numbers, farming is by far the biggest issue concerning avian pain.

Both the layer hen industry and broiler (meat chicken) industry have numerous routine practices (such as de-beaking or de-spurring) done on conscious birds in the absence of pain relief. Harvesting, transport, lairage and slaughter are all major events in the life of a farmed bird with potential and evidence for major injury (such as getting stuck or caught).

The main acquired painful conditions are bone fractures in the layer hen industry and chronic leg pain in the broiler industry. Farmed birds are the only animals in the UK shackled upside down prior to stunning, and the evidence for chronic leg pain among broilers questions whether this is an appropriate kill method (Wathes, 2009).

A note on laboratory birds

In animal research, birds represent a fairly small proportion of the animals used – in 2016, there were 2.02 million experimental procedures carried out in the UK. Around 150,000 (or 7%) of these procedures involved birds. They are used for a variety of experiments, but limited in comparison to, for example, rodents (Home Office Data, 2016). The author has found information for laboratory bird experimentation difficult to access.

Pain behaviours

Research in avian pain is limited, but much of it comes from welfare science with a concern for routine farming practices. Much of the research in **Table 1** looks at pain behaviours in farmed birds, but it is likely to be applicable in many ways to birds we see in practice.

When a bird is in pain there is normally a change or absence of one or more of

Buzzard with an oral trauma, that progressed to an abscess. Any sizeable abscess is a painful condition and would warrant pain relief *(courtesy of Adina Valentine)*

It is difficult in this case to ascertain whether this behaviour is caused by general debilitation, or pain, until diagnosis. The pigeon was diagnosed with *Trichomoniasis*, or 'mouth canker'. The patient was in early stages of shock, due to being weak, dehydrated and hypothermic from having been unable to eat for so long. So the fluffed up appearance and lethargic behaviour could be a result of the illness, but there might also be potential for some oral discomfort. *Photo courtesy of Vale Wildlife Hospital.*

This young kestrel presented with hypersalivation and neurological signs. It was started on butorphanol as an analgesic just in case there was any gastro-intestinal pain or discomfort due to ingestion of a potentially toxic substance.

Baby Verreaux's eagle with a gastro-intestinal infection. Note the dull eyes which are not fully open. The patient exhibited twittering vocalisation and a hunched/ head down posture, which resolved with administrations of butorphanol

Bumble foot is a common painful condition in farmed birds. *With kind permission from the British Hen Welfare Trust*

the normal behaviours (Paul-Murphy & Hawkins, 2015). These include:

- Changes in demeanour, posture and appearance:
  - Hunched appearance
  - Drooping or miserable demeanour
  - Fluffed up
  - Closing eyes
  - Poor appearance/feather quality
  - Tucked-up abdomen
  - One-legged standing
- Changes in locomotion:
  - Lameness, decreased weight-bearing
  - Slower speed
  - Difficulty perching/climbing
  - Falling, stumbling
  - Reduced confidence in mobility
- Changes in temperament or personality:
  - Aggression or passivity depending on normal behaviour
  - Antisocial behaviour or reduced social interaction
  - Lethargy, apathy
  - Decreased interest in surroundings
  - Anxiety, fear or restlessness
  - Escape reactions
  - Passive immobility
  - Sleep deprivation
- Guarding behaviour:
  - Guarding the affected area (or ensuring it is not accessible to us)
- Changes in grooming behaviour:
  - Feather-destructive behaviour
  - Overgrooming
  - Self-mutilation
- Changes in normal eating, drinking or toileting habits:
  - Innappetance
  - Constipation

Cloacal prolapse is a common painful condition in farmed laying hens. *With kind permission from the British Hen Welfare Trust*

The difficulty in this photo is differentiating between pain and anaesthetic recovery. This is an ex- battery hen post right femoral fracture repair surgery. However given that chickens rarely show outward signs of pain and do their best to pretend they are normal, and this bird had been extubated two hours prior to this photo and was minimally responsive to stimulus, the decision was to increase the frequency of the analgesia post op

The same patient the next morning following four hourly butorphanol, an injection of meloxicam, and two administrations of fluids and crop feeding. Although she has fully recovered from the anaesthetic, note the almost normal weight bearing on the affected leg.

Chicken showing signs of pain following a cloacal prolapse. She was administered tramadol and a cold compress, and following fluid therapy, meloxicam

- Changes in vocalisation:
  - Painful birds sometimes may vocalise on palpation of the affected area (but not always)
  - Birds that are normally talkative may become quiet, or vice versa (smaller species tend to vocalise less in general)
- Changes in physiological parameters:
  - Tachycardia, tachypnea and hypertension in acute pain
- Changes in weight:
  - Weight/muscle mass loss in chronic pain states

(Pablo, 2002; Hawkins, 2006; Paul-Murphy, 2006; Lierz & Korbel, 2012; Girling, 2013; Paul-Murphy & Hawkins, 2015; Kubiak, 2016a; Miesle, 2017

Options for analgesia (see Table 2)

Opioids

Opioid pain receptors in avian species differ slightly from those in mammals. A study in one avian species, the pigeon, showed that K-receptors predominate in the forebrain rather than μ-receptors (Herling et al., 1980). Work in other species is ongoing. Consequently the strong k-agonist butorphanol has shown to be the most useful (so far) in the common avian species.

Butorphanol combined with midazolam has shown to be an effective premedicant in some species (Kubiak, 2016b).

Tramadol, which works centrally as a μ-receptor agonist and peripherally to inhibit serotonin and norepinephrine reuptake, has shown some success in avian pain studies.

