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2 Symptoms experienced by patients with acute myocardial infarction that the triage nurses should know in the emergency department: a systematic review

Abstract

Background: Vascular and heart disease present a big problem in public health society. Acute myocardial infarction (AMI), which belongs under acute coronary syndromes, is one of the most common diseases and biggest causes of early death in developed countries. Symptoms in patients with myocardial infarction vary between typical and atypical symptoms. This review aims to identify different AMI symptoms of patients who seek medical attention in the emergency department (ED).

Methods: A systematic review of the literature in CINAHL, MEDLINE, ScienceDirect, and SAGE was conducted to identify studies on detected symptoms in patients with myocardial infarction over 18 years in the ED. The search was limited to studies on this topic published up to December 2021. The data analysis was based on thematic analysis.

Results: Out of 2,814 studies retrieved, 11 studies were included. The data analysis identified one main theme: clinical symptoms and three subcategories.

Conclusion: The triage nurses need to pay attention to cardiovascular symptoms, such as chest pain, the most common symptom. Their focus also needs to be redirected to epigastric pain and cold sweating, which are abdominal and systemic symptoms, and anxiety and nausea/vomiting in patients with diabetes.

Impact: AMI is one of the most common diseases and causes of early death in developed countries. The literature lacks knowledge about the different symptoms of AMI, which the triage nurses must be careful about. The knowledge and rapid identification of myocardial infarction helps triage nurses provide the best outcomes.

Keywords: acute coronary syndrome, emergency department, myocardial infarction, review

2.1 Introduction

Cardiovascular conditions are the most frequent cause of death in Europe, representing 45% of all deaths, 49% of female deaths, and 40% of male deaths [1]. Acute

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myocardial infarction (AMI) is the most common and important form of ischemic cardiac disease and falls under acute coronary syndrome (ACS) [2]. ACS develops because of erosion or rupture of atherosclerosis plaque in the coronary artery by which a blood clot is formed. The blood clot partially or entirely blocks the lumen in coronary arteries, leading to the heart muscle's ischemia. Long-lasting ischemia leads to an AMI; however, blood clots are the leading cause of myocardial infarction [3].

AMI can manifest itself in two ways, namely with ST-segment elevation (STEMI) or without ST-segment elevation (NSTEMI) [4]. The symptoms of myocardial infarction may be hard to distinguish clinically. Therefore, the diagnosis can be verified only by electrocardiography, elevated blood biomarkers, or radiological diagnostics [5]. The most common cardinal symptom when dealing with AMI is chest pain [6].

In addition, it is well known that certain groups of patients (e.g., women, older patients, and individuals with diabetes) [7–10] do not always have chest pain and experience fewer characteristic symptoms [7]. The nonspecific symptoms of AMI could be found by history taking or physical examination and are presented as fatigue, shortness of breath, pain in the back, neck, arm or upper abdomen, oedema, and nausea [11]. Furthermore, Thygesen et al. [12] describes nonspecific symptoms of ischemia of the myocardium as uncomfortable pressure in the chest, upper extremities, and jaw. The diagnosis could incorrectly be identified and often confused with gastrointestinal, neurological, pulmonary, or musculoskeletal diseases because of these symptoms [13].

The emergency department (ED) is the first point of contact for many patients seeking help [14]. Once the patient arrives at the ED, the first step is triage. In triage, a nurse assesses the patient's condition and asks the patient a series of questions about their main complaints, medical history, the clinical presentation of the symptoms, transportation mode, the presence and time-frame of pain in the chest area, and the patient's general appearance [15, 16]. The measurement of vital signs such as body temperature, heart rate, respiratory rate, blood pressure, and pulse oximetry is considered a standard part of the triage examination. All that information determines the patient's appropriate triage category [17]. The accuracy of nurses' triage decisions, based on their experience, knowledge, perceptions, and intuition to achieve the quickest medical evaluation, electrocardiogram (ECG) recording, and interpretation of that record within 10 min of arrival to the ED, are potential interventions that could save the patient's life [18].

However, triage nurses can sometimes overlook the AMI symptoms because of the patient's appearance and clinical signs, especially when presented with AMI's atypical or nonspecific clinical signs [19]. In such cases, the triage nurse could evaluate a patient's symptoms as other diseases, and the patient may not receive timely treatment [20]. Moreover, in one kind of AMI (NSTEMI), there are typically no changes in the ECG, and patients do not present with AMI's typical signs and symptoms [21]. Consequently, triage nurses should rely not only on the empirical data but also on their attitudes, experiences, intuition, and intuition when dealing with AMI and in decision-making for further health care and treatment of those patients [22].

Many studies have been focused either on symptoms of potential ACSs or conducted to measure different demographic factors such as gender, race, and other variables separately [23]. Therefore, the chapter aims to identify what symptoms a triage nurse needs to know in patients with suspected AMI in an ED.

2.2 Methods

A systematic review was conducted following the methodology and recommendations of Preferred Reporting Items for Systematic Reviews (PRISMA) [24]. This methodological approach allows analysis, knowledge synthesis, and applicability of the results to practice. The process of searching and data extraction of the studies was guided by the PRISMA [24] guidelines and is presented in the flow diagram (Fig. 2.1).

