

NATIONAL INSTITUTE FOR HEALTH AND CLINICAL EXCELLENCE

INTERVENTIONAL PROCEDURES PROGRAMME

Interventional procedure overview of trabeculotomy ab interno for open-angle glaucoma

Treating glaucoma by removing a small strip of tissue to reduce pressure within the eye

Primary open-angle glaucoma is a condition associated with a long-term increase of pressure within the eye. It may gradually lead to permanent loss of sight because of damage to the nerve that connects the eye to the brain (optic nerve).

This procedure uses a specifically designed surgical instrument to remove a portion of tissue to improve the eye's drainage pathway, leading to a reduction in pressure within the eye.

Introduction

The National Institute for Health and Clinical Excellence (NICE) has prepared this overview to help members of the Interventional Procedures Advisory Committee (IPAC) make recommendations about the safety and efficacy of an interventional procedure. It is based on a rapid review of the medical literature and specialist opinion. It should not be regarded as a definitive assessment of the procedure.

Date prepared

This overview was prepared in July 2010.

Procedure name

- Trabeculotomy ab interno for open-angle glaucoma

Specialty societies

- Royal College of Ophthalmologists

Description

Indications and current treatment

Glaucoma is a condition in which there is an elevated intraocular pressure. A certain level of pressure is needed within the eye for it to keep its shape. This pressure is maintained by the flow of a fluid (aqueous humour) within the eye. Within the drainage angle of the eye, the aqueous humour passes through the trabecular meshwork and into a collector channel known as Schlemm's canal (which is situated around the iris). It then drains away back into the blood stream. A balance between the fluid entering and leaving the eye determines the pressure in the eye (the intraocular pressure). Glaucoma can cause progressive damage to the optic nerve at the back of the eye.

There are two main types of glaucoma, 'open-angle' where there is no physical obstruction of the drainage angle of the eye and 'closed-angle' where there is a sudden complete blockage of the trabecular meshwork. The majority of people with glaucoma have primary open-angle glaucoma. Primary open-angle glaucoma (POAG) is the most common form of glaucoma in the West and affects about 2% of the population over the age of 40 years.

The early stages of primary open-angle glaucoma are usually asymptomatic; there is no pain and visual loss is in the mid-peripheral field of vision. As the condition progresses, the field of vision gradually becomes more impaired. If it remains untreated, central vision may also be lost. Both eyes are usually affected by the condition.

Treatment for glaucoma is designed to reduce the level of intraocular pressure. The first stage of treatment is usually eye drops which alter either the inflow or the outflow of aqueous humour within the eyes. Laser trabeculoplasty (ablation of discrete areas of the trabecular meshwork) and laser cyclophotocoagulation (destroying part of the ciliary body that produces aqueous humour) are minimally invasive alternatives.

If these are ineffective then the most common surgical technique for primary open-angle glaucoma is trabeculectomy (filtration surgery) which involves creating a flap over a small hole that is made in the outer wall of the eye (sclera) to allow aqueous humour to leave the eye. Other, more invasive glaucoma drainage devices / tube shunts are sometimes used to treat glaucoma that does not respond to trabeculectomy.

What the procedure involves

The aim of trabeculotomy ab interno is to reduce IOP by removing a portion of the trabecular meshwork to improve drainage of aqueous humour. It avoids the creation of a subconjunctival bleb associated with traditional trabeculectomy.

A scleral incision is made and a small amount of viscoelastic may be inserted into the anterior chamber to maintain the working space and to protect the corneal endothelium. Electrical ablation is used to remove a strip (or strips) of the trabecular meshwork. A goniolens is used to help this process. The eye is then irrigated and the viscoelastic is aspirated from the anterior chamber. The incision is sutured. The procedure is performed with the patient under local anaesthetic.

Literature review

Rapid review of literature

The medical literature was searched to identify studies and reviews relevant to treatment of open-angle glaucoma using ab interno trabeculotomy. Searches were conducted of the following databases, covering the period from their commencement to 29 July 2010. MEDLINE, PREMEDLINE, EMBASE, Cochrane Library and other databases. Trial registries and the Internet were also searched. No language restriction was applied to the searches (see appendix C for details of search strategy). Relevant published studies identified during consultation or resolution that are published after this date may also be considered for inclusion.

The following selection criteria (table 1) were applied to the abstracts identified by the literature search. Where selection criteria could not be determined from the abstracts the full paper was retrieved.

Table 1 Inclusion criteria for identification of relevant studies

Characteristic	Criteria
Publication type	Clinical studies were included. Emphasis was placed on identifying good quality studies. Abstracts were excluded where no clinical outcomes were reported, or where the paper was a review, editorial, or a laboratory or animal study. Conference abstracts were also excluded because of the difficulty of appraising study methodology, unless they reported specific adverse events that were not available in the published literature.
Patient	Patients with open-angle glaucoma.
Intervention/test	Trabeculotomy ab interno.
Outcome	Articles were retrieved if the abstract contained information relevant to the safety and/or efficacy.
Language	Non-English-language articles were excluded unless they were thought to add substantively to the English-language evidence base.

List of studies included in the overview

This overview is based on approximately 2849 patients from 2 non-randomised comparative studies^{1,2} and 6 case series^{3,4,5,6,7,8}. There is a degree of overlap between the case series referenced 1, 3, 4 and 6 but the level of overlap is unclear.

Other studies that were considered to be relevant to the procedure but were not included in the main extraction table (table 2) have been listed in appendix A.

Table 2 Summary of key efficacy and safety findings on trabeculotomy ab interno for open-angle glaucoma

