Ocular Surface & Tear Film Changes in Patients Undergoing Small Incision Cataract Surgery - A Hospital Based Prospective Clinical Study in South Kerala

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ABSTRACT

BACKGROUND

Dry eye is an important factor affecting the quality of life especially elderly. The major cause of adult blindness in India is cataract. After cataract surgery many are beleaguered by dry eye symptoms. Since small incision cataract surgery remains the most commonly performed surgical procedure for cataract in India the ocular surface and tear film changes occurring in patients after cataract surgery in our hospital was studied.

METHODS

A prospective observational study was conducted among 120 patients who underwent uncomplicated cataract surgery at RIO, Thiruvananthapuram for a period of 12 months from July 2019 - June 2020 to assess the changes that occur in ocular surface and tear film after small incision cataract surgery. The dry eye status was measured using Schirmer tests, tear film breakup time, tear film height, fluorescein and lissamine green staining and finally graded using OSDI score. The score was assessed preoperatively & postoperatively at 1 week, 4 weeks & 12 weeks.

RESULTS

Pre & postoperative OSDI score showed that 1 week after surgery only 5 % patients remained with no dry eye changes. 4 weeks after the surgery mild dry eye was found in 35 %, moderate dry eye in 40 % & severe dry eye in 23 % patients. 12 weeks after surgery mild dry eye was found in 53.3 %, moderate in 33.3 % & severe in 1.7 %. The occurrence of dry eye was seen to increase 1wk postoperatively & peak around 4weeks postoperatively.

CONCLUSIONS

Small incision cataract surgery induces significant dry eye changes in patients whose ocular surface & tear film was normal preoperatively. The dry eye changes were noted to worsen maximum at 4 weeks after surgery & these changes persisted in low grade even at 12 weeks after surgery.

KEYWORDS

Dry Eyes, Small Incision Cataract Surgery (SICS), OSDI (Ocular Surface Disease Index) Score

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BACKGROUND

Dry eye syndrome is a leading cause of ocular discomfort affecting millions of people worldwide and it has been reported as one of the important factors influencing the quality of life.[1] According to the WHO, in South Asia including India it is estimated that 51 % of blindness is due to cataract.[2] The incidence of dry eye after SICS range from 33.8 % to 66.2 %.[3] This includes a spectrum of disorders with varied clinical presentations ranging from mild eye strain to very severe dry eyes with sight threatening complications.[4] The incidence of dry eye in patients presenting with ocular surface symptoms in ophthalmology OPD was seen to be around 63.6% with a male to female ratio of 1:3.5.[5] Dry eye has become one of the most important factors influencing quality of life in the elderly population.[6] Affected individuals may experience many secondary symptoms associated with dry eye such as foreign body sensation, grittiness, itching, irritation, mucus secretion, ocular fatigue and redness of eyes.[7] Patients with dry eyes are extremely sensitive to their environment and the symptoms usually increase in polluted conditions and dry weather conditions of low humidity. The diagnosis and treatment of tear deficiencies can prove to be extremely challenging to the ophthalmologists. The therapeutic goal is control of the disease process in order to preserve vision and to provide comfort. Cataract is the most common cause of blindness worldwide in elderly.[8] Cataract surgery has given innumerable persons good visual acuity, but many are beleaguered by dry eye after the procedure.[9] After cataract surgery, these symptoms frequently occur and persist in some patients until effective treatment is adopted.[10,11,12] Cataract surgery result in damage to innervations to lacrimal gland, conjunctiva, lacrimal gland, and goblet cells. Since small incision cataract surgery remains the most commonly performed surgical procedure for the removal of cataract in our setting and because there are many factors that might affect the ocular surface environment after cataract surgery, the ocular surface and tear film changes occurring in patients after cataract surgery was studied.

Objectives

The aim of the study was to assess the changes in ocular surface and tear film in patients undergoing small incision cataract surgery in a tertiary eye care centre. The study also aimed at determining the association of demographic, therapeutic (antihypertensive medications) and systemic factors (diabetes mellitus) on these ocular surface and tear film changes.

