



A case series study: Corneal lesions and subsequent needs for Corneal Grafting

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ABSTRACT

Background: Corneal lesions handicap all age groups and corneal grafts, provided by do-nors, treat most of the isolated corneal lesions that has wide diverse etiologies. **Methods and patients:** This study analyzed corneal lesion etiologies and determined the percentage of candidates that required corneal grafts. This study was conducted in Al-Thawra Modern General hospital (ATGMH) in 2004. We enrolled all new patients with corneal lesions attending the clinic during the study period. The corneal lesions were either isolated or combined with other eye lesions. We determined the demography, etiology, and visual acuity by Snellen's E- chart, slit lamp, ultrasound, and accordingly documented the plan of treatment. Those that had trauma and/or inflammation were treated with followed up for two months to plan their potential need for corneal graft. **Results:** From 1440 ophthalmic patients visiting the eye clinic in 2004, the incidence rates of eyes affected by corneal lesions were 9.41% (N=135). Among the causes requiring primary and secondary level intervention were trauma (61) 4.236% and inflammation (18) 1.25%. Among the treated suffers, 15% obtained visual acuity 6/36 and better. Tertiary intervention by corneal graft was required among degenerative lesions (9) 0.625%, keratoconus (12) 0.833%, edema (12) 0.833%, dryness (7) 0.278%, dystrophy (6) 0.416%. Meanwhile, the fourth level required cosmetic treatment and rehabilitation. The lesions were bilateral in (27) 20%, congenital in (6) 0.416% and tumors found in (2) 0.138%.

Conclusion: The incidence of corneal lesions was high (9.4%) among our patients, 63.94% were due to preventable trauma and inflammation and 69% were candidates for corneal graft.

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1. Introduction:

The cornea represents the anterior sixth of the eyeball and it is of 12mm in diameter and a 0.6mm thickness at its center to 1.0 mm at its periphery.¹ It is transparent tissue and centered by the visual axis of the eye.¹ Corneal blindness is the fifth leading cause of global blindness.² The burden of corneal blindness on people can be

huge, particularly as it tends to affect an individual at a relatively younger age than other blinding reasons such as cataract and glaucoma.² A multivariate analyses showed the prevalence of corneal blindness was significantly higher with decreasing socioeconomic status and with increasing age.^{3, 4} Early detection and timely medical intervention of keratitis can deter and

halt the disease progression having a better prognosis, visual acuity, and even preservation of the ocular integrity. Otherwise, keratitis can get worse rapidly with time, potentially leading to permanent vision loss and even corneal perforation.² Infection finds its way after disruption of the surface epithelium by trivial traumas such as by contact lens misuse and rarely virulent organisms that are able to invade the intact cornea as diplococcal *N. gonorrhoe*, which is found in the birth canal or contaminated swimming pools.^{2,3} Fungal infections, which are serious, get access to the cornea, secondary to trauma by wood in agricultural fields, mandates protective measures to those vulnerable.^{2, 4, 5} Also viral infections might be recurrent.^{4, 5} The whole eye could be involved with any infection if not controlled early.^{2,6,7} The density of corneal opacity depended on the treatment facility, depth of the corneal injury, organism virulence, patient immunity and compliance for a correct treatment.⁵⁻¹⁸

Keratitis is an acute corneal lesion that presents early due to symptoms of severe redness from naked nerve irritation in the ulcer bed and if treatment is not prompt, the healing process will cause a visual defect and a white-eye opacity.²⁻⁵ This corneal scar or opacity is graded from just lost lusters, grey to frank white color.^{1, 2, 3-9} Corneal opacities from congenital glaucoma or rare anomalies are candidates for rehabilitation, because of amblyopia, optic atrophy at the presentation and known for a very high rejection rate of the host to donor cornea before 5 years age.^{4,7} Isolated and some of the other eye lesions are treated by corneal graft provided by donors.¹⁰⁻¹²

Corneal grafting is an operation in which either penetrating or lamellar keratoplasty of a transparent corneal tissue provided from a donor, usually after 6 months of inflammation stability.¹⁻⁹ However, prompt therapeutic corneal graft indicated either to save the eye contents if eminent corneal perforation in resistant infection or to save the optic nerve in open eye injuries.²⁻⁶ Corneal grafting is the ultimate treatment for the isolated corneal blindness; especially corneal

scarring, advanced keratoconus, advanced pterygium dystrophies, degeneration and corneal edema especially post intraocular surgery.⁸⁻¹² It is less successful if there is vascularization, viral infection, active inflammation, dryness of neurotrophic or neuroparalytic origin or ages less than 5 years.^{1, 2, 4}

