

Effect of visceral manipulation on pain, mobility and functional disability in subjects with right shoulder Adhesive Capsulitis

Efeito da manipulação visceral na dor, mobilidade e incapacidade funcional em pessoas com capsulite adesiva de ombro direito

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ABSTRACT | INTRODUCTION: Adhesive capsulitis is a common, painful and debilitating condition of the glenohumeral joint affecting about 2-5% of the population. Internal organs and musculoskeletal system are inter-connected through the support membranes. Tension in these support membranes may further cause mechanical restrictions and pain in musculoskeletal structures and also restrict the mobility of the visceral organ. **OBJECTIVE:** To explore the effect of organ specific visceral manipulation on adhesive capsulitis in subjects with right shoulder adhesive capsulitis. **METHODOLOGY:** Twenty subjects with adhesive capsulitis were assessed for eligibility, out of which fourteen subjects were recruited using convenience sampling method. Two sessions of Placebo Visceral Manipulation was administered for the first two weeks, followed by a two sessions of visceral manipulation of liver for next two weeks. Digital goniometer, Shoulder pain and disability index and Modified sphygmomanometer were used to measure the pre and post outcomes. **RESULTS:** Between group comparison of the outcomes showed a statistically significant difference in the shoulder range of motions scores [flexion ($p=0.001$), external rotation ($p=0.001$) and internal rotation ($p=0.001$)] and Shoulder pain and disability index score (0.004). No significant changes were observed in the strength outcome. **CONCLUSION:** Two sessions of visceral manipulation for the liver may be beneficial in improving the right shoulder mobility, pain and disability.

Clinical Trials number (REF/2019/09/028271 N)

KEYWORDS: Adhesive Capsulitis. Visceral Manipulation. Mobility. Pain. Liver.

RESUMO | INTRODUÇÃO: A capsulite adesiva é uma condição dolorosa comum e debilitante da articulação glenohumeral que afeta cerca de 2 a 5% da população. Os órgãos internos e o sistema musculoesquelético são interligados por meio das membranas de sustentação. A tensão nessas membranas pode causar ainda mais restrições mecânicas, dor nas estruturas musculoesqueléticas e também restringir a mobilidade de órgãos viscerais. **OBJETIVO:** Explorar o efeito da manipulação visceral específica de órgãos na capsulite adesiva em pessoas afetadas no ombro direito. **METODOLOGIA:** Vinte indivíduos com capsulite adesiva foram avaliados para elegibilidade, dos quais 14 foram recrutados usando o método de amostragem por conveniência. Duas sessões de manipulação visceral comparada com manipulação placebo foram administradas nas primeiras duas semanas, seguidas de duas sessões de manipulação visceral do fígado nas duas semanas seguintes. O goniômetro digital, o nível de dor, a incapacidade no ombro e o esfigmomanômetro modificado foram usados para medir os resultados pré e pós intervenção. **RESULTADOS:** A comparação dos resultados entre os grupos mostrou uma diferença estatisticamente significativa nos escores de amplitude de movimentos [flexão ($p = 0,001$), rotação externa ($p = 0,001$), rotação interna ($p = 0,001$)], dor no ombro e escore do índice de incapacidade (0,004). Nenhuma mudança significativa foi observada no resultado de força. **CONCLUSÃO:** Duas sessões de manipulação visceral para o fígado podem ser benéficas na melhora da mobilidade do ombro direito, dor e incapacidade.

O número de registro no Clinical Trial é 019/09/028271.

PALAVRAS-CHAVE: Capsulite adesiva. Manipulação visceral. Mobilidade. Dor. Fígado.

Introduction

Adhesive capsulitis (AC), or 'frozen shoulder' is a disabling pathological condition of the shoulder joint, which is denoted by stiffness, pain and dysfunction. The American Shoulder and Elbow Surgeons consensus definition outlines Adhesive capsulitis as "physiological restriction of both active and passive shoulder range of motion for which radiographs of the glenohumeral joint are essentially unremarkable¹. It is believed that inflammation in rotator interval, results in painful motion and subsequent fibrosis, and stiffness that limits movements².