METHODS

The study design was that of a prospective observational type. The study was conducted among 120 patients who underwent uncomplicated cataract surgery at RIO, Thiruvananthapuram for a period of 12 months starting from July 2019 to June 2020. Patients who require cataract surgery in the opposite eye during the period of study, patients with established dry eye or on treatment for dry eye, patients with history of prior ocular surgery, those on prolonged topical medications, those with history of contact lens use, history of ocular trauma in the past, history of drug allergy and those who developed postoperative uveitis were excluded from the study. The sample size was calculated using open epi software with expected prevalence as 61% with an absolute precision of 9% for a 95% confidence interval. The study was started after obtaining clearance from ethical committee (IEC No-031 / HEC / RIOTVPM / 2019). Written informed consent was obtained from all patients. Socio demographic details of the patients was noted. History of any systemic illness, drug intake, any ocular complaints also noted. This was followed by dry evaluation consisting of detailed anterior segment examination using slit lamp biomicroscopy along with Schirmer test, tear film breakup time, tear film height, lissamine green staining and fluorescein staining.

Dry eye status was determined using OSDI Score. The score is based on 4 parameters. Individual scores were given for tear film breakup time, lissamine green staining, fluorescein staining and Schirmer value. The amount of wetting in the Schirmer strip was measured in millimetres and scored. After fluorescein was instilled, slit lamp examination was done and the tear film breakup time was noted using cobalt blue filter. The time taken for the first dry spot to appear was recorded. The test was repeated 3 times and the average of the three values taken. Under the slit lamp conjunctiva and cornea was examined for any staining pattern after the tear film was stained with fluorescein and lissamine green. With fluorescein if punctuate staining was identified a score of 1 was given. Finally, from the above four parameters total score was calculated and the dry eye status was further categorised as mild moderate and severe as shown in the table below.

Scoring System (OSDI Score)

Schirmer Value Score
< 5mm – 2, 5 -10 mm – 1, > 10 mm - 0

Fluorescein Staining
Punctate staining - + 1, Absent - 0

BUT (Seconds) Score
5-10 – 4, 11-15 – 3, 16-20 – 2, 21-25 – 1, > 25 - 0

Lissamine Green Staining
Nasal conjunctival staining, temporal conjunctival staining/ corneal staining.
Any one present – 1, Any two present – 2, All present – 3

Dry Eye Status Score
Mild- 1 - 3
Moderate- 4 - 6
Severe- 7 - 10

All these tests were done two days prior to the surgery and repeated 1 week, 4 weeks and 12 weeks after the surgery. The results obtained from this score was compared

& analysed using SPSS version 27. The effect of age, sex, menopause, diabetes & systemic drug intake on these ocular surface changes were analysed

Statistical Analysis

Data analysed using computer software SPSS version 27. Data is expressed in its frequency and percentage as well as mean and standard deviation. To elucidate the associations and comparisons between different parameters, Chi square (x^2) test as nonparametric test was used. Student's t-test was used to compare mean values between two groups. Analysis of variance (repeated measures anova) test was used to compare different variables.

RESULTS

This study included 120 patients who underwent uncomplicated cataract surgery at RIO, Thiruvananthapuram. Most of our patients (36.7 %) were in the age group 60 - 69.26 % patients were in the age group 70 - 79. There were 62 males & 58 females. 66.7 %of the patients had no systemic drug intake. 10 % of them had antihypertensive intake. 10 % include patients with antihypertensive and diuretic intake. 10 % were patients with antihypertensive & other drug intake. 25 % of our patients were diabetics & only 5 % had thyroid dysfunction.

