Treatment of age-related macular degeneration after cataract surgery: a study from the Swedish National Cataract and Macula Registers

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ABSTRACT.
Purpose: To characterize pre- and perioperative factors associated with treatment for wet age-related macular degeneration (wet AMD) after cataract surgery.
Methods: This register-based cohort study with data from the Swedish National Cataract Register (NCR) and the Swedish Macula Register (SMR) from 2010 to 2017 compared eyes with and without preoperative AMD that had undergone cataract surgery and was subsequently treated for wet AMD to eyes not treated within the study period. All first-eye surgeries registered in the NCR from 2010 to 2017 and matching eyes found in the SMR that had undergone treatment for wet AMD ≥ 1 year after the cataract procedure were included. Data for cataract surgery date, age and gender, use of a blue-blocking IOL, preoperative visual acuity, ocular comorbidities, posterior capsule rupture and date of AMD treatment initiation were extracted.
Results: The only independent factor associated with postoperative treatment of wet AMD in both groups was female gender (67.3% vs. 58.8%, p < 0.001 and 66.4% vs. 60.6%, p = 0.001, respectively). Older age was an independent factor in eyes without preoperative AMD (78.4 ± 6.5 vs. 73.4 ± 9.6 years, p < 0.001). A blue-blocking IOL appeared to decrease the likelihood of subsequent wet AMD treatment slightly but not statistically significant in eyes with preoperative AMD (52.7% vs. 56.8%, p = 0.110).
Conclusions: Some factors (female gender, high age) are associated with undergoing subsequent treatment for wet AMD to a higher extent. If the use of a blue-blocking IOL offers any protection from undergoing AMD treatment after cataract surgery, such an effect must be very small.

Key words: age-related macular degeneration – blue-blocking IOLs – cataract surgery – register-based cohort study

Introduction
Cataract and wet age-related macular degeneration (AMD) are two major causes of visual impairment in the elderly (Buch et al. 2004). The well-known success story of cataract surgery has been followed in recent years by successful treatments also for wet AMD. The constant improvement of surgical outcomes after cataract surgery has likely contributed to the considerable increase in surgical rates seen in recent decades in the Western world (Behndig et al. 2011). AMD is a major factor limiting visual improvement after cataract surgery (Lundstrom et al. 2000; Panchapakesan et al. 2004; Chatziralli et al. 2011; Fong et al. 2011; Grimfors et al. 2014). Still, it has been convincingly shown that
patients with pre-existing AMD do benefit from a cataract procedure (Lundstrom et al. 2000; Armbrecht et al. 2000; Forooghian et al. 2009; Lundstrom et al. 2002; Huynh et al. 2014), even patients with co-existing wet AMD (Tabandeh et al. 2012). Assessment of the demographic characteristics of people undergoing AMD treatment after cataract surgery, as well as pre- and perioperative factors associated with undergoing treatment for wet AMD postoperatively, is therefore of major clinical interest. Factors possibly affecting the likelihood of developing symptoms requiring postoperative AMD treatment might include age, gender, preoperative visual acuity, ocular comorbidities and surgical complications such as posterior capsule rupture.

A factor that has been suggested to offer protection from development of postoperative AMD is the use of a blue-blocking intraocular lens (IOL), although such an effect still remains to be proven (Hayashi & Hayashi 2006; Algvere et al. 2006; Yang & Afshari 2014). Yellow-tinted, blue-blocking intraocular lenses were designed to achieve a light transmission similar to that of the natural crystalline lens without affecting the visual function (Hayashi & Hayashi 2006), and also to reduce the macula’s exposure to blue light, the so-called ‘blue light hazard’, which has been demonstrated to have a negative impact on photoreceptor and retinal pigment epithelium function in animal models (Downie et al. 2019).

Data on age, gender, the use of blue-blocking IOL:s, preoperative AMD, preoperative visual acuity, intraoperative complications and ocular comorbidities are included in the list of variables of the Swedish National Cataract Register (NCR) (Behndig et al. 2011). Since incomplete registrations are not accepted by the NCR register database, these data exist for all cases registered in the NCR.