Adhesive capsulitis commonly present in the sixth decade of life with the peak age of 56 years, and it is more common in women than in men³. From 3 to 5 % cases of frozen shoulder are reported in general population and up to 20% in those with diabetes. In primary adhesive capsulitis, bilateral shoulder involvement is reported in 40% to 50% of cases and in a few cases non-dominant extremity is more commonly involved⁴.

Visceral manipulation (VM) is developed by French osteopath Jean-Pierre Barral. It is a organ specific fascial mobilization based on the free movement within the body. Any restriction in the tissues and organs leading to the vascular, neural, musculoskeletal, pulmonary dysfunction⁶. Therefore, visceral restrictions leads to the increase in musculoskeletal restrictions and alleviate the pain severity in the tissues supplied by the relative spinal level via viscerosomatic reflexes. Due to this, the afferent fibers affect the motor or sympathetic nerve⁵.

Visceral manipulation evaluates and treats the structural and fascial dysfunction which leads to increase in proprioceptive communication within the body and relieving the symptoms of pain and dysfunction. According to this study hypothesis visceral manipulation aims to restore the liver mobility by releasing the restrictions in all three planes of motion, which leads to the improvement in the right shoulder symptoms (pain and mobility). There is a dearth of objective therapeutic evidence for supporting the effect of visceral manipulation on right shoulder pain, mobility, and functional disability in subjects with right shoulder adhesive capsulitis.

The objective of the study was to determine the effect of organ specific mobilization on adhesive capsulitis in subjects with right shoulder adhesive capsulitis

Methodology

Study subjects

A convenience sample of 20 subjects diagnosed with right sided adhesive capsulitis enrolled in the study. Out of the 20 screened subjects, 14 subjects diagnosed with right sided adhesive capsulitis and restricted range of motion for three months, aged between 45-65 years including both male and female were recruited for the study using convenience sampling. The patient with history of recent neck and right shoulder surgery, trauma, any tumour and with Chronic liver diseases were excluded from the study. This pilot study was conducted in a Physiotherapy department of a recognized multi-specialty hospital, Mohali. The study protocol was approved by the Institutional Ethical Committee of recognized hospital, Mohali and registered in Clinical Trials (REF/2019/09/028271 N). Written informed consent was obtained from the study participants prior to the study.

Outcome measure

The primary outcome measures used were the shoulder pain and disability index (SPADI), digital goniometer and modified sphygmomanometer used as a secondary outcome measure.

The SPADI is a self-reported questionnaire consisting of 13 items on two subscales: pain 5 items and disability 8 items, using an 11-point numerical rating scale of difficulty from 0 to 10. The scale produces a total score out of 130 and is subdivided into pain out of 50 and disability out of 80. The internal consistencies of the SPADI subscales were high ($\alpha > 0.92$). Correlations $r > 0.60$, were observed between the SPADI and pain reported on a VAS pain scale during active and passive movement. The scale have been shown to be valid and reliable tools to measure pain and disability in primary care settings with good construct validity for a variety of shoulder conditions including frozen shoulder⁶.

Digital goniometer is a hand-held, pocket-sized goniometer using low-level Class 1 laser technology to measure joint angles. Digital goniometer has Intra-rater reliability ICCs between 0.82 and 0.91 and Inter-rater reliability between 0.89 to 0.987. Modified sphygmomanometer is used for the measurement of muscle strength. The modified Sphygmomanometer was found to have excellent test-retest reliability (ICC=0.995-0.999) to assess the maximum voluntary isometric contraction of shoulder muscles⁸.

Intervention

Subjects received two sessions of placebo visceral manipulation (PVM) for two weeks. Study subject was positioned supine on the couch with abdomen region exposed. Therapist stood on the right side of the patient facing the head and placed his right hand flat over the participant abdomen at the right epigastric region or hepatic region, fingertips above the sternoxiphoid line, with no tissue movement. Session was given once a week for 10 minutes.

