Causes of Corneal Blindness: A Multi-Center Retrospective Review

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Objective: *To assess prevalence and causes of corneal blindness in four hospitals in Thailand and to compare the causes between hospitals.*
Material and Method: *A retrospective chart review of six hundred and sixty four patients records with best-corrected visual acuity not better than 6/60 in at least one eye due to corneal disease in Siriraj, Mettapracharak, Sappasitthiprasong and Banmee Hospitals in a one-year period were reviewed. The collected data included age, sex, laterality, causes of corneal blindness, and prognosis.*
Results: *Seven hundred and sixty nine eyes with corneal blindness and a median age of 55.0 years were reviewed. Leading causes of cornea blindness were corneal infection (35.6%), surgical bullous keratopathy (27.8%), and trauma (14.0%). The prevalence at Siriraj Hospital was 1.7% (498/28,728 patients). Most of the treatable cases (84.6%) underwent penetrating keratoplasty procedures and 73% of patients had a chance of recovery.*
Conclusion: *Corneal infection and surgical bullous keratopathy were the leading causes of corneal blindness.*

Keywords: *Corneal blindness, Corneal infection, Surgical bullous keratopathy, Traumatic leukoma, Penetrating keratoplasty*

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Diseases affecting the cornea are major causes of blindness worldwide, second only to cataract[1]. The epidemiology of corneal blindness is complicated, and encompasses a wide variety of infectious and inflammatory eye diseases. The prevalence of corneal blindness varies from country to country and from one population to another, depending on many factors, such as availability and standards of eye care[1]. In Thailand, the national epidemiological survey of corneal blindness is still not available. The survey of causes of blindness in northern Thailand in 1987 revealed that in Lampang Province, corneal diseases accounted for 4% of all blindness, and corneal ulcer was the leading cause of corneal blindness (42%)[2]. A recent survey of blindness in the Outpatient Department at Siriraj Hospital in 2004 revealed that corneal diseases were the third major cause of blindness (12.7%), next to retinal diseases (30.9%), and cataract (21.8%), respectively[3].

For these reasons, it would be interesting to know the cause of corneal blindness in Thailand and variations in different areas.

The authors conducted the present study in four different types of hospitals to find the causes of corneal blindness in different places. The first was Siriraj Hospital (SI), a university hospital and tertiary eye care center in Bangkok. Second was Mettapracharak Hospital (MP), also a tertiary eye care and referral center located in Nakhon Pathom Province, near Bangkok. Third was Sappasitthiprasong Hospital (SP), Ubon Ratchathani Province, a large secondary eye care and

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referral center in northeastern Thailand. Last, was Ban Mi Hospital (BM), Lopburi Province, also a secondary eye care center located in central Thailand. Penetrating keratoplasty procedures were only available in the first two hospitals.

Material and Method

The present study was approved by each hospital committee for retrospective chart reviewing. Charts of all patients who visited the Eye Department, in Siriraj, Mettapracharak, Sappasitthiprasong, and Ban Mi Hospital between October 1, 2004 and September 30, 2005 were reviewed. In the present study, an eye was considered to have corneal blindness if the best-corrected visual acuity (BCVA) in that eye was not better than 6/60 (defined by Snellen chart) as a result of corneal disease. All patients underwent a complete ocular examination, including visual acuity testing and anterior and posterior segment evaluation. Ultrasonography of the posterior segment and/or electroretinography, if available, was performed in cases of obscured fundus to exclude posterior segment diseases. If the present study, participants had more than one ocular pathology, whether the major cause of blindness was due to a corneal cause, or not, was determined by the ophthalmologist who examined those patients. The collected data included best-corrected visual acuity (BCVA), age, sex, laterality, cause of corneal blindness, and prognosis. The one-year data were collected in all four hospitals as described above. Data on blindness due to corneal disease was analyzed and categorized as corneal blindness in one versus both eyes. The demographic associations of corneal blindness with age and level of eye care were assessed.

