

MANAGEMENT OF ACUTE MYOCARDIAL INFRACTION IN CARDIORENAL SYNDROME – UPDATING THE DEMOGRAPHIC INDICES AND IDENTIFYING THE INVOLVED COMORBIDITIES

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Keywords: myocardial infarction, renal dysfunction

Abstract: The relation between renal impairment and cardiovascular disease is currently a well documented problem within the “heart-kidney axis” concept. In the patients with coronary heart disease, acute renal dysfunction occurs with an incidence of between 9 and 19%.(1) Regarding the pre-existing renal function status, status with a powerful prognostic significance, this may occur in the patients with normal renal function or with the renal failure. In our study, we wish to characterize the profile of patients through an analytical, observational, retrospective cohort study on a group of patients hospitalized between 01.01.2012 and 01.03.2012 in the Cardiology Clinic within the County Clinical Emergency Hospital of Sibiu, associated with a descriptive study of this group. This study is useful to establish a relation between myocardial infarction and renal dysfunction.

Cuvinte cheie: infarct miocardic, disfuncție renală

Rezumat: Relația dintre afectarea renală și patologia cardiovasculară este o problemă bine documentată în prezent în cadrul conceptului „ax cord-rinichi”. La pacienții coronarieni, disfuncția renală acută apare cu o incidență cuprinsă între 9 și 19%.[1]. Din punct de vedere al statusului funcției renale preexistente-status cu importanță prognostică deosebită, aceasta se poate instala la pacienții cu funcție renală normală sau cu insuficiență renală. În studiul nostru dorim să caracterizăm profilul pacienților printr-un studiu analitic, observațional, retrospectiv de tip cohortă pe un lot de pacienți internați în intervalul 01.01.2012-01.03.2012 în Clinica de Cardiologie a Spitalului Clinic Județean de Urgență Sibiu, asociat cu un studiu descriptiv al acestui lot. Acest studiu este util pentru a stabili existența unei relații între infarctul miocardic acut și disfuncția renală.

INTRODUCTION

Cardiovascular diseases are currently the leading cause of death in the industrialized countries and are expected to become the leading cause of death in the developing countries by 2020.

Acute myocardial infarction (AMI) is the leading cause of death in the patients with a diagnosis of ischemic heart disease. According to the data published by some studies, 52% of deaths occur before patients reach the hospital.(2) According to the studies conducted by the American Society of Cardiology, approximately 700,000 people are diagnosed annually with acute coronary syndrome.(3) Of them, a percentage between 25-40% have acute myocardial infarction with ST-segment elevation.(4) Myocardial infarction is considered a cardiology emergency requiring rapid diagnostic with the aim to identify the patients in whom the early interventions can improve prognosis.

Renal impairment is a common phenomenon in the acute phase of myocardial infarction with a multifactorial etiology i.e.: hemodynamic alterations in interrelation with the volemic ones, affecting the renin-angiotensin-aldosterone system through both extrinsic and intrinsic mechanisms, antidiuretic hormone secretion increase and the modification of atrial natriuretic peptide secretion. All these lead to increased physiological renal medullary hypoxia and to the occurrence of reversible or irreversible renal ischemia.

The use of contrast agents for diagnostic and / or therapeutic purposes is another condition with multiple

impacts.(5)

Recent data from the Mayo Clinic and the Veterans Affairs Hospital of the University of San Francisco showed a significantly increased risk of morbidity and mortality in the patients with renal dysfunction, even the mild form, suffering from acute coronary syndromes.(6) A number of studies have shown that mild and moderate renal dysfunction in the patients with acute coronary syndrome increases cardiovascular morbidity and mortality at 30 and 180 days.(7) There are also significant associations between renal function and mortality on short term in the patients with acute myocardial infarction. Also, a number of studies have reported an association approximately linear between the degree of renal dysfunction and the risk of mortality when patients were followed for a period of up to one year. Similar results were also obtained for in-hospital mortality risk.(8) The reduction in creatinine clearance increases the risk of serious cardiovascular complications by about 20%, compared to the subjects with normal renal function.(8)

PURPOSE

The aim of the study is to bring current, real and accurate information about the peculiarities of acute myocardial infarction among the patients in Sibiu County and to emphasize the importance of rapid diagnosis and risk stratification to identify those patients in whom a rapid therapeutic intervention can significantly improve prognosis.