Corneal transplantation from young donors needs cooperation of people and health plans by eye bank and skilled technicians, as well as legislation. The Eye Bank keeps and provides delivery of corneal tissues taken from a cadaver eye within 24 hours from death.^{2, 3, 10-12} The absence of an Eye Bank in Yemen let many eyes with corneal blindness untreated. Further, these need urgent therapeutic graft to save the whole eye; might replacement by an artificial eye prosthesis as a rehabilitation measure for persistent pain or eye atrophy.⁷

The cornea is avascular tissue, so corneal graft, wholly or partial, as the most effective and most often solid organ transplants, is safe and rejection is rare.¹

In a meta-analysis of the published literatures for causes and prevalence of moderate to severe visual impairment in Asia was 0.4%, with a 20-fold difference in the national prevalence across the region. In addition, keratoplasty indications vary more according to the gross national income than the geographical location and only a few Asian countries have rates of corneal transplant above international means.¹³⁻¹⁹

The aims of this study were to determine the hospital-based incidence rates and proportions of each corneal lesions. Also to determine the proportion of potential needs for corneal grafting after stability of vision that might get benefit from corneal grafts, a human tissue that is still imported from out-side the country.

2. Patients and Method

The ATMGH was the major referral center for all eye problems across Yemen. The hospital was the only referral hospital for 24 hours duties for repairing eye injuries also issued official reports for qualifying visual efficiency requests for any purpose as legal-courts and ultimate abroad

reports for consulting specialized eye center outside Yemen for all ophthalmic and medical branches.

This cross sectional observational study agreed by the ophthalmic department and done in a general hospital among general eye patients during their follow-up in the eye clinic, without any referral and accordingly sooner or later (by 2 months follow up), qualified their corneal graft need. The registration was at first time attendance (new eye patients) by an ophthalmologist researcher 2 days weekly in 2004 from January to December. Excluding these came for follow up and registered previously or followed by other colleague ophthalmologists.

Among the new attendances, all patients who had corneal lesions, either isolated or combined, were subjected for documentation of their basic data, full history, and address (living in or outside Sana'a city). Then they had an examination of visual acuity by Snellen's E Chart, anterior segment evaluation by slit lamp and posterior segment evaluation by an ultrasound B- scan to determine the treatment plan and follow up. Acute lesions as trauma, ulcer, post-surgical, exposure keratitis were treated until stable and potential visual acuity recorded.

Visual loss grading- depended on the World Health Organization definition (but here belongs monocular vision rather than best eye vision per a patient) of visual deterioration $\leq 6/18$, and blindness $\leq 3 / 60$ in the better eyes.^{3, 8-10} In this study, the grade for deterioration extended to 6/36 for a glasses trial and the blindness to 6/60 to include those that needed follow up. Blindness in this study was defined as a visual acuity of $\leq 6/60$.⁴ In the extremes, a third group included these better than 6/36 advised for glasses and were not candidate for corneal graft, and the forth group, were the worst with no perception of light or lost eye.

The study determined incidence rates and proportions of corneal lesions etiologies. It analyzed the controllable trauma and / or inflammations then categorized the need for corneal graft among them according to their

potential visual acuity after 2 months follow up.⁸⁻¹⁰ A total of 135 eyes had corneal lesions belonging to 118 patients out of the total 1440 patients examined either isolated or combined with other eye lesions (for example with lens opacity, uveitis, increased intraocular pressure or retinal detachment).

In this study, the corneal lesions included any corneal haze or opacities, ulcers, severe dryness and lid margin mal-positions, various traumas as cut wound, foreign bodies, chemical injuries, corneal edema, pre-excised pterygia, keratoconus, dystrophies and tumors as dermoid or squamous cell carcinoma involving the cornea. Bomb explosions were challenges among rock workers suffering contusion and chemical insults to the eyes mostly asymmetrical with bad prognosis.

