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Pain in rabbits: a review for veterinary nurses, part one: assessment of pain

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ABSTRACT: Pain management involves considering pain, recognising pain, and managing pain. This three-part article will focus on recognition and management of pain in rabbits. Part One (this article) will look at assessment and recognition of pain. This discusses the physiological and behavioural signs that indicate pain. Part Two (next article) will look at managing pain. Analgesic options are discussed to cover all aspects of the pain pathway. Dose ranges for constant rate infusions are available. Local anaesthesia and analgesia techniques are discussed. Part Three will look at managing chronic pain in rabbits at home.

Keywords: rabbit pain; pain assessment; rabbit pain recognition

Introduction

The rabbit is the third most popular pet in the UK, and has always been a commonly used research animal. It is estimated that in 2019, there were 900,000 pet rabbits in the UK (PDSA PAW Report, 2019). In 2019, there were 10,188 experimental procedures on research rabbits in the UK (Home Office Data, 2020).

Incorrect or outdated pet rabbit welfare is an on-going problem, and has fortunately been highlighted by researchers (see Rioja-Lang et al., 2019) and welfare organisations (PDSA PAW Report, 2019).

In the largest practice-based research to date of rabbit health in England, O'Neill et al. (2020) reveal that in a study of 6,349 pet rabbits, the most prevalent conditions were dental disease, perianal soiling, ileus, and overgrown nails. The most common cause of death was myiasis (flystrike), followed by anorexia, collapse, and ileus. Pain is a factor in all of these conditions.

Assessment and management of pain in rabbits has for a long time, been inadequate (Benato et al., 2019; Lichtenberger & Lennox, 2008).

A brief and turbulent history with humans

The rabbit is a prey species with a short domestication history that, for the most part, has endured a 'negative' relationship

with humans. Worldwide, they are laboratory subjects, hunted, or farmed for meat and fur. Concealment of pain is important for survival (Goldberg, 2017a).

However, with the increasing popularity of this species as a household pet and 'member of the family', this dynamic may begin to change.

Knowing the normal behaviour of a species

While behavioural assessment is fundamental to pain assessment, there are two issues that need to be considered. Firstly, many behaviours associated with pain, are also associated with 'sickness' or 'stress' behaviours. Secondly, if the staff are unfamiliar with the normal behaviour of a rabbit (because they only see sick or painful rabbits), then the behaviour of the sick or painful rabbit becomes 'normal' ('bad becomes normal'): this creates a problem in assessment.

The normal behaviour of a well-socialised domestic rabbit can include the following:

- Inquisitiveness;
- Adventurous in familiar surroundings, but potentially anxious or tentative in unfamiliar surroundings;
- Exploratory in situations where they feel safe.

Being a prey species, they are more inclined to be anxious than gregarious, but when there is no evident threat, a healthy

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Figure 1. Rabbit exploring consult room floor.



Figure 2. Relaxed rabbit. (See Appendix 1 in the online supplementary files for a rabbit behaviour infographic).

domestic rabbit that is well socialised will be inclined to explore a new environment e.g., a consult room floor (Figure 1) or if in familiar surroundings, behave in a relaxed manner (Figure 2).

Painful rabbits will not be inquisitive, adventurous, or exploratory. An experienced or observant carer will be able to 'scale' the rabbit's pain by judging how far their behaviour has departed from normal.

Assessing rabbit pain: 'the great pretenders'

When we are able to assess rabbit pain, we are then able to assess whether analgesia has worked (Leach et al., 2009). This is something we can all aim towards.

Subtle signs

Very subtle signals will be picked up by an observant owner, such as a slight change in their normal routine, posture, behaviour, demeanour or appearance, or a subtle alteration in appetite. Unobservant owners may not notice, or think it is normal.

Either way, these behaviours will disappear as soon as a rabbit is boxed up to go to a veterinary practice.

For instance, SNORS rabbit sanctuary have identified that a very subtle head lifting behaviour indicated abdominal pain in one of their rabbits. The behaviour resolved with

treatment by buprenorphine at home, but returned once the buprenorphine had worn off. However, no such behaviour occurred when the rabbit was hospitalised, whether given buprenorphine or not (SNORS rabbit sanctuary, 2020).