2.2.1 Research question

For the systematic review, we developed a PIO question: Among patients with AMI who are seeking help at the ED (P), which signs and symptoms (I) are identified by triage nurses (O)?

2.2.2 Search strategy

We conducted a systematic review in CINAHL, MEDLINE, SAGE, and ScienceDirect databases using the search terms in English: AMI, symptoms, signs, emergency, and triage nurses, including their synonyms and Boolean operators (AND/OR). The posed limitations were research papers in English relating to the research topic without a set timespan.

2.2.3 Review approach and selection criteria

Inclusion criteria for the selection of papers were: (1) adult person with diagnosed AMI; (2) seeking help at the ED; (3) research papers that used quantitative, qualitative, and mixed-methods research approaches; and (4) identifying signs and symptoms of AMI. Exclusion criteria were: (1) adult person without diagnosed AMI, (2) not seeking help at the ED; (3) papers that used systematic review as a research methodology or other types of reviews of the literature; and (4) not identifying signs and symptoms of AMI by health care professionals. We used the exact search term in all the databases, search limits, inclusion, and exclusion criteria.

2.2.4 Methodology assessment

Two authors independently assessed the methodology of papers using the Newcastle-Ottawa Scales (NOS) for cross-sectional studies of research papers [25] which contains seven items categorized into three domains: (1) selection, (2) comparability, and (3) outcome. This scale is based on the star grading system, where the items can be rated from zero to two stars. The maximum achievable points are 10, which represents the highest methodological quality. The assessment of the methodological quality of the included papers was divided into three groups according to the overall assessment scores: low quality (0–4), moderate quality (5–6), and high quality (7–10) [26].

2.2.5 Data extraction and synthesis

A meta-analysis was inappropriate due to the samples' excessive heterogeneity and variation in the studies reviewed [27]; therefore, the findings are presented systematically. For each of the included studies, we extracted contextual information: author(s), year of publication, research design, the aim of the research, sample size, and funding source (Tab. 3.2). Data analysis was conducted through a thematic analysis of the included studies based on the recommendations by Thomas and Harden [28]. These guidelines for data analysis were chosen for their realistic approach, which tends to be more research-oriented and focus on contexts. Using these guidelines enabled the achievement of detailed data summaries from the included studies [29]. After reviewing the heterogeneity of the included studies, we extracted only primary and paraphrased statements of the results from each paper. Two authors independently read the extracted results of the included studies, defined the codes, and added the codes into the MaxQda program for further analysis and management of data. We undertook three steps to synthesize data: first, the authors searched through the texts and defined codes by reading each study line-by-line. Second, the authors identified codes from the first steps, refined them, and organized them into descriptive primary subthemes with an inductive approach. In the last step, we included the third author to review and discuss all the steps of thematic analysis, interpretation, and development of the descriptive primary level subthemes into secondary-level subthemes from which a thematic framework was developed.

2.3 Results

Using the search strategy and within the limits of the search, we found 1,434 records in CINAHL, 1,008 in MEDLINE, 4 in SAGE, and 368 in ScienceDirect. Additionally, we identified four through other sources. The records were imported into the EndNote program for managing references, and with the help of the program, we identified

and removed duplicates. At first, two authors independently searched all titles and abstracts and chose those to be read in full based on the posed inclusion criteria studies. The steps of choosing the papers are displayed in Fig. 2.1.