For the visual acuity potential, acute inflammation or corneal cut wounds examined every 3-8 weeks in the outpatient clinic to estimate the provisional corneal graft need.^{1, 2}

Visual acuity $\geq 6/36$ relatively good vision among these got isolated superficial corneal abrasions, viral keratitis in addition to faint opacities as, post-ptyerygia excision, foreign body removal, and some of post-surgical corneal edema. These were not candidates for corneal graft (sent for further glasses trial) and so treated efficiently before getting corneal blindness.

Visual acuity from $\leq 6/60$, to hand movement represented the limit of the worse vision. Some needed follow up for treating combined risks as cataract, retinal detachment, to safe the optic nerve from persisting uveitis, and glaucoma. These complications needed planning for management within 2 months of trauma and could lead to ultimate irreversible visual loss due to optic atrophy or eye atrophy from multiple eye lesions. Some would be benefit from urgent therapeutic corneal grafts as keratitis impending perforation, corneal holes as well as opacities prevented urgent retinal detachment surgery with or without intraocular foreign bodies.

The age groups depended on activity and independency in attending medical advice and the four social groups as Children 1-6 years,

Young 7- 18 years, Adults 19 to 50 years and senile if more than 50 years. The P-value and chi- square were calculated.

3. Results

Figure 1: The total eye patients examined during 2004 were (1440). Figure (1) showed among these patients, these suffered from isolated or corneal involved eye lesions were (118) 8.19% in incidence. In term of the affected eyes, they were (135) 9.34%, the extra (17) eyes, over patients' number (118) were belong to bilateral corneal lesions with an incidence rate of 1.18% and with a proportion of 14.41%. The table showed also that, males were affected in (84) 71.19%, while females were only (34) 28.81%.

Figure 2: The preventable trauma with or without inflammation were, unlike other etiologies, mostly monocular and occupied (69) 51% of the total corneal lesions. Table 1: showed the demography: The AGMH was a referral hospital, received (79) 66.9% of the patients from outside Sana'a reflecting the deficiency in eye care services and consequently the delay in the right prompt treatment of the acute lesion, as corneal ulcers or cut wounds, with shortage in follow-up and that participated more avoidable corneal blindness. Among the 135 eyes with corneal lesions, the right eye was affected in 55.56% (N=75), meanwhile the left eye was affected in 44.4% (N=60) among eyes with corneal lesions. The corneal lesions among patient's age groups <1 year: (1) 0.85%, between 1- 6 years: (6) 5.08%. These between < 7 years: (7) 5.93%, 7-

18 years old: (36) 30.51%, between 19-50 years occupied (72) 61.02% meanwhile (15) 12.7% ages >50 years. The established corneal opacities showed ascending manner by aging, this might be related to the absence of an eye bank, let corneal blindness untreated. Nevertheless, among the oldest group, which is less active age group, the proportion declined to 15 % and the incidence of corneal lesions was mostly from recent corneal edema post intraocular surgery, tumor or glaucoma.

Table 2: showed the pattern of trauma that presented urgently and/or those complicated by infection. The inflammatory that had not precipitated by trauma were due to viral infection and these came with keratitis without trauma.

The study showed neither trachomatous corneal blindness, which was endemic in areas with poor water supply and bad environmental sanitation and nor xerophthalmia that related to vitamin A deficiency from measles or malnutrition dated in early childhood,

Figure 3: showed the four groups of visual acuity among the eyes with corneal lesions and related to the presumed need for corneal graft belong to visual acuity 6/60 or worse these were (93) 68.89% and were (85) 62.96% as elective and (8) 5.92% as therapeutic corneal grafts.

Figure 2 and Table 2, showed, the preventable etiologies responsible for corneal blindness (visual acuity ≤ 6/60) were traumas: responsible for (69) 51.11% and with incidence of 4.79% meanwhile, inflammations responsible for 13.33% and 1.25% in incidence.

