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RESEARCH ARTICLE

ORIGINAL ARTICLE: STUDY OF SLEEP PATTERNS IN PATIENTS OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE: A SINGLE TERTIARY CARE CENTRE STUDY

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Key words:-
Body Mass Index, Chronic Pulmonary Obstructive Pulmonary Disease, Epworth Sleeping Scale, Polysomnography

Abstract

Introduction: Chronic obstructive pulmonary disease (COPD) is a common, preventable and treatable disease that is characterized by persistent respiratory symptoms and airflow limitation that is due to airway and/or alveolar abnormalities usually caused by significant exposure to noxious particles or gases. Sleep problems and sleepiness are common in COPD patients, partly due to symptoms but also because of the medications used to treat COPD.

Method: This was a cross-sectional observational study conducted at CD Hospital of GMC Jammu for a period of one year from December 2020 to November 2021. 60 subjects were taken for sleep study by polysomnography with Alice 5 sleep system.

Aim: To find out total sleep period and sleep efficiency and to find out correlation between spirometric & polysomnoghraphic variables.

Result: Mean age of study sample is 60 years with standard deviation of 6.9 years. No significant difference observed in age and sex of study sample.

Conclusion: 18 (30%) having hypertension as co-morbid condition. 31 (51.7%) samples were having smoking history, while 112 (20%) were reformed smokers. Excessive daytime sleepiness were present in 10 (16.7%) of study sample, Snoring was present in 9 (15%) of study sample.

Introduction:-

The prevalence of COPD reported from different population- based studies from India is highly variable. The prevalence rates in male subjects vary from 2.21% to 9.4% in the studies reported from North India and studies from South India reported the prevalence of 1.4% to 4.8% in male subjects[1]. Sleep-related disturbances and insomnia have been shown to be higher in chronic obstructive pulmonary disease (COPD) sufferers than in the general population, with between 50 and 70% of patients reporting difficulty in initiating or maintaining sleep, or poor sleep quality[2,3]. . In addition, changes in breathing patterns that occur during normal sleep that do not affect healthy people may lead to more severe consequences in people with COPD, which may worsen and complicate COPD since they reduce blood oxygen.[4,5]

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Methodology:-

Place of study area

The study was conducted at CD Hospital of GMC Jammu.

Study design:

Observational study

Sample design:

Sample size calculation

Prevalence of sleep disorder is 60% (p) in COPD patients [4,5]

so q = 100 - p = 100 - 60 = 40

$N = 4pq / L^2$

N = 4 x 60 x 40 N = 42.6

15 x 15

So in this study minimum 43 samples were needed, we have 60 samples in study.

ii. Sampling unit: Sampling unit was "individual"

iii. Sampling technique: Convenient Sampling technique

iv. Inclusion Criteria:

All patients fulfilling GOLD criteria of COPD (In patients with FEV1/FVC < 0.70:

GOLD 1: Mild FEV1 > 80% predicted
GOLD 2: Moderate 50% < FEV1 < 80% predicted
GOLD 3: Severe 30% < FEV1 < 50% predicted
GOLD 4: Very Severe FEV1 < 30% predicted)

- Clinically stable COPD condition
- COPD patients with PaO2 > 60 mmHg
- Patient willing for giving consent & willing to follow the study protocol

Exclusion Criteria:

1. Patients with any neurological deficit
2. Not willing to give consent for study
3. COPD patients with exacerbation within 4 weeks
4. COPD patients with renal or liver impairment

Data collection:

Full night polysomnography with Alice 5 sleep system was done at usually sleeping time of patient. All those who fulfilled the inclusion criteria were eligible to participate in the study. The purpose of the study explained to patients. Informed written consent was taken prior to actual participation of patient into the study.

Data Analysis:

Data was analyzed using SPSS software 15 version, Microsoft Excel 2007, Med Calc statistical software version 12.1.1 and WHO Anthro Plus software**.** Chi square test was used to test the association between variables.

Ethics

Institute Ethical committee approval was taken prior to the study.

Consent of patient taken only after giving full information about study.

Results:-

Table1:- Showing frequency distribution of study samples according to symptoms of sleep disturbance.

