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### ► To cite this version:

Ameenat Lola Solebo, Isabelle Russell-Eggitt, Ken K Nischal, Anthony T Moore, Phillippa Cumberland, et al.. Cataract surgery and primary intraocular lens implantation in children  $\leq 2$  years old in the United Kingdom and Ireland: findings of national surveys. *British Journal of Ophthalmology*, 2009, 93 (11), pp.1495-n/a. 10.1136/bjo.2009.160069 . hal-00477856

**HAL Id: hal-00477856**

**<https://hal.science/hal-00477856>**

Submitted on 30 Apr 2010

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# Cataract surgery and primary intraocular lens implantation in children $\leq 2$ years old in the United Kingdom and Ireland: finding of national surveys

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**Keywords:** Cataract  
Infant  
Operations  
Lens Implantation, Intraocular  
Methodology, Survey

**Word Count:** **1736 (including abstract = 1940)**  
2 tables, 0 figures, 25 references, appendix attached

## **ABSTRACT**

### **Background**

We have investigated the current patterns of practice relating to primary intraocular lens (IOL) implantation in children  $\leq 2$  years old in the UK and Ireland

### **Methods**

National postal questionnaire surveys of consultant ophthalmologists in the UK & Ireland.

### **Results**

76% of 928 surveyed ophthalmologists replied. 47 (7%) of the respondents operated on children aged under  $\leq 2$  with cataract. 41 (87%) of respondents performed primary IOL implantation, but 25% would not implant an IOL in a child under 1 year old. 88% of surgeons used limbal wounds, 80% manual capsulotomies, 98% posterior capsulotomies, and 100% hydrophobic acrylic lenses. The SRK/T formula was most commonly used (70%). Exclusion criteria for primary IOL implantation varied considerably and included microphthalmos (64% of respondents), anterior and posterior segment anomalies (53%, 58%), and glaucoma (19%).

### **Discussion**

Primary IOL implantation in children  $\leq 2$  has been widely adopted in the UK & Ireland. There is concordance of practice with regards to surgical technique and choice of IOL model. However, variation exists in eligibility criteria for primary IOLs: this may reflect a lack of consensus on which children are most likely to benefit. Thus there is a need for systematic studies of the outcomes of primary IOL implantation in younger children.

## **BACKGROUND**

Primary intraocular (IOL) implantation has become accepted practice for older children with cataract.<sup>1,2</sup> Whilst primary IOL implantation is being increasingly undertaken in

children in the first 2 years of life,<sup>3,4</sup> the long term benefits and the factors associated with positive and negative outcomes are unclear.<sup>1;2;5-9</sup>

The British Isles Congenital Cataract Interest Group (BCCIG), a research network comprising British and Irish ophthalmic consultants, was established in 1995 in order to study the incidence, detection, causes, management and outcomes of congenital and infantile cataract.<sup>10-14</sup> A national epidemiological study to investigate outcomes following primary IOL implantation in children  $\leq 2$  years old with congenital and infantile cataract is now being undertaken through the BCCIG. As a foundation for this research, we have investigated the surgical management of cataract in younger children in the UK and Ireland, with a focus on primary IOL implantation.

## **METHODS**

In October 2008, 960 consultants comprising all members of the BCCIG, all consultant members of the Royal College of Ophthalmologists and Irish consultant ophthalmologists with a known interest in congenital cataract, were contacted using postal questionnaires accompanied by hand addressed cover letters and postage paid reply envelopes. Members of the BCCIG who did not respond to the mailing were sent reminders.

We sought to discover the number of children  $\leq 2$  years old with congenital or infantile cataract managed over the previous year, the number undergoing surgery with and without primary IOL implantation and the details of surgical management. Respondents were asked to estimate the number of children managed over the preceding year. Exclusion criteria for primary implantation in children  $\leq 2$  were requested, as was preferred IOL model and IOL power calculation formulae together with details of surgical technique including lens aspiration and vitrectomy approaches and capsulotomy practices. The post operative measurement of axial length was also investigated.

## **Statistical analysis**

Free text answers on exclusion criteria were coded. Descriptive analysis of the responses was undertaken.

## RESULTS

32 of the 960 distributed questionnaires were returned as undeliverable. 709 (76%) of the remaining 928 contacted consultants replied to the survey. Replies were received between October 2008 and January 2009. 47 (7%) of the 709 respondents stated that they operated on children  $\leq 2$  years old, estimating that over the preceding year they had operated on a total of 301 children. 6 (13%) of the 47 surgeons did not perform primary IOL implantation in any child  $\leq 2$ . The 41 surgeons who did perform primary IOL implantation estimated that in the preceding year they had operated on 268 children (116 with unilateral, 152 with bilateral cataract), undertaking primary IOL implantation in 65% (table 1).

