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Clinical presentation in EMS patients with acute chest pain in relation to sex, age and medical history: prospective cohort study

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ABSTRACT

Objective To assess symptom presentation related to age, sex and previous medical history in patients with chest pain.

Design Prospective observational cohort study.

Setting Two-centre study in a Swedish county emergency medical service (EMS) organisation.

Participants Unselected inclusion of 2917 patients with chest pain cared for by the EMS during 2018.

Data analysis Multivariate analysis on the association between symptom characteristics, patients' sex, age, previous acute coronary syndrome (ACS) or diabetes and the final outcome of acute myocardial infarction (AMI).

Results Symptomology in patients assessed by the EMS due to acute chest pain varied with sex and age and also with previous ACS or diabetes. Women suffered more often from nausea (OR 1.6) and pain in throat (OR 2.1) or back (OR 2.1). Their pain was more often affected by palpation (1.7) or movement (OR 1.4). Older patients more often described pain onset while sleeping (OR 1.5) and that the onset of symptoms was slow, over hours rather than minutes (OR 1.4). They were less likely to report pain in other parts of their body than their chest (OR 1.4). They were to a lesser extent clammy (OR 0.6) or nauseous (OR 0.6). These differences were present regardless of whether the symptoms were caused by AMI or not.

Conclusions A number of aspects of the symptom of chest pain appear to differ in unselected prehospital patients with chest pain in relation to age, sex and medical history, regardless of whether the chest pain was caused by a myocardial infarction or not. This complicates the possibility in prehospital care of using symptoms to predict the underlying aetiology of acute chest pain.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ The unselected inclusion of a close to complete county population of patients with chest pain cared for by the emergency medical services (EMS) constitutes a strength.
⇒ Low rates of missing data considering the use of EMS data also constitute a strength.
⇒ Some variables involved high rates of missing data when compared with studies conducted in the hospital setting, which was a limitation.
⇒ Another limitation was that a study conducted in only one county reduces generalisability.

BACKGROUND

Chest pain is one of the most common reports among emergency medical services (EMS) patients. About 10%–15% of all patient-related EMS missions concern patients with chest pain,[1 2] out of which about 10% have an acute myocardial infarction (AMI).[3]

Clinical presentation is, along with ECG and biomedical markers, one cornerstone when differentiating those with AMI from those with other causes of their chest pain.[4 5] Numerous studies have investigated whether patients' sex, age, diabetes mellitus or previous acute coronary syndrome (ACS) are associated with differences in clinical presentation in patients diagnosed with AMI.[4–7] Even if the results vary, the general opinion is that at least age, sex and diabetes mellitus are associated with differences in symptomology at least in some patients when seeking care for AMI.[4 5 8]

These factors are not solely associated with the type of symptoms that the patients experience but also with to what extent the patients delay seeking care.[9 10] They are also associated with patients' use of the EMS or if they use other means for transportation to hospital when suffering from chest pain.[11]

The above-cited studies are mainly based on hospital data. Thus, it is not possible to determine whether or not these findings also apply in the EMS setting. Furthermore, most of these studies only included patients diagnosed with AMI. This makes it difficult to determine whether these differences in symptomology are also valid among patients with chest pain in general, including patients without AMI. This is of clinical relevance, since we need to know whether such differences in

Table 1 Incidence of diagnosis of AMI on hospital discharge

	All % (n)	Acute myocardial infarction on hospital discharge % (n)	P value*
All	100 (2917)	12 (335)	–
Male	50 (1465)	64 (214)	<0.001
Age >72 years	49 (1436)	55 (183)	0.036
Previous history of ACS	29 (856)	25 (84)	0.068
Previous history of diabetes mellitus	20 (578)	26 (86)	0.004

*χ^2 test.
ACS, acute coronary syndrome; AMI, acute myocardial infarction.

clinical presentation associated with the factors stated should be taken into account when assessing patients with chest pain in the EMS setting. Furthermore, at the time of the EMS assessment, the EMS clinician does not know with certainty whether the patient is suffering from a myocardial infarction or not.

This study, therefore, investigates whether patients with chest pain, assessed in the EMS setting, differ in symptomology based on sex, age, diabetes mellitus or previous ACS, including any type of AMI or unstable angina, regardless of whether their chest pain is caused by AMI or not.

Objective
To assess symptom presentation related to age, sex and previous medical history in patients with chest pain.

METHODS
The study is part of the BRIAN research programme. The primary objective of the BRIAN research programme is to develop a prediction model for risk stratification of EMS patients with acute chest pain. In this study, collected data are analysed further to investigate associations between sex, age, medical history and clinical presentation. Study population, data collection and clinical setting have been previously described[12–14] and are, therefore, summarised briefly.

Study population
In all, 3121 EMS missions were carried out in 2018 in the county catchment area, including patients ≥18 years old, with a chief report of chest pain according to EMS personnel. All these missions were eligible for inclusion. Patients with other symptoms suggestive of AMI, for example, dyspnoea, but not reporting chest pain were not included, since the objective was to investigate patients with chest pain and not patients with suspected AMI in general. This also provided clearer and more objective criteria for inclusion, improving the generalisability of the results by applying a subjective suspicion of AMI. After excluding patients declining to participate and patients who were lost to follow-up, 2917 EMS missions remained.

