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Elektif Katarakt Ameliyatı Öncesinde Covid-19 RT-PCR Testi Yapılmalı mı? Prevelans ve Maliyet Analizi Işığında Bir Çalışma

Should Covid-19 RT-PCR Test Be Performed Before Elective Cataract Surgery? A study In the Light of Prevalence and Cost Analysis

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ÖZ

Amaç: Elektif katarakt ameliyatı planlanan hastalarda asemptomatik Covid-19 seroprevalansını, Covid-19'un katarakt ameliyatına maliyet etkilerini ve tarama testinin ameliyat öncesi rutin olarak kullanılmasının etkilerini tartışmak amaçlanmıştır.

Materyal ve Metot: Bu çalışma kesitsel ve gözlemsel bir çalışmadır. Çalışma grubunu pandemi döneminde ameliyat öncesi SARS CoV 2 için gerçek zamanlı polimeraz zincir reaksiyonu (RT PCR) testi yapılan hiçbir Covid-19 semptomu olmayan 217 hasta kontrol grubunu ise pandemi öncesi daha önce elektif katarakt ameliyatı geçiren 200 hasta oluşturdu. Demografik özellikleri ve hastanede kalış süreleri kaydedildi. Ekipman ücretleri, laboratuvar ücretleri, ilaç ücretleri ve hastane hizmet ücretleri kayıt altına alınarak maliyet analizi yapıldı. Covid-19 seroprevalansı hesaplandı.

Bulgular: Hastanemizde pandemi döneminde elektif katarakt cerrahisi uygulanan tüm hastalarda asemptomatik Covid-19 enfeksiyonu seroprevalansı %1,8 idi. Grupların ortalama maliyeti arasında anlamlı fark vardı ($p<0,001$).

Sonuç: Asemptomatik hastalarda hastalığın seroprevalansı çok düşük olmasına ve hastalığın ameliyat maliyetini artırmasına rağmen, asemptomatik hastaları belirlemek ve bulaşıcılığı azaltmak için COVID-19 taramasına devam edilmesi gerektiğini düşünüyoruz.

Anahtar Kelimeler: Ameliyat öncesi testler, covid-19, katarakt cerrahisi, seroprevalans, tedavi maliyeti

ABSTRACT

Objective: It was aimed to argue the asymptomatic Covid -19 seroprevalence in patients scheduled for elective cataract surgery, to investigate the cost effects of Covid-19 on cataract surgery, and the effects of routinely using the screening test before surgery.

Materials and Methods: This is a cross-sectional and observational study. The study group included 217 patients without any symptoms of Covid-19 who underwent real-time polymerase chain reaction (RT PCR) testing for SARS CoV 2 before surgery during the pandemic period and the control group included 200 patients who underwent elective cataract surgery procedure before the Covid-19 pandemic. Their demographic characteristics and the length of hospital stay were recorded. Equipment fees, laboratory fees, drug fees, and hospital service fees were recorded, and cost analysis was made. Seroprevalence of Covid-19 was calculated.

Results: The seroprevalence of the asymptomatic Covid-19 infection among all elective cataract surgery patients in our hospital was 1.8%. There was a significant difference between the average cost of the groups ($p<0.001$).

Conclusion: Although the seroprevalence of the disease is very low among asymptomatic patients and the disease increases the cost of the surgery, we think that to identify asymptomatic patients and reduce contagiousness, screening for COVID-19 should continue.

Keywords: Cataract surgery, cost of treatment, covid-19, preoperative testing, seroprevalence

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INTRODUCTION

The most important health issue of the year 2020 is the severe acute respiratory syndrome coronavirus 2 (SARS CoV 2) (Covid 19) and it is still important in 2021. The disease has been spread rapidly and became a pandemic within a short period of time.

With the onset of the pandemic, in March 2020, health institutions had to make changes in their routine works.[1] In pandemic hospitals, elective surgeries have been postponed. The purpose of the delay is to protect the patients from hospital-induced viral transmission and to use healthcare workers' energy optimum. The number of postponed surgeries has been reported as approximately 28 million.[2] Following the recognition that the cancellation of elective surgeries will have a significant impact on patients and have devastating consequences, governments, and international authorities have made a number of decisions to safely restart elective surgeries. An important decision is elective testing before surgeries. This has been proposed by international authorities.[3] In our hospital, from June 2020, it was proposed that testing for Covid 19 for asymptomatic patients coming for elective surgeries should be performed. Moreover, it has also been suggested to take equipment, and cleaning measures in the operating room.[4] In our hospital, real-time polymerase chain reaction (RT-PCR) testing for the SARS-CoV-2 virus which results within 4 to 8 hours has been performed by laboratory workers.