Sr. No.	Symptom	Yes / No	Frequency	Percent
1	Excessive Daytime Sleepiness	Yes	10	16.7
		No	50	83.3
2	Snoring	Yes	9	15.0
		No	51	85.0

Above table shows that, 10 (16.7%) of study samples were having excessive daytime sleepiness. While 9 (15%) of study samples were having snoring.

Table 2:- Showing Correlation between Polysomnoghraphic variables among study samples.

	Total Sleep Time	**BMI**	**AHI**	**Average O2Sat**	**Neck Circumfrence**	**Epworth Sleepiness Scale**	**Sleep Period**	**Wake Time**	**A plus H**
Total Sleep Time	1	.086	-.134	.068	.048	-.160	**.646****	**-.810****	**.267***
		.516	.306	.606	.716	.221	**.000**	**.000**	**.039**
BMI	.086	1	-.011	**-.408****	**.811****	-.039	.218	-.113	.077
	.516		.933	**.001**	**.000**	.766	.094	.391	.558
AHI	-.134	-.011	1	**-.428****	.091	**.749****	-.208	.190	**.828****
	.306	.933		**.001**	.488	**.000**	.111	.146	**.000**
Average O2 Saturation	.068	**-.408****	**-.428****	1	**-.317***	**-.311***	-.201	-.224	**-.433****
	.606	**.001**	**.001**		**.013**	**.016**	.123	.085	**.001**
Neck Circumfrence	.048	**.811****	.091	**-.317***	1	.074	.137	-.035	.105
	.716	**.000**	.488	**.013**		.574	.297	.793	.426
Epworth Sleepiness Scale	-.160	-.039	**.749****	**-.311***	.074	1	-.119	.153	**.661****
	.221	.766	**.000**	**.016**	.574		.367	.242	**.000**
Sleep Period	**.646****	.218	-.208	-.201	.137	-.119	1	**-.305***	.122
	.000	.094	.111	.123	.297	.367		**.018**	.355
Wake Time	**-.810****	-.113	.190	-.224	-.035	.153	**-.305***	1	-.162
	.000	.391	.146	.085	.793	.242	**.018**		.215
A plus H	**.267***	.077	**.828****	**-.433****	.105	**.661****	.122	-.162	1
	.039	.558	**.000**	**.001**	.426	**.000**	.355	.215	

Sig 2 tail

Pearson value

* Correlation is significant at the 0.05 level (2-tailed)

** Correlation is significant at the 0.01 level (2-tailed).

Discussion:-

Age and Gender wise distribution of study population:

In the study population, male were three times than females, there were 45 (75%) males and 15 (25%) females, which are much lower than sex ratio according Census Maharashtra state 2011(925 Females/1000 Males). In all age group males are more than females. Mean age in this study population was 60.82 yrs (SD 6.9) which is more than study population in Ajit Vigg[6] (mean 55, SD 2.5).

Smoking:

Biomass exposure was there in 15 (25%) of study population. There were 43 (71.7%) smokers in this study, 12 among them were reformed one, while 17 were not having any smoking history. 94 were ex-smokers (75%), whereas 31 subjects were current smokers in study done by Ajit Vigg[6]. Smoking contributes to development of nocturnal hypoxaemia was proven by Multiple linear regression in study done by Vos PJ, Folgering HT el al.[7]

Hypertension:

18 (30%) of study samples in this study were having hypertension as co-morbid condition. Minimally symptomatic group complaining insomnia, nocturia, night sweats, apnea& awakening 177 cases (50.43%), 157 cases (44.73%), 130 cases (37.04%), 296 cases (84.33%), 182 cases (51.85%)] in study done by Tang S, Zhou XF et al[8] were having co-morbidities including hypertension. The rate of diabetes in minimally symptomatic group [28 cases (13.53%)] was also higher but the difference was not statistical significance.

Daytime sleepiness & Snoring:
Excessive daytime sleepiness were present in 10 (16.7%) of study sample while Snoring was present in 9 (15%) of study sample. Septal deviation, macroglossia, Retrognathia & dental malocclusion were also observed in patient of COPD.

