

Impact of COVID-19 Pandemics in Patients Submitted to Glaucoma Surgery: A 3-Year Comparative Report in a Hospital Center

Impacto da Pandemia por COVID-19 nos Doentes Submetidos a Cirurgia de Glaucoma: Um Estudo Comparativo de 3 Anos num Centro Hospitalar

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ABSTRACT

INTRODUCTION: COVID-19 pandemics forced the reorganization of healthcare systems in order to provide care for ill patients infected with the novel coronavirus. Ophthalmology departments had to reduce elective procedures with mobilization of resources for non-ophthalmological purposes.

This study aims to describe the glaucoma surgical volume during the pandemic year and to compare with the pre-pandemic and post-pandemic period.

METHODS: A retrospective study was conducted at Hospital Pedro Hispano, Portugal, collecting glaucoma surgery characteristics and patient clinical and demographic data, from clinical records, from a 3-year period, between 18 March 2019 and 17 March 2022. Demographic data such as age and gender and clinical data such as glaucoma type, glaucoma surgical procedure and type of anesthesia, glaucoma staging based on Advanced Glaucoma Intervention Study (AGIS) visual score, in dB, and pre procedure intraocular pressure (IOP), in mmHg, were collected and analyzed. The primary outcomes included MD (mean deviation), IOP measured pre procedure and the number of procedures performed. The type of procedures performed was considered a secondary outcome.

Three groups were analyzed and compared: the pandemic period (between 18 March 2020 and 17 March 2021), the pre-pandemic period (homologous period between 2019 and 2020) and the post-pandemic period (homologous period between 2021 and 2022).

RESULTS: The number of total glaucoma surgeries performed during the pandemic period was similar to the pre-pandemic period, where 79 and 78 glaucoma surgeries were performed respectively. In the post-pandemic period there was an increase of 45.6% in the total glaucoma surgeries that were executed at our center resulting in 115 surgeries performed.

During the first quarter of the pandemic period there was a reduction of 36% in glaucoma surgeries performed in comparison with the same period in the previous year, where a gradual increment of the number of surgeries performed was observed in the following quarters.

The mean pre procedure IOP in the pandemic period was 23.8 (\pm 9.26) mmHg, a variation of +0.42% from the pre-pandemic group with a mean value of 23.7 (\pm 10.1) mmHg ($p=0.475$). The vari-

ation between the post-pandemic [± 24.6 (± 9.5) mmHg] and the pandemic period pre procedure IOP was +3.25% ($p=0.638$). Significance level was set as $p<0.05$.

Regarding the glaucoma staging, the mean MD in patients who underwent glaucoma surgery in the pandemic period was -14.1 dB, with a variation of -1.42% from the pre-pandemic group ($p=0.796$), -2.76% was the variation from the post-pandemic group comparing with the pandemic group ($p=0.813$).

CONCLUSION: The total number of surgeries performed at our center during the pandemic period was similar to the number performed in pre-pandemic homologous period. There was no statistically significant difference in the mean pre procedure IOP and MD of patients that were submitted to glaucoma surgery during the pandemic period in comparison with those submitted to the same type of surgery during the pre-pandemic or post-pandemic period. It is, then, possible to conclude that, besides the necessary reorganization of healthcare systems due to COVID-19 pandemics, no significant changes were made on glaucoma patients with indication of surgery.

KEYWORDS: COVID-19; Glaucoma/surgery; Intraocular Pressure.

RESUMO

INTRODUÇÃO: A pandemia por COVID-19 forçou uma reorganização dos sistemas de saúde de forma a providenciar cuidados de saúde a doentes infetados pelo novo coronavírus. Os departamentos de oftalmologia foram obrigados a reduzir procedimentos eletivos com a mobilização de recursos para fins não oftalmológicos.

Este estudo tem como objetivo principal descrever o volume de cirurgia de glaucoma durante período pandémico e comparar com o período pré e pós pandémico.

