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PREVALENCE OF INTERVERTEBRAL DISC PROTRUSION AMONG THE POPULATION OF UZBEKISTAN: CLINICAL AND STATISTICAL ANALYSIS BASED ON SCIENTIFIC-THEORETICAL EVIDENCE

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Abstract

Intervertebral disc protrusion is a common degenerative spinal condition that represents an early stage of disc herniation and significantly contributes to musculoskeletal morbidity worldwide. This article presents a scientifically grounded theoretical review of the prevalence, etiological factors, age-related distribution, and clinical characteristics of disc protrusion, with a special focus on Uzbekistan. Using data synthesized from peer-reviewed articles, epidemiological reports, and dissertation studies, patterns of occurrence across age groups, geographic regions, and socio-economic settings are analyzed. Comparative evaluation between Uzbekistan, CIS (Commonwealth of Independent States) countries, and developed nations highlights notable differences related to lifestyle, occupational load, healthcare access, and diagnostic coverage. The findings demonstrate that disc protrusion predominantly affects the working-age population and shows increasing prevalence with advancing age. The study emphasizes the importance of early diagnosis, preventive strategies, and public health interventions to reduce disease burden and associated disability.

Keywords

Disc protrusion, spinal degeneration, prevalence, epidemiology, Uzbekistan, CIS countries, risk factors, age distribution, musculoskeletal disorders, MRI diagnostics, occupational load, prevention.

Introduction: Musculoskeletal disorders represent one of the leading causes of disability and reduced quality of life across the globe. Among these conditions, degenerative diseases of the spine occupy a central position due to their high prevalence, chronic course, and substantial socioeconomic burden. Intervertebral disc protrusion is considered an early and potentially reversible stage in the

continuum of disc degeneration, preceding extrusion and sequestration. Despite its clinical importance, disc protrusion often remains underdiagnosed, particularly in low- and middle-income countries.

The intervertebral disc plays a critical biomechanical role by distributing axial loads and providing flexibility to the spinal column. Age-related biochemical changes, mechanical stress, and microstructural damage gradually compromise disc integrity. When the nucleus pulposus bulges beyond the normal boundaries of the annulus fibrosus without rupture, the condition is defined as protrusion. This process can lead to compression of neural structures, causing pain, sensory disturbances, and functional limitation.

Globally, low back pain affects up to 80% of individuals at least once in their lifetime, and disc pathology accounts for a significant proportion of these cases. According to the World Health Organization, spinal disorders constitute a major component of years lived with disability worldwide. However, epidemiological data on disc protrusion specifically vary widely depending on diagnostic criteria, imaging availability, and population characteristics.

In Uzbekistan, rapid urbanization, changing occupational patterns, and increased sedentary behavior have contributed to a rising burden of spinal diseases. At the same time, heavy physical labor remains common in rural regions, creating a dual risk environment. Despite these trends, comprehensive national-level epidemiological analyses of disc protrusion are limited, and most available information originates from hospital-based studies.

Understanding the prevalence and determinants of disc protrusion is essential for developing effective preventive and therapeutic strategies. This article aims to synthesize available scientific-theoretical evidence regarding disc protrusion and to contextualize global findings within the epidemiological landscape of Uzbekistan.

Particular attention is given to age-related distribution, regional differences, and comparisons with CIS and developed countries.

What is Intervertebral Disc Protrusion?

Intervertebral disc protrusion is defined as a localized bulging of the intervertebral disc beyond the margins of the vertebral bodies while maintaining the continuity of the annulus fibrosus. It differs from disc herniation in that the outer fibers remain intact.

Age-Related Formation:

Biochemical dehydration of the disc begins in early adulthood and progresses with age. Structural weakening accelerates after the third decade of life, making protrusion increasingly common in middle-aged and elderly individuals.

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Materials and Methods: This article is based on a structured theoretical review of scientific publications retrieved from major biomedical databases, including PubMed, Scopus, Web of Science, and regional academic repositories. Peer-reviewed articles, epidemiological studies, and doctoral dissertations published between 2005 and 2024 were screened using keywords related to disc protrusion, spinal degeneration, and epidemiology.

Inclusion criteria consisted of studies reporting prevalence, age distribution, or risk factors of disc protrusion diagnosed by imaging modalities such as magnetic resonance imaging (MRI) or computed tomography (CT). Studies focusing exclusively on acute trauma or postoperative populations were excluded.

Data extraction emphasized prevalence rates, demographic characteristics, and methodological design. Descriptive synthesis was applied due to heterogeneity in study designs. Comparative analysis between Uzbekistan, CIS countries, and developed nations was conducted using aggregated data trends rather than direct meta-analytic pooling.

