INTERNATIONAL JOURNAL OF MEDICAL SCIENCE AND DENTAL HEALTH
(ISSN: 2454-4191)
www.ijmsdh.org (2026)

Received: 09 Feb 2026
Revised: 21 Mar 2026
Accepted: 21 Apr 2026
Published: 07 May 2026

Page No - 21-32
DOI - 10.55640/ijmsdh-12-05-04

Manuscript Type
Original Research Article

Article Citation: Adeniyi, D. O. (2026). Spectrum of Clinical Presentation of Cervical Spinal Cord Injury in Ado-Ekiti. International Journal of Medical Science and Dental Health, 12(05), 21-32. https://doi.org/10.55640/ijmsdh-12-05-04

Spectrum of Clinical Presentation of Cervical Spinal Cord Injury in Ado-Ekiti

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Abstract

Background: Cervical spinal cord injury (CSCI) is a devastating condition associated with significant morbidity and mortality, particularly in low- and middle-income settings where pre-hospital care and trauma systems are often suboptimal. Understanding the clinical spectrum and determinants of outcome is essential for improving management strategies.

Objective: To evaluate the spectrum of clinical presentation and identify predictors of mortality among adult patients with cervical spinal cord injury in Ado-Ekiti.

Methods: This was a hospital-based prospective descriptive and analytical study conducted over an 18-month period between July 2024 and December 2025 and involved 43 adult patients with confirmed cervical spinal cord injury. Data were collected using a structured proforma for capturing socio-demographic characteristics, injury mechanisms, clinical presentation, radiological findings, management, complications, and outcomes. Neurological status was assessed using the ASIA impairment scale. Data were analyzed using descriptive statistics and multivariate logistic regression to identify predictors of mortality, with statistical significance set at $p < 0.05$.

Results: The majority of patients were males (72.1%), with the peak age group being 18–30 years (27.9%). Road traffic accidents were the leading cause of injury (65.1%), with motorcycle-related incidents predominating. Most patients presented late, with over half presenting after 24 hours, and 67.4% received no pre-hospital care. Clinically, neck pain (81.4%), limb weakness, and severe neurological deficits such as quadriparesis (46.5%) and quadriplegia (41.9%) were common. Complete spinal cord injury (ASIA A) was observed in 32.5% of patients. The mortality rate was 18.6%, while only 23.2% achieved functional independence at discharge. Independent predictors of mortality included

complete injury (aOR = 6.85, p = 0.006), upper cervical level involvement (aOR = 4.92, p = 0.019), respiratory difficulty (aOR = 5.63, p = 0.014), and delayed presentation beyond 24 hours (aOR = 3.76, p = 0.048).

Conclusion: Cervical spinal cord injury in Ado-Ekiti predominantly affects young males and is largely due to preventable causes such as road traffic accidents. The clinical presentation is often severe, with a high burden of neurological deficits and complications. Mortality is significantly associated with injury severity, higher cervical involvement, delayed presentation, and respiratory compromise. Strengthening pre-hospital care, promoting early presentation, and improving acute management may enhance outcomes.

Keywords: Cervical spinal cord injury, clinical presentation, mortality predictors, Nigeria.

1. Introduction

Cervical spinal cord injury (CSCI) is one of the most devastating forms of trauma, often resulting in profound neurological deficits, long-term disability, and significant mortality. It constitutes a major public health challenge worldwide, particularly in low- and middle-income countries (LMICs), where trauma systems and rehabilitation services remain suboptimal.

Globally, spinal cord injury represents a significant public health concern, with numerous cases occurring each year across different regions of the world. The reported incidence varies widely between populations, reflecting differences in risk factors, health care systems and reporting mechanisms. [1, 2]

The burden is disproportionately higher in LMICs, where incidence and severity are often amplified by poor preventive and emergency care systems [2, 3].

The cervical spine is the most commonly affected region in traumatic spinal cord injury and is associated with severe outcomes such as tetraplegia and respiratory compromise [4]. Epidemiological data consistently demonstrate a strong male predominance, with young adults in their most economically productive years being the most affected group [5, 6]. Road traffic accidents (RTAs), particularly those involving motorcycles and pedestrians, remain the leading cause globally and in many African settings [1, 7].