Study objectives:

The study objectives are to establish a relation

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between myocardial infarction and renal dysfunction in the patients of the Clinical Department of Cardiology within the County Clinical Emergency Hospital of Sibiu and to carry out a statistical analysis using the obtained data.

Patients' selection

The patients admitted to the Cardiology Clinic of Sibiu were selected according to the following criteria:

*Inclusion criteria in the study group:

- diagnosis of acute myocardial infarction (AMI) with ST segment elevation (STEMI) recorded on the discharge summary;

*Exclusion criteria were determined by:

- AMI without ST elevation;
- AMI has not been documented clinically and through laboratory data;

METHODS

We conducted an analytical, observational, retrospective cohort study on a group of patients hospitalized between 01.01.2012 and 01.03.2012 in the Cardiology Clinic within the County Clinical Emergency Hospital of Sibiu, associated with a descriptive study of this group.

Data acquisition

To obtain the information necessary for the study, we used the database of Sibiu Clinical County Emergency Hospital. The patients included in the study were selected according to the main diagnosis upon admission: acute myocardial infarction with ST-segment elevation (STEMI).

From the demographic data, the following parameters: age, gender, origin were taken into consideration.

We followed previous medical history recorded in the database.

Regarding the laboratory tests, we recorded blood glucose and creatinine, with normal values established according to the laboratory of Sibiu County Clinical Emergency Hospital:

- BG: normal value established between 70-115 mg / dl;

- Creatinine: normal value for females between 0.57 to 1.11 mg / dL and for males from 0.72 to 1.25 mg / dl;

Creatinine clearance was calculated using the formula MDRD (Modification of Diet in Renal Disease) using as parameters: gender, age, and serum creatinine, expressed in ml / min / 1.73 m²: $GFR = 186 \times (\text{serum creatinine})^{-1.154} \times (\text{age})^{-0.203} \times (0.742 \text{ for females})$.

Depending on creatinine clearance values, four groups

were defined corresponding to different degrees of renal function impairment:

- Group 1: Creatinine clearance > 90 ml/min/1,73 m²
- Group 2: Clearance between 60-90 ml/min/1,73 m²
- Group 3: Clearance between 30-60 ml/min/1,73 m²
- Group 4: Clearance <30 ml/min/1,73 m²

For data processing, Microsoft Excel 2007 software was used.

RESULTS

Heart-kidney interaction is considered one of the most important global health problems due to the fact that renal dysfunction, even moderate, is an independent risk factor for cardiovascular events and is associated with a significant increase in cardiovascular morbidity and mortality.(9)

Presentation of the groups under study: there were selected a number of 88 patients admitted to the Cardiology Department within Sibiu County Clinical Emergency Hospital between 01.01.2012 and 01.03.2012, the patients being divided into four groups according to the degree of renal impairment (figure no. 1).

- **Group 1** with a total of 15 patients having severe renal impairment (creatinine clearance <30 ml / min)
- **Group 2** consisting of 16 patients with moderate renal impairment (creatinine clearance between 30-60 ml / min)
- **Group 3** consists of a total of 31 patients who had mild renal impairment (creatinine clearance 60-90 ml / min)
- **Group 4** consisting of 26 patients who had normal renal function (creatinine clearance> 90 ml / min)