In the preoperative dry eye assessment 42 % of the patients with moderate dry eye were in the age group 70 & 79 yrs. 39.1 %of patients with moderate dry eye & 35.1 %with mild dry eye were in the age group 60 - 69 at 1 week. At 4 weeks interval 50 % of the patients with severe dry eye & 30 % with moderate dry eye were in 60 - 69. At 12 weeks interval 33 % with moderate dry eye & 39 % with mild dry eye were in 60 - 69 years age group. Only 2 patients in our study remained with severe dry eye at 12 weeks after surgery. Both of them were in the age group 70 - 79. Chi square test also revealed a very significant p value of < .001. Hence, we inferred progression of dry eye after cataract surgery was on the higher side as age advances. Also, the persistence& severity of dry eye even after 3 months of cataract surgery was also noted to be higher in older age group. Regarding the correlation with diabetes Chi square test revealed a statistical significance (p value < .01) between the 2 groups only at 1 month interval after the surgery. There was no statistical significance noted at 1 week & 12 weeks after surgery (p value > 0.05). Hence diabetes can be considered as a risk factor which aggravated dry eye at I month postoperative. 42.9 % of patients with antihypertensive and systemic drug intake had preoperative dry eye. But in our study the influence of these drugs which usually contributes to dry eye has not shown to influence the severity or progression postoperatively. The reason may be due to the small group of patients with systemic drug intake in our study. The association between OSDI score & menopause showed 93.3 % of patients with moderate dry eye at 1 week, all patients with severe dry eye at 4 weeks & 2 of the patients with severe changes 3 months after surgery were females who attained menopause (p value < .01). Hence menopause can be considered as a factor contributing to progression & severity of dry eye after surgery. All the parameters used to assess dry eye except Schirmer showed significant change (p < .001) at 1 week & 4 weeks postoperatively& maximum change noted at 1 month. In our study we found tear film breakup time & tear film height along with staining methods as useful & better indices than Schirmer tests in detecting dry eye.

Majority of those who had no dry eye preoperatively persisted with mild dry eye changes at 3 months after SICS. Half of those with mild dry eye persisted with same changes& half changed to moderate dry eye at 3 months interval. Those who had pre-existing moderate dry eye only 14 % persisted with severe changes & majority retained the same status. The OSDI score prior to surgery showed a mean value of 1.5 with a Standard deviation (SD) of +1.5. At one week after the surgery the mean value had changed to 2.98 + 1.68. At 4 weeks postoperatively the mean value was 4.55 + 1.91. 12 weeks after the surgery the mean value was 2.8 + 1.92. p value is < .001 which indicates that the change in OSDI score after the surgery is statistically highly significant. Figure 1 showing the association between severity of dry eye in patients at different intervals of evaluation preoperatively and postoperatively. Figure 2 denotes the mean values of the various dry eye evaluation methods between the operated & non operated eyes 1 week postoperatively. Fig 3 denotes the mean values of various dry eye evaluation methods between the operated & non operated eyes 4 weeks after SICS. Fig 4 denotes the mean values of various dry eye evaluation methods between the operated &non operated eyes 12 weeks after SICS.

		Mean	+ SD	F value	P Value
TBUT	Preop day	20.7	4.39	21.031	< .001*
	Week 1	18.45	3.71		
	Week4	16.58	3.69		
	Week12	18.67	4.25		
Schirmer 1	Preop day	20.5	5.22	3.358	< . 05*
	Week 1	19.55	5.64		
	Week4	18.13	6.08		
	Week 12	19.19	5.79		
Schirmer 2	Preop day	18.78	5.16	4.08	< 0.01*
	Week 1	17.81	5.59		
	Week 4	16.18	6.26		
	Week 12	17.35	5.82		
Fluorescein staining	Preop day	1.35	0.48	39.817	< 0.001*
	Week 1	1.68	0.47		
	Week 4	1.95	0.22		
	Week 12	1.60	0.49		
Lissamine green staining	Preop day	1.07	0.25	40.616	< 0.001*
	Week 1	1.37	0.48		
	Week 4	1.68	0.47		
	Week 12	1.37	0.48		
Tear film height	Preop day	1.13	0.29	33.535	< 0.001*
	Week 1	0.93	0.37		
	Week4	0.74	0.30		
	Week12	1.06	0.33		
OSDI Score	Preop day	1.57	1.50	57.968	< 0.001*
	Week 1	2.98	1.68		
	Week 4	4.55	1.91		
	Week 12	2.80	1.92		

