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"Frequency of Confusion Between Anxiety and Cardiac Complaints in the Emergency Department: A Cross-Sectional Study Conducted at Esenyurt Necmi Kadioğlu State Hospital (January 1, 2024 - December 31, 2024)"

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Abstract

This study aims to determine the rate of diagnostic errors between anxiety and cardiac diseases in the Emergency Department of Esenyurt Necmi Kadioğlu State Hospital for the year 2024. Data from 800 patients was analyzed using a retrospective cross-sectional design. The results show that sixty percent of patients were diagnosed with anxiety and forty percent with cardiac diseases. The total misdiagnosis rate was 12%. Out of these, 10% of patients who were initially diagnosed with anxiety were later found to have a cardiac condition and 15% of those diagnosed with cardiac conditions were later found to have anxiety. Age, smoking, hypertension and chest pain were found to be significant factors associated with diagnostic errors. The probability of misdiagnosis increased with age, and higher rates were found among female patients, smokers, and hypertensive patients. Patients with lower troponin levels were more likely to be diagnosed with anxiety. The ECG findings did not have any significant relation with the diagnostic accuracy. These results underscore the importance of a more systematic and individualized diagnostic approach in emergency settings. Integrating patient-specific factors like age, gender, and comorbidities into clinical decision making and diagnostic algorithms may help decrease misdiagnosis and avoid unnecessary testing. It is recommended to perform a comprehensive cardiac evaluation before diagnosing anxiety in elderly patients, while psychiatric assessment may prevent overuse of cardiac investigations in patients with anxiety-like symptoms.

Keywords: Emergency department, anxiety, cardiac disease, misdiagnosis, troponin, hypertension, aging

Abbreviations

CVD: Cardiovascular Disease

ECG: Electrocardiogram

GAD: Generalized Anxiety Disorder

DSM-5: Diagnostic and Statistical Manual of Mental Disorders, 5th Edition

ESC: European Society of Cardiology

AHA: American Heart Association

CK-MB: Creatine Kinase-MB

HIMS: Hospital Information Management System

Introduction

Emergency departments are major healthcare delivery systems which provide initial assessment and management of patients with diverse problems to the rest of the healthcare system. Cardiovascular diseases (CVDs) are the leading cause of death globally and the emergency department is often times busy with patients with such complaints (1). Many times symptoms of cardiac diseases which include chest pain, palpitations, shortness of breath, sweating and fainting are of serious concern to patients and result in them seeking care from the emergency department (2).

Anxiety disorders can also have the same symptoms which can be a problem in diagnosis in emergency departments (3). Psychiatric conditions like panic disorder, generalized anxiety disorder and somatization disorder may have symptoms that are similar to those of cardiac diseases which can lead to wrong diagnosis (4). Hyperventilation syndrome, over activation of the nervous system and psychosomatic processes can produce the feeling of having a real cardiac event in the patient (5).

A misdiagnosis can have adverse impact on the patient's safety and the health care delivery system. If a patient who has a cardiac disease is diagnosed to have anxiety, then there will be a delay in diagnosis and management which may lead



to development of complications like myocardial infarction, heart failure and arrhythmias (6). On the other hand, patients with anxiety disorders can be subjected to costly and sometimes invasive cardiac tests and treatments, causing them both psychological and economic suffering, and thereby utilizing health care resources in a wrong manner (7).

As of now there are studies on the rates of misdiagnosis of anxiety and cardiac complaints in emergency departments, however there is a lack of regional and population based research on this subject (8). For instance, a thorough examination of certain factors like patient's characteristics, co-morbid illnesses, biochemical markers utilized in diagnosis, and the accuracy of the diagnostic procedures including ECG can help in deriving important information that can be used to prevent diagnostic errors (9).

The purpose of this study is to find out the frequency of diagnostic dilemma between anxiety and cardiac problems in the patients who were referred to the Emergency Department of Esenyurt Necmi Kadioğlu State Hospital from January 1, 2024 to December 31, 2024. It also aims to assess frequencies of diagnostic mistakes, the precision of the diagnostic procedures, and the effect of patients' characteristics on this process.

