

# SILENT ACUTE MYOCARDIAL INFARCTION IN DIABETIC PATIENTS IN EMERGENCY MEDICINE

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*Aim of the Study:* Silent acute myocardial infarction occurs commonly in diabetic patients. Currently, it is not fully understood whether altered perception of ischemia also predisposes atypical presentations, and therefore leads to under-diagnosing the acute myocardial infarction (AMI) in diabetic patients. In this study, we tried to determine whether chest pain in AMI occurred less frequently in diabetic patients. *Methods:* In this retrospective study, we included patients admitted from April 2014 to November 2019. Data were collected using eHitna and BIS as the nation-wide programs for patient tracking and registry in Croatia. All patients included in the study had initially called Department of Emergency Medicine of Brod-Posavina County, which then resulted in an intervention. Patients were then transferred to Dr Josip Benčević General Hospital, where they were hospitalized. All patients had discharge letters with the diagnosis specified by ICD-10 classification as I21 spectrum (I21.0, I21.1, I21.2, I21.3, I21.4, I21.9), i.e. AMI. *Results:* In this study, we included 180 patients having suffered AMI who were hospitalized and treated. There were 35 (19%) diabetic patients (DP) and 145 (81%) non-diabetic patients (non-DP). Chest pain was absent in nine (26%) DP and 13 (9%) non-DP ( $p=0.007$ ). There was no difference in sex distribution within the two groups, with 60% and 68% male patients in DP and non-DP, respectively ( $p=0.395$ ). The mean patient age was significantly different between the two groups, i.e. 69 years in DP and 64 years in non-DP ( $p=0.034$ ). *Discussion:* AMI in diabetic patients could have altered clinical presentation, which has often been researched therefore. Some researchers have reported that atypical or silent presentations are more frequent in DP with AMI, whereas others found no differences when compared to non-DP. In our study, absence of chest pain as a characteristic of silent AMI was experienced by 17% more DP as compared to non-DP, suggesting that DM influences clinical presentation of AMI. It is important to emphasize the importance of such findings in emergency medicine where patients often describe their various symptoms. The mean age of DP having suffered AMI was significantly higher (even up to 5 years) in comparison to non-DP. Despite the fact that DM is a risk factor for developing AMI, this finding could be explained by the fact that DM is more common in elderly population. *Conclusion:* Chest pain occurs significantly less frequently in DP that develop AMI than in non-DP. Therefore, DP have a higher probability of developing silent AMI.

**KEY WORDS:** silent acute myocardial infarction, diabetes mellitus, chest pain, diabetic patients

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## INTRODUCTION

Cardiovascular diseases are the leading cause of morbidity and mortality worldwide. This is true in all areas of the world except for Africa (1). Cardiovascular complications are also the leading cause of morbidity and mortality among patients with diabetes mellitus (DM). The risk of cardiovascular diseases is two to four times higher among people with DM than in other populations (2).

Acute myocardial infarction (AMI), also known as heart attack, occurs when blood flow decreases or stops to a part of the heart, referred to as ischemia, thus causing damage to the heart muscle. The most common symptom is chest pain or discomfort, which may radiate to the shoulder, arm, back, neck or jaw (3). Chest pain occurs due to the 'crosstalk' between somatic and visceral afferent neural pathways (4).

In patients with diabetes, however, several studies have reported that ischemia may be painless or experienced atypically (5-7). Several explanations are possible for this atypical presentation. Cardiac autonomic neuropathy almost certainly plays an important role, potentially involving dysfunction at varying levels, from pain receptors, afferent neurons or gating mechanisms to the supratentorial translation of ischemia into pain (8). Such silent AMI, defined as the objective evidence for acute myocardial ischemia in the absence of symptoms, particularly chest pain, has important clinical implications for the patient with coronary artery disease and diabetes, especially in emergency medicine.

## THE AIM OF THE STUDY

Silent AMI occurs commonly in diabetic patients. It is currently not fully understood whether altered perception of ischemia also predisposes atypical presentations and therefore leads to under diagnosing AMI in diabetic patients. In this study, we tried to determine whether chest pain in AMI occurred less frequently in diabetic patients. Also, we tried to assess the impact of the potential factors such as age and sex. Finally, we describe clinical presentation of the patients having suffered from silent AMI.

