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THE INCIDENCE, ETHIOLOGY AND EPIDEMYOLOGY OF HEART FAILURE AT ADMITTANCE IN EMERGENCY ROOM

Radu JIPA[1]*, Maria PUȘCHIȚĂ[1,2]

[1] Emergency Unit, Emergency Clinical County Hospital, Arad, Romania
[2] "Vasile Goldis" Western University, Faculty of Medicine, Pharmacy and Dental Medicine, Arad, Romania

ABSTRACT. Heart failure is a very common cause of presenting at Emergency Room (E.R.). In this study I have tried to establish the most reliable diagnostic criteria of heart failure in E.R., based on clinical and paraclinical grounds. The study was made on a group of unselected patients, arrived with dyspnoea at E.R., and had the following objectives: establishing of the heart failure prevalence; establishing the common causes of decompensation; establishing the clinical and paraclinical parameters; finding the other diseases that can produce dyspnoea; establishing the most reliable diagnostic criteria. We found the most frequent causes of acute heart failure in our area and the fact that the most accurate diagnostic tool to diagnose this disease, have to include echocardiography. Also, we found that the clinical criteria discover the smallest number of really sick patients. To improve the quality of medical services and gain time in establishing the diagnosis and initialising the treatment, we need to use either echocardiography in our investigations (difficult because of the technical limitations and low level of patient's cooperation), or the use new methods (like NTproBNP, subject of another clinical study).

Keywords: dyspnoea, heart failure, natriuretic peptides, NT pro-BNP

INTRODUCTION

Dyspnea (shortness of breathing), is a very common cause of accessing medical services. Worldwide, the newest biochemical parameter in investigating patients with dyspnea is B-type natriuretic hormone, released in circulation in connection with diseases that increase the stretch of the ventricular wall (Kucher N. et al., 2003; Januzzi J.L. et al., 2005). Out of these diseases the most frequent is heart-failure, left or right. Among these diseases are present, in much smaller proportion, the ischemic unstable heart-disease (Heeschen C. et al., 2004; Bassan R. et al., 2004), some pulmonary diseases (Lok Bin Yap et al., 2004; Kucher N. et al., 2003; Morrison K. et al., 2002), septic shock (Brueckmann M. et al., 2005), and end-stage renal failure.

BNP is a neuro-hormone released from ventricles as a response of the ventricular wall-stretch at intraventricular pressure raise. It's synthesized in the cardio-miocytes as pre-hormone (pre-pro BNP, 134 amino acids), from whom, after splitting a 26 amino acids sequences, is produced pro BNP, a hormone with 108 amino acids (sequence 1-108). After the metabolization of the last one, there is produced the N-terminal fragment (NT- pro BNP inactive, sequence 176 amino acids, with a half-life between 62-120 minutes), and BNP (sequence 77-108 amino acids, with a half-time of about 18 minutes, rapidly plasmatic metabolized, and, therefore, much more difficult to be found at maximum value). In medical literature the maximal normal value ranges between 100-300 pg/ml (Maisel A. et al., 2004; Packer M. et al., 2003).

The purposes of this study are represented by establishing the prevalence of heart-failure in an unselected group of patients from ED, the prevalence of other diseases in which is present dyspnea, the importance of different

*Correspondence: Radu Jipa, MD, Unitatea de primire a urgenţelor, Spital Clinic Judeţean de Urgenţă Arad
E-mail: r_jipa@yahoo.com

diagnostic criteria of heart-failure, and the necessity and importance of determining and using NT pro-BNP among the classic criteria; I have tried to establish the normal maximal value of this hormone, the cut-in value (values above which we can be sure that dyspnea is caused by cardiac decompensation), and cut-off values (value below which the cardiac cause of shortness of breathing is uncommon) of NT pro-BNP. I have studied the limits of this criterion, the methods to minimalize the errors possibly induced by this method, and the influence of age on NT pro-BNP values.

