Time Trends in Indication for Cataract Surgery

Line Kessel*, Birgitte Haargaard, Gøril Boberg-Ans and Vibeke Henning

Department of Ophthalmology, Glostrup Hospital, Denmark

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-morbidities, 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 blefaritis).

Statistical analyses were performed using the SAS computer.
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 1.12-1.20) 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, respectively, p<0.0001) and for second eyes (OR 1.04 per year (95% CI 1.02-1.07) for second eyes, p values ≤0.0001) (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 for second eyes.

Discussion

We examined the time trends in indication for cataract surgery

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 | 0.86 (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)                 | ≤59: 2.01 (1.60-2.51)                   | 0.022   | ≤59: 1.94 (0.79-1.11)                   | 0.176   |
|                                | 60-69: 2.15 (1.77-2.60)                 | <0.0001 | 60-69: 0.65 (0.56-0.76)                 | <0.0001 |
|                                | 70-79: 1.99 (1.67-2.38)                 | 0.002   | 70-79: 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.
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 lifes. 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.

---

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

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

**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).
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 it 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.

References

1. Resnikoff S, Pascolini D, Etya’ale D, Kocur I, Pararajasegaram R, et al. (2004) Global data on visual impairment in the year 2002. Bulletin of the World Health Organization 82: 844-851.
2. Kessel L (2010) Can we meet the future demands for cataract surgery? Acta Ophthalmol.
3. Tuulonen A, Salminen H, Linna M, Perkola M (2009) The need and total cost of cataract surgery. Acta Ophthalmol 86: 648-654.
4. Olen T, Roydon L, Hennings V, Lundberg L, Ring K, et al. (2004) Kat-Base. Danske Kvalitetstidsskrift for katarakt (grå stær) - kirurgi. Annual Report 2004. 1-26.
5. Holladay JT (2004) Visual acuity measurements. J. Cataract Refract. Surg 30: 287-290. PM:15030802
6. Holladay JT, Prager TC (1991) Mean visual acuity. Am J Ophthalmol 111: 372-374.
7. Lundstrom M, Stenew U, Thorburn W (2001) Age-related utilisation of cataract surgery in Sweden during 1992-1999. A retrospective study of cataract surgery rate in one-year age groups based on the Swedish National Cataract Register. Acta Ophthalmol Scand 79: 342-349.
8. Shah SP, Dineen B, Jadoon Z, Bourne R, Khan MA, et al. (2007) Lens opacities in adults in Pakistan: prevalence and risk factors. Ophthalmic Epidemiol 14: 381-389.
9. McCarty CA, Mukesh BN, Fu CL, Taylor HR (1999) The epidemiology of cataract in Australia. Am J Ophthalmol 128: 446-465.
10. Kanthan GL, Wang JI, Rochtchina E, Tan AG, Lee A, Chia EM, Mitchell P (2008) Ten-year incidence of age-related cataract and cataract surgery in an older Australian population. The Blue Mountains Eye Study. Ophthalmology 115: 808-814.
11. Klein BE, Klein R, Lee KE, Gangnon RE (2008) Incidence of age-related cataract over a 15-year interval the Beaver Dam Eye Study. Ophthalmology 115: 477-482.
12. Ananthasiv PA, Edussuriya K, Senaratne T, Sennanayake S, Sullivan T, et al. (2010) Cataract in central Sri Lanka: prevalence and risk factors from the Kandy Eye Study. Ophthalmic Epidemiol 17: 34-40.
13. Varma R, Torres M (2004) Prevalence of lens opacities in Latinos: the Los Angeles Latino Eye Study. Ophthalmology 111: 1449-1456.
14. Worzala K, Hiller R, Sperduto RD, Mutilak K, Muratlo JM, et al. (2001) Postmenopausal estrogen use, type of menopause, and lens opacities: the Framingham studies. Arch Intern Med 161: 1448-1454.
15. He L, Sheehy K, Culbertson W (2010) Femtosecond laser-assisted cataract surgery. Curr Opin Ophthalmol.
16. Norregaard JC, Berth-Petersen P, Alonso J, Dunn E, Black C, et al. (1998) Variation in indications for cataract surgery in the United States, Denmark, Canada, and Spain: results from the International Cataract Surgery Outcomes Study. Br J Ophthalmol Scand 82: 1107-1111.
17. Cairns L, Sommer A (1984) Changing indications for cataract surgery. Pan Am Ophthalmol Soc 82: 166-175.
18. Norregaard JC, Berth-Petersen P, Andersen TF (1996) Changing threshold for cataract surgery in Denmark between 1980 and 1992. Results from the Danish Cataract Surgery Outcomes Study. II. Acta Ophthalmol Scand 74: 604-608.
19. Falck A, Kuoppala J, Winblad I, Tuulonen A (2008) The Pyhäjarvi Cataract Study. I. Study design, baseline characteristics and the demand for cataract surgery. Acta Ophthalmol 86: 648-654.