

## Prevalence of cervical spine degenerative changes in elderly population and its weak association with again neck pain and osteoporosis

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### Abstract

**Background:** Pain in the neck region is a serious public health issue, both in terms of individual health and overall well-being, as well as the financial costs connected with it. The use of magnetic resonance imaging (MRI) to explore the aetiology of neck discomfort is prevalent; however, the link between MRI findings of cervical spine degenerative changes and neck complaints is not well defined. Asymptomatic people, especially those over the age of 40, are more likely to have cervical degenerative results. In asymptomatic individuals, the frequency and range of cervical spine degenerative findings are likewise substantially age-dependent. **Aim:** To evaluate prevalence of cervical spine degenerative changes in elderly population and its weak association with again neck pain and osteoporosis. **Methods:** T2 weighted sagittal MR images of the cervical spine were obtained in 391 males (mean age: 82.9±3.83) and 261 females (mean age: 83.6±5.38) from a general population sample. Degenerative alterations were classified after images were evaluated. The participants were divided into two groups: younger (group A, under 80 years old) and older (group B, over 80 years old). The question for neck discomfort was structured as follows: "Have you had any neck pain in the last 12 months?" The hip bone mineral density (BMD) of 391 males and 261 females was also assessed. **Results:** At least one degenerative alteration was found in 97.3 percent of the individuals at one or more vertebral levels. The highest overall frequency of degenerative alterations was found at the C5/6 level. Females were more likely than males to develop degenerative alterations. Degenerative findings were more common or more severe in the older female group than in the younger group. Neck pain was experienced by 12.5 percent of males and 23.7 percent of females, with male respondents having a somewhat higher prevalence of cervical degenerative alterations. There was a weak link between osteoporosis and a higher prevalence of high signal in the spinal cord and stenosis in the spinal canal. **Conclusions:** Females' cervical spine degenerative alterations were more age-dependent than males'. Neck pain and osteoporosis were found to be weakly linked to a higher incidence of cervical degenerative alterations.

**Keywords:** Cervical spine; degenerative changes; MRI; aging; neck pain.

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### Introduction

Pain in the neck region is a serious public health issue, both in terms of individual health and overall well-being, as well as the financial costs connected with it. Fejer et al. showed that the point, one-year, and lifetime prevalence of neck pain were 7.6%, 37.2 percent, and 48.5 percent, respectively, in one meta-analysis, with women suffering more neck pain than males. Muscle sprains and strains, ligamentous injuries, and spinal degenerative changes are thought to be the most common causes of basic neck pain[1-4]. The use of magnetic resonance imaging (MRI) to explore the aetiology of neck discomfort is prevalent; however, the link between MRI findings of cervical spine degenerative changes and neck complaints is not well defined.

Asymptomatic people, especially those over the age of 40, are more likely to have cervical degenerative results. In asymptomatic individuals, the frequency and range of cervical spine degenerative findings are likewise substantially age-dependent[5-7].

In the general population, MRI of the spine is useful for detecting age-related changes.

Until date, there hasn't been a focused MRI research of cervical spine degeneration in the elderly general population. This study looked at the prevalence of MRI degenerative abnormalities of the cervical spine in old males and females using a population-based sample. In addition, we tried to respond to the following questions:

(I) Are cervical degenerations more common or severe in elderly ladies than in age-matched senior males? (II) Are cervical degenerations still age-dependent at the average advanced age of 82 years? (III) Are degenerative abnormalities on cervical MRI more likely in people who have neck pain? Is decreased bone mineral density (BMD) linked to a higher prevalence or severity of cervical degenerations?[10-12]

### Methods

391 males (mean age: 82.9±3.83) and 261 females (mean age: 83.6±5.38) had cervical spine MRI. The MRI sample was chosen at random, with a possible bias in favour of more mobile patients because they were more likely to participate.

A Philips Achieva TX 3.0T scanner with twin transmitters was used for the MRI (Philips Healthcare, Best, The Netherlands). The subjects were scanned in the supine position, with the body coil acting as the transmitter and a dedicated spine coil acting as the receiver of the radiofrequency signal. Only T2 weighted sagittal images were collected due to the time constraints of the MRI machine available for this population investigation.