Cataract surgery is one of the most common operations performed both worldwide.[5] During the Covid-19 pandemic, patients with cataract which causes disruption in daily work, are mostly operated on. Patients with Covid-19 symptoms are not operated on. Asymptomatic patients are also tested in pandemic hospitals.

In this study, it was aimed to argue whether preoperative Covid-19 testing is necessary for elective cataract surgery in the light of prevalence findings and surgical cost analysis.

MATERIALS AND METHODS

This observational and cross-sectional study was performed at the Department of Ophthalmology of a tertiary care hospital in Turkey from January 1, 2020, to January 1, 2021. Firstly, ethics committee approval (Date: 09.12.2020, decision no: 356) and Scientific Research Platform of the Ministry of Health approval were obtained, and then the study was performed. This study adhered to the tenets of the Declaration of Helsinki. Written informed consent was obtained from all patients prior to enrollment in this study separately for the intervention and the Covid 19 RT-PCR testing. Patients with comorbid diseases such as uncontrolled hypertension and/or diabetes, pregnancy, heart disease, lung disease, or immunocompromised status were excluded from the study.

Patients who have been examined before and decided to the operation were called to the hospital 1 day before surgery. On this day, the Covid 19 questionnaire with questions about their systemic health condition (fever, cough, headache, myalgia, and throat pain) was taken from all patients. Travel history and any history of contact with Covid 19 positive patient or the symptomatic patient were questioned. Patients with symptoms or a history of contact were referred to the Department of Infectious Diseases and excluded from the study. The patient group that made up this study consisted of patients with asymptomatic and uncomplicated cataract surgery.

After each patient was placed in single rooms, the clinic technician with adequate personal protective equipment (PPE) collected oropharyngeal and nasopharyngeal swabs and transferred them to the laboratory in our hospital for RT PCR. The test was performed on SARS CoV-2 Double Gene RT-q PCR kits (Bio-Speedy®) using the CFX96 Real-Time System (Bio-Rad, USA). Tests resulted within 4 to 8 hours. The next day, phacoemulsification surgery under local anesthesia was performed on the patients with negative test results. An Infiniti Vision System device (Alcon Inc. Fort Worth, TX, USA) was used in all surgeries. In all surgeries, adequate PPE for all health care workers was used both in the clinic and the operation room. After each surgery; operation room tables, the lens of the operating microscope, and floors were cleaned. Standard and universal precautions have been followed. Patients with positive results were referred to the Department of Infectious Diseases. After treatment and with a negative report for SARS CoV 2 RT PCR, these patients were operated on.

Cost Analysis: A retrospective review of cataract surgeries performed at our institution was conducted over the three-months period (ie, January 1, 2020 - March 1, 2020). This represents our baseline control group outside of the Covid-19 pandemic period.

During the week of March 16, 2020, to June 1, 2020, our institution started to postpone all semi-elective procedures. On June 1, PCR testing for the SARS-CoV-2 virus became available for elective surgery patients and PCR testing was performed for all patients systematically. We performed a second review of cataract surgeries performed between June 1, 2020, and January 1, 2021. During this period all patients were tested within 24 hours before their planned cataract surgery. This represents our study group during the Covid-19 pandemic period.

The same materials were used in both the study group and the control group; Infiniti Vision System

device (Alcon Inc., Fort Worth, TX, USA), 2,2 mm clear corneal incision blade, MVR blade (BVI BEAVER VISITEC), viscoelastic materials (VEM); sodium hyaluronate 1.4% and 3% (protectalon, VSY Biotechnology), balanced salt solution (BSS OCROSOL, Polifarma), AcrySof® intraocular lens (Alcon), tropicamide 1% and cyclopentolate 1% for dilating pupil, sub-Tenon's block using lidocaine HCI 2% for local anesthesia, 10% povidone-iodine for sterilizing the skin, 5% povidone-iodine for sterilizing the ocular surface. After surgeries, all patients used topical moxifloxacin for 2 weeks and topical dexamethasone for 4 weeks.