Study details	Key efficacy findings	Key safety findings	Comments																								
<p>Abbreviations used: COAG, chronic open-angle glaucoma; ECP, endoscopic cyclophotocoagulation; IOP, intraocular pressure; LTP, laser trabeculoplasty; NS, not significant; POAG, primary open-angle glaucoma; SLT, select laser trabeculectomy.</p> <p>Mosaed S (2010)¹</p> <p>Non-randomised comparative study</p> <p>USA</p> <p>Recruitment period: not reported</p> <p>Study population: adults with uncontrolled open-angle glaucoma on maximally tolerated medical therapy.</p> <p>n = 828 (538 vs 290)</p> <p>Age: trabeculotomy ab interno alone: 68 years (mean), trabeculotomy ab interno + phacoemulsification: not reported</p> <p>Sex: trabeculotomy ab interno alone: 45% (242/538) male, trabeculotomy ab interno + phacoemulsification: not reported</p> <p>Ethnicity: not reported</p> <p>Patient selection criteria: patients who had completed 1-year follow-up</p> <p>Technique: trabeculotomy ab interno using Trabectome[®] alone or trabeculotomy ab interno using Trabectome[®] combined with phacoemulsification.</p> <p>Follow-up: 1 year</p> <p>Conflict of interest/source of funding: lead author is a paid consultant to the manufacturer.</p>	<p>Number of patients analysed: 828 (538 vs 290)</p> <p><u>Success of procedure</u> (defined as final IOP < 21mmHg and a 20% reduction in IOP in 2 consecutive visits after 3 months postoperatively and no secondary glaucoma incision surgery): Trabeculotomy ab interno alone: 64.9% (349/538) at 1 year; trabeculotomy ab interno + phacoemulsification: 86.9% (252/290) at 1 year (p < 0.001)</p> <p>Mean IOP (mmHg)</p> <table border="1" data-bbox="674 659 1297 886"> <thead> <tr> <th></th> <th>Trabeculotomy ab interno alone (n = 538)</th> <th>Trabeculotomy ab interno + phacoemulsification (n = 290)</th> </tr> </thead> <tbody> <tr> <td>Preoperatively</td> <td>26.3 ± 7.7</td> <td>20.2 ± 6.0</td> </tr> <tr> <td>1 year</td> <td>16.6 ± 4.0 (31% reduction)</td> <td>15.6 ± 3.7 (18% reduction)</td> </tr> <tr> <td>p value</td> <td><0.0001</td> <td>Not reported</td> </tr> </tbody> </table> <p>Mean number of glaucoma medications</p> <table border="1" data-bbox="674 943 1297 1170"> <thead> <tr> <th></th> <th>Trabeculotomy ab interno alone (n = 538)</th> <th>Trabeculotomy ab interno + phacoemulsification (n = 290)</th> </tr> </thead> <tbody> <tr> <td>Preoperatively</td> <td>2.88 ± 1.30</td> <td>2.54 ± 1.07</td> </tr> <tr> <td>1 year</td> <td>2.09 ± 1.35 (28% reduction)</td> <td>1.69 ± 1.33 (33% reduction)</td> </tr> <tr> <td>p value</td> <td><0.0001</td> <td>Not reported</td> </tr> </tbody> </table> <p><u>Secondary</u> glaucoma procedures required: trabeculotomy ab interno alone: 32% (175/538) trabeculotomy ab interno + phacoemulsification: 8.28% (24/290)</p>		Trabeculotomy ab interno alone (n = 538)	Trabeculotomy ab interno + phacoemulsification (n = 290)	Preoperatively	26.3 ± 7.7	20.2 ± 6.0	1 year	16.6 ± 4.0 (31% reduction)	15.6 ± 3.7 (18% reduction)	p value	<0.0001	Not reported		Trabeculotomy ab interno alone (n = 538)	Trabeculotomy ab interno + phacoemulsification (n = 290)	Preoperatively	2.88 ± 1.30	2.54 ± 1.07	1 year	2.09 ± 1.35 (28% reduction)	1.69 ± 1.33 (33% reduction)	p value	<0.0001	Not reported	<p>Aqueous misdirection: 1 patient (group unknown)</p> <p>Presumed cyclodialysis cleft that closed spontaneously: 1 patient (group unknown)</p> <p>Transient corneal epithelial defects occurred in less than 5% of patients.</p> <p>Timing and treatment of complications is not reported unless otherwise stated.</p> <p>No reports of sustained hypotony beyond day 1, infections, cases of reduced Snellen acuity greater than 2 lines, choroidal effusions or maculopathy.</p>	<p>Lead author has confirmed some overlap with other table 2 studies, although none of Minckler's patients are included and any patients with less than 1 year follow-up were excluded (a significant proportion of all the prior papers). This paper also includes subjects from two centres (the University of California in San Diego and Massachusetts Eye and Ear Infirmary) which are not in other manuscripts.</p> <p>Follow-up issues:</p> <ul style="list-style-type: none"> All patients completed 1-year follow-up <p>Study design issues:</p> <ul style="list-style-type: none"> Multicentre study.
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<p>Francis BA (2010)²</p> <p>Non-randomised comparative study USA Recruitment period: 2007–2009 Study population: patients with primary or secondary open-angle glaucoma</p> <p>n = 259 (114 trabeculotomy ab interno + phacoemulsification cataract extraction and intraocular lens insertion vs. 145 phacoemulsification cataract extraction and intraocular lens insertion)</p> <p>Age: trabeculotomy ab interno group: 77 years (mean), no trabeculotomy ab interno: 74 years (mean) Sex: trabeculotomy ab interno group: 38% male, no trabeculotomy ab interno group: 32% male. Ethnicity: not reported</p> <p>Patient selection criteria: trabeculotomy ab interno group: unobstructed view of the angle, ≥ 18 years old, visually significant cataract and able to complete 6-month follow-up. No ab interno trabeculotomy ab interno group: visually significant cataract, > 18 years old, able to complete 6-month follow-up.</p> <p>Technique: trabeculotomy ab interno using Trabectome[®] combined with phacoemulsification cataract extraction and intraocular lens insertion vs phacoemulsification cataract extraction and intraocular lens insertion only</p> <p>Follow-up: 24 months Conflict of interest/source of funding: not reported</p>	<p>Number of patients analysed: 259 (114 vs. 145)</p> <p><u>Success of procedure</u> (defined as no additional glaucoma surgery and IOP < 21 mmHg and IOP reduced by 20% below baseline on the last two consecutive follow-up visits after 3 months postoperatively): Trabeculotomy ab interno + phacoemulsification: 80% at 24 months Phacoemulsification: 46% at 24 months.