Swedish treatments for wet AMD have been registered by the Swedish Macula Register (SMR), which collects information on patients in active treatment of choroidal neovascularization with intravitreal injections. Data from NCR registrations of first-eye surgeries performed during 2010–2017 were used as a basis for a search for matching cases in the SMR to find all eyes operated with phacoemulsification cataract surgery and subsequently treated for wet AMD during the study period. The aim of the study was to identify factors affecting the probability of undergoing treatment for wet AMD ≥ 1 year after phacoemulsification cataract surgery.

Materials and Methods

This cohort study was approved by the Regional Ethical Review Board at Umeå University, Umeå Sweden. Data were collected from the NCR and SMR registers from 1 January 2010 to 1 September 2017. Since 2010, the identity of all patients registered in the NCR has been traceable via the Swedish personal identity number, which is also registered in the SMR. The SMR includes demographic data, and data on type of neovascular lesion, VA outcome (number of ETDRS letters, Snellen and near VA) and frequency of injections and clinical visits, as well as which intravitreal treatment given and adverse events. Neovascular AMD (wet AMD) represents 97% of all diagnoses registered in the SMR. Baseline variables such as age, gender and type of AMD lesion are registered at treatment start. Cases with dry AMD are not part of the SMR.

For each first-eye cataract procedure registered in the NCR within the abovementioned time frame, a search was performed in the SMR for start of treatment for wet AMD on the same eye within the same period. For all matching cases, the dates for surgery and initiation of AMD treatment were registered. Nine factors were investigated for association with postoperative AMD treatment age, gender, use of a blue-blocking IOL, registration of preoperative AMD in the NCR, preoperative best spectacle corrected visual acuity (BSCVA, converted to logMAR visual acuity), posterior capsule rupture during the cataract procedure and ocular comorbidities (glaucoma, diabetes retinopathy and “other”). Type of AMD is not registered in the NCR, and to minimize the risk for including eyes with co-existing wet AMD at the time of surgery, we chose to exclude eyes treated for wet AMD within the first year after cataract surgery. Only eyes treated for AMD ≥ 1 year after cataract surgery were included, and were divided into two groups, eyes with no preoperatively registered AMD (Study group 1) and eyes with preoperatively registered AMD (Study group 2) (Flow chart shown in Fig. 1). Eyes already treated for AMD before the study period were not included.

Complete first-eye surgery data for the study period from both registers were used for inter-individual comparisons. A difference in a certain factor between the proportion of eyes treated for wet AMD and the corresponding controls was interpreted as this factor having an impact on the probability of undergoing treatment for wet AMD after cataract surgery.

Statistics

Independent t-test was used for univariate analysis of normally distributed data; the data are presented as means ± standard deviations. A chi-squared test was used for nominal data (use of blue-blocking IOL: s, pre-existing AMD, posterior capsule ruptures and ocular comorbidities). Mann–Whitney U-tests were used to check for differences in VA (logMAR).

Finally, a multivariate logistic regression analysis was used for all nine variables investigated (see above) to assess independent factors associated with AMD treatment after cataract surgery. To counteract the influence of different follow-up time, year of surgery was also included as a covariate in the analysis. All statistical calculations were performed using spss version 25 (IBM SPSS Inc., Chicago, IL, USA). p < 0.05 was considered statistically significant.

Results

Demographics

During 1 January 2010 – 1 September 2017, 696 862 first-eye cataract procedures were registered in the NCR: 451 805 without preoperative AMD and 121 771 with preoperatively registered AMD. Of these, 909 (0.2%) without preoperative AMD and 744 (0.6%) with preoperative AMD were subsequently treated for wet AMD ≥ 1 year after the cataract procedure and registered in the SMR with initiation of AMD treatment within the study period.

The coverage of the registers during these years was 96.4% and 80.0% for
the NCR and the SMR, respectively. The NCR coverage was calculated from the Swedish Ophthalmological Society’s registration of cataract procedures; the SMR coverage was compared with the national patient diagnose database for all visits in health care.