2-D turbo spin echo sequence, TR =3,000 ms, TE =120 ms, flip angle =90, slice thickness =3.5 mm, and inter-slice gap =0.4 mm, FOV =

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270 mm 189 mm, Matrix =340263, NEX =1 were the parameters for MRI. All of the MRIs were done on Saturday morning. The study was set up in such a way that the guys would be assessed first. Because this Saturday morning MRI time was no longer available due to logistical issues during the trial, more males were scanned than girls at the conclusion. To match the number of female subjects, 152 males (mean: 82.23.93 years; range, 77–99 years) were chosen at random, and male data were examined using both the overall (n=391) and subgroup (n=261) data.

Because there was no discernible difference between the whole group and subgroup analyses, the data for the entire male group are reported in this study. The cervical levels from C2-T1 were assessed using the criteria listed in Tables 1,2,3. A radiologist and a physiotherapist with experience reading spine MRIs read the images. The MR pictures were first rated independently by these two readers, and then the findings were compared. When score findings were in disagreement, the MR images were read again until a consensus was obtained. The distribution of degenerative alterations at each spinal level was compared between males and females, as well as the age difference. Males were divided into two groups: group A (age: 79.54±1.21 years; range, 77–81 years) and group B (age: 85.27±3.22 years; range, 82–99 years). Females were divided into two groups: group A (age: 78.65±1.37 years; range, 75–81 years) and group B (age: 85.62±3.57 years; range, 82–100 years). The question for neck discomfort was framed as follows: "Have you had any neck pain in the last 12 months?" 391 males and 261 females responded. The rest of the subjects did not have their BMD measured (QDR-4500W densitometer, Hologic Inc., Waltham, MA, USA), and the rest of the individuals did not have their BMD measured. Three hundred and ninety-one men and two hundred and sixty-one women had their hip bone mineral density (BMD) tested as well.

The degenerative alterations were divided into two categories: "by each spinal level" and "by subject." The existence and degree of degenerative alterations were counted for each individual for the six vertebral levels using the "by-each vertebral level" technique. Only the level with the highest severe score was counted in the 'by-subject' method for each type of degenerative alteration. The 'by-subject' results are reported since the 'by-each vertebral level'

and 'by-subject' outcomes in this study were identical.

**Results**

Tables 4,5,6 illustrate the prevalence and types of cervical degenerative findings. At least one MRI degenerative sign at one or more vertebral levels was seen in 97.3 percent of the patients. Females were more likely to develop these degenerative alterations, but statistical significance was not obtained. At the C3/4, C4/5, and C5/6 levels, spinal canal stenosis, disc space narrowing, and disc bulging/protrusion were all prevalent, with C5/6 having the greatest overall positive frequency. At C4/C5 levels, strong signal in the spinal cord was more common. Cervical compressive deformity was most common in the C5 vertebra. The incidence of degenerative results was greater in the female elder group.

391 males and 261 females were surveyed about neck pain. In men, 241 participants (age mean: 82.76±3.76; range, 77–99 yrs) reported no neck discomfort, while (11.4 percent) reported neck pain (age mean: 84.13±4.14). In females, 119 participants (age: 81.4±4.32 years; range, 74–100 years) did not have neck pain, but 31 subjects (age: 81.65±4.20 years; range, 76–93 years) did. Table 3 demonstrates that participants with neck pain had a higher frequency of cervical spine degenerations, which was more noticeable in males who had a larger sample size than females, with spinal canal stenosis statistically more prevalent in males with neck pain (P=0.025) and with spine curvature straightening and disc space narrowing being marginally more prevalent in male subjects with neck pain (P<0.1).

There were normal BMD patients (45.2 percent, age mean: 82.13±3.57; range, 77–97 years), osteopenia participants (48.0 percent, age mean: 83.94±4.02; range, 78–99 years), and osteoporosis subjects (6.7 percent, age mean: 83.47±2.87 range: 79–90 years) in the male group. There were normal BMD patients (18.6%, age mean: 80.48±3.28; range, 77–88 years), osteopenia subjects (58.2%, age mean: 81.15±3.71; range, 77–91 years), and osteoporosis subjects (23.1 percent, age mean: 84.45±5.46; range, 77–100 years) in the female group. There was a link between osteoporosis and a higher prevalence of strong signal in the spinal cord and stenosis in the spinal canal.(Table4,5,6)

