

# Viscogonioplasty: an effective procedure for lowering intraocular pressure in primary angle closure glaucoma

D Varma, O Baylis, N Wride, PS Phelan and  
 SG Fraser

## Abstract

**Purpose** To evaluate the safety and intraocular pressure (IOP) lowering effect of combined phacoemulsification and viscogonioplasty (Phaco-VGP) in managing primary acute closed-angle glaucoma (ACAG) unresponsive to conventional therapy (patent PI).

**Patient and Methods** In all, 15 consecutive eyes of patients with refractory ACAG and greater than 270° peripheral anterior synechiae (PAS) underwent VGP. The technique of VGP involved routine phacoemulsification with intraocular lens implantation (Phaco/IOL) under topical anaesthetic. Following IOL implantation a heavy viscoelastic was used to deepen the anterior chamber and then injected near the angle for 360° (without touching the trabecular meshwork) to break the PAS. No surgical instrument was used to physically break the PAS. Upon completion of VGP, automated irrigation with balanced salt solution to remove the viscoelastic was performed.

**Results** Mean IOP reduced from 52.1 to 14.1 mmHg by Phaco-VGP at 6-months review. 14/15 patients were free of glaucoma medications at 6-month review. All angles showed exposure of the trabecular meshwork over 360° postoperatively without evidence of residual synechiae. No untoward complications were observed in any patient.

**Conclusion** VGP may have a role in controlling IOP effectively and safely in patients with refractory ACAG. It produces a large drop in the IOP and opening of the angle. It is a relatively simple technique to learn and we would recommend its use in the

eyes of all patients who have had ACAG and are undergoing cataract extraction.

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## Introduction

Acute closed-angle glaucoma (ACAG) is the apposition or adhesion of the iris to the trabecular meshwork (TM) resulting in a decrease in aqueous outflow and increase in intraocular pressure (IOP) to clinically significant levels. Management of an ACAG attack is usually done with medical therapy and Nd:YAG laser peripheral iridotomy (PI) to the affected and fellow eye. In some cases, permanent peripheral anterior synechiae (PAS) develop and, when greater than 180° of the angle is closed, the IOP rises despite medical therapy or patent PI.<sup>1</sup> Various glaucoma operations<sup>2</sup> have been advocated to open the angle in such patients with refractory ACAG. However, these interventions can be associated with serious side effects resulting in long-term visual deterioration. Other procedures described include laser trabeculoplasty and goniosynechialysis. Goniosynechialysis is a procedure designed to break PAS and restore trabecular filtration in eyes with angle closure. Conventionally this has been described using surgical instruments or by Nd:YAG laser.<sup>3–5</sup> In this paper, we describe a new technique termed Viscogonioplasty (VGP) whereby a viscoelastic instead of a surgical instrument is used to break

Department of  
 Ophthalmology, Sunderland  
 Eye Infirmary, Sunderland,  
 Tyne and Wear, UK

Correspondence: SG Fraser,  
 Department of  
 Ophthalmology,  
 Sunderland Eye Infirmary,  
 Queen Alexandra Road,  
 Sunderland, Tyne and Wear  
 SR2 9HP, UK  
 Tel: +44 191 569 9853;  
 Fax: +44 191 569 9060.  
 E-mail: sfraser100@  
 totalise.co.uk

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PAS and open the angle. As far as we know this is the first time that this 'non touch' procedure has been described in the literature.

### Purpose

To evaluate the IOP lowering effect of combined phacoemulsification and viscogonioplasty (Phaco-VGP) in managing primary ACAG unresponsive to conventional therapy (PI).

### Patient and methods

In all, 15 consecutive eyes of patients with primary ACAG were included in the study. Refractory ACAG was defined as ACAG patients where IOP was raised despite medical therapy and patent laser PI. All the patients included in the case series had suffered a classic (ie no cause other than anatomic predisposition was identified) attack of ACAG.

Inclusion criteria included iris occluding the trabeculum for at least 270° of the angle as confirmed by gonioscopy, uncontrolled IOP (without anti-hypertensive medication) and the presence of a patent laser PI to eliminate pupillary block. Exclusion criteria included plateau iris, other glaucomas, previous glaucoma surgery (ALT/trabeculectomy), retinal disease and history of ocular injury. The duration of increase IOP or synechial angle closure was not one of our inclusion or exclusion criteria but the maximum length of time since the acute attack was no more than 4 months.

