Determinant Variable in Corneal Transplantation Success Rate in Bahrain

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SUMMARY

CORNEAL transplantation in Bahrain was started in June 1979. The first twenty-four cases were reviewed retrospectively. The majority of the cases were of severe trachomatous corneal scarring with severe vascularisation. The success rate was compared with the international published series. Inspite of the unfavourable cases operated upon and the poor quality of donor grafts, good success rate was achieved. Twenty of twentyfour cases had achieved clear or slight oedematous graft. Also reported here are the good results obtained in a group of severe trachomatous cases, which are considered very unfavourable.

INTRODUCTION

The history of tissue transplantation appropriately starts with Adam and Eve. De Quengry[1] in France first suggested in 1789 that a corneal opacity could be excised and replaced by a convex disc of clear glass. The challenge was repeated seven years later by Erasmus Darwin[1], who further suggested that such a slight and not painful operation might be facilitated by cutting the cornea with a kind of trephine. Astley Cooper[1] in London was the first to perform a successful skin graft in 1817 and then Reisinger[2].

In 1837 Samuel Bigger[1] described how he had successfully inlaid a homograft into a pet gazelle's eye. Later Richard Kissinan in 1844[1] sutured a cornea of a six months old pig into place of a staphyloma of a blind Irishman. In 1872 Henry Power[1] reported his series of grafting experiments on rabbits, dogs, cats and even humans. It had already become apparent (from their almost universal failure) that success required not only freedom from infection, freshness of material, exactness of placement and minimal trauma to the donor, but that even more essential were the use of homoplastic material and the preservation of the corneal endothelium and Descemet's membrane.

Finally Van Hippel[1], who in 1886 had invented a clock work trephine for cutting the graft, achieved the first limited success in a human. He implanted a full-thickness rabbit graft as a lamilla on to a girl's cornea and thereby improving her vision from counting finger to 6/60[1].

However, the credit for the first full thickness graft in man that remained clear and transparent is generally ascribed to Zirm 1906[1].

In Bahrain, our first corneal transplant was performed in June 1979 and since then 56 cases of full thickness corneal transplants have been performed.

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We report here on the first 24 cases of full thickness corneal transplants done at the Salmaniya Medical Centre in Bahrain. The cases which were usually advised and selected for Keratoplasty were the worst type of cases which previously had been denied any hope for visual recovery. (fig. 1).

PATIENTS AND METHODS

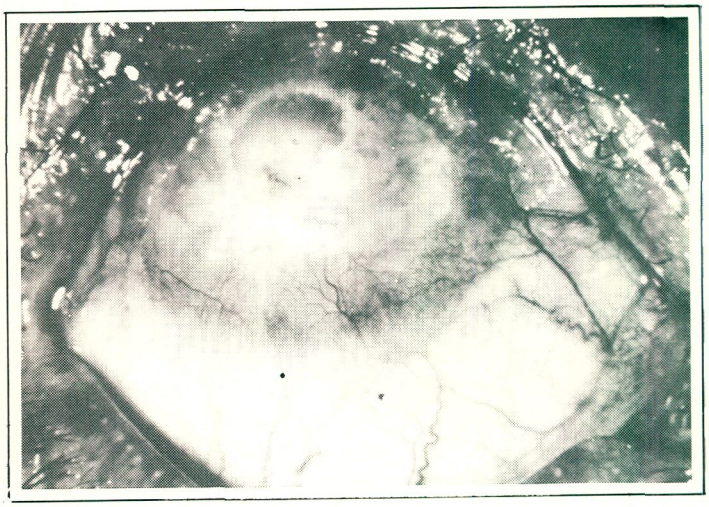
The first two cases were operated in June 1979 and the last case included in this study was operated in November 1980. The longest period of follow up was 20 months and the shortest period was 6 months. There were 12 females and 12 males and all of them were of Bahraini nationality. The main indication for selecting these patients was the very poor vision as a result of chronic trachoma complications which caused severe corneal scarring and advanced vascularisation (fig. 2). They made up 79% of these cases (19 cases), four cases were the result of aphakic bullous keratopathy and one case was due to intractable unhealed corneal ulcer.

