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PREVALENCE OF UPPER CROSS SYNDROME IN STUDENTS STUDYING FOR COMPETITIVE EXAMS USING PRESSURE BIOFEEDBACK.

An Observational Study

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Abstract: Upper crossed syndrome is caused by weak lower and middle trapezius, tight upper trapezius and levator scapulae, weak deep-neck flexors, tight suboccipital muscles and sternocleidomastoid, weak serratus anterior, and tight pectoralis major and minor. Poor posture is the main driver of UCS. Classes going students generally assume variety of postures during their lectures. Being students who are studying for competitive exams it's imperative for them to sit for longer duration at a stretch. Now a days due to heavy competition student's studying hours hasn't reduced but has added a burden of improper posture maintained by the students. There is marked deterioration in the posture due to wrong sitting positions which can lead to Upper cross syndrome which can then lead to complications like pain in back, difficulty in activities of daily living, numbness, tingling and pain in upper limb.

Method – Observational study was conducted on 114 subjects at several MPSC and UPSC classes. Individuals were selected according to the inclusion and exclusion criteria. Individuals were explained about the procedure and informed consent was taken from all the included subjects before starting the procedure of the study.. Pectoralis major contracture test and lower and middle trapezius weakness test were done. Upper trapezius tightness test and Cranio-cervical flexion test were performed

Result - According to the tests performed as mentioned above 12 % population was tested positive for pectoralis major contracture test, 11 % tested positive for middle and lower trapezius weakness test, 53 % tested positive for upper trapezius tightness test and 43 % population showed values of performance index lower than average in cranio-cervical flexion test which suggests weakness of cervical flexors.

Conclusion - According to result 11% participants studying for competitive exams have Upper Cross Syndrome.

Index Terms – Upper cross syndrome, poor posture, Upper trapezius muscle length test, Lower and Middle trapezius weakness test, Cranio-cervical flexion test, Pectoralis major contracture test.

I. INTRODUCTION

In Upper Cross Syndrome (UCS) there is tightness of the upper trapezius and levator scapula on the dorsal side crosses with tightness of the pectoralis major and minor. Weakness of the deep cervical flexors, ventrally, crosses with weakness of the middle and lower trapezius. UCS is often seen in individuals who sit for prolonged periods with static posture, particularly students who study for competitive exams [1].

The development of UCS is primarily attributed to imbalances between tonic and weak muscles [2]. Our body consists of two types of muscles: postural muscles, such as the pectoralis major, upper trapezius, and sternocleidomastoid, and phasic muscles, such as the deep-neck flexors and lower trapezius. Postural muscles tend to tighten as they are frequently activated in various movements, while phasic muscles, responsible for dynamic functions, tend to weaken [3]. This imbalance between opposing muscle groups in UCS leads to postural disturbances [4].

Individuals with upper crossed syndrome often exhibit forward head posture (FHP), thoracic spine hunching (rounded upper back), raised and protracted shoulders, scapular winging, and limited mobility in the thoracic spine [5]. In some cases, musculoskeletal disorders can be caused by manual material handling activities, particularly when performed in inappropriate positions and involving repetitive actions in poor posture throughout the workday [6][7].

The simultaneous occurrence of forward head posture and rounded shoulders is a typical manifestation of upper crossed syndrome [8]. Musculoskeletal injuries often affect the neck and upper limbs, particularly in professions involving repetitive tasks which involve muscles of neck and upper back, prolonged static postures, and heavy lifting [9]. Prolonged maintenance of abnormal or inappropriate postures is a common cause of forward head posture [10]. Studies have demonstrated that occupational factors, such as long working hours and repetitive tasks, can contribute to postural defects and deviations.

Students studying for competitive exams often spend prolonged periods in a seated position, which can lead to poor posture and muscle imbalances. UCS, characterized by weakened and tight muscles in the neck, shoulders, and upper back, can have detrimental effects on musculoskeletal health. Understanding the prevalence of UCS in this specific student population will helps identify the extent of the issue and raises awareness about the importance of maintaining proper posture and ergonomics during study sessions.

UCS can cause physical discomfort, pain, and limitations in daily activities. Students preparing for competitive exams already experience high levels of stress and pressure. The presence of UCS further adds to their physical and mental burden. By understanding the prevalence of UCS and its impact on students' well-being, appropriate interventions can be developed to alleviate the symptoms and improve their overall quality of life as early as possible.