**Table 1: Evaluation and grading scheme for cervical spine deneneration**

| Spine conditions assessed | Evaluation and grading   |
|---------------------------|--|
| Spine curvature           | 0: normal; 1: straightened or kyphotic   |
| Spinal cord high signal   | 0: normal signal; 1: spinal cord regional high signal  |
| Spinal canal stenosis     | 0: normal or minimal subarachnoid space narrowing; 1: Anterior subarachnoid space to narrowed by ≥50% without compression of spinal cord; 2: canal stenosis ≥50% and with compression of spinal cord |

**Table 2: Evaluation and grading scheme for vertebral disc degeneration**

| Vertebral disc parameters | Evaluation and grading  |
|---------------------------|---|
| Posterior disc protrusion | 0: normal appearance and mild disc bulging; class-1: disc protrusion; class-2: disc extrusion (including sequestration) |
| Dorsal osteophyte         | 0: none; 1: notable dorsal osteophyte   |
| Schmorl node              | 0: none; 1: schmorl node exists   |

**Table 3: Evaluation and grading scheme for vertebral body degeneration**

| Vertebral body parameters.           | Evaluation and grading   |
|--------------------------------------|--|
| Vertebral body compressive deformity | 0: normal or minimal vertebral height loss; 1: estimated >30% vertebral height loss  |
| Disc space narrowing                 | 0: normal; grade-1: mild narrowing (<30% reduction in disc height); grade-2: moderate narrowing(30–60% reduction in disc height); grade-3 severe narrowing (>60% reduction in disc height) |

**Table 4: Prevalence of cervical spine degenerations among elderly males and females**

| Spine conditions assessed      | Evaluation/grading | Male        | Female      | Total       | M<F? |
|--------------------------------|--------------------|-------------|-------------|-------------|------|
| Spinal cord high signal        | Positive rate      | 7.4%        | 10.7% [16]  | 8.5% [36]   | Yes  |
| Vertebra compressive deformity | Positive rate      | 8.1%        | 12.0% [18]  | 9.5% [40]   | Yes  |
| Dorsal osteophyte              | Positive rate      | 93.4%       | 95.3% [143] | 94.1% [397] | Yes  |
| Spine curvature                | Positive rate      | 66.2% [180] | 62.7% [94]  | 64.9% [274] | No   |

**Table 5: Prevalence of cervical spine degenerations regarding vertebral disc among elderly males and females**

| Vertebral disc parameters | Evaluation/grading | Male  | Female | Total | M<F? |
|---------------------------|--------------------|-------|--------|-------|------|
| Spine curvature           | Positive rate      | 66.2% | 62.7%  | 64.9% | No   |
| Spine canal stenosis      | Grade-1            | 38.6% | 38.7%  | 38.6% | No   |
|                           | Grade-2            | 48.9% | 51.3%  | 49.8% | Yes  |
| Disc space narrowing      | Grade-1            | 37.5% | 28.7%  | 34.4% | No   |
|                           | Grade-2            | 37.9% | 42.7%  | 39.6% | Yes  |
|                           | Grade-3            | 3.3%  | 5.3%   | 4.0%  | Yes  |

**Table 6: Prevalence of cervical spine degenerations regarding vertebral body among elderly males and females**

| Vertebral body parameters. | Evaluation/grading | Male  | Female | Total | M<F? |
|----------------------------|--------------------|-------|--------|-------|------|
| Disc space narrowing       | Grade-1            | 37.5% | 28.7%  | 34.4% | No   |
|                            | Grade-2            | 37.9% | 42.7%  | 39.6% | Yes  |
|                            | Grade-3            | 3.3%  | 5.3%   | 4.0%  | Yes  |
| Schmorl node               | Positive rate      | 8.1%  | 10.0%  | 8.8%  | Yes  |
| Posterior disc protrusion  | Class-1            | 50.7% | 48.7%  | 50.0% | No   |
|                            | Class-2            | 5.5%  | 10.0%  | 7.1%  | Yes  |

