

Indications for penetrating keratoplasty in west Malaysia

S C Reddy, I Tajunisah

Department of Ophthalmology, Faculty of Medicine, University of Malaya, Kuala Lumpur, Malaysia

Correspondence to: S C Reddy. Department of Ophthalmology, International Medical University, Clinical School, Jalan Rasah, 70300 Seremban, Negeri Sembilan, Malaysia. screddy98@hotmail.com

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Abstract

- **AIM:** To determine the indications for penetrating keratoplasty in Malaysia and to compare the leading indications with recently published data from other countries.
- **METHODS:** A retrospective review of the medical records of all patients who underwent penetrating keratoplasty at Medical Centre, University of Malaya, Kuala Lumpur, Malaysia over a period of fifteen years (1991/2005) was done. The gender, age, race of patients, eye operated, indication for surgery were noted from the records, and analyzed.
- **RESULTS:** A total of 125 penetrating keratoplasties were performed in 105 patients (male 71 and female 34; Chinese 55, Indians 33, and Malays 17; unilateral 85 and bilateral 20) during the study period. The mean age of patients was 51.3 years (range 13-79 years). The indications for penetrating keratoplasty were pseudophakic bullous keratopathy (28.8%), corneal scar (20.0%), keratoconus (17.6%), regrafts (9.6%), corneal dystrophies (8.8%) and corneal perforations (7.2%).
- **CONCLUSION:** Pseudophakic bullous keratopathy is the most common indication for penetrating keratoplasty in Malaysia. The three leading indications (pseudophakic bullous keratopathy, corneal scar and keratoconus) in our study are similar to many countries in the world, but they differ in the order of frequency from some countries.
- **KEYWORDS:** penetrating keratoplasty; pseudophakic bullous keratopathy; corneal scar; keratoconus; regraft; corneal dystrophies

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INTRODUCTION

Corneal diseases are one of the major causes of blindness and visual impairment in developing countries [1]. Penetrating keratoplasty (PK) is still the procedure of choice for visual rehabilitation of patients with corneal blindness. The leading indications for PK reported in the literature from different countries [2-41] include pseudophakic bullous keratopathy (PBK), corneal scarring following infections and injuries, keratoconus, failed corneal grafts, purulent keratitis/ corneal ulcer, corneal dystrophies and degenerations. However, the most common indication varies from one centre to another centre in the same country, from one country to another country in the same region and from one region to another region globally based on geographical variation, socio-economic status (developed/developing) of the country and the availability of health care services. The Pubmed search showed numerous reports published from different countries in the world, but none from Malaysia. Therefore, we conducted a retrospective study to determine the indications for penetrating keratoplasty in a tertiary medical centre in west Malaysia (University of Malaya Medical Centre, Kuala Lumpur), and compared the leading indications with the recently published data from different countries.

MATERIALS AND METHODS

A retrospective review of the medical records of all patients who underwent PK over a period of fifteen years (1991/2005) was done. The gender, age, race of patients, eye operated, indication for surgery were noted from the records, and analyzed. The graft failure was defined as irreversible graft reaction after intensive medical therapy, resulting in corneal opacification and poor vision (<3/60). The primary indication for which the PK was performed earlier, was noted in patients with regrafts.

RESULTS

A total of 125 PKs were performed in 105 patients. Males were predominant (71) than females (34) in this study; Chinese were 55 followed by Indians (33) and Malays (17).

Indications for penetrating keratoplasty in west Malaysia

Table 1 Indications for penetrating keratoplasty (n =125 eyes)

Indication	n (%)	Subcategory of indication	n (%)
Pseudophakic bullous keratopathy	36(28.8)	ACIOL ¹	20(16.0)
		PCIOL ²	16(12.8)
Corneal scar	25(20.0)	Bacterial keratitis	12(9.6)
		Trauma	8(6.4)
		Fungal	3(2.4)
		Viral keratitis	2(1.6)
Keratoconus	22(17.6)		
Regrafts	12(9.6)	PBK ³	10(8.0)
		Corneal perforation	2(1.6)
Corneal dystrophies	11(8.8)	Fuch's endothelial dystrophy	5(4.0)
		Lattice dystrophy	5(4.0)
		Granular dystrophy	1(0.8)
Bullous keratopathy	10(8.0)	Aphakia	8(6.4)
		Open angle glaucoma	1(0.8)
		Acute congestive glaucoma	1(0.8)
Corneal perforations	9(7.2)	Corneal ulcer	8(6.4)
		Sjogren syndrome	1(0.8)