MATERIALS AND METHODS

In the group we've enrolled 183 unselected patients, complaining for shortness of breathing in E.R., consulted between September 2007 and April 2008. We selected patients with at least 30 years old, with the only including criteria the presence of dyspnea and with no exclusion criteria. Each

patient had a form with personal records, medical history, clinical data, lab results, rest ECG, arterial saturation in oxygen, body temperature, pulmonary X-ray, echocardiography. At the end of these investigations, the emergency physicians evaluated the presence of heart-failure for each patient. Each form was then mathematically coded and statistically analyzed with SPSS 10. The results of this mathematical analysis were the grounds for the conclusions of the study.

RESULTS AND DISCUSSIONS

Demography

The patients realized a homogenous lot from the point of view of age, gender, weight, medical history (Table 1). Most of the patients were men, with body mass index around 30, both for men and for women. Median age was 65.72 years and median body weight 77.40 kg.

Table 1

Lot distribution, based on gender, age, residence and body-mass-index

Gender	Age (years)	Weight (kg)	Residence place		BMI		
			Urban (56%)	Rural (44%)	Below 24	25-29	Over 30
Men: 99	64.17	80.97	55 (53 %)	44 (55%)	34 (18.6%)	42 (22.9%)	23 (12.6%)
Women: 84	67.54	73.14	48 (47%)	36 (45%)	16 (8.7%)	42 (22.9%)	26 (14.2%)

Most of the patients were from the urban area (55 men and 44 women), 24% were smokers, and 8% claimed a regular use of alcohol. 34 men presented with normal body-weight (only 16 women had normal weight, while 42, both men and woman were over-weight).

Personal pathological records, grouped in cardiac and pulmonary, are presented in Table 2. At least 155 patients declared at least one of the following: heart failure, ischemic heart disease, arterial hypertension, arterial fibrillation, or other cardiac pathology (valvulopathies, other arrhythmias, precardial diseases, infections). Similarly presented, we

have found 57 patients with pulmonary pathology (COPD, bronchial asthma or rare pulmonary diseases). Some patients presented with one or more heart diseases with/or one or more pulmonary diseases.

Clinical data

We have studied the personal pathological records, symptoms and cardiovascular parameters. We found out that 81% of patients presented with orthopnea, 56% with polypnea and 42% with wet rales and much less, wheezing, cough, cyanosis, elevated body temperature.

Table 2

The incidence of various medical history

	Heart failure	Ischemic coronary disease	Hypertension	Atrial fibrillation	Other cardiac	C.O.P.D.	Bronchial asthma	Other pulmonary
Number of cases	65	130	85	37	44	34	10	18
Percent from total cases	35.5	71	46.4	20.2	24	18.6	5.5	9.8

Table 3

The incidence of symptoms at arrival in E.D.

Symptoms	Dyspnea	Orthopnea	Wet rales	Wheezing	Bronchial rales	Cough	Sweat	Cyanosis
Number of patients	176	149	77	58	67	78	19	68
Percent from total cases	96.2	81.4	42.1	31.7	36.6	42.6	10.4	37.2

Table 4

The incidence of clinical abnormalities

Paraclinical abnormalities	Sinus rhythm	Modified ECG	Systolic dysfunction	Diastolic dysfunction	Left atria enlargement	Left ventricular enlargement	Pulmonary hypertrophy	Chest X-ray vascular congestion
Number of patients	128	137	73	148	100	66	65	80
Percent from total cases	69.9	74.9	39.9	80.9	54.5	36.1	35.5	43.7

From the paraclinical point of view we have recorded the blood pressure values, arterial oxygenation, rest ECG, chest X-Ray, and echocardiography. Most of the patients were in sinus rhythm (70%), 75% presented an abnormal ECG (at least one of the followings: atrial fibrillation, atrial and/or ventricular hypertrophy, various types of blocks and presence of pace-maker). At echocardiography, the most frequent abnormality was the diastolic dysfunction (81%), followed by left atrium enlargement (55%), and systolic dysfunction (40%).

