Complications of nerve blocks

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Nerve and joint blocks are an essential part of the lameness examination. This can be to localise the source of pain prior to imaging of the affected area, or to confirm the significance of clinical signs or imaging findings. The techniques and locations for these blocks have been widely reported and described.

The most important complication, bar none, is human injury. Equine veterinary surgeons have the highest risk of injury of all civilian professions, with approximately 27,000 injuries per 100,000 employees per annum. By comparison Prison Service personnel report 10,760 injuries per 100,000 per year, the Police (Sergeant and below) – 8700, welding and metal formers – 6980, skilled construction workers – 4760 and farm workers – 4620. A kick from a hindlimb is the commonest cause of injury. Performing one of the following appeared to present a greater risk: distal limb nerve block; minor surgical procedure; female reproductive examination; intra-articular injection; endoscopy/gastroscopy; foaling related examination.

So how to do nerve blocks safely? There is no question some people have the knack; in the same way some people have a particular way with horses in many situations. However, no reliable safe way has been taught. We find these extension sets helpful, allowing the horse to move a bit after the needle has penetrated the skin. The easiest way to annoy the horse is to stick the needle through the skin, then pull it out while trying to connect it to a syringe and repeat the procedure. Skin blebs are always difficult. In essence, if you choose to put a bleb in, the horse will remain motionless, and you could have done the nerve block in the same time. If you choose to do the block straight away, the horse will lash out, injuring you, itself, and now also being impossible to get a skin bleb in. In the UK a skin freezing alcohol-based spray has become available. This does seem to reduce the horse's reaction to a needle stick. Local anaesthetic-based creams, Emla® with lidocaine and prilocaine, appear to be less effective in the hairy skin of a horse and also take a long time to work.

Restraint should be considered. Twitches are widely used and are quite effective. The problem with a twitch is that a horse will tend to "explode" when the degree of stimulus overrides the restraint of the twitch. Holding the limb, when appropriate, is often indicated. Ideally, this is done with another operator holding the limb, who can used both hands. However, veterinary surgeons are often reluctant to ask someone to hold the limb for them, perhaps considering they are putting someone else in harm's way. However, it is much less controlled if one person tries to hold the limb and inject at the same time. My preferred technique for a subcarpal block is to have the limb held, and to approach from the other side of the horse, allowing the limb holder room to escape, and to inject using an extension set.

The most dangerous part of the nerve block procedure is not the horse, but the walls of the room. Many serious injuries are the result of being kicked straight into a wall and sustaining a head injury. This is an example of the use of protective clothing. A helmet, such as a jockey skull cap, will be very helpful in this situation. For standing surgery, I prefer a cricket helmet, as this comes with some face protection as well. The alternative of course, is to do the nerve block outdoors. At Donnington Grove Veterinary Surgery we do increasing numbers of nerve blocks outside rooms for this specific reason. The other simple piece of protective clothing is steel toe cap boots. Horses often stamp a foreleg down after a needle is inserted, potentially if the needle hits a nerve. It is impossible to hold this limb up no matter how strong you are. The result is that broken toes are a common injury. Steel toe cap (or other safety) boots are the simplest way of preventing this injury. At Donnington Grove Veterinary Surgery up to £90 is refunded to employees yearly on production of a receipt for purchase of safety toe cap boots.

Other complications of nerve blocks are unusual. They have to be, as clients are very unforgiving of complications during diagnosis. Septic arthritis is one complication for which there is significant evidence. It is established that bacterial contamination of the skin is increased by clipping and following aseptic preparation the bacterial count of clipped and unclipped skin is equally effectively reduced (Hague *et al.* 1997).

