

Time Trends in Indication for Cataract Surgery

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Abstract

Background: Due to the increasing proportion of elderly citizens the need for cataract surgery is expected to increase markedly within the next two decades but also the indication level for cataract surgery will influence the need for surgery. The aim of the present study was to examine if the indication for cataract surgery has remained stable over an eight year period in a university clinic setting in the Capitol Region of Copenhagen, Denmark.

Methods: All pre-operative visits from 2002 to 2010 were evaluated yielding a total of 14,701 eyes (9,474 first eye surgeries and 5,227 second eye surgeries). Information was drawn from a database where pre-, peri- and post-operative data regarding all cataract surgeries (except for congenital and childhood cataract) performed at the clinic had been entered at the time of examination/surgery. Evaluation of the indication level for cataract surgery was assessed primarily based on visual acuity.

Results: In the 8 year period, mean visual acuity increased significantly from 0.18 to 0.24 Snellen (corresponding to 0.74 to 0.62 logMAR) in the eyes that underwent surgery first and in second eyes from 0.29 to 0.41 Snellen (corresponding to 0.54 to 0.39 LogMAR, respectively, p-values <0.0001) and concomitantly the mean age of patients at the time of surgery decreased from 75.4 to 71.6 years in females and 72.1 to 69.1 years in males.

Conclusion: During the time period from 2002 to 2010 the indication for cataract surgery changed towards patients being operated at better visual acuities and at younger ages. In the same time period, there was an increase in life expectancy by 2 years. Expectedly, the need for surgery will increase dramatically not only because of an increased proportion of elderly citizens but also because of a tendency towards surgery earlier in the disease process.

Keywords: Cataract; Epidemiology; Indication; Surgery

Introduction

Cataract is a significant health care problem in all parts of the world. Untreated, cataract may develop into a blinding condition and in spite of an effective treatment it remains the most prevalent cause of blindness globally [1]. Cataract is predominantly a disease associated with old age and due to the demographic changes in the Western World the need for cataract surgery is expected to double within the next 20 years [2]. This demand can be hard to meet only by increasing the number of cataract surgeons since an ageing population also will have other eye diseases, such as glaucoma and age-related macular degeneration, that will need the attention of ophthalmologists [3].

One approach to reduce the future need for cataract surgery could be by changing the criteria for surgery towards more advanced cataract at the time of surgery or by setting national criteria for surgery as has been done in Finland [3]. Assuming that life expectancies are unchanged, the need for surgery can be reduced by 1/3 if the time of surgery is postponed by 5 years [2]. The aim of the present study was to examine the time trends for cataract surgery indications in a university clinic setting in the Capitol Region of Denmark.

Methods

Since the year 2002 all patients undergoing cataract surgery at the University Eye Clinic at Glostrup Hospital have been entered into a database, KatBase, containing information about the pre-, peri-, and post-operative data such as age and sex of patients, general health, preoperative visual acuity and biometric data, ocular co-morbidity, operational procedure, post-operative visual acuity and complications. The database was developed after an initiative by the Danish National Board of Health and funded by the Ministry of Health. In the years from 2002 to 2004 the database was nation-wide but funding stopped in 2004 [4] and since then the database was continued locally.

For the present evaluation all pre-operative visits for surgeries

performed from 2002 to 2010 (excluding congenital and childhood cataracts) were drawn from the database yielding a total of 14,701 eyes (9,474 first eye surgeries and 5,227 second eye surgeries). To avoid problems with inter-eye interaction, the analyses were separated into first eye surgeries and second eye surgeries. However, only second eyes that were operated on within one year of the first eye were included in the second eye analyses (n=4,677). Thus, 550 eyes that were operated more than 1 year later than the first eye were excluded from the study.

At the pre-operative visit all patients had a full ophthalmic examination including determination of best corrected visual acuity and a thorough slitlamp examination after pharmaceutical pupil dilation as well as biometric measurements including determination of axial length and radii of curvatures. Furthermore, patients were interviewed about cataract related symptoms as well as general health status. Any ocular co-morbidities were evaluated. For the statistical analyses, patients were grouped into those with ocular co-morbidities thought to be of significance for the visual acuity (e.g. age-related macular degeneration, glaucoma, previous retinal detachment, or previous vitreoretinal surgery) and those who did not have visually significant ocular co-morbidity (e.g. no other eye disease except cataract or visually insignificant eye disease such as blepharitis).