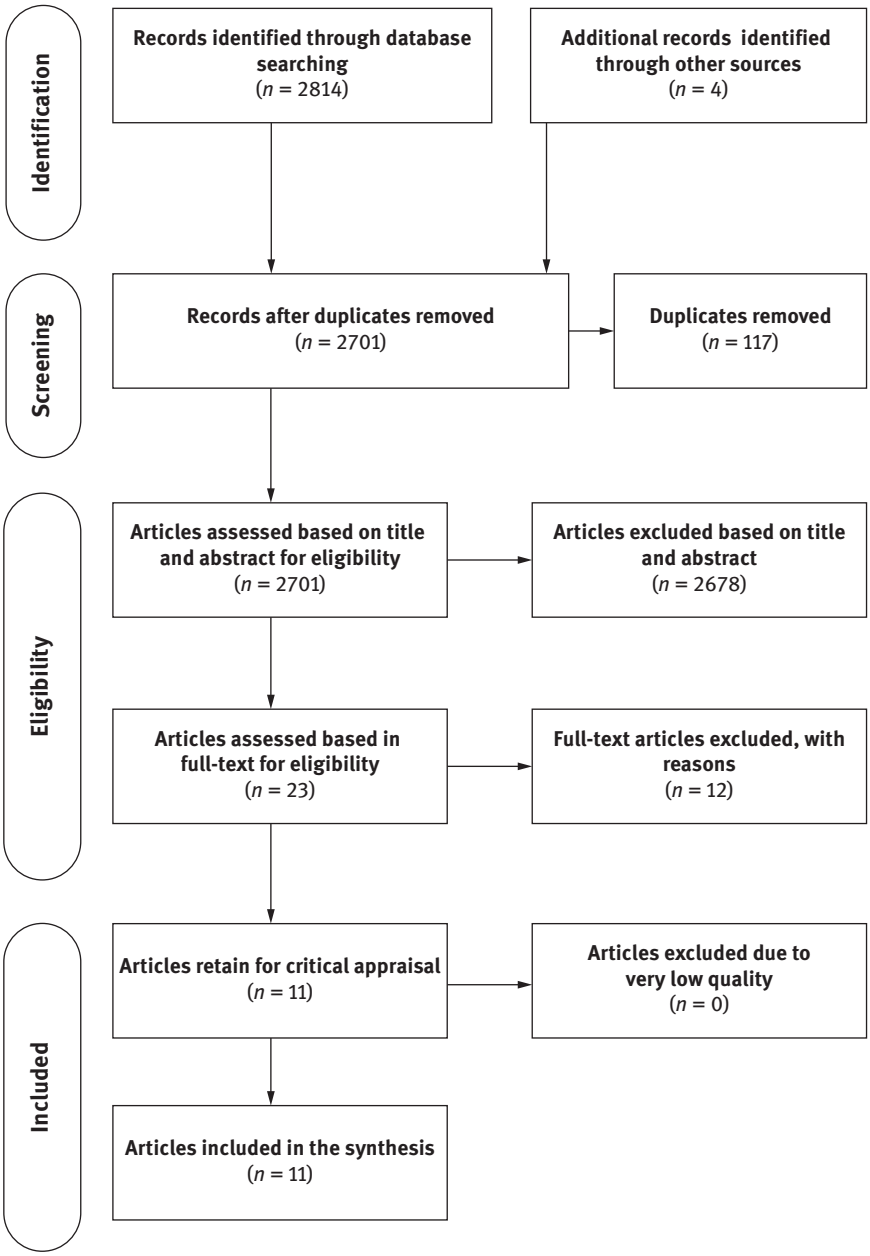

Fig. 2.1: The process of selecting the studies.

To achieve consistency and reduce bias, we included a third author. Cohen's kappa coefficient was used to assess the authors' agreement to increase the review's transparency and the risk of publishing. In the process of collecting (title, abstract, and full reading) the papers for review, the authors reached almost perfect agreement ($\kappa = 0.960$; $p = 0.001$), and similar results were obtained for determining risk of bias ($\kappa = 0.963$; $p = 0.001$). Of the 2,814 identified records, 11 papers matched the inclusion criteria and included detailed data extraction and analysis. The appraisal of the quality of evidence ranged from moderate to high. Most of the research papers (10/11) were high quality, and one study was deemed moderate (Tab. 2.1).

Tab. 2.1: Methodology assessment of each study.

Critically appraised papers	Selection (max. 5 stars)				Comparability (max. 2 stars)	Outcome (max. 3 stars)		Total scores
	1	2	3	4	5	6	7	
DeVon and Zerwic [30]	⁎	–	–	⁎⁎	⁎	⁎⁎	⁎	7
DeVon et al. [31]	⁎	⁎	⁎	⁎⁎	⁎	⁎⁎	⁎	9
McSweeney et al. [32]	⁎	⁎	⁎	⁎⁎	⁎	⁎⁎	⁎	9
Hwang et al. [33]	⁎	–	–	⁎⁎	⁎	⁎⁎	⁎	7
Morgan [34]	⁎	–	⁎	⁎⁎	⁎	⁎⁎	⁎	8
Løvlien et al. [35]	⁎	⁎	⁎	⁎	⁎	⁎⁎	⁎	8
Kirchberger et al. [36]	⁎	⁎	⁎	–	⁎	⁎⁎	⁎	7
Ahmed et al. [37]	⁎	–	⁎	⁎⁎	⁎	⁎⁎	⁎	8
Berg et al. [11]	⁎	–	⁎	⁎⁎	⁎	⁎⁎	⁎	7
DeVon et al. [8]	⁎	⁎	⁎	⁎⁎	⁎	⁎⁎	⁎	9
Kayhan et al. [38]	⁎	–	–	–	⁎	⁎⁎	⁎	5

1, representativeness of the sample; 2, sample size; 3, non-respondents; 4, ascertainment of the exposure; 5, the subjects in different outcome groups are comparable, based on the study design or analysis; 6, assessment of the outcome; 7, statistical test; –, 0 point; ⁎, 1 point; ⁎⁎,2 point; max., maximum.

We included 11 studies in a systematic review of the literature related to the detected symptoms in patients with myocardial infarction in the ED. No study used qualitative or mixed methods, and 11 used a quantitative design. The extraction of included studies is displayed in Tab. 2.2.

To identify detected symptoms and timespan for seeking help in patients with myocardial infarction, line-by-line coding for all studies enabled the identification of free codes ($n = 122$), leading to the development of six descriptive primary level subthemes: ACS; Associated disease; Women; Men; Older adults; and Younger adults. Through the analysis and comparison, we identified three secondary-level themes: illness, gender, and age. All themes were analysed to develop a thematic framework from which the one main theme was identified: Clinical symptoms. The results from the data synthesis of included studies can be found in Fig. 2.2.

Tab. 2.2: Characteristics of included papers.