After the first two weeks, subjects received two sessions of visceral manipulation (VM) of liver for next two weeks. Liver manipulations involve three techniques in different planes. Each technique was repeated for 3 cycles in a session, complete session last for 15 minutes and given once in a week. There are three liver manipulation techniques in three different planes that is mobility treatment techniques in coronal plane, transverse plane and in sagittal plane.

Mobility treatment technique in transverse plane - Each subject was instructed to lie down comfortably on the treatment table in the side lying position with right side up and both legs bent towards the

chest and the therapist stood on the right side of the patient. Liver manipulation began with the therapist's left hand over the right epigastric region (between fifth/ tenth rib) and the right hand behind the left hand on top of the right costal arch, more ventrolaterally. Therapist placed the hands to load the fascia and connect the liver behind the ribs and follow the movement (medial/lateral rolling) of the liver in the direction of ease. This cycle was repeated for 3 repetitions.

Mobility treatment technique in coronal plane - Each subject was instructed to lie down comfortably on the treatment table in supine lying position and the therapist stood on the right side of the patient towards the head side. Therapist placed his right hand (fingers pointing towards the umbilicus) over the fifth /sixth ribs and the left hand below the right hand over the right costal arch. Therapist placed the hands to load the fascia to connect the liver behind the rib and follow the movement inferiorly (towards the pelvis) and superiorly (towards the right shoulder) of the liver in the direction of ease. This cycle was repeated for 3 repetitions.

Mobility treatment technique in sagittal plane -The subject was in the side lying position with right side up and both legs bent towards the chest and the therapist stood behind the patient towards the head side. Therapist placed his left hand vertically on the posterior side of the fifth/sixth rib at the right costal arch and the right hand vertically on the anteriorly side of the right costal arch. Both thumbs pointing towards the right shoulder. Therapist placed the hands to load the fascia to connect the liver and follow the movement (anterior/posterior rolling) of the liver in the direction of ease. This cycle was repeated for 3 repetitions.

