Original Article

Myofascial Pain Syndrome and Its Relation to Trigger Points, Facial Form, Muscular Hypertrophy, Deflection, Joint Loading, Body Mass Index, Age and Educational Status

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ABSTRACT

Introduction: Myofascial pain (MFP) is a type of pain characterized by the presence of a trigger point (TrPs) in taut band of skeletal muscles or its fascia. Based on the current literature, the prevalence of head and neck myofascial pain (HNMFP) varies among different communities. To better understand this condition and its relation to facial form, muscular hypertrophy, deflection, and joint loading, the study aimed at evaluating the prevalence of HNMFP among the population of Jeddah, Saudi Arabia. **Materials and Methods:** This was a cross-sectional study to survey a sample of Jeddah residents, Saudi Arabi between the ages of 18–65 for HNMFP who were attending a public event in December 2019. Participants were asked to complete a questionnaire for demographics and history of HMFP signs and symptoms followed by a comprehensive clinical examination including facial form, muscular hypertrophy, maximum vertical opening, and joint loading. In addition, examination of upper quarter muscles was completed using flat or pincer palpation as needed. Data were collected and summarized as frequencies and percentages and group differences were tested using the chi-square statistical method. **Results:** A total of 197 participants were examined in this study, in which 136 (69.0%) had signs and symptoms consistent with HNMFP. Study subjects' educational status was significantly associated with HNMFP ($P = 0.008$). Older subjects were more likely to report spontaneous pain whereas younger subjects were more likely to report pain following trauma ($P = 0.049$). Older subjects were more likely to have muscular hypertrophy ($P = 0.011$), while Younger subjects were more likely to have symmetrical facial form ($P = 0.004$). In terms of gender, males were more likely to experience pain aggravation with pressure and cold application whereas females were more sensitive to jaw function ($P = 0.015$). Distribution of joint loading showed a statistically significant difference between males and females ($P = 0.008$) with females having deflection on opening more frequently compared to males ($P = 0.001$). Furthermore, female subjects showed a significantly higher frequency of positive TrPs compared to males. **Conclusion:** Based on the current data, HNMFP is a common condition among the population of Jeddah. Factors such as body mass index and educational level were found to be linked to HNMFP. Younger subjects were more likely to have

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symmetrical facial form while older subjects were more likely to have muscular hypertrophy. The distribution of joint loading showed a statistically significant difference between males and females with females having deflection on opening more frequently compared to males. Further studies with a larger group of patients are needed to confirm these findings.

Keywords: *Head and neck myofascial pain, myofascial pain syndrome, prevalence*

Introduction

Myofascial pain (MFP), known also as myofascial pain syndrome (MPS), is a type of pain characterized by the presence of a trigger point (TrPs) in a taut band of skeletal muscles or its fascia.[1,2] Several factors have been linked to MFP including emotional and behavioral statuses, poor posture, muscular tension, and history of road traffic accidents (RTAs). Other comorbidities such as tension-type headaches and temporomandibular joint pain have also been reported to trigger an MFP episode.[3-6] The proposed pathogenesis of MFP include interactions of varying intrinsic factors (i.e., central sensitization, decreased coping ability) and extrinsic factors (psychological, behavioral, and psychosocial factors) with consistent hypercontraction of sarcomeres forming TrPs within muscle tissues.[7] Due to continuous neural activation and action potential generation in these TrPs, an increase in secretion of myokines, inflammatory cytokines, and neurotransmitters with a reduction in blood flow will take place.[8-10] These mechanisms combined with psychological stresses are believed to sensitize the muscle TrPs causing the patient's symptoms.[4,11,12]

Subjective symptoms of MFP in the head and neck region (HNMFP) often include continuous, dull aching pain that is present at rest and increases with function (jaw loading) varying from mild discomfort to debilitating pain.[13,14] Objective finding commonly includes jaw deviation with function, aggravated by palpation of muscles of mastication during examination.[15] In general, diagnosis of HNMFP is a challenging process due to variation in the condition patterns and wide range of reported symptoms in addition to lack of adequate dental practitioners' experiences in some occasions. Therefore, the diagnosis process mostly relies on a combination of detailed patient's history, clinical examination, and imagining on a case-by-case basis.[16,17] Inaccurate or late diagnoses are more likely to lead to improper intervention and exacerbation of patient's symptoms.

