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ORIGINAL ARTICLE

Acute asthma in emergency department, prevalence of respiratory and non-respiratory symptoms



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KEYWORDS

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Abstract *Background:* Although asthma is a well identified presentation to the emergency department, little is known about the frequency and percentage of respiratory and non-respiratory symptoms in patients with acute asthma in the emergency department (ED).

Objective: The aim of this study is to identify the relationship between acute asthma exacerbation and different respiratory and non-respiratory symptoms including chest pain encountered by patients visiting the emergency department.

Subjects and methods: Prospective study included 169 (97 females and 72 males) asthmatic patients who were admitted to emergency department of two tertiary care facility hospitals for asthma exacerbation from the period of September 2010 to August 2013, an anonymous questionnaire was used to collect symptoms and analysis of symptoms.

Results: 97 (57%) of the patients were females, mean age was 35.6 years; dyspnea on exertion was the commonest symptom accounting for 161 (95.2%) of patients, followed by dyspnea at rest in 155 (91.7%), wheezing in 152 (89.9%), chest pain was present in 82 patients (48.5%), burning pain was experienced in 36 (43.9%) of the total patients with chest pain. Non-respiratory symptoms were seen frequently in acute asthma in ED.

Conclusions: Dyspnea was the commonest chest symptom encountered in patients with acute asthma followed by wheezing. Chest pain in acute asthma is a common symptom and should be fully studied to exclude misdiagnosis as of cardiac origin; there is a need for a better dissemination of knowledge about this disease association with chest pain. It was also noted that other non-respiratory symptoms are frequently encountered with acute asthma in emergency department.

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Introduction

Asthma is a chronic inflammatory disorder of the airways associated with hyper-responsiveness, reversible airflow limitation, and respiratory symptoms. It is the most common chronic lung disease in both the developed and developing

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countries. Bronchial asthma is a common chronic disease that affects people of all ages. Insufficient asthma control may cause frequent emergency department (ED) visit by patients who seek crisis management of their acute asthma exacerbation [1]. Acute asthma exacerbation is a common medical emergency [2], it represents the 11th most frequent ED diagnosis that is faced by the emergency department and intensive care specialists, a disease entity that must be diagnosed and treated urgently. All patients with asthma are at risk of having exacerbations characterized by a progressive increase in shortness of breath, cough, wheezing or chest tightness [3]. Respiratory symptoms, including breathlessness, wheezing cough and sputum production, are characteristic features of the disease and have significant adverse effects on patient functioning and quality of life. Although spirometric measures are useful for diagnosis and evaluating change in lung function, they do not capture symptom severity or variability; and their weak correlations between lung function and symptoms. A number of circumstances may mimic the diagnosis of Acute Asthma (COPD, congestive heart failure, upper airway obstruction, hyperventilation syndrome, or vocal cord dysfunction), usually, they can be identified by history and physical examination. A brief history pertinent to any exacerbation should be obtained. Morbidity and mortality are most often associated with failure to appreciate the severity of the exacerbation, resulting in inadequate emergency treatment and delay in referring to hospital. The occasional presence of unusual symptoms either respiratory or non-respiratory results in diagnostic confusion.

Although asthma is a well identified presentation to the emergency department, little is known about the percentage of respiratory and non-respiratory symptoms, and search in the literature did not reveal enough data for this entity.

The aim of this study is to identify the relationship between acute asthma exacerbation and different respiratory and non-respiratory symptoms including chest pain encountered by patients visiting the emergency department.

Subjects and methods

A total of 169 consecutive patients (97 females and 72 males) who were confirmed before as asthmatics, or first presentation of asthma exacerbation, who were admitted to the emergency department for asthma exacerbation are enrolled in this prospective study.

Patients were eligible for the study if they met all the following criteria: (1) age ≥ 18 years old; (2) has any, or all, of the following clinical features as defined by the Global Initiative for National Asthma (GINA) Guidelines [4]: dyspnea, wheeze, acute cough, increased work of breathing, increased requirement for beta2-agonist from baseline use, O_2 saturation $< 95\%$, a peak expiratory flow (PEF) at presentation to the emergency department $\leq 80\%$ of their known best (within the last 12 months) or, in the absence of this information, of their predicted PEF. Patients readmitted were not studied a second time. Exclusion criteria included patients below 18 years, patients with fever, CXR shadows suggestive of infection or other identified etiological cause for pulmonary symptoms, pneumothorax, pleural effusion, positive EKG findings or positive cardiac enzymes, cases with evidence of pulmonary embolism, and patients with chest trauma, patients with

COPD anemia renal impairment, congestive heart failure or any identified disease causing dyspnea were also excluded from the study.