Statistical analysis

The data for each patient were entered into Excel tables, and SPSS for Windows Version 13.0 was used to analyze the data. The difference of causes of corneal blindness in each hospital was analyzed using the Chi-square test. A *p*-value less than 0.5 was regarded as statistically significant.

Results

Demographic data

There were 664 patients, [341 males (51.4%), 323 females (48.6%)] that had corneal blindness in at least one eye. The median age of patients in all four hospitals was 55.0 years. Median ages of patients in Siriraj, Mettapracharak, Sappasitthiprasong, and Ban Mi Hospitals were 54.0 (range 0.08-93 yrs), 55.0 (15-84 yrs), 61.5 (18-83 yrs), and 65.0 (33-88 yrs) years, respectively (Fig. 1). Sappasitthiprasong and Ban Mi Hospitals were limited by their small population, thus statistical significance was not valid.

Prevalence of corneal blindness

Five hundred and fifty nine patients had corneal blindness in one eye while 105 patients suffered from bilateral corneal blindness. In Siriraj Hospital, 498 patients (585 eyes) had some corneal blindness (411 in one eye and 411 in two eyes). The prevalence of corneal blindness was 1.7% (498/28,728). In Mettapracharak, Sappasitthiprasong, and Ban Mi Hospitals there were 98, 34, and 34 patients, respectively, who were blind from corneal diseases in at least one eye. The number of patients with bilateral corneal blindness in each hospital was 9, 5, and 4, respectively (Table 1). Most patients had best-corrected visual