Significant hair and tissue debris is often physically implanted into a joint by the needle during joint injection and bacteria can be cultured from this debris despite aseptic preparation (2.6%) (Wahl, Adams and Moore 2012). Larger needles result in more contamination and spinal needles with stylet result in more contamination in unclipped skin but less in clipped skin (Adams *et al.* 2010. Again, this study confirmed that clipping or shaving the hair increases the chances of contamination. Many years ago, we did a small study of 1500 cases of joint injection at Donnington Grove. The incidence of iatrogenic sepsis was 0.2% (20 per 10,000). Of the injections 693 were clipped with 2 septic cases (0.29%) (29 per 10,000) and 1 case in 807 unclipped injections (0.12%) (12 per 10,000) p=0.59, Fisher's Exact Test. A large study of 16,624 joint injections from Australia showed the risk of septic arthritis following joint medication was 0.078% (7.8 per 10,000 injections). The veterinary surgeon was a significant risk factor. A survey of veterinary surgeons, potentially therefore less accurate, showed the incidence of septic arthritis was 0.021% (2.1 per 10,000).

Infection rates were significantly lower when veterinarians prepared their own injection sites (50 x) and had <20 years of practice experience (50 x). In this survey infection rates were significantly higher when hair was removed at the injection site (520 x).

Septic arthritis can follow nerve blocks as well as joint blocks. The 'Wheat block', analgesia of the lateral palmar nerve midway between the head of the lateral splint bone and the accessory carpal bone may result in inadvertent medication of the carpal sheath. The sheath lies just deep to the lateral palmar nerve at this level. Thus, aseptic preparation is mandatory prior to this nerve block. The conventional subcarpal nerve block, analgesia of the palmar metacarpal nerves just axial to the head of the lateral and medial splint bones, is very close the palmar pouch of the carpometacarpal joint. The middle carpal joint is commonly injected following this block, four of eight limbs in one study (Nagy, Bodó and Dyson 2012). Following a four point nerve block, two of ten horses had injection into the tendon sheath and the experienced authors had no concept this had happened prior to radiography (Nagy *et al.* 2010). Despite the frequency of intra synovial injection, septic arthritis is rare after nerve blocks. Infection following nerve blocks is observed. We have seen abscesses following median and ulnar nerve blocks in the pectoral muscles.

Exacerbation of the condition is the nightmare scenario for veterinary surgeons. Fractures can occur or propagate under nerve block. We have observed this happen on occasion. We were once contacted by a a "client", insisting we send an x-ray machine out, but no veterinary surgeon. Further questioning revealed there was a veterinarian there who did not speak English. Fortunately, a colleague speaks fluent Spanish and was able to establish that an unregistered South American veterinarian was working, and a horse had fractured under nerve block. It is illegal to perform veterinary surgery in the UK without registration, hence the client's insurance was invalid. Once these factors were explained the enthusiasm for a visit dissipated. Practically it is very difficult to prevent a fracture under nerve block. It is however poor practice to block the fetlock region of a racehorse without prior radiographs.

Needle breakage is usually associated with rapid movement of the horse after injection. It is rare but can happen. The needle usually breaks at the hub, so it can be possible to grasp it and remove. Regardless, my advice is to get the needle out, no matter what the cost, or who will bear this cost. This can usually be done under sedation and local anaesthesia, with x-ray or ultrasound guided incision. You must have orthogonal planes to locate the needle on radiographs. Ultrasonography is ideal until incision is made, at which point it is complicated by air. Needles are much harder to find than thorns and may need general anaesthesia on occasion. Regardless my advice is never leave something behind which is visible on radiographs. No one will believe a broken needle or instrument is insignificant, and they may be right.

Another complication for which there is significant evidence, is when nerve blocks result in a misleading diagnosis. It is clearly established that interpretation of lameness is affected by knowledge of a nerve block – we are none of us as good at interpreting lameness as we think (Arkell *et al.* 2006). This may be compounded by the inability of clinicians to detect the difference. Inertial sensor systems are more sensitive than human eye (McCracken *et al.* 2012).