Author; year; country	Research design	Aim of research	Sample size	Main findings related to detected symptoms
DeVon and Zerwic [30]; 2004; USA	Quantitative study; cross-sectional observational study	Discovering if symptoms of unstable angina pectoris (UAP) differed from acute myocardial infarction (AMI) symptoms	$n = 338$ ($n = 100$ patients with UAP and $n = 238$ patients with myocardial infarction)	– Patients with UAP more significantly reported dizziness ($p = 0.05$), numbness in the hands ($p < 0.01$), chest pain ($p = 0.05$), and unusual fear. – Patients with AMI more significantly reported nausea ($p = 0.05$), vomiting ($p < 0.001$), indigestion ($p < 0.01$), fatigue, and sweating. – Most patients experienced chest discomfort. – Patients with myocardial infarction evaluated chest pain higher ($\bar{x} = 8.46$; SD = 2.2), on the scale from 1 to 10, than patients with UAP ($\bar{x} = 7.69$; SD = 2.39; $t = 2.62$, $p < 0.01$).

(continued)

Tab. 2.2 (continued)

Author; year; country	Research design	Aim of research	Sample size	Main findings related to detected symptoms
DeVon and Ryan [31]; 2008; US A	Quantitative study; cross-sectional observational study	To indicate symptoms difference between women and men with unstable angina pectoris, myocardial infarction without ST elevation, and myocardial infarction with ST-elevation. They follow age, anxiety, depression, functional status, and diabetes	$n = 256$ ($n = 112$ women and $n = 144$ men)	– More than half of all patients answered that their symptoms were not caused by effort, emotional agitation, or rest. – Women complained more often about indigestion ($p = 0.04$), palpitation ($p = 0.02$), nausea ($p < 0.01$), numbness in the hands ($p = 0.03$), and unusual fatigue ($p < 0.01$). – Women more often reported pain in the jaw ($p = 0.02$) and in the neck ($p < 0.01$) compared to men. – Men with elevated ST myocardial infarction more often complained about dizziness ($p < 0.01$). – Women with unstable angina pectoris and without elevated ST myocardial infarction felt weakness more often ($p < 0.01$). – Women with elevated ST AMI complained of newly existing cough more often ($p < 0.01$). – Women described chest pain as feeling anxious ($p = 0.03$) and tingling; on the other hand, men described their pain as burning.

McSweeney et al. [32]; 2010; US A	Quantitative study; multicentre retrospective research	To compare cardiovascular disease warning signs with AIM symptoms in women of black, Latin, and white races	$n = 1,270$ ($n = 454$ black women, $n = 539$ white women and $n = 186$ Latino women)	– 95% of all women, regardless of race, reported early prodromal symptoms, and the most common symptom was fatigue. – Anxiety was the second most common symptom in Latino women ($p < 0.001$). – Chest pain/discomfort was the most common symptom in Latino and white women and the second most common symptom in black women. – Black women reported two generalized symptoms: feeling hot and indigestion more often than Latino and white women ($p < 0.001$).
Hwang et al. [33]; 2006; US A	Quantitative methodology; cross-sectional observational study	Investigate the effect of age on the onset of symptoms	$n = 239$ (older adults older more than 65 years old ($n = 96$) and younger adults younger than $n = 143$ 65 years old)	– Older adults (65–89 years old) more often had hypertension ($p < 0.001$), diabetes, and a history of stroke ($p = 0.05$). – Older adults had significantly fewer symptoms than younger adults; symptoms that appear more often are weakness, sweating, fear, nausea, and indigestion ($p = 0.05$). – 58% of older adults said that experienced symptoms were not the same as expected.

(continued)

Tab. 2.2 (continued)

Author; year; country	Research design	Aim of research	Sample size	Main findings related to detected symptoms
Morgan [34]; 2005; USA	Quantitative study; correlation study	The aim was to determine the extent of incompatibility between AMI's expected and actual symptoms	$n = 110$ (62 men and 36 women)	– Women reported pain in hands, arms, jaw, and neck more often than men. – Men more often reported symptoms like dizziness, nausea, headache, sweating, and shortness of breath. – In women, fatigue ($p = 0.05$), nausea and vomiting, dizziness, and numbness in hands or palms were dominant symptoms. – Heartburn or indigestion, diarrhoea, and dizziness appeared approximately the same in both sexes. – The most common symptom that patients expected was chest pain; that same symptom was the most common.
Løvlien et al. [35]; 2006; Norway	Quantitative methodology; cross-sectional retrospective study	Compare the symptoms and course of the disease in both genders with diagnosed AIM	$n = 82$ (patients aged up to 65 years old who had their first AIM)	– Chest pain was the most common symptom in both genders. – Women and men who were 50 years old or less often experienced pain in both arms ($p < 0.01$). Men and women older than 50 reported back pain ($p = 0.05$). – More men (84%) than women (66%) attributed the pain to heart disease ($p = 0.05$). – Women who did not attribute their symptoms to heart disease had chest pain and arm pain (33%).