¹ACIOL: anterior chamber intraocular lens; ²PCIOL: posterior chamber intraocular lens; ³PBK: pseudophakic bullous keratopathy

The mean age of patients was 51.3 years, ranging between 13 and 79 years. In keratoconus patients, the mean age was 22.6 years with a range between 13 and 36 years. The surgery was done in one eye in 85 patients and in both eyes in 20 patients (total 125 procedures); regrafts were done in 12 eyes of patients in whom one eye was operated already. Bilateral PK was performed in 10 patients with keratoconus, in 6 with pseudophakic bullous keratopathy, in 2 with lattice corneal dystrophy, in 1 patient with aphakic bullous keratopathy (ABK) and Fuchs' endothelial dystrophy each. In our study, the most common indication was pseudophakic bullous keratopathy (28.8%) followed by corneal scarring (Table 1). Pseudophakic bullous keratopathy was noted more frequently in anterior chamber intraocular lens implantation. Nearly half the number of corneal scars were due to bacterial keratitis. In regrant cases, primary indication for doing earlier PK was PBK. Majority of bullous keratopathy patients were aphakic; Fuchs' endothelial dystrophy and lattice corneal dystrophy were equal in number in our study.

DISCUSSION

The most common indication for PK varies from country to country in different regions of the world. The period of study, number of PKs done, and the percentage of leading three indications published in the literature during the past eighteen years is shown in Table 2. It is evident that the three leading indications for PK were different in the order of frequency from region to region. When the percentages of

indications from different centres in the region are added together, the order of leading indications is as follows: USA—PBK, keratoconus, regrafts; UK—regrafts, keratoconus, corneal scar; Europe—PBK, keratoconus, regrafts; Canada—regrafts, PBK, keratoconus; Australia & New Zealand—keratoconus, PBK and ABK, regrafts; India—corneal scar, active infectious keratitis, regrafts; and China—corneal scar, purulent keratitis, keratoconus.

In countries like India and China where the population is very large, corneal scar followed by the corneal infections and corneal injuries is the first leading indication for PK. The probable reason for this could be that majority of people in these countries live in rural areas and they may not be in a position to afford the cost of the treatment which is available quite far away from their places, thus suffering from corneal blindness.

In our study, PBK (28.8%) was the most common and first leading indication for PK which is similar to the figures reported from Canada [29], Denmark [31], France [16], and USA [18,26,30,35]. However, its frequency is much higher than the figures reported from Singapore (11.4%) [27] and Thailand (12.6%) [39]. Cataract surgery related to corneal edema (PBK/ABK) accounted for 35.2% of PKs in our study which is much higher than the figures of similar cause from Canada (22.2%) [38], Slovenia (23.1%) [3], Singapore (26.3%) [27], and Thailand (28.9%) [14] (Table 2). The routine practice of intraocular lens implantation following cataract surgery in many countries and the learning curve of the surgeons in the initial years of practice could be the possible causes for the increased frequency of PK in patients with PBK.

The second leading indication for PK in our study was corneal scar (20%), which resulted from corneal infections (13.6%) and corneal trauma (6.4%). However, the corneal scar was reported as the first indication for PK in many countries like China [8], India [9,28], Nepal [11], Taiwan [19], Thailand [39], UK [25], and Zimbabwe [23], and the reported figures varied between 26% [25] and 55.9% [8] (Table 2). In majority of these patients, it was post infectious keratitis scarring. Delayed diagnosis, inadequate treatment, failure to implement standard management protocol for corneal infections may be the contributing factors for higher proportion of dense corneal scarring following corneal infections. In patients with corneal scar following trauma, 2.2% [14] to 16.7% [9] required penetrating keratoplasty.

Keratoconus (17.6%) was the third leading indication in our study. However, it was the first leading indication in Australia [34], Brazil [5], France [20], Germany [24], Iran [2], Israel [7], New Zealand [17], Sweden [40], UK & Ireland [33], USA [36,37], and West Bank & Gaza [41]; with the reported figures ranging between 24% [37] and 65% [5] (Table 2).