All patients were subjected to thorough history taking including smoking history and medication usage, cardinal chest symptoms (dyspnea wheezing cough sputum production and hemoptysis), prevalence and duration of symptoms, and possible exacerbating factors or certain exposures, associated disorders diagnosed before as allergic rhinitis gastroesophageal reflux eczema or allergic bronchopulmonary aspergillosis were asked about. Comorbid conditions were also recorded. Prior medications used before ER visits were recorded. Clinical examination and assessment of vital signs including oxygen saturation at presentation, PEFR measurement with reference to previous or best PEFR if available or percentage of predicted are recorded, patients were categorized as mild (PEFR above 70%), moderate (between 40% and 69%), and severe (if below 40%) according to the recommendations of Expert Panel Report 3 (EPR-3) (2007) [5] whenever applicable as there are patients with extreme illness cannot perform, CXR and EKG, and in patients with chest pain cardiac enzyme analysis D dimer and where uncertain, echocardiography was performed. The outcome after ER visit was mentioned in the questionnaire.

The authors in collaboration with emergency department developed an anonymous questionnaire, each patient was given this questionnaire on encountered respiratory symptoms including chest pain and non-respiratory symptoms associated with their asthma attack, chest pain was analyzed by its quality or nature, location, reference and severity, after this questionnaire had been completed the answers were discussed with the emergency department physician. Patients complaining from chest pain with normal EKG and normal cardiac enzymes were referred to cardiology and subjected to stress echocardiography and enrolled in the study only if the stress echocardiography was normal. Data were collected and analyzed and descriptive statistics were calculated. All the analyses were performed including all symptoms using SPSS release 17.0 (SPSS Inc., Chicago, IL, USA). For its analysis, symptoms were computed without excluding missing answers, which were therefore counted as negative or "no symptoms".

Results

In this study the questionnaire was administered to the enrolled patients (169 patients) after exclusion of 15 patients with chest pain of other cause rather than asthma and 4 patients with positive stress echocardiography, a description of the studied sample of subjects is given in Table 1.

Demographic data of acute asthma in emergency department

97 (57%) of the patients were females. Newly diagnosed asthmatics were 54 (32%), Smoking habit in this study was categorized as current smokers, ex-smokers and never smokers, where the current smokers were the ones that who have smoked greater than 100 cigarettes in their lifetime and reported having smoked during the last month in the presentation, ex-smokers who have smoked greater than 100 cigarettes in their lifetime and do not currently smoke and never smokers who smoked less than 100 cigarettes in their whole life.

Table 1 Demographic characteristics of study patients.

		n (%)
1. Age (years) mean (min-max ± SD)	35.6 (19–65 ± 27.3)	
2. Age at start of asthma (years) mean (min-max ± SD)	31.8 (2–57 ± 23.7)	
3. Duration of asthma (years) mean (min-max ± SD)	21.5 (1–25 ± 13.9)	
4. Gender	Females	97 (57.3%)
	Males	72 (42.6%)
5. Smoking habit	Never smokers	115 (68%)
	Smokers	43 (25.4%)
	Ex-smokers	11 (6.5%)
6. Associated disorders	Allergic rhinitis	59 (34.9%)
	Eczema	19 (11.2%)
	GERD	48 (28.4%)
	ABPA	3 (1.7%)
	Obesity BMI above ≥30	58 (34.3%)
	Occupational exposure	28 (16.5%)
7. Asthma triggers	Infections	45 (26.6%)
	Exposure to allergens	36 (21.3%)
	Weather changes	48 (28.4)
	Exercise	13 (7.6%)
	Drugs	7 (4.1%)
	Unknown	20 (11.8%)
8. PEF (% of predicted)	> 70%	22 (13%)
	≤69% to ≥40%	58 (34.3%)
	< 40%	89 (52.6%)
9. Treatment before attack	No treatment	40 (23.6%)
	SABA	37 (21.8%)
	LABA and ICS	89 (52.6%)
	Montelukast	41 (24.2%)
	Systemic steroids	19 (11.2%)
10. Oxygen saturation	≥95%	117 (69.2%)
	< 95%	52 (30.7%)
11. Emergency treatment outcome	Hospital admission	18 (10.6%)
	Discharge	151 (89.3%)
12. Asthma diagnosis	Newly diagnosed	54 (32%)
	Diagnosed before	115 (68%)
13. Type of asthma	Perennial	79 (46.7%)
	Seasonal	41 (24.2%)
	Allergic	15 (8.8%)
	Exercise induced	20 (11.8%)
	Others	14 (8.2%)
14. Comorbid conditions	Diabetes mellitus	19 (11.2%)
	Essential hypertension	15 (8.8%)
	Ischemic heart disease	4 (2.3%)
	Arrhythmia	2 (1.18%)
	Congestive heart failure	1 (0.5%)
	Depression	3 (1.7%)