Kirchberger et al. [36]; 2016; Germany	Quantitative study; observational retrospective study	Consider the frequency of symptom mismatching and which factors are associated with the mismatching of symptoms	$n = 1{,}282$ ($n = 990$ men and $n = 292$ women)	– Among all patients, 94.3% had a different range of expressed symptoms at re-infarction compared to the first infraction. – According to a re-infarction, men have a lower probability of mismatching symptoms at first infarction in pain between shoulder blades and jaw/neck, nausea, vomit, and fear of death than women. – Several mismatching symptoms at first infarction and re-infarction were significantly lower in men than in women ($p < 0.001$).
Ahmed et al. [37]; 2018; Pakistan	Quantitative methodology; cross-sectional study	Evaluate the symptoms in patients with myocardial infarction and diabetes or without diabetes	$n = 280$ ($n = 130$ patients with diabetes and $n = 150$ non-diabetes patients)	– Chest pain was the most common symptom in patients with diabetes and those without diabetes. – Patients with diabetes reported less often chest pain than patients without diabetes (77.7% vs 86.7%) ($p = 0.049$). – Sweating, dyspnoea, nausea, and vomiting are symptoms that have appeared equally common in patients with and without diabetes.

(continued)

Tab. 2.2 (continued)

Author; year; country	Research design	Aim of research	Sample size	Main findings related to detected symptoms
Berg et al. [11]; 2009; Sweden	Quantitative methodology; retrospective study	Analyses the differences in experiencing symptoms of AMI between gender	$n = 225$ ($n = 52$ women and $n = 173$ men)	– Most women and men had pain in the chest. There was no significant difference between gender. – Nausea has been more often in women (53.8%) than in men (29.5%). – Women reported pain in the back (odds ratio – OR = 4.29) and dizziness (OR = 2.60). – Women had a higher number of symptoms (4–6) than men (3) ($p = 0.04$). – Central (squeezing) chest pain is the most common pain in both genders.
DeVon et al. [8]; 2014; USA	Quantitative study; prospective study	To investigate differences in symptoms between black and white patients who arrived at an emergency	$n = 663$ ($n = 116$ black patients and $n = 547$ white patients)	– Black patients report more symptoms than white patients. – Black patients complain more often about pressure and pain in the chest, sweating ($p < 0.001$), pain in the upper back ($p < 0.001$), and palpitation ($p = 0.05$) than white patients.
Kayhan et al. [38]; 2017; Turkey	Quantitative study; retrospective study	The aim was to identify symptoms in patients diagnosed with AMI admitted to the ED	$n = 285$ ($n = 59$ women and $n = 226$ men)	– The most common symptom in men and women with STEMI and NSTEMI is chest pain. – Patients with NSTEMI more often complain about pain in the left arm and dyspnoea than patients with STEMI.

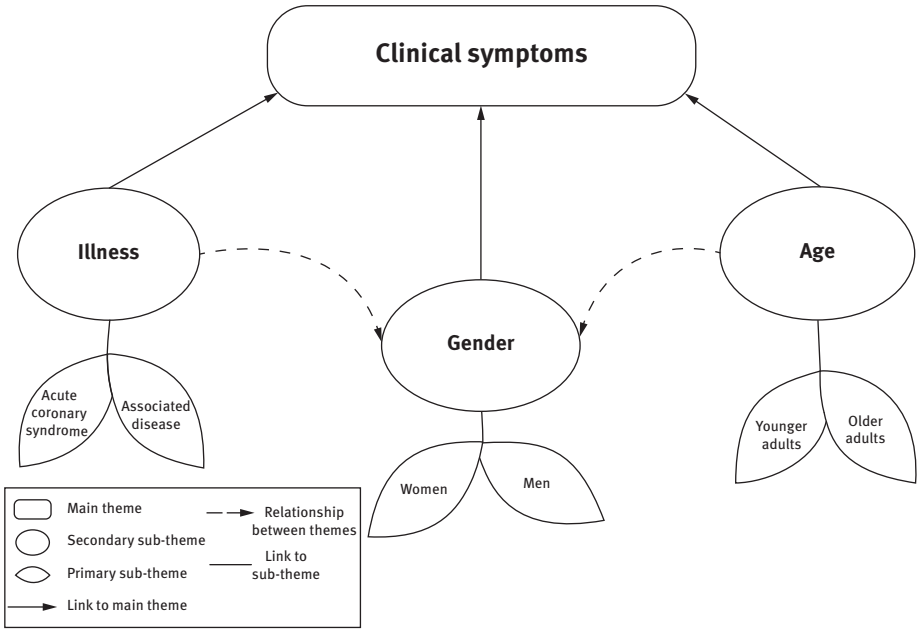

Fig. 2.2: The results from data synthesis of included studies.

2.3.1 Clinical symptoms

Three secondary-level subthemes were defined within clinical symptoms: illness, gender, and age.

Illness

The subtheme of illness contains two descriptive elements: ACS and associated diseases. Certain differences in the occurrence of symptoms regarding the type of AMI have been identified [37]. Among patients with myocardial infarction, those diagnosed with STEMI (77.5%) dominate compared to NSTEMI (22.5%) [38]. The most commonly expressed symptom, regardless of the type of AMI, is chest pain [27, 37], which appeared in all identified studies. Ahmed et al. [37] note that chest pain is the most common symptom identified by patients with diabetes and those without it. Furthermore, they note that patients with diabetes are less likely to report chest pain (77.5%) as compared with patients without diabetes (86.7%) ($p = 0.049$). Patients with NSTEMI more frequently report dyspnoea and pain in their left shoulder (7.81%); meanwhile, patients with STEMI more frequently report nausea (3.16%)

and syncope (3.62%). However, regardless of the type of AMI, there is no statistically significant difference in those symptoms ($p = 0.458$) [38].