The age ranged between 35 to 80 years. Most of the cases were above 40 years (Table I). All patients who underwent full thickness grafting had rubbing eye lashes and sequelae of advanced trachoma and some of those patients had to undergo correction of entropion or electrolysis to alleviate factors of irritation and subsequent epithelial and stromal damage of the transplanted cornea. (fig. 3).

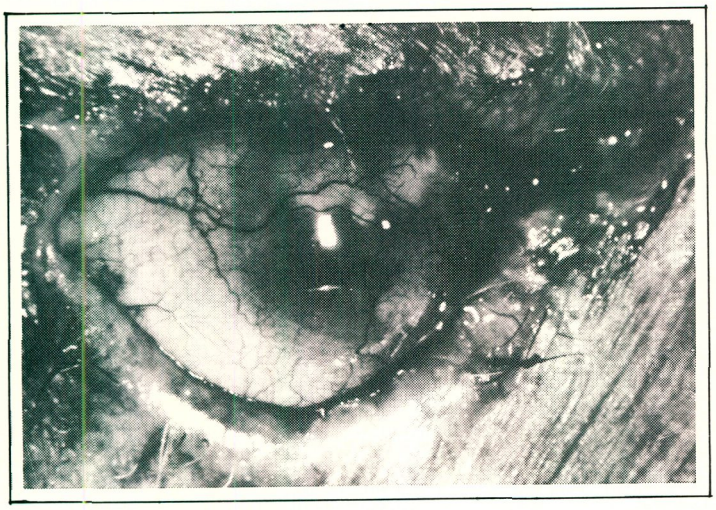
DONORS

Donor corneals were regularly received from the International Eye Bank in Sri Lanka by air. The eyes were enucleated and sent in a special container at 4°C. The age of the donors as in Table II shows that the majority of donors were above 40 years of age.

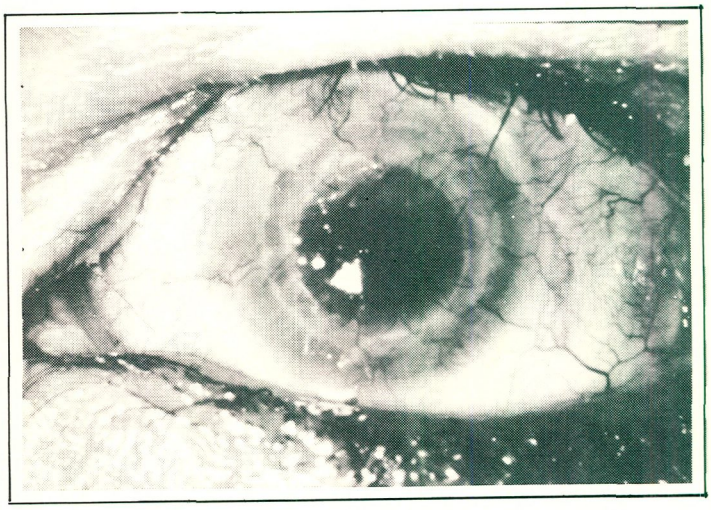
1. *Pre op. shows severe corneal calcified degeneration*



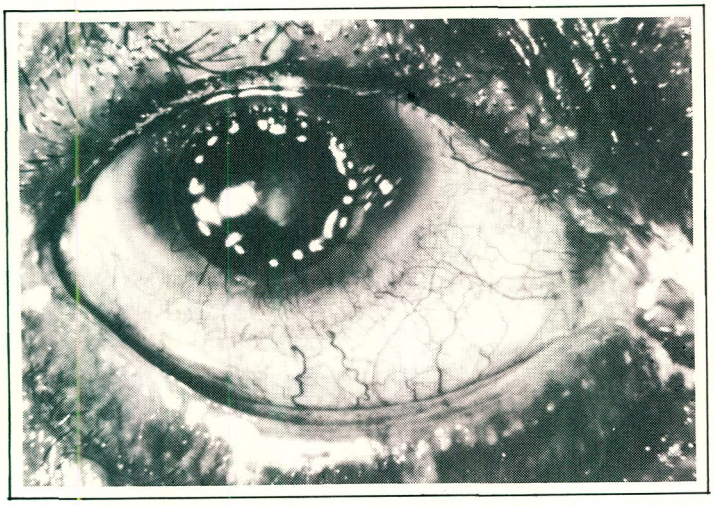
2. *Pre op. shows advanced trachomatous pannus*



3. *Pre op. showed advanced pannus and deep & superficial vascular invasion of previous corneal ulcer*



4. *Clear graft 3 months post op. shows the continuous 10 - 0 monofilament. The graft surrounded by severely scarred cornea.*



5. *Three weeks post op. clear graft shows the continuous 10 - 0 monofilament*

6. *Post op. stitch abscess 3 months following the operation (case No. 8)*

TABLE I
Age distribution of recipients

Age in years	*Number*
40	6
40 — 60	9
65	9

The youngest donor was 15 years and the oldest donor was 78 years old. The age of donated corneal from the time of enucleation until transplantation is seen in Table III.