It is advisable for owners to video-record these behaviours at home and show them to their veterinary surgeon (VS) or veterinary nurse (VN), so that the problem can be investigated.

Moderate signs

Moderate signs of pain are also likely to be missed in veterinary practice. Rabbits will do these behaviours once they are left to their own devices and unobserved. This may include occasional grimacing or abdominal pressing, and being quieter than normal. GI (gastro-intestinal) stasis can occur at this stage. 'Inactivity' is cited as the most common behavioural sign of pain in rabbits.

However, they may not exhibit any of these symptoms in a consult room, therefore careful owner questioning is essential.

A quiet rabbit, or one showing any of these moderate signs, requires urgent veterinary attention and hospitalisation.

Severe signs

It is more likely that the moderate to severe, or severe stages of pain, are noticed by owners, VS and VNs. A rabbit that is inactive, or very quiet, exhibiting bruxism, grimacing, and seems to have shifted his or her focus inwards and has become less aware of the environment - despite the presence of observers - is a critical patient. The rabbit may no longer 'care' about appearing normal, or is unable to keep up a pretence of normality any longer. This is an emergency.

Looking into rabbit pain assessment

So far, rabbit pain assessment has looked at physiological and physical parameters such

as heart rate, respiratory rate, blood glucose, body weight, food and water intake, and serum cortisol levels.

Some studies have looked only at behaviour, such as frequency and duration of activity, exploratory behaviour, rearing behaviour, grooming, eating, digging, etc.

Other research has looked at both behavioural and physiological/physical parameters. Figure 3 and Figure 4 outline some general physiological and behavioural changes. Grimacing may occur only during a painful stimulus of *particular* severity and duration. The absence of a grimace does not mean the absence of pain (Langford et al., 2010). Changes in facial expression might occur during waking up, squinting in bright lights, or for behavioural communication, as well as being affected by certain procedures (see Figure 7). Therefore, the grimace scale should *always* be used in conjunction with other parameters, and not as a stand-alone method.

Some rabbits even defy your expectations: in the authors limited experience with rabbits presenting with limb fractures or large abscesses, they will sometimes exhibit pain behaviours, but at other times 'act' completely normally in veterinary practice. This has been reported elsewhere (Hedley, 2019).

In these cases, a chronic pain behaviour at home (such as the abscess example) has likely been 'normalised' by the owner ('he has always been quiet') or ('she always has always been grumpy').

Similarly, being a prey species, rabbits do not always react to palpation.

Leach et al. (2009) revealed (via remote camera recording) the following pain behaviours in an ovariohysterectomy rabbit model: twitch, wince, abdominal press, stagger, fall, flinch, writhe and arch (see Figures 8-10).

The reason why remote camera video recording is used is because, as we all know, rabbits drastically change both their behaviour and their facial expression when they are being observed, in order to 'appear normal'.

They even occasionally do things like 'pretend to eat', where they will pick up the food when being observed, but drop it later (author's observations, SNORS sanctuary 2020).

While remote camera recording may be a luxury, baby monitors or pet cameras are a cheaper option.

