

The Distributions and Changes of Nerve Fiber in Human Nucleus Pulposus According to the Degenerative Changes

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– Abstract –

Study design: This was a retrospective study to evaluate the nerve fibers in human nucleus pulposus.

Objective: To study the changes in the pain receptor, including the nerve fiber of the disc, immunohistologic studies were performed for S-100, synaptophysin and CD 31.

Summary of literature review: Degeneration in a human intervertebral disc is one of the most important causes of back pain.

Materials and Methods: This study used disc materials obtained from patients that had undergone an operation. According to the patient's age and diagnoses, the disc materials were subdivided into 3 groups. Group 1; HNP patients aged in their twenties and thirties, with a mean age of 28.3 years. Group 2; HNP patients aged above forty, with a mean age of 43.8 years. Group 3; patients diagnosed with degenerative disc disease through preoperative MRI or discogram, with a mean age of 40.2 years. There were ten in each group. H & E staining, immunohistologic studies for S-100, synaptophysin and CD 31 staining were investigated to find the relationship between blood vessels and nerve fibers.

Results: From the H & E staining, inflammatory cells were detected in groups 1 and 2, and partially detected in group 3, but no significant differences were detected between the groups. The chondrocyte morphologies were similar in groups 1 and 2, but the number of chondrocyte in group 3 was significantly decreased, and degeneration was also detected. From the S-100 staining, 0, 10 and 40% positive findings were detected in groups 1, 2 and 3, respectively. For the synaptophysin staining, no positive findings were detected in groups 1 and 2, whereas, 30% positive findings were detected in group 3. No positive results for the CD 31 staining were seen in any of the three groups.

Conclusion: Pain due to a degenerative disc can be explained by the above results, but its relationship to blood vessels was insufficient. Further study on the changes in the vertebral endplate and annulus fibrosus is recommended

Key Words: Degenerative disc disease, Nerve fiber, S-100, Synaptophysin, CD-31

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가 , 가 , 2. 1) 3- amino-propyltriethoxysilane-coated slide paraffin 3 μ m . Paraffin formalin free dewaxing solution (10 mM sodium citrate buffer) . CD-31 2) dewaxing solution 2 alcohol , formalin B5 Zenker crys- tal Lugol 's iodine iodine 5% tiosulfate . formalin ficin, trypsin, pepsin . biotinlayed secondary antibody strepa- vidin enzyme HRP avidin 3%

Table 1. Data of each group

case	1		2		3	
1	21/M	HNP L4-5	40/M	HNP L4-5	34/M	DDD L4-5
2	23/F	HNP L4-5	41/M	HNP L4-5	31/M	DDD L4-5
3	29/M	HNP L5-S1	43/F	HNP L5-S1	48/M	DDD L2-3,4-5
4	30/M	HNP L4-5	43/M	HNP L4-5	40/M	DDD L4-5
5	36/F	HNP L4-5	40/M	HNP L3-4,4-5	30/M	DDD L4-5
6	26/M	HNP L5-S1	48/F	HNP L4-5	49/F	DDD L4-5
7	39/M	HNP L4-5,L5-S1	47/F	HNP L5-S1	51/M	DDD L4-5,L5-S1
8	20/M	HNP L4-5	46/M	HNP L4-5	38/M	DDD L4-5
9	32/F	HNP L5-S1	48/M	HNP L4-5,L5-S1	39/M	DDD L4-5
10	27/M	HNP L4-5	42/M	HNP L4-5	42/F	DDD L3-4-5

peroxidase
 . Washing buffer PBS , protein
 blocker 10% . S-100 가
 (1:200, DAKO, carpinteria, CA) synaptophysin (1:20,
 DAKO, carpinteria, CA) edge artifact 가
 , EnVision mouse and rabbit kits (DAKO,
 Carpinteria, CA) . 15
 S-100 synaptophysin
 30 incuba- 가
 tion , PBS . envision, peroxi-
 dase reagent (DAKP, carpinteria, CA) 30
 incubation , DAB (3,3-diaminobenzi-
 dine) chromogen 5 incubation . control) .
 Meyer 's hematoxylin counterstain (quality
 . PBS 가
 . DAB
 Canada balssam .
 3 .
 1. Hematoxylin-Eosin
 3)
 hydrogen per- 가
 oxidase 10 proteinase K 10 , 1 2
 CD31 1:20 . 3
 1:100 anti-rat HRP
 conjugated antibody 30
 (2) DAB 5 3
 . 1 2
 , 2
 4)
 DAB 3 가
 가 가
 (× 20)

