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Original Article

# Frequency of referral maxillofacial pain in ischemic heart patients

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**Abstract**

**Background:** Ischemic heart disease is one of the leading causes of death worldwide among adults. Pain originating from the heart may manifest in the maxillofacial area because cardiac pain signals converge onto the pathways of the trigeminal nerve. There is a lack of comprehensive research in the dental and cardiovascular fields on the frequency of ischemic myocardial pain presenting in the maxillofacial area. This study investigated the frequency distribution of referred maxillofacial pain in patients with ischemic heart disease at Afshar Hospital in Yazd, Iran, in 2024.

**Methods:** This descriptive cross-sectional study, conducted at the Emergency Ward of Afshar Heart Hospital in Yazd, utilized patients' medical records to create a checklist. This checklist included demographic information such as age and gender, smoking status, and details related to pain, including the presence of pain referral and the location of the referred pain. Data were analyzed using SPSS 16, employing descriptive statistics and the Chi-square test.

**Results:** A total of 369 patients with ischemic heart disease participated in the study, of which 31.20% experienced maxillofacial pain. No significant relationship was found between maxillofacial pain and gender ($P=0.687$), age groups ($P=0.361$), or smoking status ($P=0.983$). The most commonly referred site was the mandible (48.2%), and the most common region was the left side (76.3%).

**Conclusion:** Our study revealed that referred cardiogenic pain in the maxillofacial region was relatively common, with the majority of cases occurring in the mandible and throat. The presence of maxillofacial pain was not significantly related to gender, age, or smoking. The most common pain referral sites were located in the mandible and were unilateral on the left side.

**Keywords:** Maxillofacial pain, Ischemia, Myocardial infarction (MI), Referred pain

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## Introduction

Ischemic heart disease (IHD) is responsible for a significant number of deaths in adults.[1] Myocardial ischemia occurs when the heart muscle is deprived of adequate oxygen supply. This oxygen deficiency, known as ischemia, results from insufficient blood flow to the heart. The most common reason for this reduced blood flow is the narrowing or blockage of the heart's arteries due to atherosclerosis.[2] The primary symptom of IHD is typically chest pain. This pain often arises during physical activity, emotional stress, or even after eating.[3] Ischemic heart disease can manifest as angina (chest pain) or a more severe event like a myocardial infarction (heart attack).[4] While chest pain radiating to the arms, neck, and jaw is common, heart disease can sometimes present with less typical symptoms.[5] These include shortness of breath or pain felt only in the neck, jaw, arms, or wrists.[6-8]

Facial pain can be a symptom of heart conditions. A study found that approximately 40% of heart attack patients experienced facial pain, with a higher risk among women. Therefore, dentists need to be aware that IHD can sometimes be mistaken for a toothache. The pain originating from the heart is often described as "tight" or "burning," unlike the "throbbing" or "tingling" sensations associated with dental pain. Symptoms that worsen with exercise, improve with rest, or are present on both sides of the face may indicate a cardiac condition.[9] Craniofacial pain can be the only symptom of ischemic pain in 4% of patients.[8] Unfortunately, in cases where angina pain presents only with craniofacial pain, patients may be misdiagnosed with high mortality rates.[10]

The phenomenon of experiencing heart pain in the

facial region can be attributed to the intricate connections and pathways of our nervous system. Pain signals from the heart can travel along nerves that connect with the nerves of the face in the brainstem.[11] This meeting point is called the trigeminal nucleus caudalis. In this context, the signals originating from the heart may be misinterpreted as those originating from the face or mouth. The upper part of the neck also plays a role in this.[12] Additionally, the nervous system can become more sensitive, amplifying the pain. This nerve connection explains why a heart condition can present with pain in the jaw, teeth, or the joint in front of the ear. [13]

Facial pain with cardiac origin is often felt first in the throat. Other common areas include the left and right sides of the lower jaw, the left temporomandibular joint (TMJ), the area around the ear, and the teeth. This pain typically begins suddenly and can be triggered by physical activity. It usually does not change with mouth movements or touch, and typically resolves when the heart issue is addressed. Most mouth pain typically originates from the teeth, gums, or the muscles of the jaw. The face is a complex area, and pain can come from different sources.[14] Pain in a place far from its source, also known as referred pain or heterotopic pain, is a common challenge for dentists.[15] As a result, dentists often see patients with various types of pain in the face and mouth. Therefore, medical professionals need to be aware of all possible causes of pain to make an accurate diagnosis. Misdiagnosing the cause of pain can lead to unnecessary dental work.[16] Moreover, patients may continue to experience persistent discomfort with an undetermined etiology following dental interventions.[9] Nonetheless, there is a lack of extensive investigation into how often ischemic cardiac pain manifests in craniofacial areas within both dental and cardiac literature.[17] Despite the clinical significance of recognizing maxillofacial pain of cardiac origin, a notable gap exists in research regarding the prevalence of orofacial pain originating from cardiac events in individuals diagnosed with ischemic heart conditions in both dental and cardiovascular literature. Such ambiguity may delay the detection of underlying cardiac disorders, increasing the risk of serious complications and patient mortality. This study aimed to determine the frequency of facial pain of cardiac origin in patients with IHD at Afshar Hospital in Yazd, central Iran, in 2024.