UCS is not limited to the student phase; if left unaddressed, it can persist into older adulthood and impact individuals' professional and personal lives. Early detection and intervention during the student years can prevent the progression of UCS and its associated health consequences. By studying the prevalence of UCS in students studying for competitive exams, healthcare professionals and policymakers can devise strategies for early identification, treatment, and long-term management of UCS.

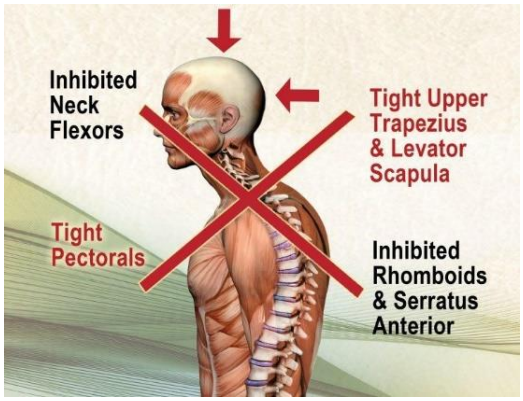


Fig 1

II. METHODOLOGY

This Observational study is conducted on 114 subjects that are students studying for competitive exams age 18-30 years old with mean of 24.17 years old at several MPSC and UPSC classes. Ethical committee clearance was obtained and permission was taken from the department. Written consent was taken from the subjects who fulfil the inclusion criteria and exclusion criteria. The subjects were informed about the procedure. Pectoralis major contracture test and lower and middle trapezius weakness test were done. Upper trapezius tightness test and Cranio-cervical flexion test were performed.

II.A INCLUSION CRITERIA

- Students attending classes for competitive exams like MPSC and UPSC.
- Both genders.
- Age – 18 to 30 years.
- Studying for more than 6 hrs i.e., Weekly 30 hrs

II.B EXCLUSION CRITERIA

- Participants with any spinal deformity.
- Participants who have undergone recent surgery of related joints.
- Participants with fractures in vertebrae.
- Participants with a malignancy condition.
- Congenital shoulder deformities.
- Recent fractures to related joints.

II.C OUTCOME MEASURES

1. PECTORALIS MAJOR CONTRACTURE TEST [11]

PURPOSE: To check the pectoral muscle tightness
PATIENT POSITON: The patient lies supine and clasps the hands together behind the head.
PROCEDURE: The arms are then lowered until the elbows touch the examining table.
POSITIVE RESULT: A positive test occurs if the elbows do not reach the table and indicates a tight pectoralis major muscle

2. TRAPEZIUS WEAKNESS TEST [11]

Middle trapezius muscle:

PATIENT POSITION: The patient position is prone lying with the arms abducted to 90 degree and laterally rotated.

THERAPIST POSITION: The test involves the examiner testing horizontal extension of the arm watching for retraction of the scapula, which should normally occur. POSITIVE RESULT: If scapular protraction occurs, the middle fibres of trapezius are weak (Fig 2).

Lower trapezius muscle:

PATIENT POSITION: The patient position is prone lying with the arm abducted to 120 degree and shoulder laterally rotated.

THERAPIST POSITION: The examiner applies resistance to diagonal extension and watches for scapular retraction that should normally occur.

POSITIVE RESULT: If scapular protraction occurs, the lower trapezius is weak

3.UPPER TRAPEZIUS MUSCLE LENGTH TEST [12]

PROCEDURE –

The patient lies supine. Practitioner stands at the head of the table facing the patient. Flex the patient's neck fully and laterally flex away from the tested side (Fig. 15). The patient's head and neck are supported by the practitioner's hand and forearm on the non-tested side and may also be gently stabilized on your abdomen. Using your hand on the tested side, depress the patient's shoulder girdle on the tested side by applying pressure caudally over the distal clavicle and acromioclavicular joint. To selectively increase tension on the upper fibres, ipsilateral neck rotation may be added. Length is assessed by the quality of the end-feel, which should be a smooth and gradual increase in resistance to shoulder depression, as well as by comparing the right and left sides

4.Cranio-cervical flexion test [13]