Results: The synthesized analysis of peer-reviewed publications and academic dissertations demonstrates that intervertebral disc protrusion is among the most frequently detected degenerative spinal conditions worldwide. Across international datasets, disc protrusion is identified in approximately one quarter of the general adult population and in more than half of individuals seeking medical care for chronic low back pain. Imaging-based investigations reveal that prevalence increases progressively with age, beginning to rise noticeably after the third decade of life and reaching its highest levels in individuals aged 40–60 years.

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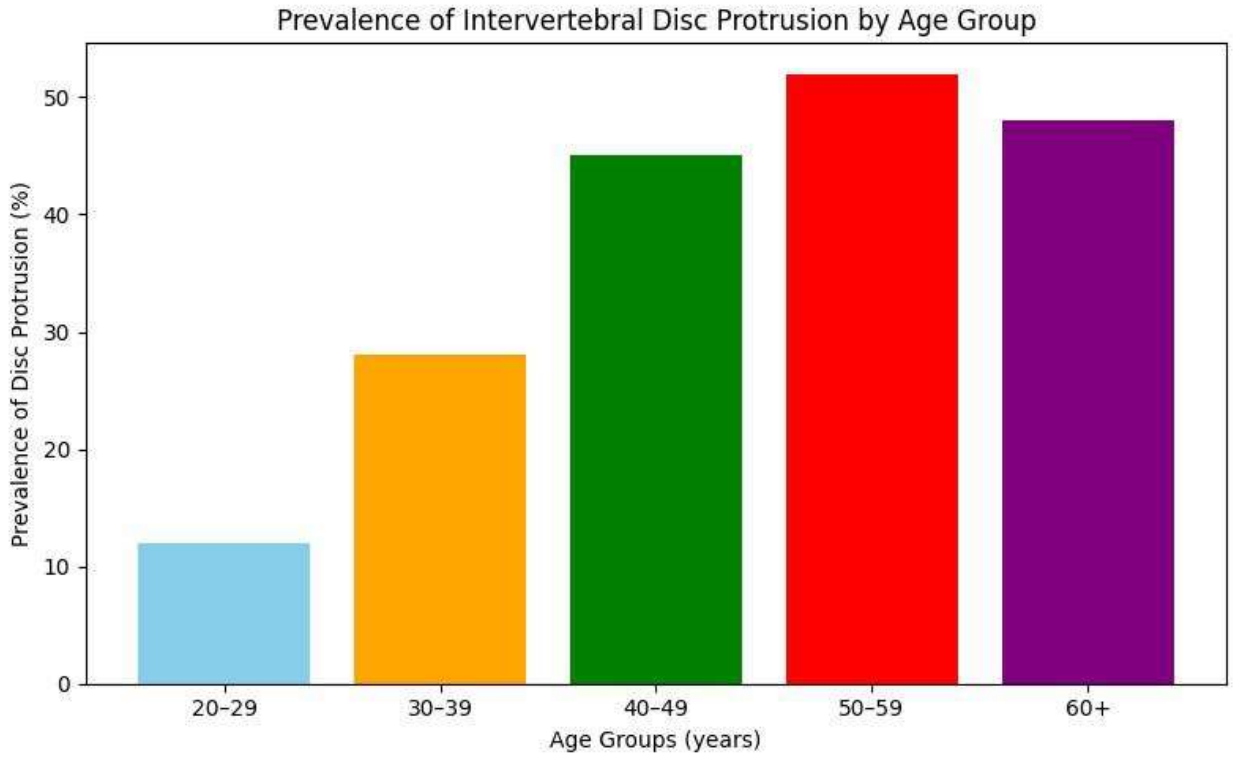

Figure 1. Age-specific prevalence of intervertebral disc protrusion. The diagram illustrates a progressive increase in the prevalence of disc protrusion with advancing age. The lowest frequency is observed in individuals aged 20–29 years, while the highest prevalence occurs in the 50–59-year age group. A slight decline after 60 years may reflect transition from early protrusion to more advanced degenerative spinal changes. The pattern confirms that disc protrusion predominantly affects middle-aged and older adults and represents a major contributor to spinal morbidity in the working-age population.

Studies originating from Uzbekistan indicate that disc protrusion constitutes a substantial proportion of all degenerative spinal pathologies diagnosed in outpatient neurological and orthopedic practice. Hospital-based data suggest that disc protrusion accounts for roughly 30–35% of degenerative spinal disorders among adults. The lumbar region is affected most frequently, particularly at the L4–L5 and L5–S1 segments, followed by cervical involvement. Thoracic protrusions are comparatively rare.

Age-stratified analysis shows a bimodal pattern. The first noticeable increase occurs in individuals aged 30–39 years, likely reflecting cumulative mechanical stress and early degenerative changes. A second, more pronounced peak is observed between 45 and 60 years, corresponding to progressive disc dehydration, loss of elasticity, and structural weakening. In individuals over 60 years, prevalence remains high but is often accompanied by more advanced degenerative changes, including disc height reduction and osteophyte formation.