Figure no. 1. Presentation of groups according to the renal impairment

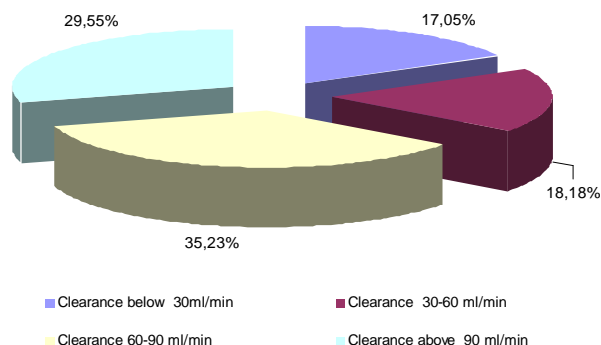


Table no. 1. Groups' characterisation according to age, gender, origin

Analyzed parameter	Group 1		Group 2		Group 3		Group 4		Total
	No. of patients	%	No. of patients	%	No. of patients	%	No. of patients	%	
Age									
<50 years old	1	14,29%	0	0%	4	57,14%	2	28,57%	7
50-59 years old	2	13,33%	1	6,67%	5	33,33%	7	46,67%	15
60-69 years old	5	17,24%	5	17,24%	11	37,93%	8	27,59%	29
70-79 years old	4	19,05%	5	23,81%	5	23,81%	7	33,33%	21
80-89 years old	3	20%	5	33,33%	5	33,33%	2	13,33%	15
>90 years old	0	0%	0	0%	1	100%	0	0	1
Gender									
feminine	4	14,29%	7	25%	12	42,86%	5	17,86%	28
masculine	11	18,44%	9	15%	19	31,67%	21	35%	60
Origin									
urban	9	15,79%	8	14,04%	20	35,09%	20	35,09%	57
rural	6	19,35%	8	25,81%	11	35,48%	6	19,35%	31

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Table no. 2. Presentation of groups according to: number, age, death during hospitalization, days of hospitalization, risk factors, AMI and personal pathological antecedents (PPA)

Analyzed parameter	Value	Percentage(%)
Total patients (number)	88	100
Medium age of patients (years old)	67,25	
Patients deceased during hospitalization (number)	4	
Average of hospitalization days (number)	8	
Coronary risk factors		
Hypertension	53	60,23
Diabetes mellitus	34	38,64
Dyslipidemia	26	29,55
Obesity	13	14,77
AMI localization		
Anterior MI	62	70,45
Inferior MI	18	20,45
MI with other localizations	8	9,09
PPA		
Right bundle branch block	1	1,14
Left bundle branch block	4	4,55
Atrioventricular block	4	4,55
Congestive heart failure	23	26,14
Left ventricular insufficiency	17	19,32
Aortic insufficiency	4	4,55
Mitral insufficiency	16	18,18
Tricuspid insufficiency	5	5,68
Aortic stenosis	3	3,41
Atrial fibrillation	12	13,64
Chronic renal dysfunction	10	11,36
History of ischemic heart disease		
Chronic ischemic heart disease	33	37,50
Angina pectoris	27	30,68
Old myocardial infraction	11	12,50
Aneurism of left ventricle	15	17,05
PTCA (Percutaneous transluminal coronary angioplasty)	9	10,23

By analyzing the data in table no. 2, it is observed that those 88 patients admitted between 01.01.2012 and 01.03.2012 amounted a total of 718 days of hospitalization, the average length of stay being 8 days.

The average age of the patients taken in this study was 67.25 years, value included within a range with a minimum of 39 years old and a maximum of 92 years old.

The distribution of patients reported to the age decades indicated a maximum incidence between 60 and 69 years old with a total of 29 patients, followed by 21 patients aged between 70-79 years old. In terms of patients' gender, males are predominant.

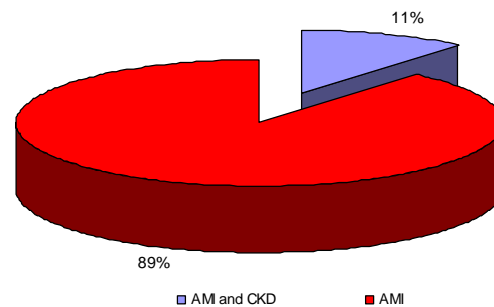
Among the parameters aimed at identifying the comorbidities with a potential risk for triggering the AMI, respectively hypertension, diabetes, dyslipidemia and obesity, we noticed the largest share for the following pathology: hypertension, which is found in a percentage of 60.23% (53 patients).

Following the data in table no. 2, it is shown that the localization of the myocardial infarction, the most frequently encountered, is the anterior one in 62 patients (70% of cases), followed by the inferior localization with a total of 14 cases (20%).

Of the 88 patients, 4 died during hospitalization.

According to the data presented in figure no. 2, it is observed that of the total patients included in the study, 10, that is 11% were with chronic renal dysfunction.