## METHODS

In this retrospective study, we included patients in period from April 2014 to November 2019. Data were collected using eHitna and BIS as the nation-wide programs for patient tracking and registry in Croatia.

All patients included in the study had initially called Department of Emergency Medicine of Brod-Posav-

ina County, which then resulted in an intervention. Patients were then transferred to Dr Josip Benčević General Hospital where they were hospitalized. These patients underwent either coronary catheterization, were treated conservatively, or developed cardiac shock and died. All patients had discharge letters with the diagnosis specified by ICD-10 classification as I21 spectrum (I21.0, I21.1, I21.2, I21.3, I21.4, I21.9), i.e. AMI.

Chest pain was assessed by physicians ranging from 0 (no pain), 1 (mild pain) to 2 (strong pain). Diabetes was recorded in patients on insulin or oral hypoglycemic drugs and included both type 1 and type 2 diabetes. Time of arrival was defined as the time it took for the emergency ambulance to arrive to the place of intervention, for town area and rural area, under ten and twenty minutes, respectively. Hemodynamic instability referred to systolic blood pressure  $\leq 90$  mm Hg. Therapies applied and included in analysis were acetylsalicylic acid, oxygen, nitroglycerin and morphine.

Data were analyzed in Microsoft Office Excel. The  $\chi^2$ -test was used to determine the relationship between chest pain in diabetics and non-diabetics. It was also used to assess difference in sex ratio between two groups. T-independent test was used to assess the significance of between-group difference in mean age. The value of  $p < 0.05$  was considered statistically significant.

## RESULTS

In this study, we included 180 patients having suffered AMI and hospitalized for treatment. There were 35 (19%) diabetic patients (DP) and 145 (81%) non-diabetic patients (non-DP). Chest pain was absent in nine (26%) DP and 13 (9%) non-DP ( $p=0.007$ ) (Figure 1).

There was no difference in sex distribution within the two groups, with 60% and 68% male patients in DP and non-DP, respectively ( $p=0.395$ ). The mean patient age was significantly different between the two groups, i.e. 69 years in DP and 64 years in non-DP ( $p=0.034$ ). Figure 2 illustrates age distribution among DP and non-DP. The recommended time of arrival was achieved in 144 (86%) interventions.

We analyzed clinical presentation of patients having suffered AMI in the absence of chest pain. There were 22 (12%) patients, both DP and non-DP, who felt no pain. We analyzed hemodynamic instability and altered level of consciousness. Table 1 shows their characteristics. Percentages of the four most frequently administered therapies in DP and non-DP are shown in Table 2.

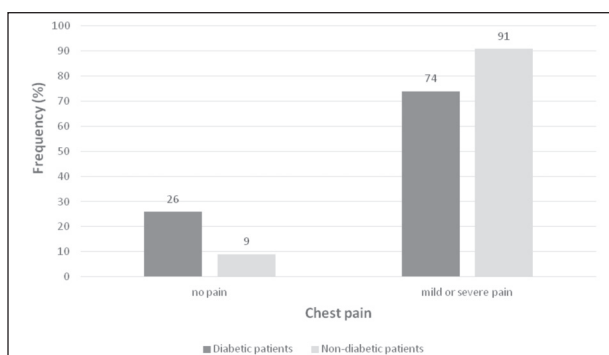


Fig. 1. Chest pain frequency.

Frequency of chest pain experienced by diabetic patients (N=35) and non-diabetic patients (N=145). Chest pain was assessed as no pain, mild pain and severe pain. There was a significantly higher prevalence of patients with absence of pain in diabetic patients than in non-diabetic patients (26% and 9%, respectively;  $p=0.007$ ). figure 2

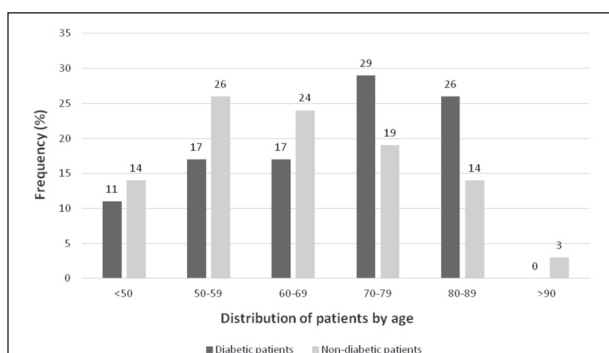


Fig. 2. Patient distribution according to age (years).

