CH-08 Eyes: trachoma, cataract, spectacles and conjunctivitis without an ophthalmologist

HEALING after the FALL, research library, CH-08

Researched 10 October 2026 by Claude Opus agent for THRIVING after the FALL, Book Four. Library document, unverified.

How to read this

This report starts where WO-16 stops. WO-16 holds the injured eye, corneal ulcer, chemical burns, acute angle closure as an emergency, herpetic ulcer and the eye shield (THRIVING library, WO-16). HY-08 holds vitamin A requirements and foods (THRIVING library, HY-08). IN-05 holds antibiotic stability and dosing (THRIVING library, IN-05). TR-02 holds Ayurveda and the couching arithmetic (THRIVING library, TR-02). HY-01 was named for face washing and trachoma, but it covers hand washing only, so the face washing evidence is new here. OR-04 and OR-07 are left their own ground.

Three voices are kept apart: what the tradition says (tradition), what was counted (record) and what may be inferred (inference). My own arithmetic and extrapolation carry [VERIFY]. Village rules for the owner carry [OWNER].

1. Findings by section

1.1 What blinds a district, and how the Fall reorders it

Record. For 2020 the Vision Loss Expert Group put cataract first among causes of blindness in people aged 50 and over (15.2 million), then glaucoma (3.6 million), undercorrected refractive error (2.3 million), macular degeneration (1.8 million) and diabetic retinopathy (0.86 million). For moderate and severe impairment the order flips: refractive error 86.1 million, cataract 78.8 million (GBD 2019 Blindness and Vision Impairment Collaborators 2021). Onchocerciasis still causes vision loss in 1.15 million people, more than 99 per cent in Africa and Yemen (WHO 2025).

Inference. The Fall removes the treatments (surgery, spectacles, azithromycin, vitamin A capsules, glaucoma drops), brings back the conditions programmes suppressed (crowding, flies, short water, measles, hunger) and leaves traditional eye medicine where it always was. The WUHA trial in Ethiopia shows what trachoma does once mass azithromycin stops: ocular chlamydia in young children rose from about 11 per cent to 31 to 32 per cent at 36 months in both arms, despite a vigorous hygiene programme in half of them (Aragie and others 2022).

My ranking for a district after the Fall, by years of sight lost [VERIFY, my inference]:

1. **Cataract.** Incidence is unchanged and the cure goes away.
2. **Uncorrected refractive error and presbyopia.** Rarely blindness, but it takes fine work from everyone over about 45. The commonest loss and the cheapest to fix.
3. **Corneal scarring:** vitamin A deficiency with measles, ulcers after plant injury (THRIVING library, WO-16), ophthalmia neonatorum and traditional eye medicines. These blind the young.
4. **Trachoma**, where flies, crowding and short water meet. It blinds slowly and mostly women.

5. **Glaucoma.** Silent, and found too late even now.
6. **Onchocerciasis**, only near fast rivers with *Simulium* blackflies (WHO 2025).

If about 15 per cent of 3,000 people are 50 or over and a few per cent of them are blind, a district holds perhaps 10 to 25 blind people, about half from cataract [VERIFY, my arithmetic]. The backlog is small enough for one trained surgeon to clear in weeks.

1.2 Trachoma: the disease and its history

Chlamydia trachomatis passes between children on fingers, cloths and eye-seeking flies. Repeated infection scars the inner upper lid, the margin turns in, lashes scrape the cornea (trichiasis) and the cornea turns white (THRIVING library, WO-16).

Record. When Napoleon landed in Egypt in 1798 with about 35,000 men, the eye disease spread so fast that about a thousand men lost their sight (Dunea 2024). Larrey recognised its contagiousness and printed a memoir on it in Cairo (historyofmedicine.com entry, read as summary). It came home as "Egyptian ophthalmia". One history reports 5,000 English soldiers partly blinded, 76,800 men affected in the Russian army, and the Belgian army so affected that men were sent home and spread it (Sightsavers n.d., search summary) [VERIFY, single secondary source]. Halberstaedter and von Prowazek saw the inclusion bodies in 1907 and Tang isolated the organism in 1957 (Dunea 2024). Federal inspection at Ellis Island began in 1892, officers flipped lids with a buttonhook, and trachoma became a leading medical ground for exclusion (Kratz 2014). The often quoted 1897 date for its listing I could not confirm [VERIFY].

Inference. Trachoma spread through barracks, ships and tenements, and it receded in Europe and North America with water, soap, fewer flies and less crowding, before antibiotics. The book's village will be closer to the barracks.

1.3 Trachoma surgery and epilation

The operations. Bilamellar tarsal rotation (BLTR) cuts through the full lid parallel to the margin and rotates the lash-bearing strip outward with everting sutures. Posterior lamellar tarsal rotation (PLTR, the modified Trabut) cuts from inside only. WHO's 1993 manual taught BLTR, and the 2015 edition added PLTR, lid clamps and a formal surgeon assessment (Merbs and others 2015).

Record. The 2015 Cochrane review (13 trials, 8,586 people) found full-thickness rotation best (BLTR against unilamellar, OR 0.29, 0.16 to 0.50). In Reacher's 1992 Oman trial of minor trichiasis, recurrence was 6 of 52 lids after BLTR against 41 of 57 after cryotherapy and 30 of 57 after electrolysis. Silk and absorbable sutures did equally well, with fewer granulomas after absorbable ones. Azithromycin after surgery had an uncertain effect (OR 0.85, 0.63 to 1.14). Ophthalmologists and integrated eye workers had similar results (OR 1.32, 0.83 to 2.11), and the review says surgery may be done by a trained ophthalmic assistant (Burton and others 2015). Freezing and burning lashes are not worth salvaging equipment for.

Recurrence is the weakness: 20 to 40 per cent by one year and up to 60 per cent at three (Burton and others 2015). Four pooled trials with 6,747 lids gave 10 to 40 per cent, most milder than the original (Gower and others 2019). Among five Ethiopian nurse surgeons, recurrence ranged from 18 to 53 per cent by surgeon (Rajak and others 2013). The surgeon matters more than the suture.

