Degenerative disc disease (DDD) is a common condition affecting the intervertebral discs of the spine, characterized by progressive deterioration and structural changes over time. It is a leading cause of chronic low back pain and disability, posing significant healthcare and socioeconomic burdens worldwide (Kim et al., 2020). While the specific etiology of DDD stays multifactorial and ineffectively comprehended, different hereditary, mechanical, and ecological variables are embroiled in its pathogenesis. Understanding the complicated life systems of the spine and the fundamental instruments of plate degeneration is significant for explaining the pathophysiology of DDD and creating robust restorative methodologies (Modic and Pfirrmann, 2012). Late progressions in imaging modalities, for example, attractive reverberation imaging (X-ray) and computed tomography (CT), have given extraordinary examples, paving the way for appropriate surgical interventions (Lebret et al., 2023). Degenerative disc disease stands as a prominent cause of chronic back pain among the elderly globally. The disc comprises the nucleus pulposus, annulus fibrosus, and neighboring cartilaginous end plates. Extensive research has explored various factors to unveil the underlying causes of degenerative disc disease and its pathways for pain generation, aiming to reverse or halt further degeneration or devise optimal pain management strategies. Many factors, including genetics, environment, biomechanics, and anatomical variations, have been scrutinized for their association with degenerative disc disease (Sweetwood et al., 2023). While pain generators are primarily attributed to discogenic origins, recent studies have highlighted associations with adjacent vertebral end plates and vertebral bodies, termed modic changes. Usually, a disc lacks neural and vascular elements, but in pathological states, pain innervation pathways emerge through}

**Keywords:** Degenerative Disc Disease, Spinal Anatomy, Radiological Findings, MRI, CT Scans, Disc Height Loss
inflammatory stimulation by secreted cytokines, triggering the negotiation of the diseased disc (Noor et al., 2024). The study's main objective is to find the spinal anatomy and investigate degenerative disc disease in spinal patients.

**Methodology**

This mixed-methods study was conducted in- in one of the public hospital of Karachi, Pakistan from March 2023 to September 2023. Fifty patients diagnosed with DDD are enrolled, with comprehensive clinical assessments conducted to evaluate symptomatology, functional impairment, and radiological findings. The study includes patients aged 18 years and above with a clinical diagnosis of Degenerative Disc Disease confirmed by a qualified physician who is able to provide informed consent for participation. Exclusion criteria encompass individuals with a history of spinal trauma or surgery, as well as those with known spinal infections or malignancies. Fifty patients diagnosed with DDD are enrolled, with comprehensive clinical assessments conducted to evaluate symptomatology, functional impairment, and radiological findings. Each selected patient goes through clinical evaluations, including a definite clinical history, physical examination, and assessment of symptomatology connected with DDD. Functional impairment is evaluated utilizing validated outcome measures, for example, the Oswestry Incapacity Record (ODI) and Visual Simple Scale (VAS) for torment. High-level imaging modalities, including Attractive Reverberation Imaging (X-ray) and Registered Tomography (CT), clarify primary changes inside the spinal section. X-ray gives an itemized representation of circle morphology, degenerative changes, and related spinal line or nerve root pressure. CT checks offer extra data on complex life structures, for example, osteophyte arrangement and aspect joint hypertrophy. Data were analyzed using SPSS v27. Correlation analyses are performed to explore associations between clinical symptomatology, functional impairment, and radiological features of DDD.

**Results**

Data was collected from 50 patients. The mean age of the patients was 55.12±5.82 years. There were 28 male and 22 female patients. Table 1 shows the clinical assessment of the study population based on the Oswestry Disability Index (ODI) and Visual Analog Scale (VAS) for Pain.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oswestry Disability Index (ODI)</td>
<td>45.2±12.3</td>
</tr>
<tr>
<td>Visual Analog Scale (VAS) for Pain</td>
<td>7.8±1.4</td>
</tr>
</tbody>
</table>

Table 1: Clinical assessment of patients (n=50)

