APPLANATION BIOMETRY IN ILORIN, NIGERIA

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SUMMARY

Background: Extracapsular cataract surgery with posterior chamber intraocular lens implant (ECCE-IOL) is still routinely done without biometry in most developing nations for various reasons but mainly due to non availability of the required equipment.

Aim

- To evaluate the accuracy of the choice of intraocular lens in cataract surgery with recently acquired biometry equipment
- To carry out a comparative study of refractive outcome of cataract surgery with and without biometry in a tertiary teaching hospital in Ilorin, Kwara State, Nigeria

Patients and method: This is a non randomized prospective study of the visual outcome of all cases of ECCE-IOL surgery done by the same group of surgeons before and after the availability of biometry. Biometry was by A scan applanation contact technique using the SRK-2 formula. Only patients who did not have any surgical complication were included in the study.

Results: For patients who had surgery without biometry, average keratometry reading (K_1) was 43.38D. Minimum and maximum values were 33.30D and 47.25D respectively, while average (K_2) value for surgery with biometry was 43.47D, with a minimum of 36.10D and maximum of 49.13D. The average axial length was 22.87mm with standard deviation of ± 2.4 and standard error of 0.23. Evaluation of the accuracy of the IOL power used showed that 56%, 75%, 95% and 99% of the patients were within 1D, 2D, 3D and 4D of predicted value respectively. Visual outcome at discharge and at two months without refraction was better in the group without biometry (P value < 0.05). The visual outcome at two months with refraction was statistically the same but the series with biometry met the WHO guideline of 90% good outcome as compared to 83.8% in the group without biometry.

Conclusion: The main reasons for the seeming lack of benefit from biometry include wrong IOL power calculation, and non availability of calculated power in the range below 17D and above 22D. We recommend local production of IOL or central purchasing of the not commonly used IOL powers. Users of newly acquired equipment must be trained while trained biometrists could be assigned to routinely carry out biometry.

Key words: visual outcome, biometry, ECCE-PC IOL

INTRODUCTION

Cataract surgery is the most commonly performed intraocular surgery in Nigeria and in many parts of the world. It is noted for its high success rate and patient satisfaction. Cataract surgery in Nigeria and other developing countries in Africa is still by intracapsular cataract extraction although there is increasing conversion to extracapsular cataract extraction with intraocular lens implant (ECCE-PC-IOL).[1-3] Many of the lens implant done in these countries are however performed without biometry,[2-4] usually due to the cost of the required equipment and maintenance difficulty. In the developed nations, innovations such as ocular biometry, phacoemulsification and IOL predictive lens formula have greatly improved the refractive outcome of cataract surgery in the last five the goal now is to improve refractive surgical technique. Modern cataract surgery consists of the removal of the cataract and the placement of an IOL into the eye for visual and refractive rehabilitation.[6] The refractive accuracy of the IOL chosen by the surgeon is an important element in obtaining excellent visual function after surgery.[6] In a

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survey of American and European refractive surgeries, Mamalis[7] reported that incorrect IOL power was the most common indication for removal of foldable IOL. An assessment of the visual outcome of ECCE-PCIOL cases done without biometry in our centre was earlier reported[8] and like many other studies reviewed in the region on ECCE-IOL surgery, the belief is that visual outcome would improve when biometry becomes available.[3,4,8] This work therefore aims at evaluating the accuracy of our IOL calculation as well as comparing the visual outcome and residual error with patients undergoing ECCE-IOL surgery without biometry. This will help document the benefit of the acquired biometry equipments as well as evaluate the problems encountered in its use. Auditing of cataract surgery or any other medical service is a useful tool for improving medical service, particularly when new techniques and equipments are in use.[9]

PATIENTS AND METHOD

This is a non randomized prospective study of all patients who presented to the clinical practice of the University of Ilorin Teaching Hospital for ECCE-PCIOL surgery. The first series (n=111) included patients who had ECCE PC-IOL surgery without biometry (January 2001 and July 2002). The second series (n=109) included all consecutive patients operated with biometry (August 2003 and December 2004). The surgeries were done by the same set of surgeons. Ethical considerations did not permit a randomized setting. In the first series, the lenses were randomly selected from 19D to 21D depending on the available power. Most patients did not have the benefit of refraction since 98% had preoperative vision of less than 3/60 and many had a cataract in the second eye preventing refraction. In the second series, preoperative measurement of axial length was performed with contact A scan biometry and keratometry measurement to arrive at the IOL power. These were done by the resident doctors. A scan by contact technique was done with the patient in a sitting position. The probe was cleaned after each use.

In the two groups, emmetropia was the visual goal. Visual acuity at discharge and eight weeks post surgery was recorded without refraction while all patients available at eight weeks had retinoscopy. Patients with hazy media or poor vision from other causes aside refractive error were excluded during refraction at eight weeks. Postoperative refractive accuracy of the IOL chosen was determined by comparing the postoperative spherical equivalent at two months with the refraction predicted by preoperative measurement and IOL calculation in series 2. The difference for each patient is referred to as the absolute error of post operative refraction measured in diopters and reported as within 1.0D, 2.0D, 3.0D and 4.0D. Statistical comparison was by P value, chi square.