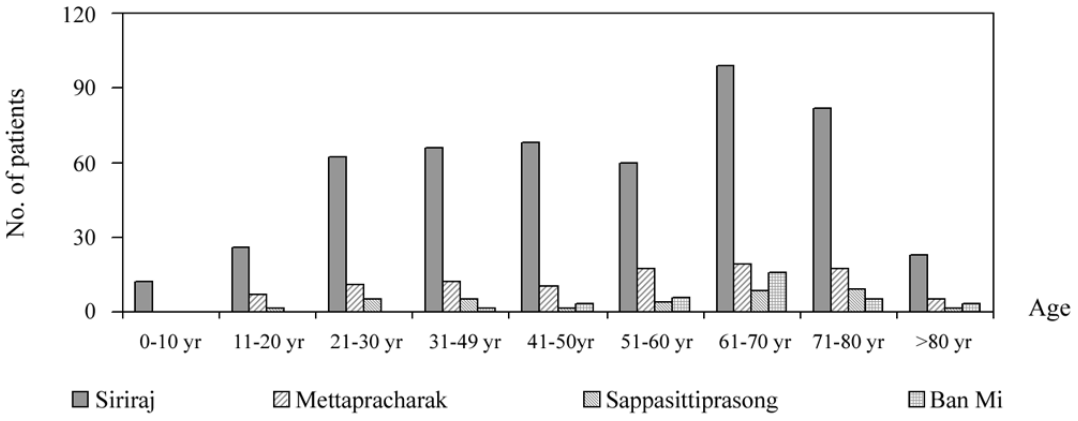


Fig. 1 Age distribution in each hospital

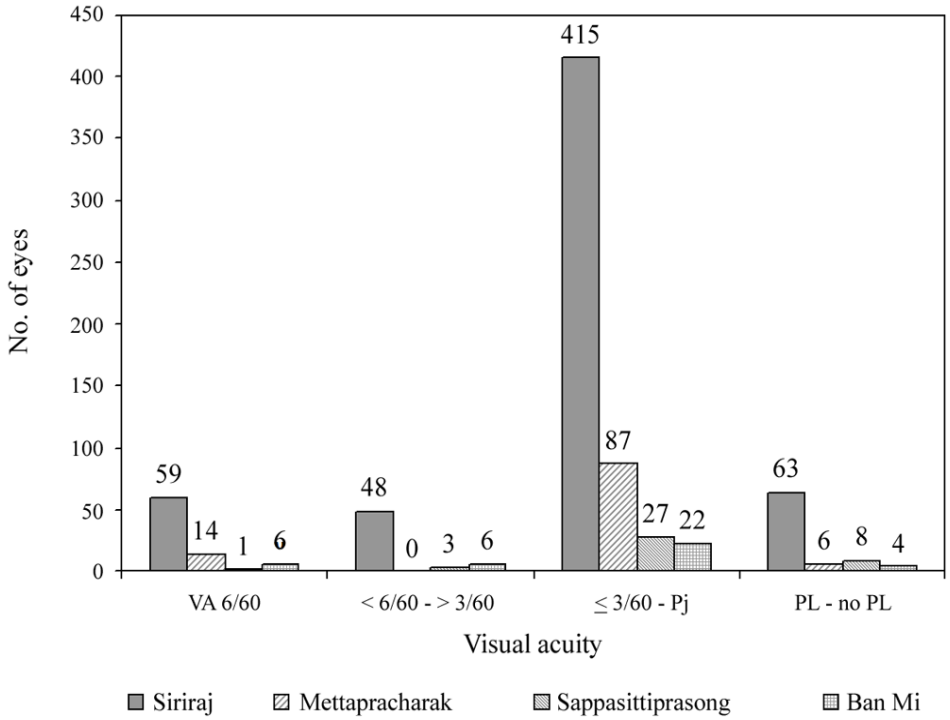


Fig. 2 Visual acuity distribution in each hospital

acuity (BCVA) in the range of ≤ 3/60 to light perception, as shown in Fig. 2.

Causes of corneal blindness

The causes of corneal blindness in all hospitals were corneal infection (35.6%; 274/769 eyes), surgical bullous keratopathy (27.8% 213/769 eyes), trauma (14%; 108/769 eyes), congenital and dystrophy diseases (12.7%; 98/769 eyes) and autoimmune diseases (7.4%; 57/769 eyes) respectively as details in Table 2 and Fig. 3. Besides Siriraj Hospital, corneal infection and trauma were the major causes. In cases of bilateral corneal blindness, the most common causes were congenital and autoimmune diseases (Fig. 4) which was found more in large centers such as Siriraj Hospital.

The leading causes of corneal blindness in Siriraj Hospital were surgical bullous keratopathy (32.5%; 190/585 eyes), infection (30.5%; 178/585 eyes), and congenital and dystrophy diseases (13.3%; 78/585 eyes). This was significantly different from

Table 1. General data of patients with corneal blindness

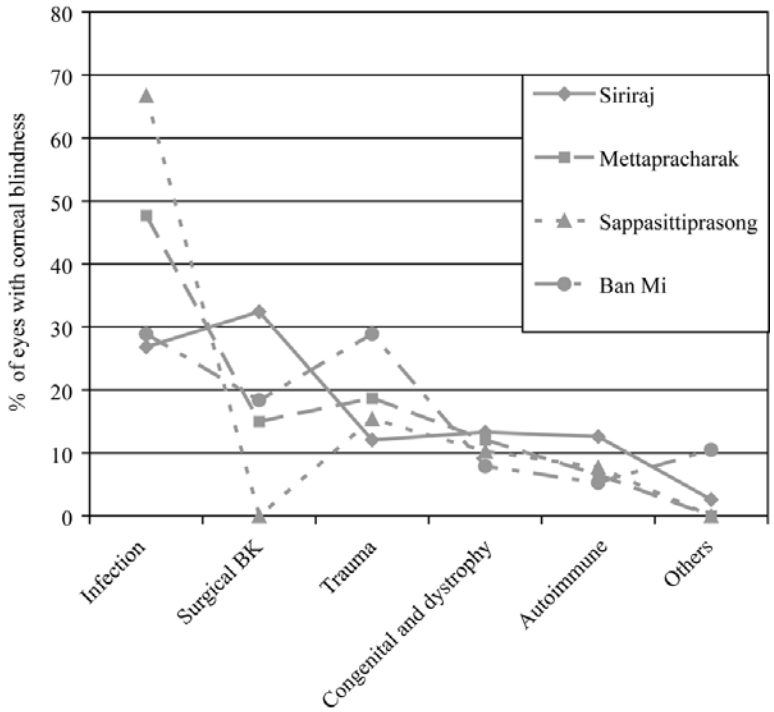
Corneal blindness	Hospital				
	SI	MP	SP	BM	Total
No. of patients (males/females)	498 (247/251)	98 (56/42)	34 (18/16)	34 (20/14)	664 (341/323)
No. of eyes	585	107	39	38	769
No. of patients with bilateral corneal blindness	87	9	5	4	105
Median age (yrs)	54	55	61.5	65	55.0
Age range	0.08-93	15-84	18-83	33-88	0.08-93