In table 5 we presented the most common cardiovascular-origin decompensation: arterial hypertension in 37.2%, followed by unstable angina (16%) or atrial fibrillation (13%). There were patients who presented with at least 2 causes of decompensation.

Relatively to the left or right heart-failure most of the patients presented with symptoms of left heart-failure (57.9%) followed by right heart-failure (30.6%) or global (10.2%).

In the evaluation of the presence of congestive heart-failure, based on the emergency physician opinion, we have obtained the results presented in Table 7.

Table 5

The incidence of the cardiovasculary causes of heart decompensation

Decompensation	HTA	Unstable angina	Atrial fibrillation	Pulmonary embolism
Number of patients	68	29	24	3
Percent from total cases	37.2	15.8	13.1	1.6

Table 6

The incidence of cases related to the origin of heart decompensation

Heart decompensation	Left decompensation	Right decompensation	Global decompensation
Number of patients	106	56	19
Percent from total cases	57.9	30.6	10.2

Table 7

The evaluation of the presence of heart failure by the emergency physician

Percent of cases	Number of patients	Percent from total cases
Below25 %	45	24.6
Between 25-75 %	83	45.4
Over 75%	55	30.1

Establishing the final diagnosis

After performing all methods of investigation, we found 140 patients whose heart decompensation was the cause of shortness of breathing. More than ¾ of the total number of patients presented with a form of heart failure, while dyspnea was produced by a pulmonary cause in less than ¼ of patients.

In establishing the final diagnosis of heart-failure we have used clinical criteria and different paraclinical criteria. The usefulness of different combinations of those criteria is presented below (table 9):

- Clinical (dyspnea + orthopnea + wet rales): 74 patients; using strictly and concomitantly, just this criteria, we've found the smallest number of patients;

- Modified echocardiography and ECG: 124 patients

- Modified echocardiography and reduced SpO_2: 125 patients

- Modified ECG and reduced SpO_2: 113 patients

- Modified echocardiography, modified ECG and reduced SpO_2: 103 patients

Table 8

The incidence of heart failure

	Number of patients	Percent from total cases
Without heart failure	43	22.4
With heart failure	140	77.6

Table 9

The number of cases diagnosed by different type of diagnostic methods

	True sick cases	Clinical criteria	Criteria: Echo+SpO_2	Criteria: ECHO + ECG	Criteria: EKG + SpO_2	Criteria: ECHO+EKG+SpO_2
Number of cases	140	74	125	124	113	103
Percent (%)	100%	53%	89%	88%	80%	74%

Table 10

Diagnostic criteria	Sensitivity	Specificity
Clinical criteria	0.464	0.791
Echo + SpO_2	0.750	0.535
Echo + EKG	0.757	0.581
EKG + SpO_2	0.686	0.605
Echo + EKG + SpO_2	0.643	0.698

CONCLUSIONS

Using only paraclinical criteria, (without the clinical ones), we are able to find a bigger number of really sick patients, variably relatively to the type of paraclinical methods used (table 9). Echocardiography, associated, either with modified ECG or reduced arterial oxygenation, found the biggest number of really sick patients (almost 89% from the total number). The importance of each factor (clinical or paraclinical), was studied statistically with the help of regression curves, which gave us the following results: the greatest sensibility in diagnosing the disease is given by the use of echocardiography with modified ECG or arterial desaturation. The greatest specificity can be obtained by using the clinical criteria.

There were a number of 5 patients who had no sign of heart or pulmonary failure.

Because the number of the patients with dyspnea who arrives in the ER is very high, and because the time and local resources are, most of the time, limited, it's very important to find more faster and reliable pathways to diagnose patients with heart-failure. In this direction, worldwide is under study the use of B-Type natriuretic peptides.

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