Preoperatively, all patients underwent complete ocular examination including visual acuity (VA) by Snellen' testing, IOP measurement, slit-lamp biomicroscopic examination of anterior and posterior segment. The same glaucoma surgeon performed phaco-VGP in all the cases. The operations were performed between April 2002 and December 2004. Postoperative therapy included oral acetazolamide (250 mg) four times a day for 24 h, topical steroid (1% prednisolone acetate) four times a day and topical ketorolac drops, four times a day in the operated eye. Other antiglaucoma medications were discontinued and restarted according to IOP response. To evaluate the medical antiglaucomatous treatment, we used a scoring system as used by Kubota *et al*.<sup>6</sup> In this one point was assigned for each antiglaucomatous medication and two points for oral acetazolamide. At each postoperative follow-up, complete ocular examination including gonioscopy was done in all the patients.

### Technique of viscogonioplasty

Patients underwent routine phacoemulsification with intraocular lens (IOL) implantation under topical

anaesthetic. Phacoemulsification was performed via a 3.2 mm temporal incision as a standard method and a 5.5 mm foldable acrylic posterior chamber IOL was implanted in the bag in all the cases. Following IOL implantation a heavy viscoelastic (*Artivisc plus*<sup>®</sup>) was used to deepen the anterior chamber and then injected near the angle for 360° (without touching the TM) to break the PAS, taking care to avoid ciliary body recession and inadvertent injury to the surrounding tissues. Care should also be exercised while injecting the heavy viscoelastic to avoid inadvertent release of the cannula and damage to angle. No surgical instrument was used to physically break the PAS. Upon completion of VGP, automated irrigation with balanced salt solution (BSS) to remove the viscoelastic was performed.

### Results

The results are presented in Tables 1 and 2. In all, 15 Caucasian patients who presented to the eye department with ACAG and treated with laser PI fulfilled the study criteria. The mean age of patients was 64 years. All patients in this series had ACAG with at least 270° PAS occluding the TM on gonioscopy. The mean IOP without any anti-glaucoma treatment (ie the presenting IOP) was 52.1 mmHg while immediate preoperative mean IOP (on anti-glaucoma medication) was 27.4 mmHg. All patients were on at least two medications (range 2–4). Eight patients were on oral acetazolamide. Status of lens in the patients included from early to moderate lens opacity. The patients were followed-up for at least 6 months. Mean follow-up of patients was 10.6 months, (range 6–24 months).

Postoperative state of patients was as follows:

#### *Intraocular pressure*

Following combined cataract extraction and VGP mean immediate preoperative IOP reduced from 27.4 mmHg on anti-glaucoma therapy to 14.1 mmHg without any treatment at 6 months review in majority (14/15) of the study cases. Out of 15, six (40%) eyes completed 1-year follow-up and mean IOP at 1 year was 13.6 mmHg. None of the patients needed subsequent trabeculectomy or any other surgical intervention to lower IOP. Out of 15 eyes, in 14 eyes (93%) the IOP was controlled without any antiglaucoma therapy. Post operatively none of the patients needed oral acetazolamide.

#### *Gonioscopy*

Postoperatively gonioscopy showed opening of angle in all the patients. All study patients had the previously occluded TM exposed over 360° and to date there have

**Table 1** Patient data

Case no.	Sex	Age (years)	Laterality	Preoperative IOP (mmHg)		Preoperative medication	Postoperative IOP mmHg (6 months)	Postoperative medication
				Without treatment	With treatment			
1	F	76	L	47	32	4 <sup>a</sup>	12	0
2	M	42	R	46	27	4 <sup>a</sup>	12	0
3	F	70	R	44	36	2	18	0
4	F	63	L	70	56	2	17	1
5	F	64	R	49	26	2	14	0
6	F	59	R	63	15	2	14	0
7	F	78	L	64	10	4 <sup>a</sup>	8	0
8	M	63	R	44	17	4 <sup>a</sup>	12	0
9	M	51	L	54	33	2	17	0
10	M	58	R	68	30	3 <sup>a</sup>	12	0
11	M	55	R	43	30	2	21	0
12	F	59	L	54	22	3 <sup>a</sup>	10	0
13	F	63	R	40	18	2	19	0
14	F	63	L	55	30	2 <sup>a</sup>	16	0
15	F	65	R	40	29	3 <sup>a</sup>	17	0

<sup>a</sup>ACAG pts on oral acetazolamide.