While other symptoms of sleep disturbances among COPD patients like problem falling asleep (87 patients), Nocturnal awakening (67 subjects), early morning wheezing & cough (44 subjects), Unrefreshing quality of Sleep (56 subjects), difficulty in sleeping flat on bed (50 subjects) was reported in a study conducted by Agit Vigg[6]. 91 subjects also reported snoring as problem in study conducted by Larsson LG, Lindberg A et al[9]. Daytime sleepiness (ESS >= 10) was present in 34.8% COPD patients in Ali Zohal M, Yazdi Z et al[10].

Body Mass Index:
BMI in study sample was slightly lower than the samples of study conducted by Shridhar Venkateswaran, Augustine Tee[11] (BMI 23.7). The majority of patients in the study had overlap syndrome and minimal exacerbations, were not obese or sleepy. While study done by Carl P. Browman, Michael G. Sampsonet et al[12] shows the relation between apneas per hour of sleep and body weight. A modest decrease in weight was thus associated with a disproportionally larger decrease in the rate of apneas. The results suggested that dieting and weight loss lead to an improvement in sleep apnea and related sequelae.

Epworth Sleeping Scale:
Average ESS of study samples was 9.6 with standard deviation of 5.5, with the highest 24 and the lowest 0; 39 were having normal, 10 mild, 2 moderate and 9 sever ESS. The association between AHI and ESS were found to be statistically highly significant (p 0.0027). It means normal ESS samples having ≥ 5 AHI are statistically significant different from those with AHI < 5**.** Positive correlation is observed in ESS and AHI (0.749) in the study and it was highly significant (0.000).

ESS in this study is higher than ESS (Mean 7.3 SD 4.4) in study by Carlos Eduardo Ventura Gaio Dos Santos[13]. While no significant correlation found in spirometeric variable and polysomnoghraphic variable in that study.

In Tang S, Zhou XF et al[8] study, members in daytime sleepiness group had the highest probability of daytime sleepiness, tiredness, irritableness and the highest Epworth Sleeping Scale score [329 cases (73.11%), 280 cases (62.22%), 223 cases (49.56%) and (13.50±4.93). Daytime sleepiness (ESS>=10) was present in 34.8% of the COPD patients and 15% of control people in study done by Ali Zohal M, Yazdi Z et al[10] with 32.1% of the patients had good sleep quality (PSQI score less than 5) and 67.9% had poor sleep quality.

There were 27 patients in study having ESS 15 or more when compare with 11 patients with ESS >10 of study by Claudia Enz, Stefanie Brighenti-Zogg et al[14]. It also states multiple linear regression age ($\boldsymbol{\beta} = -0.254$, $\mathbf{p} < 0.05$), AHI ($\boldsymbol{\beta} = 0.287$, $\mathbf{p} < 0.05$) and CAT score ($\boldsymbol{\beta} = 0.380$, $\mathbf{p} < 0.01$) were independent predictors of ESS. ESS score is lower in Shridhar Venkateswaran, Augustine Tee[11] study (Mean 5.6 SD 5.8), and in which majority of patients had overlap syndrome been not obese or sleepy.

GOLD Criteria ($FEV_1/FVC<0.7$):
There were 16 subjects were having obstruction falling in mild group (GOLD stage 1), 32 moderate obstruction (GOLD stage 2), 11 severe obstruction (GOLD stage 3) and 1 was having very sever obstruction (GOLD stage 4) by spirometeric test. Fisher's exact test shows association between BMI and GOLD stage of COPD was not statistically significant (p 0.4215). Mean of FEV_1/FVC 63.8% with SD 6.56% in Sanders MH, Newman AB et al[15] was slightly higher than Mean 54 in Carlos Eduardo Ventura Gaio Dos Santos[13] with SD 13%; which is further higher than Xavier Soler, Eduardo Gaio et al[16] (Mean 42.8 SD 13.1). Regarding FEV_1/FVC negative correlation is observed with $PaCO_2$ in Carlos Eduardo Ventura Gaio Dos Santos[13].

Nocturnal desaturation reduction was due mainly to a decrease in tidal volume (VT) and hypoventilation was most pronounced during REM sleep, irrespective of the underlying disease Becker HF, Piper AJ, Flynn WE et al[17].