Current smokers constitute 43 (25%) of the patients studied, whereas ex-smokers constituted 11 (6.5%), the prevalent associated disorder was allergic rhinitis in 59 (34.9%) followed by GERD 48 (28.4%), PEF was below 40% of the predicted in 89 (52.6%) of patients according to Expert Panel Report 3 (EPR-3) (2007), and 58 (34.3%) were between ≤69% and ≥40%. 89 (52.6%) of patients were treated with a combination of ICS and LABA at the time of presentation to ER, while 19 (11.2%) were on systemic steroids. 18 (10.6%) did not

respond fully to ER management and were hospitalized, none of them were intubated or mechanically ventilated whereas 151 (89.3%) did not require hospitalization and discharged home. 115 (68%) of the patients studied were known to have asthma before, compared to 54 (32%) who were first time to present with asthma and diagnosed in the emergency department, patients with perennial asthma constituted 79 (46.7%) of the patients followed by 41 seasonal asthma patients (24.2%), the prevalent disease in the studied group is diabetes mellitus seen in 19 (11.2%), followed by essential hypertension in 15 (8.8%).

Cardinal chest symptoms in acute asthma

The cardinal chest symptoms are summarized in [Table 2](#), Chest pain was the symptom complained by 82 (48.5%) of the studied patients, the most encountered symptom was dyspnea either at rest 161 (95%) or during exertion 155 (91%), wheezing was encountered in 152 (89.9%) cough was seen in 142 (84%) and sputum production in 122 (72.1%). 9 (5.3%) complained from haemoptysis.

Chest pain with acute asthma in emergency department

Chest pain was found in 82 patients from the studied patients with acute asthma, characteristics of chest pain are summarized in [Table 3](#). 59.7% (49 patients) were below the age of 40 years and females constituted 64.6% (53 patients), moderately severe exacerbation assessed by PEF in the range of ≤69% to ≥40% was the highest group complaining from chest pain comprising 48 (58.5%) compared to 27 patients (32.9%) with severe exacerbation (PEFR below 40%), burning pain was the commonest character of chest pain and encountered in 36 patients (43.9%) followed by stabbing pain in 23 patients (28%), and dull aching pain in 19 patients (23.1%), the commonest site is retrosternal pain in 37.8% of those who complained of epigastric 28% and suprasternal 21.9%, chest pain was more prevalent in patients who present with acute asthma exacerbation during the same day or 2 days (68 patients) 82.8%, compared to patients who present later in 14 patients (17.0%), chest pain was more common in non-smokers 51.2% (42 patients) compared to ex-smokers 15 patients (18.2%) or current smokers 25 patients (30.4%), the pain was not severe in most of the studied group according to pain scale from 1 to 10 degrees, where the highest pain was towards 10 degrees, where from degrees 1 to 4 account for 56% of the total patients with chest pain (46 patients), whereas patients with pain degrees from more than 4 up to

Table 2 Chest cardinal symptoms during acute asthma exacerbation.

Symptoms	n (%)
Dyspnea on exertion	161 (95.2%)
Dyspnea at rest	155 (91.7%)
Wheezing	152 (89.9%)
Cough	142 (84%)
Sputum production	122 (72.1%)
Chest pain	82 (48.5%)
Haemoptysis	9 (5.3%)

Table 3 Chest pain characteristics in acute asthma patients.

	Character	n (%) [*]
Age	< 40 years	49 (59.7%)
	≥40 years	33 (40.2%)
Sex	Females	53 (64.6%)
	Males	29.3 (36.3%)
PEFR	> 70%	7 (8.5%)
	≤69% to ≥40%	48 (58.5%)
	< 40%	27 (32.9%)
Site	Localized Retrosternal	31 (37.8%)
	Epigastric chest pain	23 (28%)
	Suprasternal	18 (21.9%)
	Diffuse	10 (12.1%)
Character	Dull aching	19 (23.1%)
	Stabbing	23 (28%)
	Burning	36 (43.9%)
	Stitching	4 (4.8%)
	Acute Asthma exacerbation duration	Less than 1 day
	1–2 days	28 (34.1%)
	More than 2 days	14 (17.0%)
Smoking habit	Never smoker	42 (51.2%)
	Ex-smoker	15 (18.2%)
	Current smoker	25 (30.4%)
Pain intensity from 1–10	9–10	18 (21.9%)
	7–8	7 (8.5%)
	5–6	11 (13.4%)
	3–4	9 (10.9%)
	1–2	37 (45.1%)
Diagnosis	Newly diagnosed	19 (23.1%)
	Confirmed before	63 (76.8%)
Education	Illiterate	13 (15.8%)
	Primary school	12 (14.6%)
	High school	18 (21.9%)
	University	28 (34.1%)
	Postgraduate	11 (13.4%)

* % patients affected.