Gender

A secondary subtheme of gender includes two descriptive primary subthemes. Chest pain is the most common symptom, regardless of gender [11, 31, 32, 34, 35, 38]. In symptoms like pain in the hands or arms, sweating, dyspnoea, tiredness, neck and back pain, abdominal or epigastric pain, vomiting, syncope, nausea, heartburn, diarrhoea, and jaw pain, a significant statistical difference was not found between genders ($p = 0.260$) [11, 38]. The average number of symptoms patients had was slightly higher in women than in men, but there was a small difference [31]. Berg et al. [11] similarly note that women, on average, report a more significant number of symptoms (between 4 and 6) than men, who report, on average, three symptoms ($p = 0.04$) [36].

Age

Hwang et al. [33] note that older adults (65–89 years old) more frequently had associated diseases like arterial hypertension ($p < 0.001$), diabetes mellitus, and a history of stroke ($p = 0.05$). Older adults also significantly less frequently reported pain in the middle of their chest area ($p = 0.05$) and less frequently complained about sweating, fear, indigestion ($p = 0.05$), nausea, fainting, and dizziness, which dominated in younger adults (31–64 years old). Expressed pain intensity is not significantly different between young and older adult patients. Young adults more frequently reported pain as burning ($p = 0.05$), sharp ($p = 0.05$), and heavy ($p = 0.05$) in comparison with older adults. The appearance of shortness of breath, tiredness, weakness, vomiting, and palpitation is not significantly different with regard to the age of the patients. Older adults complained about fewer symptoms in comparison with younger adults. Fifty-eight per cent of older adult patients reported that the expected symptoms of AMI were not the same as they experienced [33].

2.4 Discussion

Based on our systematic review of the literature on the perceived symptoms of AMI that help triage nurses to identify timely, we identified that the most common symptom, regardless of the kind of AMI or gender, is chest pain [11, 30–32, 34, 39]. Other symptoms include nausea, vomiting [30], and indigestion [31, 32]. Shortness of breath,

tiredness, weakness [31, 32, 34], sweating, neck, and jaw pain [11] can also appear. Kayhan et al. [38] identified that patients report shortness of breath, tiredness, weakness, and sweating to roughly the same extent, regardless of whether diagnosed with UAP or AMI. Further, McSweeney et al. [32], Morgan [34], DeVon et al. [31] and Ryan et al. [19] report that the most common symptoms of AMI in females, regardless of race, are shortness of breath, weakness, and fatigue. Berg, Björck [11] also note that sweating, tiredness, neck and jaw pain, dyspnoea, abdominal pain, and syncope appear in both men and women with the same frequency. Kayhan et al. [38] similarly report incidences of dyspnoea and syncope between the sexes, as with pain in the left shoulder and back.

Our review identified that patients with AMI commonly report nausea and vomiting [30, 38], which is more common among women [34]. Additional research [31, 35, 38] found similar results for nausea alone. Kayhan et al. [38] state that the appearance of nausea and vomiting in men and women does not significantly differ.

Men reported worse pain than women and further reported similar locations and the quality of the pain [31]. Berg et al. [11] describe that women had occasional pain that was not long-lasting. According to Hwang et al. [33], young adults more frequently reported pain in the middle of their chest in comparison with the older adults. Older adults described the pain as burning, sharp, and challenging [33].

In the ED, the diagnosis needs to be initiated when the patient arrives, and the main complaints present as typical or atypical symptoms of AMI to the triage nurse. Jaeger, Wildi [39] state that it may be possible to diagnose AMI with the help of anamnesis, physical examination, 12-lead ECG, pulse oximetry, standard laboratory test, and chest radiography. Furthermore, Body et al. [40] recommended additional tests such as measuring a high-sensitivity cardiac troponin concentration, age, risk factors, and Troponin (HEART) score or the Troponin-only Manchester Acute Coronary Syndromes (T-MACS) decision aid. With these specific algorithms, we can calculate each individual patient's probability of AMI following a single blood test at the time of arrival at the ED to guide decision-making [41]. Furthermore, T-MACS identify individuals at high risk of AMI who require referral to cardiology [42].

2.4.1 Recommendations

Our chapter presents the symptoms and signs triage nurses detect in AMI patients seeking help at an ED. More research is necessary that focuses on timely identification of symptoms that indicate AMI, the role of decision-making skills in determining the appropriate triage category for those patients and follow-up action by healthcare practitioners in EDs. Furthermore, emphasis should be placed on researching the influence of education, knowledge, resources, and skills among triage nurses in relation to the timely identification of symptoms of AMI as a life-threatening condition.

2.4.2 Limitations

This review has several limitations. Some important papers have probably been excluded based on the eligibility criteria. Also, this review included only studies published in English, and this criterion may have excluded relevant literature published in other languages as the translation was unavailable. Quality assessment was performed with the NOS, which is a useful tool, although its reliability could be improved by an additional assessment of the methodological quality of the included studies. To reduce reporting bias, we followed the recommendations by Higgins and Green [29] and the PRISMA Checklist [24].