SI = Siriraj, MP = Mettapracharak, SP = Sappasittiprasong, BM = Banmee

Table 2. Prevalence of causes of corneal blindness

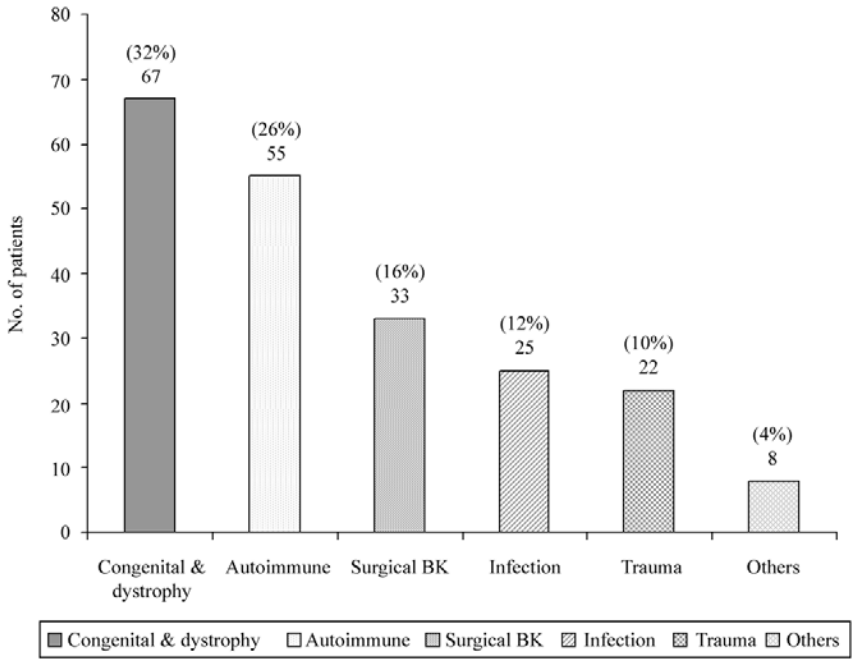
Corneal blindness	Hospital				
	SI No. (%)	MP No. (%)	SP No. (%)	BM No. (%)	Total No. (%)
Infection	178 (30.5)	56 (52.3)	27 (69.2)	13 (34.2)	274 (35.6)
Acute infection	116	29	25	6	176
Bacteria/Fungus/Mixed	60/51/5	18/10/1	21/4/-	5/1/-	104/66/6
HSV	21	5	1	2	29
Old infection	41	22	1	5	69
Surgical BK	190 (32.5)	16 (14.9)	-	7 (18.4)	213 (27.8)
Cataract/Glaucoma/Other	117/10/6	10/1/-	-/-/-	5/1/-	132/12/6
Graft rejection	57	5	-	1	63
Trauma	71 (12.1)	20 (18.7)	6 (15.4)	11 (29.0)	108 (14.0)
Old/New	67/4	16/4	6/-	11/-	100/8
Congenital&dystrophy	78 (13.3)	13 (12.2)	4 (10.3)	3 (7.9)	98 (12.7)
Cong/other dystrophies	31/31	2/1	-/4	-/3	33/39
Fuch's /ICE/keratoconus	9/4/3	6/1/3	-/-/-	-/-/-	15/5/6
Autoimmune	53 (9.1)	2(1.9)	2(5.1)	-	57 (7.4)
SJS/OCP/PUK/Others	36/3/7/7	2/-/-/-	2/-/-/-	-/-/-/-	40/3/7/7
Miscelleneous	15 (2.5)	-	-	4 (10.5)	19 (2.5)
Total	585	107	39	38	769

