

## VISUAL IMPAIRMENT AS A CAUSE OF FRACTURES IN ELDERLY INDIVIDUALS: A CROSS-SECTIONAL OBSERVATIONAL STUDY

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### Abstract

**Background:** Visual impairment is a significant but underrecognized risk factor for fractures among elderly individuals. Age-related ocular conditions, including cataracts, macular degeneration, glaucoma, and diabetic retinopathy, can impair spatial awareness, depth perception, and balance, increasing the likelihood of falls and subsequent fractures. This study examines the relationship between visual impairment and fracture risk in individuals aged 50 years and above. **Materials and Methods:** A cross-sectional observational study was conducted among 100 elderly patients admitted with fractures at a government hospital. Detailed ophthalmic evaluations, including slit-lamp examinations and visual acuity assessments, were performed. Patients were categorized based on visual acuity levels, and the types of fractures sustained were recorded. Statistical analysis was conducted using SPSS 27.0, with p-values <0.05 considered significant. **Result:** The mean age of participants was 61.5 years (SD = 3.5). The most common causes of visual impairment were cataracts (35%), age-related macular degeneration (25%), and glaucoma (15%). Hip fractures were the most prevalent (50%), followed by vertebral compression fractures (30%) and wrist fractures (20%). A significant correlation was observed between visual impairment severity and fracture occurrence ( $p < 0.05$ ). Profoundly visually impaired individuals had the highest risk of hip fractures (18%), while those with normal vision had the lowest (8%). **Conclusion:** Visual impairment is a critical yet modifiable risk factor for fractures in the elderly. Routine ophthalmic screening, early cataract surgery, and fall-prevention interventions may reduce fracture incidence in this vulnerable population.

## INTRODUCTION

Visual impairment is a significant yet often overlooked contributor to falls and fractures among elderly individuals.<sup>[1]</sup> With advancing age, deterioration in visual function including reduced visual acuity, contrast sensitivity, depth perception, and visual field loss becomes increasingly prevalent.<sup>[2,3]</sup> These impairments compromise spatial awareness, balance control, and the ability to detect obstacles, leading to a higher risk of falls and subsequent fractures.<sup>[4]</sup> Studies suggest that older adults with visual impairments are nearly twice as likely to experience falls compared to those with normal vision, making vision loss a crucial factor in fracture prevention strategies.<sup>[5]</sup>

The primary causes of visual impairment in the elderly include age-related macular degeneration (AMD), cataracts, glaucoma, and diabetic

retinopathy. AMD leads to central vision loss, significantly affecting mobility and daily activities.<sup>[6]</sup> Cataracts cause lens opacity, resulting in blurred vision and increased sensitivity to glare. Glaucoma, often asymptomatic in its early stages, leads to progressive peripheral vision loss, which impairs navigation and increases fall risk.<sup>[7]</sup> Diabetic retinopathy, associated with long-standing diabetes, causes retinal damage that can severely compromise visual function.<sup>[7]</sup>

Fractures in the elderly, particularly hip fractures, are associated with high morbidity, reduced functional independence, and increased mortality.<sup>6</sup> Osteoporosis, a condition characterized by decreased bone mineral density, further exacerbates fracture risk. Given the synergistic impact of vision loss and osteoporosis, visually impaired elderly individuals are at a substantially heightened risk of sustaining fractures.

Understanding the interplay between visual impairment and fractures is essential for designing effective intervention strategies. This study aims to evaluate the ophthalmic status of elderly patients with fractures and analyze the relationship between visual impairment severity and fracture occurrence, thereby highlighting the need for vision screening and fall prevention programs in geriatric care.

## MATERIALS AND METHODS

**Study Design:** This cross-sectional observational study was conducted over an 18-month period, from June 2023 to December 2024, to evaluate the association between visual impairment and fracture occurrence in individuals aged 50 years and above. The study included a comprehensive ophthalmic examination and an assessment of fracture patterns to determine the impact of vision loss on fall-related injuries.

**Study Setting and Population:** The study was carried out at Government Medical college and General Hospital, Siddipet, among patients admitted to the orthopedic ward with fractures. The study population included 100 elderly individuals aged 50 years and above who met the inclusion criteria.

### Inclusion Criteria

Individuals aged 50 years and above.  
Patients who sustained fractures due to falls.  
Patients willing to undergo ophthalmic examination and participate in the study.

### Exclusion Criteria

Individuals below 50 years of age.  
Patients with fractures caused by road traffic accidents (RTA) or other high-impact trauma.  
Patients unwilling to participate in the study.

### Sample Size

The sample size was calculated using a prevalence-based formula:

$$n = (1.96)^2 \times p \times q / d^2$$

where p is the prevalence of visual impairment from previous studies, q = (1 - p), and d = 0.05.