MÉTODOS: Foi realizado um estudo retrospectivo no Hospital Pedro Hispano, Portugal, onde foram colhidas informações, a partir dos processos clínicos dos doentes, relativamente às características das cirurgias de glaucoma realizadas e à caracterização demográfica e clínica dos doentes submetidos às mesmas durante um período de 3 anos, de 18 de março de 2019 a 17 de março de 2022. A caracterização demográfica incluiu a idade e o género. No que concerne a caracterização clínica, foram incluídos o tipo de glaucoma, cirurgia de glaucoma realizada e tipo de anestesia, estadio do glaucoma com base no *Advanced Glaucoma Intervention Study* (AGIS) *visual score*, em dB, e pressão intraocular (PIO) pré procedimento, em mmHg. Os parâmetros principais considerados para análise consistiram no desvio médio (MD), PIO pré procedimento e o número de cirurgias realizado. O tipo de cirurgia realizada foi considerado parâmetro secundário. Foram analisados e comparados 3 grupos: o período pandémico (entre 18 de março de 2020 e 17 de março de 2021), período pré-pandémico (período homólogo em 2019/2020) e período pós-pandémico (período homólogo em 2021/2022)

RESULTADOS: O número total de cirurgias de glaucoma realizadas durante o período pandémico foi similar ao período pré pandémico, tendo sido realizadas 79 e 78 cirurgias de glaucoma respetivamente. No período pós-pandémico foram realizadas 115 cirurgias, resultando num aumento de 45,6% no número total de cirurgias de glaucoma realizadas no nosso centro relativamente ao período pandémico.

Durante o primeiro trimestre do período pandémico foi verificada uma diminuição de 36% no número total de cirurgias realizadas em relação ao mesmo período do ano prévio, havendo um incremento gradual do número de cirurgias realizado nos restantes trimestres do período em questão.

O valor médio de PIO pré procedimento foi de 23,8 ($\pm 9,26$) mmHg durante o período pandémico, resultando numa variação de +0,42% em relação ao período pré pandémico, com um valor médio de PIO de 23,7 ($\pm 10,1$) mmHg ($p=0,475$). A variação entre o período pós-pandémico, com um valor médio de 24,6 ($\pm 9,5$) mmHg, e o período pandémico resultou num aumento de +3,25% no valor médio de PIO pré procedimento ($p=0,638$). O valor de p foi considerado estatisticamente significativo se $p<0,05$.

Relativamente ao estadio do glaucoma, o MD médio dos doentes submetidos a cirurgia de glaucoma durante o período pandémico foi -14,1 dD, com uma variação de -1,42% em relação ao

período pré-pandémico ($p=0,796$), relativamente à variação do MD entre o grupo pós-pandémico e o grupo pandémico obtivemos um valor de $-2,76\%$ ($p=0,813$).

CONCLUSÃO: O número total de cirurgias realizadas no nosso centro durante o período pandémico foi semelhante ao período pré-pandémico. Não foi observada diferença estatisticamente significativa entre PIO média e MD pré procedimento dos doentes submetidos a cirurgia de glaucoma durante o período pandémico em comparação com o período pré ou pós pandémico. É possível concluir que, apesar da forte pressão sentida pelos sistemas de saúde durante o período pandémico, não foram registadas alterações significativas na gestão de doentes com patologia glaucomatosa com indicação cirúrgica.

PALAVRAS-CHAVE: COVID-19; Glaucoma/cirurgia; Pressão Intraocular.

INTRODUCTION

The World Health Organization (WHO) has declared the novel coronavirus a pandemic on 11 March 2020,¹ by that time, in Portugal, there was 59 confirmed COVID-19 patients. On 18 March 2020 state of emergency was declared.² In response for this healthcare crisis, the healthcare systems were forced to reorganize, prioritizing the treatment and monitoring of COVID-19 ill patients.

There was a required reduction in the activity of ophthalmology departments with the adjournment of all non-urgent activities. In response to the pandemic, the American Academy of Ophthalmology has collected a list of emergent and urgent ophthalmologic procedures, where the different types of glaucoma surgery were present in case of medically uncontrolled intraocular pressure that was sight-threatening.³

Therefore, especially during the first wave of COVID-19, there was a mobilization of either healthcare professionals or recovery rooms from the operating rooms for the hospitalization and treatment of COVID-19 patients.

The aim of this study was to describe the glaucoma surgical volume of a Portuguese ophthalmological department during the pandemic year and to compare those with the pre-pandemic and post-pandemic year.