Figure no. 2. Pathologies presented in the study group



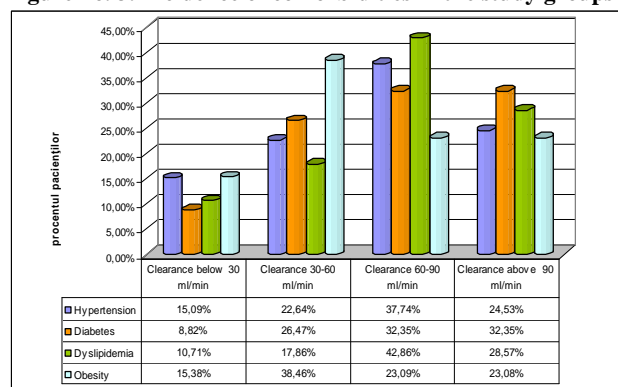
2. Incidence of comorbidities in the study groups

The data represented in figure no. 3 show a higher incidence of comorbidities that may represent risk factors in the production of AMI. Within these comorbidities, the following were included: hypertension, diabetes, dyslipidemia and obesity.

The most frequently incriminated pathology was the hypertension in a percentage of 60.23% (53 patients), followed by diabetes at a rate of 38.64% (34 patients), dyslipidemia 31.82% (28 patients), and obesity seen in 13 patients, representing 14.77%. By analyzing the incidence of these diseases in the study groups, we see that in every group, there is another pathology frequently incriminated, so that in group 1 that of patients with severe renal dysfunction, the most incriminated pathology was obesity (15.38%), with an incidence approximately equal to that of hypertension (15,08). The other two pathologies were found in a small percentage, dyslipidemia in 10.71% of patients and DM in 8.82% of patients.

In group 2, the most common pathology was obesity (38,46%), followed by DM (22,64%). Hypertension incidence in this group registered significantly higher values compared with group 2, respectively 22,64%, and dyslipidemia was found as an associated pathology in 17.86% of the patients in this group. For the patients with mild renal impairment, the risk factors were represented primarily by dyslipidemia (42.86), followed by hypertension (37.74%) and DM at a rate of 32.35 patients.

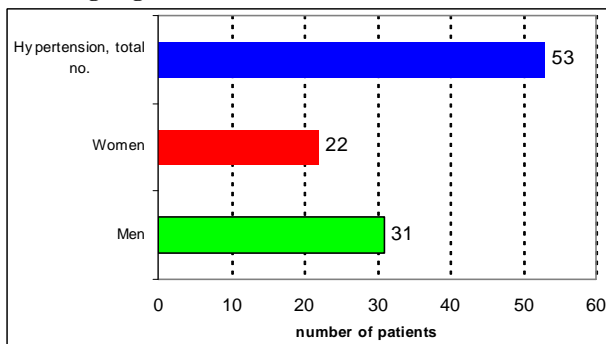
Figure no. 3. Incidence of comorbidities in the study groups



a) Hypertension

Of the 88 patients, 53 had hypertension, i.e. 60.23% of the total. The number of men diagnosed with hypertension was 31, i.e. 35.23%, higher than that of women, of only 22 cases, representing 25.00%. Men: women ratio in this case was of 1.4:1 (figure no. 4).

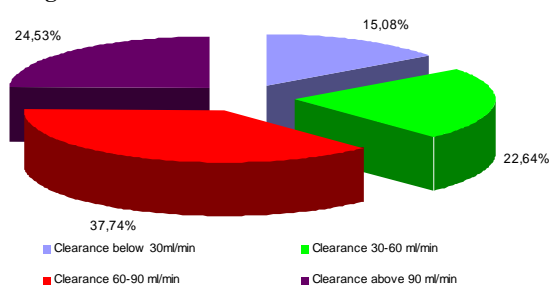
Figure no. 4. Presence of hypertension in the study groups according to gender



Within this study, hypertension was associated most commonly in the patients with mild renal impairment and in those with normal renal function. The incidence of hypertension in the patients with moderate impairment was of 22.64%, and 15.08 for severe damage% (figure no. 5).