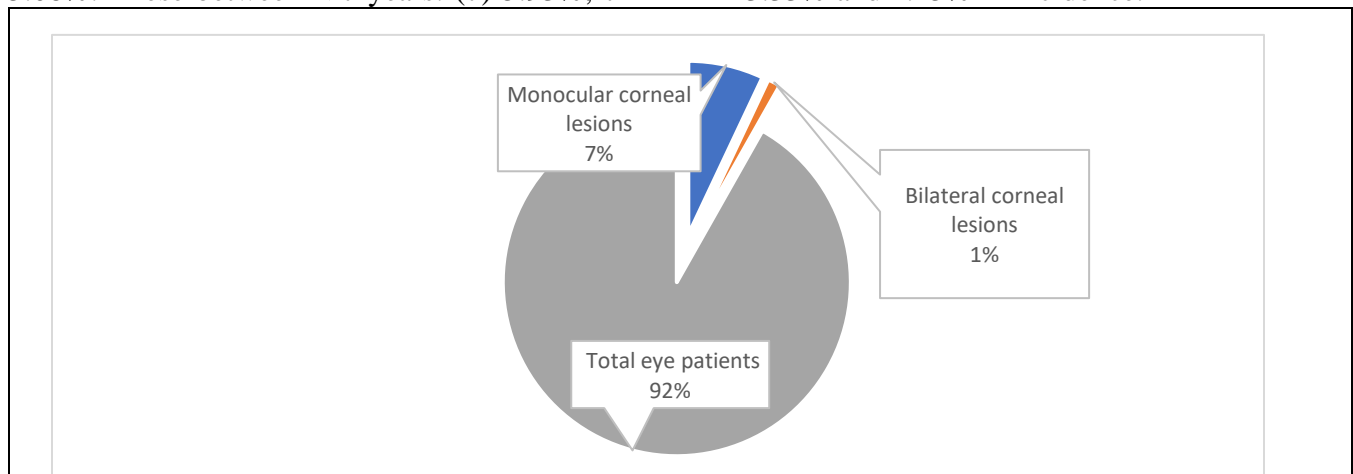


Figure 1: The Presumed Incidence of the corneal lesions (Total 1440)

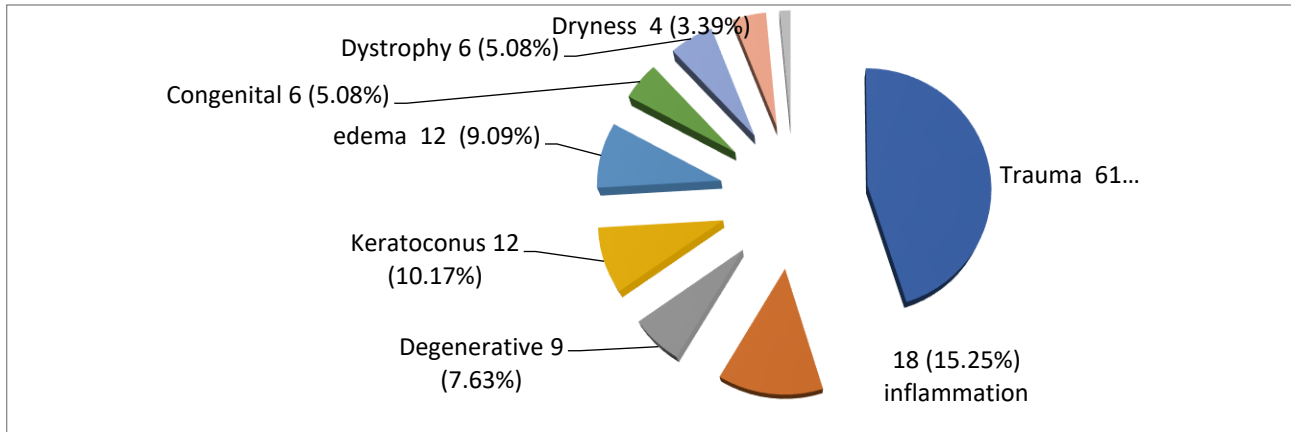


Figure 2: Proportions eyes with various etiologies of corneal lesions (Total 135).

Table 1: Demography of the corneal lesions-samples in the respective years.

Corneal lesions	Per: Eyes Patients		Eye		Laterality		Sex		Sana'a living	
			Right	Left	Mono	BE	M	F	Out	In
(N)	(135)	(118)	(75)	(60)	(118)	(17)	(84)	(34)	(79)	(39)
Incidence	9.37	8.19			8	1.18				
%	100	100	55.56	44.4	87	14	73.73	28.8	66.9	33.05

Population = 1440

Mono: one eye, BE both eyes, M: males, F: females, Out: live outside Sana'a, In: live inside Sana'a