Statistical analyses were performed using the SAS computer

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Received May 24, 2011; Accepted July 19, 2011; Published July 23, 2011

Citation: Kessel L, Haargaard B, Boberg-Ans G, Henning V (2011) Time Trends in Indication for Cataract Surgery. J Clin Exp Ophthalmol 2:174. doi:10.4172/2155-9570.1000174

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software (version 9.1, SAS Institute Inc., Cary, NC, USA). Visual acuity was measured in Snellen fraction but transformed to logMAR units for the statistical analyses to avoid statistical problems [5]. Since Snellen fraction is more widely used clinically, the results were backtransformed from the LogMAR to Snellen fraction. The LogMAR results are given in parentheses. Our cataract population was compared to the general Danish population by obtaining information on life expectancy, number of males and females and age distribution in the general population from the homepage of the Danish Statistical Bureau (Statistics Denmark/StatBank Denmark, homepage <http://www.statistikbanken.dk>, entered on March 22nd, 2011).

Results

During the time period from 2002 to 2010 best corrected visual acuity at the pre-operative visit increased significantly both in the first and second eyes ($p < 0.0001$) (Table 1 and Figures 1-3) and concomitantly, the age of patients decreased significantly both for first and second eye surgeries ($p < 0.0001$), (Table 1 and Figure 4). Not surprisingly, visual acuity was better in second eyes than in first eyes on average Snellen fractions 0.38 and 0.23 (corresponding to logMAR (mean (SD)) 0.42 (0.30) versus 0.64 (0.42), $p < 0.0001$ for all years).

The probability of having a visual acuity of 0.55 Snellen fraction or better (equivalent to 0.26 logMAR) increased significantly over the years both for first eyes (OR 1.16 per year (95% CI 1.12-1.20) and 1.21 (95% CI 1.21-1.32) for eyes without and with other eye disease, respectively, $p < 0.0001$) and for second eyes (OR 1.18 per year (95% CI 1.14-1.23) and 1.24 (95% CI 1.19-1.29) for eyes without and with other eye disease, respectively, $p < 0.0001$). There was a decrease in the number of eyes with visual acuity ≤ 0.05 among first eyes with no other eye disease (OR 0.96 per year (95% CI 0.92-1.00), $p = 0.032$) but not for first eyes with other eye disease or for second eyes with or without other eye disease (all p -values > 0.08) (Figures 2 and 3). For first eye surgeries,

the odds ratio of having better visual acuity at the time of surgery was positively related to being operated in a later year, at a younger age, having no other eye disease but having a systemic disease. In contrast, the odds ratio of having visual acuity ≤ 0.05 was positively related to being operated in an earlier year, being male, having other ocular disease and being between the ages of 70 to 79 years (Table 2), only the result from first eye surgeries is shown, similar results were obtained for second eyes.

For age groups 59 years or younger the proportion of males in the cataract population was comparable to the background Danish population (48.5 versus 50.7%, χ^2 0.08) but in all other age groups males were underrepresented in the cataract population compared to the Danish population (age group 60-69: 40.6 versus 49.1% $\chi^2 < 0.001$, age group 70-79: 34.3 versus 44.9% $\chi^2 < 0.001$, age group ≥ 80 : 32.5 versus 34.2% $\chi^2 = 0.02$). The proportion of males increased significantly throughout the study period (OR 1.04 per year (95% CI 1.02-1.06) for first eyes and OR 1.04 (95% CI 1.02-1.07) for second eyes, p values ≤ 0.001) (Table 1) but the increase was comparable to the increase of males in the relevant age groups in the general population. In first eyes, females had on average slightly better visual acuity than males in first eyes (Snellen fractions of 0.23 and 0.22 corresponding to logMAR (mean (SD)) 0.63 (0.41) versus 0.65 (0.44), $p = 0.04$) but not in second eyes ($p = 0.4$) and also not when looking at individual years ($p > 0.05$). For first eye surgeries, females were significantly older at the time of surgery than males (75.4 (10.3) versus 72.1 (11.2), mean (SD), in 2002 ($p < 0.0001$)) but the age gap decreased with time to 71.6 (11.3) versus 69.1 (13.0) in 2010 ($p = 0.0006$). There was no change in the proportion of eyes with other eye disease over the years neither for first nor second eyes ($p = 0.4$).