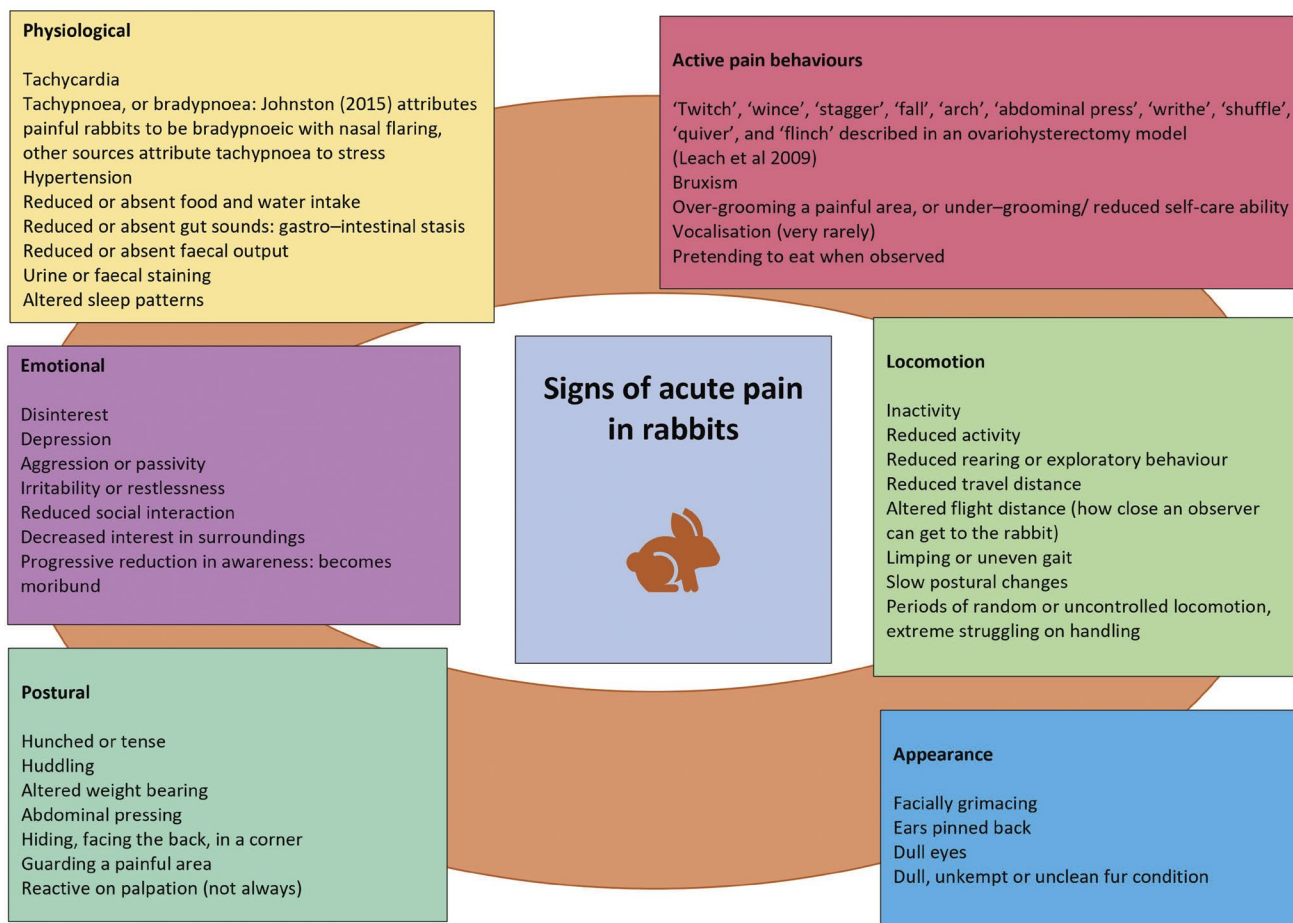


Figure 3. Signs of acute pain in rabbits. Sources: Johnston (2005), Hawkins (2006), Kohn et al. (2007), Leach et al. (2009), Weaver et al. (2010), Leach et al. (2011), Wenger (2012), Keating et al. (2012), Thompson (2014), Johnston (2015), Lafferty et al. (2015), Goldberg (2017a).



Rabbit and Rodent pain scoring

** You must be familiar with the appearance and behaviour of your species and your individual patient's temperament before scoring. Stress can be associated with many of these behaviours such as tachypnoea and anorexia. **