- **PATIENT POSITION** :- Supine
- **PROCEDURE** :-

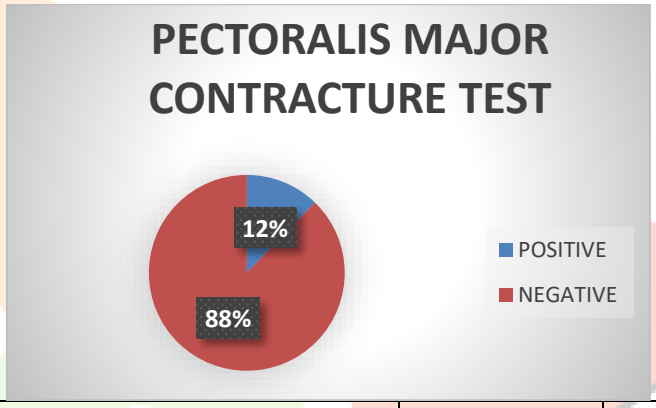
The CCFT is performed with the patient in supine crook lying with the neck in a neutral position (no pillow). The uninflated pressure sensor is placed behind the neck so that it abuts the occiput and is inflated to a stable baseline pressure of 20 mm Hg, a standard pressure sufficient to fill the space between the testing surface and the neck but not push the neck into a lordosis. The device provides the feedback and direction to the patient to perform the required five stages of the test. The movement is performed gently and slowly as a head nodding action (as if saying "yes"). The CCFT tests the activation and endurance of the deep cervical flexors in progressive inner range positions as the patient attempts to sequentially target five, 2-mm Hg progressive pressure increases from the baseline of 20 mm Hg to a maximum of 30 mm Hg as well as to maintain a isometric contraction at the progressive pressures as an endurance task .When the test was first described, performance was scored via the pressure level that the patient was able to achieve (activation score) and hold for 10 repetitions of 10-second duration. A performance index was calculated based on the number of times the patient could hold the pressure level achieved for 10 seconds[14]. For example, if a patient could achieve the second level of the test (24 mm Hg) and perform six 10-second holds with the correct action of craniocervical flexion, then their performance index was 4 × 6 = 24. The highest activation score was 10 mm Hg, and highest performance index, 100. Preliminary research on an asymptomatic population aged 18 to 68 years revealed no age or sex effects on test performance and determined a mean activation score of 7.6 ± 2.1 and a performance index of 65.8 ± 27.5, which showed between-day repeatability determined by the Intraclass Correlation Coefficient (ICC = .81 and .93 for the activation score and performance index respectively),[14,15] values which were later replicated by others.[16,17]

Of clinical importance, studies of neck pain groups and single case studies using the original clinical test were showing that performance in patients with neck disorders was inferior with mean activation scores in the vicinity of 4 and performance indices of 10. [14,16-21]

III. STATISTICAL ANALYSIS

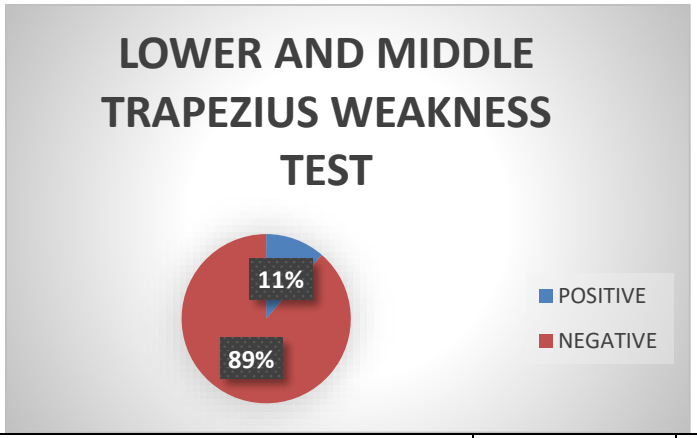
Data was collected and analysed .