## Materials And Methods

### *Study Type and Design*

The study employed a descriptive cross-sectional design.

### *Study Population*

Participants included patients with ischemic heart disease (IHD) presenting to Afshar Hospital in Yazd, Iran.

### *Sampling Method and Sample Size Determination*

Based on the study by Bakhshi et al,[10] in which 19% of cardiac patients reported craniofacial pain, and considering a 5% significance level and a maximum error of 0.045, the required sample size was calculated using the standard formula for estimating proportions:

According to this formula, the minimum required sample size was estimated at 292 individuals. Considering an anticipated 20% dropout rate, a final sample of 365 participants was selected. Sampling was conducted using a convenience method, which is a form of non-probability sampling.

### *Study Procedure*

This study examined the frequency distribution of referred orofacial pain in patients with ischemic heart disease at Afshar Hospital in Yazd during 2024–2025 (corresponding to the year 1403). The target population consisted of 365 patients with cardiac conditions who met the inclusion criteria. Non-probability consecutive sampling was used.

### *Inclusion Criteria*

Patients diagnosed with ischemic heart disease, confirmed by a cardiologist and who provided informed consent, were included in the study.

### *Exclusion Criteria*

During completion of the checklist, if a patient withdrew from the study due to emergency conditions, they were excluded from the study.

The researcher attended the emergency department of Afshar Heart Hospital on various workdays and shifts. After confirming inclusion criteria and collecting medical histories regarding orofacial pain, each eligible patient with IHD was evaluated. A checklist was completed for each patient. To ensure the accuracy of the data, all checklists were reviewed by the researcher. Patients were asked to provide demographic information (age, gender), pain information, and details about the presence of pain referral, including its location (unilateral or bilateral, right or left), and smoking status.

### *Data Collection Method*

Data were collected using a structured checklist specifically designed for this study.

### *Data Analysis Method*

Data analysis was performed using SPSS software version 16. The findings were summarized using descriptive statistics. To evaluate the differences in symptoms between individuals with pain and those without pain, we applied the Chi-square test, considering factors such as gender, age groups, history of toothache, and smoking status.

### *Ethical Considerations*

The implementation phase began after receiving approval from the Research Council of the Faculty of Dentistry and

obtaining an ethics code from the Biomedical Research Ethics Committee of Yazd Dental School. Informed consent was obtained from all participants before they were enrolled in the study (Ethics Approval Code: IR.SSU.REC.1403.006).

## Results

### *Demographic characteristics*

A total of 369 patients with ischemic heart disease (IHD) were enrolled in the study, with a mean age of 65.84 ± 12.40 years (ranging from 17 to 92 years). Among these, 227 patients (61.5%) were male, while 142 (38.5%) were female.

### *Frequency of maxillofacial pain*

In total, 31.2% (n = 115) of patients with ischemic heart disease (IHD) reported experiencing maxillofacial pain. The prevalence was 32.4% among females (n = 46) and 30.4% among males (n = 69). Statistical analysis revealed no significant association between gender and the presence of maxillofacial pain (Chi-square test, $P = 0.687$) (see Table 1).

### *Age and maxillofacial pain*

Participants were categorized into two age groups: those ≤ 68 years old (45.3%) and those > 68 years old (54.7%), based on the median age. The presence of maxillofacial pain showed no significant correlation with age group (Chi-square test, $P = 0.361$) (Table 1).

### *History of toothache*

Most participants (96.2%, n = 355) reported no prior history of toothache. Among those with or without such a history, the incidence of maxillofacial pain did not differ significantly (Chi-square test, $P = 0.708$) (Table 1).

### *Smoking status*

Regarding tobacco use, 74% (n = 273) of the patients were non-smokers. The presence of maxillofacial pain was not significantly associated with smoking status (Chi-square test, $P = 0.983$) (Table 1).