Healthcare system
The county of Halland covers an area of $5500 \, km^2$ and had 329 000 inhabitants in 2018. These are served by two emergency hospitals, including one with PCI capabilities. The EMS consists of eight ambulance stations with 19 ambulance vehicles. In 2018, a total of 30 672 missions were carried out by the EMS (inter-hospital site transports excluded). The EMS is staffed mainly by nurses.[12]

Data collection
Each patient was tracked throughout the entire healthcare chain, from EMS mission to hospital discharge. Data on symptoms were retrieved using a novel 15-item questionnaire, integrated in the digital EMS medical record, filled in by the EMS personnel. The EMS medical record and thereby also the questionnaire was available bedside and enroute by using electronic tablets. Consequently, the EMS personnel was blinded to diagnose on hospital discharge when completing the questionnaire. The questionnaire contained items mainly focusing on the patients' pain narratives identifying onset, provocation/palliation, quality, radiation, severity, etc. The questionnaire also contained items regarding nausea/vomiting, dyspnoea, paleness and clamminess.

Table 2 Clinical presentation based on sex, age and previous medical history of ACS or diabetes mellitus

	All % (n)	Women % (n)	Age >72 % (n)	History of ACS % (n)	History of diabetes mellitus % (n)
All (number of missing)	100 (2917)	49.8 (1452)	49.2 (1436)	29.3 (856)	19.8 (578)
Pale (565)	16.4 (386)	13.5 (157)	16.7 (196)	19.9 (140)	17.1 (81)
Clammy (565)	8.7 (204)	7.4 (86)	6.4 (75)	6.2 (44)	7.8 (37)
Nausea (576)	27.1 (635)	31.3 (363)	23.2 (270)	24.0 (169)	28.9 (137)
Vomiting (576)	7.0 (165)	6.9 (80)	6.3 (74)	5.4 (38)	7.4 (35)
Affected breathing according to patient (596)	44.6 (1040)	46.8 (537)	44.2 (514)	49.6 (347)	49.0 (229)

ACS, acute coronary syndrome.

Table 3 Pain narrative based on sex, age and previous medical history of ACS or diabetes mellitus

All (number of missing)	100 (2917)	49.8 (1452)	49.2 (1436)	29.3 (856)	19.8 (578)
Pain in other parts of the body (1197)					
Head	2.5 (43)	3.3 (29)	1.8 (15)	2.0 (10)	2.3 (8)
Throat	10.3 (177)	13.3 (117)	8.6 (73)	8.8 (45)	9.1 (32)
Jaw	5.3 (92)	5.8 (51)	3.8 (32)	5.3 (27)	4.5 (16)
Neck	2.5 (43)	3.4 (30)	2.5 (21)	2.9 (15)	3.4 (12)
Between scapulars	2.2 (37)	2.7 (24)	1.5 (13)	1.6 (8)	1.4 (5)
Back	15.2 (261)	19.5 (171)	16.4 (139)	17.5 (89)	17.8 (63)
Left shoulder	8.5 (147)	9.0 (79)	7.5 (64)	9.0 (46)	9.1 (32)
Right shoulder	4.2 (72)	4.6 (40)	4.0 (34)	3.5 (18)	5.4 (19)
Left arm	24.0 (412)	23.0 (202)	23.1 (196)	29.4 (150)	28.0 (99)
Right arm	8.4 (145)	8.8 (77)	8.5 (72)	9.4 (48)	11.0 (39)
Left hand	1.0 (17)	0.7 (6)	0.4 (3)	0.2 (1)	0.8 (3)
Right hand	0.3 (6)	0.1 (1)	0.2 (2)	0.2 (1)	0.6 (2)
Stomach	7.0 (121)	7.1 (62)	7.5 (64)	6.5 (33)	8.2 (29)
Left leg	1.7 (29)	1.8 (16)	1.8 (15)	1.0 (5)	2.8 (10)
Right leg	1.4 (24)	1.4 (12)	1.4 (12)	0.6 (3)	2.8 (10)
No other pain	39.3 (676)	34.2 (301)	41.3 (351)	35.9 (183)	35.4 (125)
Pain quality (1175)					
Band-shaped	3.3 (58)	3.7 (32)	3.4 (29)	3.0 (15)	2.2 (8)
Burning	4.4 (76)	5.4 (46)	3.5 (30)	4.3 (22)	5.8 (21)
Stabbing	9.7 (169)	8.3 (71)	8.8 (75)	10.7 (54)	10.2 (37)
Cramping	8.7 (151)	9.1 (78)	6.7 (57)	6.1 (31)	8.0 (29)
Dull pain	13.9 (242)	13.6 (116)	14.6 (124)	13.6 (69)	15.7 (57)
Fells like something is on the chest	0.7 (12)	0.6 (5)	0.6 (5)	0.4 (2)	0.0 (0)
Discomfort	10.2 (178)	10.8 (92)	10.6 (90)	9.7 (49)	9.9 (36)
Tingling/stinging	5.7 (99)	5.1 (44)	4.9 (42)	5.9 (30)	5.5 (20)
Swaying	1.7 (30)	1.6 (14)	1.5 (13)	2.0 (10)	1.4 (5)
Pressuring	57.9 (1008)	59.6 (510)	60.0 (510)	58.3 (295)	58.0 (211)
Heaviness	1.0 (17)	1.3 (11)	1.1 (9)	0.8 (4)	0.5 (2)
Aching	2.4 (41)	2.1 (18)	2.4 (20)	3.0 (15)	2.7 (10)
Chest pain localisation (640)					
Central pain	53.4 (1215)	53.3 (599)	54.2 (613)	55.4 (377)	55.3 (255)
Left side of chest	35.5 (809)	32.0 (359)	32.7 (370)	36.0 (245)	34.3 (461)
Right side of chest	5.1 (116)	4.8 (54)	5.4 (61)	3.5 (24)	5.9 (27)
Upper part of chest	6.7 (152)	7.9 (89)	5.9 (67)	5.7 (39)	5.2 (24)
Lower part of chest	9.0 (204)	11.1 (125)	9.3 (105)	7.2 (49)	8.9 (41)
All over the chest	11.8 (269)	12.6 (141)	12.5 (141)	11.3 (77)	12.4 (57)
Size of area affected by pain (794)					
Two inch diameter	10.7 (228)	10.2 (107)	10.4 (109)	10.1 (63)	7.0 (30)
Size of patient's palm	58.4 (1240)	57.4 (601)	56.7 (594)	60.0 (374)	58.7 (252)
Entire chest	30.9 (655)	32.4 (339)	32.9 (344)	29.9 (186)	34.3 (147)
Pain affected by movement (719)	17.0 (373)	19.6 (211)	15.5 (169)	15.9 (105)	17.1 (76)
Pain affected by breathing (692)	25.8 (573)	26.6 (292)	21.5 (236)	20.9 (139)	24.3 (109)
Palpation tenderness (655)	22.3 (505)	27.1 (302)	21.3 (239)	21.6 (146)	25.4 (115)
Pain intensity according to numeric rating scale>5 (415)	32.1 (803)	33.6 (1228)	30.1 (372)	33.7 (248)	39.8 (197)

