

Profile of Patients Presenting for Cataract Surgery in a Public Hospital: A 15 Year Perspective

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ABSTRACT: **Background:** In recent decades cataract surgery has shifted slowly from public hospitals to ambulatory surgery centers, demonstrating changes in the profile of patients presenting to public hospitals for cataract surgery. These changes may potentially affect the complexity of surgeries, their volume, resident training, and perhaps also visual outcomes and patient satisfaction.

Objectives: To assess the changes in the medical and demographic characteristics of patients undergoing cataract surgery in a public hospital over a period of 15 years.

Methods: We retrospectively reviewed the records of patients undergoing preoperative assessment before cataract surgery. Records for the period October 2000 to January 2001 (100 patients), October 2006 to January 2007 (100 patients), and October 2013 to January 2014 (150 patients) were assessed for demographic, systemic and ocular related parameters.

Results: There was a significant increase in the average age of patients (70.4, 72.4, 73.9 years, $P = 0.026$), with a significant increase in the percentage of patients of Arab ethnicity (17%, 11%, 28.7%, $P = 0.002$), and concomitant systemic co-morbidities (38%, 46%, 64.7%, $P < 0.0001$). There was an increase in the percentage of patients with narrow palpebral fissures (0%, 2%, 8%, $P = 0.003$), deep-set eyes (2%, 4%, 18%, $P < 0.0001$), dense nuclear sclerotic cataract (38%, 34.4%, 56.9%, $P = 0.001$), and a significant increase in the percentage of patients taking alpha-blocking medications (0%, 8%, 10.7 %, $P = 0.004$).

Conclusions: Patients presenting for cataract surgery in 2013 compared to those in earlier periods are older, sicker and have more ocular conditions potentially affecting cataract surgery outcomes, patient satisfaction and residents' training.

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KEY WORDS: cataract surgery, ambulatory surgery centers, single eye, deep-set eyes, alpha-blockers

Cataract extraction and intraocular lens implantation is the most commonly performed procedure in ophthalmology and is estimated to be the most common single surgical procedure performed in the developed world [1]. In the past the great majority of cataract surgeries in Israel were performed in public hospitals, but recent decades have seen a slow but steady shift to ambulatory surgery centers. While in the 1990s the majority of cataract surgeries were performed in public hospitals [2], 2006 marked a significant point along the described trend when the percentage of patients undergoing cataract surgery in ambulatory surgery centers equaled those undergoing the procedure in public hospitals (49.5% and 50.5% respectively). 2013 signifies a reversal in numbers, when out of a total of 55,398 such surgeries performed in Israel, 52.6% were carried out in ambulatory surgery centers, as compared to 47.4% in public hospitals [Dr. G. Kleinman, unpublished data].

The reasons for these changes are manifold. First, in recent years excellent surgical facilities were built outside public hospitals, sometimes even surpassing the latter in terms of surgical equipment and technology. Second, there is an increase in the number of patients with private or complementary health insurance policies who wish to select the time and place of their surgery as well as their surgeon. A third reason may be the plethora of information, online or otherwise, commercial or not, available to patients in need of cataract surgery.

With the increase in volume of cataract surgeries being performed in ambulatory surgery centers, the profile of patients presenting to public hospitals for such surgery is changing. These changes may potentially affect the complexity of surgeries, their volume, resident training, and perhaps also visual outcomes and patient satisfaction. In light of the described trend and its importance, we conducted this retrospective study to determine if the shift of cataract surgery to ambulatory surgery centers has an effect on the profile of patients presenting for surgery in public hospitals.

PATIENTS AND METHODS

This retrospective study reviewed the records of patients presenting for preoperative assessment before cataract surgery

*The first two authors contributed equally to this study

during the period 2000–2014. Random records of consecutive patients from October 2000 to January 2001 (100 patients), October 2006 to January 2007 (100 patients), and October 2013 to January 2014 (150 patients) were studied for demographic, systemic and ocular related parameters. We chose our sample size based on the assumption that there would be at least a 1.5-fold increase in the percentage of patients presenting with significant systemic co-morbidities over these time periods. To examine the basic ratio of significant systemic co-morbidities in the first period, we examined a pilot sample size of patients from the first period and found this ratio to be 40%; according to this we were expecting a ratio of at least 60% in the last period.

