

1. • Title page

FROM SKIN TO SIGHT: SEQUELAE IN HANSEN'S DISEASE

2. • Introduction

Hansen's disease or leprosy, is known as a chronic granulomatous bacterial infection caused by the obligate intracellular bacillus *Mycobacterium leprae*.⁽¹⁾ This entity primarily targets skin and peripheral nerves and its clinical presentation and histopathologic features are largely influenced by the patient's immune response. ⁽²⁾ The World Health Organization (WHO) identifies the key diagnostic criteria for leprosy as hypopigmented or erythematous macules with sensory loss, thickened peripheral nerves, and a positive skin biopsy. ^(1,3)

In Hansen's disease the musculoskeletal system is affected in most cases, with complications including deformities, fractures, and osteoporosis due to sensory loss from nerve damage. ⁽⁴⁾ Furthermore, patients may experience ocular involvement that can occur through direct infiltration or secondary to optic nerve damage, in particular, lagophthalmos, keratitis, and entropion are the most common ocular manifestations. ^(2,5)

Here, we present a case of a patient with Hansen's disease, highlighting not only the medical challenges associated with this complex condition but also the unique difficulties faced by healthcare professionals in developing countries such as Colombia. In these situations, managing such diseases is further complicated by the sociocultural factors that influence both diagnosis and timely treatment, making the approach a challenge.

3. • Case presentation with illustrations and figures

A 28-year-old male patient from a small town in Córdoba, Colombia, first sought ophthalmologic evaluation in February 2019, reporting a five-year history of progressive vision loss in both eyes (OU), predominantly affecting the right eye (OD). His vision had deteriorated to the point where he could only perceive light and shadows with OU, accompanied by sharp pain in both. He had delayed seeking medical help due to the belief that his vision loss was caused by witchcraft, a common belief in rural areas in Colombia. It was only when his last remaining functional eye began to lose vision, that he finally decided to seek medical assistance, even though he was convinced it was a curse.

The patient denied any significant medical history. During the systemic review, he reported nodular skin lesions on his forehead, ears, and extremities but denied other systemic symptoms, such as joint pain, respiratory issues, or trauma.

During the initial ophthalmic examination, the patient's visual acuity was hand motion in OU. The slit-lamp examination revealed OD with madarosis and phthisis bulbi; in the left eye (OS), there was madarosis, an inferotemporal corneal leukoma, mutton fat retro keratic precipitates, anterior and posterior inferotemporal synechiae of the iris, a marked anterior chamber flare, and the lens and posterior pole were unassessable.

Meanwhile, during the skin examination, the patient presented with multiple nodular and macular skin lesions of varying sizes, some exceeding 3 cm in diameter, showing mild hyperpigmentation and partial confluence in the frontal, auricular, and trunk areas. Additionally, papular hyperpigmented lesions were observed on the extremities, some displaying signs of lichenification. Given these findings, the patient was referred to the emergency department for further evaluation.

Given the need for targeted therapy and a differential diagnosis to rule out infectious, autoinflammatory, or neoplastic causes, laboratory tests were conducted, showing mildly elevated acute-phase reactants and a negative infectious profile (including HIV, toxoplasmosis, syphilis, tuberculosis, and Lyme disease). Unfortunately, an ocular ultrasound could not be performed at that time due to the unavailability of equipment.

At this point, the preliminary diagnosis included phthisis bulbi in the OD and granulomatous anterior uveitis in the OS, with a strong suspicion of panuveitis, although posterior segment involvement could not be definitively assessed. The dermatology department considered a diagnosis of tropical verrucous syndrome, a term referring to cutaneous infectious conditions that trigger chronic granulomatous reactions frequently seen in tropical regions, leading the department to proceed with a skin biopsy.

The biopsy confirmed a diagnosis of multibacillary lepromatous leprosy (Hansen's disease), providing a proper diagnosis for the patient's condition. He subsequently started on multidrug therapy for multibacillary leprosy (rifampicin, dapsone and clofazimine), along with topical atropine and prednisolone for the OS. Unfortunately, the COVID-19 pandemic led to a disruption in his follow-up, and the patient did not return for further evaluation until 2024, at which point his ocular condition had worsened.