IV. RESULTS



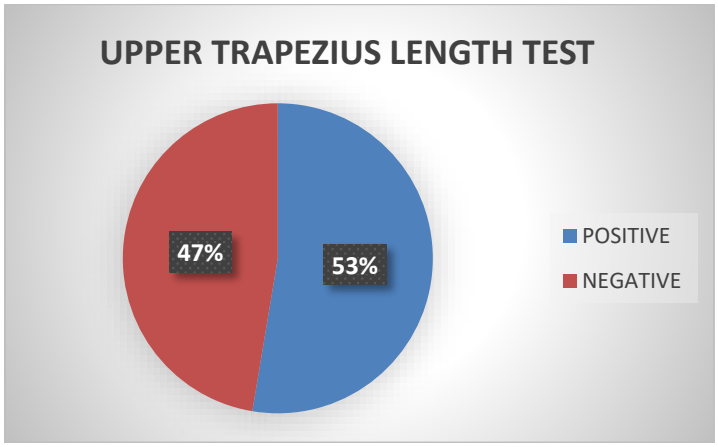
TEST	POSITIVE	NEGATIVE
PECTORALIS MAJOR CONTRACTURE TEST	14	100

Interpretation: The above pie chart shows the results of the pectoralis major contracture test. This graph shows that among 114 participants 12% (i.e. 14 participants) tested positive for this test and 88% (i.e. 100 participants) tested negative for this test .



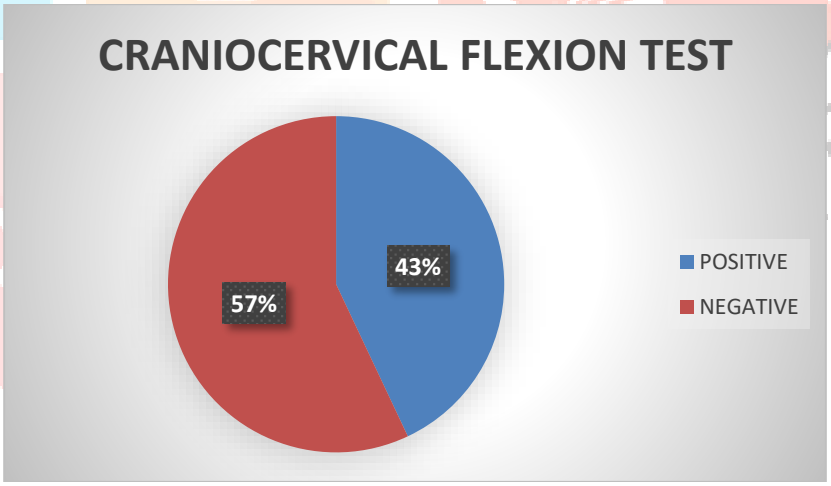
TEST	POSITIVE	NEGATIVE
LOWER AND MIDDLE TRAPEZIUS WEAKNESS TEST	13	101

Interpretation: The above pie chart shows the results of the lower and middle trapezius weakness test. This graph shows that among 114 participants 11% (i.e. 13 participants) tested positive for this test and 89% (i.e. 101 participants) tested negative for this test.



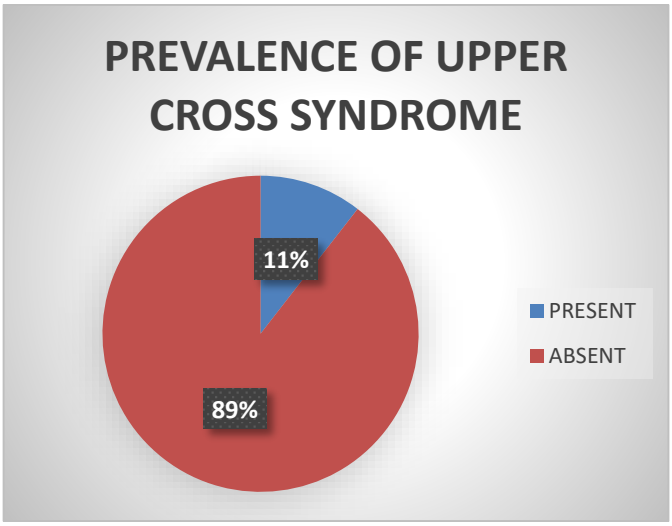
TEST	POSITIVE	NEGATIVE
UPPER TRAPEZIUS MUSCLE LENGTH TEST	60	54

Interpretation: The above pie chart shows the results of the Upper trapezius muscle length test. This graph shows that among 114 participants 53% (i.e. 60 participants) tested positive for this test and 47% (i.e. 54 participants) tested negative for this test



TEST	POSITIVE	NEGATIVE
CRANIOCERVICAL FLEXION TEST	49	65

Interpretation: The above pie chart shows the results of the cranio-cervical flexion test. This graph shows that among 114 participants 43% (i.e. 49 participants) tested positive for this test and 57% (i.e. 65 participants) tested negative for this test.