Polysomnoghraphic Variables:
Apnea events of central (Mean 3.55 SD 11.79), mixed (Mean 2.42 SD 7.4) and obstructive (Mean 46.07 SD 87.23) type was much higher mean (central - 12.1, Mixed - 1.1, Obstructive - 5.1) than in Carlos Eduardo Ventura Gaio

Dos Santos[13].The number of apneas per hour of sleep varied from 59.6 at 111 kg of weight to 3.1 at 85 kg in Carl P. Browman, Michael G. Sampsonet et al[12].

Regarding the mean distribution of sleep stages, we observed a high percentage of sleep stage 2 (Sleep stage 2 - Mean 177 min SD 180.19 min & % Sleep stage 2 - Mean 48.91 %, SD 39. 32 %) among study subjects followed by Sleep stage 1 (Sleep stage 1 - Mean 84.4 min SD 98.18 min & % Sleep stage 1 - Mean 35.218 %, SD 31.54 %).

% Sleep stage 2 mean (48.91 %) is lower than its mean (51.4 %) in Carlos Eduardo Ventura Gaio Dos Santos[13]. % Sleep stage 1 mean (35.82 %) is higher than its mean (23.6 %) in Carlos Eduardo Ventura Gaio Dos Santos[13].

REM sleep having shortest sleep stage with Mean 17.308 minutes, with SD 50.47 min. % REM mean (6.95 %) is lower than its mean (15.0 %) in Carlos Eduardo Ventura Gaio Dos Santos[13].

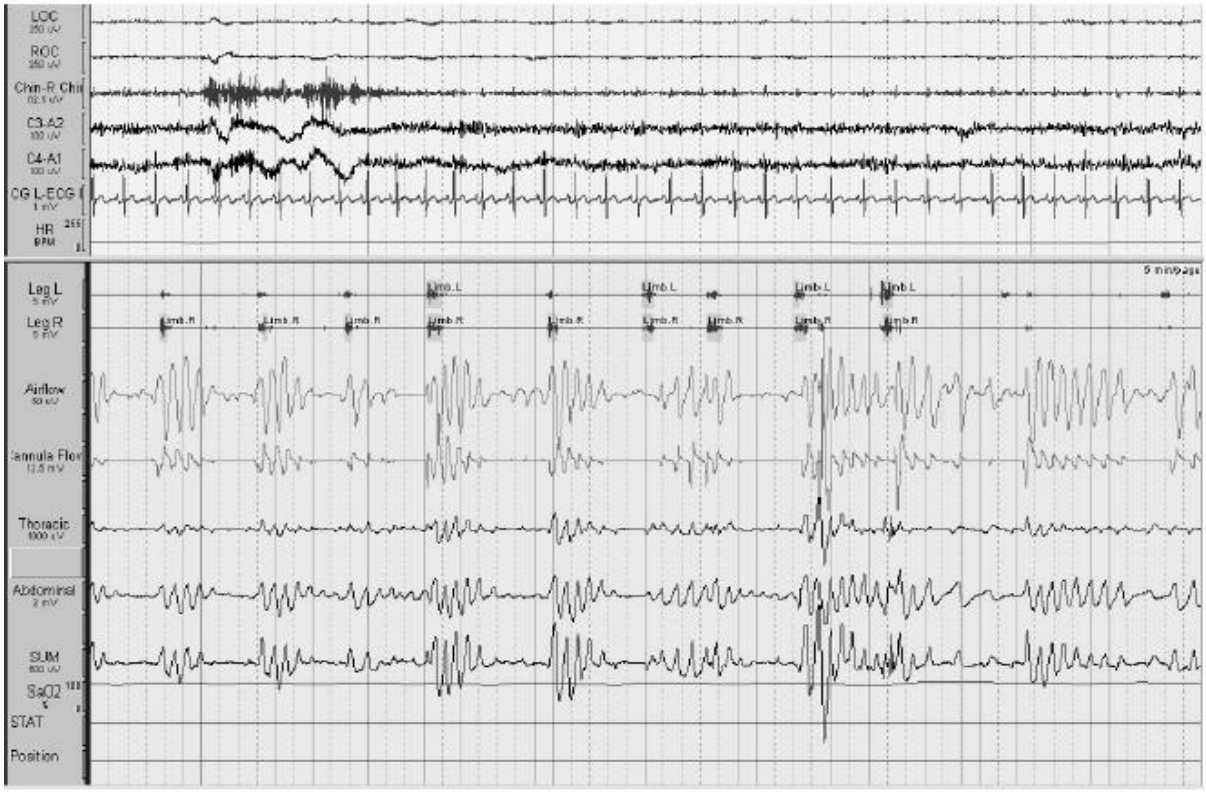
Total recording time mean 448.325 minutes (SD 86.14) & sleep period mean 381.681 minutes (SD 111.84) in this study is lower than 479.3 (SD 39.1) & 436 (SD 56.6) that in Carlos Eduardo Ventura Gaio Dos Santos[13].