Upon examination in 2024, the patient presented amputations of the distal phalanges of the fingers with signs of lichenification in hands, and torso, with a remaining granulomatous lesion

in the forehead (**figure 1**). His visual acuity had deteriorated to no light perception in the OD and light perception in the OS. In the slit lamp examination OU showed madarosis and lagophthalmos, a positive bilateral Bell reflex facilitated some degree of corneal lubrication and protection, the patient also presented with generalized hyperemia of the conjunctiva, there was no fluorescein staining observed at the time. The OD had a completely opaque and highly vascularized cornea, a temporal anterior chamber plastron occupying the visual axis, and an iris with significant architectural loss, remaining in a state of phthisis bulbi. The OS exhibited advanced corneal and iris changes as described in (**Figure 2**), lense and posterior pole were not accessible in OU.



Figure 1: (A) The image shows the external physical examination of both eyes, highlighting significant lagophthalmos, madarosis, and conjunctival hyperemia in both eyes. Additionally, an old frontal lesion is visible. (B) The image shows the patient's hands, revealing the sequelae of amputated distal phalanges and signs of skin lichenification.

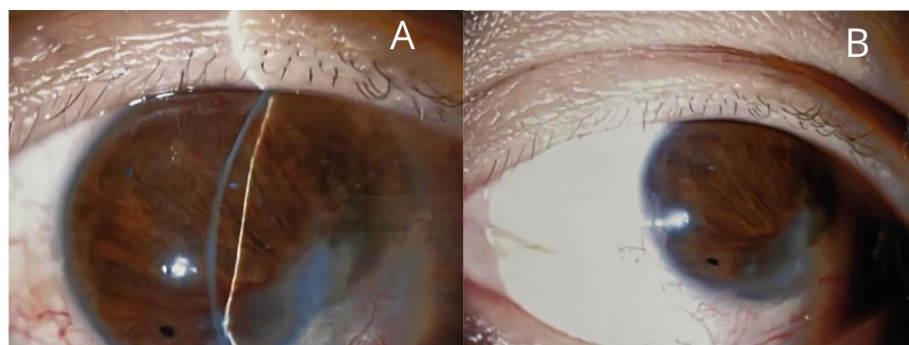


Figure 2: (A-B) Left eye with corneal neovascularization and old retro keratic precipitates, inferotemporal leukoma, atalamia, iris with extensive anterior and posterior synechiae, lense and posterior pole were not accessible.

To evaluate the visual potential in his OS, an ocular ultrasound, orbital CT scan, a pentacam and OS visual evoked potentials (VEP) were requested. The ocular ultrasound findings revealed a phakic OD with a total retinal detachment in an open funnel shape and a

OCULUS - PENTACAM 4 mapas refractivos

Reflexivo

Córnea Anterior

R: 9.88 mm K1: 37.5 D
 R: 7.27 mm K2: 46.4 D
 R: 6.13 mm Kax: 41.5 D
 Q: 0.78 µm R: 6.87 mm Rho: 6.87 mm
 Q (Bios): 0.74 µm R: 6.87 mm Rho: 6.87 mm

Córnea Posterior

R: 7.23 mm K1: 45.5 D
 R: 6.82 mm K2: 44.6 D
 R: 6.43 mm Kax: 44.8 D
 Q: 0.78 µm R: 6.47 mm Rho: 6.47 mm
 Q (Bios): 0.78 µm R: 6.47 mm Rho: 6.47 mm

Centro pupila
 Posición pupila N: 0.00 µm
 Posición pupila N: 0.00 µm
 K Mide (Front): 0.00 D
 K Mide (Post): 0.00 D

Volumen córnea: 0.3 mm³ Ø Córnea: 11.3 mm
 Volumen cámara: 0.3 mm³ Ángulo: 58.5°
 Prof. cámara nat [µm]: 0.00 D Prof. Pup [µm]: 0.00 mm
 Dist KDP [D/µm]: 0.78 mm Exp. cor: 0.00 mm

Curvatura Sagital (frontal)

Elevación (frontal)
 DF: 0.46 Flase: 0.00

Espejo Corneal

Elevación (Posterior)
 DF: 0.43 Flase: 0.00

Color scale: 0.00 to 2.5 µm Height

The treatment plan, aimed at providing a more functional eye, included the administration of atropine OS, lubricants OU, and a surgical intervention consisting of pupilloplasty, phacoemulsification without intraocular lens implantation, posterior vitrectomy, endophotocoagulation, and the use of air in the vitreous cavity the OS (**Video 1**). The decision to leave the eye aphakic was made due to concerns about the possibility of corneal decompensation, inflammation, and the intraoperative finding that the sclera appeared too fragile during surgery to support a scleral-anchored lens.