Pain score	0	1 MONITOR	2 REASSESS PAIN RELIEF	3 REASSESS PAIN RELIEF	4 IMMEDIATE VET ATTENTION
Grimace scale	<ul style="list-style-type: none"> - Normal facial tone and appearance 	<ul style="list-style-type: none"> - Slight/no squint - Ears normal or slightly back - Whiskers slightly back 	<ul style="list-style-type: none"> - Noticeable squint - Ears slightly pulled back - Noticeable cheek flattening - Whiskers pulled slightly back 	<ul style="list-style-type: none"> - Severe squint - Ears noticeably pulled back - Cheek flattening - Whiskers pulled back 	<ul style="list-style-type: none"> - Eyes closed/severe squint - Ears pulled back or limp - Cheek flattening or none at all - Whiskers pulled back or limp
Behaviour	<ul style="list-style-type: none"> - Normal eating habits - Interactive with surrounding and humans - Self/mutual grooming - Normal gait 	<ul style="list-style-type: none"> - Reduced appetite (picky/only favourites eaten) - Porphyrin staining (rats) - Reduced activity 	<ul style="list-style-type: none"> - Moderate or completely anorexic - Over-grooming - Mild bruxism - Hunched posture - Piloerection - Tachypnoea - Tachycardia - Vocalising (guinea pigs/rats) - Mild lameness - Urinary incontinence - Moderate reduced activity 	<ul style="list-style-type: none"> - Anorexia - Bruxism - Hunched posture/abdominal pressing - Self-traumatising - Vocalising (guinea pig/rat) - Tachycardia - Tachypnoea - Pronounced lameness - Aggression (when previously docile) - Incontinence - Reluctance to move 	<ul style="list-style-type: none"> - Anorexia - Bruxism - Ridged or immobile - Vocalising (rabbits) - Brady or tachypnoea - Tachycardic - May be unresponsive

Figure 4. Example of a rabbit and rodent pain scale. With kind permission from Abigail Edis.



THE PAC



Rabbit Grimace Scale (RbtGS) Score Sheet

Developed by Dr Matt Leach and the Pain and Animal Welfare (PAWS) group at Newcastle University.

Instructions

The Rabbit Grimace Scale describes five action units that should be scored. These action units have been shown to increase in intensity in response to post-procedural pain (Keating et al. 2012.) These action units **should** only be used in awake animals. Each animal should be observed for a short period of time to avoid scoring brief changes in facial expressions that are unrelated to the animal's welfare.

Observe the rabbit considering each of the facial action units outlined in this sheet to assign a score. To assist with scoring, use the scoring sheet alongside the poster and manual which contain visual and text descriptions of each action. This scoring sheet **should** always be used alongside other validated indices of pain.

Rabbit's Name	[Redacted]	ID No	[Redacted]
Condition	Post R. hind # repair	Date	[Redacted]
Time of assessment	8am		
Vet / Nurse initials	AM		
Observation	Observation 1	Observation 2	Observation 3
	Observation 4		

- Is there a narrowing of the orbital area with a closing of the eyelid? Over 1/2 closed is a score of '2'.
- A score of '2' can include an eye squeeze (contraction of muscles around the eye).

1 Orbital Tightening	Not present	0	0	0	0
	Moderately present	1	1	1	1
	Obviously present	2	2	2	2

- Have the cheeks lost their rounded (bulging) shape and become flatter? At a score of '2' cheeks have a sunken look.
- Have the edges of the cheek muscles lost their definition (i.e. visibility)? At a score of '2' they are not very visible.
- Has the general face shape changed from rounded to angular and have the edges of the cheek muscles become less visible?

2 Cheek Flattening	Not present	0	0	0	0
	Moderately present	1	1	1	1
	Obviously present	2	2	2	2

- Has the upper edge of the nostrils lost its 'U-shaped' profile and formed a more 'V-shaped' profile?
- Has the lower edge of the nostrils lost its curved profile and become straighter and more vertical?
- Please note, the openness of the nostrils is NOT related to the nostril shape.

3 Nostril (Nare) Shape	Not present	0	0	0	0
	Moderately present	1	1	1	1
	Obviously present	2	2	2	2

- Have the whiskers lost their relaxed, natural curved profile to become increasingly straight?
- Have the whiskers clumped together?
- Do most of the whiskers point in the same direction? At a score of '2', most of the whiskers seem to point downwards.

4 Whisker Shape & Position	Not present	0	0	0	0
	Moderately present	1	1	1	1
	Obviously present	2	2	2	2

- Have the ear apertures lost their open (dish-shaped) appearance and become folded/curled inwards (more cylindrical)?
- Has the distance between the lower inside edges of the ears decreased? At a score of '2' they are almost touching.
- Have the ears moved from standing vertically to the back or side of the rabbit? At a score of '1', the ears are at a 45° angle relative to the back or sides. At a score of '2', the ears are held closer to the back or sides of the body.