ACS, acute coronary syndrome.

Table 4 Time aspect of pain based on sex, age and previous medical history of ACS or diabetes mellitus

	All % (n)	Women % (n)	Age >72% (n)	History of ACS % (n)	History of diabetes mellitus % (n)
All (number of missing)	100 (2917)	49.8 (1452)	49.2 (1436)	29.3 (856)	19.8 (578)
Time elapsed since pain onset >3 hours (1007)	45.2 (863)	46.5 (442)	47.3 (445)	43.4 (245)	50.4 (195)
Debut					
Debut during activity (752)	22.1 (479)	20.5 (217)	17.8 (191)	20.8 (132)	14.7 (64)
Debut while resting (752)	65.5 (1419)	67.4 (714)	67.6 (725)	67.8 (431)	71.3 (310)
Debut while sleeping (752)	15.8 (342)	15.6 (165)	18.1 (194)	14.2 (90)	16.6 (72)
Sudden debut, within seconds (875)	35.7 (729)	36.1 (361)	31.4 (313)	32.7 (199)	33.0 (136)
Quick debut, within minutes (875)	35.2 (718)	33.2 (332)	35.8 (357)	36.6 (223)	36.2 (149)
Slow debut, within hours (875)	29.1 (595)	30.8 (308)	32.7 (326)	30.7 (187)	30.8 (127)
Constant pain (732)	55.5 (1212)	53.3 (574)	57.1 (615)	54.9 (358)	59.8 (266)
Fluctuating pain (732)	40.4 (883)	42.3 (456)	40.0 (431)	40.0 (261)	34.8 (155)
Pain aggravating over time (732)	10.8 (237)	10.8 (116)	9.4 (101)	12.0 (78)	11.5 (51)

ACS, acute coronary syndrome.

Diagnosis of AMI on hospital discharge according to physician in charge was retrieved from the hospital medical record. AMI was defined as a diagnosis on hospital discharge including any of the following International Statistical Classification of Diseases and Related Health Problems 10-codes (ICD-10):

► I21—AMI.
► I22—subsequent ST elevation myocardial infarction (STEMI) and non-ST elevation myocardial infarction. (NSTEMI).
► I24.1—Dressler's syndrome.
► I24.8—Other forms of acute ischaemic heart disease

Diagnosis of unstable angina was not included in the definition of AMI. Data collection did not affect patient care.

Previous ACS was defined as diagnosed with any of the following ICD-10 codes before the EMS mission included here, according to hospital and primary care medical records:

► I21—myocardial infarction.
► I22 – STEMI and NSTEMI.
► cI23—Certain current complications following STEMI and NSTEMI (within the 28-day period).
► I24—other acute ischaemic heart diseases.
► I252—old myocardial infarction.
► I220—STEMI of anterior wall.