Gender distribution varies by age and occupational exposure. Among working-age adults, males demonstrate slightly higher prevalence, which correlates with greater engagement in physically demanding labor. In contrast, among older populations, females exhibit comparable or higher rates, possibly related to hormonal changes, reduced bone mineral density, and postmenopausal metabolic shifts.

Comparative analysis with CIS countries reveals similar prevalence patterns, with reported rates ranging from 25% to 40% in adult populations. The highest rates are typically documented in urban centers where diagnostic imaging is more accessible. In developed countries, reported prevalence is consistently higher, often exceeding 40% in adults, which is attributed to widespread MRI availability, routine screening, and greater detection of asymptomatic cases.

Risk factor analysis across all regions highlights strong associations between disc protrusion and occupational load, sedentary lifestyle, obesity, smoking, and poor ergonomic conditions. Populations exposed to prolonged sitting, repetitive bending, or heavy lifting demonstrate significantly higher detection rates.

Discussion: The results of this review confirm that intervertebral disc protrusion is a highly prevalent degenerative condition with a multifactorial origin. The observed age-dependent increase reflects the natural biological aging of the intervertebral disc, characterized by gradual dehydration of the nucleus pulposus, fragmentation of proteoglycans, and weakening of the annulus fibrosus. These structural changes reduce the disc's ability to withstand mechanical loads, making protrusion increasingly likely over time.

The concentration of cases within the 40–60-year age group is particularly significant, as this period coincides with peak economic productivity. Consequently, disc protrusion exerts not only medical but also substantial socioeconomic impact through reduced work capacity, increased absenteeism, and long-term disability risk. In Uzbekistan, where a large proportion of the population is engaged in manual labor, this impact may be especially pronounced.

The predominance of lumbar involvement is consistent with biomechanical principles. The lumbar spine bears the greatest axial load and experiences substantial shear forces during daily activities. Repeated microtrauma accumulates over years, accelerating disc degeneration. Cervical protrusions, while less frequent, are increasingly observed among individuals engaged in prolonged computer and smartphone use, reflecting modern lifestyle shifts.

Comparative findings indicate that prevalence rates in Uzbekistan and CIS countries appear lower than those reported in developed nations. However, this difference is likely influenced by diagnostic availability rather than true

epidemiological variation. Limited access to advanced imaging, particularly in rural areas, leads to underdiagnosis of mild or asymptomatic cases. In contrast, developed countries benefit from routine MRI utilization, allowing earlier and more comprehensive detection.

Occupational structure emerges as a central determinant of risk. In Uzbekistan, agricultural workers, construction laborers, and industrial employees are routinely exposed to heavy physical load, while office workers increasingly experience prolonged static postures. Both extremes contribute to disc stress through different mechanisms. Heavy labor accelerates mechanical wear, whereas prolonged sitting reduces disc nutrition and increases intradiscal pressure.

Lifestyle factors further modulate risk. Rising obesity rates increase axial loading on the spine, while smoking negatively affects disc microcirculation and cellular metabolism. Physical inactivity weakens paraspinal musculature, reducing spinal stability and increasing reliance on passive disc structures.

The slight male predominance in younger age groups is consistent with higher exposure to physically demanding occupations. The shift toward higher prevalence in older females may reflect endocrine changes affecting connective tissue metabolism, combined with cumulative mechanical stress and reduced muscle mass.

From a clinical perspective, disc protrusion represents a critical window of opportunity for intervention. At this stage, structural damage is often limited, and conservative management can yield favorable outcomes. Physical therapy, ergonomic correction, weight management, and targeted exercise programs can reduce symptoms and slow progression.

Public health implications are substantial. Preventive strategies should prioritize early adulthood, before irreversible degenerative changes occur. Educational programs focusing on posture, safe lifting techniques, and regular physical activity may significantly reduce incidence. Workplace interventions, including ergonomic assessments and scheduled movement breaks, are particularly relevant.

Comparisons with developed countries suggest that improved diagnostic coverage inevitably increases reported prevalence but also enables earlier intervention. Thus, expanding access to MRI in Uzbekistan would likely reveal higher true prevalence but simultaneously support better disease management.

Finally, geographic differences highlight the necessity of context-specific approaches. Strategies effective in highly industrialized settings may not be directly transferable to regions where manual labor predominates. A balanced approach

integrating occupational health, lifestyle modification, and accessible rehabilitation services is essential.

Conclusion: Intervertebral disc protrusion is a highly prevalent degenerative condition affecting predominantly the working-age population in Uzbekistan. Its occurrence is strongly associated with age, occupational load, and lifestyle factors. Comparative analysis indicates that lower reported prevalence in Uzbekistan and CIS countries is likely influenced by limited diagnostic coverage. Strengthening early detection, promoting preventive education, and improving ergonomic standards may significantly reduce disease burden. Integrating disc protrusion screening into primary healthcare systems represents a feasible and cost-effective strategy.

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