Tables 1A, 1B, 2A and 2B show data for patients in study group 1 and study group 2 and respective controls.

### Preoperative visual acuity

Visual acuity at baseline for AMD treatment was 0.42 ± 0.26 for Study group 1 and 0.52 ± 0.29 for Study group 2.

### Posterior capsule rupture and ocular comorbidities

Posterior capsule rupture had occurred during the cataract procedure in 15 and 10 eyes later treated for AMD in study groups 1 and 2, respectively, which did not differ significantly from the corresponding controls (n.s.). Similarly, glaucoma, diabetes retinopathy and ‘other ocular comorbidity’ were not associated with a higher likelihood of undergoing AMD treatment after cataract surgery. On the contrary diabetes retinopathy seems to be associated with less treatment for wet AMD.

### Blue-blocking intraocular lenses

The proportion of blue-blocking IOLs equalled the controls in study group 1 (55.0 % vs. 57.3%; n.s.). For eyes in study group 2, the proportion of blue-blocking IOLs was lower than the controls (52.7% vs. 56.8%), and for eyes implanted with a conventional IOL, there were slightly more cases treated for wet AMD after cataract surgery, but analysis showed that this difference was not statistically significant (p = 0.110). For patients in Study group 1 with blue-blocking IOLs, the mean time from cataract surgery to AMD treatment was 1205 ± 571 days, compared with 1200 ± 559 days (p = 0.03) The mean time difference for start of AMD treatment is small, and the clinical relevance is therefore minor.

Diabetes retinopathy was present in 1.7% treated for AMD and 3.3% not treated for AMD.

### Tables

#### Table 1A. Factors evaluated for association with postoperative AMD treatment for eyes without preoperative AMD (n = 909). Univariate analysis, logistic regression.

| NCR + SMR | NCR | p     | Exp(B)/OR |
|-----------|-----|-------|-----------|
| Age, years | 78.4 ± 6.5 | 73.4 ± 9.6 | <0.001 | 1.067 |
| Gender (female), % | 67.3 | 58.8 | <0.001 | 1.445 |
| Preoperative VA, LogMAR | 0.48 ± 0.25 | 0.49 ± 0.38 | 0.108 | 0.861 |
| Glaucoma, % | 12.0 | 9.9 | 0.037 | 0.808 |
| Diabetes, % | 3.3 | 4.7 | 0.047 | 1.447 |
| Other ocular comorbidity % | 7.2 | 8.6 | 0.122 | 1.220 |
| Posterior capsule rupture, % | 1.7 | 1.2 | 0.223 | 1.374 |
| Blue-blocking IOLs, % | 55.0 | 57.3 | 0.165 | 0.911 |
| Surgery year | <0.001 | 0.702 |

Exp(B) = exponentiation of B; LogMAR = logarithm of the minimum angle of resolution; OR = odds ration; VA = visual acuity.

#### Table 1B. Factors evaluated for association with postoperative AMD treatment for eyes without preoperative AMD (n = 909). Multivariate analysis, logistic regression.

| NCR + SMR | NCR | p     | Exp(B)/OR | 95% CI, lower | 95% CI, upper |
|-----------|-----|-------|-----------|---------------|---------------|
| Age, years | 78.4 ± 6.5 | 73.4 ± 9.6 | <0.001 | 1.063 | 1.054 | 1.071 |
| Gender (female), % | 67.3 | 58.8 | <0.001 | 1.343 | 1.168 | 1.543 |
| Glaucoma, % | 12.0 | 9.9 | 0.704 | 1.040 | 0.850 | 1.273 |
| Diabetes, % | 3.3 | 4.7 | 0.159 | 1.300 | 0.902 | 1.873 |
| Surgery year | <0.001 | 0.707 | 0.683 | 0.731 |

CI = Confidence Interval; Exp(B) = exponentiation of B; OR = odds ration.
Table 2A. Factors evaluated for association with postoperative AMD treatment for eyes with preoperative AMD (n = 744). Univariate analysis, logistic regression.