Based on the current literature, the prevalence of HNMFP varies among different communities. In the US, up to 85% of the general population may have experienced HNMFP at one point in life.[1] Out of all the cases, 30-85% would have a true TrPs with females being more affected than males with age range between 27 and 50 years.[18,19] To deliver standard of care to patients in need, national data on prevalence of HNMFP is crucial. Therefore, the study aimed at evaluating the prevalence of HNMFP among the population of Jeddah, Saudi Arabia. We believe the outcome of this study will help to fill the gap in national databases on HNMFP and support the development of educational programs for the public as well as health care providers.

Materials and Methods

A human research ethical approval was obtained through AlFarabi Dental College, Jeddah, Saudi Arabia. This was a cross-sectional study to survey a sample from residents of Jeddah, Saudi Arabi between the ages of 18–65 for HNMFP. The study exclusion criteria included (1) subjects who are not willing to undergo a thorough head and neck examination; (2) history of fibromyalgia or multiple complex medical conditions which could present with HNMFP-like signs and symptoms such as complex regional pain syndrome, psychiatric disorders, trauma or injury to the palpation site, neurological conditions and or rheumatologic disorders; and (3) participants who are currently on pain medications for any reason, antidepressant, anti-epileptic, and/or antipsychotic medication. The study was conducted at an annual public dental awareness event which took place over 3 days in Jeddah Waterfront Zone in December 2019. The event was held on a one-square-kilometer space with a total attendees 2500 attendees in which all were invited to participate in the study.

Participants were first asked to complete a questionnaire composed of two sections. The first section included demographic questions on age, gender, educational level, marital status, and occupation. The second section was adopted from McGill pain questionnaire.[20] Including HNMFP-related questions, if present, such as symptoms' onset, location, aggravating and alleviating factors, and

pain location on a multiple view diagram. Next, all subjects had a comprehensive clinical examination completed by one of six calibrated co-investigators and included facial form, muscular hypertrophy, maximum vertical opening, deflection, and joint loading following Simons *et al.*[1] MFP diagnostic criteria. In addition, examination of upper quarter muscles (i.e., temporalis, masseter, sternocleidomastoid, and upper trapezius muscles) was completed using flat or pincer palpation as needed. Using this method, a TrP was identified when a pressure of 4 kg/cm^2 was applied for 5–10 s to each muscle resulted in pain or tenderness.[1] Following completion of clinical examination, subjects were provided with an educational pamphlet on HNMFP and answered all questions related to condition diagnosis and management. In addition, referral information was provided to symptomatic participants for further management.

For the purpose of this analysis, participants with one or more TrP were identified to have HNMFP. Collected data were summarized as frequencies and percentages. The presence of HNMFP was cross-tabulated with the demographic (i.e., age and gender). Then, group differences in pain characteristics, clinical examination, and presence of TrPs were tested using chi-square statistical method with a statistical significance value set at $P < 0.05$. IBM SPSS Statistics for Windows, version 23.0 was used to analyze the data.

Results

A total of 197 subjects participated in the study with a response rate of 9.8%. Overall, 136 (69.0%) had signs and symptoms consistent with HNMFP.

Demographics

About two-thirds (63.5%) of subjects were in the 18–35 age group and the remaining 36.5% aged between 36 and 65 years. In total, there were 113 (57.4%) males and (42.6%) females. In terms of educational levels, 29.9% had completed high school, 61.9% had a bachelor's degree, and 8.1% had a master's degree or higher. Overall, the risk of HNMFP was significantly associated with the educational status ($P = 0.008$). Categorization of subjects based on body mass index (BMI) showed that 56% were overweight or obese and 36.5% were within normal weight range. Accounting for BMI, overweight and obese subjects had higher tendency to report pain ($P = 0.062$). Details of study subjects' demographics are listed in Table 1.

