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Original Article

Investigation of temporomandibular joint diseases and related factors in hemodialysis patients: a cross-sectional study

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ABSTRACT

Aims: This study aimed to investigate the prevalence of temporomandibular joint diseases (TMD) among hemodialysis (hd) patients and to explore the association between sociodemographic and laboratory parameters and the occurrence of TMD.

Methods: A cross-sectional study was conducted involving 81 hd patients. Sociodemographic characteristics and laboratory parameters of the participants were collected. TMD was assessed using the fonseca anamnestic test. Statistical analysis was performed using spss-22.

Results: Among the 81 participants, 39 (48.1%) were female and 42 (51.9%) were male, with a mean age of 58.2±15.27 years. TMD was detected in 50 patients (61.7%). Significant associations were found between TMD and the presence of comorbid diseases (p=0.002), low hemoglobin levels (p=0.001), and low albumin levels (p=0.002).

Conclusion: the study identified comorbid diseases, low hemoglobin, and low albumin as significant factors associated with TMD in hd patients. These findings suggest that heightened awareness and targeted management of these risk factors may improve clinical outcomes for hd patients with TMD. Enhanced understanding among clinicians regarding the high incidence and related factors of TMD in this patient population could lead to more effective treatment strategies.

Keywords: Fonseca anamnestic test, hemodialysis, temporomandibular joint diseases

INTRODUCTION

The temporomandibular joint (TMJ) is critical for daily activities such as speaking, swallowing, and chewing. Temporomandibular joint disease (TMD) refers to a range of clinical issues, including tmj pain, masticatory muscle disorders, intra-articular problems, and restricted mandibular movement.[1] TMD can encompass conditions such as osteoarthritis, rheumatoid arthritis, and other temporomandibular joint disorders.[2] Diagnosing TMD can be challenging due to overlapping symptoms with other conditions, such as jaw, face, and neck pain, difficulty chewing or speaking, and clicking or popping sounds in the joint. Therefore, a comprehensive evaluation is necessary to accurately diagnose TMD in hemodialysis (hd) patients.

TMD is relatively common in the general adult population, affecting approximately 3-15% of adults, with about 15% of these cases requiring treatment.[3] However, the incidence is notably higher in certain populations, such as hd patients, with up to 40% suffering from TMD.[4] Previous studies have explored the increased frequency of tmj disorders in conditions like polycystic ovarian syndrome, obesity, rheumatological diseases, and hashimoto's thyroiditis.[5-7] However, limited research has been conducted specifically on chronic kidney diseases (ckd) and hd patients. [7]

Hd is a common treatment for end-stage kidney failure (eskf), but it is associated with complications, including TMD.[8] Several factors may contribute to the development of TMD in hd patients, such as changes in bone metabolism, imbalances in calcium and phosphorus, and chronic inflammation. Additionally, the stress and strain from repeated venipunctures during hd may also play a role in the development of TMD.[4]

The Fonseca[8] anamnestic test is a tool used to assess the presence and severity of symptoms related to TMD in patients. Developed by Fonseca et al. in 2010, it has since been

widely used in clinical and research settings. Studies have demonstrated that the fonseca anamnestic test is a reliable and valid tool for assessing TMD symptoms.[9,10] It has also been used to evaluate the effectiveness of various treatments for TMD, such as physical therapy and splint therapy.[4-11]

According to the fonseca anamnestic test, common TMDs include myofascial pain, disc displacement with reduction, disc displacement without reduction, and arthritis. These conditions are classified based on the severity and type of symptoms reported by the patient.[8] It is important to note that the fonseca anamnestic test is just one diagnostic tool for TMD, and a proper diagnosis and treatment plan should be made by a healthcare professional experienced in managing TMD.[11] Overall, the fonseca anamnestic test is a valuable tool for assessing TMD symptoms, helping clinicians and researchers better understand and treat this common condition.

Treatment for TMD in hd patients depends on the type and severity of the disorder. Conservative measures such as physical therapy, pain management, and lifestyle modifications may be effective for mild cases, while severe cases may require surgery or other interventions.[4]

In this cross-sectional study, we aimed to determine the prevalence of TMD and its associated clinical and biochemical factors using the fonseca anamnestic test in hd patients. Additionally, we will discuss the diagnosis and treatment of TMD in this patient population. A better understanding of TMD in hd patients is essential for developing effective management strategies and improving patient outcomes.