|                | NCR + SMR | NCR | p     | Exp(B)/OR | 95% CI lower | 95% CI upper |
|----------------|-----------|-----|-------|------------|--------------|--------------|
| Age, years     | 79.0 ± 6.1| 79.2 ± 7.8 | 0.406 | 0.996      |              |              |
| Gender (female), % | 66.4       | 60.6 | 0.001 | 1.285      |              |              |
| Preoperative VA, LogMAR | 0.48 ± 0.23 | 0.52 ± 0.31 | 0.002 | 0.672      |              |              |
| Glaucoma, %    | 9.0       | 7.6  | 0.160 | 1.198      |              |              |
| Diabetes, %    | 1.7       | 3.3  | 0.018 | 1.940      |              |              |
| Other ocular comorbidity | 3.0        | 5.4  | 0.004 | 1.881      |              |              |
| Posterior capsule rupture, % | 1.3        | 1.1  | 0.447 | 1.275      |              |              |
| Blue-blocking IOL: s, % | 52.7       | 56.8 | 0.023 | 1.183      |              |              |

Exp(B) = exponentiation of B; LogMAR = logarithm of the minimum angle of resolution; OR = odds ratio; VA = visual acuity.

The mean age of the patients treated for wet AMD was significantly higher than the non-treated patients in Study group 1 (78.5 ± 6.5 years vs. 73.4 ± 9.6 years; p < 0.001), and in Study group 2, the age was similar between patients treated for AMD and non-treated patients (79.0 ± 6.1 years vs. 79.2 ± 7.8 years; p < 0.348) and also closer to the SMR population (78.9 ± 8.2 years).

In eyes with pre-existing AMD, high age is associated with a higher probability for undergoing AMD treatment following cataract surgery. In cases without pre-existing AMD, high age is associated with a higher probability of undergoing AMD treatment following cataract surgery.

In this study based on data from the Swedish National Cataract Register and the Swedish Macula Register, we show that female gender is associated with an increased probability of undergoing treatment for wet AMD from 1 to 8 years after the cataract procedure. In cases without pre-existing AMD, female gender is associated with a higher probability of undergoing AMD treatment following cataract surgery.

Based on the present findings when we analyse cases with or without preoperative AMD, eyes without preoperative AMD are treated for wet AMD year 1–8 postoperatively to the same extent, regardless of choice of IOL (conventional or blue-blocking).

In eyes with pre-existing AMD before cataract surgery, we find it is a reasonable assumption that an eye with AMD operated for cataract and then treated for wet AMD ≥ 1 year after cataract surgery is unlikely to have had wet AMD at the time of the cataract procedure. Presumably, the vast majority of these cases comprised dry AMD: s that progressed to wet AMD: s after cataract surgery. Blue-blocking IOL: s were slightly under-represented in eyes subsequently undergoing treatment for wet AMD (52.7% vs. 56.8% in the non-treated). This is interpreted as the effect of blue-blocking IOL: s in this respect appears to be very small.

In eyes with pre-existing AMD before cataract surgery, the gender distribution resembled the general SMR population (65% female).

Discussion

In this study based on data from the Swedish National Cataract Register and the Swedish Macula Register, we show that female gender is associated with an increased probability of undergoing treatment for wet AMD from 1 to 8 years after the cataract procedure. In cases without pre-existing AMD, female gender is associated with a higher probability of undergoing AMD treatment following cataract surgery.

In this context, it is important to emphasize that the present study does not aim to answer the question if cataract surgery per se increases the risk for subsequent wet AMD treatment. It rather provides information on patient characteristics and cataract operation data and their association with subsequent treatment for wetAMD. The proportion of cases initiating wet AMD treatment ≥ 1 year after all cataract surgery is low (0.2%). For cases with preoperative AMD, a larger proportion (0.6%) start AMD treatment ≥ 1 year after surgery. For all cataract cases, the time from cataract surgery to wet AMD treatment is similar and there is no difference in time to treatment between for example conventional and blue-blocking IOL: s.