METHODS

A retrospective review of all glaucoma surgeries performed was conducted at Hospital Pedro Hispano (in Portugal) from 18 March 2019 to 17 March 2022. The period from 18 March 2020 to 17 March 2021, considered “pandemic”, was compared with the homologous period in 2019/2020, considered “pre-pandemic” and in 2021/2022, considered “post-pandemic”.

Demographic data such as age and gender and clinical data such as glaucoma type, glaucoma surgical procedure and type of anesthesia, glaucoma staging based on the Advanced Glaucoma Intervention Study (AGIS) visual score^{4,5} (mean deviation (MD), in dB, given by 24-2 SITA Standard visual field tests, Humphrey® Field Analyzer) and pre pro-

cedure intraocular pressure (IOP), in mmHg, was collected and analyzed. Each year was divided into quarters (Q1, Q2, Q3 and Q4) and comparison between the 3 periods was made. The primary outcomes included MD, IOP measured pre procedure and the number of procedures performed. The type of procedures performed was considered a secondary outcome.

Statistical analyses were performed using SPSS Statistics for MacOS, version 29.0 (SPSS Inc., Chicago, Ill., USA). Descriptive statistics of each variable were reported. Shapiro-Wilk and Kolmogorov-Smirnov tests were conducted to access the normality of data. Mann-Whitney U test was used to compare quantitative variables between the periods. Significance level was set as $p<0.05$.

RESULTS

DEMOGRAPHIC DATA

Average age of patients having glaucoma surgery was 71.3 (± 8.4), 68.8 (± 12.2) and 71.3 (± 10.5) respectively in the pre-pandemic, pandemic and post-pandemic period. A percentage of 60% of the patients who underwent glaucoma surgery in the pandemic period were females, 54.2% during the pre-pandemic period and 48.7% during the pandemic period.

CLINICAL DATA

Between 18 March 2020 and 17 March 2021, 79 glaucoma surgeries were performed comparing with 78 procedures the previous year. The following year, 115 surgeries were performed, which accounted for a 45.6% increase comparing with the pandemic group.

The main glaucoma type in all 3 groups analyzed (pre-pandemic, pandemic and post-pandemic), shown in Fig. 1, was primary open angle glaucoma (POAG) with 33 (42.3%), 27 (34.2%) and 48 (41.7%) respectively, with pseudoexfoliation glaucoma (GPEX) being the second most described in all 3 groups [26 (33.3%), 15 (19%) and 25 (21.7%) respectively].

Demographic and clinical data of patients submitted to glaucoma surgery in this 3-year period report is shown in Table 1.

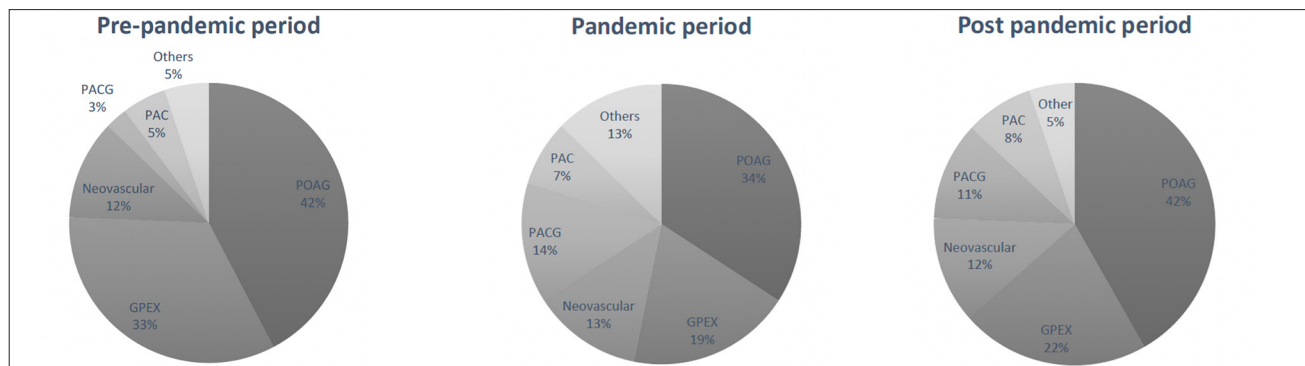


Figure 1. Classification of glaucoma type.

