

Notochordal Cells in Mature Caprine Intervertebral Discs

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INTRODUCTION: Currently used models studying degeneration *in vivo* vary considerably in the status of their notochordal cells. This status is relevant because the disappearance of these cells precedes the onset of disc degeneration in humans and it has been reported that they stimulate matrix production by the chondrocyte-like cells of the nucleus pulposus (NP) ¹ Therefore they could influence the degeneration process. The small animals used for degeneration models also have relatively small discs and different mechanical loading in comparison with the human spine.² To overcome these shortcomings we are developing a large animal disc degeneration model in the goat.

In this study we investigated whether notochordal cells are present in the intervertebral discs of mature Dutch milk goats.

METHODS: Six mature female Dutch milk goats over the age of three years were sacrificed. The intervertebral discs between T12-S1 were harvested and half of the intervertebral discs were selected for histologic preparation. Parasagittal slices were fixed in 10% neutral buffered formalin, decalcified in formic acid, paraffin-embedded and sectioned to 7 µm thickness slices. The sections were stained with hematoxylin and eosin (H&E) for cellular constituents. Four intervertebral discs of six goats (n=24) were carefully examined at different magnifications by two examiners. Notochordal cells were defined as relatively large, vacuolated cells laying in clusters or in cord-like formations within the nucleus pulposus.³ Chondrocyte-like cells were defined as relatively small, rounded cells lacking interconnections and vacuoles.⁴

RESULTS: Representative pictures of the histology specimens are shown in figure 1. In none of the examined slices cells with the notochordal phenotype were observed. Chondrocyte-like cells were present throughout the entire NP in all of the specimens.

DISCUSSION Based on the observations of this study, we conclude that mature caprine intervertebral discs lack notochordal cells. This

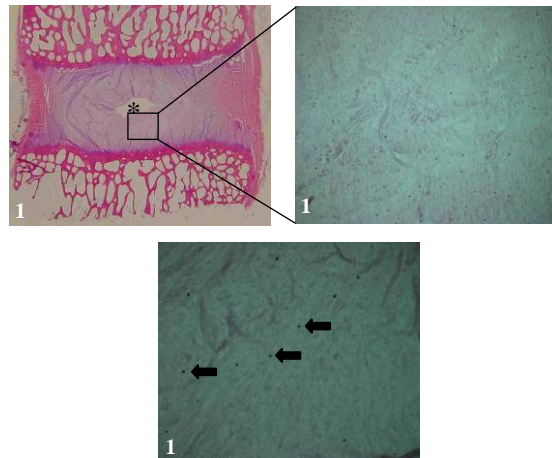


Figure 1A to C: H&E staining. Figure 1A shows the entire intervertebral disc. 1B shows a representative detail of the NP (100X), 1C the same detail at a higher magnification (200X) Arrows show the chondrocyte-like cells. Cells with a notochordal phenotype were not observed. * = section artefact.

was also observed in the (closely related) ovine model.⁴ Additional ongoing studies address the recently described specific actin⁵ and cytokeratin⁶ stainings to verify the absence of notochordal cells. Also, fetal and juvenile goat intervertebral discs will be examined to study the presence of notochordal cells in these young nuclei pulposi.

The absence of notochordal cells in mature goats, and the presence of chondrocyte-like cells mimicking the human population, positively identifies the goat as a suitable animal for a disc degeneration model. This is corroborated by the more similar mechanical loading and geometry of the goat lumbar spine in comparison with the human spine.⁷

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