While Total sleep time mean 302.84 minutes (SD 147.30) & sleep efficiency mean 66.84 % (SD 29.21) in this study is higher than 287.3 (SD 84) & 65.3 (SD 15.6) in Carlos Eduardo Ventura Gaio Dos Santos[13]. Sleep efficiency was poor in 45 % subjects of Xavier Soler, Eduardo Gaio et al[16].No significant difference observed in Sleep efficiency in those with and without COPD in Rohit Budhiraja, Tauseef et al[18].

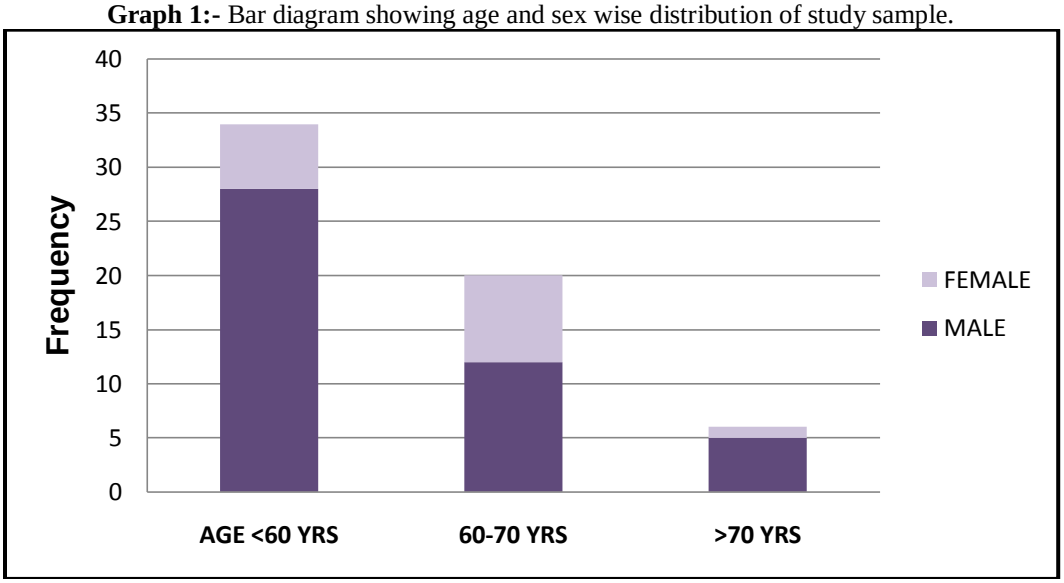
Conclusions:-

Mean age of study sample is 60 years with standard deviation of 6.9 years. No significant difference observed in age and sex of study sample. 18 (30%) having hypertension as co-morbid condition. 31 (51.7%) samples were having smoking history, while 112 (20%) were reformed smokers. Excessive daytime sleepiness were present in 10 (16.7%) of study sample, Snoring was present in 9 (15%) of study sample. Mean sleep efficiency ((Total Sleep Time / Total Time) x 100) was 66 % with SD 29.21 %, with the highest 100 % and the lowest 4.9 %. Mean AHI was 23.02 with standard deviation of 25.6, with the highest 108 per minute and the lowest 0.4.