Table 1. Comparison of demographic and clinical characteristics of patients having glaucoma surgery.

	Pre-pandemic	Pandemic	Variation (%)	Post-pandemic	Variation (%)
Procedures, <i>n</i>	78	79	+1.3	115	+45.6
Eyes, <i>n</i>	72	75	+4.2	105	+40
Females, <i>n</i> (%)	39 (54.2)	45 (60)	+5.8	56 (48.7)	+24
Age, mean (SD)	71.3 (8.4)	68.8 (12.2)	-3.5	71.3 (10.5)	+3.5
Reoperations, <i>n</i> (%)	6 (7.7)	4 (5.1)	-2.6	10 (8.7)	+3.6
General anesthesia, <i>n</i> (%)	8 (10.3)	7 (8.9)	-1.4	16 (14.3)	+5.4
<i>Glaucoma type, n (%)</i>					
POAG	33 (42.3)	27 (34.2)	-8.1	48 (41.7)	+7.5
GPEX	26 (33.3)	15 (19)	-14.3	25 (21.7)	+2.7
Neovascular	9 (11.5)	10 (12.7)	+1.2	14 (12.2)	-0.5
PACG	2 (2.5)	11 (13)	+10.5	13 (11.3)	-1.7
PAC	4 (5.1)	6 (7.6)	+2.5	9 (7.8)	+0.2
Others*	4 (5.1)	10 (12.7)	+7.6	6 (5.2)	-7.5

*Pigmentary, FAP, uveitic, steroid-induced, post-trauma.

POAG: primary open angle glaucoma; GPEX: pseudoexfoliation glaucoma; PACG: primary angle closure glaucoma; PAC: primary angle closure; FAP: trans-thyretin familial amyloid polyneuropathy.

Fig. 2 shows the variation of number of glaucoma surgery per quarter of year. A reduction of surgeries of 36% in Q1 was observed between the pre-pandemic group and the pandemic group. In the later 3 quarters there was a subsequent increase in the number of procedures performed in the pandemic period (+100%, +33.3% and +16.7%).

Between the pandemic group and the post-pandemic group, there was an increment of 3 times and 1.5 times the number of surgeries performed in Q1 and Q2 respectively.

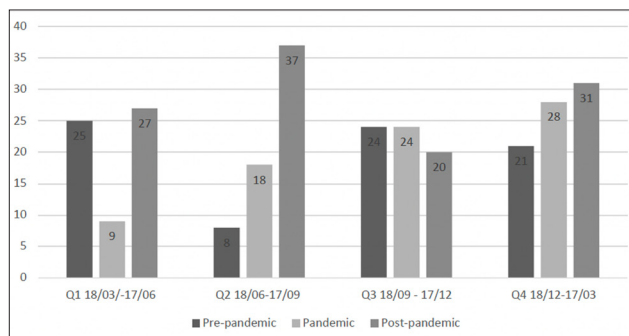


Figure 2. Comparison of number of procedures (*n*).

*Q1: first quarter, Q2: second quarter, Q3: third quarter, Q4: fourth quarter

In the later 2 quarters of the year, comparing with the pandemic group, the variation in the number of surgeries in Q3 was 0 (0%) and -4 (-16.7%) for the pre-pandemic and post-pandemic group respectively. In Q4 the variation was -7 (-14.3%) and +3 (+10.7%) respectively.

Table 2 illustrates the different types of surgeries performed in the three different periods. Ahmed valve implantation occurred in 19 procedures during the pandemic period, having an increase of 13.8% (+11) comparing with the pre-pandemic period, and a drop of 10.2% (-3) in the post-pandemic period. Trabeculectomy was performed in 5 surgeries (6.3%), with a decrease in 6.5% comparing with the pre-pandemic period (-5), on the post-pandemic there was an increase in 0.2% (+2). Non-penetrating deep sclerectomy (NDS) was the most performed procedure in all 3 periods in study, 41.8% of the surgeries performed in the pandemic time were NDS, with a decrease in 12.1% comparing with the pre-pandemic period, and an increase in 5.2% in the post-pandemic period.

No Kahook Dual Blade® goniotomy was performed during the pandemic period, which represented a decrease in 2.56% in comparison with the pre-pandemic group, on the post-pandemic group there was a 0.1% increase in this procedure.

