

Brief communication (Original)

Indications for corneal transplantation in Thailand between 1996 and 2008

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Background: Corneal transplantation is the most frequent organ transplantation worldwide. Many indications for corneal transplantation have been proposed and several novel indications have been reported in various studies. Nevertheless, there is no national data from Thailand to date.

Objective: We identified indications and evolving trends of corneal transplantations in Thailand between January 1996 and December 2008

Methods: Corneal graft registry records of the Thai Red Cross Eye Bank during January 1996 and December 2008 were retrospectively reviewed. Diagnosis of the recipient eye is considered as an indication for transplantation. Patients' demographic data, diagnosis, operating hospitals, and number of collected corneal tissues annually were collected. Analyzed data were shown in scattergram and simple linear regression. A p value of 0.05 was considered significant.

Results: Among 3,582 records, 2,802 (78.2%) had the transplantation done for an optical reason. Others were performed due to either therapeutic or tectonic reasons. None of the cases was operated for a cosmetic concern. Mean age of patients was 51.8 years. Male (56.8%) was slightly predominant over female (43.2%). Corneal scar (20.44%) was the most frequent indicated reasons followed by corneal ulcer (19.15%), pseudophakic and aphakic bullous keratopathy (16.81%), corneal dystrophies (11.08%) and regrant (10.75%). PBK/ABK and regrant showed an increasing trend during the study period.

Conclusion: Common indications for corneal transplantation in Thailand were corneal scar, corneal ulcer, PBK/ABK, corneal dystrophies and regrant respectively. Due to imbalanced demand and supply of donated corneas, not all of the patients received corneal transplantations in a timely manner. As a result, this study might not truly represent the actual indications for corneal transplantation in Thailand. With continued development in donation awareness, financial support and inter-organizational collaborations and healthcare as a whole, adequate numbers of corneal supply might be possible in the future.

Keywords: Corneal transplantation, indication, penetrating keratoplasty

Corneal transplantation is the most frequent organ transplantation worldwide. Under the missions of corneal recruitment, harvesting, processing, storage, and distributing corneal tissues throughout the country, the Thai Red Cross Eye Bank [TRCEB] was established in 1965. Advances in medical technology, availability of infrastructure for corneal surgery and

good quality of donor tissues lead to the rising numbers of corneal transplantation in Thailand. Indications for corneal transplantation considerably vary in different countries [1-14]. In the past decade, many indications for corneal transplantation have been proposed and several novel indications have been reported in various studies. Nevertheless, there is no national data from Thailand to date. Therefore, we retrospectively reviewed clinical indications for corneal transplantation in Thailand during a 13-year period from January 1, 1996 to December 31, 2008 and compared the data to other series.

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Materials and methods

Corneal graft registry records of the Thai Red Cross Eye Bank during January 1996 and December 2008 were retrospectively reviewed. Among 3,889 donor eyes collected and distributed for transplantation in this period, 3,821 register forms were available. Recipient diagnoses represented indications for transplantation. Two hundred thirty nine records were excluded due to the absence of an operating date; therefore, 3,582 forms were analyzed.

Indications for corneal transplantation were classified into 11 categories. From TRCEB database, patients' demographic data, operating hospital and the number of collected corneal tissues annually were reported.

Analyzed data were shown in either scattergram or simple linear regression, where appropriate. A p value of 0.05 was considered significant.

Results

Three thousand five hundred eighty two operations from 3,196 patients were performed during the 13-year period. Table 1 shows the number of corneal transplantation performed on each eye. The review

indicated that 2,802 (78.2%) operations had been done for an optical reason. Others were performed due to several therapeutic causes such as uncontrolled keratitis and impending perforated or perforated infective keratitis. None of the cases was operated for cosmetic concerns. Mean age of patients was 51.8 years, ranging from two months to 97 years as shown in Figure 1. Male (56.8%) slightly predominated than female (43.2%).

The indications for corneal transplantation were classified into 11 categories (Figure 2 and Table 2). Corneal scar (20.44%) was the most frequent indicated reasons followed by corneal ulcer (19.15%), pseudophakic and aphakic bullous keratopathy (16.81%), corneal dystrophies (11.08%) and regrant (10.75%), respectively. The number of transplantations due to PBK/ABK and regrant has increased every year while other indications did not show that increasing trend by scattergram as can be seen in Figure 3. Both bullous keratopathy, including PBK and ABK and regrant showed a statistically significant increase in the number of cases each year as shown by simple linear regression analysis ($p < 0.05$).