The main purpose of this study is to establish the rate of anxiety and cardiac diseases' confusion in the emergency department and the rates of wrong diagnosis between the two conditions. In addition, it seeks to answer several key questions: How often are anxiety and cardiac complaints mixed up in emergency care? What patient factors (age, gender, other diseases) are associated with misdiagnosis? How accurate are ECG, biochemical markers (Troponin, CK-MB, etc.) and other diagnostic tests in this setting? Which patients are most likely to be misdiagnosed? What other procedures can be used to enhance the accuracy of the diagnosis in the emergency department?

The study will test the following hypotheses: 10% of patients who present with cardiac complaints in the emergency department are misdiagnosed with anxiety. 11% of patients who present with anxiety symptoms in the emergency department are misdiagnosed with cardiac disease. The rate of misdiagnosis depends on age, gender, the presence of comorbid conditions (diabetes, hypertension, obesity, etc.) and psychiatric history (12). The combination of electrocardiography (ECG), biochemical markers (Troponin, CK-MB) and clinical examination is more accurate in the differentiation of anxiety and cardiac diseases than any of the methods used alone (13).

The purpose of this paper is to test the hypotheses that the presented lists of hypotheses will help to contribute to the improvement of the diagnostic processes in the emergency departments and limit the use of unnecessary medical testing. The results of this study can provide the emergency physicians with the diagnostic guidance to make the right and timely treatment decisions. This research will be one of the first cross-sectional studies to explore the rates of diagnostic confusion between anxiety and cardiac diseases in the

Emergency Department of Esenyurt Necmi Kadioğlu State Hospital. The findings will benefit healthcare professionals in enhancing patient safety and the effectiveness of healthcare services. The findings of this study are expected to serve as a basis for subsequent large-scale diagnostic algorithm development studies and for the enhancement of patient management protocols in emergency departments.

Methods

This study is a retrospective, cross-sectional, observational study that involves patients' data collected from the Emergency Department of Esenyurt Necmi Kadioğlu State Hospital from January 1, 2024, to December 31, 2024. The study purpose is to identify the incidence of diagnostic dilemma between anxiety and cardiac diseases in the emergency department and to find out the causes of such misdiagnoses. The study protocol was developed in accordance with the Declaration of Helsinki and ethical clearances were sought from the appropriate ethical committees.

The study was conducted in one of the busiest healthcare centers in Istanbul, the Emergency Department of Esenyurt Necmi Kadioğlu State Hospital. All patients who were aged 18 years and above and who presented to the emergency department from January 1, 2024, to December 31, 2024, were included in the study. Data collection was done consecutively and included reviewing hospital records.

The study inclusion criteria involved subjects 18 years and older who had chest pain, palpitations, shortness of breath, fainting, or chest tightness and who had been seen in the emergency department. All patients had to have obtained an anxiety or cardiac disease diagnosis from their emergency department admission. The study only included patients with adequate electronic health system documentation of the relevant diagnosis, examination, and treatment.

Exclusion criteria included patients with missing medical information, those with symptoms similar to acute trauma, neurological diseases (stroke, epilepsy), or pulmonary diseases (pulmonary embolism, COPD exacerbation)sp. Patients with previous psychiatric disorders and who were on continuous treatment were also excluded from the study.

The dependent variable in the study was the diagnosis of anxiety or cardiac disease in the emergency department. Age, gender, marital status, comorbidities (hypertension, diabetes, obesity, etc.), smoking and alcohol use, presenting symptoms (chest pain, palpitations, shortness of breath, fainting sensation, chest tightness), diagnostic findings (electrocardiography (ECG), troponin, CK-MB, D-dimer, echocardiography results), and were considered as independent variables. Outcomes included the diagnosis of cardiac disease or anxiety, the rate of misdiagnosis, the need for additional testing, the length of stay in the emergency department, and hospitalization. The current study used a secondary data collected from the hospital information management system (HIMS), and the reasons for patient admissions, laboratory results, ECG

findings, and final diagnoses were analyzed. The criteria for diagnosing cardiac diseases were followed by the guidelines of European Society of Cardiology (ESC) and American Heart Association (AHA), and these included myocardial infarction (MI), stable angina, arrhythmias and other cardiovascular diseases. The diagnoses of anxiety were made using DSM-5 diagnostic criteria, including generalized anxiety disorder (GAD), panic disorder, and acute stress reaction. Data entry was verified by two independent researchers and any potential errors were identified and corrected.

