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Optimal pain indicators for field trial assessment of analgesic efficacy in piglets undergoing surgical castration

Die geeignetsten Schmerz-Indikatoren zur Beurteilung der analgetischen Wirksamkeit bei der chirurgischen Kastration von Ferkeln im Feldversuch

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TABLE 1: *Summary of, and recommendations regarding, indicator methods used for field assessment of castration-associated pain in neonatal piglets*

Method	Method Details	Sensitivity (to detect change in piglets undergoing castration)	Specificity (to pain)	Reproducibility	Recommendation	Comment
Physiological response	Markers of HPA axis/SNS activation (adrenalcorticotrophic hormone/cortisol/adrenalin)	High	Low	Moderate	Not recommended for assessment of pain mitigation via general or local anaesthesia (blockade of neural pain transmission) May provide indication of efficacy for NSAIDs (blockade of inflammatory-induced pain)	Confounded by extraneous factors such as duration of restraint/ surgical stress response/ degree of bleeding or tissue trauma.
	Markers of neuropeptide/ inflammatory response (TNF-α, IL-1β, C-reactive protein)	Moderate	Low	Moderate		
Nociceptor motor response	Scored via NRS/VAS or ordinal scale	High	High	High	Recommended	Optimally, scoring restricted to time of acute pain generation.
Nociceptive vocal responses	Measured via peak dB, total vocal response (such as area under the dB/time waveform), the frequency (Hz) of call with the highest intensity (dB (A)), rate of high frequency calls (>1000 Hz) or stress vocalisations using the STREMODO system	High	Moderate (depending on assessment method)	Moderate (depending on assessment method)	Recommended with qualification	Sensitivity/specificity may be reduced in non-acoustically separated environment
Mechanical wound sensory testing	Measured using von-Frey, needlestick or pressure algometry	High	High (to evoked pain/ hyperalgesia) Low (to spontaneous pain)	High (von-Frey) Low (pressure algometry)	Recommended (von-Frey) Not recommended (pressure algometry)	Optimally should be used in combination with a method to assess spontaneous pain
Post-operative pain behaviour	General postures and behaviours (time spent lying, standing sitting, nursing etc.)	Moderate	Low	Low	Not recommended	Confounded by neonatal piglet response to restraint, handling and separation from sow
	Specific pain associated behaviours (Huddling up, prostration, tremors/trembling, stiffness, scratching abnormal gait)	Low (Evident in first minutes and hours following castration, when recorded by direct quiet observation).	High	Moderate (depending on assessment method)	Recommended	Continuous video recording techniques appear insensitive to acute pain related behaviours, however, may be sensitive to subacute behavioural abnormalities (scratching/ tail-wagging)
Facial grimace score	Assessed via – orbital tightening, ear position, cheek tightening/nose bulge	Moderate	Low	Low	Further development/evidence required	May be impacted by body weight or activity state
Infra-red thermography	Reduction in skin surface temperature secondary to pain-related activation of SNS	High	Low	Low	Not recommended	Confounded by piglet response to stress and inflammatory response to tissue trauma