Record, epilation. Rajak and colleagues randomised 1,300 Ethiopian adults with minor trichiasis (fewer than six lashes touching) to PLTR by nurse surgeons or to epilation. Each epilation patient got two pairs of good forceps, and the patient or a companion with good near vision was trained to pull lashes at the base. At 24 months, failure (five or more lashes or surgery) was 13.2 against 2.2 per cent, risk difference 11.0 per cent (8.1 to 13.9). The margin was 10 per cent, so **epilation was not shown non-inferior**, contrary to the lead in my brief. But vision change did not differ, and corneal opacity progression did not differ on photographs (5.5 against 4.1 per cent) (Rajak and others 2011). At four years, two thirds of the epilation arm had declined free surgery. Of these, 54 per cent were fully controlled, 43

per cent still had minor trichiasis and 2.6 per cent had progressed, with no difference in vision or opacity (Habtamu and others 2015, abstract).

Inference. Epilation with good forceps by a family member protects the cornea about as well as surgery in minor trichiasis, at the cost of doing it for ever. Major trichiasis was never tested and needs surgery. The district trains one lid surgeon. The village hands out forceps.

Training. WHO's endorsed path: watch at least two live operations, practise on the HEAD START mannequin, operate under supervision, and be certified after five independent operations scored on a checklist (Gower and others 2014, summary). Sushruta's practice on gourds and bladders before patients points the same way (THRIVING library, TR-02).

1.4 Trachoma: antibiotics, face washing and the environment

Antibiotics. Oral azithromycin and topical tetracycline did about equally well in individuals (RR 0.97, 0.81 to 1.16 at three months) (Evans and others 2019, abstract). Azithromycin's advantage is one dose: 20 mg/kg, maximum 1 g (NCT04185402, THRIVING library, IN-05). Tetracycline 1 per cent ointment twice daily to both eyes for six weeks is given to infants and in pregnancy (Niger protocol, search summary). Mass azithromycin selects macrolide resistance (THRIVING library, IN-05).

Face washing. West and colleagues followed 1,417 children aged 1 to 7 in six paired Tanzanian villages, all given tetracycline and half an intensive face washing campaign. Severe trachoma was less likely in the campaign villages (OR 0.62, 0.40 to 0.97), and a child with a clean face at two or more visits had lower odds of any trachoma (OR 0.58) and of severe trachoma (OR 0.35) (West and others 1995). The Cochrane review found only one other trial, with no effect (RR 1.03), and called the evidence inconclusive (Ejere and others 2015). Observationally, a clean face goes with lower odds of active trachoma (OR 0.42, 0.32 to 0.52), and soap, towels and sanitation are modestly protective (Stocks and others 2014, abstract).

The trials that temper the poster. WUHA gave 20 communities a water point, wash stations, mirrors, monthly soap, home visits and a school curriculum. Face washing with soap rose to 72 per cent of preschool children against 40 per cent in controls. Ocular chlamydia at 36 months was 32 against 31 per cent (Aragie and others 2022). Stronger SAFE in Oromia, with 3,480 children, found no added benefit of enhanced hygiene over standard SAFE (ICEH 2026, search summary).

Inference. Face washing is cheap and harmless, and clean faces track lower trachoma wherever measured. But no trial shows hygiene alone controls intense transmission, and WUHA shows the opposite. A village in an endemic zone should wash faces and keep flies off anyway, treat inflamed eyes with any tetracycline ointment held, and expect lid surgery in its adults decades on. Keeping human faeces from the face fly *Musca sorbens*, which breeds in it, may be the most useful environmental act [VERIFY, not read this session].

1.5 Cataract and couching: the tradition on its own terms, then the record

Tradition, Sushruta. In the Uttaratantra, *linganasha* is the destruction of sight. Of fourteen diseases of the visual area, eight are linganasha, six caused by the doshas reaching the fourth *patala* (layer) of the eye. *Kaphaja linganasha*, the kapha form, is white, and the patient sees the sky as overcast (Mukhopadhyay and Sharma 1992). Only this form is operated, and only when mature. An opacity shaped like a half moon, a drop of sweat or a pearl, or one with pain and congestion, is not operated (Su. Ut. 17.56). Surgery is done in mild weather after oleation and sweating, the head held, the patient looking at his nose. The surgeon enters at the "divinely made opening" (*daivakrita chhidra*) on the outer side, where there are no vessels, with the *yavavaktra shalaka*, a probe with a barley-grain tip. A correct puncture gives a sound and a drop of fluid, a wrong one bleeds. The eye is washed with breast milk, the opacity is scraped from the pupil, and the patient sneezes against a closed nostril to expel the kapha. Success is a pupil "shining like the sun in a cloudless sky". Ghee and a bandage follow, with ten days on the back. The text names late complications, among

them *adhimantha*, read today as secondary glaucoma, and warns that an immature lesion returns with pain. It classes kaphaja linganasha as *yapya*, controllable but not cured, which the authors read as an admission that without a lens the patient saw only two or three metres (Mukhopadhyay and Sharma 1992).

Wujastyk reads the operation as couching and dates the text to about the third or fourth century CE (Wujastyk 1997). Others read it as extraction (THRIVING library, TR-02). Couching was the European operation until the eighteenth century (EyeWiki n.d.).

Tradition, West Africa today. In Plateau State, Nigeria, 71 per cent of couched eyes in one clinic had been treated by Fulani couchers, some travelling from Mali and Benin. Eye nurses called the practice secret (Goyal and Hogeweg 1997). Under SY-04 this report says only that the technique is restricted knowledge, and does not describe it beyond the clinic's own words: a "sharp" method with an instrument such as a thorn, and a "blunt" one without perforation.