To avoid potential biases, patient selection was done retrospectively by independent researchers who cross checked the diagnosis codes. Standardization of diagnostic criteria was checked and for missing data (for example, absence of biochemical tests) the patient's records were reviewed and the incomplete entries were excluded from the analysis.

A power analysis was performed using G*Power 3.1 software and it was calculated that at least 800 patients were required for the current study. This sample size was considered to be sufficient to determine the rates of misdiagnosis and to compare the statistics between the groups.

All numerical variables were checked for normal distribution using the Kolmogorov-Smirnov test. Numerical data that had a normal distribution were reported as mean $\pm$ standard deviation (SD), while numerical data that had not met the criteria for normal distribution were reported as median (min-max).

For descriptive statistics continuous variables were means $\pm$ standard deviations or medians (IQR), and categorical variables were percentages (%). The Independent Samples T-Test was used for comparisons between groups for normally distributed data, the MannWhitney U Test for nonnormal data, and the Chi square test for categorical data. To identify factors associated with misdiagnosis, logistic regression analysis was applied.

Since the missing data rate was less than 5%, missing values were dealt with using the "listwise deletion" method (complete case analysis). Subgroup analyses were conducted by age and gender to evaluate rates of misdiagnosis. Some sensitivity analyses were carried out by comparing other diagnostic methods.

All statistical analyses were performed using SPSS 26.0 (IBM Corp., Armonk, NY, USA) and all statistical analyses were performed using a p value of < 0.05 .

Results

1,000 patients were assessed in this study, but 150 patients with incomplete medical records and 50 patients who were incongruous owing to acute trauma or neurological dysfunction were excluded. Finally, 800 patients were included in the final analysis.

The age of the 800 patients used in the analysis was also calculated to be 52.8 ± 18.5 years. Among the participants, 52.4% were male and 47.6% were female. The prevalence of

smoking was 30%; alcohol consumption was 15%. In terms of comorbidities, 50% of the participants had hypertension, 30% had diabetes, and 25% had obesity (Table-1).

Chest pain was reported by 60% of the patients as their presenting symptom, 50% had palpitations, 45% had shortness of breath, and 30% had light headedness. Laboratory findings showed that the mean troponin level was 0.256 mg/L, CK-MB level was 5.12 U/L, and D-Dimer level was 242.5 ng/mL. In examination of ECG results it was seen that 50% of patients had normal ECG, 20% had arrhythmias, 20% had ischemic changes and 10% had other abnormalities (Table-1) (Figure-1).

The analysis of missing data established that all variables in the study were completely recorded. Six hundred patients were included, and 60% had anxiety and 40% had a cardiac disease. The overall rate of misdiagnosis was 12%. Further examination of rates of misdiagnosis established that 10% of the patients who were first diagnosed as having anxiety were found to have a cardiac disease and 15% of the patients diagnosed with cardiac disease were found to have anxiety. The emergency department length of stay was on an average 4.8 ± 2.3 hours. Thirty percent of patients diagnosed with cardiac disease were admitted, whereas all patients diagnosed with anxiety were discharged. Age, smoking, hypertension and the presence of chest pain were found to be factors significantly associated with misdiagnosis in logistic regression analysis (Table-2) (Figure-2).

It was noticed that the probability of the wrong diagnosis increased with age, with a 2% increase in the probability of wrong diagnosis for every year of age (OR = 1.02, 95% CI: 1.01-1.04, p value < 0.001). Patients who smoked had a higher rate of misdiagnosis and smoking was found to increase the odds of misdiagnosis by 35% (OR = 1.35, 95% CI: 1.10-1.65, p value = 0.002).

Hypertension was also found to be significantly associated with misdiagnosis. Patients with hypertension had 28% more likely to have misdiagnosis than patients without hypertension (OR = 1.28, 95% CI: 1.05-1.57, p value = 0.015). Furthermore, patients with chest pain had 50% more likely to have misdiagnosis than patients without chest pain (OR = 1.50, 95% CI: 1.22-1.84, p value < 0.001).