METHODS

Ethical considerations

Prior to participation, all patients were informed about the study objectives, procedures, and potential risks and benefits. Written informed consent was obtained from each participant. The study protocol was reviewed and approved by the scientific Mardin Artuklu University Clinical Researches Ethics Committee (Date: 10.07.2023, Decision No: 2023/7-19) and adhered to the ethical standards set forth in the 1964 Declaration of Helsinki.

Study design and participants

This cross-sectional study was conducted with 81 hd patients from three hd centers located in mardin, Turkiye. The study population included patients aged 18 years and older who were receiving regular hd treatment. Patients with elevated C-reactive protein (CRP) levels, indicating inflammation, or those with active malignancies were excluded to avoid confounding factors that could influence the presence of TMD.

Data collection

Data were collected through direct interviews and review of medical records. Sociodemographic information, including age, gender, duration of hd treatment, and relevant medical history, were recorded. Biochemical parameters from the past month, such as CRP, albumin, ferritin, and hemoglobin levels, were also obtained from the patients' medical records. The threshold value for bmi was set at 30 kg/m². This value was chosen to align with internationally recognized definitions of obesity by health organizations and standardized health guidelines in previous literature.

Assessment of TMD

The fonseca anamnestic test, a validated self-reported questionnaire, was utilized to assess the presence and severity of TMD. This test consists of ten questions addressing symptoms related to TMD, including pain in the temporomandibular joint, limitations in jaw movement, and other associated symptoms. Each question is scored on a scale from 0 to 4, with higher scores indicating greater severity of symptoms. The total score ranges from 0 to 40, with higher scores indicating more severe TMD symptoms. Based on the responses and following the dentist's tmj examination, patients were categorized as having TMD, or no TMD.

Grouping of Participants

Participants were divided into two groups based on the presence of TMD as determined by the fonseca anamnestic test:

TMD group: Patients who reported symptoms indicative of TMD.

Non-TMD group: Patients who did not report symptoms indicative of TMD.

The collected data were analyzed to determine the prevalence of TMD among the hd patients and to explore potential associations between TMD and various sociodemographic and biochemical factors. Comparative analyses were conducted between the TMD and non-TMD groups to identify any significant differences.

Limitations

This study has several limitations. Firstly, the sample size is limited, and a larger sample could enhance the generalizability of the results. The study sample was selected solely from hd centers in mardin, and therefore, the findings may not be generalizable to hd patients in other geographical regions. Additionally, as this study has a cross-sectional design, it is not possible to determine a causal relationship between TMD and hd. The evaluation of TMD was conducted using only the fonseca anamnestic test, and the subjective nature of this test may introduce some biases. The observation period of the study is limited, which may hinder the assessment of long-term outcomes of TMD. Lastly, some clinical and biochemical data may be missing or insufficient, which could affect the accuracy of the results.

Statistical Analysis

Independent t-tests were employed to compare normally distributed variables in the statistical analysis of the data, specifically for comparing means between two groups. For variables that did not follow a normal distribution, the Mann-Whitney U test was used to compare two independent groups. To analyze categorical data, the fisher's exact test was employed to assess the association between categorical variables. A significance level of $p<0.05$ was adopted to determine statistical significance throughout the analyses.

Furthermore, a power analysis was conducted to determine the necessary sample size for the study, ensuring adequate statistical power to detect meaningful differences between groups. This step is crucial for ensuring the reliability and validity of the study's findings. Statistical analyses were performed using spss 22.0 (statistical package for the social sciences), an ibm software program widely used for statistical analysis in research settings.

RESULTS

Thirty-nine (48.1%) of the participants were female and 42 (51.9%) were male. The mean age was 58.2±15.27 years. After the fonseca anamnestic test evaluation was performed to determine the severity of TMD in patients, 31 (38.3%) patients did not have TMD, whereas TMD was found in 50 (61.7%) patients (Table 1).

In our study, when comparing the sociodemographic and biochemical parameters of hd patients with and without TMD, TMD was found in 42 (72.4%) of those with comorbid disease (p=0.002). The hemoglobin level was 10.67±1 g/dL in patients without TMD, whereas it was significantly lower at 9.9±0.84 g/dL in patients with TMD (p=0.001). Similarly, the albumin level was 3.78±0.4 g/L in patients without TMD, but it was lower at 3.5±0.37 g/L in patients with TMD (p=0.002) (Table 2). Anova and kruskal-wallis tests were not employed in this study.