Figure 1. Placebo manipulation technique



Figure 2. Visceral manipulation in the frontal plane



Figure 3. Visceral manipulation in the transversal plane

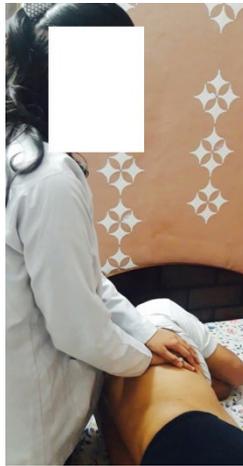
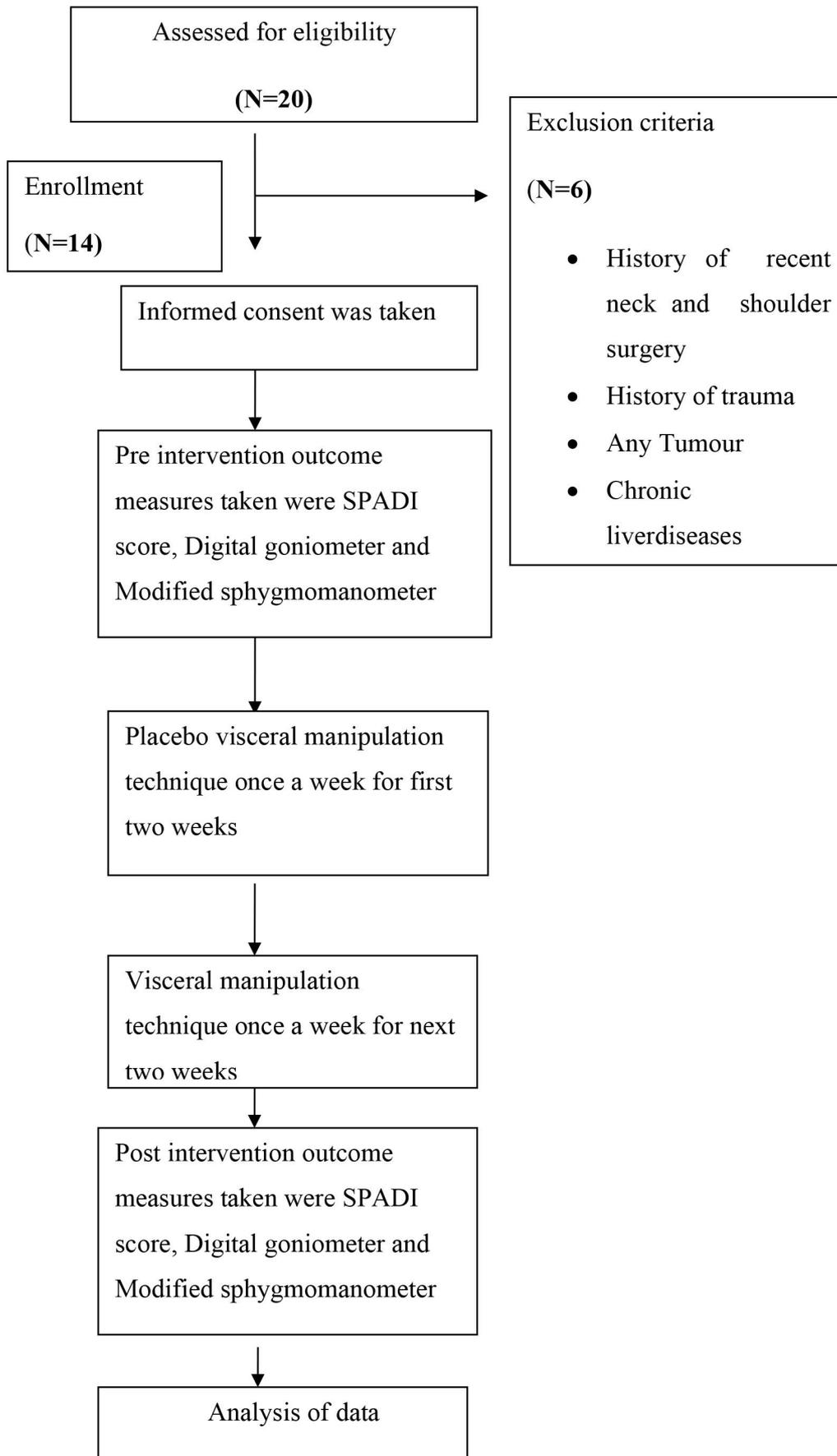


Figure 4. Visceral manipulation in the sagittal plane



Figure 5. Study protocol



Results

Fourteen subjects with a mean age (SD) of 56.5(6.51) years were recruited for this study. Baseline demographic and clinical characteristics are shown in Chart 1. Among the subjects, there were 78.5% females and 21.4% males and 28.5% were diabetic and 71.4% non-diabetic.

Chart 1. Demographic data of study subjects

| Characteristics of study participants(N=14) | | Number of participants(N) |
|---|--------------|---------------------------|
| Age (in years) | 41-50 | 5 |
| | 51-60 | 3 |
| | 61- 70 | 6 |
| Gender | Male | 3 |
| | Female | 11 |
| Diabetes | Diabetic | 4 |
| | Non-diabetic | 10 |