TEST	PRESENT	ABSENT
PREVALENCE OF UPPER CROSS SYNDROME	12	102

Interpretation: The above pie chart shows the prevalence of Upper cross syndrome. This graph shows that among 114 participants 11% (i.e. 12 participants) have Upper cross syndrome.

V. DISCUSSION

The study is aimed to investigate the prevalence of upper cross syndrome (UCS) in students studying for competitive exams, considering the prolonged study hours and potential consequences of prolonged sitting and limited rest time. The findings of this study contribute to the existing literature by shedding light on the prevalence rates of UCS in this specific population i.e., students studying for competitive exams.

In this study, a total of 114 subjects were selected based on specific inclusion and exclusion criteria. The procedure and purpose of the study were explained to the subjects, and informed consent was obtained from all participants before the start of the procedure. Several tests were conducted to assess the musculoskeletal condition of the subjects. These tests included the pectoralis major contracture test, upper trapezius muscle length test, lower and middle trapezius weakness test, and cranio-cervical flexion test. These tests aimed to evaluate the flexibility, strength, and function of various muscles and joints in the neck, shoulders, and upper back. The results showed that 11% of the population exhibited upper cross syndrome.

According to the tests performed as mentioned above 12 % population was tested positive for pectoralis major contracture test , 11 % tested positive for middle and lower trapezius weakness test , 53 % tested positive for upper trapezius tightness test and 43 % population showed values of performance index lower than average in cranio-cervical flexion test which suggests weakness of cervical flexors .

There is a significant difference in the prevalence rates of all the tests. There is a greater prevalence of upper trapezius tightness and deep cervical flexor weakness than the tightness of pectoralis major and weakness of lower and middle trapezius.

Static posture for extended periods can lead to tightness in the upper trapezius muscle. This can occur due to muscle imbalances, a forward head position, weak upper back muscles, and stress. Poor posture strains the upper trapezius, causing it to become overactive and tight. Therefore, there is a greater rate of upper trapezius tightness due to the prolonged stresses on the muscle due to the poor posture and long study hours. [22]

Forward head posture increases the workload for many of the muscles attached to the cervical spine, which has the job of holding up the head. Over time, forward head posture can lead to muscle imbalances as the body tries to adapt and find efficient ways to hold the head up for straight-ahead vision. Some muscles become elongated and weakened, whereas other muscles become shorter and tighter. The muscles that weaken are deep cervical flexors and lower and middle trapezius.[22]

The deep cervical flexor muscles, also called the longus capitus and longus colli, are located along the front of the cervical spine and help stabilize the neck. When weakened, the deep cervical flexors lengthen as the chin tilts away from the neck, often called “chin poking .” The middle trapezius and rhomboid muscles in the upper back help bring the scapulae (shoulder blades) backward to keep the shoulders back and chest open in

good posture. Weakened trapezius and rhomboid muscles allow the shoulder blades to tilt forward, further contributing to hunched shoulders and forward head posture.

After a prolonged period of maintaining poor posture for repetitive and a longer period of time there is a reduction in the length of the muscle and its fibers and in the number of sarcomeres in series within myofibrils as the result of sarcomere absorption. This absorption occurs at a faster rate than the muscle's ability to regenerate sarcomeres in an attempt to restore itself. The decrease in the overall length of the muscle fibers and there in series sarcomeres, in turn, contributes to muscle atrophy and weakness. [23,24]

During poor posture the muscle like lower and middle trapezius and the deep cervical flexors are in elongated position. If a muscle is this position for a prolonged period of time the physical stresses placed on the muscle are substantially diminished. This results in decay of contractile protein in the muscle, a decrease in muscle fiber diameter, a decrease in the number of myofibrils, and a decrease in intramuscular capillary density, the outcome of which is muscle weakness (decreased muscle force). [25,26,27]
During the assessment, the subjects were not subjected to any restrictions or control over their activities. They were allowed to engage in exercises such as running, playing, and stretching, as it was necessary for them to maintain physical fitness for their UPSE exams. This lack of intervention in their exercise routines may have contributed to the relatively lower prevalence of tightness in the pectoralis major muscle.
The study titled "Prevalence of Upper Crossed Syndrome in Physiotherapy College Students" employed pressure biofeedback to assess the strength and endurance of the deep cervical flexor muscles in patients with mechanical neck pain. This study enrolled a sample size of 46 participants, among whom 14 tested positive for the Upper Crossed Syndrome (UCS).