</p> <p>Mean IOP(mmHg)</p> <table border="1"> <thead> <tr> <th></th> <th>Trabeculotomy ab interno + phacoemulsification</th> <th>p value</th> <th>Phacoemulsification</th> <th>p value</th> </tr> </thead> <tbody> <tr> <td>Preoperatively</td> <td>22.2 ± 5.9</td> <td>-</td> <td>16.2 ± 4.2</td> <td>-</td> </tr> <tr> <td>Day 1</td> <td>17.6 ± 8.1</td> <td><0.01</td> <td>20.0 ± 7.9</td> <td><0.01</td> </tr> <tr> <td>1 month</td> <td>15.9 ± 4.6</td> <td><0.01</td> <td>15.2 ± 3.8</td> <td>0.034</td> </tr> <tr> <td>3 months</td> <td>15.4 ± 3.7</td> <td><0.01</td> <td>14.6 ± 3.6</td> <td><0.01</td> </tr> <tr> <td>6 months</td> <td>15.5 ± 3.2</td> <td><0.01</td> <td>14.8 ± 3.1</td> <td><0.01</td> </tr> <tr> <td>12 months</td> <td>15.4 ± 3.1</td> <td><0.01</td> <td>14.5 ± 3.3</td> <td><0.01</td> </tr> <tr> <td>24 months</td> <td>15.3 ± 3.5</td> <td><0.01</td> <td>14.3 ± 3.6</td> <td><0.01</td> </tr> </tbody> </table> <p>p values compared each follow-up to preoperative value</p> <p><u>Glaucoma medication:</u></p> <p>Trabeculotomy ab interno + phacoemulsification: use of medication dropped by 40% during the study period (unable to read exact number on the graph within the published paper) Phacoemulsification: use of medication not reported</p> <p><u>Additional procedures:</u> Trabeculotomy ab interno + phacoemulsification: 5 patients underwent secondary surgery by the end of the second year. Phacoemulsification: not reported</p>				Trabeculotomy ab interno + phacoemulsification	p value	Phacoemulsification	p value	Preoperatively	22.2 ± 5.9	-	16.2 ± 4.2	-	Day 1	17.6 ± 8.1	<0.01	20.0 ± 7.9	<0.01	1 month	15.9 ± 4.6	<0.01	15.2 ± 3.8	0.034	3 months	15.4 ± 3.7	<0.01	14.6 ± 3.6	<0.01	6 months	15.5 ± 3.2	<0.01	14.8 ± 3.1	<0.01	12 months	15.4 ± 3.1	<0.01	14.5 ± 3.3	<0.01	24 months	15.3 ± 3.5	<0.01	14.3 ± 3.6	<0.01	Not reported	<p>Follow-up issues:</p> <ul style="list-style-type: none"> Loss to follow-up is not reported. <p>Study design issues:</p> <ul style="list-style-type: none"> Single-centre, single-surgeon study.
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<p>Liu J (2009)³</p> <p>Case series (combined dataset of US surgeons participating in the Trabectome[®] database).</p> <p>USA</p> <p>Recruitment period: up to 2009 Study population: patients with either primary open-angle glaucoma, exfoliation glaucoma pigmentary glaucoma, uveitic glaucoma or steroid-induced glaucoma.</p> <p>n = 1688</p> <p>Age: 70 years (mean) Sex: 45.3% (765/1688) male Ethnicity: 64.9% (1096/1688) Caucasian, 7.3% (123/1688) African-American, 6.6% (111/1688) Hispanic, 4.2% (71/1688) Japanese, 3.4% (58/1688) other Asian descent and 13.6% (229/1688) other ethnicities.</p> <p>Patient selection criteria: not reported</p> <p>Technique: trabeculectomy ab interno using Trabectome[®] either alone or in combination with phacoemulsification.</p> <p>Follow-up: 5 years Conflict of interest/source of funding: third author is a paid consultant to the manufacturer.</p>	<p>Number of patients analysed:1688</p> <p>Mean IOP (mmHg)</p> <table border="1"> <tr> <td>Preoperatively</td> <td>23.5 ± 7.7</td> </tr> <tr> <td>3 months</td> <td>15.9 ± 4.2</td> </tr> <tr> <td>6 months</td> <td>15.8 ± 3.7</td> </tr> <tr> <td>12 months</td> <td>15.8 ± 3.3</td> </tr> <tr> <td>2 years</td> <td>16.4 ± 3.8</td> </tr> <tr> <td>3 years</td> <td>16.1 ± 2.6</td> </tr> <tr> <td>4 years</td> <td>16.1 ± 2.6</td> </tr> <tr> <td>5 years</td> <td>16.4 ± 2.3</td> </tr> </table> <p>Mean number of glaucoma medications used</p> <table border="1"> <tr> <td>Preoperatively</td> <td>2.83 ± 1.2</td> </tr> <tr> <td>3 months</td> <td>2.13 ± 1.4</td> </tr> <tr> <td>6 months</td> <td>1.89 ± 1.4</td> </tr> <tr> <td>12 months</td> <td>1.71 ± 1.3</td> </tr> <tr> <td>2 years</td> <td>1.39 ± 1.1</td> </tr> <tr> <td>3 years</td> <td>1.16 ± 1.0</td> </tr> <tr> <td>4 years</td> <td>0.96 ± 0.96</td> </tr> <tr> <td>5 years</td> <td>1.0 ± 0.94</td> </tr> </table> <p>Additional procedures required following failed Trabectome[®]</p> <table border="1"> <tr> <td>Total</td> <td>9.6% (162/1688)</td> </tr> <tr> <td>Trabeculectomy</td> <td>5.7% (96/1688)</td> </tr> <tr> <td>Aqueous tube shunt</td> <td>2.4% (41/1688)</td> </tr> <tr> <td>Repeat Trabectome[®]</td> <td>0.8% (14/1688)</td> </tr> <tr> <td>Selective laser trabeculoplasty</td> <td>0.3% (5/1688)</td> </tr> <tr> <td>Diode laser cyclophotocoagulation</td> <td>0.2% (4/1688)</td> </tr> <tr> <td>Endoscopic cyclophotocoagulation</td> <td>0.1% (2/1688)</td> </tr> </table>	Preoperatively	23.5 ± 7.7	3 months	15.9 ± 4.2	6 months	15.8 ± 3.7	12 months	15.8 ± 3.3	2 years	16.4 ± 3.8	3 years	16.1 ± 2.6	4 years	16.1 ± 2.6	5 years	16.4 ± 2.3	Preoperatively	2.83 ± 1.2	3 months	2.13 ± 1.4	6 months	1.89 ± 1.4	12 months	1.71 ± 1.3	2 years	1.39 ± 1.1	3 years	1.16 ± 1.0	4 years	0.96 ± 0.96	5 years	1.0 ± 0.94	Total	9.6% (162/1688)	Trabeculectomy	5.7% (96/1688)	Aqueous tube shunt	2.4% (41/1688)	Repeat Trabectome [®]	0.8% (14/1688)	Selective laser trabeculoplasty	0.3% (5/1688)	Diode laser cyclophotocoagulation	0.2% (4/1688)	Endoscopic cyclophotocoagulation	0.1% (2/1688)	<table border="1"> <tr> <td>IOP >10 mmHg from baseline</td> <td>5.7% (96/1688)</td> </tr> <tr> <td>Hypotony (IOP <5 mmHg) on postoperative day 1</td> <td>1.4% (24/1688)</td> </tr> <tr> <td>Iris injury</td> <td>0.3% (5/1688)</td> </tr> <tr> <td>Corneal Descemet's membrane tear (limited)</td> <td>0.2% (4/1688)</td> </tr> <tr> <td>Aqueous misdirection (intraoperative) that resolved</td> <td>0.06% (1/1688)</td> </tr> <tr> <td>Choroidal haemorrhage</td> <td>0.06% (1/1688)</td> </tr> </table> <p>Timing and treatment of complications is not reported unless otherwise stated.</p>	IOP >10 mmHg from baseline	5.7% (96/1688)	Hypotony (IOP <5 mmHg) on postoperative day 1	1.4% (24/1688)	Iris injury	0.3% (5/1688)	Corneal Descemet's membrane tear (limited)	0.2% (4/1688)	Aqueous misdirection (intraoperative) that resolved	0.06% (1/1688)	Choroidal haemorrhage	0.06% (1/1688)	<p>Follow-up issues:</p> <ul style="list-style-type: none"> Completeness of follow-up is not reported. <p>Study design issues:</p> <ul style="list-style-type: none"> Trabectome[®] Study Group surgeons performed all the procedures. <p>Study population issues:</p> <ul style="list-style-type: none"> Prior surgeries: 25.1% (424/1688) selective laser trabeculoplasty, 16.3% (275/1688) argon laser trabeculoplasty, 7.9% (133/1688) aqueous tube shunt, 0.5% (8/1688), Trabectome[®] and 0.5% (7/1688) endocyclophotocoagulation.
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<p>Trabectome[®] were excluded.</p> <p>Technique: trabeculotomy ab interno using Trabectome[®].</p> <p>Follow-up: 36 months</p> <p>Conflict of interest/source of funding: key author is a trainer for the manufacturer.</p>	Additional procedures required following trabeculotomy ab interno procedure				
		No LTP	LTP	p-value	
	Trabeculectomy	6% (51/852)	7.7% (38/493)	0.221	
	Shunt	2.2% (19/852)	2.6% (13/493)	0.637	
	Diode laser cyclophotocoagulation	0.11% (1/852)	0.41% (2/493)	0.28	
	SLT	0.11% (1/852)	0.61% (3/493)	0.111	
	Phakoemulsification	0.11% (1/852)	0	0.447	
	ECP	0.11% (1/852)	0.2% (1/493)	0.695	
	Express shunt	0.1% (1/852)	0	0.447	
	Repeat Trabectome [®] (patient request)	0.94% (8/852)	0.61% (3/493)	0.516	
Total secondary procedures	9.7% (83/852)	12.2% (60/493)	0.164		