Table 1. Repeated Measures ANOVA Comparing Different Intervals on Operated Eye

*indicates significant statistical difference

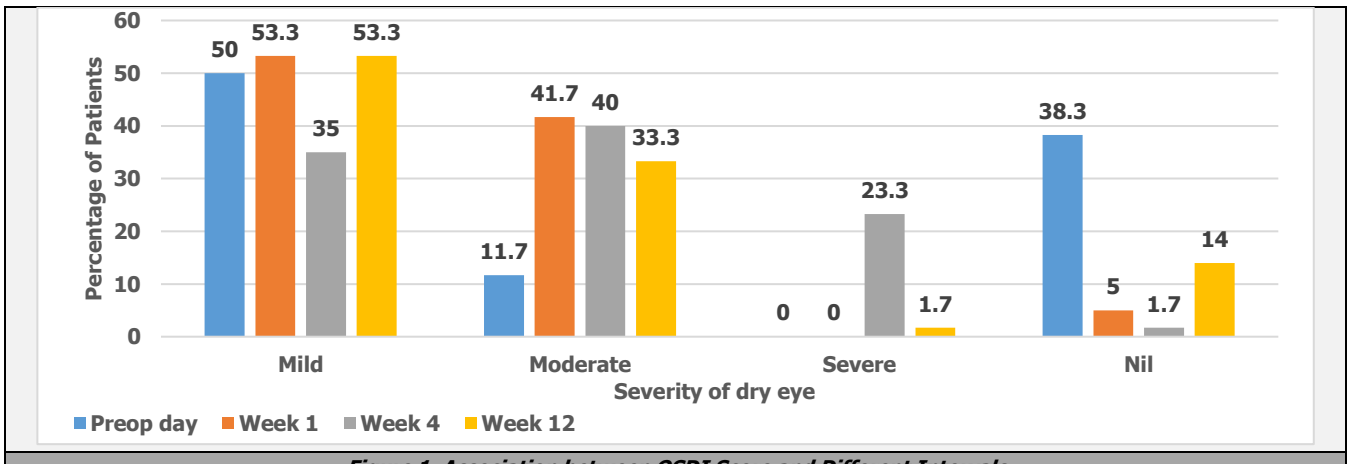

Figure 1. Association between OSDI Score and Different Intervals

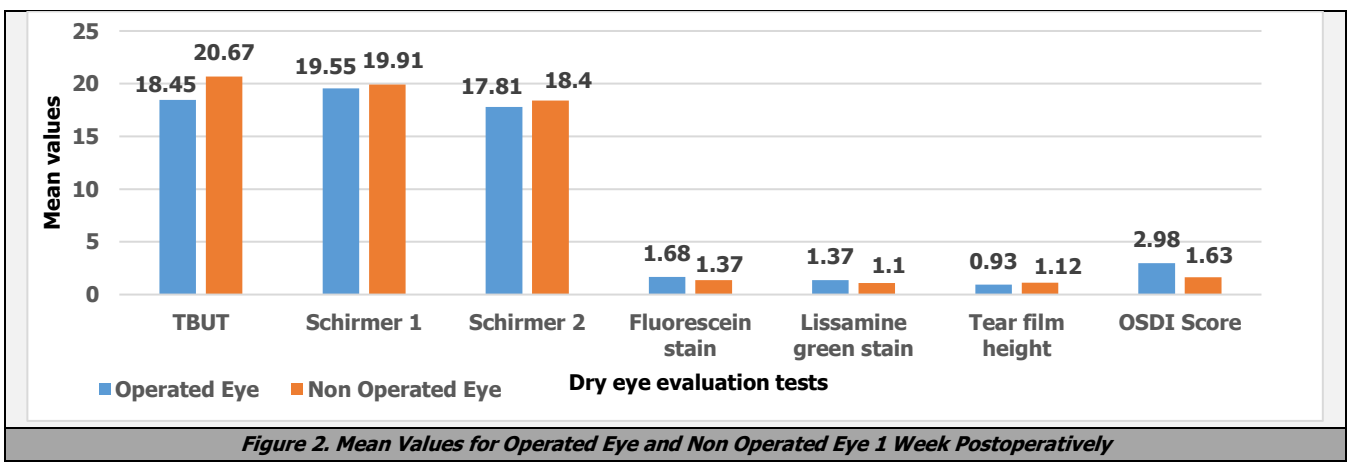

Figure 2. Mean Values for Operated Eye and Non Operated Eye 1 Week Postoperatively