In Nigeria, spinal cord injury has emerged as a significant contributor to trauma-related morbidity and mortality. Studies from different parts of the country have shown that the majority of affected individuals are young males, with RTAs accounting for over 60-70% of cases [8-10]. Furthermore, patients often present late with severe neurological deficits, including a high proportion of complete injuries (ASIA A), which significantly worsen outcomes [9, 11].

The clinical presentation of cervical spinal cord injury is variable, ranging from neck pain and mild neurological deficits to complete quadriplegia and respiratory failure. The severity of neurological impairment is commonly assessed using the American Spinal Injury Association (ASIA) Impairment Scale, which provides a standardized framework for classification and prognostication [12].

Despite the growing burden of cervical spinal cord injury in Nigeria, there remains a paucity of detailed data on the spectrum of clinical presentation and predictors of outcome, particularly in semi-urban settings such as Ado-Ekiti. This study therefore aims to evaluate the spectrum of clinical presentation and identify predictors of mortality among adult patients with cervical spinal cord injury in Ado-Ekiti.

2. Methodology

2.1. Study Design and Setting

This study was a hospital-based prospective descriptive and analytical study conducted at Ekiti State University Teaching Hospital, Ado-Ekiti, Ekiti State, Nigeria. The hospital serves as a major referral center for trauma cases within the state and neighboring regions, providing neurosurgical and radiological services.

2.2. Study Population

The study involved adult patients (≥18 years) who presented with cervical spinal cord injury (CSCI) during the study period from July 2024 to December 2025.

2.3. Study Duration

The study was carried out over a period of 18 months, spanning from July 2024 to December 2025.

2.4. Inclusion Criteria

Eligible participants were adult patients aged 18 years and above with clinically and/or radiologically confirmed spinal cord injury who were admitted and managed at the study center during the study period. In addition, only patients who, or whose caregivers, provided informed consent were included in the study.

Patients were excluded if they had non-cervical spinal cord injuries, isolated vertebral fractures without neurological deficits,

or if they were brought in dead. Cases with incomplete clinical records were also excluded from the analysis.

2.5. Sample Size and Sampling Technique

A total of 43 consecutive eligible patients who met the inclusion criteria were recruited during the study period using a consecutive sampling technique.

2.6. Data Collection

Data were collected using a structured proforma specifically designed for the study. Information obtained included socio-demographic characteristics such as age, sex, marital status, occupation, and level of education. Details related to the injury were also documented, including the mechanism and type of injury, time to presentation, mode of transportation to the hospital, and whether any pre-hospital care was received.

Clinical information at presentation was carefully recorded, including level of consciousness, presenting symptoms, neurological deficits, reflex status, and presence of spinal shock. The severity of neurological impairment was assessed using the American Spinal Injury Association (ASIA) Impairment Scale.

Radiological data were obtained from available imaging studies, including X-rays, computed tomography (CT), and magnetic resonance imaging (MRI), with documentation of findings such as fractures, dislocations, and cord compression. Details of management, whether conservative or surgical, as well as admission to the intensive care unit (ICU) were also captured.

In addition, information on in-hospital complications, duration of hospital stays, functional status at discharge, and mortality outcomes was recorded for each patient.

2.7. Outcome Measures

The primary outcome was mortality during hospitalization. Secondary outcomes included neurological status, functional outcome at discharge, and occurrence of complications.

2.8. Data Analysis

Data were entered and analyzed using Statistical Package for the Social Sciences (SPSS) version 25.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize variables. Categorical variables were presented as frequencies and percentages. Continuous variables were expressed as means ± standard deviation. Multivariate binary logistic regression analysis was performed to identify independent predictors of mortality. Variables with clinical relevance and those with $p < 0.20$ on bivariate analysis were included in the model. Results were presented as adjusted odds ratios (aORs) with 95% confidence intervals (CIs). A p-value < 0.05 was considered statistically significant.

2.9. Ethical Considerations

Ethical approval for the study was obtained from the Ethics and Research Committee of the institution. Informed consent was obtained from patients or their caregivers where applicable. Patient confidentiality was maintained throughout the study by anonymizing all data and ensuring secure data handling.

2.10. Study Limitations

The study has some limitations that should be considered when interpreting the findings. Being a single-center hospital-based study with a relatively small sample size, the results may not be fully generalizable to other settings. The study design may also be subject to selection bias, as it included only patients who presented to the hospital, thereby excluding those who died before arrival or did not seek care.