RESULTS

In series 1, a total of 105 patients (111 eyes) were operated without biometry. The age range was 7-89 years with a mean of 64 years and a male to female ratio of 1:1.2. Most of the patients (98%) had a preoperative visual acuity of <3/60 in the operated eye.

In series 2, a total of 107 patients (109 eyes) were operated with biometry. Age range was 6-85 years with a mean of 60 years and a male to female ratio of 1.01:1. The preoperative visual acuity in 94% of the patients was <3/60 in the operated eye.

In patients with biometry, average keratometry (K_1) reading was 43.38D, with a minimum of 33.30D and a maximum of 47.25D. In patients without biometry, the average keratometry (K_2) reading was 43.47D, with a minimum of 36.00D and a maximum of 49.13D. Mean axial length was 22.87mm with a standard deviation of 2.40 and a standard error of 0.23. Figure 1 shows the accuracy of the choice of IOL reviewed only in the patients who had the required lens inserted.

Comparative visual acuity at discharge, unaided at two months and after refraction for the two groups is as shown in table 1, and figures 2, 3 and 4.

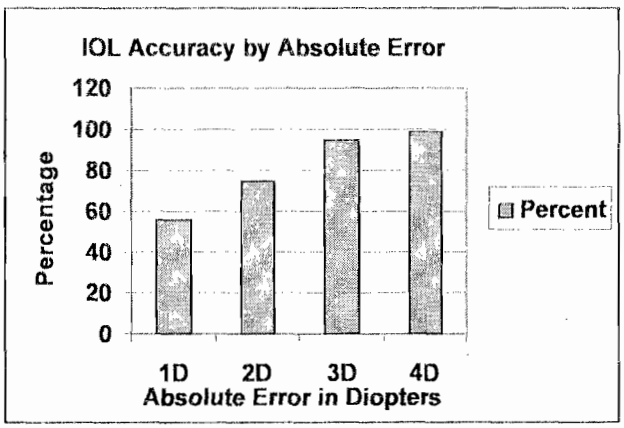

Figure 1. Accuracy of IOL power

Table 1. Presenting visual acuity of PC-IOL patients during the period of review

Period	6/6-6/9	6/12-6/18	6/24-6/36	6/60-3/60	<3/60	Total
	No (%)	No (%)	No (%)	No (%)	No (%)	No (%)
UCVA						
At <1/52a	1(0.9)	9(8.1)	43(38.7)	39(35.1)	19(17.1)	111(100)
At <1/52b	-	2(1.9)	22(20.4)	33(30.6)	51(47.2)	109(100)
UCVA						
At2/12a	9(9.8)	31(33.7)	41(44.6)	5(5.4)	6(6.5)	92(83.6)
At2/12b	7(7.9)	29(32.6)	25(28.1)	16(18)	12(13.5)	89(81.65)
BCVA						
At 2/12a	37(54.4)	20(29.4)	7(10.3)	2(2.9)	2(2.9)	68(61.8)
At 2/12b	26(53.2)	18(36.8)	4(8.0)	1(2.0)	-	49(44.95)

Key: a without biometry; b with biometry
UCVA=uncorrected visual acuity; BCVA=best corrected visual acuity

Table 2. Comparison to WHO guidelines at 2 months

Postoperative acuity	Best Corrected recommended	Without biometry	With biometry
Good 6/6-6/18	90%+	83.8	90
Borderline <6/18-6/60	5%-	13.2	10
Poor <3/60	5%-	2.9	0