### *Characteristics of the referred pain*

Among the 115 patients with reported maxillofacial pain, the mandible (48.2%) and throat (35.1%) were identified as the most common referred sites (Figure 1). Pain localization was predominantly left-sided (76.3%), compared to right-sided or bilateral presentations (Figure 2).

### *Summary and contextual implications*

Although nearly one-third of patients with ischemic heart disease experienced maxillofacial pain, no statistically significant relationships were found with age, gender, smoking, hyperlipidemia, or history of toothache.

**Table 1.** The frequency distribution of maxillofacial pain in cardiac ischemic patients in terms of demographic variables

| Presence of maxillofacial pain | | No | Yes | Total | *P* value |
|---|---|---|---|---|---|
| Gender | Female | (67.6) 96 | (32.4) 46 | (100) 142 | 0.687 |
| | Male | (69.6) 158 | (30.4) 69 | (100) 227 | |
| Age groups (year) | 68 and less | (71.3) 119 | (28.7) 48 | (100) 167 | 0.361 |
| | 68 + years | (66.8) 135 | (33.2) 67 | (100) 202 | |
| History of tooth pain | No | (69) 245 | (31) 110 | (100) 355 | 0.708 |
| | Yes | (64.3) 9 | (35.7) 5 | (100) 14 | |
| Smoking | No | (68.9) 188 | (31.1) 85 | (100) 273 | 0.983 |
| | Yes | (68.8) 66 | (31.3) 30 | (100) 96 | |

*Chi-square test

## Discussion

Cardiovascular disease (CVD) continues to be a significant global health challenge, contributing to about 30% of all deaths worldwide.[18] Among various heart conditions, coronary heart disease (CHD) is the main cause of mortality worldwide. [19] Cardiac pain may present as referred discomfort in the maxillofacial region. This study was designed to assess the prevalence and distribution of referred maxillofacial pain in patients diagnosed with ischemic heart disease, with an emphasis on the clinical significance of recognizing atypical presentations.

### *Comparison with Existing Literature*

#### *Frequency*

In our study, 31.20% of ischemic heart patients suffered from maxillofacial pain. This finding is consistent with other research. Danesh-Sani et al[20] reported 34.2% craniofacial pain during ischemic episodes and 48% during MI. Lopez-Lopez et al[14] reported that 32% of their patients had maxillofacial pain. However, another study by Kreiner et al[8] reported a higher rate of 38% during heart attacks. Bakshi et al[10] found a much lower frequency of 17.9%. Differences in sample sizes may explain these variations. The actual frequency of cardiac-related maxillofacial pain may be underestimated due to low public awareness [10].

The variations observed in the reported prevalence rates may be attributed to differences in study methodologies, such as variations in sample sizes, criteria for patient inclusion, modes of data collection, and the specific criteria used to define maxillofacial pain. For instance, studies with larger sample sizes, such as our study, may provide a more representative estimate of the true prevalence. Furthermore, the diverse populations studied in different geographical locations could also contribute to these variations.

#### *Gender*

In this study, no significant gender differences were found in maxillofacial pain among patients with ischemic heart disease. This finding is in agreement with the results reported by Salehi et al[21] and Bakshi et al[10]. In

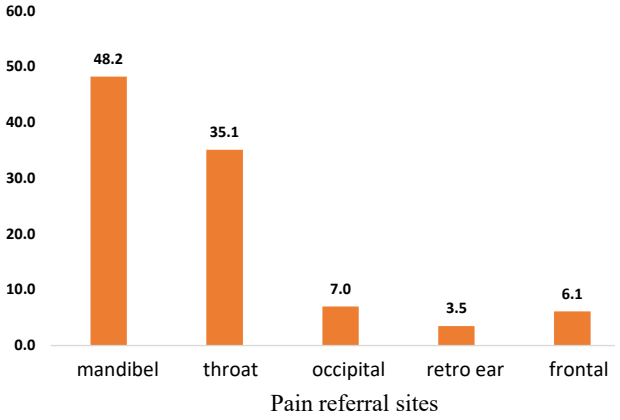


**Figure 1.** The frequency distribution of maxillofacial pain in cardiac ischemic patients in terms of pain referral sites