In addition, the relatively small sample size may have limited the statistical power of the analysis, particularly in identifying predictors of mortality. Delayed presentation and the lack of structured pre-hospital care in many cases may also have influenced the severity of clinical presentation and outcomes observed.

3. Results

A total of 43 adult patients with cervical spinal cord injury were studied.

3.1. Socio-demographic Characteristics

The highest proportion of patients was in the 18–30 years age group (27.9%), followed by those aged 31-40 years (23.3%) (Table 1). The mean age distribution showed a gradual decline with increasing age, with only 13.9% of patients older than 60 years. There was a marked male predominance, as 31 patients (72.1%) were male, giving a male-to-female ratio of approximately 2.6:1.

Most patients were married (48.8%), while 41.9% were single. In terms of occupation, artisans (23.3%) and students (20.9%) constituted the largest groups, followed by civil servants (18.6%) and traders (16.3%). Regarding educational status, the majority had at least secondary education, with 39.5% having secondary and 30.2% having tertiary education, while 11.7% had no formal education.

3.2. Injury Characteristics

Road traffic accidents (RTAs) were the leading cause of injury, accounting for 65.1% of cases (Table 2). Falls from height contributed 16.3%, while other causes such as assault and sports injuries were relatively uncommon. Among RTA cases, motorcycle-related injuries predominated (53.5%), followed by car crashes (32.6%) and pedestrian injuries (13.9%).

The timing of presentation revealed delays in many cases, with only 14.0% presenting within 6 hours of injury. The majority presented between 6–24 hours (34.9%), while 51.2% presented after 24 hours.

Transportation to hospital was mainly via private vehicles (46.5%) and public transport (34.9%), whereas ambulance use was notably low (11.6%). Furthermore, 67.4% of patients did not receive any form of pre-hospital care.

3.3. Clinical Presentation

At presentation, most patients were fully conscious (69.8%), while 18.6% were drowsy and 11.6% were unconscious (Table 3).

The most common presenting symptom was neck pain (81.4%), followed by lower limb weakness (74.4%) and upper limb weakness (65.1%). A substantial proportion of patients presented with severe neurological deficits, including quadriparesis (46.5%) and quadriplegia (41.9%). Sensory loss was observed in 60.5% of patients.

Autonomic dysfunction was also frequent, with bladder dysfunction in 51.2% and bowel dysfunction in 41.9%. Respiratory difficulty was noted in 20.9% of patients.

Overall, combined motor and sensory deficits (74.4%) were the most common neurological pattern. Reflex abnormalities were also observed, with hyperreflexia (34.9%) and hyporeflexia (27.9%) being the most frequent findings. Spinal shock was present in 44.2% of patients at presentation.

3.4. Injury Level, Severity, Radiological Findings and Management

The most commonly affected level of injury was C5-C6 (41.9%), followed by C3-C4 (25.6%), while upper cervical injuries (C1-C2) accounted for 11.6% of cases (Table 4).

Based on the ASIA impairment scale, complete injuries (ASIA A) constituted 32.5% of cases, while varying degrees of incomplete injuries were observed in the remaining patients.

In terms of imaging, CT scan was the most frequently used modality (46.5%), either alone or in combination with MRI. Radiologically, vertebral fractures (67.4%) and cord compression (46.5%) were the most common findings. Dislocations and subluxations were less frequent.

Regarding management, the majority of patients (60.5%) were managed conservatively, while 39.5% underwent surgical intervention. About one-third (34.9%) required admission to the intensive care unit.

3.5. Complications and Outcome

The most common complication observed was pressure sores (39.5%), followed by urinary tract infections (27.9%) and respiratory complications (23.3%) (Table 5). Deep vein thrombosis was relatively uncommon (9.3%).

At discharge, 44.2% of patients showed clinical improvement, while 25.6% had no improvement and 11.6% deteriorated. The overall mortality rate was 18.6%.

In terms of functional status, only 23.3% of patients were independent at discharge, whereas 41.9% were dependent on assistance and 34.9% were wheelchair-bound. The mean duration of hospital stay was 18.6 ± 7.4 days.

3.6. Predictors of Mortality

Multivariate logistic regression analysis identified several independent predictors of mortality. Patients who presented more than 24 hours after injury had significantly higher odds of death (aOR = 3.76, p = 0.048) as seen in Table 6.