### Discussion

Despite the fact that the majority of acute neck pain episodes disappear on their own, more than a third of those who are affected experience low-grade symptoms or recurrences more than a year later. For majority of these individuals, surgery is more beneficial than conservative treatment in the short term but not in the long run; additionally, early treatment has no influence on prognosis. Female sex, advanced age, presence of radiculopathy, higher baseline pain intensity, multiple pain sites, smoking, obesity, poor general health, and a range of psychosocial problems are all factors that predict neck pain persistence[12-15]. More than 83 percent of people over the age of 60 suffer from cervical disc degeneration with no symptoms. Physiological ageing changes and pathological changes are both examples of degenerative changes. This study demonstrates that degenerative changes are quite widespread in elderly people, as expected. Spinal canal stenosis, disc space narrowing, and disc bulge/protrusion were prevalent at C3/4, C4/5, and C5/6 levels, with the highest at C5/6 level, consistent with prior studies of younger participants. High signal in the spinal cord was more common at C4/C5 levels in both males and females[16-18]. Spinal cord high signal, which is related with spinal cord liquidation, is thought to be produced by spinal canal stenosis, especially when impinged by protruded discs or osteophytes. As a result, our research reveals a mismatch between the cervical level with the highest frequency of spinal canal stenosis and the highest frequency of spinal cord high signal, which may be related in part to frequent rotation of the upper cervical spine segment. The elder group (>81 years old) nevertheless had a higher prevalence of degenerative findings or a higher severity of degenerative findings, according to this study, and the age-dependence was more noticeable in females[19-22]. Our research also found that cervical spine degenerative alterations were more common in senior ladies than in elderly males, and that females had more severe grades of degeneration. Furthermore, whereas both males and females had a similar incidence of spinal canal stenosis, females have a much higher prevalence of spinal cord high signal, indicating that females are more likely to develop cervical myelopathy. According to Fejer et al research's women experience more neck pain than men, with females reporting 1/3 more neck pain than males on average. This disparity in neck discomfort prevalence is most likely attributable to both structural and functional deterioration[23-27]. Women's pain thresholds and reactions to pain are often lower than men's. In a study of pain characteristics in persons 65 and older who were referred to a tertiary pain management clinic, the older patients had more physical difficulties that corresponded to their complaints, but fewer psychological concerns that contributed to disability than the younger pain patients. Recent data suggests that oestrogen insufficiency may have a role in postmenopausal women's accelerated lumbar disc degradation and degenerative spondylolisthesis, which is linked to a higher prevalence of lower

back pain[28-32].

A similar trend may have been detected in the cervical spine. Matsumoto et al. found disc degeneration in 17 percent of men's discs and 12 percent of women's discs in their twenties, as well as 86 percent and 89 percent of both men and women's discs after 60 years of age. However, it is unknown how long this 'post-menopause faster spine degradation phase in women compared to men' lasts after menopause. After menopause, disc space indicates a steady decline, according to Gambacciani et al. that happens almost entirely in the first 5 to 10 years after menopause. However, our recent findings from a four-year follow-up study that began at the age of 72.5 years suggest that there was a greater lateral thoracic and lumbar disc area loss in women than in men[33-38]. Despite the lack of a relationship between radiological abnormality and low back pain symptoms patients with degenerative lumbar spine changes are more likely to experience low back pain. This study lends credence to the theory that degenerative alterations in the cervical spine are linked to neck pain. On the other hand, this study shows that cervical spinal degenerative changes are highly prevalent in people who don't have neck pain, and that high signal and compressive deformity in the spinal cord are also common in those who don't have neck pain. There was no link between Schmorl nodes and neck pain in this investigation. The overall occurrence of this indication, however, was low[39]. Senior ladies are more likely to develop osteoporosis and osteoporotic vertebral fractures than elderly males, and senile osteoporosis is linked to lumbar disc degeneration. Osteoporosis may play a role in the development of disc degeneration, as it causes a reduction of vertebral height, which leads to instability, facet arthrosis, and disc degeneration. While compressive deformation of the thoracic and lumbar vertebrae is widespread in clinical practise, there are few research investigations on this component of the cervical spine[40-41]. There are some flaws in this research. Although the research participants number is considerable compared to many other reports, this study was not specifically planned to look at cervical spine degenerations, and statistical power was not evaluated at the outset. As a result, rather than focusing solely on the p-values, we should consider the overall pattern of the study's findings. If both men and women exhibit the same patterns, the patterns are more likely to be true.

### Conclusion

In conclusion, this study found that degenerative alterations in the cervical spine are highly common in the senior population. Even at later ages, degenerative alterations revealed age-dependency, and this age-dependency was more noticeable in females. The prevalence of cervical degenerative alterations was higher in people who had neck pain, but the link was relatively weak. There was also some evidence that osteoporosis is linked to a higher prevalence of cervical spine degenerations.

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