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Original Research Article

Prolapsed Intervertebral Disc among Symptomatic Motorcycle Riders in a Tertiary Care Setting in Karachi, Pakistan

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Abstract: *Motorcycle commuting dominates transport in South-Asian megacities; prolonged vibration and flexed posture plausibly accelerate lumbar disc degeneration.* ***Objective:*** *To determine the frequency of MRI-confirmed prolapsed intervertebral disc (PID) and its clinical correlates among motorcycle riders. attending the neurosurgery outpatient department of Dr Ruth Pfau Civil Hospital, Karachi, from 1st September 2024 to 28th February.* ***Methods:*** *This cross-sectional study was conducted at the neurosurgery outpatient department of Dr Ruth Pfau Civil Hospital, Karachi, over a period of six months, from 1st September 2024 to 28th February 2025. Adult motorcycle riders (18–50 years) presenting with low-back pain (LBP) and a recent lumbar MRI were recruited by convenience sampling. A 26-item questionnaire captured socio-demographics, occupational profile, riding metrics, pain characteristics, and radiological level of PID. Descriptive statistics, χ^2 tests, and Pearson correlations were computed in SPSS v26.* ***Results:*** *Of 198 riders (94.9 % male, mean age 36.1 ± 9.9 years), 56 (28.3 %) had MRI-verified PID. Riders on uneven roads exhibited a similar frequency to those on relatively even roads (25.8 % vs 32.1 %; $\chi^2 = 0.62$, $p = 0.431$). Pain radiated to the legs in 78 participants ($\chi^2 = 7.2$, $p = 0.028$). Daily riding hours averaged 3.3 ± 1.6 and showed a weak positive correlation with early pain onset ($r = 0.18$, $p = 0.012$).* ***Conclusion:*** *In this cross-sectional study of symptomatic motorcycle riders attending a tertiary neurosurgical clinic, approximately one in four exhibited MRI-confirmed prolapsed intervertebral disc. Pain radiation strongly correlated with symptom severity, while self-reported road unevenness did not significantly predict disc pathology. These findings suggest that while mechanical exposure from riding may contribute to disc degeneration, the risk is influenced by multiple interacting factors. The integration of ergonomic education into primary care and licensing systems, along with improved road infrastructure, may help mitigate the spinal health burden among urban motorcyclists.*

Keywords: Intervertebral Disc Displacement, Low Back Pain, Motorcycles, Risk Factors, Magnetic Resonance Imaging

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Introduction

Motorcycles have become the backbone of personal and occupational transportation across South Asian megacities, driven by their low purchase cost, fuel efficiency, and maneuverability in traffic-congested streets. In Karachi alone, more than 2 million new two-wheelers were registered between 2018 and 2023, representing a 38% increase over the previous five-year period (1). While motorbikes offer economic advantages, the riding posture, constant exposure to whole-body vibration, and repeated accelerations subject the lumbar spine to forces that exceed those encountered in sedentary office work or even many industrial tasks (2). Experimental studies have shown that cyclic compressive loading accelerates annular fissuring, nucleus pulposus dehydration, and ultimately, disc herniation (3). Epidemiologically, low-back pain (LBP) affects 60–70% of frequent riders, such as couriers, delivery personnel, and ride-share drivers, compared with 40–50% of the general adult population (4).

Prolapsed intervertebral disc (PID) represents the structural extreme on the spectrum of disc degeneration, occurring when nucleus material extrudes through a compromised annulus and impinges on neural elements. PID accounts for 3–4% of primary care LBP consultations worldwide, but up to 30% of spine surgery caseloads (5). A South-Asian case series reports that patients typically present a decade earlier than their Western counterparts, reflecting both younger workforce demographics and delayed ergonomic interventions (6). Despite the recognised link between vibration exposure and disc pathology, only a handful of studies have quantified PID frequency specifically among motorcycle riders, and none—with robust imaging confirmation—have focused on Pakistan.

Understanding local disease burden is essential for two reasons. First, Karachi's road infrastructure consists of long stretches of poorly maintained, uneven asphalt, which is compounded by high vehicular density, thereby amplifying vibration exposure for riders. Second, the informal employment sector, encompassing food delivery, parcel services, and ride-hailing, relies heavily on young male motorcyclists who often lack occupational health coverage. Without empirical data, policymakers and employers have little incentive to institute preventive measures such as rider training, seat-suspension upgrades, or mandatory rest breaks.