Age distribution of diabetic patients (N=35) and non-diabetic patients (N=145): mean age was 69 and 64 years in diabetic patients and non-diabetic patients, respectively;  $p=0.034$ ).

Table 1. Characteristics of patients having suffered silent myocardial infarction

	N=22
Male	15 (68%)
Mean age (years)	62
Diabetic patients	9 (41%)
Instability: Hemodynamically unstable*	7 (32%)
Altered level of consciousness and hemodynamically unstable	4 (18%)

Characteristics of patients who had no chest pain and suffered acute myocardial infarction: among other symptoms recorded in these patients were nausea, vomiting, syncope, dizziness and dyspnea.

\*Hemodynamically unstable refers to patients with systolic blood pressure  $\leq 90$  mm Hg.

Table 2. Therapies administered in two patient groups

	Diabetic patients, N=35	Non-diabetic patients, N=145
Therapy administered	n (%)	n (%)
Acetylsalicylic acid	31 (89)	131 (90)
Oxygen	30 (86)	115 (79)
Nitroglycerin	19 (54)	84 (58)
Morphine	4 (11)	19 (13)

As expected, morphine was more frequently used in non-diabetic patients.

## DISCUSSION

Acute myocardial infarction MI in diabetic patients may have altered clinical presentation and therefore is has been widely researched. Some researchers have reported that atypical or silent presentations are more frequent in diabetic patients with AMI (9-17), whereas others found no differences when compared to non-diabetic patients (18-23). In our study, absence of chest pain as a characteristic of silent AMI was recorded in 17% more DP as compared to non-DP, suggesting that DM influences clinical presentation of AMI. It is important to emphasize the importance of such findings in emergency medicine where patients often describe their various symptoms.

In 22 patients who suffered AMI in the absence of characteristic chest pain, 18% had altered levels of consciousness, so they may not have correctly estimated the severity of chest pain. Others, on the other hand, presented atypical symptoms such as nausea, vomiting, syncope, dizziness or dyspnea.

Diabetes mellitus and its chronic complications pose a major health problem all over the world. It is estimated that currently 366 million people suffer from DM worldwide and that by the year 2030 the number of diabetics will increase to 552 million. The prevalence of DM is rising in all countries, and 80% percent of the world population suffering from diabetes live in developing countries or newly industrialized countries (24). In Croatia, the number of diabetics in 2010 was approximately 316,000, of which over 190,000 patients had been diagnosed with the disease, while nearly 123,000 remained undiagnosed (25). The mean age of diabetic patients who suffered AMI was significantly higher, even up to 5 years, than in those without DM. Despite the fact that DM is a risk factor for developing AMI, this finding could be explained by the fact that DM is more common in elderly population.

The factors of the emergency medicine efficiency are time to response and availability. According to quality indicators that are systematically monitored by the

Croatian Institute of Emergency Medicine, in 80% of cases emergency medicine teams arrive at the place of intervention no later than 10 minutes from the call in urban areas and 20 minutes from the call in rural areas (26). The result regarding the time of arrival to the intervention was by 6% higher in this study.

The administration of morphine is widely accepted as treatment for chest pain in the setting of an AMI (27). In a large retrospective cohort study, in-hospital complications and 1-year mortality were unaffected by pre-hospital morphine use in patients with ST elevation myocardial infarction (STEMI), implying its safety in this patient population (28). However, there have been several studies questioning the safety of morphine use in patients with AMI, citing delayed and decreased efficacy of antiplatelet agents (28,29). In this study, morphine was used more frequently in non-DP patients. Out of all 158 patients having experienced chest pain, morphine as analgesic therapy was administered in 7% of patients with mild pain and 25% of patients with severe pain. Table 2 shows that oxygen therapy was used in high frequencies. Since the patients had been recorded from 2014, this can be explained by the then nonexistence of the latest guidelines for oxygen therapy in AMI, which suggest applying it only if blood saturation is lower than 90%.

