Successful Cataract Surgery Leads to an Improvement in Depressive Symptomatology

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Keywords

Cataract · Depression · Phacoemulsification · Beck's Depression Inventory-II · Health-related quality of life

Abstract

Introduction: Cataract is the most common reversible cause of blindness worldwide, and the associated vision impairment has been associated with an adverse impact on health-related quality of life and mental health in particular. However, findings from studies on the mental health improvement of patients after cataract surgery remain inconclusive. The objective of this study is to ascertain whether the outcome on best-corrected visual acuity (BCVA) following cataract surgery is associated with depressive symptomatology. **Methods:** This is an observational prospective study of a cohort of 150 consecutive patients who underwent phacoemulsification surgery and who were evaluated for changes in depressive symptomatology with Beck's Depression Inventory-II (BDI-II). **Results:** The difference in BDI-II scores pre- and postoperatively correlated with the difference in BCVA pre- and postoperatively ($p < 0.001$). A paired-samples t test revealed a statistically significant difference in the preoperative and postoperative BDI-II scores ($p < 0.001$). A related-

samples Wilcoxon signed-rank test revealed a statistically significant improvement of depression status among the patients ($p = 0.004$). A stepwise regression analysis concluded that the only statistically significant predictor in assessing the difference in total BDI-II score before and after the operation was the respective difference in visual acuity. **Discussion/Conclusion:** The success of phacoemulsification surgery for cataract as evaluated with the change in BCVA is related to the rate of improvement in depressive symptomatology.

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Introduction

Cataract is the most common reversible cause of blindness worldwide, linked to an estimated 35% of blindness cases in 2015 and to 24% of all cases with moderate to severe visual impairment [1]. During the past years a number of surgical procedures have been devised that, coupled with improvements in intraocular lens replacement technology, have reliably addressed the visual impairment associated with cataract, thus resulting in notable vision improvement for the patient [2].

Severe vision impairment associated with untreated cataract has a notable adverse impact on health-related quality of life and especially on mental health. A community-based sample of 662 individuals aged over 70 years in Australia found that 43.4% reported eye disease (either cataract, glaucoma or age-related macular degeneration) with 7.7% reporting more than 1 disease. Cataract patients reported having clinically significant depressive symptoms in 6.7% of cases, and this rate was nearly double compared to individuals with no eye disease [3]. Since cataract is more readily addressed than other causes of severe vision impairment, there are more patient expectations for a restoration of previous visual function compared to other eye diseases. A study of 278 patients undergoing planned cataract surgery found that postoperative depression was significantly higher in patients without any improvement in their vision compared to those presenting improved visual acuity [4]. In Australia researchers compared the number of mental health contacts for anxiety or depression a year before and a year after cataract surgery and found that there was a decrease of 18.8% after controlling for confounding factors [5]. Depressive symptomatology in cataract patients has also been linked to duration of untreated disease with researchers reporting that 26% of 672 patients awaiting cataract surgery in Canada showed signs of depression before the intervention (Geriatric Depression Scale-30 ≥ 10). Results indicated that patients with worse visual acuity were more likely to be depressed while waiting for cataract surgery.

Although most studies converge that depressive symptomatology is subject to change for the better after cataract surgery, there are opposing findings as well; a study of 88 Japanese elderly patients failed to find statistical significance in the drop in depressive symptomatology following cataract surgery, although depressive mental status improved in parallel with vision-related quality of life [6]. The study did not however include a power analysis or offer effect sizes. In another study of 3 groups of 150 cataract patients each that included patients receiving cataract surgery, the authors concluded that the improvement in vision appeared to have no measurable impact on reducing the symptoms of depression [7]. However, the study group had a lower than expected mean of depressive symptoms at baseline, which may be attributed to higher socioeconomic status. Also, a number of individuals with more depressive symptoms were lost to follow-up, and no power analysis or effect sizes were offered here either. The possible issue with small sample sizes has possibly also affected other studies with just 13 [8], 25 [9] and

30 patients [10]. Those studies have focused on other end points related to vision-related or general quality of life that apparently have a higher effect size of improvement after cataract surgery compared to depressive symptomatology.

Methods

This is an observational prospective study of a cohort of 150 consecutive patients who underwent phacoemulsification surgery in the 2nd Department of Ophthalmology, Aristotle University of Thessaloniki. Exclusion criteria were any complications related to phacoemulsification, previous cataract surgery, the existence of other comorbid eye diseases and any diagnosed psychiatric disorder in the medical history. Sample size calculation for an α -value of 0.05 and a β -value of 0.2 with a presumed moderate effect size of 0.35 returned a necessary sample of 144 patients.

