Establishment of a novel porcine model to study the impact of active stretching on inflammation

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BACKGROUND

• Active stretching of the body is integral to mind-body therapies such as yoga, as well as conventional exercise and manual therapies, yet biological mechanisms underlying its therapeutic effects remain largely unknown.
• Studies in rodents support that active stretching can markedly impact inflammatory processes and wound healing.
• However, differences in subdermal anatomy between rodents and humans limit the translation of findings to clinical studies.

AIMS

• To test the feasibility of using a porcine model, with a closer resemblance to human anatomy, to study the effects of active stretching in the onset resolution of localized inflammation.
• To collect preliminary measurements of cell infiltration, resolvins, and gene expression.

MATERIALS AND METHODS

Female pigs (12 – 20 kg); N = 12 (6 pigs per group) 100 μl SC injection of Carrageenan 2% 0.75 cm lateral of the spine at L3.

Active stretching 2X/day for 5 minutes over 48 hours post-injection

Fig. 1. Illustration of the wheelbarrow active stretching method that was well-tolerated by all animals.

Four stretching sessions in total

48h post injection, animals were euthanized for lesion size measure, blood, and tissue collection

Lesion size, flow cytometry for neutrophil and macrophage count, ELISA for resolvins, and qPCR for gene expression

RESULTS

ELISA:
• Lesion levels of Resolvin D1 (RvD1) and Lipoxin A4 (LXA4) and serum levels of Prostaglandin D2 (PGD2) and RvD1 were measured using a competitive ELISA kit.

qPCR:
• Quantitative real-time PCR (qPCR) was performed using the delta-delta cycle threshold method, with the geometric mean of beta-actin (ACTB) used to normalize each gene.

CONCLUSION

In serum both specialized pro-resolving mediators LXA4 and RvD1 tended to increase in response to active stretching, while pro-inflammatory mediator PGD2 was reduced with stretching.

DISCUSSION/CONCLUSION

• A porcine model combining subcutaneous induced inflammation with active stretching is feasible.
• Active stretching decreases the size of Carrageenan-induced lesions, paralleling previous results in rodents.
• Levels of inflammatory cell infiltration at the lesion site, production of pro-resolving and inflammatory lipid mediators locally and systemically, and gene expression from three different anatomical compartments showed additional interesting trends supporting the need for future studies.
• Future studies will contribute to understanding the complex biological mechanisms underlying stretching-related components of mind-body and related therapies and their potential therapeutic effects on pain and other inflammatory conditions.

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