We did not find any significant association between misdiagnosis and other symptoms such as palpitations, shortness of breath, and fainting sensation (p > 0.05). When patients were divided into three age groups (18-40, 41-65 and 66+), the highest rate of misdiagnosis was seen in the 66 and above age group.

The subgroup analysis established that female patients had a higher rate of misdiagnosis than male patients (14% vs. 10%, p = 0.03). The sensitivity analysis showed that there was no moderate association between ECG findings and the rates of diagnostic error. However, patients with lower troponin levels had a higher likelihood of being diagnosed with anxiety (p < 0.001) while CK-MB and D-Dimer levels were not related to misdiagnosis (p > 0.05).

This study shows that anxiety and cardiac diseases are often misdiagnosed in the emergency department and that older patients, smokers, and those with hypertension have higher rates of misdiagnosis. These findings therefore suggest the need for more systematic approach to the diagnostic processes in emergency settings in order to reduce the rates of misdiagnosis and enhance patients' outcomes.

Discussion

The purpose of this study was to establish the frequency of diagnostic confusion between anxiety and cardiac diseases in the emergency department and the result showed that 12% of patients were misdiagnosed. It was identified that 10% of patients who were diagnosed with anxiety were incorrectly given the diagnosis of cardiac disease and 15% of patients who were diagnosed with cardiac disease were incorrectly given a diagnosis of anxiety.

The results of logistic regression analyses revealed that age, smoking, hypertension and chest pain were all significantly associated with misdiagnosis. The researchers noticed that the rate of misdiagnosis increased with age. For instance, patients 66 years and above had the highest rate of misdiagnosis.

Subgroup analyses also showed that female patients had a higher misdiagnosis rate than male patients (14% vs. 10%, $p = 0.03$). Furthermore, although ECG findings were not related to diagnostic errors, patients with low troponin levels were likely to be diagnosed with anxiety.

As a retrospective study, it was not always possible to guarantee that all clinical variables were ideally documented. Further, in some patients, subjective symptoms may have been poorly documented. The generalisability of the results to other geographical regions or different healthcare systems is restricted as the study included only admissions from a single hospital.

Another is that there is no further detail on the criteria used for diagnosis. In retrospective data analysis it was not feasible to directly evaluate the use of diagnostic tools like ECG, laboratory tests and clinical examination in decision making processes.

Furthermore, this study did not assess the long-term implications of misdiagnosis. For example, patients who were first diagnosed with anxiety and then had a cardiac event, or patients with anxiety who underwent unnecessary cardiac tests, were not followed up. A potential limitation of the study could be the demographic characteristics of the study population. Furthermore, 50 percent of the patients had hypertension and 30 percent had diabetes, which means that the sample population had more comorbidities than the general population. This may be a comparison to the overall emergency department admission profile. This paper shows that diagnostic uncertainty between anxiety and cardiac diseases is frequent in the emergency department and that certain factors are related to these errors. The results are in agreement with previous researches (14). Previous research has indicated that young patients with low cardiac risk should

be expected to be misdiagnosed with anxiety (15). In the same manner, studies have pointed out that delay in diagnosis of cardiac disease is more common among the patients 65 years and above (16).

With respect to the clinical implications for practice, it is recommended that the diagnostic algorithms used in emergency departments be modified to include age, gender, and risk factors. For instance, elderly patients should undergo more detailed cardiac workup before being diagnosed with anxiety, and younger patients should not undergo unnecessary invasive cardiac tests.

The findings also suggest the importance of the psychiatric evaluation in the diagnostic process in the emergency departments. Some emergency department protocols guide the exclusion of cardiac diseases in patients with anxiety, whereas psychiatric assessments for cardiac patients are rarely considered (17). This omission can result in costly and unnecessary testing and the utilization of other resources within the healthcare system.

Since the ECG results were not always related to the misdiagnosis rates, it appears that clinical decision making should not be based on ECG data alone. Instead, a more complete workup that includes the clinical assessment and biochemical markers is required. Furthermore, the fact that patients with low troponin levels were tended to be diagnosed as having anxiety means that there is a need to know how biochemical tests can be used better to avoid misdiagnosis.