Based on the present findings when we analyse cases with or without preoperative AMD, eyes without preoperative AMD are treated for wet AMD year 1–8 postoperatively to the same extent, regardless of choice of IOL (conventional or blue-blocking).

In this respect, we found no evidence supporting that blue-blocking IOL: s protects against subsequent treatment for wet AMD in eyes with a healthy macula in a maximum follow-up time of eight years after the cataract procedure.

In eyes with pre-existing AMD before cataract surgery, we find it is a reasonable assumption that an eye with AMD operated for cataract and then treated for wet AMD ≥ 1 year after cataract surgery is unlikely to have had wet AMD at the time of the cataract procedure. Presumably, the vast majority of these cases comprised dry AMD: s that progressed to wet AMD: s after cataract surgery. Blue-blocking IOL: s were slightly under-represented in eyes subsequently undergoing treatment for wet AMD (52.7% vs. 56.8% in the non-treated). This is interpreted as the effect of blue-blocking IOL: s in this respect appears to be very small.

The limited follow-up time can be another weak point in our study design, but this time was limited by the introduction of Swedish personal identity numbers in the NCR in 2010. Moreover, an average follow-up time of 3.9 years corresponds to 62% and 1195 ± 557 days for eyes with blue-blocking IOL: s, and 1193 ± 534 days for eyes with conventional IOL: s (means ± SD; n.s.), and the proportion of eyes treated at different postoperative time intervals was similar between blue-blocking and conventional IOL: s regardless of preoperative AMD status. (Figs 2 and 3).

Age and gender

The mean age of the patients treated for wet AMD was significantly higher than the non-treated patients in Study group 1 (78.5 ± 6.5 years vs. 73.4 ± 9.6 years; p < 0.001), and in Study group 2, the age was similar between patients treated for AMD and non-treated patients (79.0 ± 6.1 years vs. 79.2 ± 7.8 years; p < 0.348) and also closer to the SMR population (78.9 ± 8.2 years).

Women were over-represented both in Study group 1 (67% vs. 59%; p < 0.001) and in Study group 2 (66% vs. 61%; p = 0.002). In eyes subsequently treated for wet AMD after cataract surgery, the gender distribution resembled the general SMR population (65% female).

Table 2B. Factors evaluated for association with postoperative AMD treatment for eyes with preoperative AMD (n = 744). Multivariate analysis, logistic regression.

|                | NCR + SMR | NCR | p     | Exp(B)/OR | 95% CI lower | 95% CI upper |
|----------------|-----------|-----|-------|------------|--------------|--------------|
| Gender (female), % | 66.4       | 60.6 | 0.008 | 1.228      | 1.054        | 1.432        |
| Preoperative VA, LogMAR | 0.48 ± 0.23 | 0.52 ± 0.31 | <0.001 | 0.554      | 0.432        | 0.725        |
| Diabetes, %      | 1.7       | 3.3  | 0.049 | 1.740      | 1.003        | 3.017        |
| Other ocular comorbidity | 3.0        | 5.4  | 0.038 | 1.571      | 1.025        | 2.407        |
| Blue-blocking IOL: s, % | 52.7       | 56.8 | 0.094 | 1.132      | 0.979        | 1.308        |
| Surgery year     | <0.001    | 0.675| 0.649 | 0.702      |              |              |

CI = Confidence Interval; Exp(B) = exponentiation of B; OR = odds ratio.
39% of the remaining life expectancy in these age groups in Sweden for men and women, respectively (Anticipated life expectancy in Sweden, sorted on age and gender 2014). Another weakness in our study is that we do not know the number of non-treated patients that has died or for other reasons have been unavailable for comparison.

Not surprisingly, a high proportion of eyes treated for AMD after cataract surgery had known AMD pre-surgery. These eyes were also more likely to subsequently undergo AMD treatment. A correct diagnosis of AMD before cataract surgery can be of great importance in providing adequate patient information, not least to give the patient realistic expectations of outcome after the cataract procedure (Ronbeck et al. 2011).