Discussion

We examined the time trends in indication for cataract surgery

	2002	2003	2004	2005	2006	2007	2008	2009	2010
<i>All surgeries</i>									
Number	945	1,811	1,938	1,755	1,749	1,610	1,444	1,759	1,140
<i>First eyes</i>									
Number	787	1,198	1,296	1,216	1,147	1,037	901	1,108	784
Age (yr)	74.3 (10.8)	74.2 (10.9)	73.5 (11.5)	72.7 (11.2)	71.9 (11.1)	71.4 (12.1)	73.0 (11.5)	72.0 (11.1)	70.5 (12.1)
Males (%)	35.3	36.0	35.6	35.1	39.3	38.4	38.4	40.6	43.1
Eye disease (%)	51.2	56.3	57.3	47.9	48.7	55.2	63.0	57.5	48.0
Snellen VA	0.18	0.18	0.19	0.28	0.27	0.24	0.23	0.25	0.24
<i>Second eyes</i>									
Number	158	613	642	539	602	573	543	651	356
Age (yr)	74.9 (9.3)	76.1 (9.6)	75.4 (10.2)	74.5 (10.6)	74.6 (9.5)	74.0 (10.1)	75.1 (9.8)	73.8 (9.5)	72.9 (10.7)
Males (%)	29.8	31.3	31.3	29.1	35.2	36.3	34.6	38.1	34.3
Eye disease (%)	54.4	57.9	56.5	46.4	46.7	52.2	59.3	54.5	50.0
Snellen VA	0.29	0.30	0.32	0.42	0.48	0.43	0.38	0.43	0.41

Snellen visual acuity is reported as the geometric mean after backtransformation from LogMAR notation as explained in the Methods section.

Table 1: Demographic data.

Variable	Visual acuity ≥ 0.55 Odds ratio (95% CI)	p-value	Visual acuity ≤ 0.05 Odds ratio (95% CI)	p-value
Year of operation (2002-2010)	1.20 (1.17-1.23)	< 0.0001	0.96 (0.94-0.99)	0.002
Sex (female versus male)	0.94 (0.82-1.07)	0.32	0.86 (0.76-0.97)	0.017
Eye disease (No versus Yes)	1.73 (1.53-1.97)	< 0.0001	0.67 (0.60-0.76)	< 0.0001
General disease (No versus Yes)	0.67 (0.59-0.76)	< 0.0001	1.12 (0.99-1.28)	0.077
Age (≥ 80 years)	1		1	
≤ 59	2.01 (1.60-2.51)	0.022	0.94 (0.79-1.11)	0.176
60-69	2.15 (1.77-2.60)	< 0.0001	0.65 (0.56-0.76)	< 0.0001
70-79	1.99 (1.67-2.38)	0.002	1.73 (1.45-2.07)	< 0.0001

Table 2: The probability of having visual acuity of better than 0.55 or worse than 0.05 for first eye surgeries.

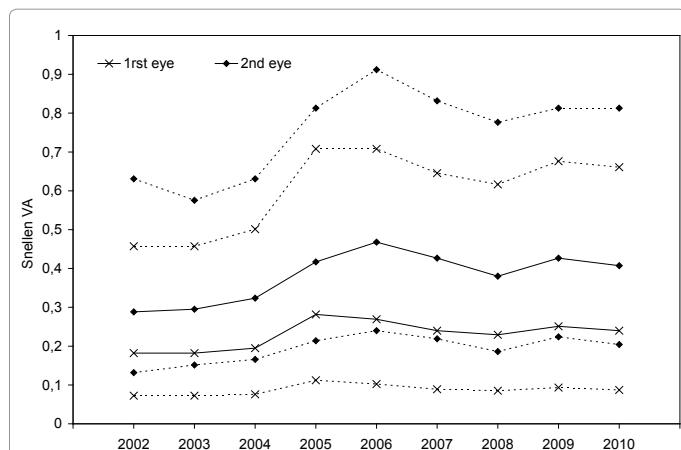


Figure 1: Snellen visual acuities for first eyes (x) and second eye (♦) surgeries from 2002 to 2010. Visual acuities are shown as the mean value (fully drawn lines) and \pm SD (shown as hatched lines). The statistical analyses were performed on LogMAR visual acuities and backtransformed to Snellen notation shown as fully drawn.