2.5 Conclusion

Based on a literature review, the most frequently detected symptom in AMI patients is chest pain. In patients with AMI, various symptoms range from typical chest pain, shortness of breath, sweating, and pain in the hands, to atypical symptoms such as indigestion, weakness, numbness in the hands, and upper abdominal pain, anxiety, and headache. We found that men are more likely to report abdominal pain, left shoulder pain, headache, dizziness, and nausea than women, who often experience fatigue, vomiting, nausea, and collapse. Race, gender, age, and associated diseases, especially diabetes mellitus, affect the onset of symptoms. Furthermore, we discovered that women report more symptoms (from 4 to 6), while men, on average, report three symptoms. Thus, triage nurses need to pay attention to cardiovascular symptoms. Their focus also needs to be redirected to epigastric pain and cold sweating, which are abdominal and systemic symptoms, and anxiety and nausea/vomiting in patients with diabetes.

References

[1] Thomas H, Diamond J, Vieco A, Chaudhuri S, Shinnar E, Cromer S, et al. Global atlas of cardiovascular disease. Glob Heart, 2018, 13, 143–163.
[2] Rashidi A, Whitehead L, Glass C. Factors affecting hospital readmission rates following an acute coronary syndrome: A systematic review. J Clin Nurs, 2021.
[3] Holc I. Akutni koronarni sindrom. In: Holc I, Križmarić M, Mekiš D, Pajnkihar M, Kamenik M, Eds. Klinična patofiziologija nujnih stanj: Izbrana poglavja. Maribor, Univerza v Mariboru, Fakulteta za zdravstvene vede, 2016, 145–151.
[4] Štajer D, Koželj M. Kardiologija. In: Košnik M, Mrevlje F, Štajer D, et al., Eds. Interna medicina. 4th ed. Ljubljana, Littera picta, Slovensko medicinsko društvo, 2011, 113–351.
[5] Bevc S, Penko M, Zorman T. Simulacija akutnega koronarnega sindroma pri predmetu Interna medicina: Učno gradivo. 6. izd. ed. Maribor, Medicinska fakulteta, 2015, 21 f. p.

[6] Bandstein N, Ljung R, Johansson M, Holzmann MJ. Undetectable high-sensitivity cardiac troponin T level in the ED and risk of myocardial infarction. J Am Coll Cardiol, 2014, 63(23), 2569–2578.
[7] Banharak S, Prasankok C, Lach HW. Factors related to a delay in seeking treatment for acute myocardial infarction in older adults: An integrative review. Pac Rim Int J Nurs Res, 2020, 24(4), 553–568.
[8] DeVon HA, Burke LA, Nelson H, Zerwic JJ, Riley B. Disparities in patients presenting to the ED with potential acute coronary syndrome: It matters if you are Black or White. Heart & Lung, 2014, 43(4), 270–277.
[9] Fu R, Li S-D, Song C-X, Yang J-A, Xu H-Y, Gao X-J, et al. Clinical significance of diabetes on symptom and patient delay among patients with acute myocardial infarction – an analysis from China Acute Myocardial Infarction (CAMI) registry. J Geriatr Cardiol, 2019, 16(5), 395.
[10] Lichtman JH, Leifheit EC, Safdar B, Bao H, Krumholz HM, Lorenze NP, et al. Sex differences in the presentation and perception of symptoms among young patients with myocardial infarction: Evidence from the VIRGO study (variation in recovery: Role of gender on outcomes of young AMI patients). Circulation, 2018, 137(8), 781–790.
[11] Berg J, Björck L, Dudas K, Lappas G, Rosengren A. Symptoms of a first acute myocardial infarction in women and men. Gender Med, 2009, 6(3), 454–462.
[12] Thygesen K, Alpert JS, Jaffe AS, Simoons ML, Chaitman BR, White HD, et al. Third universal definition of myocardial infarction. J Am Coll Cardiol, 2012, 60(16), 1581–1598.
[13] Soares Passinho R, Garcia Romero Sipolatti W, Fioresi M, Caniçali Primo C. Signs, symptoms and complications of acute myocardial infarction. Rev Enferm, 2018, 12(1), 247–264.
[14] Ekwall A, Gerdtz M, Manias E. The influence of patient acuity on satisfaction with emergency care: Perspectives of family, friends and carers. J Clin Nurs, 2008, 17(6), 800–809.
[15] Fekonja Z, Pajnkihar M. Implementation of Manchester triage system in an ED in Slovenia. Egészség-akadémia, 2016, 7(3), 151–158.
[16] Forsman B, Forsgren S, Carlström ED. Nurses working with Manchester triage–the impact of experience on patient security. Aust Emerg Nurs J, 2012, 15(2), 100–107.
[17] Shamsi NM. Improving vital signs measurement and documentation in the triage room: A quality improvement project. Bahrain Med Bull, 2018, 40(3), 171–173.
[18] Arslanian-Engoren C. Explicating nurses' cardiac triage decisions. J Cardiovasc Nurs, 2009, 24(1), 50–57.
[19] Ryan K, Greenslade J, Dalton E, Chu K, Brown AF, Cullen L. Factors associated with triage assignment of ED patients ultimately diagnosed with acute myocardial infarction. Aust Crit Care, 2016, 29(1), 23–26.
[20] Andersson H, Ullgren A, Holmberg M, Karlsson T, Herlitz J, Wireklint Sundström B. Acute coronary syndrome in relation to the occurrence of associated symptoms: A quantitative study in prehospital emergency care. Int Emerg Nurs, 2016, 33.
[21] Canto AJ, Kiefe CI, Goldberg RJ, Rogers WJ, Peterson ED, Wenger NK, et al. Differences in symptom presentation and hospital mortality according to type of acute myocardial infarction. Am Heart J, 2012, 163(4), 572–579.
[22] Reblora JM, Lopez V, Goh Y-S. Experiences of nurses working in a triage area: An integrative review. Aust Crit Care, 2020, 33(6), 567–575.
[23] Hollander JE, Than M, Mueller C. State-of-the-art evaluation of ED patients presenting with potential acute coronary syndromes. Circulation, 2016, 134(7), 547–564.
[24] Moher D, Liberati A, Tetzlaff J, Altman DG, The PG. Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. PLOS Med, 2009, 6(7), e1000097.