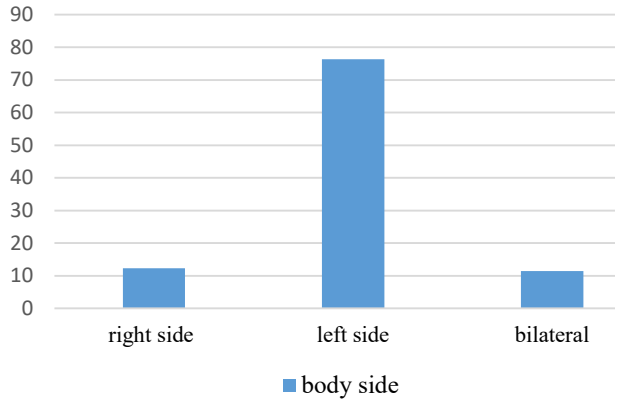


**Figure 2.** The frequency distribution of maxillofacial pain in cardiac ischemic patients in terms of body side

contrast, Kreiner et al[22] and Danesh-Sani et al[20] found that women were more likely to experience maxillofacial pain of cardiac origin. In the Hui et al[1] study, women had higher rates of angina (1:2), but women with CAD often had atypical symptoms. One study [23] showed that men more often reported typical angina (chest and arm discomfort), while women reported atypical pain in the jaw, neck, shoulders, and back.[5] Another study [24] reported that women presented with more atypical symptoms. Abdullatif et a. noted that men experienced more non-classical pain, although the difference was not statistically significant.[25] They suggested that decreasing alcohol and tobacco consumption in Saudi women may reduce their CAD risk, which was consistent with our findings.

### *Age*

The findings of the current research revealed that patient age did not significantly influence the severity of maxillofacial pain of ischemic origin. Similar to the outcomes reported by Salehi et al[21] and Bakshi et al,[10] no notable differences were observed among various age categories in terms of the extent of maxillofacial discomfort. Cardiac ischemia was more common in middle-aged and older individuals. At the same time, dental pain was commonly seen in adolescents and younger adults.[26,27] The age range of the study population matched the general population. It is justifiable that the missing age data in the maxillofacial pain group had little effect on the results of this study, because age does not affect the quality of pain in this area.[28,29] The lack of an age effect indicates that the likelihood of experiencing referred maxillofacial pain due to cardiac ischemia is not significantly affected by age. This finding highlights the importance of considering this symptom across all adult age groups.

### *Smoking*

In this study, no statistically significant correlation was found between smoking and maxillofacial pain, a finding consistent with the work of Kreiner et al [22] In contrast, Abdullatif et al [25] demonstrated a significant relationship between atypical pain and smoking. However, in their study, atypical pain was investigated in all areas, not merely in the maxillofacial region.

### *Referral Patterns and Clinical Implications*

In the present study, the most common referral sites were the mandible (48.2%) and the throat (35.1%). Odontogenic pains may also be referred to these areas. Therefore, it is essential to consider cardiac-related pain as a differential diagnosis when evaluating patients with referred maxillofacial discomfort. Dentists can help diagnose ischemic heart disease by recognizing the features that indicate heart pain. This pain is often described as pressure or burning, triggered by activity, and relieved by rest. It may occur on both sides of the face. Odontogenic pain is often one-sided and described as throbbing.[28] In the study by Danesh-Sani et al[20] pain most frequently affected the left mandibular region, accounting for 42.4% of cases, while the TMJ and ear comprised 25%. In the study by Kreiner et al[17] the throat, left mandible, and right mandible were the most common areas of maxillofacial pain; this finding is consistent with the results of the present study. Consistent with the results of the present study, a study by Sharifi et al[30] in Kermanshah found that none of the patients experienced referral pain in the periodontium. Kreiner et al[17] concluded that only 4.2% of patients with previous episodes of ischemic cardiac events, including myocardial infarction, present with dental pain. Such findings in studies suggest that toothaches are not often reported in patients with cardiac ischemia.[31]

### *Pain location*

In our study, pain was more frequent on the left side. Unilateral pain was also more common than bilateral pain, with a ratio of 8:1. Bakhshi et al[10] in Tehran also reported more frequent left-sided maxillofacial pain. Kreiner et al[8] found a 6:1 ratio of unilateral to bilateral cases in Uruguay.