Diabetes mellitus was defined as diagnosed with any of the following ICD-10 codes before the EMS mission included here, according to hospital and primary care medical records:

► E10—type 1 diabetes mellitus.
► E11—type 2 diabetes mellitus.

Endpoint
Occurrence of the following symptoms:
► Paleness or clamminess.

► Nausea or vomiting.
► Dyspnoea.
► Pain according to the OPQRST[15] mnemonic:
  – Onset.
  – Provocation/palliation.
  – Quality.
  – Region and localisation.
  – Severity.
 – Time (behaviour over time).

Statistical analysis
The results are presented using descriptive statistics including percentage (%), number of patients (n), mean, median, SD and quartiles where appropriate.

The association between patients' sex, age, diabetes or previous ACS and occurrence of stated symptoms was analysed using multivariate regression. The analyses were adjusted for diagnosis of AMI at hospital discharge. Patients' age was dichotomised in the analyses, using cohort median age as cut point. No multivariate analyses were performed if the symptom of interest occurred in fewer than 100 patients. This was to ensure that the assumptions for logistic regression analyses were not violated. P values below 0.01 were considered statistically significant (instead of 0.05 due to multiple tests). All analyses were carried out using IBM SPSS Statistics V.27.

Analyses were not carried out of associations between factors other than sex, age, diabetes or previous ACS and symptoms presentation. We, thereby, limited the risk of chance findings by avoiding multiple tests and too small sub-groups.

Data imputation was not performed, but cases with missing data were excluded from the analyses instead. The incidence of missing data is reported in parentheses after each variable in the tables, which are included in the results.
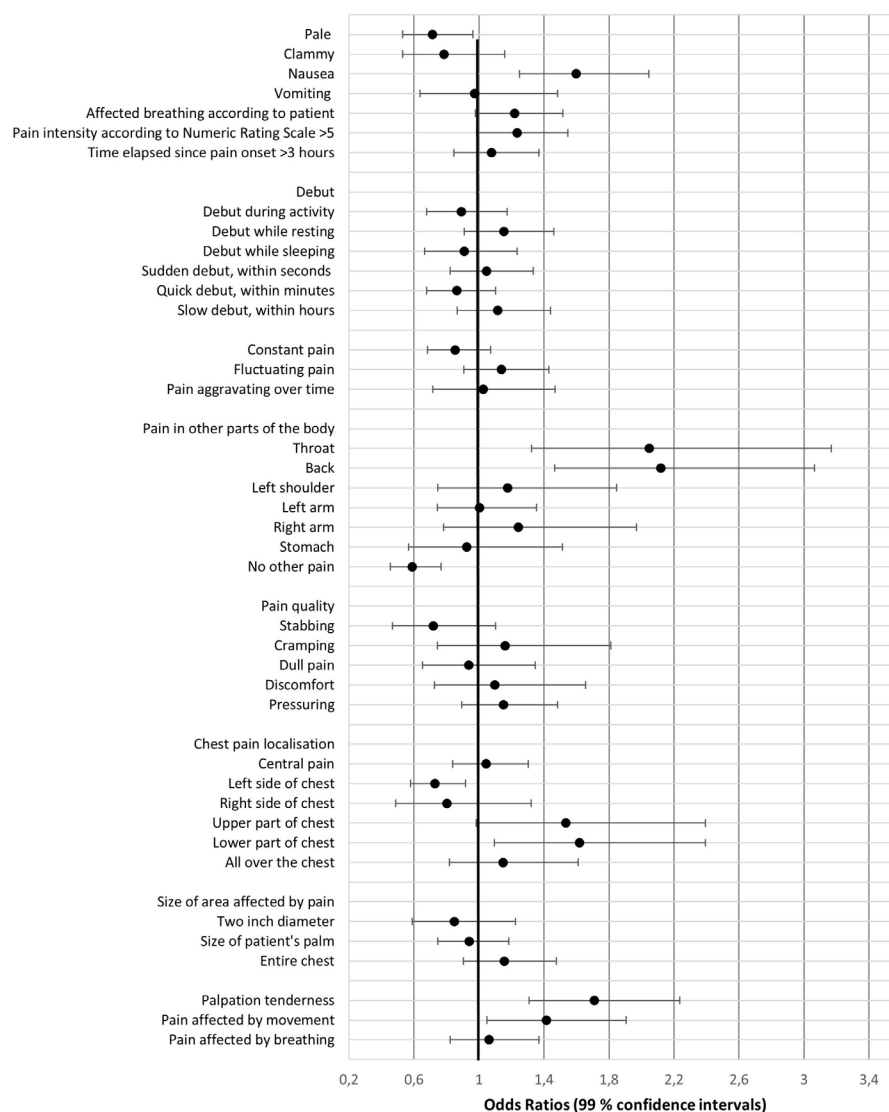
Figure 1 Differences in clinical presentation based on sex.