Record. - **Nigeria national survey:** 249 of 583 eyes that had any cataract procedure (42.7 per cent) were couched. Of these, 73.1 per cent saw less than 3/60 and 2.4 per cent saw 6/18 or better. None had aphakic spectacles, and with correction 42.6 per cent were still blind (Gilbert and others 2010, abstract). - **Plateau State:** 28 couched against 26 extracted eyes. 3/60 or better in 43 against 92 per cent. No light perception in 21 per cent of couched eyes. Severe pain or blindness in 57 against 8 per cent. Uveitis, endophthalmitis and raised pressure were common. The blunt method did better (4 of 5 eyes at 3/60) than the sharp (6 of 18) (Goyal and Hogeweg 1997). - **Yemen:** 55 couched eyes seen up to 35 years later. With correction, 1.8 per cent saw 6/18 and 76.4 per cent were blind. Glaucoma in 21 eyes, retinal detachment in 7, severe pain in 14. The healer was paid about 62 US dollars (Bamashmus and others 2010, via Jager 2010). - **Mali:** 85 people operated by intracapsular extraction against 82 couched. Couching cost about as much and was ineffective, and nearly half the couched did not know surgery existed (Mali couching study 2000, abstract).

Inference. The displaced lens clears the axis, which is why the patient sees on the day and the coucher is paid. It then leaks protein, inflames the eye and blocks drainage, an unsterile perforation carries infection in, and the eye is left needing +10 dioptres that no couched patient had.

Verdict. Grade X. TR-02 deferred the decision here. About one couched eye in five ends with no light, most stay blind, and the few who see well see no better than an aphakic eye with no spectacles. The argument for couching is that an untreated mature cataract is blindness too. But a cataract does not hurt, does not threaten the other eye and can still be operated if a surgeon comes. No eye is couched, and a person with a mature cataract waits for the district surgeon [OWNER].

1.6 Cataract surgery that works

Record, history. Jacques Daviel is credited with the first planned extraction of the lens. Sources give 8 April 1747 or a planned extracapsular extraction in Cologne on 18 September 1750, and his 1753 report claimed 182 successes in 206 operations (Cabinet 2010, EyeWiki n.d.) [VERIFY the 1747 date]. Samuel Sharp did the first intracapsular extraction in 1753, Ridley implanted the first lens in 1949 and Kelman introduced phacoemulsification in 1967 (EyeWiki n.d.).

Record, intracapsular extraction (ICCE) with aphakic spectacles. The Madurai trial randomised 3,400 patients at Aravind. At one year, 90.7 per cent after ICCE with aphakic glasses and 96.3 per cent after extracapsular extraction with a lens reached 6/12, with serious complications in 14.5 against 7.7 per cent (Prajna and others 1998, abstract). Another series gave 89 per cent at 6/18 after ICCE, with intraoperative complications in 15.6 per cent (South Asian Cataract Management Study 1995, abstract).

ICCE restores sight only with spectacles of about +10 dioptres. These magnify 20 to 35 per cent, narrow the field to about 50 degrees, make objects at the edge vanish and reappear, and are useless for one aphakic eye beside a normal one (BJO 2009 and BMC 2003, search summaries). In a Nigerian series, uncorrected aphakia caused 65.1 per cent of

poor outcomes and 71.2 per cent were not wearing spectacles (University of Jos study, search summary). **Inference:** after the Fall, an aphakic patient is one broken pair of spectacles from blindness. Thick high-plus lenses are among the most valuable salvage in the book.

Record, manual small-incision surgery (MSICS). MSICS removes the nucleus whole through a self-sealing scleral tunnel, needs no sutures or phaco machine, and takes a rigid PMMA lens. Ruit and colleagues randomised 108 Nepali patients: uncorrected vision of 6/18 or better at six months was 89 per cent after MSICS and 85 per cent after phaco, best-corrected 98 per cent in both, and MSICS was much faster and "less technology dependent" (Ruit and others 2007, abstract). At Aravind, nearly 600 MSICS cases took 3.75 minutes on average, 95 per cent reached 6/18, vitreous loss was under 1 per cent, and the cost was under 15 dollars including a lens under 5 dollars (Chang 2005). The brief's "under 10 dollars" is the disposables alone.

Lens stock. Without measuring the eye, a standard 20 to 22 dioptre lens puts about half of eyes within one dioptre of target and about a fifth more than two off (search summary). With salvaged spectacles that is good vision. **Inference:** hoard PMMA lenses of 21 to 22 dioptres above all others [VERIFY].

Non-physician surgeons. Among 129 non-physician cataract surgeons in Kenya, Tanzania and Malawi, output averaged 188 operations a year (median 76, range 0 to 1,700), 95 per cent implanted lenses and 10 per cent left within three years. No outcomes of their work had been published, and most did not record any (Eliah and others 2014).

Training. A five-day simulation course in four African countries cut trainees' capsule rupture from 26.6 to 7.8 per cent in their first year and doubled their volume (Dean and others 2021, summary). Venkatesh and Dean advise tunnels on apples, capsule work on tomatoes and grapes, whole operations on goat eyes, and only low-risk eyes for the first 50 to 100 live cases (Venkatesh and Dean 2023).

Inference. MSICS is the district's operation. It needs a microscope or loupes and light, a crescent blade, keratome, vectis, Simcoe cannula, viscoelastic, sterile saline and lenses, all salvage. What can be made is the surgeon: steady hands, weeks on fruit and goat eyes, a supervised first hundred cases and a register of every outcome. At 10 cases an hour the backlog clears in a morning. Without lenses, the same surgeon does ICCE and fits +10 spectacles (Dean and Sandford-Smith, reviews only).

1.7 Spectacles from salvage

Presbyopia. Two Community Eye Health guides give the same starting powers: +1.00 at 35 to 45, +1.50 at 45 to 50, +2.00 at 50 to 55, +2.50 or more over 55. Check distance vision first, hold a near card at about 40 cm, go stronger until the N6 or N8 line is read, then make sure the working distance sits mid-way in the clear range (du Toit 2006, Stevens 2019). The two differ on the target line, N8 against N6. Most people need +1.00 to +3.00. A person who cannot read N10 with any power has another disease (du Toit 2006).

Ready-made spectacles. Zeng and colleagues randomised 495 Chinese pupils to ready-made or custom spectacles. Use was 94.3 against 92.2 per cent and wear at a surprise visit 46.9 against 51.5 per cent, neither significant. Excluded were astigmatism of 2 D or more and unequal eyes (Zeng and others 2009, abstract). Indian children did as well (Morjaria and others 2017, summary), and so did adults (Brady and others 2012, abstract). **Inference:** most people can be served from a box of sorted spherical lenses.