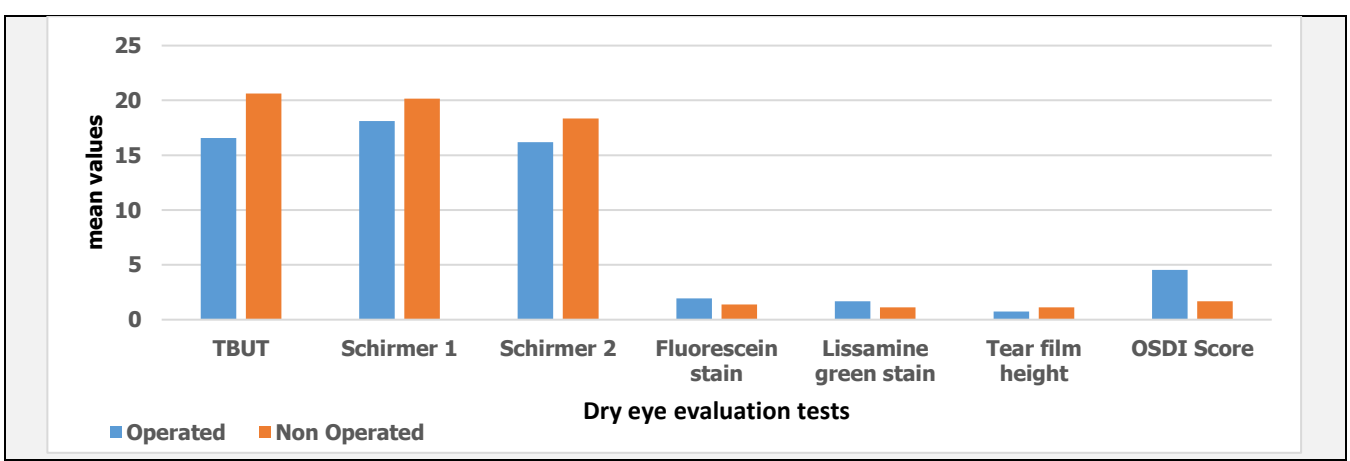

Figure 3. Mean Values for Operated Eye and Non Operated Eye for Week 4

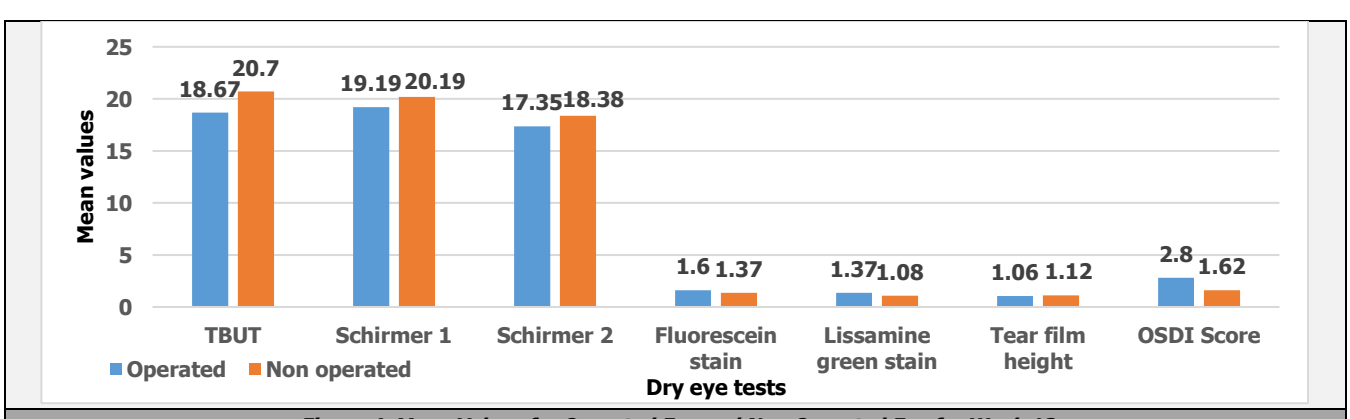

Figure 4. Mean Values for Operated Eye and Non Operated Eye for Week 12

DISCUSSION

Many a time even after an optically & surgically successful cataract surgery, patients may be unhappy due to irritating & annoying symptoms of dry eye syndrome. In our scenario SICS still remains a safe, simple, consistent, stable and cost-effective way of cataract removal in a developing country like India where cataract constitutes the most common cause of blindness among adults.

Hence we studied the ocular surface & tear film changes occurring after small incision cataract surgery. This study included 120 patients who underwent uncomplicated SICS at RIO, Trivandrum. In the present study we also studied the influence of age, gender, diabetes, antihypertensive drug use and menopause in the progression of dry eye after surgery.