Patient and public involvement

Patients have not been directly involved in planning or conducting this study. The design of the questionnaire was partly based on patient narratives from a previous study within this research project[16] and other studies based on patient interviews. Furthermore, KW had personal contact with several patients who contacted him by phone or e-mail due to the opt-out procedure, both patients wanting to opt out and those who wanted to remain in the study. The results of the study will be presented directly to those patients who request this when contacting KW.

RESULTS

The median age of the cohort was 72 years old (Q25-Q75, 58–82). Sex was evenly distributed. Of EMS missions included, almost 30% of patients had a previous ACS and 20% of the patients had diabetes mellitus. The prevalence of AMI in terms of diagnosis on hospital discharge was 12%. Diagnoses on hospital discharge varied widely. Other common diagnoses on

hospital discharge were unspecified chest pain (42 %), atrial fibrillation (4 %) and heart failure (without pulmonary oedema) (2 %). The proportion of patients with AMI on hospital discharge was associated with sex and diabetes mellitus with a higher rate among men and among patients with diabetes mellitus (table 1). Eight per cent had the combination of diabetes and previous history of ACS.

The most common symptom characteristics were affected breathing (table 2), pressuring pain located in the central chest about the size of a palm (table 3), time debut less than 3 hours before EMS arrival, pain debut while resting and constant pain (table 4). This pattern was found regardless of patients' sex, age, diabetes or previous ACS (tables 2–4).

Women more often suffered from nausea and pain in the throat or back. They also more commonly localised their pain to the lower part of the chest. Their pain was more often affected by palpation or movement. They were more likely to report pain in other parts of the body
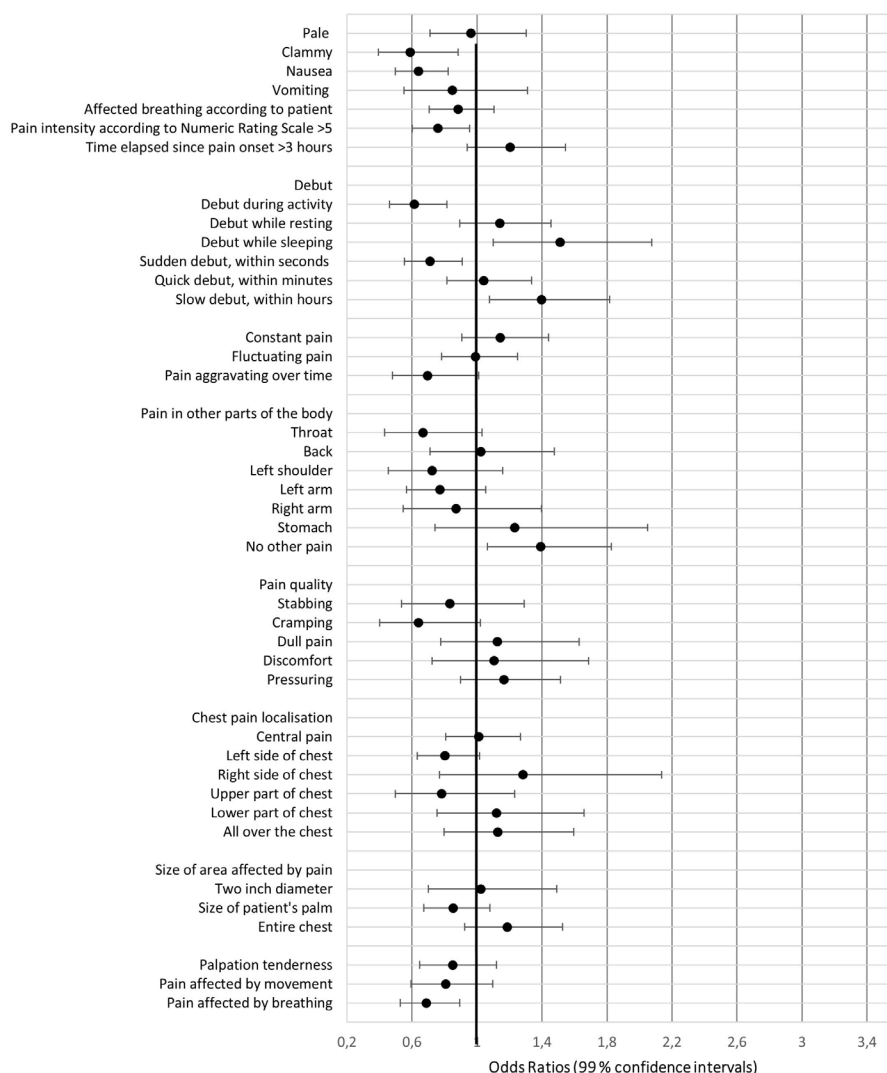
Figure 2 Differences in clinical presentation based on age.

than their chest. They were less often pale and had a lower incidence of left-sided chest pain (figure 1).

Older patients more often described pain onset while sleeping and that the onset of symptoms was slow, over hours rather than minutes. They were less likely to report pain in other parts of their body than the chest. They were to a lesser extent clammy or nauseous. They rated their pain intensity lower and their chest pain onset occurred less often during activity. Their breathing movements more seldom affected their pain (figure 2).