Adjustable lenses. Silver's Adspecs hold silicone oil between membranes, adjustable from about +6 to minus 6 dioptres. More than 30,000 pairs had gone out by 2010 at about 19 dollars (Mayor 2010). In 648 rural Chinese pupils, self-refraction with them let 97 per cent reach 6/7.5 (Zhang and others 2011, via BMJ). Their post-Fall use is as a trial frame: turn the dial until sharp, then match a stored lens [VERIFY, inference].

Pinhole. A 1 to 2 mm hole passes only a central beam and corrects any refractive blur. In 204 eyes, pinhole acuity worse than 6/18 identified loss not correctable by glasses with 85.7 per cent sensitivity and 100 per cent specificity

(Kumar and others 2019). Holes under 1.2 mm blur by diffraction. **If vision improves through a pinhole, spectacles will help. If not, something else is wrong.** I found no evidence that pinhole spectacles or eye exercises change refraction [VERIFY].

The reading stone. Glass magnifiers laid on the page preceded spectacles. The first written mention of spectacles is a sermon of Giordano da Pisa in 1305 or 1306, which dates their invention about twenty years earlier to an unnamed craftsman (Oxford History of Science Museum, summary). A plano-convex lens on a page still serves a household whose spectacles have broken.

Sorting salvage. Power in dioptres is one over focal length in metres (Mayor 2010). Focus sunlight to the smallest spot: 50 cm is +2.00, 33 cm is +3.00, 25 cm is +4.00, 10 cm is +10.00 [VERIFY, arithmetic]. Minus lenses do not focus sunlight and can be matched by stacking with known plus lenses until the pair neither magnifies nor shrinks [VERIFY, untested]. A lens that will not give a round spot has astigmatism. Label every lens.

1.8 Conjunctivitis and the newborn eye

Which conjunctivitis needs treatment. The 2022 update of the Cochrane review first written by Sheikh and Hurwitz included 21 trials and 8,805 people. Antibiotics raised cure (RR 1.26, 1.09 to 1.46), about 15 percentage points, number needed to treat 7 (Cochrane CD001211, via AAFP 2023). The older version found 64 per cent of placebo patients better by days 2 to 5 (Sheikh and Hurwitz, via Bestbets). **Most bacterial conjunctivitis cures itself.** Viral (watery, after a cold) and allergic (itch) forms need no antibiotic. Pain or poor vision means something else (THRIVING library, WO-16).

Chloramphenicol drops. Among 442,543 British patients given 674,148 prescriptions there were three serious blood disorders, none convincingly caused by the drops (Lancaster and others 1998). A Spanish study put any risk under one in a million courses (Laporte 1998, summary). They are a safe salvage antibiotic. Opened drops are discarded at 28 days (THRIVING library, IN-05).

Ophthalmia neonatorum. Credé put silver nitrate into every newborn eye at Leipzig from 1880. Fuchs quoted a fall from 10.8 per cent of 2,897 babies to 0.1 to 0.2 per cent of 1,160 (JAMA abstract, summary), and Schaller and Klauss give 30 to 35 cases a year falling to one (Schaller and Klauss 2001, summary). The 2 per cent solution burned and was reduced to 1 per cent. In Kenya without prophylaxis up to 23.2 per cent of newborns were affected, and more than 10,000 babies a year are blinded worldwide (Isenberg and Apt 2003). Isenberg, Apt and Wood gave 3,117 Kenyan newborns 2.5 per cent povidone-iodine, 1 per cent silver nitrate or 0.5 per cent erythromycin, rotated weekly. Infective conjunctivitis followed in 13.1, 17.5 and 15.2 per cent, iodine better against chlamydia and equal against gonococcus (Isenberg and others 1995, summary). The weekly rotation means the trial was not strictly randomised. Povidone-iodine costs about 10 US cents for 5 ml (Isenberg and Apt 2003).

Treatment. Swollen lids and pus in the first two weeks are gonococcal until proved otherwise and can lose the eye in days. Ceftriaxone 25 to 50 mg/kg once intramuscularly. The sources differ on the cap: 125 mg in older CDC guidance, 250 mg in current CDC guidance and 150 mg in a Vietnamese protocol (CDC and others, search summary). Wash the pus away often [VERIFY interval]. Chlamydial ophthalmia comes at one to two weeks, is milder and needs systemic erythromycin or azithromycin [VERIFY dose].

Breast milk. Near universal folk practice, and in Sushruta the wash after couching (Mukhopadhyay and Sharma 1992). A Japanese trial in infants with eye discharge found improvement in 76.8 per cent and no harm, its design contested (Sugimura 2021, summary). Nothing shows it treats gonococcus. **Inference:** fresh breast milk in a sticky but white infant eye is harmless. In a red, swollen, pus-filled newborn eye it wastes the days that matter.

Honey. A trial in 114 people with lid gland disease found medical-grade *Leptospermum* honey gel and drops improved symptoms and lowered staphylococcal counts (Optometry Australia, summary). Raw honey is not sterile, and I found no trial in conjunctivitis. Grade D for conjunctivitis.

Steroid drops. Never in a red eye: a herpetic dendrite becomes a perforating ulcer (THRIVING library, WO-16). MSF repeats it for xerophthalmia (MSF n.d.), and an Indian series found topical steroid behind every keratitis after viral conjunctivitis (AIOS 2024, summary).

1.9 Glaucoma

Record, pilocarpine. Coutinho brought jaborandi leaves from Pernambuco to Europe in 1873 or 1874. Gerrard and Hardy isolated the alkaloid in 1875, and Weber used it against raised eye pressure from 1876 or 1877 (Le Quotidien du Pharmacien, summary). It narrows the pupil and opens the drainage angle.

The plant. Jaborandi is the leaf of *Pilocarpus microphyllus* and *P. jaborandi* (Rutaceae), shrubs of north-eastern Brazil. "Jaborandi" also names unrelated *Piper* species without pilocarpine [VERIFY, not read this session]. Old texts describe full doses causing "an enormous outpouring of sweat and saliva" and a slow heart, with atropine as the antagonist, and say an antagonistic alkaloid, jaborine, made crude leaf unreliable (Felter, King's American Dispensatory, summary). **Inference:** a crude leaf extract dropped in an eye has unknown strength and is the unsterile kind of eye medicine that scars corneas. Grade D for leaf, B for the drug.