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<p>Francis BA (2008)^b</p> <p>Case series</p> <p>USA</p> <p>Recruitment period: not reported</p> <p>Study population: patients with open-angle glaucoma and cataract</p> <p>n = 304</p> <p>Age: 75 years (mean)</p> <p>Sex: 37% (110/297) male (where reported)</p> <p>Ethnicity: 5.6% (17/304) African-American, 3.3% (10/304) Asian, 4.3% (13/304) Hispanic, 29.7% (240/304) Caucasian and 7.9% (24/304) other ethnicities.</p> <p>Patient selection criteria: see above.</p> <p>Technique: trabeculotomy ab interno using Trabectome[®] combined with phacoemulsification cataract extraction and intraocular lens insertion.</p> <p>Follow-up: 21 months (maximum)</p> <p>Conflict of interest/source of funding: first two authors are paid consultants to the manufacturer.</p>	<p>Number of patients analysed: 304</p> <p><u>Success of procedure</u> (defined as 20% or greater drop in IOP or decrease in glaucoma medications without need for additional medications or glaucoma procedures, including laser trabeculectomy): 78% at 6 months and 64% at 12 months.</p> <p><u>IOP</u></p> <table border="1"> <thead> <tr> <th></th> <th>Mean IOP (mmHg)</th> </tr> </thead> <tbody> <tr> <td>Preoperatively (n = 304)</td> <td>20.0 ± 6.3</td> </tr> <tr> <td>Day 1 (n = 288)</td> <td>18.1 ± 9.3</td> </tr> <tr> <td>3 months (n = 193)</td> <td>14.9 ± 3.7</td> </tr> <tr> <td>6 months (n = 106)</td> <td>14.8 ± 3.5</td> </tr> <tr> <td>12 months (n = 34)</td> <td>15.5 ± 2.9</td> </tr> <tr> <td>21 months (n = 7)</td> <td>16.7 ± 3.5</td> </tr> </tbody> </table> <p><u>Glaucoma medication</u></p> <table border="1"> <thead> <tr> <th></th> <th>Number of glaucoma medications</th> </tr> </thead> <tbody> <tr> <td>Preoperatively (n = 304)</td> <td>2.65 ± 1.13</td> </tr> <tr> <td>Day 1 (n = 288)</td> <td>1.65 ± 1.58</td> </tr> <tr> <td>3 months (n = 193)</td> <td>1.77 ± 1.33</td> </tr> <tr> <td>6 months (n = 106)</td> <td>1.76 ± 1.25</td> </tr> <tr> <td>12 months (n = 34)</td> <td>1.44 ± 1.29</td> </tr> <tr> <td>21 months (n = 7)</td> <td>1.43 ± 1.28</td> </tr> </tbody> </table> <p><u>Additional procedures</u></p> <p>Subsequent glaucoma procedures performed in 9 patients (7 trabeculectomy, 1 shunt and 1 SLT).</p>		Mean IOP (mmHg)	Preoperatively (n = 304)	20.0 ± 6.3	Day 1 (n = 288)	18.1 ± 9.3	3 months (n = 193)	14.9 ± 3.7	6 months (n = 106)	14.8 ± 3.5	12 months (n = 34)	15.5 ± 2.9	21 months (n = 7)	16.7 ± 3.5		Number of glaucoma medications	Preoperatively (n = 304)	2.65 ± 1.13	Day 1 (n = 288)	1.65 ± 1.58	3 months (n = 193)	1.77 ± 1.33	6 months (n = 106)	1.76 ± 1.25	12 months (n = 34)	1.44 ± 1.29	21 months (n = 7)	1.43 ± 1.28	<p>Minor iris injury from Trabectome[®] tip: 1.3% (4/304)</p> <p>Damage to lens capsule during surgery: 0.66% (2/304) [this did not affect ability to perform cataract extraction]</p> <p>Blood reflux (resolved within a few days): 78.6% (239/304)</p> <p>Hypotony (IOP <5 mmHg at day 1: 1.3% (4/304)</p> <p>IOP at day 2 > 10 mmHg higher than preoperative reading: 8.6% (26/304)</p> <p>IOP at 1 week >10 mmHg higher than preoperative reading: 2% (6/304)</p> <p>Timing and treatment of complications is not reported unless otherwise stated.</p>	<p>Probable overlap with Francis 2010. Lead author has confirmed there is no overlap between this study and other Trabectome[®] studies.</p> <p>Follow-up issues:</p> <ul style="list-style-type: none"> Lost to follow-up: 65.1% (198/304) at 6 months and 97.7% (297/304) at 21 months. <p>Study design issues:</p> <ul style="list-style-type: none"> Multicentre study; includes patients from all surgical centres in the Trabectome[®] users group. All surgeons new to the technique after Jan 2006 had mandatory training sessions at accredited facilities. <p>Study population issues:</p> <ul style="list-style-type: none"> Diagnosis: POAG: 70.7% (215/304), pseudoexfoliation syndrome: 9.5% (29/304), COAG: 3.3% (10/304), pigment dispersion: 2% (6/304), steroid-induced glaucoma: 1.6% (5/304), uveitic: 2% (6/304) and other: 10.9% (33/304).
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<p>Minckler D (2006)^b</p> <p>Case series</p> <p>USA and Mexico Recruitment period: not reported</p> <p>Study population: patients with open-angle glaucoma (confirmed by disc or visual field findings with an open angle of Shaffer grade I or above)</p> <p>n = 101</p> <p>Age: 65 years (mean) Sex: 47.5% (48/101) male Ethnicity: 3% (3/101) African-American, 2% (2/101) Asian, 56.4% (57/101) Hispanic and 38.6% (39/101) Caucasian.</p> <p>Patient selection criteria: inclusion criteria: elevated IOP judged likely to lead to progressive nerve damage on maximal medication. Exclusion criteria: vision less than hand motion, corneal oedema or other opacities preventing a good view, inability to maintain follow-up, a too-shallow anterior chamber, anatomically confusing angles without clear definition of the sclera spur or meshwork; neovascularisation of the iris or angle. None of the patients in this series had serious cardiovascular problems, uncontrolled diabetes, bleeding disorders, clotting disorders or chronic obstructive pulmonary disease.</p> <p>Technique: trabeculotomy ab interno using Trabectome[®]</p> <p>Follow-up: 30 months</p>	<p>Number of patients analysed: 101</p> <table border="1"> <thead> <tr> <th></th> <th>Mean IOP (mmHg)</th> <th>p-value (comparison with baseline)</th> </tr> </thead> <tbody> <tr> <td>Preoperatively (n = 101)</td> <td>27.6 ± 7.2</td> <td>-</td> </tr> <tr> <td>Day 1 (n = 89)</td> <td>18.8 ± 11.2</td> <td><0.0001</td> </tr> <tr> <td>1 week (n = 86)</td> <td>17.5 ± 5.0</td> <td><0.0001</td> </tr> <tr> <td>1 month (n = 81)</td> <td>18.2 ± 5.8</td> <td><0.0001</td> </tr> <tr> <td>6 months (n = 46)</td> <td>18.4 ± 4.5</td> <td><0.0001</td> </tr> <tr> <td>12 months (n = 37)</td> <td>16.4 ± 2.2</td> <td><0.0001</td> </tr> <tr> <td>30 months (n = 11)</td> <td>16.3 ± 3.3</td> <td><0.0001</td> </tr> </tbody> </table> <p>The mean percentage drop over the whole course of follow-up is reported to be 40%.</p> <p>Success of procedure (defined as IOP ≤ 21 mmHg with or without medications and no subsequent surgery): 84.2% (85/101)</p> <p>Of those where the procedure failed: 8.9% (9/101) required subsequent trabeculectomy 6.9% (7/101) had IOP >21 mmHg with or without resuming topical medications.</p>			Mean IOP (mmHg)	p-value (comparison with baseline)	Preoperatively (n = 101)	27.6 ± 7.2	-	Day 1 (n = 89)	18.8 ± 11.2	<0.0001	1 week (n = 86)	17.5 ± 5.0	<0.0001	1 month (n = 81)	18.2 ± 5.8	<0.0001	6 months (n = 46)	18.4 ± 4.5	<0.0001	12 months (n = 37)	16.4 ± 2.2	<0.0001	30 months (n = 11)	16.3 ± 3.3	<0.0001	<p>Blood reflux: 100% (101/101) Epithelial defect: 3% (3/101) Descemet's haemorrhage: 1% (1/101) Descemet's scroll/detachment: 1% (1/101) Persisting Descemet's injury: 1% (1/101) Partial gonioynechia at follow-up: 13.9% (14/101) Day 1 postoperative IOP spikes (40 to 60 mmHg): 4 out of 5 cases in which Amvisc [a type of viscoelastic] was used. Hypotony (IOP 2 mmHg) on day 1: 1% (1/101) Vision loss during follow-up ≥2 Snellen lines below preoperative: 1% (1/101)</p> <p>Timing and treatment of complications is not reported unless otherwise stated.</p>	<p>Possible that these patients are reported in Vold 2010</p> <p>Follow-up issues:</p> <ul style="list-style-type: none"> Lost to follow-up: 11.9% (12/101) at day 1, 19.8% (20/101) at 1 month, 63.4% (64/101) at 12 month and 89.1% (90/101) at 30 months. Study extends follow-up of the first 37 cases to receive this procedure and adds short-term data on an additional 64 cases. <p>Study design issues:</p> <ul style="list-style-type: none"> Multicentre study. <p>Study population issues:</p> <ul style="list-style-type: none"> Includes patients with POAG, pseudoexfoliation, myopic degeneration, juvenile rheumatoid arthritis and steroid-induced glaucoma. Procedure combined with cataract extraction: 10.9% (11/101).
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<p>Conflict of interest/source of funding: 3 authors are paid consultants for the manufacturer and 1 of the other authors is one of the inventors of Trabectome® .</p>			