Patients with a previous ACS were more often pale and experienced their breathing as affected. They more often had pain in their left arm. They reported right-sided chest pain to a lesser extent, and they felt pain in any other part of their body than in the chest to a greater extent (figure 3).

Regarding patients with diabetes mellitus, their pain more often started while they were resting and they rated their pain intensity as higher. Their pain was less likely to start during activity (figure 4).

In total, patients' sex was associated with the occurrence of nine different types of symptoms and the same was true

for patients' age. Previous ACS or diabetes were associated with the occurrence of five or three different symptoms, respectively (online supplemental files 1–4). When comparing these analyses based on age, sex and previous medical history to analyses of association between symptoms and AMI, that is, AMI predictors, (online supplemental file 5), one can observe that several symptoms associated with sex, age and previous medical history are not associated with AMI and vice versa.

DISCUSSION

Our study shows that the prevalence of numerous symptoms in EMS patients with chest pain is associated most of all not only with sex and age but also with the patient's previous ACS or diabetes. This is observed regardless of whether the patient's chest pain is caused by an AMI or not. To the best of our knowledge, this is the first study reporting results on symptomology differences in acute chest pain patients based on sex, age and previous ACS or diabetes, when simultaneously adjusting for AMI incidence.
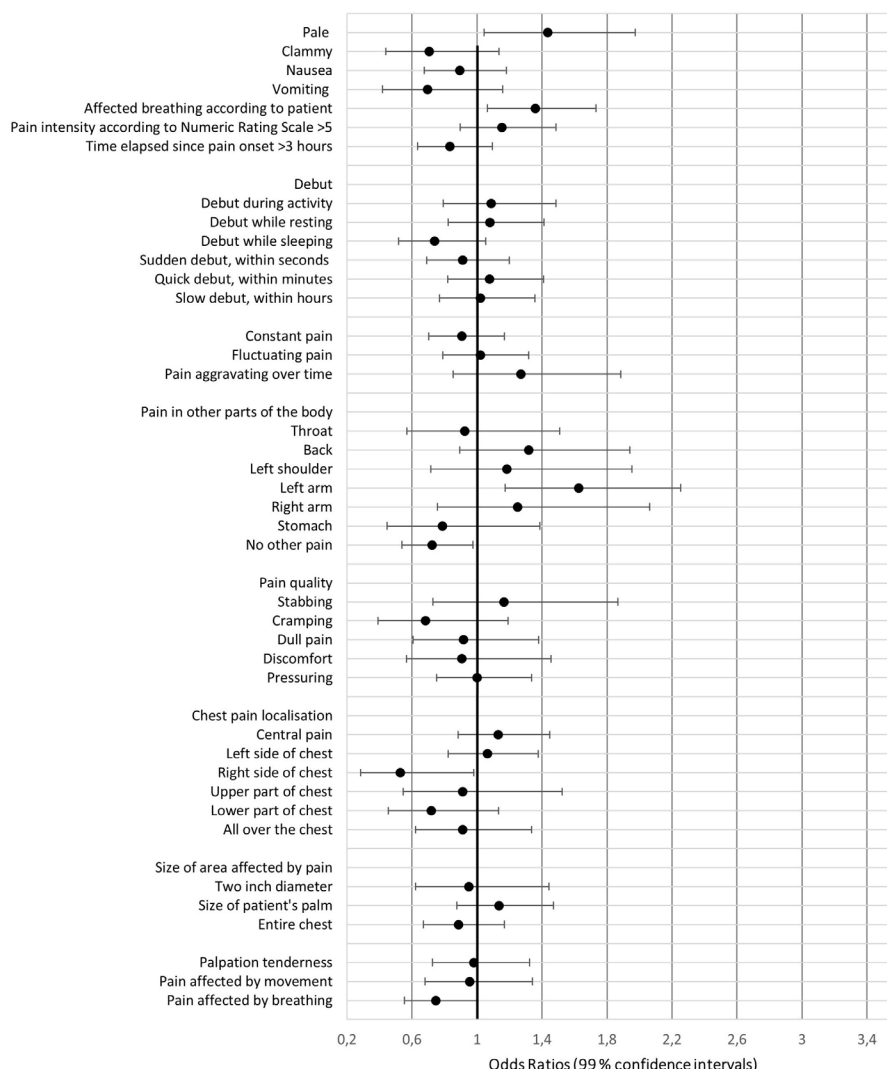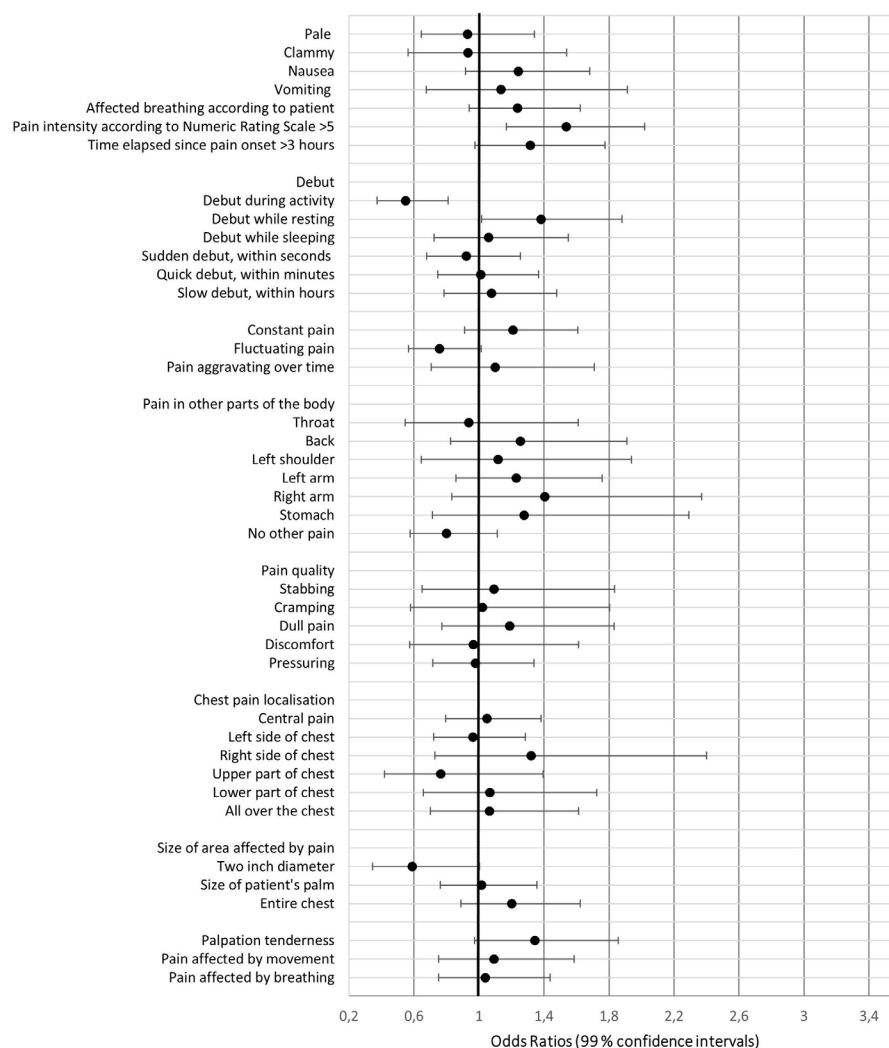
Figure 3 Differences in clinical presentation based on history of ACS. ACS, acute coronary syndrome.