With an expected 10% non-response rate, the final sample size was determined to be 100 participants.

**Data Collection:** Eligible patients were subjected to a detailed ophthalmic examination in the Department of Ophthalmology.

Visual acuity assessment was performed using a Snellen chart, and patients were classified based on the severity of visual impairment:

Normal vision (20/20 or better)  
Mild visual impairment (20/30 - 20/60)  
Moderate visual impairment (20/70 - 20/160)  
Severe visual impairment (20/200 - 20/400)  
Profound visual impairment / Blindness (worse than 20/400)

A slit-lamp examination was conducted to evaluate anterior segment abnormalities (cataracts, corneal diseases).

Fundus examination using direct and indirect ophthalmoscopy was performed to identify posterior segment pathology (AMD, diabetic retinopathy, glaucoma). The type and location of fractures were documented based on radiological reports and clinical assessment.

**Statistical Analysis:** Data was entered into MS Excel and analyzed using SPSS version 27.0. Descriptive statistics were expressed as mean  $\pm$  standard deviation (SD) for continuous variables and percentages (%) for categorical variables. The Chi-square ( $\chi^2$ ) test was used to compare proportions and establish associations between visual acuity and fracture type. Relative risk (RR) with 95% confidence intervals (CI) was calculated to assess the strength of association. A p-value of <0.05 was considered statistically significant.

**Ethical Considerations:** Ethical approval was obtained from the Institutional Ethics Committee of Government Medical college and General Hospital, Siddipet, before commencing the study. Informed written consent was obtained from all participants before enrollment. Confidentiality of patient data was maintained throughout the study.

## RESULTS

This study evaluated the association between visual impairment and fractures in elderly individuals aged 50 years and above. A total of 100 participants were included, and their socio-demographic characteristics, visual impairment status, and fracture patterns were analyzed.

**Socio-Demographic Profile:** The mean age of the participants was 61.5 years (SD = 3.5), with a range of 51–82 years. The distribution of participants across different age groups is shown in Table 1. The highest proportion of individuals belonged to the 61–70 age group (30%), followed by the 51–60 and 71–80 age groups (25% each), while 20% were aged 81 and above.

**Table 1: Socio-Demographic Details of the Study Population.**

Age Group	Number of People	Min Age	Max Age	Mean Age	Standard Deviation (SD)
51 - 60	25	51	60	55.5	2.9
61 - 70	30	61	70	65.5	2.8
71 - 80	25	71	80	75.5	2.7
81 - 82	20	81	82	81.5	0.6

The study population comprised 55% females and 45% males [Table 2]. The gender distribution indicates a slightly higher prevalence of fractures

among females, which may be attributable to the increased risk of osteoporosis and postmenopausal bone density loss.

**Table 2: Gender Distribution of Study Participants**

Gender	Number	Percentage
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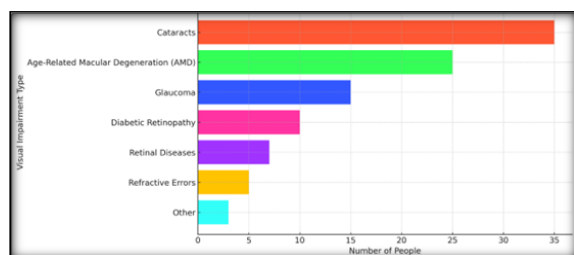
Males	45	45%
Females	55	55%
Total	100	100%

**Causes of Visual Impairment:** The leading cause of visual impairment among the study participants was cataracts (35%), followed by age-related macular degeneration (AMD) (25%), glaucoma (15%), and

diabetic retinopathy (10%). Retinal diseases and refractive errors accounted for 7% and 5% of cases, respectively, while 3% of participants had other ocular conditions [Table 3 & Figure 1].

**Table 3: Major Causes of Visual Impairment Among Study Participants**

Visual Impairment	Number of People (out of 100)
Cataracts	35
Age-Related Macular Degeneration (AMD)	25
Glaucoma	15
Diabetic Retinopathy	10
Retinal Diseases	7
Refractive Errors	5
Other	3

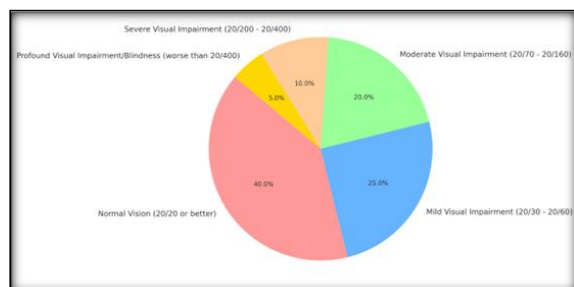


**Figure No:1. Major Causes of Visual Impairment Among Study Participants**

**Visual Acuity and Its Distribution:** Visual acuity was assessed for all participants, revealing that 40% had normal vision (20/20 or better), while 25% had mild visual impairment (20/30–20/60). Moderate visual impairment (20/70–20/160) was noted in 20% of participants, and severe visual impairment (20/200–20/400) was observed in 10%. Additionally, 5% of participants were classified as profoundly visually impaired or blind (worse than 20/400) [Table 4 & Figure 2].