Table 2 Comparison of leading three indications for penetrating keratoplasty in different countries

Author	Study year	Country	PK No.	Leading indications with percentage		
				First	Second	Third
ACGR ^[34]	1985-1991	Australia	3463	Keratoconus 31%	BK 25%	Failed graft 14%
Calix Natto <i>et al</i> ^[5]	June-Dec2003	Brazil	106 ¹	Keratoconus 65%	PBK21%	Corneal scar 10%
Damji <i>et al</i> ^[38]	1978-1987	Canada	659 ²	BK 22.2%	Keratoconus 17.1%	Corneal scar 13.5%
Liu <i>et al</i> ^[29]	1986-1995	Canada	904	PBK 28.5%	Regraft 22.4%	Keratoconus 10%
Maeno <i>et al</i> ^[21]	1964-1997	Canada	6192 ²	Regraft 18%	Keratoconus 16%	PBK 15.3%
Dorrepaal <i>et al</i> ^[4]	1986-2004	Canada	777	Regraft 26.9%	PBK 24.8%	Fuchs' dystrop 13%
Xie <i>et al</i> ^[6]	1997-2002	China	1702	Purulent keratitis 31.9%	HSK 17.6%	Keratoconus 12.9%
Zhang <i>et al</i> ^[8]	1994-2003	China	229	Corneal scar 55.9%	BK 19.9%	Keratoconus 12.2%
Haamann <i>et al</i> ^[31]	1984-1993	Denmark	180	PBK 28.3%	Fuchs' dystro.13.9%	Regraft 11.1%
Legeais <i>et al</i> ^[20]	1980-1999	France	3736	Keratoconus 28.8%	HSK 10.9%	Graft failure 9.9%
Poinard <i>et al</i> ^[16]	2000-2001	France	11598 ¹	PBK 27.7%	Keratoconus 25.3%	Fuchs' dystrop 9.1%
Cursiefen <i>et al</i> ^[24]	1992-1996	Germany	1250 ²	Keratoconus 20.9%	Corneal scar 20.4%	PBK/ABK 17%
Dandona <i>et al</i> ^[28]	1987-1995	India	1964	Corneal scar 28.1%	Regraft 17.1%	AIK 12.2%
Sony <i>et al</i> ^[9]	1997-2003	India	2022	Corneal scar 38%	AIK 28.4%	Regraft 11.5%
Kanavi <i>et al</i> ^[2]	1994-2004	Iran	19668 ³	Keratoconus 34.5%	Corneal scar 18.6%	PBK 9.2%
Yahalom <i>et al</i> ^[7]	1961-2000	Isrel	1681	Keratoconus 28.4%	Graft failure 13.4%	PBK 8.4%
Tabin <i>et al</i> ^[11]	1994-1995	Nepal	472	Corneal scar 37%	Corneal perfor. 9%	PBK 6%
Edwards <i>et al</i> ^[17]	1991-1999	New Zealand	1308	Keratoconus 45.6%	PBK/ABK 17.9%	Regraft 8.7%
Amaral <i>et al</i> ^[10]	1998-2002	Pernambuo	814	Corneal ulcer 21.3%	BK 19.9%	Keratoconus 18.6%
Al-Towerki <i>et al</i> ^[12]	1983-2002	Saudi Arabia	8318	Corneal scar 36.9%	Keratoconus 20.5%	ABK/PBK 12.3%
Chan <i>et al</i> ^[27]	1991-1995	Singapore	327	BK 26.3%	Regraft 11.9%	Corneal dyst. 10.4%
Pahor <i>et al</i> ^[3]	1985-2004	Slovenia	290	ABK/PBK 23.1%	Keratoconus 21.7%	Corneal scar 21.4%
Claesson <i>et al</i> ^[40]	1996-1998	Sweedden	1950	Keratoconus 29%	BK 21.2%	Fuchs' dystrop. 14.6%
Chaidaroon <i>et al</i> ^[14]	1996-1999	Thailand	45	BK 28.9%	Corneal scar 22.2%	Corneal dyst.°. 20%
Prechanond <i>et al</i> ^[39]	1997-2001	Thailand	366	Corneal scar 28.7%	Regraft 17.5%	PBK 12.6%
Chen <i>et al</i> ^[19]	1987-1999	Thaiwan	770	Corneal scar 27.9%	Regraft 21%	Corneal ulcer 17.9%
Ramsay <i>et al</i> ^[25]	1970-1995	UK	1486	Corneal scar 26%	Regraft 20.7%	Fuchs' dystrophy 8%
Sharif <i>et al</i> ^[32]	1971-1990	UK	3555	Regraft 40.8%	Keratoconus 17%	Corneal scar 11.7%
Vail <i>et al</i> ^[33]	1987-1991	UK& Ireland	3184	Keratoconus 19.9%	PBK 15.1%	Fuchs dystrophy 11.4%
Al-Yousuf <i>et al</i> ^[13]	1990-1999	UK	784	Regraft 40.9%	Keratoconus 15%	Fuchs dystrophy 9.3%
Lois <i>et al</i> ^[26]	1989-1995	USA	2442	PBK 26%	Regraft 17.8%	Fuchs dystrophy 15.7%
Dobbins <i>et al</i> ^[22]	1982-1996	USA	4217	PBK 31.5%	Fuchs dystro 23.2%	Keratoconus 11.4%
Cosar <i>et al</i> ^[18]	1996-2000	USA	1529	PBK 27.2%	Regraft 18.1%	Keratoconus 15.4%
Randleman <i>et al</i> ^[15]	1997-2000	USA	79	Failed graft 29.1%	BK 21.5%	Keratoconus 20.3%
Flowers <i>et al</i> ^[30]	1989-1993	USA	1104	PBK 24.8%	Regraft 21.3%	Corneal scar 11.1%
Mamalis <i>et al</i> ^[36]	1981-1990	USA	999	Keratoconus 24.2%	PBK 23%	Regraft 13.1%
Hyman <i>et al</i> ^[35]	1985-1988	USA	3941	PBK 23%	Graft failure 17%	Keratoconus 13%
Lindquist <i>et al</i> ^[37]	1980-1988	USA	1594	Keratoconus 24%	PBK/ABK 21.2%	Corneal scar 13.9%
Claesson ^[41]	Jan 2001 - Nov 2002	West Bank& Gaza	154	Keratoconus 51.3%	Regraft 10.4%	BK 9.7%
Mkanganwi <i>et al</i> ^[23]	1992-1998	Zimbabwe	--	Corneal scar 39.2%	Keratoconus 26.8%	PBK 12.5%
Present study	1991-2005	Malaysia	125	PBK 28.8%	Corneal scar 20%	Keratoconus 17.6%