Sex, age and previous ACS or diabetes seem not only to be associated with how an AMI is experienced[4 5 8] but also with how acute chest pain and related symptoms are perceived in general. This finding implies that previously reported differences in clinical presentation based on patients' characteristics may be a general observation in acute chest pain patients and not necessarily associated with an AMI diagnosis. This finding further complicates the already challenging task of assessing patients with acute chest pain. Especially, since these differences in clinical presentation are at hand, both for symptoms associated with AMI and for symptoms with no such association.

These differences also complicate the use of symptom-based chest pain prediction tools not only considering, primarily, age and sex but also medical history. Since our findings indicate that the accuracy of a prediction tool may differ depending on these patient-related factors. This applies particularly to criteria-based assessment tools not considering patient sex or age such as Rapid Emergency Triage and Treatment System[17 18] or Manchester Triage System.[19] The use of more dynamic and advanced prediction models using statistical methods to adjust for examined factors may be one way to improve prediction accuracy and make it more valid for the complete chest pain population.

Sederholm et al[20] report that women with AMI experience pain in their back and throat more often than men and are more commonly nauseous. Lichtman et al[21] and Kirherberger et al[22] also found that women more often than men are nauseous. Araújo et al[23] state that women with AMI are more likely to experience referred pain compared with men. Coventry et al[24] found that women with AMI more often experience nausea and back pain. In our study, we also found an increased incidence of these symptoms among women, but in our material, this difference was present regardless of whether their chest pain was caused by AMI or not. Thus, these differences in symptomology are problematic when used for risk assessment since they are not necessarily associated with the incidence of AMI but rather with the patient's sex. This strengthens our notion that previous reported differences between men and women in AMI presentation are not necessarily associated with AMI but sometimes rather by sex itself.

Figure 4 Differences in clinical presentation based on history of diabetes mellitus.

Previous research report that older patients more often report atypical or accompanying AMI symptoms.[25] In our study, older patients differed from younger ones regarding nine different aspects of their clinical presentation. For example, they more often had a slower debut (hours rather than seconds or minutes), their pain was less intense and it more seldom started during activity. All these aspects can be considered atypical of AMI. On the other hand, older patients less often reported accompanying or atypical symptoms such as nausea and pain affected to breathing. Altogether, the relationship between age and the clinical presentation of patients with chest pain seems to be complex both for patients with and without AMI. This strengthens the need of great humbleness when assessing older patients with chest pain, especially since age itself is a strong risk factor for AMI.[8]

The aim of this study was not to explain the physiological mechanisms behind these differences in the characteristics of chest pain. One can only speculate that changes in the nervous system related to ageing make symptoms less distinct, and that the circadian rhythm for myocardial ischaemia is not as typical among the elderly, which changes the distribution of the time of symptom onset in these patients.