Patients whose preoperative assessment form was incomplete or missing were excluded. This research adhered to the tenets of the Declaration of Helsinki, and approval from the Institutional Ethics Committee was obtained.

Patients' systemic condition and medications were evaluated, and ischemic heart disease, chronic obstructive pulmonary disease (COPD) and diabetes mellitus were chosen as markers of systemic co-morbidity. We assessed the presence of coexisting ocular co-morbidities, namely glaucoma, uveitis, age-related macular degeneration (AMD), diabetic retinopathy (DR), artery occlusion, vein occlusion, strabismus, corneal disease, and neuro-ophthalmic diseases. We also assessed whether a particular ocular condition may potentially affect postoperative visual acuity. Separately, we evaluated the presence of factors potentially making cataract surgery more difficult.

Corneal cylinder and axial length were measured using the ZEISS IOLMaster® 500 (Carl Zeiss Meditec AG, Germany).

Patients were categorized as having a "single eye" when the visual acuity of the eye not operated on was 6/60 or worse for reasons unrelated to cataract or a correctable refractive error.

STATISTICAL ANALYSIS

Data are presented as a percentage for nominal variables and as mean and standard deviation for continuous parameters. In the univariate analysis chi-square test was used for quantitative variables and one-way ANOVA for continuous data. Bonferroni multiple comparison followed those tests. Parameters that differed between the first two periods and the third were entered to logistic regression. Results were considered statistically different when P was < 0.05 . All analyses were done with IBM-SPSS 22 software.

RESULTS

We analyzed 350 patients who presented to the preoperative clinic before cataract surgery: 100 during 2000–2001, 100 in 2006–2007, and 150 in 2013–2014. Data include demographic, systemic and ocular related parameters [Tables 1 and 2].

The patients presenting for cataract surgery in the later period were older (70.4 ± 11.5 , 72.4 ± 10 and 73.9 ± 9 years, $P = 0.026$), sicker, and had more ocular factors potentially affecting the complexity of surgery.

Patients' age increased significantly over the three time periods. The percentage of patients under the age of 60 was significantly smaller in the later period compared to patients in the same age group in the earlier period (4% and 15%, respectively). There was no difference in gender distribution over the years.

The ethnicity distribution of patients changed significantly in the third period compared to the two previous periods (Arab ethnicity 17%, 11%, 28.7%, $P = 0.002$).

Patients were more likely to suffer from systemic co-morbidities in the later period [Figure 1]. The percentage of patients with one or more systemic co-morbidities increased significantly between the early and late periods (38%, 46%, 64.7%, $P < 0.0001$). Specifically, the rate of diabetes mellitus increased significantly (22%, 32%, 45%, $P = 0.002$). Regarding ischemic heart disease and COPD, an insignificant increasing trend was noted (17%, 23%, 25%, $P = 0.344$, and 5%, 3%, 8%, $P = 0.233$, respectively). An increase in the records of alpha-blocker usage was also seen (0%, 8%, 10.7%, $P = 0.004$).

We found that patients in the later periods had more ocular parameters considered to be potential complicating factors in cataract surgery. We found an increase in the percentage of patients who presented for surgery in their only eye with visual potential (2%, 5%, 14.7%, $P = 0.001$). There was an increase (although not statistically different) in patients with brunescent cataracts (8%, 11%, 17.3%, $P = 0.078$), and a significant increase in the percentage of patients with narrow palpebral fissures (0%, 2%, 8%, $P = 0.003$) and deep-set eyes (2%, 4%, 18%, $P <$

Table 1. Demographic and systemic parameters by period

	2000–2001 (=1)	2006–2007 (=2)	2013–2014 (=3)	P value	Difference between periods
N=100	N=100	N=150			
Gender M/F (%)	36/64	50/50	50/50	0.06	
Age (mean ± SD)	70.4 ± 11.5	72.4 ± 10	73.9 ± 9	0.026	1≠3
Ethnicity Jews/Arabs	83/17	89/11	71.3/28.7	0.002	1≠3 & 2≠3
Co-morbidities (%)					
Diabetes mellitus	23	32	45	0.002	1≠3 & 2≠3
COPD	5	3	8	0.233	
Hematologic disorders	0	1	6	0.06	
Ischemic heart disease	17	23	24.7	0.344	
Medications (%)					
Alpha-blockers	0	8	10.7	0.004	1≠2 & 1≠3
Corticosteroids	2	4	1.3	0.374	
Anti-platelets	6	42	16	< 0.0001	1≠2 & 1≠3 & 2≠3
Coumadin	4	3	2.7	0.835	