The costs of surgeries were analyzed from hospital charges to third-party payers. The average cost of treatment was calculated based on the sum of the costs of hospital fees, laboratory fees, drugs fees, and equipment fees. The costs calculated in this study were generalized costs since they are standardized by third-party payers and the Turkish government.

The drugs used comprised topical moxifloxacin, topical dexamethasone, topical tropicamide 1%, topical cyclopentolate 1%, lidocaine HCI 2%, intracameral adrenaline, and intracameral cefuroxime (Aprokam®). The types of equipment was a phaco pack, surgical corneal knives (2.2 and MVR), ophthalmic drape, surgical glove and masks (classic surgery mask was used in the pre-pandemic period and FFP3 mask was used in the pandemic period), surgical gown (disposable surgical gown was used in the pandemic period and reusable surgical gown was used in the pre-pandemic period), intra-ocular lens, VEM (1.4%, 3%), eye closure pad, BSS, and syringes. The cost of services consisted of hospitalization fees and laboratory services (Hbs Ag, Anti-HCV, Anti-HIV, Anti-Hbs, and RT-PCR). All costs in this study were calculated in Turkish Liras (TL) and converted to United States Dollars (USD). The year and conversion rates were 2020 and 0.5, respectively (1 USD = 7.8TL).

Statistical Analysis: In this study, statistical analyses were done using SPSS (Version 22.0, SPSS Inc., Chicago, IL, USA, License: Hitit University) package program. Descriptive statistics were presented as mean ± standard deviation for normally distributed continuous data, median (min-max) for variables with non-normally distributed continuous data, and numbers and percentages (%) for categorical data. Normality distribution was examined by Kolmogorov – Smirnov and Shapiro-Wilk tests. The Student's t-test was used for the data that showed normal distribution in the mean comparisons of the study group and control group, and the Mann Whitney U test was used for non-normally distributed data. The Chi-square test was used for nominal variables. The statistical significance level was accepted as $p < 0.05$.

RESULTS

This study included 2 groups of cataract surgery patients who underwent phacoemulsification surgery; 200 patients were operated on before the Covid-19 pandemic (control group (47.96%)) and 217 patients were operated on during the Covid-19 pandemic period (study group (52.04%)). 132 (60.8%) of the patients were male and 85 (39.2%) were female in the study group. 115 (57.5%) of the patients were male and 85 (42.5%) were female in the control group. Gender distributions among the research groups were statistically similar (p:0.489). The mean age of the study group was 66.45±10.11 years (median: 68, min-max: 31-85, respectively) and the control group was 66.36±12.11 years (median:67.5, min-max:27-90, respectively). The average age of the groups was statistically similar (p:0.882). These findings are demonstrated in Table 1.

4 patients of 217 patients (study group) were found to have positive RT PCR for SARS CoV 2. The seroprevalence of the asymptomatic Covid 19 infection among all elective cataract surgery patients in our hospital was 1.8%. The patients with positive test results (4 patients) were asymptomatic. Two were women (ages were 47 years and 50 years) and two were men (ages were 77 years and 62 years) of four patients.

The costs of drugs, the cost of equipment, the costs of hospital fees, the cost of laboratory fees, and ave-

Table 1. Demographic properties of the study

Characteristic	Study group (n:217)	Control group (n: 200)	P value
Male-female distribution	132(60.8%)/85(39.2%)	115(57.5%)/85(42.5%)	NS*
Mean age, years	66.45 ± 10.11 median: 68 min-max: 31-85	66.36 ± 12.11 median: 67.5 min-max: 27-90	NS**
Operated eye (R/L)	100(46%)/117(54%)	94(47%)/106(53%)	NS*

*: Chi-square test, **: Student's t-test, NS: Not significant; R: right; L: left.

rage costs were 5.98 ± 0.33 USD, 96.70 ± 0.47, 7.07 ± 2.50 USD, 18.53 USD, 128.28 ± 2.61 USD, respectively, in the study group, while they were 5.94 ± 0.30 USD, 95.92 ± 0.52 USD, 5.75 ± 2.03 USD, 4.57 USD, and 112.18 ± 2.06 USD respectively, in the control group.

