Oral presentations

Scratching that itch – elucidating the spinal cord injury which causes reflex “phantom” scratching in canine syringomyelia

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AIMS OF STUDY

Syringomyelia (SM) is characterised by fluid filled cavities in the spinal cord. A classic sign of severe SM is a tendency to scratch towards one shoulder referred to as “phantom scratching”. Stimulation of neck skin induces a rhythmic scratching action of the ipsilateral limb. Although easy to describe, the mechanism behind this action is less easy to elucidate. A popular explanation is that the dogs experience allodynia (itch evoked by lightly touching the surrounding skin) or paraesthesia (a spontaneous or evoked sensation). However if affected dogs experience unusual sensations why do they make little or no skin contact? SM phantom scratching is similar to fictive scratch which develops a few months after transection of the caudal cervical spinal cord. In fictive scratch, stimulation of a skin receptive field results in a reflex scratching action due to hyperactivity of the scratching central pattern generator (CPG) i.e. neural circuits controlling a stereotyped sequence of muscle contractions. The similarity to fictive scratch suggests commonality of neural pathways. In this project we investigate the neuroanatomical site that relates to phantom scratching. We first investigate the hypothesis that phenomenon of phantom scratching is associated with a large dorsolateral syrinx in the upper cervical spinal cord segments. We then looked for

an association to damage in other areas of the cervical spinal cord and investigated the hypothesis that phantom scratching is not just associated with a dorsolateral syrinx but one that extends to the superficial dorsal horn (SDH).

METHODS

Medical records from a two year period were searched for Cavalier King Charles spaniels that had magnetic resonance imaging and diagnosis of clinical SM. The cohort was divided into SM with phantom scratching (19 dogs) and SM but no phantom scratching (18 dogs). The MRI studies were anonymised, randomised and viewed in EFILM™. For each transverse image the maximum perpendicular dimensions of the syrinx in each spinal cord quadrant was determined. Visual assessment was made as to whether the syrinx extended to the SDH.

RESULTS

The study found that phantom scratching is associated with a large dorsolateral syrinx that extends to the SDH in the C3-C6 spinal segments (C2-C5 vertebrae). The study did not find an association to damage of other areas of cervical spinal cord.

CONCLUSION

Phantom scratching in the dog is associated with a large syrinx that extends to the SDH in the C3-C6 spinal segments. We propose that phantom scratching is due to damage to projection neurons in lamina I of the SDH with consequent reduced descending inhibition to the lumbosacral scratching CPG. Drugs affecting SDH targets may be useful for management of phantom scratching. If a dog has SM extending to the SDH then it is at risk for phantom scratching. If an itchy SM affected dog has no SDH involvement then alternative explanations for scratching (e.g. allergic skin disease) should be investigated.

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Forebrain conformation changes in Chiari-like malformation

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AIMS OF STUDY

Chiari-like Malformation (CM) is a caudal fossa and cranio-cervical junction disorder resulting in cerebrospinal fluid pathway obstruction and variable syringomyelia (SM). Recent studies suggest that conformational changes are not confined to the hindbrain and that the entire skull base is foreshortened. Insufficient room for the forebrain may contribute to caudal displacement and overcrowding of the hindbrain. The olfactory bulbs (OB) are ventrally orientated in brachycephalic dogs; it has been suggested that this may be more extreme in CM. Recently genetic studies have suggested a candidate gene Sall-1 for canine CM. Sall-1 deficiency in mice is associated with decreased OB size and defects in the human orthologue can be associated with skull abnormalities. We hypothesise cavalier King Charles

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spaniels (CKCS) with CM and SM have smaller and more ventrally orientated OB with rostral forebrain flattening. We compared OB size, angulation between the OB and the hard palate and two measurements that represent flattening of the rostral forebrain from 5 phenotypic groups

METHODS

Medical records from a 2 year period were searched for CKCS that had brain magnetic resonance imaging (MRI) and neurological assessment. The cohort was divided as follows: SM with phantom scratching (15 dogs); clinical SM (e.g. pain) but no phantom scratching (17 dogs); behavioural signs of pain with CM but no SM (25 dogs); CKCS with no SM and no behavioural signs of pain or scratching (13 dogs). In addition medical records were searched for dogs in the 5-15kg weight range with normal brain MRI (19 dogs including 5 brachycephalic). The MRI studies were anonymised, randomised and viewed in EFILM™. 5 measurements were taken from the T2W mid-sagittal brain MRI: the OB length and height (product represented OB size), angulation between the dorsal OB and the frontal lobe (bottom angle), angulation between the frontal and parietal lobes (top angle) and angulation between the OB and hard palate (OB angle).

RESULTS

There was a trend for decreasing mean OB size with increasing

CMSM phenotype severity (SM-scratchers < SM non-scratchers < CM-pain < CKCS-control < other breed control). However post hoc analysis, Bonferroni, indicated that only "other-breed-control" was significantly different from the CMSM groups but was not significantly different from "CKCS control". ANOVA analysis for OB, bottom and top angle did not reveal a statistically significant difference between the groups however for OB angle there was an apparent separation between the control and CMSM groups suggesting a trend towards more ventrally orientated OB with increasing CMSM phenotype severity.

CONCLUSION

This study suggests that CM should be considered a more global brain and skull conformational disorder with features of extreme brachycephaly including smaller more ventrally orientated OB however further work is required and the measurement technique has been refined for future studies.

We recommend that future studies into MRI conformation of CM and SM uses rigorous phenotyping based on clinical signs and age.

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The impact of hypoxia on T regulatory cells in canine cancer and inflammation

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The presence of hypoxia and regulatory T cells (Tregs) in cancer has been associated with a poorer prognosis through treatment resistance and increased malignancy in some tumours. However, the precise relationship between

Tregs and hypoxia in canine tumours has still to be explored. The aim of this study was use immunohistochemistry to detect expression of glucose transport-1 (GLUT1) and FoxP3 as respective markers for hypoxia and T regulatory cells, in benign and malignant tumours of different histotypes. Lymph node (LN) samples categorised as tumour-draining, metastatic or reactive due to inflammation were also examined. Both regulatory T cell and GLUT1 expression varied between tumour histotypes and LN types. There was an increased prevalence of FoxP3+ cells with increased GLUT1 labelling in all tumour and LN types, but metastatic LN results were confounded by strong GLUT1 labelling of some metastatic cells. This result suggests a possible link between hypoxia and Tregs in cancer and inflammation. Further research using additional markers for hypoxia and Tregs and a greater number of samples is warranted to explore potential novel therapeutic targets in the future.

Pilot study investigating the association between road traffic accidents and *Toxoplasma gondii* seroprevalence in cats

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STUDY AIM

It has been demonstrated that the parasite *Toxoplasma gondii* is able to alter the behaviour of rodents to show reduced

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