Original Article

# Tribal Odisha Eye Disease Study (TOES) Report # 9. Eye diseases and retinal disorders in an adult and elderly tribal community in Odisha, India - A community hospital-based study

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**Purpose:** To measure the proportion of people with major ophthalmic and retinal disorders in the tribal and non-tribal people presenting to a community eye hospital in an Indian state with a sizeable tribal population. **Methods:** Hospital-based cross-sectional retrospective study of all new adult patients, examined between September 2015 and June 2020. A tribal was defined as per the Indian ethnic classification. Blindness and visual impairment were defined as per the WHO standards. Diabetes and hypertension were defined as per Indian standards. The proportion of common ophthalmic and retinal disorders between the tribal and non-tribal community were compared. **Results:** This cohort consisted of 76,166 people (45.8%; $n$ = 34,869, tribal); 39.4% ($n$ = 29,989; non-tribal 23.6% and tribal 15.8%) people had ophthalmic disorders. In the examined people 2.3% were blind (higher in tribal community 4.7% versus 0.8%; $P < 0.001$) and 8.4% had moderate-to-severe visual impairment (higher in tribal community 14.4% versus 4.4%; $P < 0.001$). Refractive error (64.4%; higher in non-tribal community, 77.3% versus 44.6%, $P < 0.001$) and operable cataract (23.9%; higher in tribal community, 40.9% versus 11.8%, $P < 0.001$) were the principal ophthalmic disorders. Retinal disorders were higher in non-tribal people (5.9% vs. 2.9%; $P < 0.001$), but the tribal group had higher proportion of retinitis pigmentosa (20% vs. 6.4%; $P < 0.001$) and lower proportion of diabetic retinopathy (8% vs. 40.7%; $P < 0.001$). **Conclusion**: The health-seeking behavior of the tribal community in India is low. A tribal person in India apparently visits the hospital when vision is grossly affected. It calls for greater advocacy, increased access to healthcare, and a larger population-based study.

**Key words:** Diabetic retinopathy, India, Odisha, ophthalmic disorders, retinal diseases, retinitis pigmentosa, tribal community

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The indigenous community, called *tribal* in India, is a collection of families bearing a common name, sharing common culture, language, history, and occupation, living in isolation in hilly areas, away from the mainstream. The Indian state, Odisha, in the eastern part of India, is home to 9.7% of the tribal population. In the 2011 census, the tribal people in Odisha were 22.8% of the state's 41.9 million population,[1] and this exceeded 50% of the entire district population in 8 of 30 districts.[2] In general, the health indices of the tribal people are behind the non-tribal people. These are mostly related to poverty, illiteracy, lack of safe drinking water, improper sanitary conditions, steep terrain, malnutrition, poor maternal and child health services, superstition, and deforestation. Diseases like anemia, upper respiratory problems, malaria, gastrointestinal disorders including parasitic infection, micronutrient deficiency, and skin infection are common. Consumption of tobacco and alcohol is high; consanguineous marriage is a practiced custom, and life expectancy is lower than the national average.

Odisha is one of the eastern states in India, and Rayagada is one of Odisha's southern districts. [Fig. 1] The tribal population of the Rayagada district is 56.0%.[3] The LV Prasad Eye Institute has established one Community Eye Hospital (in August 2015; a Community Eye Hospital serves 500,000 people) and 5 Vision Centers (between 2018-2020; each Vision Center serves a population of 50,000 people). [Fig. 1] The Community eye hospital offers a comprehensive out-patient and cataract-centric surgical service; the Vision center offers community screening, refraction, identifies common ocular disorders, and refers to the Community eye hospital.[4] Two of 5 Vision Centers in this district are in the tribal pockets.

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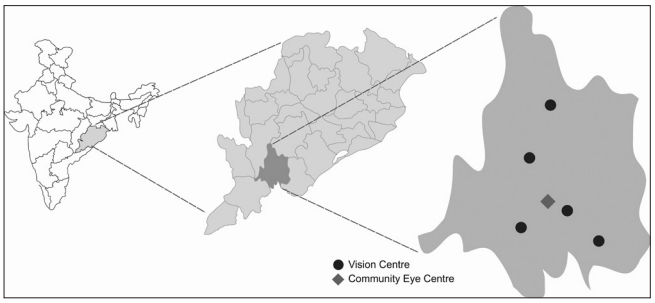