There were statistically significant differences between the groups according to the costs of hospital fees, the cost of equipment, the cost of laboratory fees, and average costs ($p<0.001$, respectively; Table 2). In addition, there was a statistical difference between the groups according to the length of hospital stay (p: 0.001; Table 2).

Table 2. The cost analysis and properties of the study and the control groups

Parameters	Study group N:217		Control group N:200		P-value
The length of hospital stays (days)	1.67±0.6		1.36±0.48		<0.001*
Cost of drugs (USD)	5.98±0.33		5.94±0.30		0.131*
Cost of equipment(USD)	96.70±0.47		95.92±0.52		<0.001*
Cost of hospital fees(USD)	7.07±2.50		5.75±2.03		<0.001*
Cost of laboratory fees(USD)	18.53		4.57		<0.001**
Average cost(USD)	128.28±2.61		112.18±2.06		<0.001*

*: Mann Whitney U test, **: Student's t-test, USD: United States Dollars

DISCUSSION AND CONCLUSION

In Turkey, the PCR method is used in the diagnosis of the Covid-19 according to the guidelines prepared by the Turkish Republic Ministry of Health. This test is only performed for patients with Covid-19 specific symptoms or a history of contact with Covid -19 patients and preoperatively.

In the study, we investigated the cataract surgery patients without any symptoms of Covid-19 and a history of contact with Covid-19 patients. We found that the seroprevalence of the disease among the patients was 1.8%. To the best of our knowledge, there were a few studies that reports the seroprevalence of asymptomatic Covid-19 infection among cataract surgery patients. According to our results, 1 patient was positive in 55 patients. Moreover, we investigated the economical effects of Covid-19 on cataract surgery and we compare the cost analysis of the cataract surgery between the Covid-19 period and before Covid-19. Our results showed that the Covid-19 increases the cost of cataract surgery. Covid-19 PCR testing and increased hospital stay are the main reasons that increase the costs of the surgery. Considering that cataract surgery is one of the most common surgeries in the world, it is seen that covid adds an extra cost to the health economy and therefore to the national economy.

Results regarding the prevalence of Covid-19 vary from region to region. For example, in a study conducted in the United Kingdom, Rivett et al. reported the seroprevalence of Covid-19 in 1032 asymptomatic healthcare workers as 3%.[6] A study from China that included 1015 asymptomatic participants, found the seroprevalence of the disease as 0.04%.[7] Clarke et al. studied the seroprevalence of Covid-19 in hemodialysis patients and they found the seroprevalence was 40.3% in asymptomatic patients.[8] In the study of Kim et al, performed in South Korea, detected the prevalence of asymptomatic Covid-19 infection was 19.2%.[9] Dong et al. studied the prevalence of Covid-19 in children in China, they reported that over 90% of pediatric Covid 19 patients were asymptomatic.[10] A systematic review and meta-analysis, according to the random-effects model, conducted by He et al. reported that seroprevalence of the disease was 0.28% in the elder population.[11]

In the literature, there are few studies investigating the seroprevalence of Covid-19 infection in asymptomatic surgery patients. A study from the United States of America, which investigated the seroprevalence of Covid-19 infection in asymptomatic preoperative/pre-procedure patients, reported the seroprevalence of the disease was 0.13%.[12] The most similar study was conducted in India by Kannan et al. They investigated the seroprevalence of the disease among elective vitreoretinal surgical patients. They reported that the prevalence rate of the asymptomatic Covid-19 infection was 2.2%.[13] Another similar study was conducted by Goel et al. They found the seroprevalence of the disease as 8.4% among 355 asymptomatic patients planned for cataract, squint, lid, lacrimal, and retinal surgery.[14] The other Department of Ophthalmology study was conducted by Alkhersan et al and they reported that one patient (0.88%) had a positive COVID-19 test among 117 patients.[15] Kaban et al. reported the seroprevalence of Covid-19 among gynecologic and obstetric patients in Turkey as 1.2%.[16] These results show us that seroprevalence of the disease is low among asymptomatic elective surgery patients.