Table 2: The preventable corneal varieties / eye

Controllable Corneal Lesions	N	Proportions /135	Incidence /1440
Traumatic	51	37.78	3.541
Penetrating eye injury	32	23.703	2.22
Intraocular foreign body	12	8.89	0.833
Bomb's explosion	2	1.48	0.138
Corneal Foreign body	3	2.22	0.208
Missed	2		
Inflammations with trauma	12	8.89	0.833
Responded to Antibiotics	6	4.44	0.417
Endophthalmitis	4	2.96	0.278
Missed	2		
Inflammation without trauma	6	4.44	0.0417
Respond to anti-viral	3	2.22	0.208
Old corneal scars	3	2,22	0.208
Trachomatus trachiasis	0	0.00	0.000
Xerophthalmia	0	0.00	0.000
Total	69	51.11	4.79

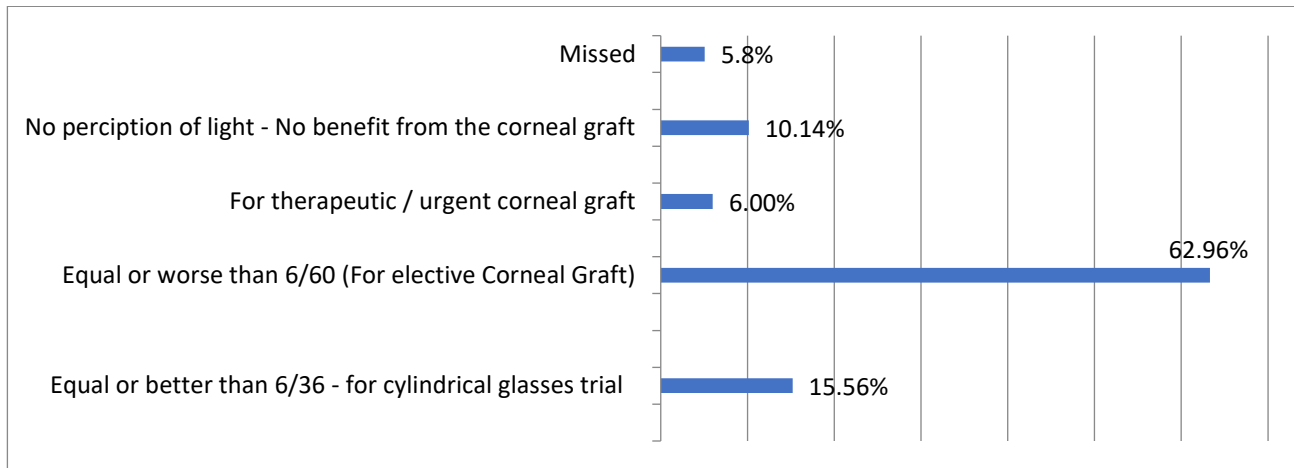


Figure 3: Corneal graft potential among corneal lesions (Total 135)

4. Discussion

This study analyzed hospital-based incidence rate of corneal lesions from a general eye clinic. Trauma and inflammation were similar to studies done in various countries, were the commonest causes of corneal lesions.³⁻¹⁶ As (61) 51.69% of the total corneal lesions were from outside Sana'a city (Table 2), Then delayed or incorrect treatments could end in corneal opacity or corneal blindness among trivial impacts, as well, same as worse impacts.

Ocular trauma is also the cause of unilateral and bilateral blindness in more than one million people.^{3,4} Ocular trauma can be prevented by risk appreciation and avoidance, widespread wearing of high performance spectacles or protective goggles, appropriate occupational processing and shielding, extension of on-the-job safety.^{3,4,14-16}

Those having visual acuity equal to or better than 6/36 up to normal 6/6 were (12) 15.19% of corneal lesions. These were not candidates for corneal graft and sent for glasses trial. The remaining 67 were eyes with cornea opacities with graded vision less than 6/36.

Visual acuity from $\leq 6/60$, to hand, movement represented 50 eyes (62.96%). These with light perception with other eye lesions as retinal detachment or cataract in a child needed urgent therapeutic corneal grafts were five eyes (6.3%). The isolated corneal lesions and adults needed elective graft (Table 3).

The worst, who had loss of vision within 2 months of follow up (no perception of light), were (8) 10% with multiple eye lesions by either optic atrophy or eye loss.

Another preventable cause of eye rupture through cornea, among the young (less than 15 years old), was dangerous games that must not find their way in the markets aiming particularly this age group like guns throwing small balls.

Delayed presentation for days, lead to endophthalmitis, eye atrophy, which was treated by surgical replacement by artificial eye prosthesis, to relieve the pain or cosmetic as rehabilitation measures.⁷ Binocular lesions among children needed blind school for learning.