[25] Modesti PA, Reboldi G, Cappuccio FP, Agyemang C, Remuzzi G, Rapi S, et al. Panethnic differences in blood pressure in Europe: A systematic review and meta-analysis. PloS One, 2016, 11(1), e0147601.
[26] Bowatte G, Tham R, Allen K, Tan D, Lau M, Dai X, et al. Breastfeeding and childhood acute otitis media: A systematic review and meta-analysis. Acta Paediatr, 2015, 104, 85–95.
[27] Kastrin A. Metaanaliza in njen pomen za psihološko metodologijo. Psihološka Obzorja, 2008, 17(3), 25–42.
[28] Thomas J, Harden A. Methods for the thematic synthesis of qualitative research in systematic reviews. BMC Med Res Methodol, 2008, 8(1), 1–10.
[29] Higgins J, Green S. Cochrane handbook for systematic review so interventions (version 5.0.2): The Cochrane Collaboration 2009. (Available from: http://handbook.cochrane.org).
[30] DeVon HA, Zerwic JJ. Differences in the symptoms associated with unstable angina and myocardial infarction. Prog Cardiovasc Dis Nurs, 2004, 19(1), 6–11.
[31] DeVon HA, Ryan CJ, Ochs AL, Shapiro M. Symptoms across the continuum of acute coronary syndromes: Differences between women and men. Am J Crit Care, 2008, 17(1), 14–24, quiz 5.
[32] McSweeney JC, O'Sullivan P, Cleves MA, Lefler LL, Cody M, Moser DK, et al. Racial differences in women's prodromal and acute symptoms of myocardial infarction. Am J Crit Care, 2010, 19(1), 63–73.
[33] Hwang SY, Ryan C, Zerwic JJ. The influence of age on acute myocardial infarction symptoms and patient delay in seeking treatment. Prog Cardiovasc Dis Nurs, 2006, 21(1), 20–27.
[34] Morgan DM. Effect of incongruence of acute myocardial infarction symptoms on the decision to seek treatment in a rural population. J Cardiovasc Nurs, 2005, 20(5), 365–371.
[35] Løvlien M, Schei B, Gjengedal E. Are there gender differences related to symptoms of acute myocardial infarction? A Norwegian perspective. Prog Cardiovasc Dis Nurs, 2006, 21(1), 14–19.
[36] Kirchberger I, Heier M, Golüke H, Kuch B, von Scheidt W, Peters A, et al. Mismatch of presenting symptoms at first and recurrent acute myocardial infarction. From the MONICA/KORA Myocardial Infarction Registry. Eur J Prev Cardiol, 2016, 23(4), 377–384.
[37] Ahmed S, Khan A, Ali SI, Saad M, Jawaid H, Islam M, et al. Differences in symptoms and presentation delay times in myocardial infarction patients with and without diabetes: A cross-sectional study in Pakistan. Indian Heart J, 2018, 70(2), 241–245.
[38] Kayhan M, Mamur A, Ünlüoğlu İ, Balcıoğlu H, Acar N, Bilge U. An assessment of initial symptoms in patients admitted to the ER of a tertiary healthcare institution and diagnosed with acute myocardial infarction. Biomed Res Ther, 2017, 28(9), 4202–4207.
[39] Jaeger C, Wildi K, Twerenbold R, Reichlin T, Gimenez MR, Neuhaus J-D, et al. One-hour rule-in and rule-out of acute myocardial infarction using high-sensitivity cardiac troponin I. Am Heart J, 2016, 171(1), 92–102.
[40] Body R, Almashali M, Morris N, Moss P, Jarman H, Appelboam A, et al. Diagnostic accuracy of the T-MACS decision aid with a contemporary point-of-care troponin assay. Heart, 2019, 105(10), 768–774.
[41] Body R. Acute coronary syndromes diagnosis, version 2.0: Tomorrow's approach to diagnosing acute coronary syndromes?. Turk J Emerg Med, 2018, 18(3), 94–99.
[42] Greenslade JH, Carlton EW, Van Hise C, Cho E, Hawkins T, Parsonage WA, et al. Diagnostic accuracy of a new high-sensitivity troponin I assay and five accelerated diagnostic pathways for ruling out acute myocardial infarction and acute coronary syndrome. Ann Emerg Med, 2018, 71(4), 439–451. e3.