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Original Article

Cognitive Consequences of Cataract Surgery: A Cross-Sectional Study

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Abstract

Background and Objective: The age-related cataract is a leading cause of vision loss, and cataract surgery is the most common intraocular surgery. Patients with cataracts may develop mild cognitive impairment due to blurred vision and vision problems. In this regard, the improvement of vision after cataract surgery may affect their cognitive function.

Materials and Methods: This cross-sectional descriptive study was conducted on 32 patients aged 40-60 years who were referred to the ophthalmology clinic of Farshchian Hospital in Hamadan with a diagnosis of bilateral cataracts within 2019-2020. Cognitive function was assessed in patients with Mini-Mental-State-Examination (MMSE) test and clock-drawing test before and after ocular cataract surgery. Patient data were analyzed in SPSS software (version 16) using paired t-test at a 95% confidence level.

Results: The mean age of patients was 53.91±4.51 years, and the majority of them (62.5%)were male. Before and after cataract surgery, the mean scores of the MMSE test were 25.09±3.25 and 26.19±2.69, and the mean scores of the clock-drawing test were reported as 3.34±1.49 and 3.72±1.32 (P=0.001). Based on the MMSE and clock-drawing test, 54.4% and 65.6% of patients, respectively, had improved cognitive function, as compared to before the surgery.

Conclusions: Cognitive function in patients with cataracts was significantly improved by cataract surgery.

Keywords: Cataract, Cataract surgery, Cognitive dysfunction

Background

Cataract is the most common cause of bilateral vision loss in the elderly and is responsible for about 48% of blindness cases in the world [1,2]. The most common cause of cataract or lens opacity is aging, and it is estimated that more than 95 million people are affected by cataracts across the globe [3]. Age-related cataracts develop slowly over time, and patients' visual acuity will definitely improve in 90% of cases if surgery is required [4]. In recent years, with advancements in intraocular lenses and changes in surgical techniques, cataract surgery has undergone dramatic changes. Phacoemulsification surgery is the most commonly preferred method for cataract surgery in adults and older children [5].

Cognitive deficit is an important cause of morbidity in the elderly, affecting one in four people over the age of 65 [6]. Mild cognitive impairment (MCI) or emerging dementia is a neurological disorder observed in the elderly [7,8]. In these patients, there is evidence of moderate cognitive decline from previous functional levels in one or more cognitive domains. Cataract vision problems appear to affect a large number of older people, and as comorbidity, it greatly increases the risk of complications in people with cognitive problems.

Objectives

Therefore, cataract surgery and improvement of visual acuity can be a saving strategy to increase cognitive function [9,10]. Due to the high prevalence of cataracts and the possibility of cognitive impairment in the elderly, as well as the lack of similar studies in Iran, the present study aimed to assess cognitive function before and after cataract surgery.

Materials and Methods

This quasi-experimental study was performed on all

patients aged 40-60 years who were referred to the ophthalmology clinic of Farshchian Hospital with a diagnosis of bilateral cataracts within 2019-2020. The participants were selected via the census method, and the written informed consent was obtained from all of them. People with anxiety disorders, depression, dementia, neurological disorders, and history of cerebrovascular accident were excluded from the study. After obtaining a history and determining visual acuity in both eyes, a clinical examination with slit lamp and fundoscopy was performed by an ophthalmologist and recorded in special sheets. Patients were evaluated before and after the surgery for cognitive function and changes. Mini-mental state exam (MMSE) and clock drawing test were employed to assess cognitive function.

The mini-mental state test was developed by Fulstein et al. (1975) to convert dementia from a qualitative attribute to a quantitative and numerical one. It consists of 11 questions and 4 subscales: 1. Orientation memory (16 points), 2. attention and focus (5 points) 3. language and comprehension ability (8 points), 4. spatial-visual ability (1 point). The whole questionnaire has 30 points and will be completed in 5-10 min. A score above the cut-off point up to 30 indicates normal individuals, and a score below the cut-off point is suggestive of dementia. A score of 24-30 signifies normal cognitive status, 18-23 is indicative of moderate involvement, and a score below 18 suggests a cognitive impairment or severe involvement [11]. In the study by Foroughan et al., a cut-off point of 21 was determined for this test with 90% sensitivity and 84% specificity [12].

For the clock-drawing test, patients were given a piece of paper with a 10 cm diameter circle on it, and they were asked to write the numbers. Thereafter, they were asked to draw a clock that shows the time of 10 minutes after 11. The clock-drawing test scores are staged as follows: 5 as normal, 4 as mild, 3 as moderate, and 2 or less as severe dementia [13]. The patients were evaluated once before cataract surgery and once 4-6 weeks after the second eye surgery following telephone call and face-to-face referral for the aforementioned tests. After the completion of the tests, the obtained information was analyzed in SPSS software (version 16) using paired t-test, chi-square, and Mac. A p-value less than 0.05 was considered statistically significant.