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<p>Pajic B (2006)¹</p> <p>Case series</p> <p>Switzerland</p> <p>Recruitment period: 2002</p> <p>Study population: patients with primary open-angle glaucoma</p> <p>n = 53</p> <p>Age: 71.8 years (mean) Sex: 67.9% (36/53) male Ethnicity: not reported</p> <p>Patient selection criteria: patients with insufficient response to medical treatment for IOP.</p> <p>Technique: sclerotherapy ab interno using bipolar current in a high-frequency diathermic probe (4 thin segments of the trabecular meshwork removed within 1 quadrant, each 0.3 mm by 0.6 mm).</p> <p>Follow-up: 24 months</p> <p>Conflict of interest/source of funding: not reported</p>	<p>Number of patients analysed: 53</p> <p><u>IOP</u></p> <table border="1"> <thead> <tr> <th></th> <th>Mean IOP (mmHg)</th> <th>p- value (comparison with baseline)</th> </tr> </thead> <tbody> <tr> <td>Preoperatively</td> <td>25.6 ± 2.3</td> <td>-</td> </tr> <tr> <td>Day 1</td> <td>17.6 ± 2.7</td> <td><0.03</td> </tr> <tr> <td>1 week</td> <td>19.0 ± 2.5</td> <td><0.03</td> </tr> <tr> <td>1 month</td> <td>16.9 ± 2.5</td> <td><0.03</td> </tr> <tr> <td>6 months</td> <td>14.7 ± 1.7</td> <td><0.03</td> </tr> <tr> <td>12 months</td> <td>14.7 ± 1.7</td> <td><0.03</td> </tr> <tr> <td>24 months</td> <td>15.0 ± 1.6</td> <td><0.005</td> </tr> </tbody> </table> <p>At 24 months, 45.3% had IOP <15 mmHg, 77% had an IOP <18 mmHg and 90.6% patients had an IOP <21 mmHg. In total, 88.7% achieved >20% reduction in IOP and 79% had achieved >30% reduction in IOP (no numbers provided).</p> <p>Overall complete success of the procedure (defined as IOP lower than 21 mmHg without medication): 90.6% at 24 months (no numbers provided). Overall qualified success of the procedure (defined as IOP lower than 21 mmHg with or without medication): 100% at 24 months.</p> <p><u>Glaucoma medication</u></p> <table border="1"> <thead> <tr> <th></th> <th>Number of glaucoma medications</th> </tr> </thead> <tbody> <tr> <td>Preoperatively</td> <td>2.6 ± 1.0</td> </tr> <tr> <td>1 month</td> <td>0.45 ± 0.72</td> </tr> <tr> <td>6 months</td> <td>0.38 ± 0.69</td> </tr> <tr> <td>12 months</td> <td>0.19 ± 0.52</td> </tr> <tr> <td>24 months</td> <td>0.21 ± 0.53*</td> </tr> </tbody> </table> <p>*9.4% (5/53) using medication at 24 months.</p>			Mean IOP (mmHg)	p- value (comparison with baseline)	Preoperatively	25.6 ± 2.3	-	Day 1	17.6 ± 2.7	<0.03	1 week	19.0 ± 2.5	<0.03	1 month	16.9 ± 2.5	<0.03	6 months	14.7 ± 1.7	<0.03	12 months	14.7 ± 1.7	<0.03	24 months	15.0 ± 1.6	<0.005		Number of glaucoma medications	Preoperatively	2.6 ± 1.0	1 month	0.45 ± 0.72	6 months	0.38 ± 0.69	12 months	0.19 ± 0.52	24 months	0.21 ± 0.53*	<p>Complications following the procedure:</p> <p>Moderate cataract with no influence on visual acuity: 11.3% (6/53)</p> <p>Cataract with visual acuity decrease of 1 Snellen line: 5.7% (3/53)</p> <p>Temporary IOP elevation: 22.6% (12/53) [patients responded well to single pressure-reducing treatment]</p> <p>Temporary hypotension lasting for 3 days after surgery: 1.9% (1/53)</p> <p>Hyphaema which disappeared within 2 weeks of the procedure: 11.3% (6/53)</p> <p>Temporary fibrin formation at papillary level: 1.9% (1/53) cleared within 1 day following frequent application of topical medication.</p> <p>Timing and treatment of complications is not reported unless otherwise stated.</p>	<p>Follow-up issues:</p> <ul style="list-style-type: none"> All patients completed 24-month follow-up. <p>Study design issues:</p> <ul style="list-style-type: none"> Unclear if single-centre study. <p>Patient population issues:</p> <ul style="list-style-type: none"> Average visual acuity was similar after the procedure (0.7 ± 0.3 preoperatively and 0.69 ± 0.31 after the procedure [follow-up point not specified]).
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<p>Babighian S (2006)^b</p> <p>Case series</p> <p>Italy</p> <p>Recruitment period: not reported</p> <p>Study population: patients with medically uncontrolled primary open-angle glaucoma</p> <p>n = 21</p> <p>Age: 58 years (mean) Sex: 42.9% (9/21) male Ethnicity: Caucasian: 100% (21/21)</p> <p>Patient selection criteria: no patients had previously received ocular laser or surgical treatment. POAG diagnosis confirmed as IOP \geq22 mmHg and glaucoma type abnormalities of the optic disk and / or visual field in at least one eye.</p> <p>Technique: trabeculotomy ab interno using an Excimer laser.</p> <p>Follow-up: 25.3 months (mean)</p> <p>Conflict of interest/source of funding: not reported</p>	<p>Number of patients analysed: 21</p> <p><u>Success of the procedure</u></p> <table border="1"> <thead> <tr> <th>Definition</th> <th>%</th> <th>Men IOP of each group after the procedure</th> </tr> </thead> <tbody> <tr> <td>IOP lowering \geq20% without additional glaucoma therapy [success]</td> <td>52.4% (11/21)</td> <td>15.2 \pm 1.2</td> </tr> <tr> <td>IOP lowering \geq20% without additional glaucoma therapy [success]</td> <td>38.1% (8/21)</td> <td>18.6 \pm 0.9</td> </tr> <tr> <td>IOP lowering <20% [failure]</td> <td>9.5% (2/21)</td> <td>19.5 \pm 0.7</td> </tr> </tbody> </table> <p><u>IOP</u></p> <table border="1"> <thead> <tr> <th></th> <th>Mean IOP (mmHg)</th> <th>p- value</th> </tr> </thead> <tbody> <tr> <td>Preoperatively</td> <td>24.8 \pm 2.0</td> <td>-</td> </tr> <tr> <td>Final follow-up</td> <td>16.9 \pm 2.1</td> <td>0.00001</td> </tr> </tbody> </table> <p><u>Glaucoma medication</u></p> <table border="1"> <thead> <tr> <th></th> <th>Mean Number of glaucoma medications</th> <th>□- value</th> </tr> </thead> <tbody> <tr> <td>Preoperatively</td> <td>2.2 \pm 0.6</td> <td>-</td> </tr> <tr> <td>Final follow-up</td> <td>0.71 \pm 0.8</td> <td>0.00001</td> </tr> </tbody> </table>		Definition	%	Men IOP of each group after the procedure	IOP lowering \geq 20% without additional glaucoma therapy [success]	52.4% (11/21)	15.2 \pm 1.2	IOP lowering \geq 20% without additional glaucoma therapy [success]	38.1% (8/21)	18.6 \pm 0.9	IOP lowering <20% [failure]	9.5% (2/21)	19.5 \pm 0.7		Mean IOP (mmHg)	p- value	Preoperatively	24.8 \pm 2.0	-	Final follow-up	16.9 \pm 2.1	0.00001		Mean Number of glaucoma medications	□- value	Preoperatively	2.2 \pm 0.6	-	Final follow-up	0.71 \pm 0.8	0.00001	<p>Slight bleed after each impact during the procedure: 80% [no actual number provided]. This spontaneously resolved within 5 days without functional consequences.</p> <p>No goniosynechias or flat anterior comber/choroidal detachment due to Hypotony were reported.</p> <p>Timing and treatment of complications is not reported unless otherwise stated.</p>	<p>Follow-up issues:</p> <ul style="list-style-type: none"> All patients completed a minimum of 24 months follow-up. <p>Study design issues:</p> <ul style="list-style-type: none"> Single-centre study.
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Efficacy