5 Ear Shape & Position	Not present	0	0	0	0
	Moderately present	1	1	1	1
	Obviously present	2	2	2	2

Totals	8/10				
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PACRGP1701

Figure 5. Rabbit Grimace Scale scoring for the patient photographed in Figure 6, a patient recovering from a fracture repair. See Appendix 2 in the online supplementary files for visual guidance on scoring.

Whole patient pain assessment

Considering a 'whole patient' approach looks at all aspects of the patient:

1. Physical
2. Physiological
3. Emotional (including their normal personality and current state)
4. Behavioural
5. Use of validated pain scales
6. Use of analogy



▣ **Figure 6.** Patient with inadequate analgesia post hind-limb fracture repair. The patient was inactive, minimally interactive, and always lying with the affected limb uppermost. He resented handling and palpation of the affected leg. See Figure 5 for his grimace scale scoring.



▣ **Figure 7.** Facial muscle changes might occur as a result of ear surgery, which can affect assessment of grimacing.



▣ **Figure 8.** Laboratory rabbit exhibiting 'press'. With kind regards from Dr Matt Leach.

'Analogy' means 'comparison': if this condition is painful to you, it would be painful to your patient. This is similar but not the same as anthropomorphism. However, as pain in animals is mostly untreated or undertreated, most sources now actually advise an anthropomorphising approach (Cital, 2016).

See Appendix Three for a whole patient pain assessment template.

Assessing chronic pain

Chronic pain is frequently overlooked in rabbits (Johnston, 2015). Chronic pain in rabbits can commonly be a result of (but not limited to):

- Pain due to underlying ear disease (especially lop-eared rabbits)
- Musculoskeletal (osteoarthritic, degenerative joint disease)
- Pain associated with organs (e.g. bladder, ocular)
- Dental pain
- Cancer pain

(Johnston, 2015).

Chronic pain rabbits present to veterinary practice (*often repeatedly*) with another issue – such as recurrent gastro-intestinal (GI) stasis, flystrike, urine or faecal scalding, or an inability to maintain their own hygiene (Figures 12–14).

A case study in Part Three will give an example of chronic pain management.

Finally, when all assessment fails...

If you suspect but are not sure that your rabbit patient is in pain: give it the benefit of the doubt.

Future considerations

A composite pain score for rabbits would be a future consideration. The challenge with pain scores is that, in an ideal world, they need to be specific not only to the species, but to the context or condition e.g. headache, ear pain, bladder pain, dental pain, gastro-intestinal pain, for both acute and chronic situations.

A future form of assessment between painful and pain-free rabbits could include Qualitative Behavioural Assessment (QBA) which utilises behavioural and emotional analysis. This has been successful so far in cows with painful mastitis (de Boyer des Roches et al., 2018) and in post-castrated lambs (Maslowska et al., 2020).



▣ **Figure 9.** Laboratory rabbit exhibiting 'wince'. With kind regards from Dr Matt Leach.



▣ **Figure 10.** Laboratory rabbit exhibiting part of the behaviour 'writhe and arch'. With kind regards from Dr Matt Leach.



▣ **Figure 11a.** Rabbit with unmanaged pain for cellulitis. See Figure 11b for his whole patient pain assessment.

Conclusion

In conclusion, this article acknowledges the difficulty in recognising and assessing pain in rabbits; but we have more information coming through all the time: it is important to keep learning and raising the standards for our rabbit patients.

Research so far looks at physiological, physical and behavioural signs. These can be subtle, moderate or severe.

Considering a 'whole patient' pain assessment approach, analogy, and the grimace scale provides the groundwork to assess patients by.

Future considerations involve creating a rabbit composite pain score, and further behavioural and emotional forms of pain assessment.