Is there a consensus on whether PCR testing should

be performed routinely in elective surgery patients? Although there are various opinions on this topic, there is no consensus yet. For example, Nekkanti et al. investigated the seroprevalence of the disease among cancer patients. They reported the seroprevalence as 8.0% and they recommended the preoperative tests.[17] Kovoor et al. recommended preoperative tests to the surgery patients according to the results of their rapid review study.[18] In our literature search, we found only one article that recommended the preoperative tests for ophthalmic surgery patients.[14] The mean age of their study population was 36.5 years and it is well known that asymptomatic COVID-19 cases are common in young and middle-aged population.[19,20] In our study, the mean age was 66.45 years and it is expected that the asymptomatic COVID-19 cases are uncommon in the elder population.[11] On the other hand, the elder population has usually comorbid diseases and comorbid diseases make the situation more dramatic. The other suggestion, by National Institute for Health and Care Excellence guideline (United Kingdom), recommends preoperative testing in areas with high prevalence but in contrast, it is not recommended that preoperative testing in areas with low prevalence.[21]

It is well known that a significant part of people with COVID-19 positive is asymptomatic. The critical question at this point is: How many people have the potential to infect if asymptomatic patients reported to be positive are not treated? There is no definite answer to this question, but there are studies in the literature that can give some ideas. For example; Mahmood et al. reported that the risk of asymptomatic transmission of COVID-19 was low(transmission risks was 0.06%).[22] It is well known that asymptomatic population plays the most important role in the continuation of the pandemic and if these populations is not treated, the contagion will increase. In our study, four cataract patient was Covid 19 positive. If we consider that these patients infect many people, we can interpret that healthcare costs will increase even more. We think that continuing the preoperative test is useful for reducing transmission both in the hospital and outside the hospital (with isolation) . In addition, the isolation of people who have come into contact with asymptomatic individuals also reduces the spread of the disease and health expenditures. This is another benefit of the screening test. On the other hand, we believe that with vaccination, the seroprevalence of the disease will reduce and preoperative screening tests can be stopped according to the controlling of the disease. We think that each country should investigate the seroprevalence of the disease in asymptomatic population and they can create their own strategies.

In conclusion, our study is an important study that investigated the seroprevalence of the Covid-19 in asymptomatic cataract surgery patients. In addition, the mean age of our patients was 66.45 years and our study also gives data about the seroprevalence of Covid-19 in the elder population. Our results give an idea not only to the ophthalmology department but also to other surgical departments. In addition, to the best of our knowledge, this is the first study that investigated the cost effects of the disease on cataract surgery. We think that our results can give an idea to the experts on whether to perform preoperative tests or not. This study has some limitations. First, the study population is relatively small. Second, the seroprevalence of the disease may change according to the wave of the disease. Last, the seroprevalence of the disease may differ in different regions of the World and countries, so the statistical results may differ.

Ethics Committee Approval: Our study was approved by the Ethics Committee of Hitit University (Date: 09.12.2020, decision no: 356). The study was carried out in accordance with the international declaration, guideline, etc.

Conflict of Interest: No conflict of interest was declared by the authors.

Author Contributions: Concept – SC; Supervision – SC, MBÜ, TŞ; Materials – SC, MBÜ, TŞ; Data Collection and/or Processing – MBU, TŞ; Analysis and/or Interpretation – SC, MBÜ, TŞ; Writing –SC.

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REFERENCES

1. Horton R. Offline: COVID-19 and the NHS-"a national scandal". Lancet. 2020;395 (10229):1022.
2. COVIDSurg Collaborative. Elective surgery cancellations due to the COVID-19 pandemic: global predictive modelling to inform surgical recovery plans. Br J Surg. 2020;107(11):1440-1449.
3. American College of Surgeons. Joint Statement: Roadmap for Resuming Elective Surgery after COVID 19 Pandemic 2020. Available from: https://www.facs.org/covid 19/clinical guidance/ roadmap elective surgery. Accessed August 13, 2020.
4. Öner F. An Overview of otorhinolaryngology and head and neck surgery practice in COVID-19 pandemic. Anatolian Clinic the Journal of Medical Sciences. 2020;25(Special Issue 1):185-194.
5. Sharma B, Abell RG, Arora T, Antony T, Vajpayee RB. Techniques of anterior capsulotomy in cataract surgery. Indian J Ophthalmol. 2019;67(4):450-460.
6. Rivett L, Sridhar S, Sparkes D, et al. Screening of healthcare workers for SARS-CoV-2 highlig-

