was recommended, because congenital methaemoglobinaemia is reported in Pomeranian dogs (Shino et al 2018). Unfortunately, this was declined by the owner.

To the authors' knowledge, this is the first report of a pulse co-oximeter being used to detect methaemoglobinaemia in a dog. In this case, conventional two-wave-length pulse oximetry showed low SpO_2 but could not determine the underlying cause (Barker et al 1989). The use of the multiple wave-length pulse co-oximeter identified a low SpO_2 and detected methaemoglobinaemia, as reported in human medicine (Barker & Badal 2008). This monitor may be used during anaesthesia or hospitalisation or both as it is noninvasive and shows real-time values, unlike blood tests, which may require several days for processing. This report highlights the advantages of using a multiple wave-length pulse co-oximeter *versus* a conventional two-wave-length pulse oximeter in the early detection of methaemoglobinaemia, when an animal exhibits cyanosis without apparent pulmonary or cardiovascular causes.

Authors' contributions

IS: preparation of manuscript. FM: preparation of manuscript. AL: preparation of manuscript. PB: preparation of manuscript.

Conflict of interest statement

The authors declare no conflict of interest.

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Plexus brachialis block as part of balanced analgesia in a sheep undergoing arthrodesis of the carpus

The plexus brachialis block (PBB) is a well-described and reliable technique for painful surgical procedures below the elbow in small animals and humans (Duke-Novakovski 2016). Ghadirian & Vesal (2013) described its use in experimental sheep, but little is known about its application under clinical circumstances in sheep. Only Rodrigo-Mocholí & Schauvliege (2015) described the paravertebral PBB as part of balanced anaesthesia in a sheep undergoing thoracic limb amputation.

A 2 year old Zwartbles sheep (51 kg) was presented for arthrodesis of the left carpus after a chronic infection. The preanaesthetic examination did not reveal anomalies aside from clear lameness, swelling and varus deformation. After premedication with 0.4 mg kg^{-1} diazepam (Ziapam; Ecuphar, Belgium) and 0.1 mg kg^{-1} methadone (Comfortan; Eurovet Animal Health BV, The Netherlands) intravenously (IV), anaesthesia was induced with 4 mg kg^{-1} propofol (PropoVet Multidose; Zoetis, Belgium) IV and maintained for 195 minutes with isoflurane (IsoFlo; Aesica Queenborough Limited, UK) in oxygen, using a semiclosed circle system (Dräger-AV1; Drägerwerk AG, Germany). The animal was mechanically ventilated throughout the anaesthesia period and lactated Ringer's solution (Vetivex 5000 mL; Dechra Limited, UK) was infused at 5 mL kg^{-1} $hour^{-1}$. Meloxicam 0.5 mg kg^{-1} (Metacam 20 mg mL^{-1}; Boehringer Ingelheim, Germany) was administered subcutaneously 30 minutes after induction.

After aseptic preparation, a left PBB was performed in right lateral recumbency 15 minutes after induction of anaesthesia, with the limb retracted in a slightly caudal position (45° angle). A nerve stimulator needle (Stimuplex Ultra 0.7 × 100 mm 22 gauge × 30° 2″; Braun Melsungen AG, Germany), attached to a nerve stimulator (TOF-Watch; Organon Teknika BV, The Netherlands), was used to verify correct needle placement. In a first attempt, the needle was inserted as described by Mahler & Adogwa (2008) in dogs. The needle was inserted cranially to the acromion, perpendicular to an imaginary line between the acromion and the greater tuberosity and advanced slowly with a stimulus of 4 mA current, 0.1 ms duration, at a frequency of 1 Hz. Only weak muscle contractions appeared, despite repositioning the needle two times and increasing the current to 5 mA. Subsequently, a different needle position was chosen, as described by Ghadirian & Vesal (2013) in experimental sheep. The needle was inserted medial to the shoulder joint, parallel to the vertebral column of the sheep, aiming towards the costochondral junctions. Using the same stimulus, strong muscle contractions and clear extension and flexion twitches of the carpus were observed. The current was decreased, but contractions of the flexors of the carpus remained visible at 0.2 mA. To avoid possible intraneural injection, the needle was slightly repositioned such that contractions were visible at 0.4, but not at 0.3 mA and subsequently, undiluted mepivacaine 0.8 mg kg^{-1} (Mepidor 20 mg mL^{-1}; Richter Pharma AG, Austria) was injected. After slightly retracting the needle, the same procedure was performed for the extensors of the carpus, with injection of a further undiluted 0.8 mg kg^{-1} of mepivacaine. Thereafter the needle was gently withdrawn while injecting a final undiluted 0.4 mg kg^{-1} mepivacaine. A total volume of 5.1 mL was injected. After the block, the sheep was positioned in dorsal recumbency for carpal arthrodesis through a dorsal approach, with removal of all articular cartilage by curettage, closure of the surgical incision and application of a full-limb cast. During surgery (120 minutes), no abrupt cardiorespiratory changes were seen, all vital parameters remained within normal limits and no rescue analgesia was required (the average end-tidal isoflurane was 1.18%). The recovery of the animal was uneventful and no clear signs of discomfort were observed. Assessment of the degree of lameness was difficult as the animal was not yet used to cope with the cast. Postoperative analgesia was provided by 0.5 mg kg^{-1} meloxicam administered subcutaneously for 5 days.

With a successful PBB, selective anaesthesia and relaxation of the limb distal to the elbow joint can be provided (Mahler & Adogwa 2008). Interestingly, the technique described by Mahler & Adogwa (2008) in dogs provided insufficient muscle contractions in this case, so the technique described in sheep by Ghadirian & Vesal (2013) and in dogs by Duke-Novakovski (2016) was performed instead. Ghadirian & Vesal (2013) used this technique to evaluate the effect of adding epinephrine or xylazine to a lidocaine solution for PBB in experimental sheep, with an overall success rate of about 89%. In the present case, the relatively low concentration of isoflurane and the absence of abrupt cardiorespiratory changes suggest that the block was successful, although the influence of meloxicam and methadone also need to be considered. Potential complications of the PBB such as puncture of the thoracic cavity or the jugular vein/axillary artery/vein, and nerve trauma, were not encountered in the present case.

In conclusion, the PBB as described by Ghadirian & Vesal (2013) can be performed as part of a multimodal plan of analgesia in sheep undergoing thoracic limb surgery. No side effects were observed in this case.

Authors' contributions

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