<i>How many children <math>\leq 2</math> years old have you operated on over the last year? (47 surgeons)</i>			
	<b>Unilateral cataract</b>	<b>Bilateral cataract</b>	<b>Total</b>
<i>Median</i>	2	2.5	5
<i>Range (min to max)</i>	0-10	0-15	0-25
<i>Total</i>	133	168	301
<i>In how many children <math>\leq 2</math> years old have you performed primary IOL implantation over the last year? (41 surgeons)</i>			
	<b>Unilateral cataract</b>	<b>Bilateral cataract</b>	<b>Total</b>
<i>Median</i>	2	1	2
<i>Range</i>	0-8	0-14	0-19
<i>Total</i>	87	86	173
<i>As a proportion of children undergoing surgery</i>	75% (87/116)	57% (86/152)	65% (173/268)

*Table 1. Surgical management of children  $\leq 2$  with cataract: number of children undergoing surgery as estimated by respondents*

### Exclusion criteria

Exclusion criteria for primary IOL implantation in children  $\leq 2$  were provided by 36 of the 41 respondents. 6 (17%) surgeons did not mention any ocular anomaly amongst their stated exclusion criteria. 23 (64%) described specific anomalies which would prevent them from implanting an IOL. Of these, 16 cited short axial length or microphthalmos, with 5 specifying different lengths below which they would not implant (16, 18 and 20mm). Anterior and posterior segment anomalies were exclusion criterion for 12 and 14

respondents respectively. 7 (19%) respondents considered the presence of any co-existent ocular anomaly to be sufficient cause for exclusion. Thus, microphthalmos is an exclusion criteria for 64% (23/36) of respondents, anterior segment anomaly 53% and posterior segment anomaly 58%. 9 (25%) cited microcornea, with surgeons again specifying differing corneal diameters, either below 9mm (3 respondents) or 10mm (3 respondents). 7 (19%) cited persistent hyperplastic primary vitreous (PHPV, or persistent fetal vasculature), with 5 of the 7 specifying ‘significant’ PHPV. Other stated exclusion criteria included abnormal capsular support (10/36 or 28%, with 4 respondents specifying ectopia lentis), glaucoma (7/36, 19%) and uveitis (3/36, 8%).

The age of the child was cited by 6/36 (17%) of the 36 respondents. Different minimum age limits were used: 12 months, 6 months and 1 month old minimal ages by 3, 2 and 1 respondent respectively. Thus, 25% (9/36) of respondents would not perform primary IOL implantation in any child under 1 year old. 7 (19%) consultant ophthalmologists commented on parental preference as an exclusion criterion for primary IOL implantation.

### **Details of routine surgical management**

As shown in table 2, all respondents used a hydrophobic acrylic IOL, with 90% using an Acrysof model. 70% reported using the SRK/T formula for IOL power calculation, with 37% using it in combination with the Hoffer Q formula. 6 respondents specified that they used either formula, dependent on the axial length of the child. With regards to routine surgical technique, 80% of surgeons used limbal wounds for surgery; manual capsulotomy techniques were used by 88%; posterior capsulotomies were created by all but 1 surgeon. Of those using posterior capsulotomies, 78% also performed anterior vitrectomy with 16% stating that their surgical approach (anterior versus posterior) depended on the axial length or age of the child. The majority of respondents (71%) do not routinely post-operatively measure the axial lengths of pseudophakic children.

<i>Number of respondents (n=41)</i>	
<b>IOL model</b>	

Acrysof	37
MA60	14
MA30	13
SA60	8
SN60AF	4
SN60 IQ	3
AMO	4
Sensar	3
Tecnis	1
HoyaVA	1
<b>IOL power calculation formulae</b>	
SRK/T	28
Hoffer Q	21
SRK/T + Hoffer Q	14
Holladay I	6
SRK II	3
Haigis	1
<b>IOL placement</b>	
In the bag	40
Optic capture	1
<b>Wound creation</b>	
Limbal	33
Scleral	8
Limbal or scleral	2
Clear corneal	3
<b>Anterior capsulotomy technique</b>	
Manual	36
Diathermy	4
Vitrectorhexis	3
<b>Posterior capsulotomy and vitrectomy</b>	
No posterior capsulotomy	1
No vitrectomy	9
Vitrectomy via anterior approach	25
Vitrectomy via posterior approach	17
<b>Post operative axial length routinely measured post operatively</b>	
Yes	12
No	29

Table 2. Details of surgical management

## DISCUSSION

Cataract surgery in children  $\leq 2$  is undertaken by a small group of sub-specialists in the UK and Ireland. Whilst the technical demands of surgery are considerable, our finding that fewer than 1 in 20 responding consultants undertake cataract surgery in these children may be an indication of the level of post operative ophthalmic, orthoptic, optometric and supportive nursing care necessary to achieve a good outcome. Primary intraocular lens implantation in children  $\leq 2$  has been adopted by the majority of the responding surgeons who manage children with cataract. There exists concordance of surgical approach, with most surgeons choosing an AcrySof hydrophobic acrylic IOL, manual curvilinear anterior

capsulorhexis, limbal wound access and posterior capsulotomy with anterior vitrectomy. However, our finding that variability exists with regards to exclusion criteria suggests that there is disparity of opinion on which children will benefit following primary IOL implantation, and which children are at least risk of complications and poor outcome. Whilst this disparity may be due to differing personal preferences within a relatively new and evolving field, it may also be a reflection of absences within the evidence base on the practice of primary IOL implantation in children  $\leq 2$ .