The strongest predictor of mortality was complete spinal cord injury (ASIA A), which increased the odds of death nearly sevenfold (aOR = 6.85, p = 0.006). Similarly, upper cervical injuries (C1–C4) were associated with significantly higher mortality (aOR = 4.92, p = 0.019).

Respiratory difficulty at presentation was also a significant predictor, with affected patients having over five times higher odds of death (aOR = 5.63, p = 0.014).

Although ICU admission and age >50 years were associated with increased odds of mortality, these did not reach statistical significance. Male sex was also not significantly associated with mortality.

3.7. Summary of Key Findings

Overall, cervical spinal cord injury in this cohort predominantly affected young males, was mainly due to road

traffic accidents, and commonly presented with severe neurological deficits. A significant proportion of patients experienced delayed presentation and lack of pre-hospital care. Mortality was strongly associated with injury severity, higher cervical level involvement, delayed presentation, and respiratory compromise.

Table 1: Socio-demographic Characteristics of Patients (n = 43)

Variable	Category	Frequency (n)	Percentage (%)
Age group	18-30	12	27.9
	31-40	10	23.3
	41-50	8	18.6
	51-60	7	16.3
	>60	6	13.9
Sex	Male	31	72.1
	Female	12	27.9
Marital status	Single	18	41.9
	Married	21	48.8
	Divorced/Widowed	4	9.3
Occupation	Student	9	20.9
	Civil servants	8	18.6
	Artisan	10	23.3
	Trader	7	16.3
	Farmer	4	9.3
	Unemployed	5	11.6
Educational level	No formal education	5	11.7
	Primary	8	18.6
	Secondary	17	39.5
	Tertiary	13	30.2

Table 2: Injury Characteristics (n = 43)

Variable	Category	Frequency	Percentage (%)
Mechanism of injury	Road traffic accident	28	65.1
	Fall from height	7	16.3
	Fall (same level)	4	9.3
	Assault	2	4.7
	Sports	1	2.3
	Others	1	2.3
Type of RTA	Motorcycle	23	53.5
	Motor vehicle	14	32.6
	Pedestrian	6	13.9
Time to presentation	< 6 hours	6	14.0
	6-24 hours	15	34.9
	1-3 days	12	27.9
	> 3 days	10	23.2
Mode of transport	Ambulance	5	11.6
	Private vehicle	20	46.5
	Public transport	15	34.9
	Others	3	7.0
Pre-hospital care	Yes	14	32.6
	No	29	67.4

Table 3: Clinical Presentation of Cervical Spinal Cord Injury (n = 43)

Variable	Category	Frequency	Percentage (%)
Level of consciousness	Alert	30	69.8
	Drowsy	8	18.6
	Unconscious	5	11.6
Presenting symptoms*	Neck pain	35	81.4
	Upper limb weakness	28	65.1
	Lower limb weakness	32	74.4
	Quadriplegia	18	41.9
	Quadriparesis	20	46.5
	Sensory loss	26	60.5
	Respiratory difficulty	9	20.9
	Bladder dysfunction	22	51.2
	Bowel dysfunction	18	41.9
Neurological deficit	Motor only	7	16.3
	Sensory only	4	9.3
	Both	32	74.4
Reflexes	Normal	10	23.2
	Hyperreflexia	15	34.9
	Hyporeflexia	12	27.9
	Areflexia	6	14.0
Spinal shock	Yes	19	44.2
	No	24	55.8

*Multiple responses are allowed

Table 4: Injury Level, Severity, Radiological Findings and Management (n = 43)

Variable	Category	Frequency	Percentage (%)
Level of injury	C1-C2	5	11.6
	C3-C4	11	25.6
	C5-C6	18	41.9
	C7-T1	9	20.9
ASIA Impairment scale	A	14	32.5
	B	6	13.9
	C	10	23.3
	D	11	25.6
	E	2	4.7
Imaging modality	X-ray only	6	13.9
	CT scan	20	46.5
	MRI	10	23.3
	Combined**	7	16.3
Radiological findings*	Fracture	29	67.4
	Dislocation	9	20.9
	Subluxation	5	11.6
	Cord compression	20	46.5
	Disc herniation	7	16.3
	Normal	2	34.7
Treatment modality	Conservative	26	60.5
	Surgical	17	39.5
ICU admission	Yes	15	34.9
	No	28	65.1

*Multiple responses allowed.

