Panretinal photocoagulation during cataract extraction in eyes with active proliferative diabetic eye disease

JUDITH A. WEST,
JONATHAN G.F. DOWLER,
A.M. PETER HAMILTON,
SHELLEY R. BOYD, PHILIP G. HYKIN

Abstract

Purpose **Cataract surgery in the presence of active proliferative diabetic eye disease carries a high risk of progression of retinopathy and neovascular glaucoma. Lens opacities may prevent panretinal photocoagulation (PRP) before surgery, and applying PRP in the immediate post-operative period can be difficult. The purpose of this study is to report results of cataract extraction combined with per-operative indirect laser PRP in a group of these patients.**

Methods **Nine eyes of 9 diabetic patients with active retinal or iris neovascularisation in which lens opacities prevented adequate pre-operative PRP underwent cataract surgery combined with indirect laser PRP after cortex aspiration and before intraocular lens implantation.**

Results **Regression of neovascularisation with this combined procedure alone was achieved in 5 eyes, 3 responded to further PRP, and 1 developed neovascular glaucoma. Visual acuity improved in all eyes, 4 achieving ⩾6/12. Four patients developed increased post-operative uveitis. One developed clinically significant macular oedema.**

Conclusions **The method described has definite practical advantages over PRP attempted in the immediate post-operative period, when many factors can prevent its application or reduce its effectiveness, and when neovascularisation may be progressing rapidly. In addition, adjunctive per-operative indirect laser PRP appears to improve the outcome of cataract surgery in eyes with active proliferative diabetic eye disease.**

Key words Cataract extraction, Diabetic retinopathy, Indirect laser, Neovascularisation, Panretinal photocoagulation, Rubeosis iridis

J.A. West
J.G.F. Dowler
A.M.P. Hamilton
S.R. Boyd
P.G. Hykin
Moorfields Eye Hospital
London, UK

P.G. Hykin, FRCS, FRCOphth ✉
Moorfields Eye Hospital
City Road
London EC1V 2PD, UK
Tel: +44 (0)171 566 2057
Fax: +44 (0)171 566 2019

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The management of cataract in the presence of active proliferative diabetic eye disease is problematic. Although diabetics may achieve good visual acuity after cataract extraction,[1] visual prognosis is heavily dependent on the severity of retinopathy,[2,3] and surgery carried out in the presence of active neovascularisation carries a poor prognosis with a high risk of progression of retinopathy and neovascular glaucoma.[2,4–7] Ideally, regression of neovascularisation should be induced by panretinal photocoagulation (PRP) before cataract extraction is undertaken. This may not be possible in practice, however, because the fundus view may be inadequate for safe PRP, even using trans-scleral diode laser, and absorption of laser energy by cataract may prevent even the application of indirect laser. Pre-operative cryotherapy is an alternative,[8] but carries a significant risk of tractional retinal detachment and vitreous haemorrhage. It may also be difficult to apply PRP in the immediate post-operative period because of pain, fibrinous uveitis,[2,9,10] poor mydriasis, capsular opacity,[11] anterior vitritis and lens edge effects. These factors may preclude PRP at a time when neovascularisation is rapidly progressive,[7] with a high risk of severe visual loss.

This study reports 9 patients with active proliferative diabetic eye disease and cataract in whom these difficulties were addressed by the application of indirect laser PRP during cataract surgery, after cortex aspiration and before lens implantation. Whilst this technique is not new, there exist no published data to support its use, despite its incorporation into guidelines for the management of diabetic retinopathy.[12]

Methods

Nine eyes of 9 patients with active proliferative diabetic eye disease and cataract sufficient to prevent pre-operative PRP were studied. All underwent cataract surgery combined with per-operative indirect laser PRP between September 1992 and February 1997. The patients' age, sex,

Table 1. *Pre-operative findings*

Patient no.	Sex	Age (years)	Diabetes type	Diabetes duration (years)	Pre-operative VA	Pre-operative NV	Previous focal	Previous PRP
1	F	31	IDDM	21	6/18	NVE	0	0
2	F	56	NIDDM	5	CF	NVI	0	0
3	F	86	IDDM	22	CF	NVI	+	0
4	F	55	NIDDM	8	HM	NVD	+	+
5	F	47	IDDM	21	CF	NVE	+	0
6	M	33	IDDM	24	CF	NVE	+	+
7	F	63	NIDDM	15	6/60	NVE	0	+
8	F	74	NIDDM	12	CF	NVE	+	+
9	M	60	IDDM	34	6/24	NVE	0	+