**Figure 1:** Study location in a tribal district of Odisha in the Indian map

## Methods

We analyzed the spectrum of eye disorders in adult and elderly people reporting to the hospital in the last 5 years. The information was retrieved from the hospital's electronic medical record (EMR) database. This cross-sectional retrospective study included all patients 18 years and older, examined between September 2015 and June 2020. The study was approved by the Institute Ethics Committee (2020-52-BHR-33) and adhered to the tenets of the Declaration of Helsinki. The data consisted of demography (age and gender) and ocular examination [presenting and best-corrected visual acuity, external eye examination using a slit-lamp, measurement of intraocular pressure (IOP), and dilated fundus examination/40° fundus image (Visuscout 100, Zeiss)]. The diagnosis of ophthalmic disorders was primarily based on clinical criteria, examined by a fellowship-trained comprehensive ophthalmologist. The entire cohort was divided into tribal (as per definition) and non-tribal populations from the consecutive data base from the EMR. This division was made at the time of registration though, this was reconfirmed with the help of staff from the local community and was primarily based on the family name and place of residence. Subjects with total cataract or corneal opacity preventing adequate retina evaluation were excluded from the analysis of retinal disorders. We used the Government issued ration card to identify an economically underprivileged person.

The ophthalmic disorders were divided into 6 broad categories: Refractive error, ocular surface disorder (chiefly pterygium), corneal opacity (all were non-trachomatous), cataract, glaucoma, and retinal diseases. Systemic history included people with known hypertension and diabetes; this was confirmed by measuring blood pressure and blood sugar and was defined per Indian guidelines. A fasting blood glucose ≥126 mg/dL or random blood sugar >140 mg/dL, systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg were considered confirmation of diabetes mellitus (DM) and hypertension respectively.[5,6] Pterygium was diagnosed by the presence of fleshy growth in the horizontal meridian with spread to cornea. Glaucoma was diagnosed by raised applanation intraocular pressure (>21 mm Hg) and an optic cup-to-disc ratio greater than 0.3. Cataract was diagnosed by slit-lamp confirmation of lens sclerosis/opacification after pupillary dilatation and proportionate reduction of distant vision. Cataract was graded as per the lens opacification classification system (LOCS III) grading system.[7] Distance vision impairment (VI) was classified as per the World Health Organization (WHO) definition as follows: Near-normal vision: ≥6/9; early VI: ≤6/12 to ≥6/18; moderate VI: <6/18 to ≥6/60; severe VI: <6/60 to ≥3/60; blind <3/60.[8]

The main retinal diseases included diabetic retinopathy (DR), retinitis pigmentosa (RP), retinal vascular occlusion (RVO), and age-related macular degeneration (AMD). The diagnostic signs on examination of the retina by slit-lamp biomicroscopy (using 78/90 D lens) and indirect ophthalmoscopy were posterior pole retinal hemorrhages, microaneurysms, new vessels, preretinal hemorrhages and exudates (for DR); segmental retinal hemorrhages, and engorged vessels (for retinal vein occlusion); posterior pole drusen and subfoveal scar/hemorrhage (for AMD); attenuated vessels, bony spicules, a pale optic disc in the event of progressive nyctalopia and manually assessed reduced visual field (for RP). Other conditions included central serous chorioretinopathy (CSCR, diagnosed by serous elevation at macula with or without subretinal fibrin, retinal pigment epithelial alteration, or pigment epithelial detachment), and rhegmatogenous retinal detachment (RRD, diagnosed by a visible/suspected retinal break and undulating retinal elevation).

### Statistics

All the data were entered in the Excel Spreadsheet (Microsoft Corp.) and analyzed using STATA-14 software at the end of the study. Demographic data were analyzed using descriptive statistics and were presented in percentage. The proportion of systemic disorders in the study population was counted from the entire cohort ($n$ = 76,166), and the community-specific proportion was counted from the people in the respective community (Tribal- 34,869 and non-tribal- 41,297). The proportion of ophthalmic disorders in the study population was counted from the entire cohort with the ophthalmic disorder ($n$ = 29,989), and the community-specific proportion was counted from the people in the respective community (Tribal- 12,035 and non-tribal- 17,954). Comparative data analysis between the tribal and non-tribal groups was done using Pearson's Chi square test, and a $P$ value <0.05 was considered significant.