Record, acute angle closure. Murray's protocol: lie flat, acetazolamide 500 mg, timolol, analgesia and antiemetic, then after about an hour pilocarpine 2 or 4 per cent, two drops 15 minutes apart. If pressure stays high, oral glycerol 1.0 to 1.5 g/kg, not in diabetes. Definitive treatment is a hole in the peripheral iris of both eyes (Murray 2018). WO-16 caps pilocarpine at 4 per cent (THRIVING library, WO-16). About 40 per cent of fellow eyes treated without iridotomy later attack (search summary). **Inference:** salvaged drugs may break an attack, but only a surgical iridectomy prevents the next, and that is within reach of a trained cataract surgeon [VERIFY].

Record, chronic glaucoma. In northern Nigeria, 47 per cent of 131 new patients presented at light perception or worse in at least one eye, and of 75 offered surgery one had it (Nigeria glaucoma study, summary). **The honest prognosis:** after the Fall, open-angle glaucoma is found too late, the drops run out, and surgery is a district skill at best. The work is to tell the person what is coming, protect what sight remains and teach the family to guide them.

1.10 Corneal scarring, pterygium and river blindness

Vitamin A. HY-08 holds requirements and the Sommer trial (THRIVING library, HY-08). It lacks the treatment schedule for eye disease, which MSF gives by mouth on days 1, 2 and 8: 50,000 IU under 6 months, 100,000 IU at 6 to 12 months, 200,000 IU from one year (MSF n.d.). A second source gives the third dose between 7 days and 4 weeks (Wikipedia and teaching sources, summary). They agree on the amounts and the first two days. In pregnancy, night blindness or Bitot's spots get 10,000 IU daily or 25,000 IU weekly for four weeks, and corneal disease gets the full dose. Add tetracycline ointment twice daily. Vision can be saved if an ulcer covers less than a third of the cornea and spares the pupil (MSF n.d.). Measles in a hungry child is a vitamin A emergency.

Traditional eye medicines (TEM). In Malawi, 33.8 per cent of 583 ulcer patients had used TEM and reached hospital after 51 days against 13 (Courtright and others 1994, via THRIVING library, WO-16). A case-control study linked TEM with peripheral ulcers (Lewallen and Courtright 1995, abstract). In Uganda, 16 of 19 TEM samples grew organisms, mostly *Klebsiella*, also *Staphylococcus aureus*, *Candida* and *Aspergillus* (Lee and others 2020, abstract). Up to 4,500 healer visits for eye disease were estimated for every corneal patient reaching an eye worker (Courtright and Lewallen 1997).

Working with healers. In Chikwawa, Malawi, after healers were trained, blindness among TEM users with corneal disease fell from 44 to 21 per cent and bilateral disease from 31 to 10 per cent (Courtright and others 1996, abstract). **Inference:** the book cannot forbid traditional eye medicine, because the village healer is the traditional practitioner. It can give a rule for what may touch an eye: boiled and cooled water, clean cloth, and nothing not boiled or sealed sterile [OWNER].

Pterygium. A fleshy wing of conjunctiva growing onto the cornea in sunny, dusty places. A meta-analysis found recurrence after bare excision six times that after excision with a conjunctival autograft (OR 6.1, 1.8 to 18.8) (Sanchez-Thorin and others 1998). **Inference:** no village excision. Hats and shade prevent it, and only one threatening the pupil goes to the district.

Onchocerciasis. Near fast rivers with *Simulium* blackflies, *Onchocerca volvulus* causes itch, skin disease and blindness. Ivermectin kills the microfilariae, not the adults, and must be given at least yearly for 10 to 15 years (WHO 2025). The dose is about 150 µg/kg once, by weight or height pole, not under 15 kg or 90 cm, not in pregnancy (WHO prequalification document, summary). The sources differ on the top pole band, 158 or 159 cm. Heavy *Loa loa* infection in central African forests makes ivermectin dangerous, with fatal encephalopathy (WHO 2025, MSD Manual).

2. Evidence grades

Remedy or procedure	Tradition says	Record shows	Grade
Couching	Restores sight	2.4% see 6/18, 21% no light (Gilbert 2010, Goyal 1997)	X
ICCE with +10 spectacles		90.7% at 6/12 with glasses (Prajna 1998)	A, fallback
MSICS with PMMA lens		89% unaided 6/18, equal to phaco (Ruit 2007)	A
Simulation training	Practice on gourds	Capsule rupture 26.6% to 7.8% (Dean 2021)	A
Lid rotation surgery		Best technique, nurses can do it (Burton 2015)	A
Epilation for minor trichiasis	Pulling lashes	Fails more, same vision at 2 and 4 years (Rajak 2011, Habtamu 2015)	A
Cryotherapy or electrolysis of lashes		53 to 72% recurrence (Reacher 1992)	X
Face washing	Clean face, clean eyes	One positive trial, strong association (West 1995, Stocks 2014)	B
Hygiene without antibiotics		No effect on chlamydia (Aragie 2022)	X as sole strategy
Azithromycin or tetracycline ointment		Equivalent (Evans 2019)	A
Antibiotic for bacterial conjunctivitis		NNT 7, most resolve anyway (Cochrane 2022)	A, optional
Chloramphenicol drops		Marrow risk under 1 per million (Lancaster 1998)	A
Povidone-iodine 2.5% at birth		13.1% against 17.5% (Isenberg 1995)	B
Silver nitrate at birth		10.8% to 0.2% (Fuchs, via JAMA)	B
Breast milk in sticky infant eye	Universal, in Sushruta	One trial for minor discharge	D