Characteristics of self-reported HNMFP

The relation between HNMFP symptoms and both age groups and gender were investigated in this study. Overall, younger subjects reported pain to occur significantly more often on the right side (36.6% for younger subjects; 24.1% for older subjects) while older subjects were more likely to report pain on the left side (33.3% for older subjects; 15.9% for younger subjects) and the difference was statistically significant ($P = 0.046$). In terms of onset, older subjects were more likely to report spontaneous pain whereas younger subjects were more likely to report pain following trauma or a specific event ($P = 0.049$). Furthermore, male subjects were more likely to experience pain aggravation by pressure (15.4% vs. 3.4% in females) and cold (11.5% vs. none in females). Whereas female subjects were more likely to report jaw function (46.6%

Table 1: Demographics of study participants

Demographic variables	Category	Total	HNMFP		*P* Value†
		N = 197	Yes	No	
			n = 136	*n* = 61	
		Frequency (%)	Frequency (%)	Frequency (%)	
Age in years	18–35	125 (63.5)	82 (65.6)	43 (34.4)	0.169
	36–65	72 (36.5)	54 (75.0)	18 (25.0)	
Gender	Female	84 (42.6)	58 (69.0)	26 (31.0)	0.997
	Male	113 (57.4)	78 (69.0)	35 (31.0)	
Ethnicity	Arabs	187 (94.9)	128 (68.4)	59 (31.6)	0.514
	Non-Arabs	10 (5.1)	8 (80.0)	2 (20.0)	
Marital status	Single	91 (46.2)	56 (38.5)	35 (38.5)	0.103
	Married	96 (48.7)	72 (75.0)	24 (25.0)	
	Divorced or widowed	10 (5.1)	8 (80.0)	2 (20.0)	
Highest educational degree	High school or less	59 (29.9)	46 (78.0)	13 (22.0)	0.008*
	Bachelor's degree	122 (61.9)	84 (68.9)	38 (31.1)	
	Master's or higher	16 (8.1)	6 (37.5)	10 (62.5)	
BMI	Underweight	13 (6.6)	7 (53.8)	6 (46.2)	0.062
	Within normal	72 (36.5)	44 (61.1)	28 (38.9)	
	Overweight or obese	112 (56.8)	85 (75.7)	27 (24.3)	

†Chi-square test

*Statistically significant at $P < 0.05$

vs. 34.6% in males) as the main aggravating factor for pain ($P = 0.015$). Details of self-reported characteristics of HNMFP are listed in Table 2.

Clinical examination

Comprehensive head and neck clinical examination was carried out for all subjects and categorized based on age and gender. Younger subjects were more likely to have symmetrical facial form compared to older subjects (96.3% vs. 81.5%; $P = 0.004$) while older subjects were more likely to have muscular hypertrophy compared to younger subjects (29.6% vs. 12.2%; $P = 0.011$). In addition, female subjects had deflection on opening more frequently compared to males (39.7% vs. 15.4%; $P = 0.001$). The distribution of joint loading showed a statistically significant difference between males and females ($P = 0.008$). Details of head and neck examination are included in Table 3.

TrP screening

No significant differences in the presence of TrPs with relation to age were noted except for the left SCM which was more tender in older subjects ($P = 0.006$). In addition, female subjects showed a significantly higher frequency of positive TrPs in 10 examined muscles (of 14 in total) compared to males. Of all, 20.5% of male

Table 2: Characteristics of self-reported HNMFP ($n = 136$)