P value 0.16

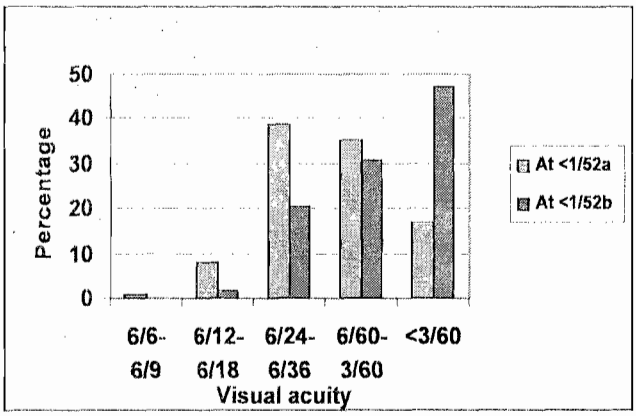

Figure 2. Visual outcome at discharge
P Value < 0.05

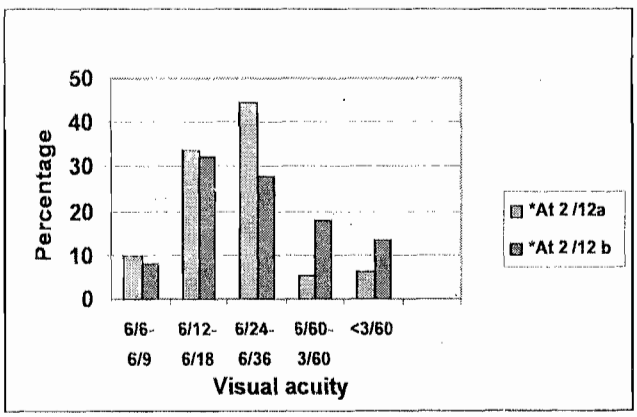

Figure 3. Visual outcome at two months without refraction
P Value < 0.05

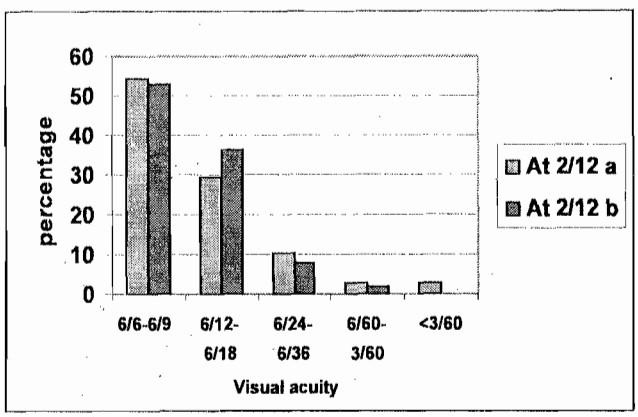

Figure 4. Visual outcome at two month with refraction
P Value 0.68

In series 2, 88% (96 out of 109 eyes) required lenses in the range of 17D to 22D, while the remaining 12% (13 out of 109 eyes) required IOL power either more than 22D or less than 17D. Although 73 eyes (76%) of the group needing 17D-22D had the required lens inserted, none in the group of <17D or >22D had the required lens inserted. Where calculated IOL power was not available, the lens closest to the calculated value was used.

DISCUSSION

The need for precision in IOL power calculation is already well established. Newer methods of assessment such as IOL master optical biometry as against A scan applanation biometry and the associated benefits are documented.[5, 10, 11] In most developing nations, however, particularly in Nigeria, A scan biometry is not widely available. Besides the cost of procurement, incessant power outage, poor maintenance culture and non availability of replacement parts are expected problems.

The finding of statistically significant better uncorrected visual acuity (UCVA) at discharge, and at two months in the group without biometry was however unexpected. Both groups had about the same vision in best corrected visual acuity (BCVA) at two months and the biometry group only had a better outcome when compared with the WHO guideline at two months with best corrected vision, although the difference was not statistically significant. These suggest that something was grossly wrong. A major contributing factor to this finding is that only 67.8 % of the patients in series 2 had the actual calculated IOL inserted due to the non availability of IOL power less than 17D and those greater than 22D. Even out of the patients requiring lens power between 17D and 22D, 11.9 % did not have the required lens power inserted due to non availability at the time. The other factor was the accuracy of the chosen IOL. This was poor as shown in the visual outcome of the patients who had the actual calculated IOL power inserted but who had post-operative refractive surprises. Only 56% of the patients who had calculated IOL power inserted were within 1D of predicted refractive error whereas Connor[11] reported 77.5% and Eleftheriadis[5] reported 93% within 1D using the applanation technique. There were also gross interpersonal differences in randomly selected patients who had biometry done by different residents. This is of great concern because the more refractive surprises there are the more difficult it may be to convince patients to undergo IOL surgery, particularly if this is added to the problem of posterior capsular opacity, which presently poses a challenge due to non availability of YAG laser.

There should be local production of IOL so that the various ranges of required power can be readily

available and at affordable cost. Alternatively central procurement by user units will enable IOL power in the extreme range to be available. There is a need for training of technicians for biometry. Also the accuracy of IOL power should be evaluated periodically. In a study carried out by Alhassan et al. at the National Eye Centre,[1] it was observed that when different doctors perform A scan biometry and keratometry, errors may occur, particularly if there is no monitoring of the accuracy of each surgeon's measurement. Also, erratic electricity supply often prevents some patients from having biometry and so the issue of power generation during ophthalmic surgery should be improved.

An agreement should be made with the manufacturing companies or suppliers on equipment maintenance and training of end users before procurement. This will ensure maximum benefit from the use of the equipment. There should be facilities for ocular B scan to check for extraneous axial length. It is advocated that axial length of <21 or > 24mm should be checked, as the most important step for an accurate calculation of IOL power is the preoperative measurement of ocular axial length.[12] Error in axial length measurement by 1mm has been shown to give post-surgery error as high as 3D.[13] This study, however, shows that in developing countries, the acquisition of these equipment does not guaranty maximum benefit unless there is proper training in their use. In addition, a wider range of IOL power should be made available at the time the patients need them. Meanwhile IOL surgery can be done with success by careful choice of IOL power where facility for biometry is not available. Where biometry is subsequently possible, there is the need for continuous monitoring to ensure good visual result of cataract surgery for patients.

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