The study titled "Prevalence of Upper Cross Syndrome in Laundry Workers" The Upper Crossed Syndrome (UCS) has been found to have a prevalence of 28% among laundry workers in Karad and the surrounding rural areas. According to this study the primary risk factor associated with this syndrome is the prolonged engagement in abnormal postures during work.
In other study titled "Prevalence of Upper Cross Syndrome in Different Occupations" The prevalence was found to be 21.32% among desk workers, 13.21% among drivers, 15.11% among teachers, and 16.024% among housewives.

The prevalence rates observed in this study align with previous research conducted on different populations, such as studies analysing the frequency of UCS and neck disabilities among IT professionals, as well as clinical assessments of the deep cervical flexor muscles using the Cranio-Cervical Flexion Test. These studies have reported similar prevalence rates, suggesting that UCS is not limited to a specific group but can affect individuals engaged in various sedentary activities or those with poor posture.
The utilization of pressure biofeedback as a diagnostic tool in this study adds strength to the research. Pressure biofeedback has been demonstrated as a reliable and valid method in previous studies, allowing for quantifiable assessments of muscle activation patterns and identifying imbalances associated with UCS. By incorporating this objective measurement technique, the current study provides a more accurate understanding of the muscle imbalances observed in students studying for competitive exams.

Further research is warranted to address these limitations and deepen our understanding of UCS in students studying for competitive exams. Future studies should employ larger and more diverse samples, incorporate control groups, and utilize objective measures of study duration and postural habits. Longitudinal studies would provide insights into the progression and changes in UCS over time. Additionally, investigating the effectiveness of specific interventions, such as ergonomic interventions or targeted exercise programs, would be valuable in guiding evidence-based strategies for the prevention and management of UCS in this population.
In conclusion, this study on the prevalence of upper cross syndrome in students studying for competitive exams using pressure biofeedback highlights the importance of addressing musculoskeletal imbalances in this specific population. The findings contribute to our understanding of UCS and underscore the need for interventions aimed at promoting proper posture, ergonomic practices, and targeted exercises to mitigate the consequences associated with UCS and enhance the well-being and performance of students studying for competitive exams.

VI. CONCLUSION

According to result 11% participants studying for competitive exams have Upper Cross Syndrome.

VII. CLINICAL IMPLICATION

- The study helps in identifying and early detection of the prevalence of upper cross syndrome enabling healthcare professionals to intervene promptly and prevent the progression of musculoskeletal imbalances.
- The study finds the prevalence of upper cross syndrome. This knowledge can guide the development of preventive measures, such as ergonomic interventions, postural awareness programs, and exercises, to reduce the incidence and impact of upper cross syndrome in this population.

VIII. LIMITATION OF STUDY

- The absence of a control group in the study limits the ability to compare the prevalence of upper cross syndrome in students studying for competitive exams to a group not studying for competitive exams.
- Without longitudinal follow-up, the study does not assess the progression or changes in upper cross syndrome over time.
- During the assessment, the subjects were not subjected to any restrictions or control over their activities. They were allowed to engage in exercises such as running, playing, and stretching, as it was necessary for them to maintain physical fitness for their UPSE exams.

IX. RECOMENDATION AND FUTURE SCOPE OF STUDY

- The article will raise awareness among students, educators, and healthcare professionals about the consequences of UCS in this specific population.
- By utilizing pressure biofeedback, the study will provide a quantitative measure of muscle imbalances associated with UCS which will enhance diagnostic accuracy by objectively assessing muscle activation patterns and identifying specific muscle groups affected in the syndrome.
- Understanding the prevalence of upper cross syndrome in students studying for competitive exams will enable healthcare professionals to develop targeted treatment approaches.
- The article will serve as a foundation for future research and studies in the field of musculoskeletal health.

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