Table 1. Corneal transplantation performed per eye from 1996-2008

Number of procedures per eye	Number of eye (%)
1	2,879 (89.8)
2	284 (8.9)
3	33 (1)
4	9 (0.2)
Total	3,205

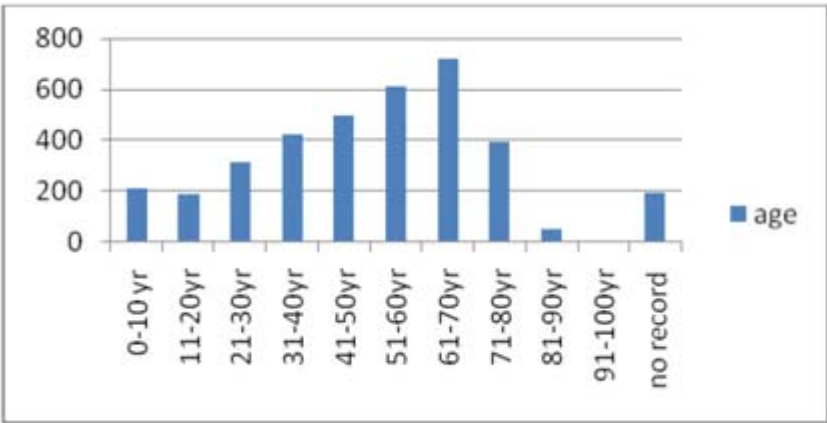


Figure 1. Age distribution of patients receiving corneal transplantation (n=3582*) *age at the year of operation performed, according to number of surgeries

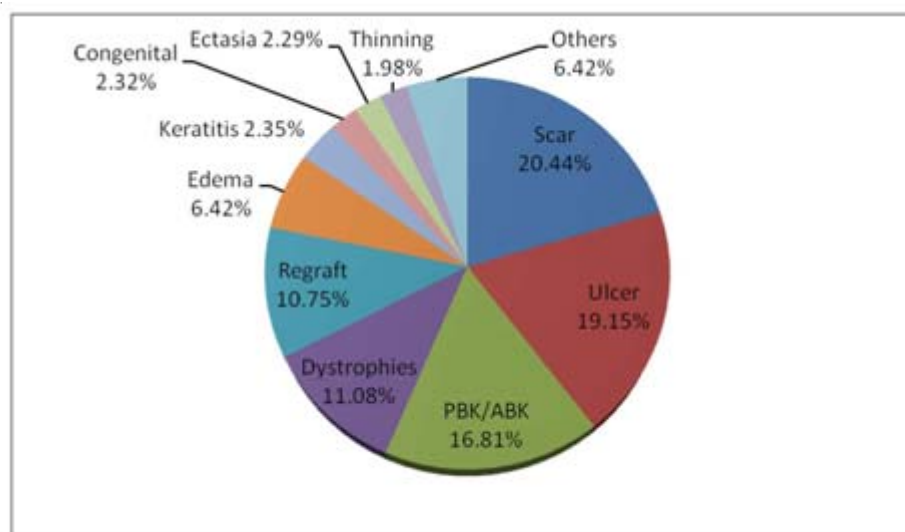


Figure 2. Indications for corneal transplantation, between 1996 and 2008. Corneal scar was the most common indication for transplantation (20.44%). Corneal ulcer was the second most common indication (19.15%), followed by pseudophakic and aphakic bullous keratopathy (16.81%), corneal dystrophies (11.08%), and regraft (10.75%).

Table 2. Indications for corneal transplantation by category and specific indications (n=3,582)

Indications	No. of surgeries (%)	Indications	No. of surgeries (%)
Corneal scar	732 (20.44%)	Keratitis	84 (2.35%)
Corneal ulcer	686 (19.15%)	HSV/HZV	46
Uncontrolled	259	Interstitial keratitis	38
Perforated	178	Congenital	83 (2.32%)
Impending perforated	249	ICESyndrome	24
PBK/ABK	602 (16.81%)	Peter's anomaly	17
PBK	475	ARsyndrome	7
ABK	127	Congenital glaucoma	3
Corneal dystrophies	397 (11.08%)	Limbal dermoid	20
Unclassified	59	Sclerocornea	10
Epithelial	2	Microphthalmos	2
Stromal	175	Ectasia	82 (2.29%)
Endothelial	161	Others	230 (6.42%)
Regraft	385 (10.75%)	Unclassified	43
Corneal edema	230 (6.42%)	Burn	50
Thinning/melting	71 (1.98%)	Trauma	
Corneal thinning	48	-Unclassified	28
Corneal melting	23	-Impending perforated	38
		-Perforated	20
		Limbal stem cell deficiency	31
		Corneal deposits	11
		Corneal degeneration	8
		S/P couching	1
		Total	3,582