Populations studies reported 0.10% prevalence of corneal blindness binocularly and 0.56% monocular. Nearly 95% of all corneal blindness was avoidable. The most frequent causes of corneal blindness, in at least one eye included keratitis during childhood 36.7%, trauma (28.6%), and keratitis during adulthood 17.7%.¹⁵

This study was comparable to other population-based studies, in some etiologies as were monocular.^{4,5,6} However both eye lesions with or without asymmetry was found in keratoconus, dystrophies and bilateral eye injury. The absence of trachoma and nutritional (xerophthalmia) etiology denoted improved socioeconomic status and health care as also found in the WHO and many community-based studies.^{3,4,6-8,11,13} In contrast, there was evolution of corneal edema related to intraocular surgery which might

indicate the surgical evolution as in a Saudi study.⁸

To control corneal blindness; the four lines of prevention can be applied which are; the primary line; toward entire prevention, secondary line; for treating predisposing and precipitating factors and decreasing the burden of corneal opacity and then blindness, tertiary line; for corneal opacity by graft and the fourth line by rehabilitation of atrophic eyes. The primary line, designed for the avoidable causes that encompasses preventable and controllable causes.²² In this study, they were keratitis, trauma, bullous keratopathy, severe astigmatism from keratoconus escaped crosslinking and delayed treatment with or without traditional eye medicine. The exophthalmia prevention attained by controlling both measles infection and vitamin A deficiency. In addition. ophthalmia neonatorum, trachoma, ocular trauma and/or infection.²² The corneal blindness from these diseases are entirely controllable by institution of effective preventive and prophylactic measure at the community level.²²

The secondary line of corneal blindness control, tackled by an effective and accessible health care service delivery network. In cases such as corneal ulceration and selected cases of scarring, with timely and prompt management. Community health programs should provide easy available antibiotics and antifungal even in rural areas.^{3-7, 13-18, 22} Keratitis is the main cause of corneal blindness worldwide, 90% in developing countries.²² Most vision loss caused by keratitis can be avoidable via early detection and treatment. The diagnosis of keratitis often requires skilled ophthalmologists.²² Pterygium excision, crosslinking to halt keratoconus progression, treat lid margin malposition, tarsorrhaphy for lagophthalmos to safe the corneal from continuous exposure and dryness, removal of foreign bodies impeded in corneal surface, surgical repair of corneal wounds and control corneal edema post intraocular surgeries. Vision retained in 15.06% of the sufferers in this study (Figure 3).

The third line of treatment is for the established corneal opacity by the corneal graft. It is a primary treatment for corneal dystrophies, which affect both eyes simultaneously.^{9, 10, 12} As it was estimated that 50% of corneal blindness is treatable.²⁰ This hospital based study, showed 62% of corneal lesions were candidates for elective and 6.0% for therapeutic corneal graft (Figure 3). Absence of Eye bank in Yemen, as well as in 53% of countries, in the world, adding more costs by importing or travelling.¹⁹ Recent trials for bio-printing-Artificial corneas by 3D technique, might replace the natural corneal graft in the future.

Many aspects of current trials of 3D Bio-printing artificial cornea by bioengineering as Corneal modeling, Bio-inks, 3D bio-printing optimization, Cellular components into bio-printed cornea said to be promising.^{19, 20}

The economic load due to corneal blindness has not been extensively studied and it has been estimated that if strategies are implemented successively to prevent 90% of preventable blindness due to the cornea by 2020.²⁰ The underdeveloped countries host 90% of preventable blindness and need paramount strategies and more viable and cost effective in the long term for reducing corneal blindness.²⁰ The fourth- line of management is the rehabilitation for irreversible eye or vision loss, as by replacing an atrophic eye by prosthesis or enrolling to blind school study for those that are still young.^{4, 7}

5. Conclusion

Corneal lesions occurred among all age groups. The incidence rate was high among the patients attending our hospital during the study; delayed presentation due to poor health care in rural areas was associated with a poor prognosis in addition to absence of an eye bank in Yemen added to the poor outcome. Feasible and even distribution of Eye care Unites outside of Sana'a as well as the launch of Eye Bank will improve the treatment outcome. A more emphasis has to be given to prevent corneal lesions by education and wearing eye goggles as indicated during hazard works.

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