TABLE III
Age of transplanted cornea

Age in hours	*Number*
18 — 24	9
24 — 48	15

The causes of death were reviewed and no corneas were used which were suspected of causing possible transmission of disease to the host. There were six enucleated eyes which remained more than 35 hours before transplantation. The estimated time elapsed for each was an average of 3 - 4 hours until the eyes were enucleated. The decision as to the suitability and the condition of the graft for transplantation was taken after examining the donor eye under the operating microscope. The graft was considered suitable when it was found to be rather clear, not very oedematous and showed only few Decemet's folds.

PROCEDURE

Our standard technique used trephination of donor corneal button graft from the enucleated eye and the size taken was 0.5 mm larger than the recipient trephined bed. The trephined corneal disc was kept in neosporine drops for about 10 - 15 minutes until the recipient bed was ready. The operation was carried out using the Zeiss operating microscope (X-Y model). Bleeders were not cauterised because we have noticed that they will usually stop bleeding within few minutes. Two or four preplaced 8 - 0 virgin silk sutures were applied. Then a continuous over and over 10 - 0 perlon monofilament suture was used keeping the end knots embedded[3]. All patients received intravenous mannitol 20% 250 ml one hour before the surgery. Phakic patients received pilocarpine 4% pre operatively to constrict the pupil. The five patients who were aphakic received no pilocarpine drops because we planned to do vitrectomy. All cases were done under general anaesthesia except one which was done under local anaesthesia because of contraindication to general anaesthesia.

Complications during the surgery were met in only two cases, 5% of the cases. One iris injury and another case had severe bleeding which persisted as hyphaema post operatively.

Immediately after surgery we routinely adminstred subconjunctival mydricain solution which was found helpful to prevent severe post operative posterior synechia. Atropine 1% eye ointment and chloromycetine eye ointment were applied and the eye was bandaged.

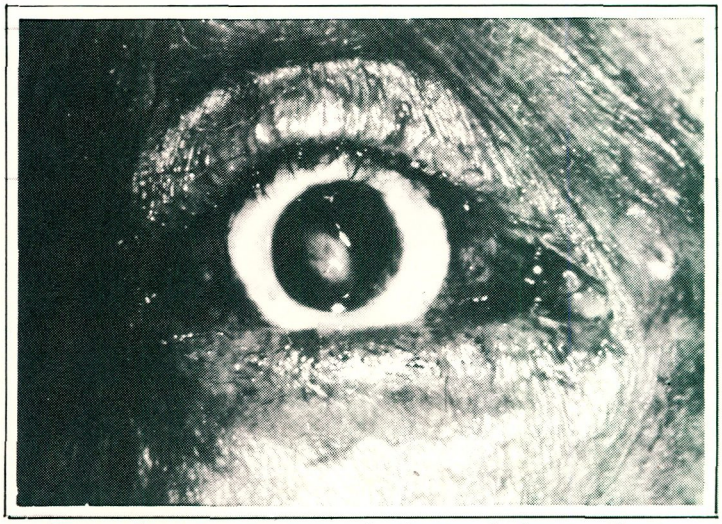
The suturing was done with 10 - 0 perlon mono filment in a continuous over and over fashion (fig. 4). Anterior chamber was kept formed as far as possible, either by injecting air bubble or saline to minimise the contact between endothelium and iris or vitreous. One or two peripheral iridectomies or iridotomies had to be done on all patients except the aphakic patients where vitrectomy was already planned.

RESULTS

The most crucial measure of the success is the post operative graft clarity and visual acuity[4]. Clarity could be considered the most significant measure and that is true when improved vision is ruled out because of other pathological conditions[5].