**Any combination of CT, MRI and X-ray

Table 5: Complications and Outcome (n = 43)

Variable	Category	Frequency	Percentages (%)
Complications	Pressure sores	17	39.5
	Respiratory complications	10	23.3
	Urinary tract infection	12	27.9
	Deep vein thrombosis	4	9.3
Outcome at discharge	Improved	19	44.2
	No improvement	11	25.6
	Deteriorated	5	11.6
	Died	8	18.6
Functional status	Independent	10	23.2
	Dependent	18	41.9
	Wheelchair-bound	15	34.9
Mean hospital stay	18.6 ± 7.4 days		

Table 6: Logistic Regression Analysis of Predictors of Mortality (n = 43)

Variable	Adjusted OR	95% CI	p-value
Age > 50	2.41	0.68-8.52	0.172
Male sex	1.32	0.29-5.94	0.718
Presentation >24 hours	3.76	1.01-13.92	**0.048**
ASIA A	6.85	1.72-27.24	**0.006**
Upper cervical injury	4.92	1.29-18.73	**0.019**
Respiratory difficulty	5.63	1.41-22.45	**0.014**
ICU admission	3.18	0.88-11.46	0.078

4. Discussion

This study highlights important patterns in the epidemiology, clinical presentation, and outcomes of cervical spinal cord injury in a Nigerian setting, with findings largely consistent with both local and global literature.

4.1. Demographic Characteristics

The predominance of young adults and males observed in this study aligns with findings from previous studies in Nigeria and elsewhere [5, 8, 9]. Uche et al. in their study in Enugu, Nigeria reported a predominance of males with male to female ratio of 3.15:1. They also reported that 52.6% of the patients with

cervical spine injury were in the age group 21-40 years [13]. In a similar study, Adigun et al. in Ibadan, Nigeria reported a male to female ratio of 3.57: 1 involvement in cervical spine injury with a mean age of 38.2 ± 16.16 years [14]. Also, in a study from Egypt, El-beshbeshy et al. found that most of the patients in a cohort with cervical spine injury were males (85.8%), and the most common age group was from 20 to < 40 years (39.0%) [15]. These show that males are more frequently involved in high-risk activities such as driving and manual labor, which predisposes them to traumatic injuries. The concentration of cases within the economically productive age group underscores the significant socioeconomic burden associated with spinal cord injury [6, 16].

4.2. Mechanism of Injury

Road traffic accidents were the leading cause of injury in this study, accounting for the majority of cases. This finding is consistent with reports from various studies in our environment and other LMICs, where RTAs remain the predominant cause of spinal cord injury [1, 7, 10]. In their study, Uche et al. reported about 76.4% of cervical spine injury were due to motor vehicular accidents of which 26.2% were due to motorcycle accidents [13]. Similarly, Zuckerman et al. reported 45.5% of cases of cervical spine injury were due to motor vehicle and motorcycle accidents; with pedestrian involvement, this increased to 56.4% [17]. The prominence of motorcycle-related injuries in present study reflects the widespread use of motorcycles as a means of transportation in many Nigerian communities. In contrast, falls are increasingly reported as the leading cause in high-income countries due to an aging population [3, 18].

4.3. Clinical Presentation

The clinical spectrum observed in this study, including neck pain, limb weakness, quadriparesis, and quadriplegia, is consistent with the known pathophysiology of cervical spinal cord injury [4]. The high prevalence of combined motor and sensory deficits and spinal shock reflects the severity of injuries at presentation. Similar findings have been reported in other previous studies, where late presentation contributes to more severe neurological impairment [11, 19]. Autonomic dysfunction, including bladder and bowel impairment, was also common in this study, reflecting the extensive neurological involvement typical of cervical injuries. Respiratory difficulty, observed in a significant proportion of patients, is a well-recognized complication of high cervical injury and a major determinant of mortality [20].

4.4. Delay in Presentation and Pre-hospital Care

A significant proportion of patients in this study presented more than 24 hours after injury, highlighting major gaps in emergency response systems. Poor access to ambulance services and reliance on informal transportation methods contribute to delays and increase the risk of secondary spinal cord injury [21]. Similar challenges have been documented across sub-Saharan Africa, where organized pre-hospital care systems are often lacking [1, 22].