**Table 4: Visual Acuity Distribution Among Study Participants**

Visual Acuity	Number of People	Percentage
Normal Vision (20/20 or better)	40	40%
Mild Visual Impairment (20/30 - 20/60)	25	25%
Moderate Visual Impairment (20/70 - 20/160)	20	20%
Severe Visual Impairment (20/200 - 20/400)	10	10%
Profound Visual Impairment/Blindness (worse than 20/400)	5	5%

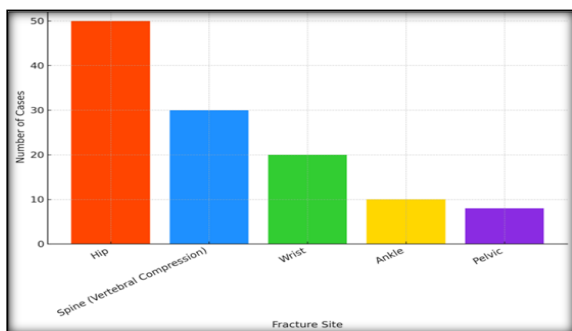


**Figure 2: Visual Acuity Distribution Among Study Participants**

**Fracture Distribution:** Among the study population, hip fractures were the most common (50%), followed by vertebral compression fractures (30%), wrist fractures (20%), ankle fractures (10%), and pelvic fractures (8%) (Table 5 & Figure No:3). The high proportion of hip fractures aligns with previous studies indicating that visual impairment significantly increases the risk of falls leading to hip injuries.

**Table 5: Distribution of Fractures Among Study Participants**

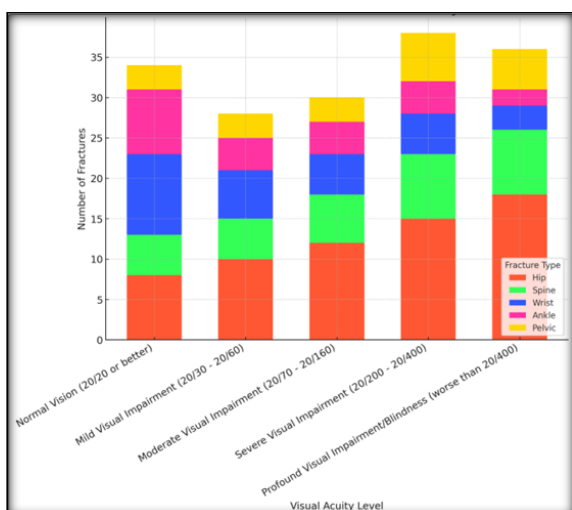
Fracture Site	Number of Cases	Percentage
Hip	50	50%
Spine (Vertebral Compression)	30	30%
Wrist	20	20%
Ankle	10	10%
Pelvic	8	8%



**Figure No:3. Distribution of Fractures Among Study Participants**

**Table 6: Fracture Distribution Based on Visual Acuity Levels**

Visual Acuity Level	Hip	Spine	Wrist	Ankle	Pelvic
Normal Vision (20/20 or better)	8	5	10	8	3
Mild Visual Impairment (20/30 - 20/60)	10	5	6	4	3
Moderate Visual Impairment (20/70 - 20/160)	12	6	5	4	3
Severe Visual Impairment (20/200 - 20/400)	15	8	5	4	6
Profound Visual Impairment/Blindness (worse than 20/400)	18	8	3	2	5



**Figure 4: Fracture Distribution Based on Visual Acuity Levels**

## DISCUSSION

This study examined the association between visual impairment and fractures in elderly individuals, emphasizing vision loss as a key risk factor for falls. The findings demonstrate a significant relationship between the severity of visual impairment and the likelihood of sustaining fractures, particularly hip fractures. These results align with previous research indicating that older adults with visual impairment have an increased risk of falls and related injuries (Hamedani et al 2019; Testa et al 2022).<sup>[12,13]</sup>

**Visual Impairment as a Risk Factor for Falls and Fractures:** Among the study population, 60% of individuals had some degree of visual impairment, with cataracts (35%) and age-related macular degeneration (25%) being the most common causes [Table 3]. These conditions impair contrast sensitivity, depth perception, and spatial awareness, making it difficult for individuals to navigate their environment safely. Glaucoma and diabetic