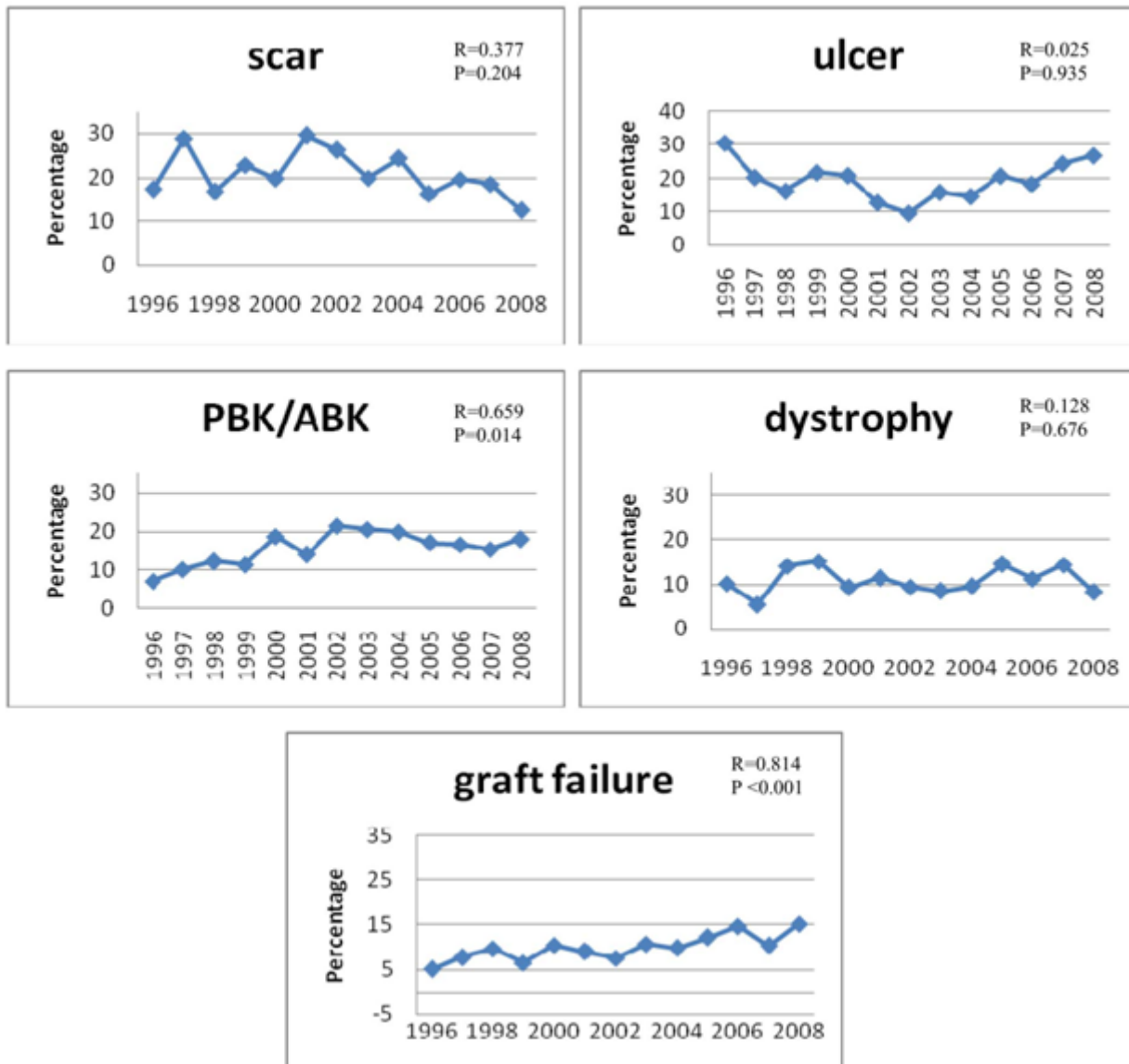


Figure 3. Trends of the leading indications for corneal transplantation, 1996 to 2008. Regraft shows a statistically significant increasing trend using linear regression analysis ($p < 0.05$). PBK and ABK also showed increasing trend with a peak in 2002 ($p < 0.05$).