**Table 2** Pre- and postoperative IOP (mmHg) after Phaco/IOL+VGP

	Eyes	Mean IOP	Range
IOP at presentation without treatment	15	52.1	18–70
Immediate preoperative on treatment	15	27.4	10–56
2 weeks postoperatively	15	14.6	8–28
3 months	15	13.8	8–23
6 months	15	14.1	10–21
1 year	6	13.6	11–15

been no instances in which further synechial closure has been observed. There is of course no guarantee that this will not occur in the long term. No dialysis or cleft of the ciliary body was observed in any patient.

**Complication**

Untoward intraoperative complications such as intraoperative haemorrhage and postoperative complications such as shallow AC, corneal oedema, retained viscoelastic, inflammation and iridodialysis were not observed in our cohort of patients. Posterior capsular rupture did not occur in any patient.

**Visual acuity**

Visual activity remained unchanged in eight eyes, improved by 1 Snellen line in four eyes, and by 2–4 Snellen lines in three eyes. VA did not worsen in any patient following Phaco/IOL and VGP in this series.

**Discussion**

Patients with shallow anterior chamber and occludable angles are predisposed to pupillary block and resultant ACAG attack. During an ACAG attack in which pupillary block is the underlying mechanism, the aqueous humour in the posterior chamber is under greater pressure than the fluid in the anterior chamber causing peripheral iris to be pushed forward against the TM. Conventional management for ACAG attack includes medical therapy and laser PI. A PI allows pressure in the two chambers to equilibrate so that the peripheral iris is no longer bowed forward and thereby relieving pupillary block. In some cases, permanent PAS develop over TM causing widespread synechial angle closure. If a greater portion of the angle has become closed (270° or more, ie 9 clock hrs or more) medical and laser therapy is ineffective and surgical therapy becomes necessary. Filtering procedures such as trabeculectomy have been widely used. However, these procedures are associated with risk of postoperative complications such as shallow anterior chamber, choroidal detachment, malignant glaucoma and hypotonic maculopathy.<sup>2</sup>

For these reasons some practitioners have described an alternative approach known as Goniosynechialysis. Described techniques for goniosynechialysis include surgically separating the PAS from the TM with a surgical instrument under direct gonioscopic visualisation or with a Q-switched neodymium: YAG laser.<sup>3–5</sup> However, complications reported with this procedure include mild-to-severe haemorrhage from iris or trabeculum, fibrin exudation, choroidal haemorrhage, choroidal detachment, shallow anterior chamber and

transient elevation of IOP in the immediate postoperative period.

Various workers have reported variable degrees of IOP lowering following a routine phacoemulsification (range 1–6 mm Hg) and following a combined phaco/IOL and surgical goniosynechialysis (13–16 mmHg) in ACAG patients.<sup>1,6–8</sup> Complications reported with surgical goniosynechialysis in these studies included fibrinoid aqueous, transient IOP elevation, photophobia and hyphema.

VGP when compared to surgical goniosynechialysis is a quick, relatively atraumatic procedure that does not require specific surgical instruments and can be performed at the time of routine phacoemulsification via the clear corneal incision.

In our case series IOP lowering was achieved with Phaco-VGP in all patients. No patient developed any of the complications previously reported with surgical goniosynechialysis.<sup>1,7</sup> The authors suggest that the possible mechanism of action of VGP is stretching and breaking PAS thereby widening of the angle recess and flattening of the angle. Undoubtedly, the patients in this study had a mix of phacomorphic and synaechial closure, which can be difficult to differentiate in ACAG eyes. It is important, in future studies of VGP, to try to look at these groups separately.

Cataract extraction itself can, in many patients with narrow/ closed angles reduce the IOP and open the angle.<sup>4</sup> However, without further angle procedures it is unusual to get such a large pressure drop as we have found and to remove angle synechiae. From our own ACAG patients prior to using this technique, we found much smaller pressure drops than with VGP and noticeably less postoperative exposure of the TM. We therefore feel VGP is additive to the IOP lowering effects of the direct angle procedures described above. To fully elucidate the additional benefits of VGP will require a randomised controlled trial and we are currently recruiting to this. We are also in the process of collecting intraoperative gonioscopy and ultrasonic measurements.

In the mean time we offer VGP as a simple and safe method of opening the angles and reducing the IOP in these potentially difficult eyes.

## Conclusion

Our small consecutive case series has shown that VGP may have a role in controlling IOP effectively and safely in patients with refractory primary ACAG with 360° PAS. Larger case series with longer follow-up are needed to substantiate these results.

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