## Results

In the study period, 76,166 patients aged 18 years or older were examined, and 45.8% ($n$ = 34,869) belonged to the tribal community. All economically underprivileged people that included the entire cohort of tribal patients were treated at no cost to them. In the entire cohort 39.4% ($n$ = 29,989) people had ophthalmic disorders and included 15.8% ($n$ = 12,035) tribal and 23.6% ($n$ = 17,954) non-tribal people. In the examined patients with ophthalmic disorders, 10.8% ($n$ = 3242) people had distance vision impairment with any ophthalmic disorders, which included 2.4% ($n$ = 718) blind and 8.4% ($n$ = 2524) with moderate to severe visual impairment (MSVI). In the tribal group with any ophthalmic disorder ($n$ = 12,035), 19.1% had distance visual impairment that included 4.7% ($n$ = 568) blind and 14.4% ($n$ = 1733) people had MSVI. In the non-tribal group with any ophthalmic disorder ($n$ = 17954), 5.2% ($n$ = 941) had distance visual impairment that included 0.8% ($n$ = 150) people blind and 4.4% ($n$ = 791) people with MSVI. The common ophthalmic disorders were refractive error and cataract; the refractive error was significantly higher in the non-tribal community, and cataract was significantly higher in the tribal community. [Table 1] Additionally, a larger proportion of people in the tribal community had blinding (VA < 3/60) cataract. The retina could

not be examined in 1.7% ($n$ = 1321, including 624 tribal) people due to media opacities such as advanced cataracts or corneal opacities. Thus, the retinal disorders (in 1418 people, 1.86%) were counted from 74,845 people and included 40,600 non-tribal and 34,245 tribal people. Among the retinal diseases, retinitis pigmentosa was significantly higher in the tribal community, and the presence of any DR was significantly higher in the non-tribal community. But there was no difference in DME between the tribal and non-tribal people with DR. [Table 1]. A statistically significant number of people from the non-tribal community had diabetes mellitus and hypertension.

## Discussion

Worldwide, the population of Indigenous people has been estimated at 300 million, representing approximately 5000 different cultures from more than 70 different countries.[9] United Nations defines the indigenous communities, peoples, and nations are those who, 'having a historical continuity with pre-invasion and pre-colonial societies that developed on their territories, consider themselves distinct from other sectors of the societies now prevailing in those territories, or parts of them.'[10] India is home to almost half the tribal population of

**Table 1: Proportion of selected systemic and ocular pathologies**

| Category | Disease subtype | Total $n$= , (%) | Tribal group $n$= , (%) [Age- mean±SD years | Non-tribal group $n$= (%) [Age-mean±SD years] | $P$, Significance of proportion of people affected between tribal and non-tribal group |
|---|---|---|---|---|---|
| Systemic disorder $n$=76 166 Tribal $n$=34 869 Non-tribal $n$=41 297 | DM | 3849 (5.0) | 285 (0.81%) [64.12±16.21] | 3564 (8.63%) [57.81±18.39] | <0.001* |
| | HTN | 5039 (6.6) | 910 (2.6%) [60.06±12.28] | 4129 (9.99%) [61.42±14.34] | <0.001* |
| Ophthalmic disorders. $n$=29 989 (39.4%) Tribal $n$=12 035 (15.8%) Non- tribal $n$=17 954 (23.6%) | | $n$=29,989 | $n$=12,035 | $n$=17,954 | |
| | Visual Impairment | Blind 718 (2.39%) | Blind 568 (4.71%) | Blind 150 (0.84%) | <0.001* |
| | | MSVI 2524 (8.41%) | MSVI 1733 (14.4%) | MSI 791 (4.4%) | <0.001* |
| | Refractive error | 19 311 (64.4) | 5372 (44.63%) [45.41±18.47] | 13 939 (77.63%) [37.92±15.82] | <0.001* |
| | Pterygium | 1677 (5.6) | 1084 (9%) [62.49±11.41] | 593 (3.3%) [47.37±13.04] | <0.001** |
| | Corneal Opacity | 211 (0.7) | 164 (1.36%) [43.45±22.57] | 47 (0.26%) [51.23±21.83] | <0.001** |
| | Cataract | 7058 (23.5) | 4934 (40.99%) [67.04±10.10] | 2124 (11.83%) [68.6±10.75] | <0.001** |
| | Glaucoma | 314 (0.1) | 130 (1.08%) [63±10.59] | 184 (1.53%) [60.55±9.61] | 0.644 |
| | Retina | 1418 (4.7) | 351 (2.91%) [45.03±24.32] | 1067 (5.94%) [49.73±25.44] | <0.001* |
| No clinically detectable six above mentioned ophthalmic disorder bilateral. $n$=46 177 (60.6%) | | | 22 834 (65.5%) | 23 343 (56.5%) | <0.001** |