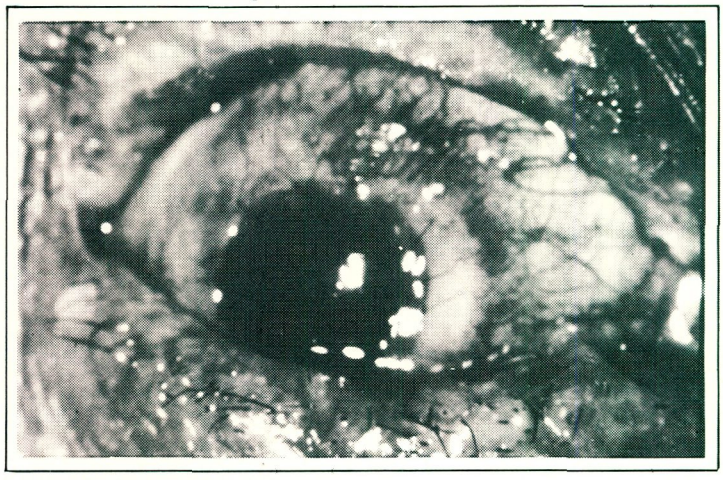
Table IV shows the results in terms of these two variables. The visual improvement compared to the successful clear grafts takes into consideration that only two cases have been prescribed correcting glasses as our older patients prefer not to wear spectacles.

The final results of the transplanted grafts showed only four cases of definite irreversible complete graft rejection and 20 cases of transplanted graft remained crystal clear (fig. 5) or semiclear (slightly oedematous). We had four cases of endophthalmitis and one case of corneal stitch abscess (fig. 6) which were all saved except two (Case No. 5 & 12). However recently



7 b. *7 months post op. patient had crystal clear graft surrounded by almost sclera like host cornea. Developed abscess responded to treatment very well.*

7 a. *A pre op. severe full thickness corneal scarring and adherent leukoma underwent successful keratoplasty*



8. *Severe vascularised trachomatous host cornea. Clear graft showing the continuous 10 - 0 monofilament.*

Case No. 5 underwent regrafting and cyclectomy, following which his vision improved from doubtful light perception to unaided vision of 6/24.

DISCUSSION

Corneal transplant success rate depends on many factors. The most important of them are the age of the graft which affects the viability of the endothelium, the atraumatic technique during transplantation and the suitability of the recipient bed[6]. Poor selection and preservation or incorrect handling of donor material may lead to an opaque graft or may transmit disease to the host[6].

From Table III we can notice that out of the 24 transplanted corneas 15 grafts were of the age of 24 hours or more. That delay would undoubtedly affect the general outcome of the clarity of the graft[6].

From the outcome of the results again we see that some of the grafts were clear after two months (fig. 7A & 7B). However, they became hazy later on for so many reasons, although in some of them the actual insulting factor could not be determined. Townley Patons[6] has mentioned clearly that inspite of meticulous technique and favourable clinical conditions, a certain percentage of corneal grafts cloud at variable periods after an apparently successful keratoplasty[6]. The

mechanism of such clouding could be attributed to the host — donor reaction — antigen — antibody reaction of delayed type sensitivity. The clouding of the graft is most probably due to an allergic phenomenon[7].

From Table No. II, it is evident that 95% of our cases have shown moderate to severe vascularization, superficial and deep caused mainly by severe trachoma (fig. 8). Such factors definitely will undoubtedly be detrimental to the success rate of keratoplasty and it is known that vascularisation of the host cornea is the most contraindicating factor to transplantation[1]. The presence of vessels in the host cornea has always been thought to reduce the chance of achieving a successful keratoplasty. While it is true that a successful result is less likely where the host cornea is vascularized[8].

The outcome of our surgery was so much determined by the type of cases selected for surgery. In Bahrain the main indication for performing surgery was the severe trachomatous scarring which is associated with advanced pannus surrounding the cornea (360 degrees). Paton and Aden[8] in their published 100 cases have classified the indications for keratoplasty in categories which included keratoconus and stromal dystrophies 18%, bullous keratopathy in phakic eye 18%, bullous keratopathy in aphakic eyes 16.9%, reoperations 18.6% and miscellaneous poor prognosis 25%. In our series the diagnosis of severe trachomatous cases as an indication for grafting made almost 80% of our keratoplasty cases and the rest were bullous aphakic keratopathy and only one case of protracted degenerative corneal ulcer.