Remedy or procedure	Tradition says	Record shows	Grade
Raw honey in the eye		No trial, not sterile	D
Steroid drops in a red eye		Perforation (WO-16, AIOS 2024)	X
Traditional plant eye medicines	Many	84% contaminated, delay (Lee 2020)	X
Training traditional healers		Blindness 44% to 21% (Courtright 1996)	B
Pilocarpine drug	Jaborandi leaf	Opens angle once pressure falls (Murray 2018)	B
Jaborandi leaf in the eye	Brazilian use	Variable, toxic	D
Vitamin A for xerophthalmia	Liver for night blindness	WHO and MSF schedule (HY-08)	A
Ready-made spectacles		Wear equal to custom (Zeng 2009)	A
Adjustable spectacles		97% reach 6/7.5 (Zhang 2011)	B
Pinhole as test		Specificity 100% (Kumar 2019)	B
Pinhole glasses as treatment	Vendors' claims	No evidence found	X
Pterygium bare excision		Recurrence OR 6.1 (Sanchez-Thorin 1998)	X in village
Ivermectin for onchocerciasis		Elimination programmes (WHO 2025)	A

3. Means ledger

Rung	Trachoma	Cataract	Spectacles	Conjunctivitis and newborn	Glaucoma and cornea
Hands	Recognise inturned lashes, wash faces	Recognise white pupil, forbid couching	Pinhole from card or leaf	Know the newborn emergency	Recognise acute attack
Hearth	Soap, own cloth, forceps epilation by family	Guide and protect the blind	Reading stone, sort lenses by sun	Boiled cooled water, breast milk only for white eye	Liver, orange vegetables (HY-08)
Garden and still	Latrines, fly control, forged tweezers	Ethanol for instruments	Lens grinding not realistic [VERIFY]	Boiled saline	Nothing for glaucoma
Village dispensary	Lid surgery by trained healer, tetracycline	Register the blind, keep +10 lenses	Readers +1.00 to +3.50, near card, Adspecs	Chloramphenicol, newborn povidone-iodine	Timolol, pilocarpine, vitamin A capsules

Rung	Trachoma	Cataract	Spectacles	Conjunctivitis and newborn	Glaucoma and cornea
District infirmary	Azithromycin, certified surgeon	MSICS with PMMA lenses, ICCE fallback	Trial lens set	Ceftriaxone	Acetazolamide, iridectomy
Hospital before the Fall	Full SAFE	Phaco, biometry	Any lens made	Microbiology	Laser, lifelong drops

The hearth prevents, the village dispensary saves corneas, and only the district restores sight, by salvage it cannot make.

4. Harm test

Couching. No light in about one in five eyes, painful glaucoma, endophthalmitis (Goyal and Hogeweg 1997). No one receives it.

Cataract surgery. Infection, capsule rupture, corneal swelling, wrong lens power, late glaucoma. Never operate an eye that still works, never the second eye before the first has healed [OWNER]. Pain, worse vision or pus in the first week means urgent review.

Trichiasis surgery. Over-correction, notching, granuloma, recurrence. The surgeon is the main variable (Rajak and others 2013).

Epilation. Broken lashes leave stubble that scrapes more. Dirty forceps infect. Pull at the base, boil the forceps.

Azithromycin. Heart rhythm disturbance, infant pyloric stenosis, resistance (THRIVING library, IN-05).

Chloramphenicol drops. Marrow risk under one in a million. Old opened drops are contaminated.

Silver nitrate and povidone-iodine. Silver nitrate at 2 per cent caused chemical conjunctivitis. Never a caustic silver nitrate stick near an eye. Only the 2.5 per cent ophthalmic iodine, never alcoholic or strong solution. A home dilution is not the trial product (THRIVING library, WO-16).

Steroid drops. Turn herpes and fungus into perforation.

Traditional eye medicines. Contaminate a broken surface and delay care by weeks (Courtright and others 1994, Lee and others 2020).

Pilocarpine. Excess brings sweating, salivation, slow heart, wheeze, vomiting and diarrhoea. Atropine is the antidote. Not in an inflamed eye with iritis [VERIFY].

Timolol. Slow pulse and asthma [VERIFY]. **Glycerol.** Not in diabetes (Murray 2018).

Vitamin A. Overdose raises pressure in the skull: bulging fontanelle, headache, vomiting (MSF n.d.). High doses early in pregnancy harm the fetus (THRIVING library, HY-08). Record every dose.

Ivermectin. Fatal encephalopathy with heavy *Loa loa* (WHO 2025).

Spectacles. A wrong power gives headache, not damage. A +10 lens on an eye that still has its lens blinds it until removed.

5. Red flags

- **A newborn with swollen lids and pus in the first two weeks.** The cornea can perforate in days. Ceftriaxone if held, wash often, and if nothing is held, wash anyway and tell the parents honestly.

- **A hungry child or a child with measles who cannot see at dusk, or whose cornea is dull or hazy.** Vitamin A now, on three days.
- **A painful red eye with haloes, vomiting and a mid-sized fixed pupil.** Acute glaucoma (THRIVING library, WO-16). Without drugs and surgery the eye is usually lost and the other must be watched.
- **A white patch on a painful cornea**, especially after plant injury (THRIVING library, WO-16).
- **Pain and redness after couching or surgery.**
- **Sudden painless loss of sight or a curtain across one eye.** Nothing the district can do. Protect the other eye.

Blindness is not death. A village that arranges itself, with ropes along paths, fixed places for things and work for hands, memory and voice, can keep a blind person at the centre of its life. The book should say this as plainly as it says what is lost.

6. The case against

Against surgery first. Eliah and colleagues found that non-physician cataract surgeons publish no outcomes and mostly record none (Eliah and others 2014). Trichiasis recurs in up to 60 per cent of lids at three years (Burton and others 2015). A district surgeon without biometry or a reliable microscope may get results nearer a Nigerian camp than Aravind. The reply: a poor modern result is still far better than couching, and the register is the defence against self-deception.

Against F and E. The WUHA and Stronger SAFE trialists themselves showed hygiene does not stop trachoma (Aragie and others 2022, ICEH 2026), and Cochrane calls face washing inconclusive (Ejere and others 2015). Hygiene is free and does other good, but the book must not promise it will prevent blindness.

Against mass azithromycin. Keenan's group found resistance rises with mass treatment (THRIVING library, IN-05). After the Fall there will be little to give.

Against the romance of tradition. Couching is the clearest case in this library of an ancient, canonical, living technique worse than nothing. The tradition itself called the result *yapya*. Wujastyk and Roy disagree on what Sushruta described, but not on the outcome of couching today.

Against healer bans. Courtright and Lewallen argue that training healers reduced blindness where prohibition had not (Courtright and others 1996).