Discussions

TRCEB is the first and the only functioning eye bank in Thailand. The indications of transplantation as shown in this paper may represent nationwide statistics. However, it precludes imported donor corneas that are being used in some hospitals.

Due to lack of donor tissue availability, registered recipients are categorized into six groups as followed: emergency, urgency, bilateral affected eyes, regular register, pediatric patient, and lamellar keratoplasty according to their different urgencies. The donor tissue is evaluated by an ophthalmologist and a TRCEB technician. After that, the tissue will be grouped based on its quality.

Corneal scar is the most common indication for corneal transplantation in Thailand in this study. Similarly, it is also the most frequent reasons in many studies from Asian countries [5, 12]. Due to the limitation of retrospective records review, original diagnosis and causes of corneal scar were difficult to identify. Since corneal scar can be the end results of many corneal diseases, it should not be regarded as one of the diagnostic categories. Therefore, a primary condition should be determined. In tropical or sub-tropical countries like Thailand, corneal scar is often caused by infectious keratitis and traumatic corneal injury [12, 13].

Corneal ulcer is the second most common indication with just a small percentage behind corneal scar. Boonpasart et al [15] reported that corneal transplantation was the most common surgery performed in patients with corneal ulcer, 34.24% (63/184), followed by evisceration and enucleation which accounted for 25% (46/184). Low socioeconomic status, healthcare accessibility, and poor health education might be the three major factors in delayed treatment that contributes to failure of medical therapy. Corneal ulcer has also been a leading indication in other developing and agricultural countries such as India and North China [12, 13].

PBK and ABK are the third leading indications in this study. Comparing to the previous study by Chaidaroon et al [7], they found that major reasons for corneal transplantation were PBK (28.9%), corneal scar (22.2%), and corneal dystrophies and degeneration (20.0%). These top three did not differ from our study. PBK also showed statistically significant increasing trend since 1996, reaching a peak in 2002 and showed declining trend afterward. The incidence of PBK in most of the published data showed the identical trend [1, 2, 4-6]. With the increasing number of cataract surgery with intraocular lenses in 1980s, the incidence of PBK was apparently rising. However, it subsequently declined because of the advances in surgical techniques, surgeon's experiences, and novel instruments.

Although regrant and corneal dystrophies are not indicated as frequently as corneal scar, regrant was reported as the most common indication in Canada, North America, and Europe [2-4, 6]. Since each study was conducted in a single tertiary referral center, overall indications for corneal transplantation may not be representative of nationwide data. In addition, the leading cause of graft failure in those studies was herpetic keratitis, which is not so common in Thailand. On the contrary, due to the limited number of donor tissues in Thailand, surgeons generally prefer choosing a patient with a high chance of success rate and a low possibility of regrant. However, with the growing awareness of eye donation, coverage of health care service by the National Health Security Office and a continuous improvement in medical management to prevent graft rejection, a statistically significant increasing trend has been shown in regrant.

Even though keratoconus is the leading indication for corneal transplantation in many countries, it was not common in our series. Genetic factor, racial and

climatic effects have not been shown to play much role in the incidence of keratoconus. The prevalence of keratoconus in Thailand has not been reported; nevertheless, from our observation, keratoconus is rarely diagnosed in Thai population. Reports of indication for corneal transplantation from eastern countries with similar climate and with Chinese ancestor also show a large number of keratoconus cases [11, 13]. Further study might be needed to explain this finding. Even though there were a small number of keratoconus cases in our study, it was more common in males, with female to male ratio of 0.58. Similar male preponderance has been reported in many series and characteristics of the patient with no sexual difference might be needed to review.

Conclusion

In summary, common indications for corneal transplantation in Thailand were corneal scar, corneal ulcer, pseudophakic and aphakic bullous keratopathy, corneal dystrophies and regrant, respectively. PBK/ABK and regrant showed a statistically significant increasing trend during this study period. Inadequacy of donor tissue might mask the true indication for corneal transplantation in the past decade. With continuous development in many aspects of healthcare including health considerations, donation awareness, more financial support and collaborations between key organizations (e.g., the Ministry of Public Health, the National Health Security Office, the Social Security Office, the Comptroller General's Department, the Government Pharmaceutical Organization, the Public Relation Department and the Thai Red Cross Society), adequate corneal supply might be achieved and actual indications for corneal transplantation in Thailand should be revealed.

The authors have no conflict of interest to report.

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