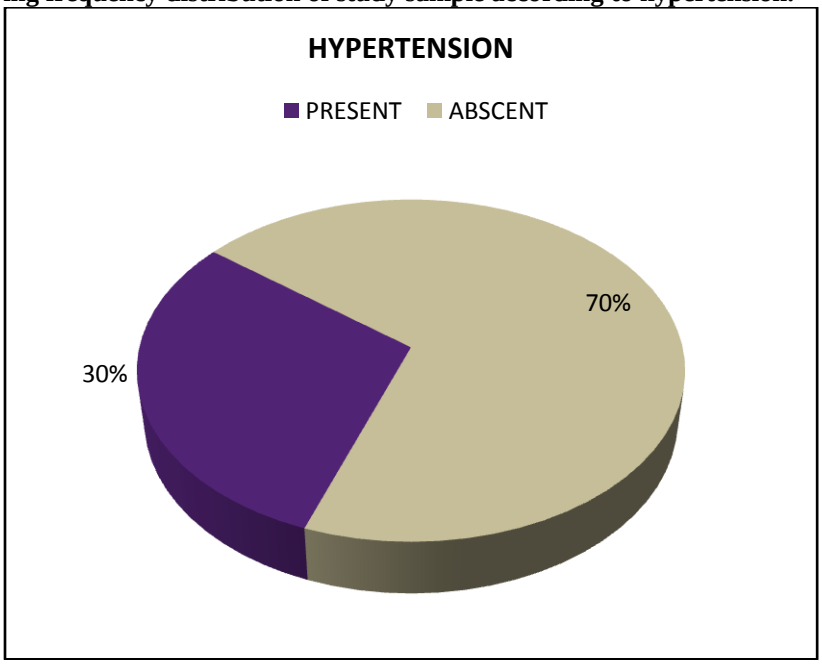
Figure 1:- Respiratory Channels demonstrate repetitive obstructive hypopnea & apnea.



Graph 1:- Bar diagram showing age and sex wise distribution of study sample.



3) Pie chart 1 showing frequency distribution of study sample according to hypertension.

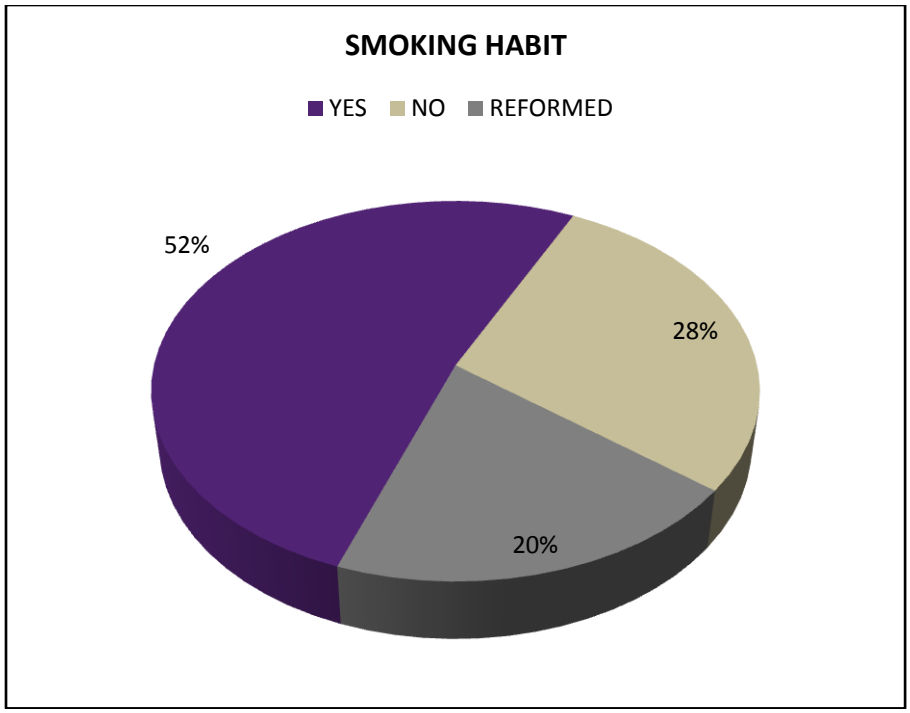


		Frequency	Percent
HTN	Absent	42	70.0
	Present	18	30.0

Above table shows 18 (30%) of study samples were having hypertension as co-morbid condition.

4) Pie chart 2 showing frequency distribution of study sample according to smoking history.

Smoking history	Frequency	Percent
No	17	28.3
Reformed	12	20.0
Yes	31	51.7
Total	60	100.0



Source of funding: none

Above table shows 31 (51.7%) samples were having smoking history. while 12 (20%) were reformed smokers.

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