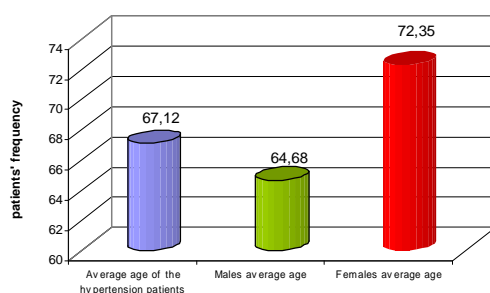
The results obtained for the patients included in the study showed hypertension presence in a much higher propensity in the patients with early renal disease (37,74%).

Figure no. 5. Incidence of hypertension in the study groups according to clearance level



The average age correlated with the incidence of hypertension in the study group was of 67.12 years old. It is noted that the average age of women with hypertension, that is 72.35 years old is significantly higher than that of men of 64.68 years old, which means an early involvement of females (figure no. 6).

Figure no. 6. Average age of patients with hypertension



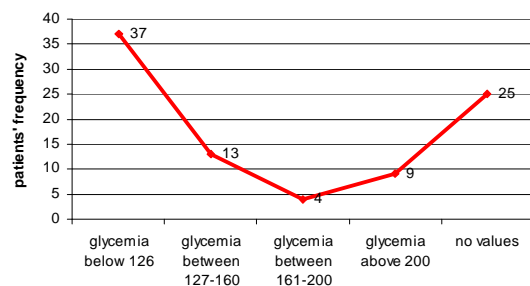
b) Diabetes mellitus – is the major risk factor for cardiovascular disease independent of other risk factors.

Of the 88 patients included in the study, blood glucose levels were measured in 63 of them. Blood sugar level was between 90-392 mg / dL, with an average value of 141.95 mg / dl. Most of the patients, respectively 37 had blood sugar under 126 mg / dl (figure no. 7).

Both the average glucose and the maximum value

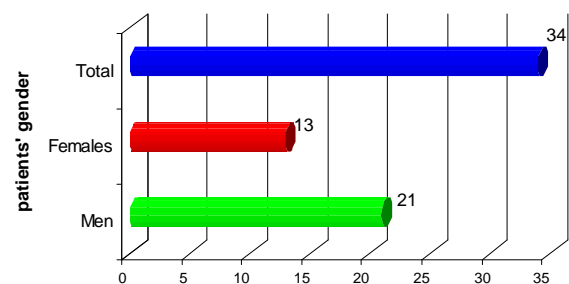
found in the studied patients were located far above the value of 110 mg / dl. These high blood sugar levels reflect a metabolic imbalance due to an inefficient control of diabetes by diet or treatment.

Figure no. 7. Patients' distribution according to glycaemia values



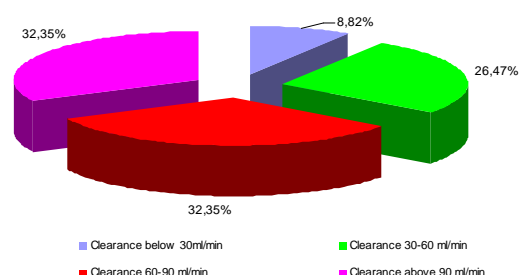
Regarding the incidence of diabetes in the patients in the study group, it was demonstrated that 38.64% (34 patients) of them had associated pathology. Male / female ratio is of 1.61: 1, which means that males are more affected (figure no. 8).

Figure no. 8. Incidence of diabetes in the study group



Diabetes is considered the main risk factor in renal disease since there was recorded a high percentage (35.29%) of the association of diabetes among the patients with low GFR (<60 ml / min); it can be stated for this study as well, that DM is an important risk factor for chronic kidney disease (figure no. 9).

Figure no. 9. Incidence of diabetes in the study groups



c) Dyslipidemia

Of the 88 patients, 26 had dyslipidemia, i.e. 29.55% of the total. The number of men with dyslipidemia, 19 i.e. 21.59% was significantly higher than the number of women (7, representing 7.95%). Men: women ratio for this parameter was of 2.71:1 (figure no. 10).

Dyslipidemia was present in a higher percentage (42.86%) in the patients with renal disease at an early stage. Of those with severe renal impairment, 17.86% had this pathology diagnosed. The incidence of dyslipidemia in the patients with

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chronic renal failure was of 10.71% (figure no. 11).