Table 2. Comparison of glaucoma surgeries.

	Pre-pandemic	Pandemic	Variation (%)	Post-pandemic	Variation (%)
Procedures, n (%)					
Ahmed valve	8 (10.3)	19 (24.1)	+13.8	16 (13.9)	-10.2
Trabeculectomy	10 (12.9)	5 (6.3)	-6.5	7 (6.1)	+0.2
NDS	42 (53.9)	33 (41.8)	-12.1	54 (47.0)	+5.2
KDB goniotomy	2 (2.56)	0 (0)	-2.56	2 (1.7)	+1.7
Cyclocryotherapy	3 (3.85)	4 (5.1)	+1.25	6 (5.2)	+0.1
Cyclophotocoagulation	2 (2.56)	3 (3.8)	-1.24	3 (2.61)	-1.19
Phacoemulsification for narrow-angle	5 (6.41)	11 (13.9)	+7.49	17 (14.8)	+0.9
Ahmed valve revision	2 (2.56)	2 (2.5)	-0.06	5 (4.3)	+1.8
Trabeculectomy revision	2 (2.56)	0 (0)	-2.56	0 (0)	0
NDS revision	2 (2.56)	2 (2.5)	-0.06	4 (3.5)	+1
Ahmed valve explantation	0 (0)	0 (0)	0	1 (0.9)	+0.9
Combined surgery	45 (57.7)	21 (26.6)	-31.1	44 (38.3)	+11.7

NDS: non-penetrating deep sclerectomy; KDB: Kahook Dual Blade®.

Table 3. Comparison of pre procedure IOP and MD.

	Pre-pandemic	Pandemic	Variation (%)	<i>p</i>	Post-pandemic	Variation (%)	<i>p</i>
IOP (mmHg), mean (SD)	23.7 (10.1)	23.8 (9.26)	+0.42	0.475	24.6 (9.5)	+3.25	0.638
MD (dB), mean (SD)	-13.9 (7.7)	-14.1 (9.2)	-1.42	0.796	-14.5 (9.1)	-2.76	0.813

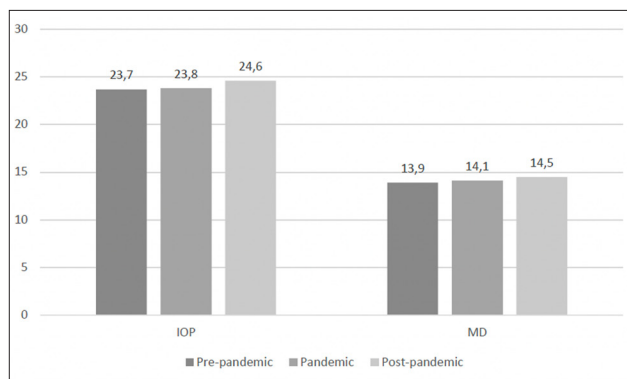


Figure 3. Comparison of pre procedure IOP and MD per period.

The number of combined surgeries (phacoemulsification and glaucoma surgery) was 26.6% of the total procedures done in the pandemic group, which had a reduction in 31.1% in comparison with the pre-pandemic group. In the post-pandemic period there was an increase in 11.7% the number of combined surgeries.

Table 3 and Fig. 3 demonstrate the variation in the mean pre procedure IOP and MD between the 3 groups subject to the study. The mean pre procedure IOP in the pandemic period was 23.8 mmHg, a variation of +0.42% from the pre-pandemic group ($p=0.475$), in the post-pandemic group the mean pre procedure IOP variation was 24.6 mmHg with a variation of +3.25% ($p=0.638$).

Regarding the glaucoma staging, the mean MD in patients who underwent glaucoma surgery in the pandemic period was -14.1 dB, with a variation of -1.42% from the pre-pandemic group ($p=0.796$). The mean MD in the post-

pandemic group was -14.5 dB, with a variation of -2.76% from the pandemic group ($p=0.813$).

DISCUSSION

This study was designed to access the impact of COVID-19 pandemics in the surgical management of glaucoma patients at our center.

