

# **Prevalence of annular tears and disc herniations on MR images of the cervical spine in symptom free volunteers**

**European Journal of Radiology**  
**September 2005, 55, 409–414**

C.W. Ernst, T.W. Stadnik, E. Peeters, C. Breucq, M.J.C. Osteau

FROM ABSTRACT

Study design:

Prospective MR analysis of the cervical spine of 30 asymptomatic volunteers.

Objectives:

To evaluate the prevalence of annular tears, bulging discs, disc herniations and medullary compression on T2-weighted and gadolinium-enhanced T1-weighted magnetic resonance (MR) images of the cervical spine in symptom free volunteers.

Summary of background data:

Few studies have reported the prevalence of cervical disc herniations in asymptomatic people, none have reported the prevalence of cervical annular tears on MR images of symptom free volunteers.

Materials and methods:

Thirty symptom-free volunteers (no history or symptoms related to the cervical spine) were examined using sagittal T2-weighted fast spin-echo (SE), sagittal gadolinium-enhanced T1-weighted SE imaging and axial T2-weighted gradient echo (GRE).

The prevalence of bulging discs, focal protrusions, extrusions, non-enhancing or enhancing annular tears and medullary compression were assessed.

Results:

The prevalence of bulging disk and focal disk protrusions was 73% (22 volunteers) and 50% (15 volunteers), respectively.

There was one extrusion (3%).

Eleven volunteers had annular tears at one or more levels (37%) and 94% of the annular tears enhanced after contrast injection.

Asymptomatic medullary compression was found in four patients (13%).

Conclusion:

Annular tears and focal disk protrusions are frequently found on MR imaging of the cervical spine, with or without contrast enhancement, in an asymptomatic population.

The extruded disk herniation and medullary compression are unusual findings in a symptom-free population.

#### THESE AUTHORS ALSO NOTE:

“The cervical and lumbar spines are among the first areas of the human body to show demonstrable imaging evidence of degenerative joint disease.”

Annular tears are frequently identified on magnetic resonance images in patients with neck or arm pain. The annulus is innervated by the recurrent meningeal nerve and by the ventral ramus of the somatic nerve. Annular tear, therefore, can be responsible for neck or arm pain.

There is a high prevalence of disc protrusions in the lumbar spine in symptom-free subjects.

These authors “examined the prevalence of abnormal findings on magnetic resonance images of the cervical spine in people without neck pain and without history of trauma.”

The MRIs were interpreted by two or three experienced neuroradiologists.

An **annular tear** was defined as a focal hyperintensity of the annulus without focal protrusion or extrusion.

**Bulging** was defined as circumferential symmetric extension of the disk beyond the end plates.

**Protrusion** was defined as focal or asymmetric protrusion of the disk beyond the end plates but in connection with the parent disk and with the base of protrusion broader than any other dimension.

**Extrusion** was defined as focal protrusion of the disk beyond the endplates without connection with the parent disk or in connection with the parent disk but with the base of protrusion narrower than the diameter of the protrusion itself.

#### RESULTS

“The prevalence of annular tears in our population of asymptomatic volunteers was 36.7%.”

11% were at the C3–C4 level

11% at the C4–C5 level

50% at the C5–C6 level

28% at the C6–C7 level

“The prevalence of bulging disk in our sample of volunteers was 73%.”

"All 12 volunteers older than 45 years had at least one bulging disk."

42 bulging disks were found in 22 volunteers:

- 33% were at the C5–C6 disk space
- 26% were at the C6–C7 disc space
- 21% were at the C4–C5 disc space
- 20% were at other levels (C2-3-4)

Disc protrusions were frequently found in our population of asymptomatic volunteers, with 50% of the 30 volunteers having at least one protrusion.

The frequency of protrusions increased as a function of age.

68% of the protrusions were to one side only, and 32% were midline.

Protrusion levels were as follows:

- 32% were at the C5–C6 disk space
- 27% were at the C3–C4 disc space
- 23% were at the C4–C5 disc space

Only one extrusion was found in this asymptomatic population, at the level C5–C6 in a 43 year old volunteer.

"The different stages of disk degeneration are very frequently found in an asymptomatic population."

"Severe disk degeneration (defined by hypointense nucleus pulposus and narrowing of the disk height) was found in one (16.6%) of the six volunteers aged 30 years or younger, and also in one (8.3%) of the 12 volunteers aged 31–45 years; this prevalence increases to 55.5% in those between 46 and 60 years and then to 100% in those older than 60 years."

Age	Annular tears	Bulging discs	Protrusions	Severe degeneration of one or more discs
<31	1/6 (17%)	3/6 (50%)	2/6 (33%)	1/6 (17%)
31–45	4/12 (33%)	7/12 (33%)	5/12 (42%)	1/12 (8%)
46–60	5/9 (56%)	9/9 (100%)	7/9 (78%)	5/9 (56%)
>61	0/3 (0)	3/3 (100%)	1/3 (33%)	3/3 (100%)
19–69	10/30 (33%)	22/30 (73%)	15/30 (50%)	10/30 (33%)

Incredibly, 13.3% (4 of 30 volunteers) of asymptomatic subjects had medullary compression that obliterated the sub-arachnoid space with an associated change of form or position of the spinal cord.

## DISCUSSION

73% of these asymptomatic patients had symmetrical central bulging (non-herniated) discs. "The prevalence of disc bulges increased with age, up to a 100% in the volunteers aged 46 years and older."

This study agrees with the previously reported frequency of bulging discs in an asymptomatic population by others.

This study found a high prevalence (50%) of protrusions in our 30 asymptomatic volunteers.

Other studies report a 63% prevalence of protrusions in the cervical spine of asymptomatic older male lifelong athletes.

Another study revealed 20% of patients aged 45–54 years and 57% of patients older than 64 to have cervical disc protrusion.

## CONCLUSIONS

This asymptomatic population demonstrates a 37% prevalence of annular tears on MRIs.

"Our results confirm previously reported prevalence of bulging discs (73%) and protrusions (50%) in a asymptomatic population."

## KEY POINTS FROM DAN MURPHY

- 1) This study shows that in asymptomatic subjects, the following is found:
  - 3% have a disc extrusion
  - 37% have annular tears at one or more levels
  - 13% have medullary compression that will displace the spinal cord
  - 50% have focal disk protrusions
  - 73% have a bulging disk
- 2) The frequency of protrusions increased as a function of age.
- 3) 100% of asymptomatic subjects older than age 45 will have at least one bulging cervical disk.
- 4) "The cervical and lumbar spines are among the first areas of the human body to show demonstrable imaging evidence of degenerative joint disease."
- 5) The disc is innervated and disc lesions can produce neck and/or arm pain.
- 6) There is a high prevalence of disc protrusions in the lumbar spine in symptom-free subjects.

7) 63% of asymptomatic older male lifelong athletes have disc protrusions in the cervical spine.

#### COMMENTS FROM DAN MURPHY

This study shows that disc degenerative changes begin early in life, they are often asymptomatic, and they progressively become worse as we age. Disc degenerative changes are not caused by chiropractic adjustments; rather they are a common component of aging.