Non-steroidal anti-inflammatories

The inflammatory response is similar to mammals (Nicol, Klingberg, & Vasko, 1992) and although research in NSAIDs has been variable, which may be due to dose or species variation, there are NSAIDs that have been proven to be effective. Commonly used NSAIDs include meloxicam and carprofen. The same considerations with NSAID use are with birds as with mammals; caution should be taken when regarding GI conditions, hypo-perfusion or hypotension, and hepatic/renal function.

Once in her kennel you can observe that she is unwilling to sit down due to the prolapse. She was also administered midazolam to help stop her straining, which is why her wings are dropped/ relaxed.

Local anaesthesia

Local block drugs such as lidocaine and bupivacaine can be administered, if utilised carefully, as birds seem particularly sensitive to the side effects. Local anaesthesia is usually not recommended to be used in a conscious bird, as happens with minor procedures in humans or large animals, because the stress of handling and restraint will be detrimental (Paul-Murphy & Hawkins, 2011). Lidocaine infiltration is a regular protocol used in crop surgery and bumblefoot surgery at the British Hen Welfare Trust (Marcella Pervesi, personal communication).

Challenges in research – early days

As knowledge is still limited, we can only do what we can with regards to assessing and treating pain in birds. Pain behaviours in birds can be very cryptic and subtle, and they do not always manifest uniformly among different species, breeds or even among individuals.

To highlight the scale of research required, we can think about this: as nurses we are all familiar with pain behaviours that vary between individual dogs that we know, or between different breeds of dogs – and this is only within one species (*Canis familiaris*). Research so far, shows that most of *Canis familiaris* respond to the same analgesic drugs, with very minor variation between breeds and individuals.

In contrast, there are around 10,000 known species of birds, with about 200 of those species kept as pets. Within each pet species there may be different breeds. Each species has a different range of behaviour and different pharmacokinetic and pharmacodynamic responses to different drugs (Paul-Murphy & Hawkins, 2015). This is not even considering different breeds. This is a significant challenge in research.

Peregrine falcon showing wing drop. On admission it received butorphanol, and on examination and x-rays, it was discovered to be a soft tissue injury. The patient was started on oral meloxicam and tramadol. This bird always positioned itself with its good wing towards us and its damaged wing away from us (guarding/ self preservation behaviour).

Conure with a beak fracture on the lower right hand side. The patient had been unable to eat for some time and was weak, dehydrated and painful. He presented on the bottom of his cage, fluffed up, closing his eyes and very quiet. This photo was taken after initial treatment of opioid analgesia, warmth, SC fluids and crop feeding. Following rehydration the bird was started on meloxicam

Recovering feather plucker in a Senegal parrot with proventricular dilatation disease. Although feather plucking has many different causes, discomfort due to this condition can be a reason, which is why this patient was on celecoxib

Table 1 outlines some of the main pain behaviours that have been researched so far.

Despite the evidence we have, it must be remembered that the pain behaviours listed are often specific for the procedures detailed in each of the studies. Therefore, we can only use them as a part of a holistic assessment of our avian patients. Table **2** shows some common analgesics used in practice.

In conclusion, this article provides a brief overview of pain behaviours in birds. It discusses the importance of being able to recognise avian pain, but accepts there is a difficulty in doing so. It recognises that there is an urgent need for ongoing pharmacokinetic and dose–response studies of drugs commonly used in avian analgesia, otherwise it will continue to be limited by anecdotal information and clinical judgement (Ludders & Matthews, 2007).

If there is tissue damage, or suspected tissue damage, and the bird is exhibiting changes in normal posture, temperament or behaviour, the veterinarian should assume the bird is experiencing pain (Jenkins, 1993). Until species and procedure-/context-specific pain scales are established, if we do not know whether the bird is in pain, it may be fair to give the animal benefit of the doubt and administer pain relief. The old adage "if it would hurt me, it would hurt my patient" is always a good guide.

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Some information on the British Hen Welfare Trust:

The British Hen Welfare Trust was founded in 2005 to rehome laying hens from the Battery system; 50,000 hens per year are found pet homes where they live out their retirement in a free-range environment. Hens are rehomed from 32 collection points around the UK staffed by 500 volunteers. The charity's ultimate aim is to see consumers and food manufacturers buying only UK-produced free-range eggs, resulting in a strong British egg industry where all commercial laying hens enjoy a good quality of life.

Two pigeons, both with foot injuries. The one on the left has a constriction injury from string and the foot was swollen, red and deformed. The bird on the right had a stump in place of its left foot. Both birds were significantly lame and exhibited one – legged standing

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Multiple Choice Questions

1. Which of the following physiological parameters would commonly be associated with acute pain in birds?

(a) Tachycardia
(b) Overgrooming
(c) Loss of muscle mass
(d) Hypotension

2. Which of the following changes in temperament or personality could indicate pain in a bird?

(a) Hypertension
(b) Sleep deprivation
(c) Constipation
(d) Tachypnoea

3. Which opioid pain receptor is predominate in the forebrain of avian species?

(a) μ- receptors
(b) α2 - receptors
(c) K- receptors
(d) δ- receptors

4. Which of the following opioids is an agonist at K- receptors?

(a) Buprenorphine
(b) Methadone
(c) Morphine
(d) Butorphanol

5. The article suggests which combination of drugs may be an effective premedicant in some avian species?

(a) Acepromazine and buprenorphine
(b) Midazolam and butorphanol
(c) Medetomodine and butophanol
(d) Midazolam and buprenorphine

6. What percentage of experimental procedures carried out in the UK in 2016 are believed to have involved birds?

(a) 7%
(b) 10%
(c) 15%
(d) 2%

7. Farming is the biggest issue concerning avian pain:

(a) True
(b) False

8. It is estimated that how many wild birds are bought home by cats every year in the UK?

(a) 10 million
(b) 25 million
(c) 55 million
(d) 100 million

For the answers to the MCQs, please go to: http://www.bvna.org.uk/publications/veterinary-nursing-journal