IDDM, insulin-dependent diabetes mellitus; NIDDM, non-insulin-dependent diabetes mellitus; VA, visual acuity; HM, hand movements; CF, count fingers; NV, severity of neovascularisation; NVD, optic disc neovascularisation; NVE, neovascularisation elsewhere; NVI, iris neovascularisation; focal, focal macular laser therapy; PRP, panretinal photocoagulation.

type and duration of diabetes, pre-operative visual acuity, retinopathy severity and previous laser treatment were recorded (Table 1).

Extracapsular cataract extraction was undertaken in 5 eyes and phacoemulsification in 4 (Table 2). Both types of procedure were carried out routinely until cortex aspiration, which was done with an adrenaline-containing infusion to maximise mydriasis, was complete. The anterior chamber was inflated with viscoelastic agent and, in extracapsular procedures, the wound temporarily secured with three 10/0 nylon sutures. Indirect PRP was applied at this stage, to avoid unwanted intraocular lens edge effects, and either diode (2 eyes) or argon laser (7 eyes) used to apply between 500 and 1300 500 μm burns of moderate intensity. The use of a self-sealing incision in eyes undergoing phacoemulsification allowed more extensive globe manipulation and indentation than was possible in eyes undergoing extracapsular cataract extraction. Following intraocular lens insertion, the procedures were completed routinely. A rigid one-piece 7 mm lens was implanted in 7 eyes, and foldable lenses with a 6 mm optic implanted in 2 eyes undergoing phacoemulsification.

Results

The patients were aged between 31 and 86 years (median 56 years). Seven were female and 5 were insulin-dependent diabetics. The median duration of diabetes was 21 years (range 5–34 years). Pre-operative visual acuity (VA) ranged from 6/18 to hand movements (median count fingers). All had active proliferative disease at the time of surgery, one with optic disc neovascularisation (NVD), 6 with new vessels elsewhere (NVE) and 2 with iris neovascularisation (NVI). Vitreous haemorrhage was present in the eye with NVD and 5 of 6 eyes with NVE. Five patients had undergone PRP in the past and 5 had had focal laser treatment for diabetic macular oedema.

No intraoperative complication was encountered in eyes undergoing cataract surgery combined with per-operative PRP. Regression of neovascularisation with the combined procedure was achieved in five eyes without further PRP, and in 3 eyes with additional post-operative PRP (Table 2). The remaining patient (patient 2) developed neovascular glaucoma 3 months after surgery, and underwent diode laser cycloablation to control the intraocular pressure. At most recent review (median follow-up 1.0 years, range 0.5–4.9 years), 1 eye (patient 7), in which the NVE had regressed after surgery, had

Table 2. *Post-operative findings*

Patient no.	Surgery	Complications	Further Rx	Follow-up (years)	VA at last review	Comment on VA	NV at last review
1	Phaco	Uveitis	PRP	4.4	6.6	Nil	Nil
2	ECCE	Uveitis, CSME, NVG	Cyclo, PI, focal	4.9	6/60	Macular ischaemia	Nil
3	ECCE	Uveitis	Synechiolysis	0.5	3/60	Macular ischaemia	Nil
4	ECCE	Uveitis	PRP	0.5	CF	Macular ischaemia	Nil
5	ECCE	Nil	Nil	3.1	6/6	Nil	Nil
6	ECCE	Nil	Nil	2.3	6/9	Nil	Nil
7	Phaco	Nil	Nil	0.5	6/18	Macular ischaemia	NVE
8	Phaco	Nil	PRP	1.0	6/60	Macular ischaemia	Nil
9	Phaco	Nil	Nil	0.5	6/12	PC thickened	Nil

Phaco, phacoemulsification; ECCE, extracapsular cataract extraction; uveitis, increased post-operative uveitis; CSME, clinically significant macular oedema; NVG, neovascular glaucoma; Rx, treatment; PRP, panretinal photocoagulation; cyclo, diode laser cycloablation; PI, Nd:YAG laser peripheral iridotomy; focal, focal macular laser therapy; synechiolysis, Nd:YAG laser synechiolysis; VA, visual acuity; CF, count fingers; PC, posterior capsule; NV, severity of neovascularisation.

developed additional NVE which remain under observation, but all other eyes were free of new vessels (Table 2).