SI = Siriraj, MP = Mettapracharak, SP = Sappasittiprasong, BM = Banmee, HSV = Herpes simplex keratitis, BK = Bullous keratopathy, ICE = Iridocornealendothelial syndrome, SJS = Stevens-Johnson syndrome, OCP = Ocular cicatricial pemphigoid, PUK = Peripheral ulcerative keratitis



Surgical BK = Surgical bullous keratopathy

Fig. 3 Causes of corneal blindness (in percent of eyes with corneal blindness) in each hospital



Surgical BK = Surgical bullous keratopathy

Fig. 4 Causes of bilateral corneal blindness in 4 hospitals

Mettapracharak Hospital, in which the leading causes were infection (52.3%; 56/107 eyes), trauma (18.7%;20/107 eyes), and surgical bullous keratopathy (15.0%; 16/107 eyes) respectively ($p < 0.001$, Chi-square test) whereas Sappasitthiprasong and Ban Mi Hospitals were limited by their small population, thus statistical significance was not valid. Utilizing the World Health Organization's (WHO) definition of blindness as a visual acuity of 3/60 or less, there were 580 patients (668 eyes) in the present study blind from corneal diseases at least one eye. The causes of the corneal blindness were the same as using visual acuity 6/60 or less. These were infection (35.6%; 238/668 eyes), surgical bullous keratopathy (28.7%; 192/668 eyes), congenital disorders (13.2%; 88/668 eyes) and traumatic leukoma (13.2%; 88/668 eyes), respectively.

Table 3. Causes of treatable and untreatable corneal blindness

Causes	Treatable (eyes) (%)	Untreatable (eyes) (%)
Surgical BK	157 (20.4)	56 (7.3)
Infection	274 (35.6)	43 (5.6)
Autoimmune	57 (7.4)	49 (6.4)
Trauma	108 (14.0)	33 (4.3)
Congenital & dystrophy	98 (12.7)	22 (2.9)
Others	17 (2.2)	2 (0.3)
Total	n = 564 (73.3)	n = 205 (26.7)

Surgical BK = Surgical bullous keratopathy

By clinician decision, all the patients with corneal blindness had a 73.3% (564/769 eyes) might have improved vision by medical or surgical care. Most (84.6%; 477/564 eyes) had plans to undergo penetrating keratoplasty procedures to treat the blindness.

Discussion

The prevalence of corneal blindness is different in each country. The National Survey in China in 1992 found that the prevalence of corneal blindness was 0.1%, but in Tanzania in 1993, it was as high as 3.2%[4,5]. The prevalence of corneal blindness in India was 0.7% in 2001[6]. In Thailand, data from the National Survey in1994 revealed that the prevalence of corneal blindness was 0.02%[7]. However, recent data from

the National Survey in 2006 is in the process of being analyzed.

Leading causes of corneal blindness are also different in each country. Infection and trauma are the leading causes of corneal blindness in many developing countries. Trachoma was the most important cause of corneal blindness in China, Tanzania, Tunisia, Kenya and Sudan[4,5,8-10]. In Nigeria and Nepal, trauma was the first leading cause of corneal blindness[11,12]. In developed countries, non-infectious causes constituted the majority. In the USA and Canada, bullous keratopathy was the major cause of corneal transplantation[13,14], whereas keratoconus was the main cause of corneal transplantation in Australia, New Zealand, and Italy[15-17].