The high (76%) response rate to this postal survey is, we believe, an indication of the current relevance of this issue to all ophthalmologists. This figure is high in comparison to other published work,<sup>4;15;16</sup> and strengthens the generalisability of our findings. We recognise that the use of free text responses may have precluded comprehensive responses in relation to exclusion criteria for primary IOL implantation. We also believe that the estimated total of 301 children undergoing cataract surgery over the preceding year, as reported in this survey, may be an overestimate: previous work undertaken through the BCCIG has shown that between 1995 and 1996, 168 children under 2 were diagnosed with congenital or infantile cataract in the UK, with surgery undertaken in 165,

Previously published literature exists on international practice styles and preferences in paediatric cataract surgery and IOL implantation,<sup>4</sup> and also preferences of surgical specifics such as IOL model<sup>15</sup> and capsulotomy method.<sup>16</sup> In 2003, Wilson et al<sup>4</sup> surveyed members of the American cataract and paediatric sub-speciality societies and reported that up to 89% of respondents would implant IOLs in a child  $\leq 2$  with unilateral cataract, and 78% in a child  $\leq 2$  with bilateral cataract. Hydrophobic acrylic IOLs were used by 71% of paediatric surgeons. There was disagreement on whether microphthalmos, anterior segment anomalies, or persistent fetal vasculature were contraindications to IOL placement in children. Whilst these findings are of interest, only 2% of the respondents to that survey were UK consultants. As such, the findings are not necessarily readily extrapolated to practices in the UK and Ireland.



Better understanding of visual development and amblyopia,<sup>17;18</sup> and the introduction of mechanical lensectomy, mechanical vitrectomy, capsulotomy techniques, ophthalmic viscous devices and other novel technologies<sup>1;2</sup> have led to improvements in visual outcomes for children with cataract.<sup>2;19</sup> Primary IOL implantation has become the treatment of choice in older children, with medium to longer-term outcome data becoming available,<sup>2;3;20</sup> and there is good biocompatibility evidence for IOL material implantation in young eyes.<sup>21</sup> Short term visual rehabilitation following IOL implantation in early childhood is at least comparable to that with contact lens correction of surgical aphakia<sup>5;7;22;23</sup> but there is uncertainty about both the long-term benefits and the risks of primary IOL implantation in children aged under 2 years, with regards to the predictability of refractive outcomes with different power equations, post operative complication rates and the need for further surgery.<sup>7;23-25</sup> The Infant Aphakia Treatment Study, currently underway in North America, is investigating outcomes in a defined cohort of infants under 6 months old with unilateral cataract<sup>6</sup> following standardised cataract surgery with and without primary IOL implantation. Their findings will be welcomed by paediatric ophthalmic surgeons. Nevertheless, further research is necessary on outcomes within a more diverse group of patients, in particular older infants and those with bilateral cataract or other ocular disease, as well as outcomes in settings outside the US where management practices and health care systems differ.

Whilst our findings reflect the increasing adoption of IOLs for children  $\leq 2$ , 13% of consultants reported that they would not use primary IOLs in any child  $\leq 2$  yrs old, a quarter would not use IOLs in a child under 1 year old, and there exists notable variance in the cited exclusion criteria. A national epidemiological study into primary IOL implantation in children  $\leq 2$ , now underway through the BCCIG, should address important unanswered questions on the outcomes and predictors of outcomes of primary IOL implantation in a nationally representative cohort of children  $\leq 2$  years old.

Competing Interests: The authors have no competing interests to declare.

Funding: Lola Solebo is supported by a fellowship awarded by the Ulverscroft Vision Research Group. The Centre for Paediatric Epidemiology and Biostatistics at ICH also benefits from funding support from the Medical Research Council in its capacity as the MRC Centre of Epidemiology for Child Health. This work was undertaken at UCL Institute of Child Health / Great Ormond Street Hospital for children which received a proportion of funding from the Department of Health's NIHR Biomedical Research Centres funding scheme. Jugnoo Rahi is supported in part by the Moorfields Eye Hospital/UCL Institute of Ophthalmology, which also receives a proportion of funding from the Department of Health's NIHR Biomedical Research Centres funding scheme.

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