Success of procedure / reduction in IOP

A non-randomised comparative study of 828 patients (comparing 538 trabeculotomy ab interno alone with 290 trabeculotomy ab interno plus phacoemulsification procedures) reported the procedure was a success (defined as final IOP < 21 mmHg and a 20% reduction in IOP in 2 consecutive visits after 3 months postoperatively and no secondary glaucoma incision surgery) in 65% (349/538) of trabeculotomy ab interno only patients and 87% (252/290) of the other group at 12-month follow-up ($p < 0.001$)¹.

A non-randomised comparative study of 259 patients (comparing 114 trabeculotomy ab interno with phacoemulsification and intraocular lens insertion procedures against 145 phacoemulsification and intraocular lens insertion only procedures) reported the procedure was a success (defined as no additional glaucoma surgery, IOP less than 21 mmHg and IOP reduced by 20% below baseline on the last 2 consecutive follow-up visits after 3 months postoperatively) in 80% of trabeculotomy ab interno patients and 46% of the other group at 24-month follow-up².

A case series of 1688 patients reported a reduction in mean IOP from 23.5 mmHg preoperatively to 16.4 mmHg at 5-year follow-up (completeness of follow-up is not reported)³.

A case series of 304 patients reported the procedure was a success (defined as 20% or greater drop in IOP or decrease in glaucoma medications without need for additional medications or glaucoma procedures, including laser trabeculectomy) in 78% (83/106) at 6-month follow-up⁵.

A case series of 53 patients reported complete overall success of the procedure (defined as IOP < 21 mmHg without the use of medication) in 91% of patients at 24-month follow-up (actual number not reported). The same study reported a significant reduction in mean IOP from 25.6 mmHg to 15.0 mmHg at 24 months ($p < 0.005$)⁷.

A case series of 21 patients reported success (defined as IOP reduction of $\geq 20\%$ with or without additional glaucoma therapy) in 90% (19/21) patients. The same study reported a significant reduction in mean IOP from 24.8 mmHg to 16.9 mmHg ($p = 0.00001$) at mean follow-up of 25.3 months⁸.

Number of glaucoma medications used

The non-randomised comparative study of 828 patients (comparing 538 trabeculotomy ab interno alone with 290 trabeculotomy ab interno plus

IP overview: Trabeculotomy ab interno for open-angle glaucoma

phacoemulsification procedures) reported a significant reduction in the mean number of glaucoma medications used from 2.88 preoperatively to 2.09 postoperatively ($p < 0.0001$) in trabeculotomy ab interno only patients and from 2.54 preoperatively to 1.69 postoperatively in the other group (no p value reported) at 12-month follow-up¹.

The non-randomised comparative study of 259 patients (comparing 114 trabeculotomy ab interno with phacoemulsification and intraocular lens insertion procedures against 145 phacoemulsification and intraocular lens insertion only procedures) reported that the use of glaucoma medication in the trabeculotomy ab interno group dropped by 40% during the study period (unable to read exact number on the graph within the published paper). The use of glaucoma medication was not reported in the other group².

The case series of 1688 patients reported a reduction in mean number of glaucoma medications used by patients from 2.83 preoperatively to 1.0 at 5-year follow-up (completeness of follow-up is not reported)³.

The case series of 53 patients reported a decrease in the mean number of glaucoma medications used from 2.6 preoperatively to 0.21 at 24-month follow-up⁷.

A case series of 21 patients reported a reduction in mean number of glaucoma medications used by patients from 2.2 preoperatively to 0.71 at mean follow-up of 25.3 months (all patients completed a minimum of 24-month follow-up)⁸.

Requirement for additional procedures

The non-randomised comparative study of 828 patients (comparing 538 trabeculotomy ab interno alone with 290 trabeculotomy ab interno plus phacoemulsification procedures) reported 32% (175/538) required secondary glaucoma procedures in the trabeculotomy ab interno only group and 8% (24/290) in the other group at 12-month follow-up¹.

The non-randomised comparative study of 259 patients (comparing 114 trabeculotomy ab interno with phacoemulsification and intraocular lens insertion procedures against 145 phacoemulsification and intraocular lens insertion only procedures) reported that 5 patients in the trabeculotomy ab interno group underwent secondary surgery by the end of the second year. Additional procedures were not reported in the other group².

The case series of 1688 patients reported that 10% (162/1688) patients required an additional procedure within 5-year follow-up (completeness of follow-up is not reported). This included 96 trabeculectomies (6% of patients), 41 aqueous tube shunts (2%) and 14 repeat trabeculotomy ab interno procedures (1%)³.