Pain character	Category	Age		*P* Value †	Gender		*P* Value†
		18–35 years	36–65 years		Male	Female	
		n = 82	*n* = 54		*n* = 78	*n* = 58	
		Frequency (%)			Frequency (%)		
Location	Right	30 (36.6)	13 (24.1)	0.046*	27 (34.6)	16 (27.6)	0.684
	Left	13 (15.9)	18 (33.3)		17 (21.8)	14 (24.1)	
	Bilateral	39 (47.6)	23 (42.6)		34 (43.6)	28 (48.3)	
Onset	Spontaneous	30 (36.6)	29 (53.7)	0.049*	34 (43.6)	25 (43.1)	0.955
	Following trauma or a specific event	52 (63.4)	25 (46.3)		44 (54.4)	33 (56.9)	
Duration	Seconds	29 (35.4)	15 (27.8)	0.494	19 (24.4)	25 (43.1)	0.083
	Minutes	29 (35.4)	25 (46.6)		35 (44.9)	19 (32.8)	
	Hours	12 (14.6)	9 (16.7)		15 (19.2)	6 (10.3)	
	Days	12 (14.6)	5 (9.3)		9 (11.5)	8 (13.8)	
Frequency	Episodic	70 (85.4)	40 (74.1)	0.101	61 (78.2)	49 (84.5)	0.357
	Continuous	12 (14.6)	14 (25.9)		17 (21.8)	9 (15.5)	
Quality	Dull	37 (45.1)	18 (33.3)	0.108	35 (44.9)	20 (34.5)	0.370
	Sharp	6 (7.3)	11 (20.4)		6 (7.7)	11 (19.0)	
	Aching	12 (14.6)	3 (5.6)		10 (12.8)	5 (8.6)	
	Throbbing	13 (15.9)	11 (20.4)		13 (16.7)	11 (19.0)	
	Electric-like	7 (8.5)	7 (13.0)		7 (9.0)	7 (12.1)	
	Others	7 (8.5)	4 (7.4)		7 (9.0)	4 (6.9)	
Aggravating factors	Pressure	7 (8.5)	7 (13.0)	0.289	12 (15.4)	2 (3.4)	0.015*
	Stress	12 (14.6)	11 (20.4)		13 (16.7)	10 (17.2)	
	Cold	6 (7.3)	3 (5.6)		9 (11.5)	0	
	Chewing and jaw movement	38 (46.3)	16 (29.6)		27 (34.6)	27 (46.6)	
	Routine activity	10 (12.2)	6 (11.1)		8 (10.3)	8 (13.8)	
	Light touch	4 (4.9)	2 (3.7)		4 (5.1)	2 (3.4)	
	Others	5 (6.1)	9 (16.7)		5 (6.4)	9 (15.5)	
Alleviating factors	Rest	47 (57.3)	23 (42.6)	0.359	45 (57.7)	25 (43.1)	0.374
	Medications	10 (12.2)	9 (16.7)		10 (12.8)	9 (15.5)	
	Physical therapy	8 (9.8)	9 (16.7)		10 (12.8)	7 (12.1)	
	Refrain from pain producing activity	7 (8.5)	3 (5.6)		5 (6.4)	5 (8.6)	
	Others	10 (12.2)	10 (18.5)		8 (10.3)	12 (20.7)	
Intensity	Mild	41 (50.0)	20 (37.0)	0.330	40 (51.3)	21 (36.2)	0.183
	Moderate	28 (34.1)	23 (42.6)		27 (34.6)	24 (41.4)	
	Severe	13 (15.9)	11 (20.4)		11 (14.1)	13 (22.4)	

†Chi-square test

*Statistically significant at $P < 0.05$

subjects had positive TrPs in right temporalis muscle compared to 41.4% in female subjects ($P = 0.008$). In addition, 14.1% of male subjects had positive TrPs in left temporalis muscle compared to 53.4% in female subjects ($P < 0.001$). For the right sternocleidomastoid muscle, 23.1% of male subjects had positive TrPs compared to 39.7% in female subjects ($P = 0.037$). At the same time, TrPs frequency in the right trapezius muscle was reported in 34.6% of males compared to 51.7% in females ($P = 0.046$). Details of TrPs screening are included in Table 4.

Discussion

HNMFP is a fairly common condition with major impact on social and professional life. Several management approaches have been propose and are usually tailored to each patient based on symptoms distribution and severity. It includes analgesics such as paracetamol, nonsteroidal anti-inflammatory medications, opioids, and/or physical therapies including myofascial TrP massage, ischemic compression, and acupuncture.[21-23] Based on the literature, treatment duration of MFP varies and is strongly related to MFP onset. Patients with acute onset are more likely to have their symptoms resolve spontaneously or with minimal intervention in few weeks. Only a small percentage of patients may progress into a chronic status as experienced pain could last up to 6 months. On the contrary, the prognosis of chronic MFP is less predictable, and the average duration of symptoms may reach up to 63 months.[24,25]