Methodological differences and evaluations by different doctors in various countries, along with varying research questions and protocols, may account for variations across studies.[17] Many patients with atypical heart attack symptoms who present only with craniofacial pain may not seek timely medical help or may die before reaching the hospital.[22] Both patients and doctors may ignore atypical craniofacial pain as a warning sign, focusing instead on typical angina symptoms. Misdiagnosis of MI patients with atypical symptoms is common in emergency rooms.[32, 33] As a result, many patients receive inappropriate treatments, such as unnecessary antibiotics and surgeries for what is actually cardiac pain, due to insufficient training.[34] Atypical presentations of IHD are well-documented, but clinical awareness appears low. These findings highlight the need for better education for both the public and healthcare professionals regarding these unusual symptoms. Recognizing referred maxillofacial pain alongside typical cardiac pain sites is crucial for preventing morbidity and mortality.[20] Dental schools should emphasize the timely diagnosis of systemic diseases, particularly ischemic conditions. Dentists need practical, updated information through continuing education.[21] A systematic review by Yatani et al[9] was conducted on patients with cardiac-related craniofacial pain who were referred to cardiologists for appropriate treatment. Our study included a larger sample size of 369 patients, which is greater than in many previous studies and may provide more robust results. The risk of overestimating the prevalence is minimal, thanks to the adequate sample size.

## Limitations and Future Directions

Our study had some limitations that should be taken into account. We did not evaluate the quality and severity of pain in the maxillofacial region. Future research should incorporate detailed pain assessments, including the use of pain scales and qualitative descriptors, to better characterize the nature of referred cardiac pain in the orofacial area and potentially aid in differentiation from other pain sources. Furthermore, we did not perform detailed clinical and radiographic dental examinations. Consequently, we were unable to determine the frequency of patients experiencing maxillofacial pain of ischemic origin in the absence of any underlying dental pathology. Future studies should include comprehensive dental evaluations to establish the true prevalence of referred cardiac pain mimicking odontogenic issues in the absence of a dental cause.

## Recommendations for Healthcare Providers

The findings of our study, along with existing literature, underscore the critical need to enhance awareness among healthcare providers regarding the atypical presentations of ischemic heart disease, particularly referred pain to the maxillofacial region. General statements about increasing awareness are insufficient. We propose the following actionable recommendations:

- Integration of the topic into medical and dental curriculum: incorporating specific modules on atypical cardiac pain, including referred maxillofacial pain, into the undergraduate and postgraduate curriculum of medical and dental schools. The program should incorporate case-based learning and simulation exercises to enhance diagnostic skills.
- Continuing professional development (CPD) programs: development and implementation of mandatory CPD courses for dentists and physicians focusing on the recognition of non-classical cardiac symptoms. These programs should utilize real-world case studies and emphasize interprofessional collaboration to enhance their effectiveness.
- Development of clinical decision support tools: creation of easily accessible clinical decision support tools (e.g., mobile applications, online resources) that include algorithms for evaluating maxillofacial pain with potential cardiac origins. These tools should guide clinicians through relevant questions about pain characteristics, triggers, and associated risk factors.
- Interdisciplinary communication protocols: establishment of clear communication protocols between dentists and physicians to facilitate the referral and evaluation of patients with suspected cardiogenic maxillofacial pain. This could involve standardized referral forms and collaborative case discussions.
- Public awareness campaigns: launching public health campaigns to educate people about jaw, neck, and ear pain as potential symptoms of heart problems, encouraging them to seek prompt medical attention.

The diagnosis of ischemic heart disease with atypical symptoms can be enhanced by implementing specific, practical recommendations. This can ultimately reduce morbidity and mortality associated with this common condition.

One limitation of this study was the absence of an assessment of the characteristics and intensity of pain experienced in the maxillofacial area. In addition, the present study did not include a detailed clinical and radiographic examination. Therefore, the population of patients with maxillofacial pain of ischemic origin and without chest pain could not be determined. It is suggested that future studies use clinical examination and radiography to investigate the cause of maxillofacial pain with a potential cardiogenic origin.

## Conclusion

The present study demonstrated that referred maxillofacial pain with cardiac origin is common, occurring most frequently in the mandible and throat. The presence of

maxillofacial pain was not significantly related to gender, age, or smoking. The most common pain referral sites were located in the mandible and were unilateral on the left side. It is also recommended to consider the quality and severity of pain referred to the craniofacial region in future studies. These findings suggest that referred orofacial pain in IHD may occur independently of traditional risk factors or dental history, underscoring the importance of interdisciplinary awareness among cardiologists and dental professionals.

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**Competing Interests**
The authors declare that they have no conflicts of interest related to this study.

**Data Availability**
The data supporting this study's findings can be obtained from the corresponding author upon request.

**Ethical Approval**
Data collection was conducted after obtaining written consent from participants, and the study protocol received approval from the Ethics Committee of Yazd Shahid Sadoughi University of Medical Sciences (approval code: IR.SSU.DENTISTRY.REC.1403.006).

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