Safety

IOP spike

The case series of 1688 patients reported IOP >10 mmHg above baseline after the procedure in 6% (96/1688) of patients (completeness of follow-up is not reported)³.

The case series of 53 patients reported temporary IOP elevation (no details provided) in 23% (12/53) patients. Patients responded well to single pressure-reducing treatment⁷.

Hypotony

The case series of 1688 patients reported hypotony (defined as IOP < 5 mmHg) on day 1 following the procedure in 1% (24/1688) (completeness of follow-up is not reported)³.

Iris injury

The case series of 1688 patients reported iris injury in 5 patients at 5-year follow-up (completeness of follow-up is not reported)³.

Corneal membrane tear

The case series of 1688 patients reported corneal Descemet's limited membrane tear in 4 patients at 5-year follow-up (completeness of follow-up is not reported)³.

Cataract

The case series of 53 patients reported moderate cataract with no influence on visual acuity in 11% (6/53) and cataract with visual acuity decrease of 1 Snellen line in 6% (3/53) at 24-month follow-up⁷.

Validity and generalisability of the studies

- It is highly probable that 3 of the studies reporting on the Trabectome[®] device overlap with each other in terms of patient numbers. The extent of the overlap is currently unclear.
- Only case series data are available, with maximum follow-up of 5 years.

Existing assessments of this procedure

There were no published assessments from other organisations identified at the time of the literature search.

Related NICE guidance

Below is a list of NICE guidance related to this procedure. Appendix B gives details of the recommendations made in each piece of guidance listed.

Interventional procedures

- Trabecular stent bypass for open-angle glaucoma. NICE interventional procedures guidance XXX (2011). Available from www.nice.org.uk/guidance/IPGXXX
- Canaloplasty for primary open-angle glaucoma. NICE interventional procedures guidance 260 (2008). Available from www.nice.org.uk/guidance/IPG260

Clinical guidelines

- Glaucoma: diagnosis and management of chronic open angle glaucoma and ocular hypertension. NICE clinical guideline 85 (2009). Available from www.nice.org.uk/guidance/CG85

Specialist Advisers' opinions

Specialist advice was sought from consultants who have been nominated or ratified by their Specialist Society or Royal College. The advice received is their individual opinion and does not represent the view of the society.

Mr K. Sheng Lim and Mr Nitin Anand (Royal College of Ophthalmologists)

- Neither Specialist Adviser has performed this procedure. One Specialist Adviser considered this procedure to be definitely novel and of uncertain safety and efficacy. The other Specialist Adviser considered it to be a minor variation on an existing procedure.
- Comparator: trabeculectomy.
- Adverse events reported in the literature / from own experience: hyphaema (blood in anterior chamber) and potential damage to the iris and lens if performed on phakic eyes without concurrent cataract extraction.

- Theoretical adverse events: bleeding, intraocular pressure rise after surgery and scarring of the trabecular meshwork, which could render the procedure ineffective after 6 – 12 months.
- Key efficacy outcome: IOP reduction or a total success (a 30% drop from baseline with the percentage drop achieving the target pressure without any glaucoma treatment).
- Training and facilities: One Specialist Adviser stated that previous specialist training in gonioscopy to identify anatomical landmarks and wet-lab training to minimise risk of damage to the iris and the lens is required. The other Specialist Adviser considered this to be a different approach from that used in standard procedures performed by most glaucoma surgeons. It may require travel to specialist centres where the procedure is done routinely to learn the new approach.
- One Specialist Adviser reported good short-term reduction in IOP but that long-term efficacy is uncertain and that patients may still have to take glaucoma medication after the procedure.
- One Specialist Adviser reported that, according to the literature, the procedure is not as effective at lowering IOP as trabeculectomy. This Adviser stated that it is similar to goniotomy (ab externo) for congenital glaucoma, which often has to be repeated 2 – 3 times to get a reasonable effect. In addition, the Adviser reported that the procedure has been around for at least 6 years and has failed to evoke a great deal of interest, even in those involved in innovative glaucoma procedures.

Patient Commentators' opinions

NICE's Patient and Public Involvement Programme was unable to gather patient commentary for this procedure.

Issues for consideration by IPAC

- Future trial: RCT in Canada [[NCT00901108](#), University of Alberta] is currently recruiting patients: “Trabectome[®] versus trabeculectomy with mitomycin C in patients with open-angle glaucoma”. The estimated enrolment is 52 patients with an estimated completion date of December 2011. Primary outcomes: IOP at 6 months and surgical complication rates.
- Chronic glaucoma becomes much more common with increasing age. It is uncommon below the age of 40 but affects 1% of people over this age and 5% over 65. All studies included in table 2 reported on patients with a mean age equal to or greater than 65 years.
- People of African origin are more at risk of chronic glaucoma. Onset may be somewhat earlier and may be more severe. Ethnicity is reported for each study population in table 2; however, none of the studies report clinical outcomes by ethnic group.

References

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2. Francis BA. (2010) Trabectome combined with phacoemulsification versus phacoemulsification alone: a prospective, non-randomised controlled surgical trial. *Clinical & Surgical Ophthalmology* 28:1-7.
3. Liu J, Jung J, Francis BA. (2009) Ab interno trabeculotomy: Trabectome surgical treatment for open-angle glaucoma. *Expert Review of Ophthalmology* 4:119-128.
4. Vold SD, Dustin L. (2010) Impact of laser trabeculoplasty on Trabectome® outcomes. *Ophthalmic Surgery, Lasers & Imaging* 41:443-451.
5. Francis BA, Minckler D, Dustin L et al. (2008) Combined cataract extraction and trabeculotomy by the internal approach for coexisting cataract and open-angle glaucoma: Initial results. *Journal of Cataract and Refractive Surgery* 34:1096-1103.
6. Minckler D, Baerveldt G, Ramirez MA et al. (2006) Clinical results with the Trabectome, a novel surgical device for treatment of open-angle glaucoma. *Transactions of the American Ophthalmological Society* 104:47.
7. Pajic B, Pallas G, Heinrich G et al. (2006) A novel technique of ab interno glaucoma surgery: follow-up results after 24 months. *Graefes Archive for Clinical & Experimental Ophthalmology* 244:22-27.
8. Babighian S, Rapizzi E, Galan A. (2006) Efficacy and safety of ab interno excimer laser trabeculotomy in primary open-angle glaucoma: Two years of follow-up. *Ophthalmologica* 220:285-290.

Appendix A: Additional papers on trabeculotomy ab interno for open-angle glaucoma

The following table outlines the studies that are considered potentially relevant to the overview but were not included in the main data extraction table (table 2). It is by no means an exhaustive list of potentially relevant studies.