From our study we could infer that increasing age, diabetes and menopause were found to be an important risk factor associated with the progression of dry eye after surgery. We could not find out a strong association between gender & use of antihypertensive drug with dry eye progression.

In our study OSDI score was seen to increase 1 week after the surgical procedure. The intensity of dry eye was found to peak around 4 weeks after the cataract surgery. When the time interval had reached 12 weeks after the cataract surgery the intensity of dry eye had shown a decline. Similar results have been reported by Xue-Min Li et al[13] in the study about dry eye status after cataract surgery.

We used TBUT, TFH, Schirmer testing & surface staining (Fluorescein and Lissamine green staining) methods to objectively assess the eye status preoperatively & 1 week, 4 weeks & 12 weeks postoperatively. All the parameters except Schirmer values showed a significant change (p value < .001) at 1 week & 4 weeks postoperatively & the maximum change was noted 4 weeks after the surgery when compared to the non-operated eye. Schirmer values had no statistically significant change when the preoperative & postoperative values were compared. The results are comparable with the study conducted by Liu Z,Luo L et al.[14] In our study, we found tear film breakup time &tear film height along with the staining methods to be useful & better indices than Schirmer test in detecting dry eye changes after SICS.

The effect of topical medications given postoperatively also might have influenced the aggravation of dry eye at four weeks interval. This is again supported by the fact that at twelve weeks after the surgery, when topical medications have been withdrawn the intensity of dry eye has decreased. Study by Li XM et al shows similar results.[15] All the patients in our study group were put on topical antibiotics, topical steroids and topical anti-inflammatory eyedrops. We did not study about the influence of topical medications on the progression of dry eye though topical steroids have been proven to aggravate the dry eye.[16]

We also studied the influence of antihypertensives intake which usually contributes to dry eye. These factors have not shown to influence the severity or progression of dry eye in our patients after undergoing the surgical procedure. The reason may be due to the small group of patients with systemic drug intake in our study.

From our study we could infer that SICS induces significant dry eye changes in patients which persist in a lower grade even at 3 months after the surgery. So also the preoperative dry eye status and other systemic factors like diabetes mellitus play a significant role in determining the ocular surface and tear film changes occurring after SICS. Hence the patients may be informed about such a consequence occurring after cataract surgery. The surgeon should also anticipate the complications that may occur in predisposed patients even if they are asymptomatic as most of our patients were. In the present scenario where the technology is so much advancing & the patients are also highly demanding an unhappy patient at the end of a successful surgery is a disappointment for the surgeon. Hence we would recommend that dry eye evaluation may also be included in the preoperative assessment of patients undergoing cataract surgery.

CONCLUSIONS

Small incision cataract includes significant dry eye changes in patients whose ocular surface and tear film was normal preoperatively. In patients with pre-existing undetected dry eye there was profound increase in the dry eye status after the surgery when compared to normal individuals. So, the preoperative dry eye status plays a significant role in determining the ocular surface and tear film changes occurring after small incision cataract surgery. These changes were noted to worsen maximum at 4 weeks after surgery and then regress. The dry eye changes persisted in a lower grade even at 12 weeks after the surgery. Increasing age was found to be an important risk factor associated with the progression of dry eye. Among females, those who were postmenopausal showed worsening of dry eye status when compared to those who were not. Diabetic status of the patient was identified as another risk factor determining the dry eye status postoperatively. In our study, anti-hypertensives and other systemic drug intake did not have statistically significant increase in the postoperative dry eye status. Among the dry eye parameters used to objectively assess the ocular surface changes, the tear-film breaks up time, tear film height and the surface staining patterns could be used to determine the dry eye status postoperatively than the Schirmer test which did not show much variation. Before small incision cataract surgery, patients should be informed about the possible increase in dry eye symptoms which may follow surgery. Also the surgeon should anticipate the worsening of dry eye status in predisposed patients.

Limitation of the Study

Since it was a short term study, large sample size was not feasible. Also the effect of topical medications which plays an important role in the production of dry eye was not studied. There were about 8 patients who lost follow up in between the study.

Data sharing statement provided by the authors is available with the full text of this article at jebmh.com.
Financial or other competing interests: None.
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