≠ denotes a statistically significant difference between the stated periods: Period 1 = 2000–2001, Period 2 = 2006–2007, Period 3 = 2013–2014

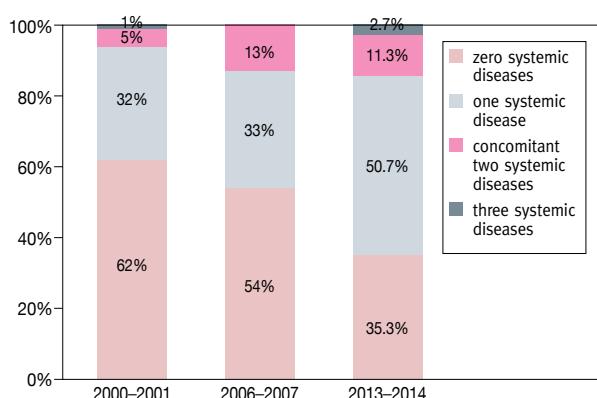
COPD = chronic obstructive pulmonary disease

Table 2. Ocular parameters by period

	2000–2001	2006–2007	2013–2014	Pvalue	Difference between periods
Concomitant ocular diseases					
Glaucoma	13%	27%	14%	0.011	2≠1 & 2≠3
Age-related macular degeneration	21%	18%	29%	0.052	2≠3
Macular pathology	27%	30%	33%	0.634	
Ocular conditions other than cataract potentially affecting visual acuity	21%	32%	22%	0.122	
History of previous eye surgeries	6%	10%	9%	0.545	
Pseudophakia in fellow eye	46%	57%	42%	0.078	
Visual acuity: logMAR (mean ± SD)	0.62 ± 0.36	0.45 ± 0.29	0.54 ± 0.29	0.002	1≠2
Intraocular pressure (mean ± SD)	14.9 ± 3.6	16.2 ± 4.4	15.3 ± 3	0.082	
Corneal cylinder (D) (IOLMaster) (mean ± SD)	1.5 ± 0.8	1.2 ± 0.8	1.4 ± 1	0.176	
Ocular characteristics potentially making surgery more difficult					
Single eye	2%	5%	15%	0.001	1≠3
Pupil size (mean ± SD)	6.49 ± 0.9	6.66 ± 0.9	6.78 ± 0.5	0.014	1≠3
Axial length (< 22 mm or > 26 mm)	31.3%	10.2%	20.8%	0.001	1≠2 & 1≠3 & 2≠3
Narrow palpebral fissure	0%	2%	8%	0.003	1≠3 & 2≠3
Deep-set eyes	2%	4%	18%	< 0.0001	1≠3 & 2≠3
Brunescence cataract	8%	11%	17%	0.078	
Mature cataract	12%	8%	5%	0.163	
Pseudoexfoliation	14%	13%	10%	0.71	
Corneal opacities	10%	7%	11%	0.523	
Shallow anterior chamber	8%	10%	5%	0.269	
Use of alpha-blockers	0%	8%	10.7%	0.004	1≠2
Poor cooperation	2%	4%	6.7%	0.212	
Grade 3-4 NSC	38%	34%	57%	0.001	2≠3
Grade 3-4 PSC	47%	42%	21%	< 0.0001	2≠3
Grade 3-4 CC	5%	14%	10%	0.377	

Period 1 = 2000–2001, Period 2 = 2006–2007, Period 3 = 2013–2014

NSC = nuclear sclerotic cataract, PSC = posterior subcapsular cataract, CC = cortical cataract

Figure 1. Number of systemic diseases per patient by period

As can be seen, over the years there is an increase in the percentage of patients presenting with one or more systemic diseases while the percentage of patients presenting with no systemic diseases at all decreased ($P < 0.001$)