Article	Number of patients/follow-up	Direction of conclusions	Reasons for non-inclusion in table 2
Ferrari E, Bandello F, Roman-Pognuz D et al. (2005) Combined clear corneal phacoemulsification and ab interno trabeculectomy: three-year case series. Journal of Cataract & Refractive Surgery 31: 1783-1788	Case series n = 11 Follow-up: 36 months Each patient had clear corneal phacoemulsification + intraocular lens implantation + trabeculotomy ab interno (using subretinal vitrectomy forceps).	10 patients completed 3-year follow-up. Mean IOP: Baseline: 25 mmHg 1 month: 15.8 mmHg 12 months: 15.4 mmHg 36 months: 15.3 mmHg Complications: Goniosynechiae: 3 patients Hyphaema: 1 patient Bleeding: 4 patients Pressure spike: 1 patient	Larger studies included in table 2
Vold SD. Impact of preoperative intraocular pressure on Trabectome outcomes: A prospective, non-randomized, observational, comparative cohort outcome study. Clinical & Surgical Ophthalmology 2010 28 (11): 1-7.	Case series n = 1401 Follow-up = 6 months	Mean reduction in IOP: Preoperative IOP \leq 17mmHg (n = 293): 7% Preoperative IOP 18-22 mmHg (n = 428): 20% Preoperative IOP 23-29 mmHg (n = 379): 33% Preoperative IOP \geq 30mmHg (n = 301): 48%	Suspect high degree of overlap with Vold 2010 paper reported in table 2 (identified during post consultation literature search)

Appendix B: Related NICE guidance for trabeculotomy ab interno for open-angle glaucoma

Guidance	Recommendations
Interventional procedures	<p>Trabecular stent bypass microsurgery for open-angle glaucoma. NICE interventional procedures guidance XXX (2011).</p> <p>1 Guidance</p> <p>1.1 Current evidence on trabecular stent bypass microsurgery for open angle glaucoma raises no major safety concerns. There is evidence of efficacy in the short term but this is based on small numbers of patients. Therefore, this procedure should only be used with special arrangements for clinical governance, consent and audit or research.</p> <p>1.2 Clinicians wishing to undertake trabecular stent bypass microsurgery for open-angle glaucoma should take the following actions.</p> <ul style="list-style-type: none"> • Inform the clinical governance leads in their Trusts. • Ensure that patients and their carers understand the uncertainty about the procedure's safety and efficacy and provide them with clear information. In addition, the use of NICE's information for patients ('Understanding NICE guidance') is recommended (available from www.nice.org.uk/IPGXXXpublicinfo). • Audit and review clinical outcomes of all patients having trabecular stent bypass microsurgery for open-angle glaucoma (see section 3.1). <p>1.3 Trabecular stent bypass microsurgery for open-angle glaucoma should only be carried out by clinicians with specific training in the procedure.</p> <p>1.4 NICE encourages the publication of further evidence on long-term efficacy and any occurrence of device extrusion.</p>
	<p>Canaloplasty for primary open-angle glaucoma. NICE interventional procedures guidance 260 (2008).</p> <p>1 Guidance</p> <p>1.1 Current evidence on the safety and efficacy of canaloplasty for primary open-angle glaucoma is inadequate in both quality and quantity. Therefore, this procedure should only be used in the context of research or formal prospective data collection. Clinicians are encouraged to collaborate in the collection and publication of data.</p> <p>1.2 Further publication of safety and efficacy outcomes will be useful. The Institute may review the procedure upon publication of further evidence.</p>
Clinical guidelines	<p>Glaucoma: diagnosis and management of chronic open angle glaucoma and ocular hypertension. NICE clinical guideline 85 (2009).</p> <p>Treatment for people with COAG</p> <p>1.4.6 Check the person's adherence to their treatment and eye drop</p>

	<p>instillation technique in people with COAG whose IOP has not been reduced sufficiently to prevent the risk of progression to sight loss despite pharmacological treatment. If adherence and eye drop instillation technique are satisfactory offer one of the following:</p> <ul style="list-style-type: none"> • alternative pharmacological treatment (a prostaglandin analogue, beta-blocker, carbonic anhydrase inhibitor or sympathomimetic); more than one agent may be needed concurrently to achieve target IOP • laser trabeculoplasty surgery with pharmacological augmentation (MMC or 5-FU¹) as indicated. <p>If the pharmacological treatment option is chosen, after trying two alternative pharmacological treatments consider offering surgery with pharmacological augmentation (MMC or 5-FU¹) as indicated or laser trabeculoplasty.</p> <p>1.4.7 Offer surgery with pharmacological augmentation (MMC or 5-FU¹) as indicated to people with COAG who are at risk of progressing to sight loss despite treatment. Offer them information on the risks and benefits associated with surgery</p> <p>1.4.9 After surgery offer people with COAG whose IOP has not been reduced sufficiently to prevent the risk of progression to sight loss one of the following:</p> <ul style="list-style-type: none"> • pharmacological treatment (a prostaglandin analogue, beta-blocker, carbonic anhydrase inhibitor or sympathomimetic); more than one agent may be needed concurrently to achieve target IOP • further surgery • laser trabeculoplasty or cyclodiode laser treatment. <p>1.4.10 Offer people with COAG who prefer not to have surgery or who are not suitable for surgery:</p> <ul style="list-style-type: none"> • pharmacological treatment (a prostaglandin analogue, beta-blocker, carbonic anhydrase inhibitor or sympathomimetic); more than one agent may be needed concurrently to achieve target IOP • laser trabeculoplasty or cyclodiode laser treatment.
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¹ At the time of publication (April 2009), MMC and 5-FU did not have UK marketing authorisation for this indication. Informed consent should be obtained and documented. Both drugs should be handled with caution and in accordance with guidance issued by the Health and Safety Executive.

Appendix C: Literature search for treatment of trabeculotomy ab interno for open-angle glaucoma

Database	Date searched	Version/files
Cochrane Database of Systematic Reviews – CDSR (Cochrane Library)	29/07/2010	July 2010
Database of Abstracts of Reviews of Effects – DARE (CRD website)	29/07/2010	-
HTA database (CRD website)	29/07/2010	-
Cochrane Central Database of Controlled Trials – CENTRAL (Cochrane Library)	29/07/2010	July 2010
MEDLINE (Ovid)	29/07/2010	1950 to July Week 3 2010
MEDLINE In-Process (Ovid)	29/07/2010	July 28, 2010
EMBASE (Ovid)	29/07/2010	1980 to 2010 Week 29
CINAHL (NLH Search 2.0)	29/07/2010	-
BLIC (Dialog DataStar)	27/07/2010	-

Trial sources searched on 29/07/2010

- National Institute for Health Research Clinical Research Network Coordinating Centre (NIHR CRN CC) Portfolio Database
- Current Controlled Trials *meta*Register of Controlled Trials – *m*RCT
- Clinicaltrials.gov

Websites searched on 22/07/2010 – 29/07/2010

- National Institute for Health and Clinical Excellence (NICE)
- Food and Drug Administration (FDA) - MAUDE database
- Australian Safety and Efficacy Register of New Interventional Procedures – Surgical (ASERNIP – S)
- Australia and New Zealand Horizon Scanning Network (ANZHSN)
- Conference search
- General internet search

MEDLINE search strategy

The following search strategy was used to identify papers in MEDLINE. A similar strategy was used to identify papers in other databases.

1	Glaucoma/
2	Glaucoma, Open-Angle/
3	(glaucoma* adj3 (compensat* or pigment* or simple* or open angle* or open-angle* or

IP overview: Trabeculotomy ab interno for open-angle glaucoma

	simplices or chronic)).tw.
4	POAG.tw.
5	Ocular Hypertension/
6	((ocular* or intraocul*) adj3 hypertens*).tw.
7	Intraocular Pressure/
8	(intraocul* adj3 pressur*).tw.
9	IOP.tw.
10	or/1-9
11	Ophthalmologic Surgical Procedures/
12	Trabeculectomy/
13	(trabeculectom* or trabeculotom*).tw.
14	(trabeculotom* adj3 ab adj3 interno).tw.
15	(trabecular meshwork adj3 (remov* or disrupt* or ablat*)).tw.
16	trabectome.tw.
17	(electro-surg* or electrosurg*).tw.
18	or/11-17
19	10 and 18
20	Animals/ not Humans/
21	19 not 20
22	limit 21 to yr="2005 -Current"