10 were 44% (36 patients). Newly diagnosed patients with asthma were less frequently symptomatizing with pain (23.1%) compared to currently diagnosed asthmatics. Higher degrees of literacy and education were shown to be more symptomatic with chest pain (high school, university and post-graduate educated patients accounts for more than 70% of symptomatizing with chest pain).

Non-respiratory symptoms in patients with asthma exacerbation

The non-respiratory symptoms encountered during asthma exacerbations are summarized in Table 4, nose and throat symptoms were the commonest accounting for 49.1% followed by sweating 46.7% and headache 33.1%, other common symptoms including dry mouth 28.4%, tiredness 28.4%, palpitation 24.8%, and dizziness 20.1%, less frequent symptoms included insomnia 8.4%, skin flushing 10%, abdominal pain 11.2%, limb tingling 11.2% and nausea 6.5%, and rare symptoms included lower limb pain 2.9%, back pain 4.7%, diarrhea 2.9% and frequency of micturition 2.3%.

Discussion

The central finding of this prospective study was the high prevalence of chest pain among patients with acute asthma in the

Table 4 Non-respiratory symptoms in patients with acute asthma exacerbation.

Symptoms	n (%)
Headache	56 (33.1%)
Insomnia	14 (8.2%)
Tiredness	48 (28.4%)
Dizziness	34 (20.1%)
Skin flushing	17 (10%)
Sweating	79 (46.7%)
Nose and throat symptoms	83 (49.1%)
Dry mouth	48 (28.4%)
Palpitation	42 (24.8%)
Abdominal pain	19 (11.2%)
Nausea	11(6.5%)
Back pain	8 (4.7%)
Lower limb pain	5 (2.9%)
Limb tingling	19 (11.2%)
Frequency of urination	4 (2.3%)
Diarrhea	5 (2.9%)

emergency department. The purpose of this study was to assess the percentages of all respiratory and non-respiratory symptoms for patients with acute asthma in the emergency department, dyspnea on exertion was the presenting symptom, followed by dyspnea at rest and chest wheezing, cough and expectoration came fourth followed by chest pain, all are symptoms of asthma symptoms mentioned in the literature [6].

Serious causes of chest pain accompanying acute asthma should be identified and excluded before dealing of chest pain as result of acute asthma, and these causes include pneumothorax [7], pneumomediastinum and pneumopericardium [8], pulmonary embolism [9], pneumonia [10], and acute coronary syndrome [11].

When patients with asthma are asked to describe their symptoms, they have trouble discriminating chest pain from chest tightness or substernal burning or even dyspnoea, so it was important for the investigators to clearly identify and acknowledge the difference between both symptoms.

Chest pain as a presentation for asthma is commonly studied in pediatrics [12]. Chest pain in adult asthmatics was seen as a presenting symptom of acute asthma in emergency department less frequently studied in and named chest pain variant asthma [13], without the characteristic attacks of bronchial asthma that improves with the use of a bronchodilator. Bronchial asthma may present with chest pain or the isolated symptom of chest discomfort and should be included in the differential diagnosis of angina pectoris; this is why a significant number of unrecognized asthmatics are found among patients with angina-like chest pain but normal cardiac evaluation [14].

The triggers and relievers of asthma and angina pectoris are similar as asthma clinical features include recurrent episodes of dyspnea wheezing and cough which occur more nocturnally or under physical or emotional stress and accompanied by non-respiratory symptoms including tightness and chest pain [15,16], symptoms with acute asthma may be misdiagnosed as of cardiac cause [14].

Patients with asthma and chest pain frequently respond to bronchodilators and leukotriene receptor antagonist [17], even if the apparent airway obstruction is not determined, indicat-

ing that the mechanism of pain in these patients is not solely related to musculoskeletal exhaustion and fatigue as the same perception of symptoms is seen in asthmatics with normal lung function performing methacholine bronchoprovocation tests [18], Edmondstone [20] in his study mentioned that chest pain is commonly related to increased work of breathing as the respiratory muscles are required to operate at a mechanical disadvantage, resulting in muscle fatigue and consequent pain.