| Category | Disease Subtype | Entire cohort $n$=1418 | Tribal community $n$=351 | Non-tribal community $n$=1067 | $P$, Significance of proportion of people affected between tribal and non-tribal group |
|---|---|---|---|---|---|
| Retinal disorders $n$=1418 Tribal. $n$=351 of 34,245 Non-tribal. $n$=1067 of 40 600 | RP | 138 (9.7%) | 70 (20.0%) | 68 (6.4%) | <0.001** |
| | AMD | 132 (9.3%) | 39 (11.1%) | 93 (8.7%) | 0.180 |
| | CSCR | 99 (7.0%) | 30 (8.5%) | 69 (6.5%) | 0.185 |
| | RRD | 83 (5.8%) | 25 (7.1%) | 58 (5.4%) | 0.243 |
| | Any DR | 462 (32.6%) | 28 (8.0%) | 434 (40.7%) | <0.001* |
| | DME in people with DR | 81 | 5 (17.8%) | 76 (17.5%) | 0.91 |
| | RVO | 83 (5.8%) | 18 (5.1%) | 65 (6.1%) | 0.505 |
| | #Other retinal disorders | 421 (29.7%) | 141 (40.2%) | 280 (26.2%) | <0.001** |

*Significantly higher in non-tribal people; **Significantly higher is tribal people. AMD=Age related macular degeneration, CSCR=Central Serous Chorioretinopathy, DM=Diabetes Mellites, DR=Diabetic retinopathy, RRD=Rhegmatogenous Retinal Detachment, RP=Retinitis pigmentosa, RVO=Retinal Venous Occlusion, HTN=Hypertension. #Otherretinaldisorders include Retinal vasculitis, posterior uveitis, uveal coloboma, macular hole, macular scar, epiretinal membrane, lattice retinal degeneration, retinal break without retinal detachment, choroidal neovascular membrane other than AMD, dystrophies other than RP, central retinal artery occlusion, retinal artery microaneurysm

the world, but there are no exclusive reports on eye diseases in the tribal community in India.[11]

This hospital-based study showed that the proportion of patients with refractive error and retinal diseases in the tribal population was less than the non-tribal population among those with ophthalmic disorders. The proportion of people with cataract, pterygium, and corneal opacity was higher in the tribal group. The first two could be related to their occupation (the tribal community is predominantly hunters and field workers with longer hours of exposure to direct sunlight). The tribal community also had a more blinding cataract. This indicates a lower health-seeking behavior for non-advanced eye diseases in tribal people. Among the retinal diseases, the prevalence of DR and RP showed a significant difference between the two groups. The lower incidence of diabetes (and DR) in the tribal community could be related to more outdoor activities and lifestyles. The incidence was lower than reported from the Indian rural population[12-16] and other indigenous communities.[17] It is not possible to speculate further in the absence of a population-based study. There was no significant difference in the proportion of people with DME, presumably also causing a reduction in vision. Hence it is probable that people considered seeking medical help only when their vision was affected. This assumption also explains why more people with RP reported to the hospital but did not explain the reasons for a higher proportion of people with RP, except for consanguineous marriage prevalent in this community.[18]

In addition to the retrospective analysis, the study limitations include not using any diagnostic equipment such as fluorescein angiography, optical coherence tomography, visual field analyzer, and electroretinography in confirming the clinical diagnosis of the retinal disorders. Additionally, this is not an age- and gender-matched study between the tribal and non-tribal patients. The strength of the study is that it is the first attempt to identifying retinal diseases in people from the tribal community in the Indian state of Odisha when the detection of cataract only is usually emphasized. These findings call for a larger population-based study to identify eye disorders in the tribal population for eye health program planning and appropriate health financing. An overall improvement in the health indices in India's tribal community also calls for administrative reforms and the empowerment of people in a missionary approach.

## Conclusion

The prevalence of various diseases in a tribal community differs from the non-tribal population. Earlier reports had examined refractive error and prevalence of cataract, but not on vitreoretinal disorders. In this first hospital-based study in the tribal dominant district, we documented a lower proportion of people with diabetic retinopathy and a higher proportion of people with retinitis pigmentosa in the tribal community.

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### Ethics approval

The study was approved by the ethics committee of LV Prasad eye institute, Odisha, India and adhered to the tenets of the declaration of Helsinki.

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### Conflicts of interest

There are no conflicts of interest.

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