¹Patients registered for penetrating keratoplasty; ²Corneal buttons of patients who underwent penetrating keratoplasty;

³Eyebank records of patients who underwent penetrating keratoplasty

BK: bullous keratopathy, PBK: pseudophakic bullous keratopathy; ABK: aphakic bullous keratopathy; HSK: herpes simplex keratitis; AIK: active infectious keratitis

Regraft accounted only for 9.6% of PKs in our study; in majority of these patients, the PK was done for PBK earlier. However, regrafting was reported as the first leading indication from well developed countries like Canada^[4,21], UK^[13,32], and USA^[15]; and the reported figures ranged from 18%^[21] to 40.9%^[13]. Fuchs' corneal dystrophy was one of the three leading indications reported from different countries such as Australia^[34], Canada^[4], Denmark^[31], France^[16],

UK^[13,25,33], and USA^[22,26]; the range of figures varied from 8%^[25] to 23.2%^[22] (Table 2). In our study, Fuchs' dystrophy accounted for only 4% of PK.

Purulent keartitis/ corneal ulceration was the first leading indication in China^[6] and Pernambuco^[10] respectively, while active infectious keratitis has been reported as second^[9] and third^[28] leading indication for PK in India. In our study, infectious keratitis accounted for 13.6% of PK while

Indications for penetrating keratoplasty in west Malaysia

perforated corneal ulcer accounted for 6.4% of PK.

In conclusion pseudophakic bullous keratopathy, corneal scarring and keratoconus are the three leading indications in Malaysia, followed by regrafts for graft failure, corneal dystrophy, bullous keratopathy and corneal perforations. The three leading indications in our study are similar to many countries in the world, but they differ in the order of frequency from some countries.

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