4.5. Injury Severity and Radiological Findings

The predominance of injuries at the C5–C6 level observed in this study is consistent with the biomechanical vulnerability of the lower cervical spine [4]. However, upper cervical injuries (C1–C4), although less frequent, were associated with worse outcomes, particularly due to respiratory compromise.

The proportion of patients with complete injury (ASIA A) observed in this study is consistent with findings from earlier Nigerian studies as well as reports from other regions [9, 11]. Uche et al. reported that 60% of patients with cervical spine injury were classified as ASIA A, while El-Beshbeshy et al. documented a prevalence of 28.8% among similar patients [13, 15]. In contrast, studies from high-income countries tend to report lower rates of complete injury, a difference that may be attributed to earlier intervention and more advanced trauma care system [14, 18].

4.6. Complications and Outcomes

Pressure sores, urinary tract infections, and respiratory complications were the most common complications observed in the present study. This is consistent with previous reports from similar studies [23, 24]. These complications significantly contribute to prolonged hospital stay and increased morbidity.

The mortality rate observed in this study is comparable to reports from similar settings but remains higher than those reported in developed countries [16, 25]. This disparity may reflect differences in critical care capacity, access to ventilatory support, and rehabilitation services.

4.7. Predictors of Mortality

This study demonstrated that complete spinal cord injury (ASIA A), involvement of the upper cervical spine, presence of respiratory compromise, and delayed presentation were independent predictors of mortality. These findings align with existing literature, which consistently identifies injury severity and anatomical level as major determinants of patient outcomes. Previous reports have similarly emphasized the prognostic significance of these factors [20, 25, 26]. Notably, Zuckerman et al. found that patients with complete injuries

(ASIA A) had more than an eleven-fold increased risk of mortality compared to those with incomplete or preserved neurological function [17].

Respiratory compromise is particularly critical in cervical spinal cord injury due to involvement of the phrenic nerve (C3-C5), explaining its strong association with mortality [20]. Delayed presentation further exacerbates secondary injury processes, leading to poorer outcomes [21].

4.8. Implications for Practice

The findings of this study emphasize the need for improved road safety enforcement, development of structured pre-hospital care systems, early referral and prompt intervention and strengthening of critical care and rehabilitation services.

Addressing these factors is essential to reduce the burden of cervical spinal cord injury in Nigeria and similar settings.

5. Conclusion

Cervical spinal cord injury in Ado-Ekiti predominantly affects young adult males and is largely attributable to road traffic accidents, particularly those involving motorcycles. The clinical presentation is often severe, with a high burden of neurological deficits, including quadriparesis and quadriplegia, reflecting significant spinal cord involvement at the time of presentation.

A substantial proportion of patients present late to hospital and without pre-hospital care, factors that contribute to worsening neurological injury and poor outcomes. The study further demonstrates that mortality is strongly associated with complete spinal cord injury, upper cervical level involvement, respiratory compromise, and delayed presentation, highlighting the critical importance of early recognition and timely intervention.

Overall outcomes remain suboptimal, with considerable rates of complications, disability, and mortality, underscoring gaps in trauma care, critical care support, and rehabilitation services within the setting.

There is an urgent need to strengthen road safety measures, develop effective pre-hospital and emergency response systems, and improve access to specialized care and rehabilitation services. Addressing these challenges is essential to reducing the burden of cervical spinal cord injury and improving patient outcomes in Nigeria and similar resource-limited environments.

Compliance with ethical standards

Author contributions

The author was solely responsible for the conception and design of the study and drafting of the manuscript. The author conducted data collection, patient evaluation and clinical follow-up.

Acknowledgements

The author acknowledges the support of the medical, nursing, and records staff of the Adult Accident and Emergency Department, Surgical wards, Intensive Care Unit, and Neurosurgical Outpatient Clinic of the institution where the study was conducted. Appreciation is also extended to the caregivers of patients that participated.

Ethical approval statement

Ethical approval was obtained from the Hospital Research and Ethics Committee prior to commencement of the study. The study was carried out in accordance with the ethical standards of the institutional research committee and the principles of the Declaration of Helsinki.

Conflict of Interest Statement

The author declares that there are no conflicts of interest regarding the publication of this article.

Funding Statement

This research received no external funding.

Data Availability Statement

The datasets generated and analyzed during the study are available from the corresponding author upon reasonable request.

United Nations Declaration of Human Rights

The author confirms that he accepts and agrees with the UN's Declaration of Human Rights.

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