The present study demonstrated that causes of corneal blindness in these four hospitals in Thailand were in the range between developed and developing countries. The leading cause of corneal blindness in the present study was infection, but mainly bacterial and fungal infections, and not trachoma as in China and some African countries[4,5,8-10]. The second most common cause in the present study was surgical bullous keratopathy, which was similar to that in developed countries[13,14]. In large referral centers such as Siriraj Hospital, the causes of corneal blindness were similar to those in developed countries, whereas infection was the leading cause in the other hospitals[13-16]. The causes of corneal blindness vary among different hospitals based on the location and complexity of each hospital. There are more complicated cases, cases with irreversible blindness, and cases that require the surgical skills of a corneal specialist in tertiary care centers.

As mentioned above, infectious keratitis is still one of the most important problems concerning ophthalmologists. Prevention programs for occupational diseases in both agricultural and industrial fields could help reduce the incidence of corneal blindness from infectious and traumatic diseases. Early diagnosis and prompt management in infectious keratitis and autoimmune diseases can inhibit the diseases from progressing to blindness. Improvement of surgical techniques and surgeon awareness might also reduce the corneal complications and corneal decompensations.

Even congenital and autoimmune diseases are minor causes of corneal blindness. They also have serious effects because they are bilateral diseases, are difficult to treat, and have a large chance of irreversibility.

In the future, further studies conducted in more hospitals or population based surveys would provide more information and may guide the direction of health care promotion in Thailand.

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สาเหตุของตาบอดจากกระจกตา

ภิญนิตา ประภาสะวัต, กนกอร ตรีทิพย์วาณิชย์, นวลจิรา ประกายรุ้งทอง, สุดารัตน์ นเรนทร์พิทักษ์, สรรเสริญ จารุโรจน์สกุลชัย, จิรภัส อนันตชัย

วัตถุประสงค์*: เพื่อศึกษาความชุกและสาเหตุของภาวะตาบอดจากกระจกตาในโรงพยาบาลที่แตกต่างกัน*

วัสดุและวิธีการ*: เก็บข้อมูลแบบย้อนหลังในผู้ป่วยทั้งหมดที่เข้ารับการตรวจรักษาที่ภาควิชาจักษุวิทยา โรงพยาบาลศิริราช และในผู้ป่วยที่รับการตรวจที่แผนกจักษุวิทยา ของ โรงพยาบาลเมตตาประชารักษ์, โรงพยาบาลสรรพสิทธิประสงค์ และโรงพยาบาลบ้านหมี่เป็นระยะเวลา 1 ปี ข้อมูลที่ทำการศึกษาได้แก่ อายุ เพศ จำนวนตาที่เป็น โรคที่เป็นสาเหตุให้เกิดตาบอดจากกระจกตา และพยากรณ์โรค*

ผลการศึกษา*: จำนวนผู้ป่วยที่มีภาวะตาบอดจากกระจกตาทั้งสิ้น 664 คน จำนวนตาที่มีภาวะตาบอดจากกระจกตา 769 ตา อายุเฉลี่ย 55.0 ปี สาเหตุตาบอดจากกระจกตาที่พบบ่อยสุดสามอันดับแรก ได้แก่ กระจกตาติดเชื้อ (35.6%), ภาวะกระจกตาเสื่อมหลังได้รับการผ่าตัด (27.8%) และอุบัติเหตุที่กระจกตา (14.0%) ความชุกของภาวะตาบอดจากกระจกตาในโรงพยาบาลศิริราช คือ 1.7% (498/28,728 คน) ผู้ป่วยส่วนใหญ่ (73.3%) จะสามารถกลับมามีระดับสายตาที่ดีกว่า 6/60 ได้ ซึ่งประมาณ 84.6% ของจำนวนผู้ป่วยเหล่านี้ระดับสายตาจะดีขึ้นได้จากการรับการผ่าตัดเปลี่ยนกระจกตา*

สรุป*: กระจกตาติดเชื้อและภาวะกระจกตาเสื่อมหลังได้รับการผ่าตัด เป็นสาเหตุสำคัญของตาบอดจากกระจกตา*