Measures

All patients were initially handed out a brief demographic questionnaire before surgery that included information on their gender, age, marital status, living arrangements, comorbid health issues and any life stressors occurring during the past 6 months, including death or divorce, loss of work or any other self-reported adversities. They were required to fill in Beck's Depression Inventory-II (BDI-II), a 21-item self-report questionnaire with strong psychometric support as a screening measure for depression among older adults in the general population [11]. This was the baseline measurement, and a second measurement was carried out with the BDI-II, 2 months after surgery. Additionally, their best-corrected visual acuity (BCVA) for the affected eye was also measured before and after surgery with the Early Treatment Diabetic Retinopathy Study charts.

Statistics

Gender differences on age and the BDI-II score were assessed with Mann-Whitney tests. The difference in BDI-II score before and after the operation was assessed with a paired-samples *t* test. A related-samples Wilcoxon signed-rank test was employed to compare depression status among the patients before and after the operation. A stepwise regression analysis was conducted to assess which factors had a statistically significant role in explaining the variance of the difference in total BDI-II score before and after the operation.

All statistics were calculated using the SPSS statistical package, version 25.

Results

Sample demographics are presented in Table 1. There were 150 patients, 86 men (57.3%) and 64 women (42.7%). The mean age for men was 73.84 years (SD 8.55 years) and for women 73.45 years (SD 7.055), and the difference was not statistically significant ($p = 0.77$). Preoperative mean

Table 1. Sample demographics

	Male	Female		
Participants, <i>n</i> (%)	86 (57.3)	64 (42.7)		
Mean age (SD), years	73.84 (8.55)	73.45 (7.055)		
Family status, <i>n</i> (%)				
Married	60 (69.8)	31 (48.4)		
Widowed	20 (23.3)	29 (45.3)		
In a relationship	5 (5.8)	3 (4.7)		
Without a relationship	1 (1.2)	1 (1.6)		
Stay, <i>n</i> (%)				
Alone	17 (19.8)	25 (39.1)		
With family/partner	69 (80.2)	39 (60.9)		
Require a caretaker, <i>n</i> (%)				
No	70 (81.4)	44 (68.8)		
Yes	16 (18.6)	20 (31.3)		
Recent stressful event, <i>n</i> (%)				
No	84 (97.7)	64 (100)		
Yes	2 (2.3)	–		
Preoperative BDI-II total score	6.42 (5.248)	8.13 (5.683)		
Postoperative BDI-II total score	5.43 (3.933)	6.72 (4.732)		
	Pre	Post	Pre	Post
Level of depressive symptomatology, <i>n</i> (%)				
Minimal depression	78 (90.7)	82 (95.3)	56 (87.5)	59 (92.2)
Mild depression	7 (8.1)	4 (4.7)	6 (9.4)	4 (6.3)
Moderate depression	–	–	1 (1.6)	1 (1.6)
Severe depression	1 (1.2)	–	1 (1.6)	–

Table 2. Stepwise regression results with difference in depression symptomatology (BDI total score) pre- and postoperatively as the dependent variable

Model	Standardized β	<i>t</i>	<i>p</i> value	95% CI for B	
				lower	upper
Constant		–3.677	<0.001	–2.721	–0.819
Difference in visual acuity pre- and postoperatively	0.488	6.801	<0.001	7.356	13.383

BDI-II scores were 6.42 (SD 5.248) for men and 8.13 (SD 5.683) for women. Postoperative mean BDI-II scores were 5.43 (SD 3.933) for men and 6.72 (SD 4.732) for women.

Men scored lower than women on the BDI-II preoperatively (Mann-Whitney $Z = 2.194$, $p = 0.028$) but not postoperatively (Mann-Whitney $Z = 1.726$, $p = 0.084$). BDI-II scores before surgery correlated with BCVA before surgery (Spearman $r_s = 0.175$, $p = 0.032$) but BDI-II scores after surgery did not correlate with postoperative BCVA. The difference in BDI-II scores pre- and postoperatively correlated with the difference in BCVA pre- and

postoperatively (Spearman $r_s = 0.529$, $p < 0.001$). A paired-samples t test revealed a statistically significant difference in the preoperative and postoperative BDI-II scores, t test (149) = 4.803, $p < 0.001$. The effect size d was 0.392, denoting a medium strength of the relationship between the outcome of the surgery and drop in BDI score [12], close to the presumed 0.35 in the power analysis.