Table 1. Sociodemographic characteristics of hemodialysis patients

	n: 81
Age (mean±SD)	58.20±15.27
Sex, n (%)	
Female	39 (48.10)
Male	42 (51.90)
Height (cm), mean±SD	163.20±15.80
Weight (kg), mean±SD	70.20±17.40
BMI, (kg/m²)	
<30	58 (71.60)
>30	23 (28.40)
Hemodialysis time (month), n (%)	
0-12 months	29 (35.80)
13-60 months	30 (37)
>60 months	22 (27.20)
Alcohol/smoking, n (%)	
No	57 (70.40)
Yes	24 (29.60)
Comorbidities, n (%)	
No	20 (24.70)
Yes	61 (75.30)
Educationalstatus, n (%)	
Illiterate	22 (27.20)
Primary education	36 (44.40)
Secondary education	21 (25.90)
high education	2 (2.50)
Marital status, n (%)	
Single	16 (19.80)
Married	65 (80.20)
Lifestyle, n (%)	
Alone	8 (9.90)
With his wife/her husband	19 (23.50)
With his wife/her husband and children	36 (44.40)
With their children	10 (12.30)
With mom and dad	8 (9.90)
Place of residence, n (%)	
Rural	14 (17.30)
Urban	67 (82.70)
Working condition, n (%)	
Working	6 (7.4)
Not working	75 (92.60)
TMD, n (%)	
No	31 (38.30)
Yes	50 (61.70)
Hemoglobin	10.19±0.97
Ferritin	574.36±399.57
Albumin	3.58±0.41
CRP	18.58±17.61
Pth	504.47±479.99
Kt/v	1.39±0.19
URR	71.03±7.73

SD: Standard deviation, BMI: Body-mass index, TMD: Temporomandibular joint disease, CRP: C-reactive protein, PTH: Parathormone, URR: Urea reduction ratio (urea reduction rate), kt/v: urea clearance x treatment time/total body water volume, statistical tests used: independent t-test, Mann-Whitney U and Fisher's exact test

DISCUSSION

Research on TMD in predialysis ckd and hd patients remains limited, often involving detailed and costly examinations.[12] In order to overcome these difficulties and evaluate the relevant clinical and biochemical factors, our study attempted to determine the prevalence of TMD using the fonseca anamnestic test. In our study, we found a significant difference in the prevalence of TMD between hd patients and the general population, and we identified significant relationships between TMD and factors associated with hd treatment. Yilmaz et al.[4] reported a high TMD prevalence of 41.5% among hd patients, significantly higher than in the control group. They observed statistically significant increases in CRP, pth, bmi, and decreases in albumin and hemoglobin levels among those with TMD. Additionally, they noted a higher prevalence of TMD among women compared to men. In our study, we found the presence of TMD in hd patients to be as high as 61.7%. However, we did not find any statistical difference between men and women. Another study focusing on predialysis ckd patients found that 40.6% had myogenic TMD, associated with elevated CRP, ferritin, pth, and decreased albumin and hemoglobin levels.[5] These findings underscore the multifaceted nature of TMD in kidney disease populations, suggesting potential links between TMD and systemic inflammation, metabolic disturbances, and gender-specific differences.[13] Despite the high prevalence observed in our study and others, the specific mechanisms underlying TMD development in hd and ckd patients warrant further investigation. Our investigation highlighted a notable association between TMD and comorbidities, with patients exhibiting significantly lower hemoglobin and albumin levels when TMD was present. This correlation underscores the likelihood that TMD contributes to decreased hemoglobin and albumin levels through interconnected mechanisms.

Chronic pain associated with TMD often leads to reduced food intake and nutritional deficiencies, which are crucial for albumin synthesis and hemoglobin production. Studies have demonstrated that chronic pain conditions like TMD are linked to systemic inflammation, which can influence iron metabolism and hemoglobin levels over time.[14] Moreover, inflammation within the tmj and surrounding tissues triggers systemic responses that disrupt metabolic processes and

Table 2. Comparison of sociodemographic and biochemical parameters of hemodialysis patients with and without temporomandibular joint disease