### Association Between Visual Acuity and Fracture Site:

A notable correlation was observed between the severity of visual impairment and the type of fractures sustained. Participants with profound visual impairment or blindness had the highest proportion of hip fractures (18 out of 50 cases), followed by those with severe visual impairment (15 cases). Conversely, individuals with normal vision experienced relatively fewer hip fractures (8 cases). Similar trends were observed for spinal, wrist, ankle, and pelvic fractures [Table 6 & Figure 4].

retinopathy, which accounted for 15% and 10% of cases, respectively, contribute to progressive vision loss, affecting peripheral vision and increasing fall risk. These findings are consistent with previous studies that have identified visual impairment as a major contributor to falls and fractures in elderly individuals (Al-Namaeh, 2022; Şahin et al, 2022).<sup>[8,9]</sup>

**Fracture Patterns and Visual Impairment:** Hip fractures were the most frequently observed injuries, affecting 50% of the study population, followed by vertebral compression fractures (30%) and wrist fractures (20%) [Table 5]. A strong correlation was observed between visual acuity levels and fracture type [Table 6]. Patients with severe visual impairment (20/200 - 20/400) and profound visual impairment (worse than 20/400) had a significantly higher prevalence of hip and spine fractures, highlighting the impact of vision loss on balance and mobility. These results are in agreement with findings from previous studies, which reported that elderly individuals with visual impairment are at an increased risk of falls, often leading to hip fractures (Testa et al, 2022; de Boer et al, 2004).<sup>[12,14]</sup>

Previous research suggests that visual impairment increases fall risk by up to 2.4 times, with hip fractures being a major consequence (Shuyi et al, 2022).<sup>[10]</sup> The impairment of depth perception, contrast sensitivity, and peripheral vision due to conditions like AMD and glaucoma contributes significantly to fall-related injuries.

**Gender Differences and Visual Impairment:** The gender distribution in this study showed that 55% of the participants were female [Table 2]. This finding is consistent with prior research indicating that women are at greater risk of osteoporosis-related fractures, particularly hip fractures, due to postmenopausal bone loss (Khandekar et al, 2010).<sup>[11]</sup> Given that women also have a higher prevalence of cataracts and AMD, the combined effect of poor vision and reduced bone density further increases their vulnerability to fractures. Previous studies have

reported similar patterns, highlighting that postmenopausal women with visual impairment are more likely to experience fractures compared to their male counterparts (Hamedani et al, 2019).<sup>[13]</sup>

**Role of Hypertension and Comorbidities:** A significant proportion (60%) of the study participants had hypertension, which has been linked to impaired retinal circulation and vision deterioration. Additionally, conditions such as diabetes, cardiovascular diseases, and neurological disorders can further contribute to visual impairment and instability. These comorbidities must be considered in fall prevention strategies for elderly individuals (de Boer et al., 2004). Previous research has demonstrated that elderly individuals with a combination of visual impairment and chronic illnesses are at an even greater risk of falls and fractures (Testa et al, 2022).<sup>[12]</sup>

**Clinical and Public Health Implications:** The results of this study underscore the importance of early ophthalmic screening and intervention in preventing fractures among the elderly. Key recommendations include: Regular vision assessments to detect early signs of cataracts, glaucoma, and retinal diseases (Al-Namaeh, 2022).<sup>[8]</sup> Early cataract surgery, which has been shown to significantly reduce fall-related fractures (Testa et al, 2022).<sup>[12]</sup> Fall-prevention strategies, such as environmental modifications (improved lighting, removal of hazards), mobility aids, and balance training programs (Şahin et al, 2022).<sup>[9]</sup> Osteoporosis screening and management, particularly in visually impaired individuals, to reduce fracture severity (Khandekar et al, 2010).<sup>[11]</sup>

#### Limitations and Future Directions

While this study provides valuable insights into the link between visual impairment and fractures, several limitations should be acknowledged: The study was cross-sectional, limiting causal inferences. Longitudinal studies are needed to track the impact of vision loss over time. The sample size was limited to 100 participants from a single hospital, which may affect generalizability. Other fall-related risk factors, such as cognitive impairment and medication use, were not extensively analyzed. Future studies should incorporate a multi-factorial risk assessment approach.

## CONCLUSION

This study demonstrates a significant association between visual impairment and fracture risk in elderly individuals. Cataracts (35%) and age-related macular degeneration (25%) were the most common causes of vision loss. Hip fractures (50%) were the most frequently observed injuries, with a higher prevalence in individuals with severe (15%) and profound visual impairment (18%). A statistically significant correlation was found between worsening visual acuity and increased fracture risk ( $p < 0.05$ ). These findings highlight the need for early

ophthalmic screening, timely cataract surgery, and fall-prevention interventions. Integrating vision care into geriatric health programs can reduce fractures, enhance mobility, and improve quality of life in elderly populations.

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