Patients treated for wet AMD after cataract surgery were slightly, but significantly older than the general cataract population, and at start of treatment for wet AMD their visual acuity was better than the mean baseline VA in the SMR (Westborg et al. 2018). The latter likely owes to the fact that these patients were operated for cataract.

Despite the increased surgical trauma in eyes with a posterior capsule rupture, this complication does not seem to influence the postoperative treatment rate of wet AMD. Likewise, glaucoma, diabetes and ‘other ocular comorbidities’ do not seem to increase the proportion undergoing treatment. In our study, diabetes seems to be associated with a slightly lower likelihood of subsequent treatment of wet AMD. The reason for this finding needs to be further analysed.

In conclusion, female gender was associated with an increased likelihood of undergoing treatment for wet AMD ≥ 1 year after cataract surgery. Older age also increases the probability, but only for patients without preoperative AMD. For patients with preoperative AMD and conventional IOLs, there were slightly more cases treated for AMD after cataract surgery although not statistically significant even in a material of this size. If the use of a blue-blocking IOL offers any protection from undergoing subsequent AMD treatment after cataract surgery, such an effect must be very small.

References

Age-Related Eye Disease Study 2 Research Group, Huynh N, Nicholson BP et al. (2014): Visual acuity after cataract surgery in patients with age-related macular degeneration: age-related eye disease study 2 report number 5. Ophthalmology 121: 1229–1236.

Algvere PV, Marshall J & Seregard S (2006): Age-related maculopathy and the impact of blue light hazard. Acta Ophthalmol Scand 84: 4–15.

Armbrecht AM, Findlay C, Kaushal S, Aspinall P, Hill AR & Dhillon B (2000): Is cataract surgery justified in patients with age related macular degeneration? A visual function and quality of life assessment. Br J Ophthalmol 84: 1343–1348.

Baatz H, Darawsha R, Ackermann H et al. (2008): Phacoemulsification does not induce neovascular age-related macular degeneration? A visual function and quality of life assessment. Invest Ophthalmol Vis Sci 49: 1079–1083.

Behndig A, Montan P, Stenevi U, Kugelberg M & Lundstrom M (2011): One million cataract surgeries: Swedish National Cataract Register 1992–2009. J Cataract Refract Surg 37: 1539–1545.

Bockelbrink A, Roll S, Ruether K, Rasch A, Greiner W & Willich SN (2008): Cataract surgery and the development or progression of age-related macular degeneration: a systematic review. Surv Ophthalmol 53: 359–367.

Buch H, Vinding T, La Cour M, Appleyard M, Jensen GB & Nielsen NV (2004): Prevalence and causes of visual impairment and blindness among 9980 Scandinavian adults: the Copenhagen City Eye Study. Ophthalmology 111: 53–61.

Chatziralli IP, Kanonidou E & Papazisis L (2011): Frequency of fundus pathology
related to patients’ dissatisfaction after phacoemulsification cataract surgery. Bull Soc Belge Ophthalmol 317: 21–24.

Chew EY, Sperduto RD, Milton RC et al. (2009): Risk of advanced age-related macular degeneration after cataract surgery in the Age-Related Eye Disease Study: AREDS report 25. Ophthalmology 116: 297–303.

Cugati S, Mitchell P, Rochtchina E, Tan AG, Smith W & Wang JJ (2006): Cataract surgery and the 10-year incidence of age-related maculopathy: the Blue Mountains Eye Study. Ophthalmology 113: 2020–2025.

Dong LM, Stark WJ, Jefferys JL et al. (2009): Progression of age-related macular degeneration after cataract surgery. Arch Ophthalmol 127: 1412–1419.

Downie LE, Worwald R, Evans J et al. (2019): Analysis of a systematic review about blue light -filtering intraocular lenses for retinal protection understanding the limitations of the evidence. JAMA Ophthalmol 137: 694–697.

Fong CS, Mitchell P, Rochtchina E, de Loryn T, Hong T & Wang JJ (2011): Sustainability of visual acuity in the first 2 years after cataract surgery. Br J Ophthalmol 95: 1652–1655.