Results

The present study which aimed to compare cognitive function in patients with cataracts before and after cataract surgery was conducted on 32 patients. The mean age of patients was reported as 53.91±4.51 years, and most of them (62.5%) were male. In terms of education, 75% of patients hold a diploma. According to the result of paired t-test illustrated in Table 1, the mean scores of clock-drawing and MMSE tests after cataract surgery were significantly higher than those obtained before the surgery.

Table 1. Comparison of mean scores of mini-mental state exam and clock-drawing in patients before and after ocular cataract surgery

Test	Assessment time		P.value*
	Before surgery Mean±Sd	After surgery Mean±Sd	
MMSE	25.09±3.25	26.10±2.69	0.008
Clock drawing test	3.34±1.49	3.72±.1.32	0.001

*Paired t-test

Table 2. Comparison of cognitive function based on MMSE test result and drawing in patients before and after cataract surgery

Cognitive impairment	Assessment time		P-value*
	Before surgery Number (%)	After surgery Number (%)	
MMSE test			
Suffering	10 (31.2)	7 (21.9)	
Not infected	22 (68.8)	25 (78.1)	0/009 *
Total	100 (32)	32 (100)	
Clock drawing test			
Normal	10 (31.2)	13 (40.6)	
Mild	7(18.8)	6 (18.75)	
Moderate	4 (12.5)	6 (18.75)	0/003**
severe	11(34.04)	7 (21.8)	
Total	32 (100)	32 (100)	

*.Chi-square test ** . Friedman test

According to the results of MMSE and clock drawing tests, cognitive function in patients demonstrated a marked improvement, compared to that before the cataract surgery. According to Table 2 and the results of clock-drawing and MMSE tests, the cognitive function score of patients after cataract surgery was significantly better and higher, as compared to that before the surgery (P<0.05).

According to the results of the Pearson correlation coefficient test, no significant correlation was observed between age and the test score of patients before cataract surgery (r= -0.160; P=0.383) and

after the surgery (r=0.040; P=0.827). There was no statistically significant difference between males and females in terms of mean MMSE score before and after cataract surgery. Nonetheless, in the clock-drawing test, the mean score of males was significantly higher (P<0.01).

There was no statistically significant difference between patients' economic status in terms of mean MMSE score before and after cataract surgery. Nevertheless, in the clock-drawing test, the mean score of patients with good financial status was significantly higher than those with poor financial status (P<0.05). There was no statistically significant difference between patients' education in terms of mean MMSE score before the cataract surgery. However, the mean scores of MMSE after surgery, as well as clock-drawing test before and after the surgery were significantly higher in people with a diploma and higher education, in comparison with those reported in subjects who hold high school education (P <0.05).

Discussion

In agreement with the results of the studies conducted by Park et al. [9], Miata et al. [10,14], Ishi et al. [15], and Tamura et al., the findings of the current research pointed out that cataract surgery significantly improved cognitive function in patients [16]. The results of the study by Park et al. on the effect of cataract surgery on the cognitive function of the elderly (MMSE scale) demonstrated that cataract surgery not only eliminated vision problems but also exerted positive effects on patients' cognitive function [9]. In line with the results of the mentioned research, in the present study, patients' cognitive function improved significantly after the surgery.

In the same context, Miyata et al. carried a study on the history of cataract surgery, dementia, and cognitive impairment with the MMSE scale in Japan in 2018. In the stated study, the patients who had previously undergone cataract surgery were significantly less likely to develop mild cognitive impairment [10]. In the study by Miata et al. who compared the frequency of cognitive impairment in patients with pseudophakia (previous history of cataract surgery) and phakic (without a history of cataract surgery) with the MMSE scale, pseudophakic patients had much better visual acuity and a lower rate of cognitive impairment, as compared to the phakic group [14]. The results of the present study on the relationship between cognitive function improvement and cataract surgery are consistent with those reported by Miata et al.

In a prospective study in Japan in 2008, Ishii et al. used the MMSE and Beck Depression Inventory to compare cognitive impairment in 102 patients with bilateral cataracts two months before and two months after surgery. The results of the referred study pointed out that after cataract surgery, their vision-related quality of life increased and cognitive impartments improved along with increased visual acuity [15]. The present study was similar to the research by Ishii et al. in the adopted method. In the present study, the mean MMSE score of patients increased from 25.09±3.25 before the surgery to 26.19±2.69 after the surgery, and this variation was significant. In a study performed by Tamura et al. on 20 patients in Japan, it was revealed that after cataract surgery, cognitive function improved in 12 (60%) patients, remained unchanged in 7 (35%) patients, and worsened in 1 (5%) patient. The researchers concluded that cataract surgery improves cognitive function in patients [16].

Conclusions

As evidenced by the obtained results, cataract surgery in patients brings about marked improvements in their vision, cognitive function, and quality of life. Furthermore, cataract surgery increases the amount of light entering the eyes, and it is of great importance regarding the effect of light on the biological clock and circadian rhythm on cognitive function. [17]

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Conflicts of Interest

The authors declare that they have no conflict of interest.

Compliance with ethical guidelines

The present study was approved by the Research Ethics Committee of Hamadan University of Medical Sciences. (IR.UMSHA.REC.1398.054). In adherence to ethical principles, informed consent was obtained from the participants.

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