Nerve blocks are nothing like as specific as we were once led to believe. Much of this data comes from work with the 'set screw' model. A shoe with nuts welded to the inside is fitted. Bolts are then tightened down until they are pressing on the sole. This produces a consistent, repeatable yet reversible lameness. Further work has

looked at diffusion of therapeutic levels of mepivacaine in recently euthanised horses (Gough *et al.* 2002). Therapeutic levels of mepivacaine diffuse from coffin joint to navicular bursa, though not necessarily vice versa. Coffin joint analgesia will alleviate lameness caused by amphotericin induced synovitis of the navicular bursa. Coffin joint analgesia results in anaesthesia of the dorsal aspect of the sole and in anaesthesia of most of the sole if greater volume is used (10ml). The specificity is not time dependent. Amphotericin induced synovitis of the navicular bursa is relieved within five minutes by coffin joint analgesia. The theory that a rapid response suggests a local effect is a myth. However, naturally occurring lameness showed a progressive improvement in lameness following coffin joint block at 2, 5 and 10 minutes, and that ~ 50% of horses which respond to a palmar digital nerve block respond to a coffin joint block, while ~75% of horses which respond to a palmar digital nerve block respond to a navicular bursa block. Clinical experience is that response to a coffin joint block can be very rapid. ~80% of horses which respond to a navicular bursa block, also respond to a coffin joint block (Dyson and Kidd 1993). ~70% of cases of deep digital flexor tendonitis improve substantially to coffin joint block. In conclusion, a coffin joint block is not specific to the joint. It might be suggested that such a block is a waste of time, effort and money, being so nonspecific it adds no information beyond a palmar digital nerve block.

The palmar digital nerve block is ideally performed as distal as possible, immediately proximal to the cartilage of the foot. It usually results in complete analgesia of the sole, not just the palmar half, confirmed by the set screw model (Schumacher *et al.* 2000). It also results in complete analgesia of the coffin joint, confirmed by endotoxin induced synovitis (Easter *et al.* 2000). If performed with larger volume or a bit further proximal it can result in analgesia of the pastern joint (Schumacher *et al.* 2010), with 1/6 horses markedly improved following injection 1cm proximal to cartilage of foot and 4/6 horses markedly improved following injection 2cm proximal to cartilage of foot, all done with 1.5ml mepivacaine.

Mepivacaine appears to be more effective than lidocaine. Using the set screw model, all horses showed lameness resolution following palmar digital nerve block with mepivacaine, but only 3/8 showed complete resolution following lidocaine block. Skin desensitisation does not confirm desensitisation of deeper structures. All horses with lidocaine lost skin sensation. It took 9–13 minutes for loss of skin sensation with mepivacaine, but 11–62 minutes for resolution of lameness (Hoerdemann *et al.* 2017).

A palmar digital nerve block often does not completely resolve lameness due to deep digital flexor tendonitis, with 24% of horses sound, 74% improved, compared to 7% sound and 63% improved after a coffin joint block. However, what has caused most concern is the discovery that a palmar digital nerve block can result in soundness with proximal lesions. A presentation at AAEP reported 15 horses had palmar digital nerve blocks with 2.5ml anaesthetic agent per site, just proximal to the cartilages of the foot, in essence a completely typical clinical practice palmar digital nerve block. All horses had proximal P1 lesions on high field MRI scans (Contino *et al*).

This is relevant to proximal P1 sagittal groove pathology, or incomplete split pasterns. These can be diagnosed by radiography, but computed tomography (CT) or MRI is much more sensitive. MRI can show increased fluid or water signal in the sagittal groove. We reported 21 horses with bone oedema of the sagittal groove (Liperi *et al.* 2018). Thirteen out of 21 horses (62%) responded to conventional 'foot' nerve blocks.

The conventional wisdom, that the palmar digital nerve block affected the flexor surface only of the navicular bone and the palmar part of the foot, that an abaxial sesamoid nerve block anaesthetised the foot but not the fetlock, and that a four-point nerve block did not anaesthetise the very front of the fetlock, is complete nonsense. It can be concluded, perhaps there is a role for intra-articular analgesia of the coffin joint? At least it is likely to be specific to the foot.

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