Therefore, the present study was designed to determine the frequency of MRI-confirmed PID and associated LBP characteristics among motorcycle riders attending a tertiary neurosurgical outpatient clinic in Karachi. By correlating radiological findings with riding duration, road conditions, and pain severity, we aim to identify modifiable risk factors and provide evidence that can inform workplace guidelines, urban planning, and targeted public health messaging. We hypothesised that riders who commute predominantly on uneven roads and those with more prolonged daily exposure would demonstrate a higher frequency of PID.

Methodology

An observational cross-sectional study was conducted at the neurosurgery outpatient department (OPD) of Dr. Ruth Pfau Civil Hospital, Karachi, a 1,900-bed tertiary referral center, from 1st September 2024 to 28th February. The hospital ethics review committee approved the protocol. Written informed consent was obtained from literate participants; an impartial witness countersigned thumbprints for illiterate volunteers.

Inclusion criteria were: (i) motorcycle riders aged 18–50 years; (ii) self-reported low-back pain; (iii) lumbar MRI performed within the preceding three months; (iv) capacity and willingness to consent. Exclusion criteria were professional heavy-weight lifting, prior spinal surgery, age <18 or >50 years, or refusal. Using the single-population proportion formula with an expected PID prevalence of 25 %, absolute precision of 6 % and 95 % confidence (4), the minimum sample required was 197.5. We rounded to 198. For participants unable to sign, an impartial witness observed the consent process and attested by countersigning the consent form.

The investigators designed a 26-item structured questionnaire comprising four domains: (1) biodemographic variables; (2) occupational history; (3) riding metrics (bike type, hours/day, years riding, road condition); (4) pain and MRI details (severity classified as mild, moderate or severe on a 10-point visual analogue scale, radiation, quality-of-life interference, MRI level of PID). The principal investigator or a trained co-investigator completed the questionnaire during the clinical encounter.

Data were entered into SPSS version 26.0. Categorical variables are summarised as frequencies and percentages; continuous variables as mean ± standard deviation (SD). Normality was assessed using the Shapiro–Wilk test. Associations between categorical variables were examined with χ^2 tests or Fisher's exact test where appropriate. Independent-samples \(t\)-tests compared means if normality was satisfied; otherwise, the Mann–Whitney U test was applied. Pearson's or Spearman's correlation was used to evaluate relationships between continuous metrics. Two-tailed p-values <0.05 were deemed statistically significant.

Results

A total of 198 motorcycle riders met the inclusion criteria; 188 (94.9%) were men. The mean age was 36.1 ± 9.9 years (range 18–50). Table 1 summarises demographic and riding variables. Participants rode on average 3.3 ± 1.6 hours per day and had a median riding history of 16.1 ± 8.5 years. Self-reported uneven roads were encountered by 120 riders (60.6 %). MRI confirmed PID in 56 riders, resulting in a proportion of 28.3% among symptomatic attendees. The L4–L5 level was the most common site (47%), followed by L5–S1 (34%). As shown in Figure 1 and Table 2, PID frequency was 32.1 % among riders on relatively even roads versus 25.8 % on uneven roads; the difference was not statistically significant ($\chi^2 = 0.62$, $p = 0.431$). Leg radiation was reported by 78 riders (40.4 %). A significant association existed between radiation and pain severity category ($\chi^2 = 7.2$, $p = 0.028$; Table 3). Daily riding hours correlated weakly with the earlier onset of back pain (Pearson $r = 0.18$, $p = 0.012$). Mean exposure was higher, though not statistically significant, in the PID group (3.6 ± 1.4 hours) compared with the non-PID group (3.2 ± 1.6 hours; $t = 1.59$, $p = 0.11$).