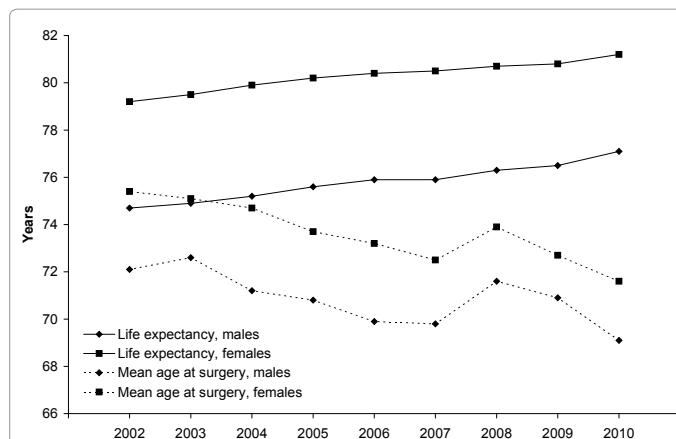


Figure 4: Trends in age at time of cataract surgery (first eye surgeries only) for males and females in comparison with national trends in life expectancy. Information on life expectancy was drawn from the Statistics Denmark/ StatBank Denmark (<http://www.statistikbanken.dk>, entered on March 22nd 2011).

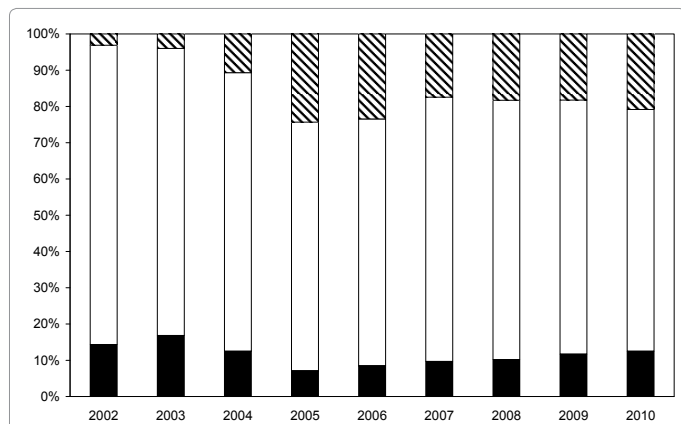


Figure 2: The distribution of visual acuities (best corrected VA) for first eye surgeries on eyes with no other eye disease. Black: $VA \leq 0.05$ (Snellen fraction, equivalent to 1.30 logMAR), white: $0.06 < VA \leq 0.50$ (Snellen fraction, equivalent to $0.30 \leq \log MAR < 1.31$), hatched: $VA \geq 0.55$ (Snellen fraction, equivalent to 0.26 logMAR).

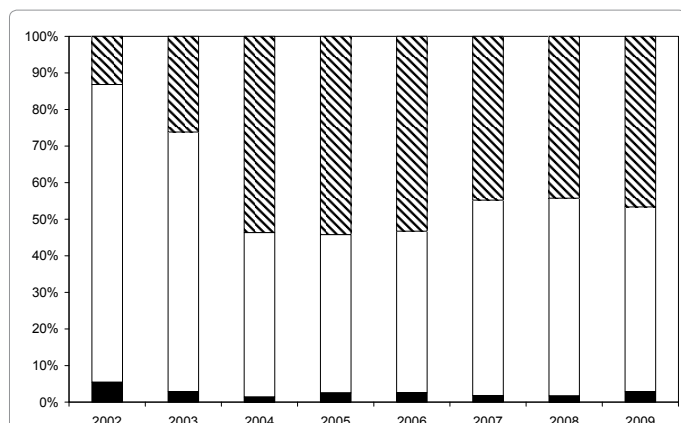


Figure 3: The distribution of visual acuities among second eye surgeries for eyes with no other eye disease. Black: $VA \leq 0.05$ (Snellen fraction, equivalent to 1.30 logMAR), white: $0.06 < VA \leq 0.50$ (Snellen fraction, equivalent to $0.30 \leq \log MAR < 1.31$), hatched: $VA \geq 0.55$ (Snellen fraction, equivalent to 0.26 logMAR).