0.0001). There was no difference in the percentage of patients with small pupils, corneal opacities, shallow anterior chambers, or pseudoexfoliation. There was a borderline significant increase in axial length (23.29 mm, 23.36 mm, 23.38 mm, $P = 0.052$) and an insignificant change in corneal cylinder (1.5 D, 1.2 D, 1.4 D, $P = 0.176$). As compared to grade 1-2 cataracts, we found an increase in the percentage of patients with grade 3-4 nuclear sclerotic cataracts (NSC) (38%, 34.4%, 56.9%, $P = 0.001$), a decrease in the percentage of patients with grade 3-4 posterior subcapsular cataracts (PSC) (47.4%, 42.2%, 21.2%, $P < 0.0001$), and no significant change in grade 3-4 cortical cataracts (CC). Around 30% of patients in all periods, with no significant differences, suffered from macular pathology potentially affecting final visual outcome. There was a significant difference in the prevalence of glaucoma (13%, 27%, 14%, $P = 0.011$) and AMD (21%, 18%, 29%, $P = 0.052$). Interestingly, there was an improvement in preoperative visual acuity (LogMAR 0.62, 0.45, 0.5, $P = 0.002$).

Table 3. Logistic regression after adjusting for age and ethnicity: Periods 1+2 vs. Period 3

Parameter	Sig.	OR	95%CI for OR	
			Lower	Upper
Ethnicity (increase in Arab population)	0.006	4.274	1.506	12.128
Age	0.008	1.082	1.021	1.147
Total no. of ocular illnesses	0.030	3.536	1.132	11.044
Anti-platelets	0.005	0.134	0.033	0.544
Single eye	0.033	7.002	1.168	41.968
Deep-set eyes	0.021	10.039	1.420	70.969

The table shows only statistically significant parameters
OR = odds ratio, 95%CI = 95% confidence interval

All variables found to be significantly different between the first and second periods to the third period (after adjusting for age and ethnicity) were entered to the logistic regression. There was a significant increase in the total number of ocular illnesses per patient: $P = 0.03$, odds ratio (OR) 3.53, 95% confidence interval (95%CI) 1.1–11. There were significantly more patients who presented for cataract surgery in their only eye ($P = 0.03$, OR 7.00, 95%CI 1.2–42), and there were significantly more patients with deep-set eyes ($P = 0.021$, OR 10.03, 95%CI 1.4–71). Table 3 shows the results of the multivariable logistic regression model for the variables found to be significantly different between the periods, after the adjustment for confounding factors.

Cases for residents are chosen out of the preoperative clinic by their level of complexity. The cases chosen are those with little or no factors potentially complicating surgery. We defined these “resident cases” as those exhibiting all the following: pupil size > 7 , eyes that are not deep-set, no pseudoexfoliation, no use of alpha-blockers, no cooperation issues, cataract not brunescence or mature, and the eye to be operated on is not the only eye with visual potential. In 2000 and 2006 combined, the percentage of “resident cases” out of the total number of patients was 56.5%, while in 2014 it was 39.3% ($P < 0.0001$).

DISCUSSION

Patients presenting for cataract surgery in 2014, as compared to those who presented in 2000 and 2006, were generally older, sicker, and had more ocular conditions potentially affecting cataract surgery outcomes. Patients’ age increased significantly over the three time periods. According to national demographic data, the life expectancy in Israel for men and women was 77.4 and 81.6 years in 2000, 78.3 and 82.2 in 2006, and 80.3 and 83.9 in 2014. Therefore, the increase in patients’ age might be a reflection of the overall increase in life expectancy. It has been reported that due to improvement in surgical technique and refractive predictability cataracts are being removed at earlier stages of their

development [3]. According to our study, this latter trend has not reached the public system in Israel, and – if it does exist – it probably occurs in the ambulatory surgery centers.

We chose diabetes, ischemic heart disease and COPD as markers of systemic co-morbidity for two reasons. The first is that the presence of one or more of these relatively common diseases is a general, albeit non-specific, indicator of general health. The second is the effect of these diseases on the course of cataract surgery, both intraoperatively and postoperatively. Patients with COPD often find it difficult to lie supine for the duration of surgery and have more compliance issues (coughing, etc.). Patients with diabetes often suffer from concomitant retinal pathologies potentially affecting visual outcome, are more likely to develop postoperative macular edema and, as a result, recover more slowly after surgery. Thus, the finding of an increase in systemic co-morbidities over the years may have an effect on the surgeries themselves, on the visual outcome, and on the burden of follow-up in the clinic.