The outcome was considered satisfactory, as the patient regained functional vision. This improvement highlights the importance of a multidisciplinary approach and surgical intervention by skilled professionals in managing complex cases like this one, emphasizing

how ophthalmologists must address such complex pathologies, considering that they can affect from the retina to the ocular surface. The challenge in these situations lies not only in the diagnosis and implementing appropriate surgical strategies but also in addressing the sociocultural factors that cause patients from developing countries to delay seeking medical assistance, often resulting in severe sequelae by the time they receive care.

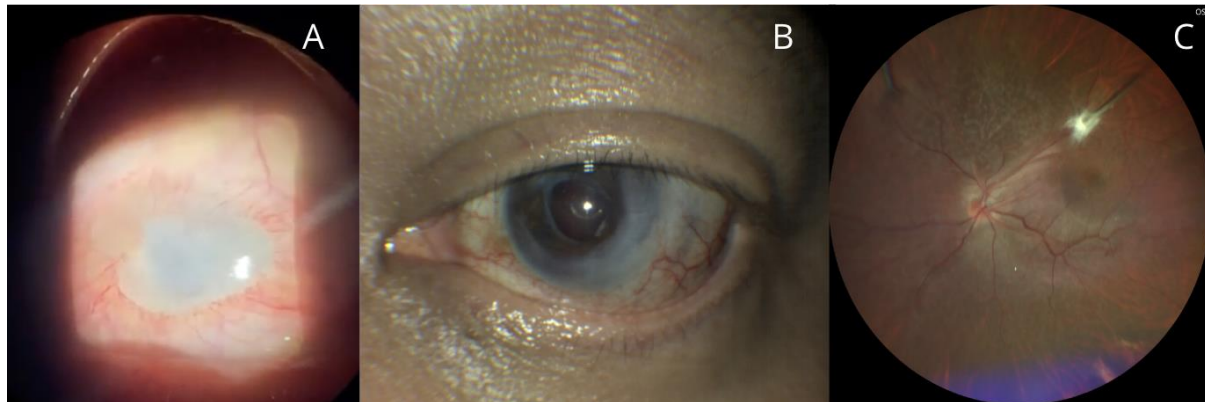


Figure 6: (A) Slit-lamp examination of the right eye showing phthisis bulbi. (B): Slit-lamp photograph of the left eye. The image shows eyelids without lesions, madarosis, mild conjunctival hyperemia, a clear cornea with inferior neovascularization, and a leukoma in the inferotemporal quadrant that does not affect the visual axis. There are old retro keratic precipitates present. The anterior chamber is formed, the iris shows extensive areas of atrophy, predominantly in the sphincter region, with a dyscoria, centered pupil, and aphakia. (C): Photograph of the posterior pole of the left eye. The optic nerve appears with poorly defined borders, difficult assessment of its excavation. The retina is attached but has a tractional membrane at the level of the superior temporal vascular arcade, causing traction around the peridiscal area and the macular zone, as well as a superior nasal tractional membrane in the mid-periphery.