Figure no. 10. Incidence of dyslipidemia in the study groups according to gender

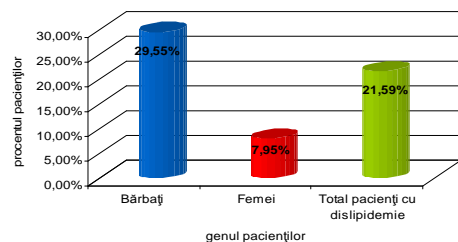
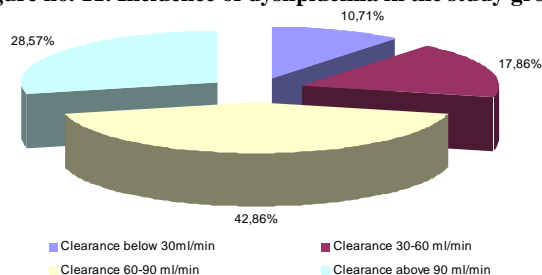


Figure no. 11. Incidence of dyslipidemia in the study groups



d) Obesity

The incidence of this disease has recorded the lowest values, so that of all patients, only 14.77% of cases (13 patients) were diagnosed with obesity. In terms of incidence by gender, it appears that the number of women (8 cases, i.e. 61.54%) is higher than that of men (5 patients, i.e. 38.46%). It is noteworthy that out of the 4 pathologies with potential risk for AMI onset, obesity was the only one found in a higher percentage in females (figure no. 12).

Figure no. 12. Incidence of obesity in the study groups

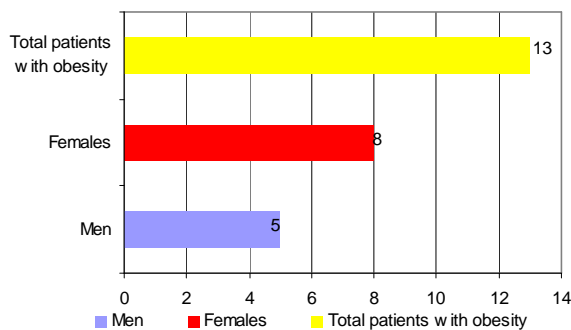
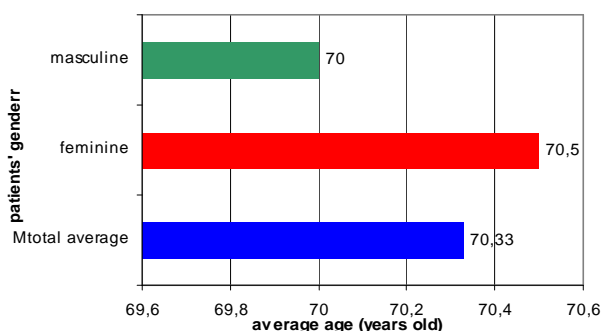


Figure no. 13. Average age of patients with obesity

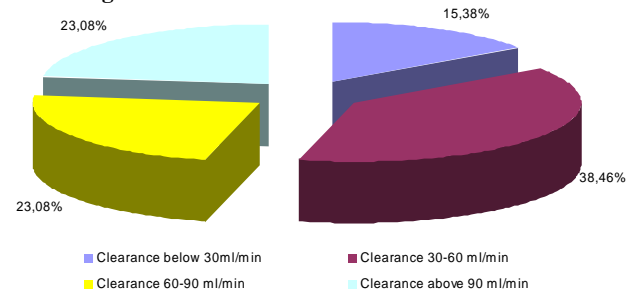


The mean age for the patients with obesity for the entire study group was 70.33 years old, with no significant

fluctuations relative to gender, so that the average age for males was 70 years and for females 70.5 years (figure no. 13).

Obesity is a major risk factor for chronic kidney disease (CKD). In this study, there is an equal incidence of this pathology in the patients with normal renal function and in those with mild renal impairment (23,08). Obesity was found in a higher percentage in the patients with moderate renal impairment (38.46%), in the patients with severely impaired renal function, the percentage was lower, respectively 15.38%, (figure no. 14).

Figure no. 14. Incidence of obesity in the study group according to clearance



DISCUSSIONS

The mean age of the study group was 67.25 years, which corresponds to the average age reported by a document of RO-STEMI register.(11) The average age of the male patients with AMI included in the study ranged around the value of 64.68, while the average age for females was higher, 72.35 years, respectively.