The ethnicity of patients presenting for surgery changed significantly over the years, with the percentage of the Arab patients increasing significantly in the later period. These changes may be due to differences in health insurance distribution between the two populations. In 2010, 32% of the Jewish population had private health insurance, compared with 4% of the Arab population. In addition, 83% of the Jewish population had health maintenance organization (HMO) supplemental medical insurance as compared to 44% of the Arab population [4]. When the results were stratified according to ethnicity, the Jewish population exhibited significant increases in the following: diabetes and ischemic heart disease, use of alpha-blockers, general medication use, narrow palpebral fissure, and only eye with visual potential. According to the Israeli National Council for Diabetes (2013 report), rates of type 2 diabetes in the Arab population are almost twice those in the Jewish population (12% vs. 6.2%). Therefore, while there was an increase in the percentage of Arab patients undergoing cataract surgery, and though the rate of diabetes is higher in the Arab population, it was the Jewish patients who were sicker and presented with more complex cases, further asserting the connection between private health insurance and public hospital-based cataract surgery. Complementary and private insurances, widespread in the Jewish population, likely shifts this demographic out of public hospitals and into the ambulatory surgical centers. The increase in the Arab population may be related to increased cultural and social awareness regarding the option for improving the quality of life of patients with cataract, and the ability to choose the surgeon.

The link between alpha-blocking medication, used to treat benign prostate hypertrophy and hypertension for nearly 40 years [6], and the intraoperative floppy iris syndrome (IFIS) was first described in 2005 [5] and has since been widely accepted as a factor potentially complicating cataract surgery.

In our study, none of the patients in 2000 were reported to take alpha-blockers, while 8% in 2006 and 11% in 2014 were using this class of drugs. Although medication lists were reviewed regardless of the IFIS entity, the fact that this condition was unknown in 2000 possibly led to under-reporting in patients' charts.

After adjusting for the confounding effects of age and ethnicity, we found a significant increase between the first two periods and the third in the total number of ocular illnesses per patient, in the proportion of patients presenting with deep-set eyes, and in the proportion of patients who presented for surgery in their only eye. This emphasizes the fact that even when patients were not older, and regardless of their ethnicity, their eyes still presented a significantly greater surgical challenge.

Variables that were significantly different in the univariate analysis but not in the logistic regression analysis were probably related to the increase in the age of patients (AMD, use of alpha-blockers, and pupil size, grade 3-4 NS and PSC cataracts) and the demographic change related to the increase in the proportion of Arab patients (diabetes mellitus).

Cataract surgeries performed in public hospitals are the main facilitators of resident training, and changes in the profile of patients presenting for surgery may adversely affect this important role of ophthalmology departments in public hospitals. While in the earlier periods 'resident cases' comprised the majority of cases who presented for surgery (56.5%), in the later period they were significantly less, 39.3%. Though this trend means fewer easy cases for beginning residents, it may also mean earlier resident exposure to difficult cases, which may in the long run have a positive effect on surgical training. In any case, if this trend continues, and an even larger percentage of cases will be complex, the potential for a significant effect on resident training should be considered.

This study has several limitations. The first is its retrospective nature. The second is the relatively small number of records

from each time period. A third is that the data represent a single medical center, and a somewhat unique one in terms of the ethnicity of its patients. Because of its location in the close vicinity of both Jewish and Arab areas, the study cohort represents the combination of these two patient populations, making our conclusions not necessarily applicable to other hospitals. Also, data of the earlier time periods (2000–2001 and 2006–2007) were collected from handwritten forms, as compared to computerized data collection in the later period (2013–2014). It is possible that the computerized forms, owing to a more binding and standardized layout, contained more comprehensive data. Moreover, all preoperative forms were filled by residents differing in experience and training.

In conclusion, with the increase in the volume of cataract surgery being performed in ambulatory surgical centers, the profile of patients presenting to public hospitals for these surgeries is changing. Patients presenting for cataract surgery in 2014 compared to those in earlier periods are older, sicker, and have more ocular conditions potentially complicating surgery. All the above may affect the volume of surgeries, visual outcomes, patient satisfaction and resident training.

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"The real index of civilization is when people are kinder than they need to be"

Louis de Bernieres (born 1954), British novelist most famous for his fourth novel, *Captain Corelli's Mandolin*