Grouped by depression severity according to the established cutoffs, there were 13 cases of mild depression (8.7%), 1 case of moderate depression (0.7%) and 2 cases of severe depression (1.3%) preoperatively. Postoperatively there were 8 cases of mild depression (5.3%) and a

single case of moderate depression (0.7%). A related-samples Wilcoxon signed-rank test revealed a statistically significant improvement (standardized test statistic = -2.887 , $p = 0.004$) among the patients.

Table 2 presents the results of stepwise regression results with difference in depression symptomatology (BDI total score) pre- and postoperatively as the dependent variable; the following variables were entered in the analysis: gender, age, family status, living arrangements, need for a caretaker and difference in visual acuity pre- and postoperatively. Results indicate that the only predictor variable that significantly predicts the variance in BDI total score pre- and postoperatively is the difference in visual acuity pre- and postoperatively ($p < 0.001$).

We also assessed the differences on each separate item of the BDI-II pre- and postoperatively. Target p for an α -value of 0.05 was set at <0.0023 to adjust for multiple comparisons using the Bonferroni criterion. Six items met this threshold, item 2 (regarding pessimism for the future), item 3 (feelings of past failure), item 7 (feelings of self-dislike and general disappointment with oneself), item 11 (general irritability), item 12 (interest in others) and item 13 (difficulty with decision-making). Those were the items on the BDI-II that contributed the most to the postoperative drop.

Discussion/Conclusions

Our results indicate a moderate improvement in depressive symptomatology following cataract surgery, in accordance with data published elsewhere [4, 5]. Seven out of the 150 participants no longer met the threshold for clinically significant depression, a notable improvement. The effect size for the relationship between change in BCVA and depressive symptomatology was also moderate, denoting that our results can be readily observed in the typical clinical setting.

In order to better understand the inner factors that play a role in this alleviation of depressive symptomatology we should look more deeply into the items on the BDI-II that had the higher rate of change pre- and postoperatively. Two items related to future actions: pessimism for the future and difficulty with decision-making were alleviated postoperatively. The patient who has had an increase in BCVA can now be more confident in him/herself and how he/she may cope with future challenges. General irritability decreased while interest in others increased, denoting that the individual can now socialize with greater ease since his/her troubles are not preoccupy-

ing him/her. Finally, feelings of past failure and feelings of self-dislike and general disappointment with oneself were also ameliorated. This finding points to the possibility that patients may have blamed themselves for their troubles. Cataract has been associated to a large extent with potentially avoidable comorbid health issues including poorly controlled diabetes mellitus, smoking, prolonged exposure to direct sunlight and alcohol use [1]. As every patient typically wants to know a root cause for his health issues, it is likely that an attribution as those mentioned above may have a negative effect on the patient's view of him/herself. Since however the surgery is the patient's own decision, the patient may experience a positive feeling from a successful outcome or, conversely, a further exacerbation of his despair if the surgery does not succeed.

A strength of this study, compared to previous inconclusive studies [8–10], was the adequate sample size and the paired-samples design. A limitation of the study is that depressive symptoms were assessed with a questionnaire and not a clinical interview. However, since very few of the participants would be considered as depression cases, there was no reason to allocate resources for a clinical interview.

In conclusion, our findings indicate that improvement on visual acuity following phacoemulsification surgery is associated with an improvement on depressive symptomatology. The positive impact of vision restoration is not limited to functional improvement but also to an improvement in mental health. This highlights the importance of adequate vision for mental health, particularly related to elderly subjects.

Statement of Ethics

The study was performed following all the guidelines for experimental investigations required by the Institutional Review Board of the Ethics Committee of the Aristotle University of Thessaloniki (approval ref. No. 4.139/17.7.2019), in accordance with the World Medical Association Declaration of Helsinki. All participants offered their informed consent, after being briefed on the study goals.

Disclosure Statement

The authors have no conflicts of interest to declare.

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Author Contributions

I.M. contributed to study design, data acquisition, data analysis, data interpretation and drafting of the manuscript. V.A. con-

tributed to manuscript critical revision. N.Z. contributed to manuscript critical revision, and I.T. contributed to study concept, manuscript critical revision and supervision. All authors gave their approval on the final paper.

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