

Aquaporin-1 Expression in Herniated Human Lumbar Intervertebral Discs

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Introduction

Intervertebral disc (IVD) degeneration is the cause of spondylosis. The pathogenesis of the actual disc degeneration is poorly understood, but disc dehydration often plays a role. Aquaporins (AQP) have been linked to degenerative changes in other joints, and AQP1 expression has been shown in post-mortem IVDs. In this study, we aim to identify and quantify AQP1 in in-vivo human degenerated IVDs obtained intraoperatively and to investigate the relationship between AQP1 levels and magnetic resonance image (MRI) T2 intensity of the disc.

Methods

In-vivo samples of nucleus pulposus (NP) tissue from lumbar IVDs were obtained from 18 consecutive patients who underwent surgery for disc herniation at L4/5 and L5/S1 level. Immunohistochemistry (IHC) was performed to determine the presence of AQP1 expression, and this was quantified by Western Blot analysis. AQP1 expression was compared to pre-op IVD signal intensity on T2-weighted magnetic resonance imaging.

Results

NP tissue was obtained from 18 patients (9 for L4/5 level and 9 for L5/S1 level) who underwent surgery for disc herniation or severe disc degeneration. AQP1 expression was detected in all samples by Western Blot and IHC for both the L4/5 level group and L5/S1 level group. AQP1 expression had a linear correlation with the preoperative IVD signal intensity on T2-weighted MRI at L4/5 level ($R^2=0.90$) and at L5/S1 level ($R^2=0.92$). AQP1 expression appeared to be higher at L5/S1 level (52.2 ± 59.0) than at L4/5 level (15.8 ± 20.6); however, the difference was not statistically significant ($p = 0.10$). Interestingly, the duration of symptoms were longer in L5/S1 group than L4/5 group ($p = 0.06$).

Conclusions

Our results show that AQP1 can be detected in IVD tissue obtained from live human subjects by Western Blot and IHC. Increased AQP1 expression is associated with greater disc hydration as measured by signal intensity on T2-weighted MRI. AQP1 may have a role in the dehydration associated with disc degeneration. And further study into AQP1 expression regulators may offer new insight and therapeutic target for degenerative disc diseases.

Learning Objectives

By the conclusion of this session, participants should be able to: 1) AQP1 can be detected from in-vivo human herniated disc

2) increased AQP1 expression is associated with higher T2 signal on MRI

References