Name: ~~██████~~ Date: ~~██████~~ Time: 12pm Initial: AM

Whole patient pain assessment (domestic)

History and signalment (complete once)

Species/ breed: Rabbit/giant lop
 Age: 2 years
 Gender/ neuter status: MN
 Vaccination status: unknown
 Previous health issues: N/A/dental spurs
 Husbandry: unknown
 Normal personality: friendly
 Presenting problem:
 ① RHS peri-orbital swelling
 ② RHS facial cellulitis
 ③ Gut stasis + pyrexia

Pain scales

Scales used: Rabbit Grimace Scale
 Scores: 8/8 Intervention levels: (None currently)
 (unable to assess ears, as lop)

Analogy

Would this condition be painful to you? Yes

Behaviour parameters

Position in the kennel/ box/ consult room/ enclosure: Facing corner, at back of kennel
 Demeanour: miserable, withdrawn, irritable
 Posture: head down, hunched, weight bearing mostly on hindlimbs
 Interaction with conspecifics/ owners/ staff unwilling to interact with staff
 Reaction to approach: shuffles away, puts his head in the corner
 Locomotion, mobility and level of activity: shuffling, stumbling
 Reaction to palpation: tremors, moves away, winces, reactive
 Reaction to handling: increased respiratory rate, winces, tremors, increased respiratory noise
 Any vocalisation?: (loud upper respiratory tract noise)
 Any extra abnormal behaviours observed? twitches and tremors

Physiological/ physical parameters

Respiratory rate/ effort/ lung sounds: tachypnoeic, loud upper respiratory noise
 Heart rate/ rhythm/ pulse quality: tachycardic, did not assess pulses
 Temperature: pyrexia, temp = 40.4°C
 Gut sounds (species applicable): No gut sounds in all abdominal quadrants
 Mucous membrane colour/ quality/ CRT: Pink mucous membranes, CRT 1 sec.
 Mentation: Reduced awareness
 Blood pressure: Not done
 Eating?: N Drinking?: N Any observations: Not swallowing syringe feeds
 Urinating?: N Defecating?: N Any observations:
 General condition and hydration: Weight loss since admission, questionable hydration
 Any lesions, wounds, injuries or relevant painful body parts?: Swollen peri-orbital membranes and swollen RHS neck, swollen RHS face, no wounds seen.

Figure 11b. Patient pain assessment for rabbit with unmanaged pain for cellulitis (see Figure 11a).