Final visual acuity ranged from 6/6 to count fingers (median 6/18), and in all eyes was better than the pre-operative VA (Table 2). Four eyes, all with NVE prior to surgery, achieved VA ≥6/12. Two further eyes with NVE prior to surgery achieved 6/18 and 6/60 respectively. All 3 eyes with NVI or NVD prior to surgery achieved VA <6/60. All 5 eyes with a final VA <6/12 had signs of macular ischaemia.

Post-operative uveitis, greater than is usually associated with cataract surgery, and requiring at least 2-hourly topical dexamethasone, occurred in 4 eyes (Table 2). One of these required Nd:YAG laser posterior synechiolysis, and another (patient 2), Nd:YAG peripheral iridectomy for pseudophakic pupil block glaucoma which arose 6 weeks after surgery. Clinically significant macular oedema developed after surgery in only 1 patient (patient 2) and was treated with focal laser.

Discussion

Cataract extraction in the presence of active proliferative diabetic eye disease is frequently complicated by rapid progression of retinopathy or iris neovascularisation,[2,7,13] with potentially disastrous results, because adequate pre-operative PRP is not possible. In this study, PRP was carried out during cataract surgery. With experience of the indirect laser, this was technically easier and more effective than attempting PRP in the immediate post-operative period, when it may be limited by pain, corneal oedema, post-operative uveitis,[2,9,10] poor mydriasis, posterior capsule thickening,[11] anterior vitritis, and edge effects from the intraocular lens. No intraoperative complications of the combined procedure were encountered. A foldable intraocular lens was used in 2 eyes, conserving the self-sealing incision, and allowing full scleral indentation and globe manipulation. A rigid large-optic lens was used in the remaining eyes, giving the advantage of better post-operative visualisation of peripheral retina.

Per-operative indirect laser PRP was effective in inducing complete regression of neovascularisation in 5 eyes with no further treatment, and in 3 with supplementary PRP, which could be delayed until later in the post-operative course when it was easier to perform. One patient developed neovascular glaucoma, but following diode laser cycloablation the intraocular pressure was normalised and further PRP was not required. These findings compare favourably with those of an earlier study[2] of patients with active proliferative diabetic retinopathy who underwent cataract surgery without per-operative PRP, in which 3 of 6 showed marked post-operative progression of retinopathy and 2 developed rubeosis iridis and neovascular glaucoma.

In addition, all 9 eyes showed post-operative improvement in VA, 4 achieving VA ≥6/12. This is in contrast to an earlier series of patients[2] with active proliferative retinopathy undergoing extracapsular cataract surgery without per-operative PRP in which no eye achieved a VA ≥6/12 and no eye showed any improvement in VA. This series is too small and uncontrolled to attribute this directly to the indirect laser, although sight-threatening complications such as traction retinal detachment and vitreous haemorrhage may have been prevented by its use. In addition, better visual acuity was associated with pre-operative NVE, all eyes with NVD or NVI having VA ≤6/60 as a result of macular ischaemia.

In this series, 4 patients had significant post-operative uveitis, and 1 developed pseudophakic pupil block glaucoma. The tendency to increased uveitis after cataract surgery in diabetics is well known,[2,9,10] and is more marked in eyes with active neovascularisation. Fibrin membrane formation and pupil block glaucoma are recognised complications.[14] This tendency may be related to abnormalities of iris vasculature in diabetics,[15] and is unlikely to be modified by per-operative PRP. The high incidence of post-operative uveitis illustrates one of the difficulties in applying PRP in the early post-operative period in these patients. Cataract extraction and PRP are both associated with the development or exacerbation of diabetic macular oedema.[16,17] It is therefore usually recommended that macular oedema is treated prior to either procedure, but this was not possible in these eyes. Despite this, and the unfractionated nature of the PRP, only one patient developed clinically significant macular oedema requiring focal laser after surgery.

In conclusion, this study suggests that combining cataract surgery with per-operative indirect laser PRP in the treatment of patients with active proliferative diabetic eye disease and cataract avoids the practical difficulties of placing laser in the post-operative period, allows control of neovascularisation thus preventing serious complications, and may lead to significant improvement in visual acuity.

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