Chart 2. Showing within the group comparison of all the outcome measures of both groups

| Outcome Measures | | Placebo manipulation | | | | Visceral manipulation | | | |
|-------------------------------|---------------------------|---------------------------|----------------------------|-----------------|---------|---------------------------|----------------------------|-----------------|---------|
| | | Pre intervention Mean(SD) | Post intervention Mean(SD) | Mean Difference | P value | Pre intervention Mean(SD) | Post intervention Mean(SD) | Mean Difference | P value |
| Range of motion(in degrees) | Flexion | 96.57 (5.28) | 94.71 (5.84) | -1.86 | 0.004 | 94.71 (5.84) | 105.42 (6.85) | 10.71 | 0.001 |
| | External rot [#] | 38.14 (6.88) | 36.14 (7.19) | -2 | 0.006 | 36.14 (7.19) | 43.07 (6.52) | 6.93 | 0.001 |
| | Internal rot [#] | 37.78 (6.85) | 35.85 (7.55) | -1.93 | 0.013 | 35.85 (7.55) | 41.85 (11.88) | 6 | 0.008 |
| SPADI* (%) | | 73.81 (6.21) | 73.81 (6.21) | 0 | - | 73.81 (6.21) | 69.47 (9.24) | -4.34 | 0.008 |

*SPADI - Shoulder Pain And Disability Index , [#]rot – Rotation

Chart 3. Showing within the group comparison of all the outcome measures of both groups

| | Placebo manipulation (Mean) | | | | Visceral manipulation (Mean) | | | |
|----------------------------|-----------------------------|-------------------|-----------------|---------|------------------------------|-------------------|-----------------|---------|
| | Pre Intervention | Post Intervention | Mean Difference | P VALUE | Pre Intervention | Post intervention | Mean Difference | P VALUE |
| Strength (in mm Hg) | | | | | | | | |
| Flexors | 57.85 (24.39) | 56.42 (23.56) | -1.43 | 0.335 | 56.64 (24.70) | 54.64 (21.16) | -2 | 0.54 |
| External rot [^] | 48.21 (15.14) | 48.21 (15.14) | 0 | - | 48.21 (15.14) | 48.21 (15.14) | 0 | - |
| Internal rot [^] | 43.92 (16.77) | 43.92 (16.77) | 0 | - | 43.92 (16.77) | 43.92 (16.77) | 0 | - |

[^]rot –Rotators

In the placebo manipulation group, mean difference was -1.86 for flexion, and -2 for external rotation and -1.93 for internal rotation. Mean difference was -1.43 for flexors strength

In the visceral manipulation group, mean difference was 10.71 for flexion, and 6.93 for external rotation and 6 for internal rotation and for SPADI mean difference was - 4.34 respectively.

Within group comparison of both groups showed a statistical significance in all 3 ranges of motions and SPADI score.

The Mean difference of the strength for flexors was -1.43 and -2 in placebo and visceral manipulation group. In the pre and post readings for strength of external and internal rotators there was no difference occurs in the both groups.

Within group comparison of both the groups for the outcome measures of strength showed no statistical significant changes.

Chart 4. Shows between the group comparison of outcome measures

| Outcome Measures | | Mean difference | Confidence interval | | P value |
|------------------|---------------------------|-----------------|---------------------|-------------|---------|
| | | | Lower limit | Upper limit | |
| Range of motion | Flexion | 8.86 | 4.50 | 13.21 | <0.001 |
| | External rot [#] | 8.93 | 5.56 | 12.29 | <0.001 |
| | Internal rot [#] | 7.93 | 3.73 | 12.12 | <0.001 |
| Strength | Flexors | -0.57 | -7.84 | 6.70 | 0.873 |
| | External rot [^] | 0 | - | - | - |
| | Internal rot [^] | 0 | - | - | - |
| SPADI* | | 4.34 | -7.19 | -1.48 | 0.004 |

*SPADI - Shoulder Pain and Disability Index, #rot – Rotation, ^rot –Rotators

In this study, the between group comparison showed a statistically significant improvement in the visceral manipulation group for the outcome measures, range of motions (i.e. flexion, external rotation and internal rotation) and SPADI score with p value of <0.001 and 0.004 respectively. There are no statistical significant changes in the shoulder flexor strength.