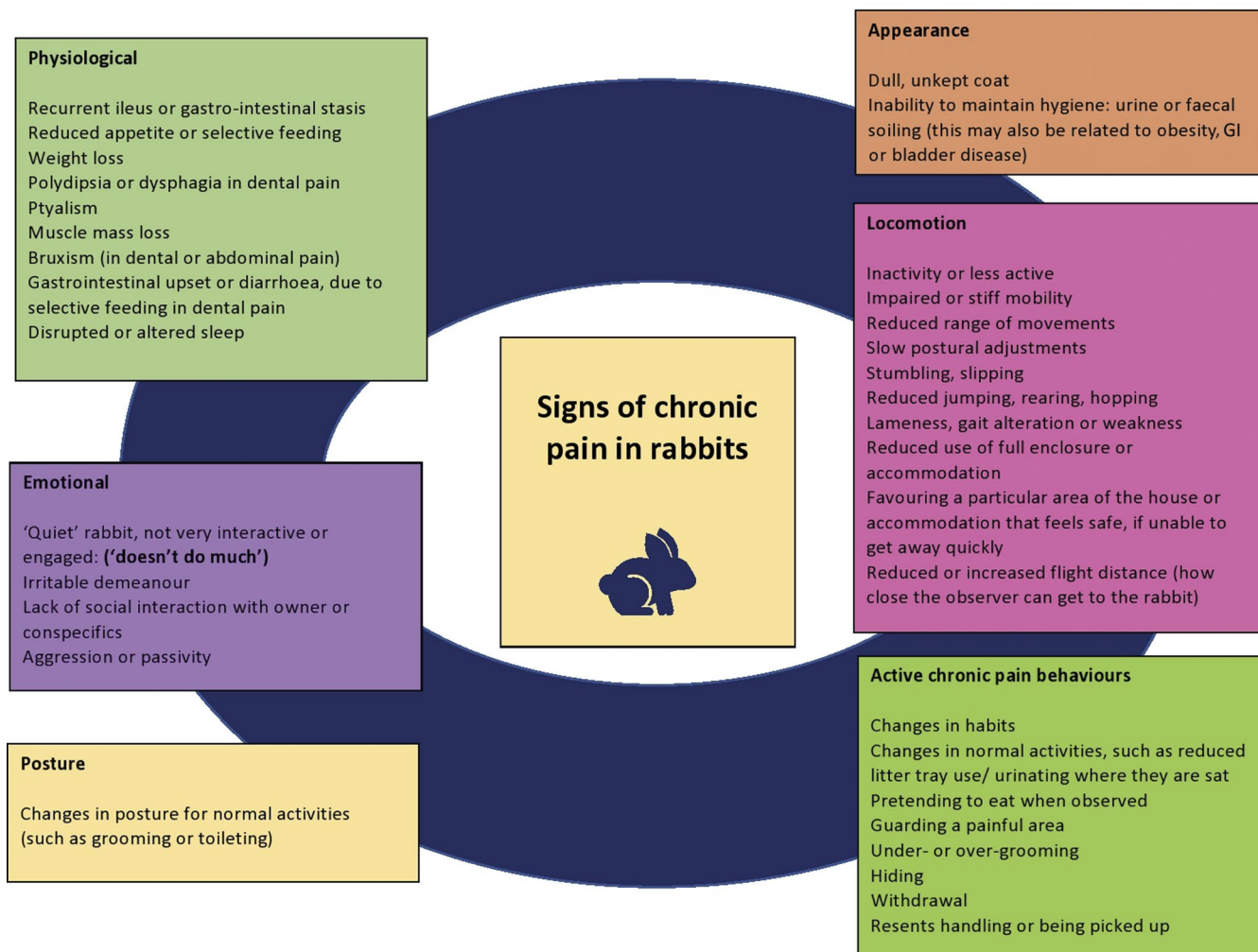


Figure 12. Signs of chronic pain in rabbits. Sources: Johnston (2005), Hawkins (2006), Kohn et al. (2007), Leach et al. (2009), Leach et al. (2011), Wenger (2012), Keating et al. (2012), Weaver et al. (2010), Thompson (2014), Johnston (2015), Lafferty et al. (2015), Goldberg (2017a), Lowe (2019).



Figure 13. Chronic pain rabbit admitted with recurrent GI stasis. Note the hunched posture, abdominal pressing and facial grimacing. A full body computed tomography (CT) scan under sedation revealed findings that included dental malocclusion and overgrowth, spinal spondylosis, mild osteoarthritic changes to the elbows, and suspected otitis externa.



Figure 14. Pain is (one of many) differentials in a patient with an inability to self-care. With kind permission from Claire Speight.

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Supplemental Material

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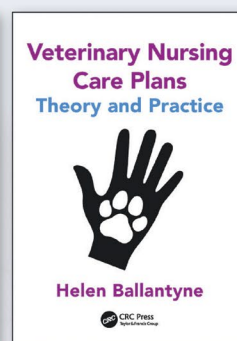
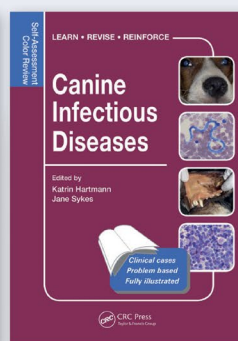
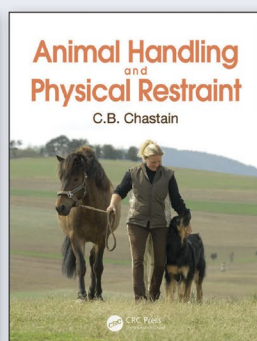
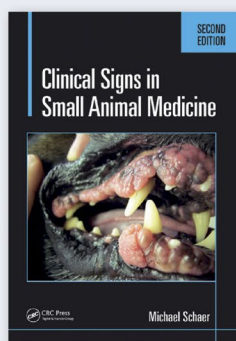
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