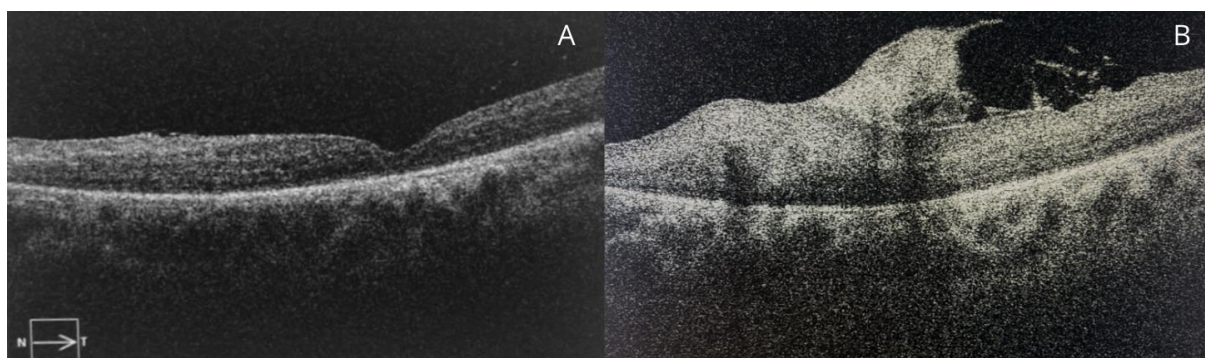


Figure 7: (A-B) OCT scans reveal a preserved retinal profile with a noticeable foveal depression and a vitreoretinal interface showing evidence of extrafoveal vitreoretinal traction. There is an altered retinal architecture with a reduced central macular thickness, affecting

both the inner and middle retinal layers, as well as slight disruption of the outer retinal layers. No biomarkers of neovascular activity are present, but there is an alteration in the Bruch's membrane-RPE complex with changes in reflectivity consistent with pigment epithelial disruption.

4. • Discussion

Hansen's disease is a chronic infectious disease that primarily affects the skin, peripheral nerves, limbs, and eyes, resulting in granulomatous inflammation. (2) Although leprosy has been known for centuries, it remains a significant health problem in certain regions, especially in resource-limited settings, where delayed diagnosis and treatment often lead to severe complications, including ocular involvement. (6)

According to the Ridley and Jopling classification, leprosy can be subdivided based on the immune response into different clinical forms: tuberculoid, lepromatous, borderline tuberculoid, borderline lepromatous, and borderline borderline. (7) The disease's progression and ocular manifestations vary according to these forms. Tuberculoid leprosy is associated with a stronger immune response, while lepromatous leprosy shows a weaker immune defense and higher bacillary load, increasing the risk of ocular complications. (8)

The ocular involvement in leprosy is approximately 70-75% of patients, with 10-50% experiencing severe ocular symptoms. (9) The involvement often results from either direct infiltration of *M. leprae* into ocular tissues or immune-mediated damage to the nerves, leading to chronic inflammation and complications such as uveitis, keratitis, and corneal ulcers. (10–12)

The anterior segment of the eye is more vulnerable to leprosy related complications due to its cooler temperature, which facilitates the growth of the bacilly. (9) The ocular surface often suffers due to lagophthalmos and facial nerve palsy, leading to exposure keratitis and a significant risk of corneal ulcers. (13) In our patient, the changes in the pentacam highlighted the chronic ocular surface damage caused by this exposure accompanied by chronic inflammation. Management of ocular surface disease in leprosy involves an integral approach to reduce inflammatory reactions, prevent corneal damage, and maintain ocular surface integrity. Strategies include the use of ocular lubricants, protective measures like wearing moisture chamber goggles, and, in severe cases, surgical interventions such as tarsorrhaphy to protect the cornea from exposure, emphasizing on the need for vigilant ocular surface management in these patients. (13–15)

5. • Conclusion

In conclusion, this case highlights the importance of a multidisciplinary approach in managing Hansen's disease with ocular involvement. The patient's post-surgical improvement, which included better control of ocular surface symptoms and restoration of functional vision, highlights the effectiveness of this comprehensive strategy. Also, sociocultural factors play a significant role in delaying the timely diagnosis and treatment of Hansen's disease. In many regions, cultural beliefs, social stigma, and limited access to healthcare lead to patients seeking care at advanced stages, resulting in severe ocular and systemic sequels. Addressing these barriers is essential for improving both the prognosis and quality of life for affected individuals.

This case also demonstrates the profound impact that a systemic condition like Hansen's disease can have not only on the skin but on the eye, from the retina to the ocular surface, emphasizing the need for early suspicion, appropriate treatment, and patient support.

6. • References

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