Most of the patients, that is 29 patients, belonged to the age group 60-69 years old. Of these, only 8 had unaffected renal function, 11 had mild renal dysfunction, 5 moderate and 5 patients had severely impaired renal function. Similar results were obtained in studies worldwide which have demonstrated that the elderly (> 65 years old) had a higher prevalence of renal dysfunction and, moreover chronic kidney disease is considered primarily a disease of the elderly.

The distribution of patients by age groups is consistent with the data from the Romanian Registry for Acute Myocardial Infarction with ST-segment elevation, the age group with the highest high frequency of STEMI is 60-69 years old, followed by the age group of 70- 79 years old.

In terms of distribution by gender in the study group, men with STEMI represent 68.18% and females - 31.82%, results which are close to those communicated by the specialized national and international literature.

In this study, it was observed a higher incidence of both cardiac damage and of renal disease in male patients. Men: female ratio for the severe dysfunction was the highest and amounted to 2.75: 1, for the moderate renal impairment, the ratio value was of 1.28: 1, value close to that obtained in the case of mild renal dysfunction of 1.58: 1. According to the literature, male gender is associated with increased susceptibility to chronic kidney disease and with a rapid progression to end-stage kidney disease, regardless of the type of the initial renal disease.

It is unclear whether this is due to the accumulation of some additional cardiovascular and renal risk factors against women or it originated in a particular genetic susceptibility in the case of males.

In this study, we considered the area of origin of patients by analyzing the proportion of the admitted patients coming from rural areas and those from urban areas, in order to

note the percentage differences and to identify a certain degree of risk in any of the above-mentioned categories. Thus, it appears that the number of patients in urban areas was about 2 times higher than those in rural areas (64.77% and 35.23%).

In recent years, numerous experimental and clinical evidences have shown that hypertension is a predictive factor in the development of cardiovascular and renal diseases. Hypertension is one of the pathogenic factors involved in the genesis and progression of cardiac and renal diseases. In addition, the degree of renal impairment is determined not only by the presence of hypertension, but also by the size and type of hypertension. There are studies that showed a better correlation of systolic blood pressure as against the diastolic one with the degree of renal impairment.(12)

The association of hypertension in these patients has a remarkable impact on cardiovascular and renal morbidity and mortality. It is, therefore, very important to control blood pressure. Hypertension is a well-established risk factor for the progression of chronic kidney disease.

Cardiovascular risk factors, such as hypertension can accelerate and aggravate both renal impairment and the cardiovascular one. Even in the case of a mild renal impairment (early chronic renal impairment), cardiovascular risk is significant, 2-4 times higher than in the general population. This has been demonstrated even for slight increases in serum creatinine (1.7 to 2.3 mg / dL) in the patients with hypertension, diabetes, history of heart attack or stroke.

Regarding the frequency of risk factors in the study group, hypertension was the most common coronary and renal risk factor, being present in 60.23% of the patients, which is consistent with data reported by the RO-STEMI register.(11) It was also noticed a significant difference between the average age of female patients with hypertension, which was of 72.35 years old, compared to the average age of men, of 64.68 years old.

Diabetes is considered the main cause of CKD in the developed countries.

In the analyzed study group, the incidence of diabetes was of 38.64% (34 patients) and regarding the distribution by gender, there was a greater impairment of the male patients, the male: female ratio being of 1,6: 1. Also, most cases of diabetes were found in the patients who had an early-stage renal disease (clearance 60-90 ml / min).

CONCLUSIONS

1. The results showed an increased incidence of myocardial infarction in the decade 60-69 years old.
2. In most of the patients included in the study, the anterior localization of myocardial infarction was the most frequent.
3. In the study group, there was an increased incidence of renal impairment, regardless of its severity and predominantly in the male patients.
4. Acute myocardial infarction occurred against a background of chronic renal failure in 11% of patients.
5. About one third of all patients with acute myocardial infarction showed moderate and severe impairment of the renal function (acute or chronic).
6. Cardiovascular risk factors found were: hypertension, diabetes, dyslipidemia and obesity, and of these, the most common was hypertension in a percentage of 60.23%.

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