based on visual acuities during the time period from 2002 to 2010. Over the years patients were operated with better visual acuities and at younger ages indicating that the patients were operated at an earlier stage in the disease process. The study was performed in a university eye clinic and even though it is the largest eye clinic in Denmark only a fraction of all surgeries in the local area was performed in our clinic. In Denmark, the health care system is financed via taxes and use of ophthalmic service, such as surgeries, is free of charge for patients, only the eye drops used post-operatively have to be paid directly by the patient. The majority of cataract surgeries are performed outside the hospital system by private ophthalmologists who are reimbursed by the public health care system. The hospital eye clinic receives patients for cataract surgery from private ophthalmologists who do not perform cataract surgery or from surgeons if the surgery is expected to be complicated (e.g. by previous surgery, complicating conditions or a need for general anaesthesia). Hence, our cataract population is composed of a group of “standard” cataract patients and a group of more complicated patients. Therefore the trend we observed towards patients being operated at an earlier stage in the disease process is expected to be a conservative estimate of the national trend.

The proportion of eyes with visual acuities ≥ 0.55 (Snellen fraction) increased from 3.1% to 20.8% in first eye surgeries and 16.7% to 46.7% in second eye surgeries during the 8 year time period. The criteria for upholding a driver’s license in Denmark is a visual acuity ≥ 0.50 in the better eye and ≥ 0.1 in the worse eye and this used to be the unofficial criteria for being eligible for cataract surgery in the public sector. Clearly an increasing number of patients were operated with better visual acuities than required for a driver’s license over the study years. Probably, this finding reflects both improved safety and outcome of cataract surgery over the years and the post-Second World War baby booming generation who will not tolerate minor visual impairment or glare in their active lives. Another important aspect is a political decision to include cataract surgery on the list of diseases where the patient is guaranteed to receive treatment within one month of referral. If the public health care system cannot meet the demand, the patient is entitled to treatment in the private sector.

Males were underrepresented in the cataract population compared to the general Danish population but yet they were operated at a younger age. Female gender is a well-described risk factor for cataract [7-11]

though not all studies have found a difference in cataract prevalence between males and females [12,13]. The reduction in female hormones encountered during menopause may provide part of the explanation for the higher prevalence of cataract in females since hormone replacement therapy has been shown to prevent or postpone cataract development [14]. We found an increased proportion of females in age groups 60 years or older than would be expected based on the national demographic data but there was no gender difference in the age group 59 years or younger and this may support the view that the change in hormones during menopause is related to the increased risk of cataract in females. In view of female gender being a risk factor for cataract surgery it may seem surprising that females are significantly older at the time of surgery. Our observation is confirmed by the finding of others [7]. Females have a longer life expectancy than males and they are overrepresented in the older age groups which may result in an older mean age at the time of surgery for females.

We found an inverse trend between age at the time of surgery and life expectancy both for males and for females. If patients are operated at an earlier age and more patients survive into old age this is expected to increase the need for surgery. Advancing the time of surgery by 5 years will approximately increase the need for surgery by 1/3 assuming that both life expectancy and indication level for cataract surgery are unchanged [2]. Combining the effect of performing cataract surgery at an earlier stage in the disease process and increasing life expectancies with the ageing of the post-Second World War baby-boomer generation is likely to put the health care system under even greater stress. Current trends in the technical development of the surgical procedure goes towards better safety of the procedure but not reducing the cost of the procedure or the number of surgeries that one surgeon can perform per day [15]. Thus, ensuring that the need for cataract surgery can be met in the future will be a challenge for health authorities.

In conclusion, we found that the indication level for cataract surgery had changed over an eight year time period with patients being operated at better visual acuities and younger ages. If this is just a local Danish trend or if the trend is more wide-spread in the Western-World is unknown since it has not been possible to find recent, comparable references in the literature. However, the indication for cataract surgery was previously found to be similar in Denmark and the USA [16]. The trend with patients being operated at better visual acuities began when the surgical technique changed from intra- to extracapsular surgery [17] and it continued in the 1980s [18]. Since patients are operated at an earlier stage in the disease process this may help explain why the increase in number of cataract surgeries performed exceeds the increasing prevalence of elderly citizens [18,19]. An opposite trend with the mean age of patients increasing over the years was found in Sweden covering a time period from 1992 to 1999 but the mean age was calculated both from first and second eye surgeries and since more second eye surgeries were performed in the later years this could explain why they found an increasing the mean age [7]. Our data confirm that eye care services may be put under stress in the future to meet the demands for treatment [3].

Acknowledgements

The study received financial support from the Danish Medical Research Council and the Foundation of June 15.

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