## CONCLUSION

Chest pain occurs significantly less frequently in diabetic patients who develop AMI than in non-diabetic patients. Therefore, diabetic patients have a higher probability of developing silent AMI. There was no difference in sex distribution within the two groups, while the mean age differed significantly between the two groups, i.e. diabetic patients were older on average. The rate of recommended time of arrival at the intervention was higher than stated in the official guidelines.

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## SAŽETAK

### NIJEMI AKUTNI INFARKT MIOKARDA KOD BOLESNIKA SA ŠEĆERNOM BOLESTI U IZVANBOLNIČKOJ HITNOJ MEDICINI

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**Cilj:** Nijemi akutni infarkt miokarda (AIM) se pojavljuje češće u bolesnika s dijabetesom. Predisponira li izmijenjena percepcija ishemijske atipičnu prezentaciju te se zbog toga nedovoljno dijagnosticira AIM u bolesnika s dijabetesom, nije još dovoljno istraženo. U ovoj studiji pokušali smo utvrditi pojavljuje li se bol u prsištu kod AIM rjeđe kod bolesnika s dijabetesom. **Metode:** U ovu retrospektivnu studiju uključili smo bolesnike primljene od travnja 2014. do studenoga 2019. godine. Koristili smo bazu podataka programa "e-hitna" i "BIS" te sakupljali i analizirali podatke o bolesnicima koji su zatražili intervenciju izvanbolničke hitne medicinske službe u našoj županiji, bili prevezeni u Opću bolnicu "Dr. Josip Benčević", hospitalizirani te im je kao otpusna dijagnoza postavljena prema klasifikaciji MKB-10 bila u spektru dijagnoze I21 (I21.0, I21.1, I21.2, I21.3, I21.4, I21.9), tj. AIM. Dijabetes je zabilježen kod bolesnika koji su bili na inzulinu ili oralnim hipoglikemicima, uključujući dijabetes tip 1 i tip 2. **Rezultati:** U studiju smo uključili 180 bolesnika koji su doživjeli AIM. Od tog broja ih je 35 (19,4 %) imalo dijabetes (DP), a 145 (80,6 %) nije imalo dijabetes (ne-DP). Bol u prsištu nije bila prisutna u devet (26 %) DP i 13 (9 %) ne-DP ( $p=0,007$ ). Nije bilo značajne razlike u distribuciji prema spolu ni u jednoj skupini bolesnika ( $p=0,35$ ). Muškaraca je bilo 60 % u DP i 68 % u ne-DP. Prosječna dob značajno se razlikovala u dvjema skupinama. U DP je prosječna dob bila 69 godina, a u ne-DP 64 godine ( $p=0,034$ ). **Rasprava:** Akutni infarkt miokarda u bolesnika s dijabetesom može se prezentirati izmijenjenom kliničkom slikom i zbog toga se često istraživao. Neki istraživači su pokazali da je atipična ili nijema prezentacija infarkta češća u bolesnika s dijabetesom, dok drugi nisu pronašli razlike u usporedbi s nedijabetičarima. U ovoj studiji smo primijetili da je izostanak boli u prsištu kao karakteristika nijemog AMI učestaliji u dijabetičara s AIM. To dovodi do zaključka da dijabetes utječe na kliničku sliku AIM. Treba istaknuti važnost takvog rezultata u izvanbolničkoj hitnoj medicini gdje se bolesnici često prezentiraju raznim simptomima. Srednja vrijednost dobi dijabetičara koji su doživjeli AIM bila je značajno veća nego u nedijabetičara. Unatoč činjenici da je dijabetes rizični čimbenik za razvoj AIM, ovaj rezultat možemo tumačiti činjenicom da je dijabetes zastupljeniji u starijoj populaciji. **Zaključak:** Bol u prsištu se javlja rjeđe u bolesnika s dijabetesom koji imaju AIM nego u onih koji nemaju dijabetes. Zbog toga dijabetičari imaju veće izgleda da razviju nijemi AIM..

**KLJUČNE RIJEČI:** tihi akutni infarkt miokarda, šećerna bolest, bol u prsištu, bolesnici sa šećernom bolešću