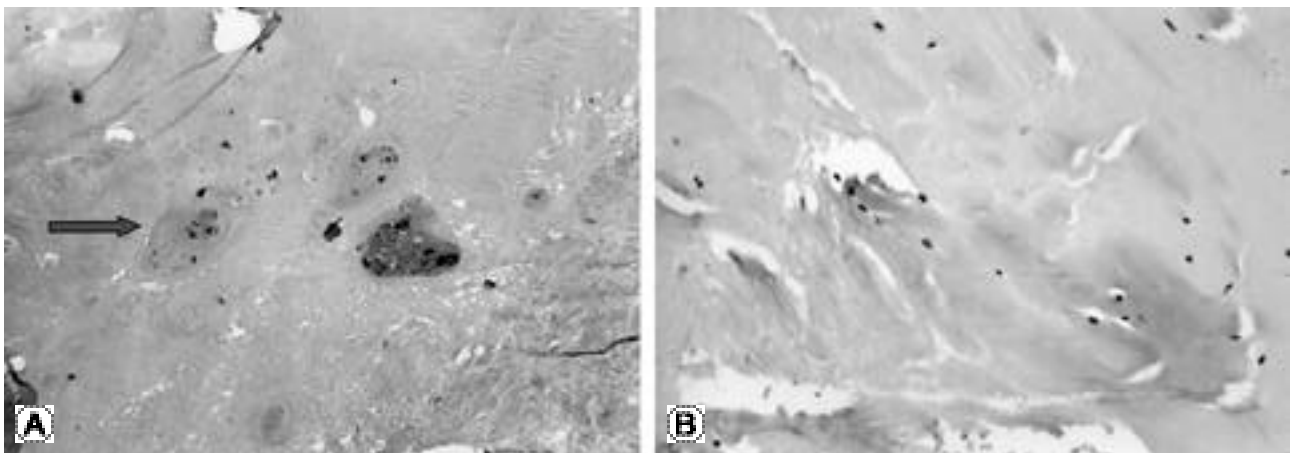


Fig. 1. (A,B) Hematoxylin counter staining A in HNP, B in DDD : Noted differences of chondrocyte and matrix between 2 groups.

(Fig 1-A, B).

3 synaptophysin
10 3 30%
S-100 (Fig. 3).

2. S-100

1 , 2 4. CD 31
S-100 1 , 2 , 3
S-100 10 4
40%
Schwann cell
(Fig. 2).

3. Synaptophysin , , 가
1 2 synaptophysin

Table 2. Immunohistochemical results(+: positive, -:negative)

case	1		2		3	
	S-100	synaptophysin	S-100	synaptophysin	S-100	synaptophysin
1	-	-	-	-	+	+
2	-	-	-	-	+	-
3	-	-	-	-	-	-
4	-	-	-	-	-	-
5	-	-	+/-	-	-	-
6	-	-	-	-	-	-
7	-	-	-	-	+	+
8	-	-	-	-	+	+
9	-	-	-	-	-	-
10	-	-	-	-	-	-

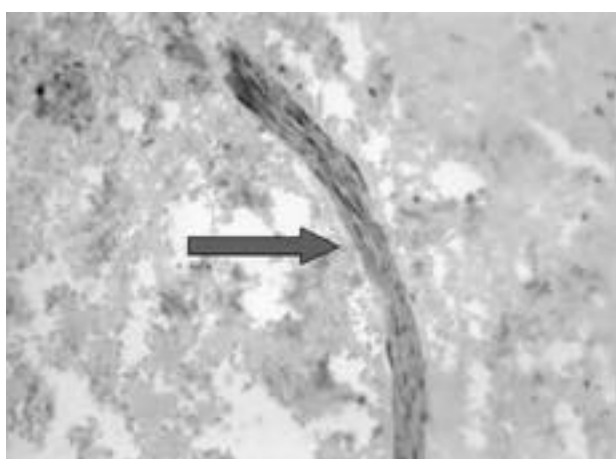


Fig. 2. S-100 positive finding in group 3(case number 1) : Noted Schwann cell(brown color) and these cells of chondrocyte and matrix look like spindle shape.

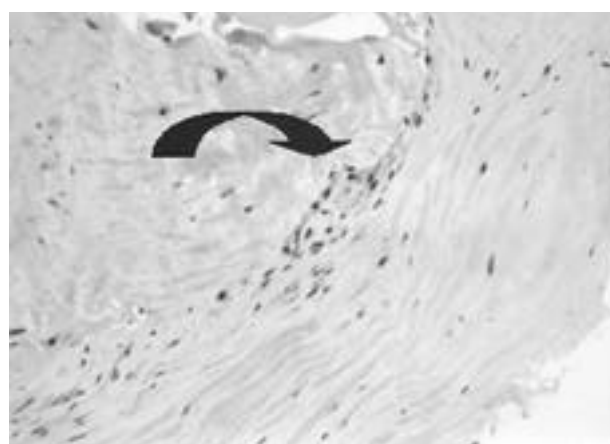


Fig. 3. Synaptophysin positive finding in group 3(case number 1). : Noted nerve fiber(arrow).

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(nociceptive afferent)

ropeptide
Bogduk⁶⁾

Freemont⁷⁾

cytokine

가

3 S-100 synaptophysin

가 가

가 가

가

S-100 synaptophysin
. S-100
glial cell Schwann cell

SP GAP 43

(double stain) 가

, synapto-

physin

가

2)

가

3-5),
2 ,
3 S-100 40%, synaptophysin 30%

가 가

neuropeptide

S-100 synaptophysin

가 S-100 40%, synapto-

physin 30%
CD-31

가

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 physin CD 31 가
 : 가
 :
 30 20-30
 1 (10) , 30 40 2 (10) , MRI,
 3 . Hematoxylin-eosin ,
 S-100 synaptophysin , CD 31
 : Hematoxylin-eosin 1, 2 가 , 3
 , . 1, 2 , 3 가
 . S-100 1 0%, 2 10% , 3 40% 가 . Synaptophysin
 3 30% 가 , 1 2 . CD31
 :
 , 가
 : , S-100, Synaptophysin, CD-31,

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640

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