The findings of this study should be discussed with the limitations of the study. The limitation of the study was that it was conducted in one hospital, and thus the findings may not be generalizable to other healthcare settings and populations. Nevertheless, since ENKSH is a large emergency center, the same effects can be expected in hospitals with similar emergency department admissions.

The age, gender, and comorbidity rate of the study population are similar to those of the general emergency department population. Nevertheless, the comparison of the results with findings from other studies can vary depending on the area, for example, among low-income groups or rural areas.

Finally, as this is a retrospective study, future research should focus on larger and prospective studies. Large cohort studies that follow people over time to see the long term impacts of misdiagnosis and clinical trials that test the ability of decision support systems to improve emergency department practice would both be significant contributions to this field.

This study shows that anxiety and cardiac diseases are often misdiagnosed in emergencies and further reveals the risk factors that lead to the incorrect diagnosis. To avoid missing the diagnosis, the need for enhanced clinical evaluation, higher regard to patients' risk factors, and stronger diagnostic decision making tools is crucial.

Conclusion

In this study it was shown that anxiety and cardiac diseases are often misdiagnosed in emergencies and older patients,

smokers and those with hypertension have higher rates of misdiagnosis. To improve diagnostic accuracy it is crucial to enhance the clinical decision making processes and take into account the patient's risk factors.

The use of diagnostic algorithms in emergency departments that are age, gender and risk factor specific may contribute to the avoidance of unnecessary invasive testing and enhance the accuracy of the diagnosis. Specifically, it is advised to perform more comprehensive cardiac assessments before diagnosing anxiety in the elderly. Furthermore, for patients with anxiety, to avoid their undergoing unnecessary cardiac tests, there should be improved psychiatric evaluation.

Prognosis and large-scale prospective studies are vital to further explore the long-term impacts of the misdiagnosis and to improve the functionality of the diagnostic decision support systems in the emergency departments. The findings of this study can help in the diagnosis and management of patients in emergency departments and thus have the potential to influence emergency physicians.

Tables:

Table 1: Patient Characteristics

Parameter	Value
Mean Age (years)	52.8 ± 18.5
Gender Distribution	Male: 52.4%, Female: 47.6%
Smoking Prevalence	30%
Alcohol Consumption	15%
Hypertension Prevalence	50%
Diabetes Prevalence	30%
Obesity Prevalence	25%
Chest Pain as Symptom	60%
Palpitations	50%
Shortness of Breath	45%
Light-headedness	30%
Mean Troponin (mg/L)	0.256
CK-MB (U/L)	5.12
D-Dimer (ng/mL)	242.5
Normal ECG	50%
Arrhythmia	20%
Ischemic Changes	20%
Other ECG Abnormalities	10%

Table 2: Logistic Regression Analysis

Variable	Odds Ratio	95% Confidence Interval (CI)	p-value
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	(OR)		
Age	1.02	1.01 - 1.04	<0.001
Smoking	1.35	1.10 - 1.65	0.002
Hypertension	1.28	1.05 - 1.57	0.015
Chest Pain	1.5	1.22 - 1.84	<0.001

Figures:

Figure 1: Misdiagnosis Rate by Key Risk Factors

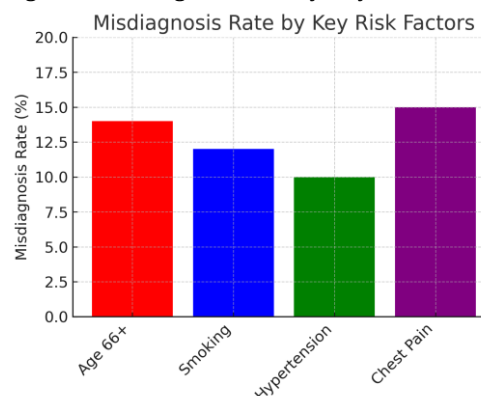
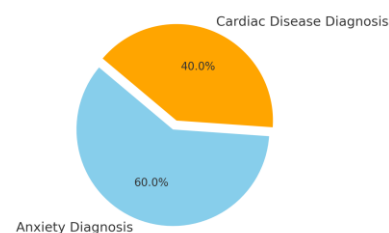


Figure 2: Proportion of Patients Diagnosed with Anxiety vs. Cardiac Disease

Proportion of Patients Diagnosed with Anxiety vs. Cardiac Disease



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