hts the role of asymptomatic carriage in COVID -19 transmission. Elife. 2020;9:e58728.
7. Ji T, Chen HL, Xu J, et al. Lockdown contained the spread of 2019 novel coronavirus disease in Huangshi city, China: early epidemiolo- gical findings. Clin Infect Dis. 2020;71(6):1454-1460
8. Clarke C, Prendecki M, Dhutia A, et al. High Prevalence of Asymptomatic COVID-19 Infection in Hemodialysis Patients Detected Using Serologic Screening. J Am Soc Nephrol. 2020;31(9):1969-1975.
9. Kim GU, Kim MJ, Ra SH, et al. Clinical characteristics of asymptomatic and symptomatic patients with mild COVID-19. Clin Microbiol Infect. 2020;26(7):948.e1-948.e3.
10. Dong Y, Mo X, Hu Y, et al. Epidemiology of COVID-19 among children in China. Pediatrics. 2020;145(6):e20200702.
11. He J, Guo Y, Mao R, Zhang J. Proportion of asymptomatic coronavirus disease 2019: A systematic review and meta-analysis. J Med Virol. 2021;93(2):820-830.
12. Singer JS, Cheng EM, Murad DA, et al. Low prevalence (0.13%) of COVID-19 infection in asymptomatic pre-operative/pre-procedure patients at a large, academic medical center informs approaches to perioperative care. Surgery. 2020;168(6):980-986.
13. Kannan NB, Sen S, Reddy H, Kumar K, Rajan RP, Ramasamy K. Preoperative COVID-19 testing for elective vitreoretinal surgeries: Experience from a major tertiary care institute in South India. Indian J Ophthalmol. 2020;68 (11):2373-2377.
14. Goel R, Arora R, Khanam S, Saxena S, Manchanda V, Pumma P. Is it essential to perform COVID-19 testing prior to ophthalmic procedures?. Indian J Ophthalmol. 2020;68(11):2335-2337.
15. Al-Khersan H, Kalavar MA, Tanenbaum R, et al. Emergent Ophthalmic Surgical Care at a Tertiary Referral Center During the COVID-19 Pandemic. Am J Ophthalmol. 2021;222:368-372.
16. Kaban I, Bacanakgil BH. COVID-19 RT-PCR Test Results of Preoperative Gynecologic and Obstetric Patients in a Pandemic Hospital in Istanbul. Crescent Journal of Medical and Biological Sciences. 2021;8(2):90-92.
17. Nekkanti SS, Vasudevan Nair S, Parmar V, et al. Mandatory preoperative COVID-19 testing for cancer patients-Is it justified? J Surg Oncol. 2020;122(7):1288-1292.
18. Kovoor JG, Tivey DR, Williamson P, et al. Screening and testing for COVID-19 before surgery. ANZ J Surg. 2020;90(10):1845-1856.
19. Hu Z, Song C, Xu C, et al. Clinical characteristics of 24 asymptomatic infections with COVID-19 screened among close contacts in Nanjing, China. Sci China Life Sci. 2020;63:706–11.
20. Wang Y, Liu Y, Liu L, Wang X, Luo N, Li L. Clinical outcomes in 55 patients with Severe acute respiratory syndrome Coronavirus- 2 who were asymptomatic at hospital admission in Shenzhen, China. J Infect Dis. 2020;221:1770–4.
21. COVID-19 rapid guideline: arranging planned care in hospitals and diagnostic services. London: National Institute for Health and Care Excellence (UK); 2020 Jul 27. (NICE Guideline, No. 179.). https://www.nice.org.uk/guidance/ng179/resources/covid19-rapid-guideline-arranging-planned-care-in-hospitals-and-diagnostic-services-pdf-66141969613765. Accessed July 27, 2020.
22. Mahmood M, Ilyas NU, Khan MF, Hasrat MN, Richwagen N. Transmission frequency of COVID-19 through pre-symptomatic and asymptomatic patients in AJK: a report of 201 cases. Virol J. 2021 Jul 3;18(1):138.