In dealing with trachomatous patients, we were facing three major problems from prognostic point of view. The severe vascularisation, the advanced corneal scarring and the dryness of the eye.

Our success rate in achieving clear corneal graft was about 80% which is comparable to the international success rate in the trachomatous patients or may be better as it is only 50% in some published series[9]. Richard Abbot[10] reported a success rate of 64% in his aphakic keratoplasty group and 84% in the combined group. Emile[9] J. Farage reported an overall success rate of 62%.

Emile Forage[9] has noted that corneal transparency was directly related to the ocular disorder itself which led to surgery, out of these with keratoconus and stromal dystrophies 54 of 60 cases of this category i.e. 90% had crystal clear corneas post operatively, and 35 of 46 patients with phakic bullous keratopathy had crystal clear corneas. Other categories varied from some with 46.2% to others with 13.3% graft transparency rate. In herpes keratitis 33% success rate, in reoperation group 13% and in miscellaneous poor prognosis group had 51% success rate[9].

Casey[1] has pointed out his opinion that the presence of vessels in the cornea should not be regarded as a contraindication to keratoplasty[1]. However he did not comment on the worst type of the advanced trachomatous patients which apparently he felt could not benefit from keratoplasty. In conclusion we feel that trachomatous patients despite advanced vascularisation, severe scarring and dryness of the eye, can benefit from corneal transplantation as much as other types of cases which need corneal grafting; severe trachoma is thus not a contraindication to keratoplasty and should be attempted even in the worst types of cases.

TABLE II

Case No.	*Age Years*	*Sex*	*Age of graft (hours)*	*Age of donor years*	*Recipient Rubbing lashes*	*Vascularisation of recipient cornea*	*Phakic or Aphakic*	*Graft clearance*			*Graft rejection*	*Endophthalmitis*
								10 days	*2 months*	*18 months*		
1	55	F	42	68	Yes	Moderate	Phakic	Yes	Yes	No	Yes	No
2	40	F	24	78	Yes	Mild	Phakic	Yes	Yes	Yes	No	No
3	60	M	48	40	Yes	Mild	Phakic	Yes	Yes	Yes	No	No
4	60	M	36	75	Yes	Mild	Aphakic	Yes	Yes	No	Yes	No
5	60	M	20	28	Yes	Mild	Phakic	Yes	Yes	No	Yes	Yes (lost)
6	50	F	21	15	Yes	Mild	Aphakic	Yes	Yes	Yes	No	No
7	50	F	not ava.	not ava.	Yes	Moderate	Phakic	Yes	No	Yes	No	No
8	60	M	24	60	Yes	Moderate	Phakic	Yes	Yes	No	Yes	Corneal abscess
9	75	F	26	62	Yes	Moderate	Phakic	Yes	Yes	No	Yes	No
10	80	F	23	78	Yes	Mild	Aphakic	Yes	Yes	Yes	No	No
11	61	F	37	58	Yes	Moderate	Phakic	Yes	No	No	No	Yes (saved)
12	35	F	48	67	No	Mild	Phakic	No	Yes	No	Yes	Yes (lost)
13	50	F	18	45	Yes	Severe	Phakic	Yes	Yes	Yes	Yes	Yes (saved)
14	50	F	33	58	Yes	Moderate	Phakic	Yes	Yes	No	Yes	No

Case No.	*Age Years*	*Sex*	*Age of graft (hours)*	*Age of donor years*	*Recipient Rubbing lashes*	*Vascularisation of recipient cornea*	*Phakic or Aphakic*	*Graft clearance*			*Graft rejection*	*Endoph-thalmitis*
								10 days	*2 months*	*18 months*		
15	45	M	24	72	Yes	No	Aphakic	Yes	Yes	Yes	No	No
16	63	M	20	72	Yes	Mild	Phakic	Yes	Yes	Yes	No	No
17	40	M	28	40	Yes	Mild	Phakic	No	Yes	Yes	No	No
18	75	F	36	62	Yes	Severe	Phakic	Yes	Yes	Yes	Yes	No
19	50	F	18	40	Yes	Mild	Phakic	No	Yes	Yes	Yes	No
20	50	F	26	62	Yes	Moderate	Phakic	Yes	No	Yes	No	No
21	60	M	41	62	Yes	Moderate	Phakic	Yes	No	Yes	Yes	No
22	60	M	14	75	Yes	Mild	Phakic	Yes	Yes	No	Yes	No
23	62	M	24	78	Yes	Moderate	Phakic	Yes	No	Yes	No	No
24	76	M	24	65	Yes	Moderate	Phakic	Yes	Yes	No	Yes	No