Facet joint degeneration was observed in 85% of cases. The mean grade on the Pfirrmann scale was 2.4, with a standard deviation of 0.65, indicating a moderate level of disc degeneration in the study population (Table 3).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presence of Facet Joint Degeneration (%)</td>
<td>85%</td>
</tr>
<tr>
<td>Mean Grade on the Pfirrmann Scale</td>
<td>2.4±0.65</td>
</tr>
</tbody>
</table>

Table 3: Facet joint degeneration

Table 4: Correlation analysis

<table>
<thead>
<tr>
<th>Variables</th>
<th>Correlation Coefficient (r)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disc Height Loss vs. Severity of Clinical Symptoms</td>
<td>0.56</td>
<td>&lt;0.001</td>
</tr>
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</table>

Discussion

The implications of these findings extend beyond mere radiological observations, as they provide valuable insights into the clinical course and management of DDD. The relationship between disc height loss and clinical side effects recommends that primary changes inside the intervertebral plates assume a vital part in the side effects of age and illness movement (Zheng et al., 2023). In this way, medications that protect circle honesty and relieve degenerative cycles might hold a guarantee in easing side effects and working on tolerant results. The pathogenesis of degenerative plate infection is unpredictable and affected by different elements (Muralidharan et al., 2023). Various examinations have highlighted a critical hereditary part, with polymorphisms in qualities connected with cytokines and lattice parts assuming an essential role. Moreover, a few gamble factors have been distinguished, including maturing, smoking, stoutness, metabolic issues, oxidative pressure, and poor-quality diseases (Lehman et al., 2024). Mechanical elements have for quite some time been related to circle degeneration, especially in the lower
lumbar district where mechanical pressure is more articulated. Nonetheless, it's critical to note that circle degeneration alone isn't guaranteed to cause torment, as proven by its high commonness in asymptomatic people (Lee et al., 2021). Instead, inflammation emerges as a central player in the degenerative process and the development of pain. Therefore, while mechanical stress and other risk factors contribute, the interplay with inflammation drives the progression of degenerative disc disease and its associated pain (Elsaka et al., 2022). CT imaging is not typically the preferred method for assessing degenerative spinal pathology, although it does offer certain advantages over MRI (Kirnaz et al., 2021). For instance, it provides a more precise visualization of osteophytes, intradiscal gas (vacuum disc), and calcifications. However, alterations observed in discs are often associated with aging, including desiccation, fibrosis, cleft formation in the nucleus, and fissuring and degeneration of the annulus. During radiological examinations, sclerosis of end-plates or osteophytes at the vertebral apophyses is commonly observed in asymptomatic patients (Diwan and Melrose, 2023; Fenn et al., 2020; Kim et al., 2020).

In the degenerative process, there is an increase in type II collagen outside the annulus, accompanied by a decrease in water content in the nucleus pulposus, leading to disc dehydration or desiccation (Kirnaz et al., 2022). Consequently, the disc undergoes progressive fibrosis, resulting in a loss of distinction between the annulus and nucleus. While CT scans offer advantages in certain aspects of visualization, MRI remains the preferred imaging modality for the comprehensive assessment of degenerative spinal conditions (Da Costa et al., 2020; Hoffeld et al., 2023).

**Conclusion**

It is concluded that this study provides the complex pathophysiology and clinical manifestations of Degenerative Disc Disease (DDD), highlighting the significant variability in structural changes and their correlation with clinical symptoms. Through a comprehensive investigation involving clinical assessments and advanced imaging techniques, we have elucidated the spectrum of degenerative changes within the intervertebral discs and facet joints.

**Declarations**

**Data Availability statement**

All data generated or analyzed during the study are included in the manuscript.

**Ethics approval and consent to participate**

Approved by the department concerned.

**Consent for publication**

Approved

**Funding**

Not applicable

**Conflict of interest**

The authors declared the absence of a conflict of interest.

**Author Contribution**

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Conception of Study, Final approval of manuscript

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Coordination of collaborative efforts.

**ABDUL REHMAN**

Methodology Design, Study Design, Review of manuscript, final approval of manuscript

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Data entry and Data analysis, drafting article

**F: AZHAR**

Manuscript drafting

**References**


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