The perception and expression of chest pain and other symptoms vary among different ethnic groups and different languages translate and mix the feeling of chest pain and chest tightness, but clinician evaluation of patient's symptoms are essential to determine and to acknowledge the significance of these symptoms [19].

Analysis of chest pain and other non-respiratory symptoms with acute asthma in Edmondstone [20] study demonstrated the presence of chest pain within 76% of patients, chest pain was characteristically observed in his study as either a dull ache or a sharp stabbing pain in the sternal or subcostal areas, whereas in our study the chest pain was described in 48% of patients, it is mostly burning or stabbing rather than a dull aching pain.

Chest pain was more prevalent in patients who reported earlier to emergency department than patients who waited longer, indicating lower perception for symptoms in the latter group who also had develop worse symptoms and reported greater adverse effects of asthma on quality of life, and more hospitalization [21].

Patients below 40 years have higher incidence of acute asthma and present more commonly than elder patient groups, although older adults with acute asthma have a substantial burden of morbidity and mortality [22], in the present study the chest pain was more common in the young age groups (≤ 40 years) indicating lower pain perception in the older age groups.

In the present study the percentage of women were 57.3%, matching with different earlier studies [23–27], despite the incidence of asthma was not noted to be different in both sexes, but being female is an independent predictor for all asthma symptoms [28], in our study asthmatic women with chest pain were almost twice as common as men in emergency department, attributing factors that resulted in higher incidence of asthma emergency visits among women in different studies included pubertal changes in sex hormones that coincide with a late adolescence, which suggests that estrogen or progesterone may cause asthma [29], higher incidence of exposure to indoor allergens [30], obesity in women is another factor [31,32], another possible explanation involves the “Yentl syndrome” [33], the under treatment of women compared with men unless women develop severe manifestation of disease or a “typical” disease presentation.

Chest pain was more seen in the never smokers in the current study compared to ex-smokers or current smokers, a finding which may be related to higher percentage of the nonsmokers in the total number of patients studied, rather than a causal finding. It is well known that inadequate literacy was common and strongly correlated with poorer knowledge of asthma and improper MDI use [34], an incidental finding of more patients with chest pain in well-educated patients (high school, university graduates and postgraduates) compared to the illiterates and primary school patients, the same finding was seen more commonly in the previously diagnosed asthmatics compared

to newly diagnosed asthmatics which in both conditions reflect that chest pain in the present study as a symptom found in these patients reflects actual pain and not a misnomer.

Although use of combination therapy including long acting beta agonists (LABA) and inhaled corticosteroids (ICS) was shown to decrease asthma exacerbation and emergency visits [35], in the present study most of the patients were on treatment with combination of LABA and ICS (52.6%), indicating both more awareness and prescription of combination therapy by the health care providers or actual severer form asthma that result in emergency visits.

Allergic rhinitis and obesity were the commonest comorbid conditions and risk factors associated with acute asthma and are linked to increased morbidity and health care facility utilization [36,37], in the present study patients with concomitant allergic rhinitis constituted 34%, and interestingly the obese patients (BMI > 30) constituted 34% of the studied patients. Climate changes increase acute asthma emergency visits [38], and the region where the study was done shows severe weather and humidity changes and these factors may be attributed as a triggering factor for asthma was seen in more than 28% of the patients in the present study and these results reinforce the need for vigilance during periods of increased risk and perhaps focused preventative strategies.

It is well recognized that patients with acute asthma present with the typical symptoms of increased dyspnea wheezing and cough, but despite the common non-respiratory symptoms that accompany acute asthma there is no mention in the literature of these non-respiratory symptoms, the commonest symptoms included nose and throat symptoms and headache. These may reflect the causal relationship between asthma and upper respiratory disorders including allergic rhinitis chronic sinusitis or may be related to prior triggers of asthma by upper respiratory tract infections, other symptoms including sweating palpitation tremors dizziness and tiredness together with limb tingling may be related to either disease severity or side effects from prior use of medications to control the disease.

In conclusion, Dyspnea either on exertion or at rest was the commonest symptom encountered in patients with acute asthma followed by wheezing. Chest pain in acute asthma is a common symptom and should be fully studied to exclude misdiagnosis as of cardiac origin; there is a need for a better dissemination of knowledge about this disease association with chest pain. It was also noted that other non-respiratory symptoms are frequently encountered with acute asthma in emergency department.

Conflict of interest

None declared.

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