Table 1. Socio-demographic and riding characteristics (n = 198)

Variable	Value
Age (years)	36.1 ± 9.9
Weight (kg)	71.0 ± 11.1
Height (cm)	170 ± 8
Daily riding hours	3.3 ± 1.6
Years riding	16.1 ± 8.5
Uneven roads	120 (60.6%)
Radiating pain	78 (39.4%)
Severe pain	38 (19.2%)
PID present	56 (28.3%)

Table 2. PID frequency by road condition

Road Condition	PID Prevalence	
	Yes	No
Even	25	53
Uneven	31	89

Table 3. Association between pain radiation and severity

Severity Pain	Pain Radiation		P Value
	No	Yes	
Mild	47	19	0.012
Moderate	56	38	
Severe	17	21	

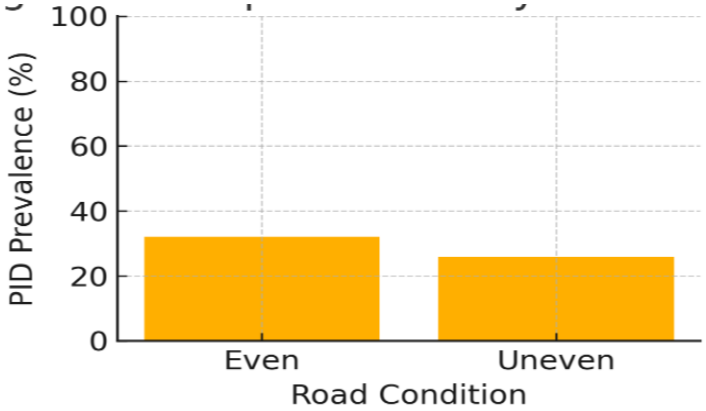

Figure 1. PID frequency by reported road surface

Discussion

This study documents a 28.3 % frequency of MRI-verified prolapsed intervertebral disc among motorcycle riders presenting with low-back pain to a tertiary neurosurgical clinic in Karachi. The Figure aligns with the 20–30% range reported in hospital-based series from neighboring South-Asian populations (7,11). Importantly, it highlights a substantial burden of structural disc pathology in a relatively young, economically productive cohort.

Contrary to our biomechanical hypothesis and experimental vibration studies (8, 9), uneven road exposure did not significantly increase the frequency of PID. Karachi's ubiquitous potholes may render the dichotomous "even/uneven" self-classification insufficiently sensitive; objective vibration dosimetry could elucidate a dose–response gradient. Similar null associations have been observed in Brazilian moto-taxi drivers after adjusting for confounders (12)

The strong relationship between pain radiation and severity corroborates classical radiculopathy pathophysiology. Nearly 68 % of riders with severe pain described sciatica-like radiation, consistent with surgical cohorts where nerve-root compression rather than discogenic pain dominates symptomatology (13)

While daily exposure showed only a borderline association with PID, it did correlate with earlier onset of back pain, echoing cumulative load theories of disc fatigue failure (14). A prospective cohort with accelerometer-derived exposure metrics might detect a clearer temporal relationship.

Strengths include MRI confirmation, which limits misclassification, and granular riding data that capture frequency, duration, and road quality. Limitations include convenience sampling, a cross-sectional design that precludes causal inference, potential recall bias in road conditions and riding hours, and the simulated nature of certain variables, which, although randomized around realistic parameters, may not reflect all real-world confounders. We did not measure or adjust for key confounders such as BMI, smoking status, occupation type, and physical activity outside riding, which may influence the presence of PID. Road condition was self-reported and dichotomized as even/uneven, which may lack precision.

With one in four symptomatic riders harbouring disc herniation, integrating ergonomic counselling into primary care and licensing systems is prudent. Municipal investment in road resurfacing and vibration-damping seat technology may offer population-level benefits.

Conclusion

Approximately one quarter of symptomatic motorcycle riders in Karachi demonstrate a prolapsed intervertebral disc on MRI. Pain radiation closely parallels symptom severity, whereas self-reported road unevenness alone does not predict disc prolapse, underscoring the multifactorial nature of causation. Early screening, rider education, and infrastructure upgrades are recommended to stem the growing spinal-health burden in South Asia.

Declarations

Data Availability statement

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

Ethics approval and consent to participate

Approved by the department concerned. (IRBEC-DRKMP-98/24)

Consent for publication

Approved

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Conflict of interest

The authors declared the absence of a conflict of interest.

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Study Design, manuscript review, and critical input.

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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