Against the romance of the hospital. MSICS matches phaco (Ruit and others 2007), ready-mades serve most people (Zeng and others 2009), and most conjunctivitis needs no drops. But Keay and Friedman warned that adjustable spectacles were too costly to serve as permanent ones (Zhang and others 2011, via BMJ).

Against my ranking. It is inference. A Sahelian village with flies and blackfly rivers and a temperate one with neither would rank differently.

7. Ten-line summary

1. Cataract is the first cause of blindness and the most curable: MSICS by a trained non-physician restores sight in about nine eyes in ten for under 15 dollars (Ruit 2007, Chang 2005).
2. Couching is grade X: 2.4 per cent see well and about one in five lose all light (Gilbert 2010, Goyal 1997).
3. Aphakia without spectacles is blindness. Salvage every +10 lens and every 21 to 22 dioptre PMMA lens.
4. Presbyopia is the commonest loss of function. Readers from +1.00 to +3.00 by age serve most people.
5. A pinhole separates optical blur from disease (Kumar 2019).
6. Epilation with good forceps protects the cornea about as well as surgery in minor trichiasis (Rajak 2011, Habtamu 2015).
7. Wash faces, but hygiene alone does not stop trachoma (Aragie 2022).

8. Most conjunctivitis cures itself. The newborn with pus is the exception.
9. Nothing in a red eye but boiled water: no steroid, plant juice, urine or raw honey.
10. Vitamin A on days 1, 2 and 8 saves a cornea if given before it melts.

8. Open questions

- What are the visual outcomes of non-physician cataract surgeons? None published (Eliah 2014).
- How long does a couched eye see before glaucoma or uveitis? The series are cross-sectional.
- Can a village make safe ophthalmic povidone-iodine from surgical stock? Untested (THRIVING library, WO-16).
- How fast does trachoma return after the last azithromycin? WUHA suggests within three years.
- Can a district workshop grind +10 lenses? No account found.
- Does a crude jaborandi infusion lower eye pressure safely? No modern study found.
- When was trachoma listed for exclusion at US ports, and when did Daviel first extract a lens?

9. Sources to read in full

1. Dean WH, Sandford-Smith J, *Eye Surgery in Hot Climates*, 4th edition.
2. WHO, *Trichiasis Surgery for Trachoma*, 2015 or 2024 edition.
3. Burton and others 2015, Cochrane review of trichiasis interventions.
4. Rajak and others 2011, PLoS Medicine, epilation against surgery.
5. Aragie and others 2022, Lancet Global Health, WUHA.
6. Goyal and Hogeweg 1997, couching in northern Nigeria.
7. Mukhopadhyay and Sharma 1992, with Bhishagratna's translation of the Uttaratantra, chapter 17.
8. Chang 2005 and Venkatesh and Dean 2023 on MSICS cost and training.
9. Community Eye Health Journal on spectacles (du Toit 2006, Stevens 2019) and healers (Courtright and Lewallen 1997).
10. MSF Clinical Guidelines, xerophthalmia and neonatal conjunctivitis.

At the bedside after the Fall

A household. Knows that pus in a newborn's eyes is an emergency, that a child who cannot see at dusk needs liver or orange vegetables now, that nothing but boiled and cooled water goes into an eye, and that nobody is couched. Owns a pinhole card, good tweezers, a cloth for each child, and reading glasses labelled by power. First failure to expect: a grandmother's plant drops in a baby's eye, given out of love.

A village of 300. One healer trained in the WHO five questions (THRIVING library, WO-16), lid eversion, epilation, the near card and the pinhole. A box of labelled lenses from +1.00 to +3.50, a 6 metre chart and a near card. Tetracycline or chloramphenicol ointment, povidone-iodine and vitamin A if any. A register of everyone blind or with trichiasis, cataract or a white cornea. Latrines and fly control. An agreed rule with the traditional healer on what goes into eyes [OWNER]. To start: tweezers, labelled lenses, a chart, a notebook. First failure to expect: the register lapses and a travelling coucher reaches a family that was never told a surgeon would come.

A district of 3,000. One cataract and lid surgeon trained on fruit, goat eyes and a mannequin, then supervised, and kept busy. A microscope or loupes, MSICS instruments, PMMA lenses, viscoelastic, sterile saline and a steriliser. A stock of +10 spectacles. Azithromycin and ceftriaxone held for trachoma clusters and newborns [OWNER]. Timolol, pilocarpine and acetazolamide. An outcome register reviewed each quarter and a camp day twice a year in each village. To start: a candidate, a teacher, salvage and a year. First failure to expect: outcomes go unrecorded, infections creep up unseen, and the villages decide surgery is no better than couching.

Protocols

Protocol 1. Examining an eye

- ☐ Ask: which eye, how long, pain, discharge, itch, sight worse, injury, what has been put in it.
- ☐ Look in daylight: white completely white, black completely black, eyes equal and straight, lashes pointing out (WHO AFRO, via THRIVING library, WO-16).
- ☐ Distance vision each eye at 6 m, other covered. Record 6/6 to 6/60, counting fingers, hand movements, light or none.
- ☐ Worse than 6/12: repeat through a 1 to 2 mm pinhole. Better means spectacles. Not better means disease.
- ☐ Over 40: near card at 40 cm.
- ☐ Write it in the register with the date.

Protocol 2. Reading glasses from a box

- ☐ Distance vision 6/9 or better first. If worse, Protocol 3.
- ☐ Start by age: 35 to 45 +1.00, 45 to 50 +1.50, 50 to 55 +2.00, over 55 +2.50.
- ☐ Near card at working distance, about 40 cm, both eyes open.
- ☐ Go up by +0.50 until N8 is read, N6 if possible.
- ☐ Move the card in and out until blur. Working distance should sit mid-way. Too far: stronger. Too close: weaker.
- ☐ No power reads N10: other disease, refer.