Kirchberger et al[26] state that patients undergoing their second AMI more often have dyspnoea compared with patients having their first AMI. In our study, patients with a history of ACS were more often dyspnoeic, also in cases where the chest pain was not caused by an AMI. One can reason that the higher rate of dyspnoea for patients who experience their second AMI reported by Kirchberger et al[26] is more common at hand for patients with a previous ACS in general and is not necessarily associated with their reinfarction. Maybe this could be explained by the higher incidence of heart failure among patients with previous ACS.

Regarding patients with diabetes mellitus suffering from AMI, Manistamara et al[27] reported that these patients tend to rate their pain as less intense compared with non-diabetic patients. In contrast, we found that patients with diabetes mellitus in general rate their chest pain as higher, regardless of AMI occurrence. These contradictory results between AMI patients and unselected chest pain patients highlight the difficulties regarding how to value pain intensity in patients with diabetes mellitus and symptoms suggestive of AMI.

Our results strengthen the idea that the diagnostic evaluation of chest pain characteristics has limitations as a

diagnostic tool and should be used with great caution.[5] The clinical presentation of patients with chest pain seems to be associated with age, sex and previous ACS or diabetes in a very complicated manner, both for patients with and without AMI as the cause of their chest pain. Altogether, clinicians should be careful when allowing patients' characteristics to influence how they evaluate patients' symptoms.[6] Furthermore, perhaps risk stratification should, when possible, put more emphasis on biochemical cardiac markers, ECG, age and sex, and to a lesser extent on symptoms. This approach is also in line with the European Society of Cardiology 0/1 hour algorithm, which is solely based on cardiac troponins and time since symptoms onset.[5]

Strengths and limitations

This study is strengthened by the close to complete and unselected inclusion of EMS missions concerning patients with chest pain, which improves generalisability. However, the use of data from a single county negatively affects the external validity.

The results are based on subanalyses of previously collected data and the absolute differences observed are sometimes small. Clinicians should, therefore, be careful not to draw over-strict conclusions on how these results should affect clinical practice.

Some of the variables included entail rather high rates of missing information. Data collection in the EMS setting is known to be challenging and often involves higher rates of missing data than the in-hospital setting.[28 29] Considering this, the rates of missing information in this study are to be regarded as low and, therefore, data may be looked on as comparatively comprehensive. Still, missing data are always problematic as it may affect the results by introducing both type I and type II errors. As it reduces the statistical power, it may introduce bias and reduce the representativeness of the cohort studied.[30] We have no reason to suspect any substantial bias due to missing data here, as the rates of missing data mainly reflect how the data were reported by the EMS personnel. There were higher rates of missing data for symptoms reported using free text in the questionnaire (pain localisation and quality) and lower rates for symptoms reported by ticking in a box. Missing data were also more common for variables reflecting symptom onset, that is, debut time and if pain onset was quick or slow. This probably reflects difficulties for the patients in answering such questions as symptom onset since it is not always distinct but rather develops over time. However, the rates of missing data indicate that the results should be interpreted with care and should preferably be validated in future studies. The take home message of this study is that clinical presentation differs according to the factors examined and that less importance should be given to the exact nature of this variation.

It would be of interest to examine if factors other than age, sex and previous ACS or diabetes also affected clinical presentation. Such potential factors are, for example, socioeconomic status, smoking, obesity, hypertension and other cardiac risk factors. However, adding more factors would increase the risk of chance findings, due to multiple analyses. Furthermore, additional factors would result in too small subgroups, thus violating the assumptions for logistic regression analyses. Therefore, only age, sex and previous ACS or diabetes were included in this study. These factors were deemed to be of most interest; age and sex as they concern, all chest pain patients and the other four factors as they have been reported to affect clinical presentation in AMI. However, this is not well described using prehospital data and when adjusting for diagnosis of AMI. Rather, differences in symptomology have been investigated using hospital data and focusing on patients with AMI regardless of their chief report.

In part, the differences in clinical presentation described in this study may be explained by an uneven distribution of diagnoses other than AMI at hospital discharge. To adjust for more diagnoses than AMI at hospital discharge, a larger study sample is needed to ensure statistical robustness. However, the fact that differences in clinical presentation are explained by other diagnoses at hospital discharge does not change the implication of our results. Thus clinicians should be careful not to allow patients' characteristics to influence how they evaluate patients' symptoms in cases of acute chest pain.

CONCLUSIONS

A number of aspects of the symptom chest pain appear to differ in unselected prehospital patients with chest pain in relation to age, sex and previous history regardless of whether the chest pain was caused by a myocardial infarction or not. This complicates the possibility in prehospital care of predicting the underlying aetiology of acute chest pain based on symptoms.

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