Following the recommendation of the American Academy of Ophthalmology,³ glaucoma surgery was prioritized as being an urgent surgery, therefore there was no reduction in the total number of glaucoma surgeries performed during the pandemic period comparing with the previous year, which was a different finding from Longo *et al*⁶ study, where a glaucoma surgery volume drop of 30.1% was observed comparing the pandemic period to the homologous period the year before. Moreover, in the following post-pandemic year there was an increase by 45.6% in the total number of glaucoma surgeries performed.

In the first quarter of the pandemic year there was a reduction of 36% in the number of glaucoma surgeries in comparison with the previous pre-pandemic year, which was consistent with the mobilization of healthcare professionals for providing care to COVID-19 patients.

By the second quarter of the pandemic year there was a rise in the number of procedures done at our center, probably due to the reduction of COVID-19 patients hospitalization and resume of normal duties in the Ophthalmology Department.

During the 3-year surgical programme the type and frequency of each surgical procedure adopted were similar between the 3 periods in study, although the Ahmed valve implantation had a rising in about 13.8% during the

pandemic period in favour of non-penetrating procedures. This rising can be explained by a larger number of patients submitted to surgery with glaucoma secondary to transslyretin familial amyloid polyneuropathy (FAP) during the pandemic period. Glaucoma related to FAP is a severe type of glaucoma and a challenging surgical choice, Ahmed valve implantation has been found as an effective and relatively safe option.⁷

Although, Ahmed valve implantation is a procedure with a stronger association with postoperative complications (such as immediate hypotony) than non-penetrating procedures,^{8,9} which requires a closer follow up after the surgery. Despite the pandemic restraints post-surgical patients still had good follow-up care during the months following the surgery.

The mean pre procedure IOP and MD, did not show a statistically significant difference between the pre-pandemic and pandemic period, nor the pandemic and post-pandemic period, that was due very likely because of not having a significant decrease in the number of glaucoma surgeries performed during the pandemic period.

This study is the first to investigate the impact of the COVID-19 pandemic on patients undergoing glaucoma surgery in Portugal, however it had several limitations: being a retrospective study, it has a selection bias that it is not possible to overcome, moreover, as a single center study, the surgical practices may be conditioned by the surgeons' techniques, which can vary from other centers. It is important to mention that the study involved a comprehensive assessment of IOP and MD, but it should be noted that the results of these parameters may be influenced by additional factors, including the type and stage of glaucoma, as well as the specific surgical procedures utilized. It is also important to note that subgroup analyses were not conducted in this study.

CONCLUSION

Our study found that despite the challenges posed by the COVID-19 pandemic, our center experienced no significant impact on the volume and characteristics of glaucoma surgeries performed, indicating the ability and effectiveness of our institution to adapt and continue delivering essential care to patients with glaucoma.

There was no statistically significant difference in the mean pre procedure IOP and MD of patients that were submitted to glaucoma surgery during the pandemic period in comparison with those submitted to surgery during the pre-pandemic or post-pandemic period.

The number of surgeries performed at our center during the pandemic period was similar to the number performed in pre-pandemic homologous period.

CONTRIBUTORSHIP STATEMENT / DECLARAÇÃO DE CONTRIBUIÇÃO:

ARS: Data collection and analysis, conceptualization

and original manuscript creation.

RG, PT: Supervision, manuscript revision.

RB, RCB, ARV: Data collection and analysis.

RESPONSABILIDADES ÉTICAS

Conflitos de Interesse: Os autores declaram a inexistência de conflitos de interesse na realização do presente trabalho.

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Confidencialidade dos Dados: Os autores declaram ter seguido os protocolos da sua instituição acerca da publicação dos dados de doentes.

Proteção de Pessoas e Animais: Os autores declaram que os procedimentos seguidos estavam de acordo com os regulamentos estabelecidos pela Comissão de Ética responsável e de acordo com a Declaração de Helsínquia revista em 2013 e da Associação Médica Mundial.

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ETHICAL DISCLOSURES

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Confidentiality of Data: The authors declare that they have followed the protocols of their work center on the publication of data from patients.

Protection of Human and Animal Subjects: The authors declare that the procedures followed were in accordance with the regulations of the relevant clinical research ethics committee and with those of the Code of Ethics of the World Medical Association (Declaration of Helsinki as revised in 2013).

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