Discussion

The objective of the study was to explore the effect of visceral manipulation on pain, disability and mobility in right shoulder adhesive capsulitis subjects. The result of this study showed an improvement in mobility, pain and disability post visceral manipulation. There was an increase in flexion, external rotation and internal rotation of the right shoulder measured by Digital goniometer and notable improvement in the shoulder functional activity and pain score measured by (SPADI) score after two weeks of visceral manipulation.

Visceral Manipulation has shown to increase proprioceptive communication through mechanical relation within the body, thereby decreasing the pain threshold, structural abnormality, and faulty posture (Barral visceral and neural manipulation and New Manual Articular Approach). The phrenic nerve that innervates the right shoulder also innervates the liver, this anatomical connection between liver and right shoulder provides the strong connectivity and reason for release of restriction of the shoulder joint movements and muscular tension around right shoulder through direct and indirect method of visceral manipulation, thereby, showing improvement in the mobility, pain and disability post intervention⁵.

Similar study conducted by Silva et al on the effect of stomach and liver visceral manipulation on neck pain, neck range of motion and trapezius muscle activity showed that there was decrease in pain and increases in upper trapezius activity. The changes brought by visceral manipulation in range of motions may be related to mechanism of tension release in the supporting membrane connecting the visceral and musculoskeletal system. Resulting in increase in proprioceptive communication within the body, hence relieving the symptoms of pain and dysfunction⁵.

Glenohumeral joint is the most mobile joint of the body, articular surface movements of the shoulder depends on the activity of the surrounding muscles. Previous studies have shown that any abnormal muscular activity may restrict the shoulder movements and lead to joint dysfunction⁹. During the physiotherapy rehabilitation, it is significant to examine the patients symptoms, stage of the condition and different movement patterns. According to yang j et al, insufficient scapulohumeral rhythm and posterior tipping of the scapula during arm elevation are important to consider in the rehabilitation of the patients with adhesive capsulitis, Treatment strategies aimed to restore shoulder mobility emphasizes towards mobilization of the shoulder and applying tension to the capsule, extra capsular ligaments and muscle tendons of the rotator cuff, in an attempt to stretch the restricting tissues¹⁰.

According to recent evidences and clinical guidelines for the management of Adhesive capsulitis, comprised of steroid injection (4-6weeks), patient awareness, electrotherapeutic modalities, joint mobilizations, manipulations, and strengthening exercises. Results are in linear with the statement by Gluraiz et al that factors attributing to pain are multi-factorial. Pain may be experienced as a result of dysfunctions in the musculoskeletal, nervous, visceral, psycho-somatic and emotional system in the body¹¹. Hence, comprehensive multi-system assessment and intervention will be effective in pain and movement dysfunction. Integrated viscera musculoskeletal assessment and visceral manipulation will be one of the effective tools in the rehabilitation strategies¹².

Post visceral manipulation, there was no significant improvement observed in the shoulder flexors, external rotators and internal rotators muscle strength, which attributes to the fact that tone of the muscle may not be influenced by visceral manipulation and physical therapy interventions such as strengthening exercises will play a vital role in activating muscles post visceral manipulation.

Limitations

Limitations of this study are small sample size, follow up was not assessed to study the retention of the treatment effect and a better objective outcome measure such as EMG may have provided a deep insight into the shoulder muscle activity. A randomized control trial with a larger sample size and electromyographic recording for shoulder muscle activity with follow-ups may be recommended for future studies.

Conclusion

Visceral Manipulation of liver has shown to increase right shoulder range of motions (flexion, external rotation and internal rotation) and decrease pain and functional disability in right shoulder adhesive capsulitis subjects. It proves to be an effective tool in a multi-model intervention and rehabilitation of adhesive capsulitis.

Author contributions

Ghillodia A and Gandhi BK conceived the research, the study design, collected and analyzed the data. Both authors approved the final version of the manuscript.

Competing interests

No financial, legal or political competing interests with third parties (government, commercial, private foundation, etc.) were disclosed for any aspect of the submitted work (including but not limited to grants, data monitoring board, study design, manuscript preparation, statistical analysis, etc.).

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