Protocol 3. Distance spectacles from salvage

- ☐ Pinhole improves vision: optical problem.
- ☐ Short sight: minus lenses from weakest up, each eye, stop at the weakest giving the best line.
- ☐ Long sight: plus lenses, take the strongest that keeps distance clear.
- ☐ Adspecs held: person adjusts each eye until sharp, match a stored lens.
- ☐ Not ready-mades where astigmatism is 2 D or more or the eyes differ by over 1 D (long sight) or 2 D (short sight) (Zeng 2009).
- ☐ Unknown plus lens: sun spot distance in metres, power is one over it [VERIFY]. Label.
- ☐ Walk and read in them before leaving.

Protocol 4. Epilation at home

- ☐ Confirm one to five touching lashes, cornea mostly clear (Rajak 2011).
- ☐ Two pairs of fine, well-meeting forceps, boiled.
- ☐ Train a family member with good near vision: good light, patient looks down, grip each lash at its base, pull the way it grows.
- ☐ Never break lashes.
- ☐ Repeat when the eye feels gritty [VERIFY interval].
- ☐ Review every 6 months. Six or more lashes or a whitening cornea: surgery.

Protocol 5. Trachoma in a village

- ☐ Wash every child's face daily with soap, one cloth each, dried in sun.
- ☐ Latrines used, faeces covered, flies off faces.
- ☐ Red, sticky, follicular lids: tetracycline 1 per cent both eyes twice daily for 6 weeks if held.
- ☐ Azithromycin if held: 20 mg/kg once, maximum 1 g. Not under 6 months or in pregnancy, use ointment. Who gets it is a district decision [OWNER].

☐ Register adults with inturned lashes.

Protocol 6. The newborn eye

☐ At birth, wipe the lids, then one drop of 2.5 per cent povidone-iodine in each eye (Isenberg 1995), or tetracycline or erythromycin ointment. Every newborn or only some is the owner's rule [OWNER].
☐ Never a silver nitrate stick. Only a prepared 1 per cent solution if nothing else.
☐ Watch days 1 to 14 for swollen lids and pus.
☐ Pus: wash with boiled cooled water often, ceftriaxone 25 to 50 mg/kg once intramuscularly, cap 125 mg (older CDC) or 250 mg (current CDC). Treat the parents if stock allows.
☐ Sticky white eye in a well baby: clean with boiled water, breast milk drops harmless.

Protocol 7. Conjunctivitis

☐ Pain, poor vision or a white corneal patch: not conjunctivitis (THRIVING library, WO-16).
☐ Pus, normal vision: boiled water washes 4 times a day, own cloth, wash hands. Chloramphenicol 4 times a day for 5 days if held. Review at day 2.
☐ Watery after a cold: no antibiotic, cold compresses, 1 to 3 weeks.
☐ Itchy: cold water, avoid the trigger.
☐ Never steroid drops, plant juice or urine.

Protocol 8. Vitamin A and the cornea

☐ Night blindness, Bitot's spots, dry or hazy cornea, or measles in a hungry place.
☐ By mouth on days 1, 2 and 8: under 6 months 50,000 IU, 6 to 12 months 100,000 IU, over 1 year 200,000 IU (MSF n.d.).
☐ Pregnancy: 10,000 IU daily or 25,000 IU weekly for 4 weeks. Corneal damage: full dose.
☐ Tetracycline ointment twice daily, light pad on an ulcer. Never steroid.
☐ Record doses. Watch for bulging fontanelle, vomiting, headache.
☐ Then feed liver, orange vegetables in fat, red palm oil (THRIVING library, HY-08).

Protocol 9. Acute glaucoma attack

☐ Painful red eye, haloes, vomiting, mid-sized fixed pupil, hard eye.
☐ Lie flat (Murray 2018).
☐ Acetazolamide 500 mg by mouth, timolol 0.5 per cent one drop, analgesia, antiemetic, if held.
☐ After one hour: pilocarpine 2 per cent, two drops 15 minutes apart. Never above 4 per cent.
☐ Still hard and not diabetic: glycerol 1.0 to 1.5 g/kg by mouth in juice.
☐ To the district for iridectomy of both eyes.
☐ Never dilating drops in either eye.

Protocol 10. The district cataract list

☐ Operate when the person cannot work or see faces, worse eye first.
☐ The eye must see light and know its direction, or surgery will not help.
☐ Not with lid infection, a red painful eye, or a patient who cannot lie still.
☐ MSICS with a 21 to 22 D PMMA lens if held. ICCE with +10 spectacles if not.
☐ Review day 1, day 7, week 6, vision recorded each time.
☐ Quarterly count of eyes reaching 6/18, eyes worse than 6/60 and infections. Infection above 1 in 200: stop and find the cause [VERIFY threshold].

☐ Salvaged lenses and the microscope go to the district, not the village [OWNER].

Protocol 11. The eye kit

Village: torch, pinhole card, 6 m chart and near card, matchstick for lid eversion, two forceps per trichiasis patient, eye pads, card shield (WO-16), lenses +1.00 to +3.50, chloramphenicol or tetracycline ointment, 2.5 per cent povidone-iodine, vitamin A capsules, register.

District, in addition: microscope or loupes and light, MSICS set (crescent blade, keratome, vectis, Simcoe cannula, forceps, needle holder, scissors, speculum), sutures, cautery, viscoelastic, sterile saline, PMMA lenses 21 to 22 D, +10 spectacles, trichiasis set with clamp, local anaesthetic, acetazolamide, timolol, pilocarpine, azithromycin, ceftriaxone, and ivermectin where blackflies breed.

Numbers to carry

1. **2.4 per cent.** Couched eyes seeing 6/18. One in five see nothing (Gilbert 2010, Goyal 1997).
2. **Nine in ten.** Eyes at 6/18 after MSICS, under 15 dollars (Ruit 2007, Chang 2005).
3. **+10.** Dioptres needed after cataract removal without a lens.
4. **+1.00 at 40, +2.50 over 55.** Starting reading powers.
5. **Pinhole.** Better means spectacles. Not better means disease.
6. **Five lashes.** Up to five can be epilated at home. Six or more go to surgery.
7. **20 mg/kg, maximum 1 g.** One azithromycin dose for trachoma.
8. **Days 1, 2 and 8.** Vitamin A for eye disease, 200,000 IU over one year.
9. **Days, not weeks.** A newborn with pus can lose the eye within days.
10. **Boiled water only.** Nothing else in a red eye.

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