Several, smaller studies have looked at the prevalence of self-reported HNMFP in different cities of Saudi Arabia and ranged between 22.4% and 42%.[26] Only few studies on HNMFP have been conducted in Jeddah, the second-largest city of Saudi Arabia, which creates a significant challenge from a public health point of view to understand this condition and develop national prevention and management programs for the general public. In addition, the potential relation between BMI and HNMFP reported in this study is of a great interest considering Saudi Arabia to have one of the highest obesity incidence in general population in addition to other chronic diseases such as hypertension and hyperlipidemia. We believe our study will be a great addition to the database of this region and HNMFP literature, which would facilitate future larger funded studies with focus on pathogenesis and intervention.[27-29]

The present study is based on a self-reported questionnaire combined with clinical examination for subjective findings. Overall, 136 (69%) subjects had at least one tender muscle and were assigned the diagnosis of HNMFP. Several risk factors for HNMFP were evaluated in this study. Overweight and obese subjects had higher tendency to report muscle pain than normal or underweight individuals, similar to what have been reported in the literature previously.[30] Available evidence suggests that obesity is associated with low-grade chronic inflammatory state where inflammatory markers such as C-reactive protein, IL-6, TNF, and serum cortisol were found to be elevated

Table 3: Clinical examination of HNMFP subjects ($n = 136$)

	Category	Age		*P* Value†	Gender		*P* Value†
		18–35 years	36–65 years		Male	Female	
		$n = 82$	$n = 54$		$n = 78$	$n = 58$	
		Frequency (%)			Frequency (%)		
Facial form	Symmetrical	79 (96.3)	44 (81.5)	0.004*	68 (87.2)	55 (94.8)	0.134
	Asymmetrical	3 (3.7)	10 (18.5)		10 (12.8)	3 (5.2)	
Muscular hypertrophy	Yes	10 (12.2)	16 (29.6)	0.011*	18 (23.1)	8 (13.8)	0.173
	No	72 (87.8)	38 (70.4)		60 (76.9)	50 (86.2)	
Deflection	Yes	19 (23.2)	16 (29.6)	0.399	12 (15.4)	23 (39.7)	0.001*
	No	63 (76.8)	38 (70.4)		66 (84.6)	35 (60.3)	
Joint loading	No pain	45 (54.9)	30 (55.6)	0.193	46 (59.0)	29 (50.0)	0.008*
	Pain on right when loading right	9 (11.0)	7 (13.0)		7 (9.0)	9 (15.5)	
	Pain on right when loading left	3 (3.7)	0		2 (2.6)	1 (1.7)	
	Pain on left when loading right	6 (7.3)	10 (18.5)		3 (3.8)	13 (22.4)	
	Pain on left when loading left	7 (8.5)	3 (5.6)		8 (10.3)	2 (3.4)	
	Bilateral pain regardless of side of loading	12 (14.6)	4 (7.4)		12 (15.4)	4 (6.9)	

†Chi-square test

*Statistically significant at $P < 0.05$

Table 4: Presence of TrPs in examined muscles (n = 136)

Muscle	Side	Age		*P* Value†	Gender		*P* Value†
		18–35 years	36–65 years		Male	Female	
		n = 82	n = 54		n = 78	n = 58	
		Frequency (%)			Frequency (%)		
Temporalis	Right	21 (25.6)	19 (35.2)	0.230	16 (20.5)	24 (41.4)	0.008*
	Left	23 (28.0)	19 (35.2)	0.378	11 (14.1)	31 (53.4)	<0.001*
Temporalis anterior	Right	22 (26.8)	15 (27.8)	0.903	16 (20.5)	21 (36.2)	0.042*
	Left	20 (24.4)	12 (22.2)	0.771	12 (15.4)	20 (34.5)	0.009*
Temporalis middle	Right	13 (15.9)	8 (14.8)	0.870	7 (9.0)	14 (24.1)	0.016*
	Left	14 (17.1)	11 (20.4)	0.627	7 (9.0)	18 (31.0)	0.001*
Temporalis posterior	Right	8 (9.8)	11 (20.4)	0.081	4 (5.1)	15 (25.9)	0.001*
	Left	8 (9.8)	10 (18.5)	0.140	2 (2.6)	16 (27.6)	<0.001*
Masseter superficial	Right	35 (42.7)	23 (42.6)	0.992	31 (39.7)	27 (46.6)	0.427
	Left	37 (45.1)	25 (46.3)	0.893	36 (46.2)	26 (44.8)	0.878
Masseter deep	Right	17 (20.7)	15 (27.8)	0.343	17 (21.8)	15 (25.9)	0.580
	Left	19 (23.2)	17 (31.5)	0.282	20 (25.6)	16 (27.6)	0.799
Sternocleidomastoid	Right	22 (26.8)	19 (35.2)	0.299	18 (23.1)	23 (39.7)	0.037*
	Left	17 (20.7)	23 (42.6)	0.006*	21 (26.9)	19 (32.8)	0.460
Trapezius	Right	39 (47.6)	18 (33.3)	0.100	27 (34.6)	30 (51.7)	0.046*
	Left	32 (39.0)	23 (42.6)	0.678	30 (38.5)	25 (43.1)	0.585