Foroozhan F, Agron E, Clemons TE, Ferris FL 3rd & Chew EY (2009): Age-Related Eye Disease Study Report 25. Ophthalmology 116: 297–303. Visual acuity outcomes after cataract surgery in patients with age-related macular degeneration: age-related eye disease study report no. 27. Ophthalmology 116: 2093–2100.

Fraser-Bell S, Choudhury F, Klein R, Azar S & Varma R (2010): Los Angeles Latino Eye Study G. Ocular risk factors for age-related macular degeneration: the Los Angeles Latino Eye Study. Am J Ophthalmol 149: 735–740.

Freeman EE, Munoz B, West SK, Tielsch JM & Schein OD (2003): Is there an association between cataract surgery and age-related macular degeneration? Data from three population-based studies. Am J Ophthalmol 135: 849–856.

Grimsby M, Mollazadeh K, Lundstrom M & Kugelberg M (2014): Ocular comorbidity and self-assessed visual function after cataract surgery. J Cataract Refract Surg 40: 1163–1169.

Hayashi K & Hayashi H (2006): Visual function in patients with yellow tinted intraocular lenses compared with vision in patients with non-tinted intraocular lenses. Br J Ophthalmol. 90: 1019–1023.

Ho L, Boekhoorn SS, Lianga X et al. (2008): Cataract surgery and the risk of aging macular disorder: the rotterdam study. Invest Ophthalmol Vis Sci 49: 4795–4800.

Kessel L, Erngraed D, Flesner P, Andresen J, Tendal B & Hjortdal J (2015): Cataract surgery and age-related macular degeneration. An evidence-based update. Acta Ophthalmol 93: 593–600.

Klein BE, Howard KP, Lee KE, Iyengar SK, Sivakumaran TA & Klein R (2012): The relationship of cataract and cataract extraction to age-related macular degeneration: the Beaver Dam Eye Study. Ophthalmology 119: 1628–1633.

Lundstrom M, Stenevi U & Thorburn W (2000): Cataract surgery in the very elderly. J Cataract Refract Surg 26: 408–414.

Lundstrom M, Brege KG, Floren I, Lundh B, Stenevi U & Thorburn W (2002): Cataract surgery and quality of life in patients with age related macular degeneration. Br J Ophthalmol 86: 1330–1335.

Panchapakesan J, Rochtchina E & Mitchell P (2004): Five-year change in visual acuity following cataract surgery in an older community: the Blue Mountains Eye Study. Eye (Lond) 18: 278–282.

Ronbeck M, Lundstrom M & Kugelberg M (2011): Study of possible predictors associated with self-assessed visual function after cataract surgery. Ophthalmology 118: 1732–1738.

Tabandeh H, Chaudhry NA, Boyer DS, Kon-Jara VA & Flynn HW Jr (2012): Outcomes of cataract surgery in patients with neovascular age-related macular degeneration in the era of anti-vascular endothelial growth factor therapy. J Cataract Refract Surg 38: 677–682.

Wang JJ, Mitchell PG, Cumming RG & Lim R (1999): Cataract and age-related maculopathy: the Blue Mountains Eye Study. Ophthalmic Epidemiol 6: 317–326.

Westborg A, Albrecht S, Jonsson T et al. (2018): Annual Report Swedish Macula register 2017. Available at: http://rcsyd.se/makulareg/wp-content/uploads/sites/2/2018/11/Arsrappport-2017-Svenska-Makula register.pdf (Accessed on 11 Aug 2019).

Yang H & Afshari NA (2014): The yellow intraocular lens and the natural ageing lens. Curr Opin Ophthalmol 25: 40–43.

Other cited Materials

Anticipated life expectancy in Sweden, sorted on age and gender (2014): Available at: http://www.statistikdatabasen.scb.se

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All eye-clinics in Sweden that register in the National Cataract Register and the Swedish Macula Register and enable real-world studies.

The corresponding author is a member of the Nordic Ophthalmological Societies.