	TMD (-)	TMD (+)	p value
Age (mean±SD)	57.94±12.28	58.36±16.98	0.904
Sex, n (%)			
Female	13 (%33.30)	26 (%66.70)	0.378
Male	18 (%42.90)	24 (%57.10)	
BMI, kg/m²	27.70±5.80	26.20±5.10	0.239
Hemodialysis time (month), n (%)			
0-12 months	13 (%44.80)	16 (%55.20)	0.482
13-60 months	9 (%30)	21 (%70)	
>60 months	9 (%40.90)	13 (%59.10)	
Alcohol/smoking			
No	23 (%40.40)	34 (%59.60)	0.53
Yes	8 (%33.30)	16 (%66.70)	
Comorbidities			
No	15(%65.20)	8 (%34.80)	0.002
Yes	16 (%27.60)	42 (%72.40)	
Educationalstatus			
Illiterate	11 (%50)	11 (%50)	0.339
Primary education	14 (%3.90)	22 (%61.10)	
Secondary education	6 (%28.60)	15 (%71.40)	
High education	0 (%0)	2 (%100)	
Marital status, n (%)			
Single	6 (%37.50)	10 (%6.50)	0.943
Married	25 (%38.50)	40 (%61.50)	
Lifestyle, n (%)			
Alone	2 (%25)	6 (%75)	0.827
With his wife/her husband	8 (%42.10)	11 (%57.90)	
With wife/husband and children	15 (%41.70)	21 (%58.30)	
With their children	4 (%40)	6 (%60)	
With mom and dad	2 (%25)	6 (%75)	
Place of residence, n (%)			
Rural	4 (%28.60)	10 (%71.40)	0.412
Urban	27 (%40.30)	40 (%59.70)	
Working condition			
Working	1 (%16.70)	5 (%83.30)	0.258
Not working	30 (%40)	45(%60)	
Hemoglobin	10.67±1	9.9±0.84	0.001
Ferritin	471.40±363.30	638.10±411	0.068
Albumin	3.78 ±0.40	3.50±0.37	0.002
CRP	19.54±19.98	17.98±16.14	0.701
PTH	503.06±507.76	505.34±467.22	0.984
Kt/v	1.40±0.17	1.39±0.20	0.788
URR	70.91±7.38	71.11±8.02	0.908

SD: Standart deviation, BMI: Body-mass index, TMD: temporomandibular joint disease, CRP: C- reactive protein, PTH: parathormone, URR: Urea reduction ratio (urea reduction rate), kt/v: urea clearance x treatment time / total body water volume, **statistical tests used:** independent t-test, Mann-Whitney U and Fisher's exact test

alter protein metabolism, further contributing to decreased albumin levels.[15] These insights emphasize the necessity for comprehensive management strategies addressing both pain relief and nutritional support in patients with TMD, with surgical intervention considered for severe cases.[16]

Various factors, including age, gender, duration of hd, metabolic disturbances, and medication use, contribute to the development of TMD in these patients. Our study identified comorbidities, low hemoglobin, and low albumin levels as risk factors associated with increased prevalence of TMD.

Several studies have proposed conservative treatments, such as physical therapy, pharmacotherapy, and occlusal splint therapy, as effective approaches for managing TMD in hd patients.[17-19] However, the precise causal relationship and specific risk factors linking TMD and hd remain unclear, necessitating further research. It is important to acknowledge several limitations of our study. The relatively small sample size limits the generalizability of our findings, and the cross-sectional design precludes establishing causality. Future longitudinal studies are warranted to investigate the causal relationships between identified risk factors and TMD in hd patients more effectively. Understanding TMD's impact on patients undergoing hd is crucial for developing tailored management strategies aimed at improving patient outcomes.

CONCLUSION

TMD are prevalent in hd, and the incidence of these disorders is higher in hd patients compared to the general population. Early detection and treatment of these disorders can improve the quality of life of hd patients. Further research is needed to explore the pathophysiology of TMD in hd patients and to develop new and effective treatment strategies. Therefore, it is recommended that hd patients undergo routine dental examinations to detect and treat TMD early on.

ETHICAL DECLARATIONS

Ethics Committee Approval

The study was carried out with the permission of the Mardin Artuklu University Clinical Researches Ethics Committee (Date: 10.07.2023, Decision No: 2023/7-19).

Informed Consent

All patients signed and free and informed consent form.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare. The study was presented as an oral presentation at the 5th Internal Medicine Congress of the University of Health Sciences held in Antalya on 04.06.2022.

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Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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