†Chi-square test

*Statistically significant at $P < 0.05$

which may have a role in altering pain modulation in HNMFP individuals.[31] In addition, the increase in mechanical stresses caused by overweight results in further production of proinflammatory cytokines from chondrocytes to overexpress body pain.

Lower educational status was another factor investigated in this study, and was significantly related to report of muscle pain by participants (P = 0.008). This finding was in line with what have been reported by Janevic *et al.*[32] in which prevalence of chronic pain in subjects suffering from arthritis, cancer, diabetes, heart disease, high blood pressure, and lung disease was association with lower education degree. Analyzing HNMFP triggers in relation to age group, older subjects experienced spontaneous pain without a trigger. However, younger subjects were more likely to have a triggering event such as trauma followed by HNMFP onset. One explanation could be the anticipated higher levels of physical activities among younger population and increased risk for trauma which can take different forms. One in particular is the use of simultaneous electronic devices which has been linked to musculoskeletal pain in adolescents within a school-based study.[33]

The role of gender was considered in this study as female subjects significantly showed a higher prevalence of positive TrPs compared to males. This relation in particular has always been immense and unclear. Diverse theories in relation to gender were proposed including links to genetics and hormonal changes such as menstrual cycle, pregnancy, and oral conceptive use which may exaggerate HNMFP symptoms.[34] At the same time, women are more likely to be vocal and tend to report pain more often than men.[35] In the current study, pain aggravating factors varied in relation to gender as male subjects were more likely to experience pain with pressure and cold. However, female subjects were more likely to report jaw function as the main aggravating factor for pain (P = 0.015). These findings are consistent with what was reported by Mogil *et al.*[36] and indicated sex differences to affect certain pain modalities compared to others such as in heat or pressure-induced pain and ischemic pain. At the same time, Spierings *et al.*[37] concluded that joint loading or function (chewing, eating, and talking) are more likely to aggravate HNMFP in females. However, a recent systematic review evaluated the relation between gender and pain perception in a total of 122 studies and reported cold and pressure to aggravate pain more often in females than males, which contradicts our findings.[38]

This study has several limitations. First, the study participants were recruited from a single event location and generalization to all population of Jeddah is not applicable especially for difference in socioeconomic levels. Furthermore, study subjects were invited to participate in the study during the event and were more likely to be educated, healthy, and self-aware due to the event setup and location. However, our result showed

diversity, specifically in gender and age groups, which may compensate for this issue to a certain capacity. Second, the study was conducted in the city of Jeddah and future studies are needed to better understand the prevalence of HNMFP in all population of Saudi Arabia.

Conclusion

MFP in the head and neck region is a common condition among adult population of Jeddah with more female subjects experiencing a significantly higher frequency of positive TrPs compared to males. In addition, factors such as BMI and educational level were found to be linked to HNMFP. Younger subjects were more likely to have symmetrical facial form while older subjects were more likely to have muscular hypertrophy. The distribution of joint loading showed a statistically significant difference between males and females with females having deflection on opening more frequently compared to males. Acknowledging the prevalence of HNMFP is important for future assessment, better understanding and management of such chronic pain condition. Further studies with larger group of patients are needed to confirm these findings.

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Conflicts of interest

There are no conflicts of interest.

Authors contributions

Not applicable.

Ethical policy and institutional review board statement

The procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation at AlFarabi Dental College, Jeddah, Saudi Arabia. Prior to launching the study, a human research ethical approval was obtained as stated in the manuscript (ethical approval reference number 20-08/6).

Patient declaration of consent

Not applicable.

Data availability statement

Not applicable.

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