TABLE IV

Preoperative & Postoperative visual outcome and cause of graft failure

Case No.	*Vision Pre. Op.*	*Vision Post. Op.*	*Graft clearance & Cause of non-improvement in vision*
1.	Rt. Eye. P.L	H.M	Pale disc (Optic atrophy), Graft rejection after 5 months.
2.	Lt. Eye. 1' F.C.	1' F.C	Crystal clear, mature cataract.
3.	Lt. Eye ½' F.C.	H.M.	Cataractous lens, Graft clear.
4.	Lt. Eye ½' F.C.	1' - 2' F.C.	For six months graft clear, six months opaque.
5.	Rt. Eye ½' F.C.	1' F.C. 6/24 C — 10 (after regrafting)	After keratoplasty developed endophathalmities Inflamation settled. Regrafted, vision improved. Graft remain crystal clear.
6.	Lt. Eye H.M.	5' - 6' F.C. C — 12, 6/36	Clear graft.
7.	Rt. Eye H.M.	6' - 7' F.C.	Clear graft.
8.	REye. 1' - 2' F.C.	H.M.	Graft was very clear initially, then developed suture abscess and cornea vascularised and graft slight opaque.
9.	Rt. Eye P.L. (Cat. & K. plasty)	6' F.C.	Initially graft was very clear for two months, then became opaque and vision reduced.
10.	Lt. Eye ½' F.C.	6' - 7' F.C.	Clear graft.
11.	Rt. Eye ½' F.C.	6½' F.C.	Graft clear but after Cat. Ext. developed endophth. and vision deteriorated and cornea vascularised.
12.	Lt. Eye H.M.	P.L. (?)	Keratoplasty & Cat. Ext., Post op. hyphaema developed endophth. (later graft opaque & vascularised) (endophthalmitis).
13.	Rt. Eye ½' F.C.	6 - 7' F.C.	Initially graft was clear. Post. op. did not attend for follow up, developed severe unveitis (Ant.) and graft hazy and vision dropped.
14.	Rt. Eye P.L.	3' F.C. C — 9	Graft clear initially, later admitted with corneal abrassion, cornea became hazy & vascularized. Cat. ext. done, vision improved with — 9 to 2 - 3' F.C.
15.	B. Eyes P.L.	H.M.	Graft crystal clear, vision not improved due to pale disc and fundi pathology.
16.	Rt. Eye 4' F.C.	C 9 5 - 6' F.C.	Graft crystal clear.
17.	Rt. Eye 4' F.C.	6/60	Crystal clear graft, later vision deteriorated due to cataractous lens.
18.	Rt. Eye P.L.	1' - 2' F.C.	Vision improved after K. plasty and Cat. Ext. after three months graft rejection. vision did not improve.
19.	Lt. Eye H.M.	1' F.C.	Developed epithelial defect which overcome and after two months sign of rejection and low vision is due to cataractous lens (operated with guarded prognosis).

Case No.	Vision Pre. Op.	Vision Post. Op.	Graft clearance & Cause of non-improvement in vision
20.	Rt. Eye H.M.	H.M.	Graft clear. Vision could not improve due to cataractous lens.
21.	Rt. Eye H.M.	H.M.	Graft dislocated and regrafting done which became hazy. Lens was cataractous.
22.	Lt. Eye 1' F.C.	2' F.C.	Graft became hazy.
23.	Lt. Eye H.M.	H.M.	Graft clear. Vision could not improve due to cataractous lens.
24.	Lt. Eye H.M.	4' - 5' F.C. c — 9	Vision improved from H.M. to 4' F.C., then dropped down due to hazy cornea, graft rejection.

Total Cases 24
Successful cases 20

(11 cases crystal clear & 9 cases slightly hazy)

4 cases — Endophthalmitis
2 were lost and 2 were saved
2 cases — Optic atrophy
6 cases — Cataractous lens

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