Risk factors of clinical types of Acute Coronary Syndrome

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Abstract

Objective: to explore clinical patterns and risk factors of Acute Coronary Syndrome (ACS).

Results: A great proportion of the patients with ACS had an age range of 46 – 59 years (47.3%), and 28.2% were younger than 46 years old. Among the cases of ACS, S-T elevation myocardial infarction (STEMI) were 23.7%, non- S-T elevation myocardial infarction (NSTEMI) were 29.5% and unstable angina (UA) were 46.8%. Chest pain (82.7%), and shortness of breath (24.7%) were the most common complaints among patients with ACS. Sweating was encountered among 9.7% of the patients. Risk factors for ACS included smoking (OR:8.95;95% CI:4.022, 19.914, and p < 0.000), and male gender (OR:0.414;95% CI:0.190, 0.902, and p < 0.026). STEMI was significantly associated with increased mean values of Na level (mean 142.1mEq/L), and young age (mean 48.5 years). NSTEMI was associated with increased value of random sugar level (mean 201.1 mg/dL). UA was associated with increased mean values of systolic and diastolic blood pressures (means 155, and 94 mmHg respectively) and increased Uric acid level (6 mg/dL). In agreement with a recent study, the present study didn't find hypercholesterolemia as a significant risk factor for ACS after allowing for possible risk factors.

Key words: Acute Coronary Syndrome, risk factors, Saudi Arabia

Introduction

Cardiovascular Diseases (CVD) are the leading cause of morbidity and mortality worldwide. (1) Coronary artery disease (CAD) is the most common CVD and accounts for morbidity and mortality of millions all over the world. Acute coronary syndrome (ACS) represents a major health problem mainly among middle aged and elderly populations, although it also affects younger age groups and imposes marked limitations on their life style (2-4). Urbanization in most of the countries has resulted in increased obesity and smoking habit, and development of diabetes mellitus, dyslipidemia, and hypertension, which provide risk factors for rising occurrence of CAD (5, 6). Saudi Arabia, with the major transformation and adoption of a western life style, has suffered from increased prevalence of risk factors for CVD. (6, 7). Among the concern of the 2030 vision of Saudi Arabia is to promote the health care systems through scrutinizing risk factors for the main health problems to deliver community based preventive measures and improve access to health care systems. Our objectives include identifying the pattern of clinical presentation, and exploring the risk factors of the different clinical types of ACS.

Method

A cross sectional study was conducted where the files of 186 patients with ACS admitted to the cardiac wards of two general hospitals: one in the North of Jeddah city and one in the southern region were reviewed during the period 2017-2018. The diagnosis of ACS was based on patient's history of chest pain, physical examination, electrocardiography, radiologic tests, and serial high sensitivity Troponins. ACS was further categorized into unstable angina (UA), non-ST-segment elevation myocardial infarction (NSTEMI), and ST-segment elevation myocardial infarction (STEMI) (8). Data regarding the underlying risk factors such as a positive family history, smoking, hypertension, fasting lipid profile for dyslipidemia, liver and kidney profile, random and fasting glycemic profile and uric acid levels were obtained. Demographic characteristics, complications and outcome were also revised. Patients with congenital or valvular heart disease were excluded. A number of 195 inpatients at the same hospitals, without current or past ACS, and who were admitted for causes other than cardiac diseases were employed as controls.

Statistical analysis: Data was analyzed using SPSS (IBM P/C version 23). The Multi-nominal Logistic regression was used; Odds ratio and 95% confidence intervals for the different risk factors were calculated. Level of significance for this study was 0.05.

Results

The majority of patients with ACS were 46 – 59 years old (47.3%); 28.2% were younger than 46 years old, while 24.2% were older than 59 years. The percentage of males among ACS patients [159 (85.5%)] was greater than that of females [27 (14.3%)]; and about one third of the patients with ACS were current smokers [62 (33.3%)]. These findings were significantly higher among patients with ACS compared to controls ($p <0.000$). Among patients with ACS: 32.3% had treatment for diabetes mellitus, 45.2% had treatment for hypertension and 15.1% had treatment for ischemic heart disease. However these differences were not significantly different from those of the control group ($p > 0.05$). Among the cases of ACS, STEMI was 23.7%, NSTEMI was 29.5%, and UA was 46.8%. Table 1 shows that smoking subjects are 9 times more likely to suffer from ACS (OR: 8.95; 95%CI: 4.022, 19.914, and $p < 0.000$) compared to non-smoking subjects, after allowing for other risk factors. Male subjects are 2.14 times more likely to suffer from ACS (OR: 0.414; 95%CI: 0.190, .0902, and $p < 0.026$) compared with females after allowing for other risk factors. Subjects with hypertension are 1.8 times more likely to suffer from ACS (OR: 0.546; 95%CI: 0.296, 1.007, and $p < 0.053$) compared with normal subjects. Subjects with Diabetes mellitus are 1.726 times more likely to suffer from ACS (OR: 1.726; 95%CI: 0.886, 3.360) compared with normal subjects; however this difference was not statistically significant ($p < 0.108$). Dyslipidemia was irrelevant to ACS, when other factors were controlled.

Table 2 shows that the males were more encountered among the ACS patients with STEMI or NESTMI, while the females were more encountered among the ACS cases with UA ($p < 0.05$). Smoking habit was more common among the patients with STEMI (47.7%) and NSTEMI (43.6%) compared to those with UA(21.8%). These differences were statistically significant ($p<0.05$). Cases with STEMI (43.2%) and with NSTEMI (40.0%) had treatment for DM significantly more than the patients with UA(21.8%). No significant differences were found between the three groups regarding treatment for hypertension or ischemic heart disease (IHD) where $p<0.05$.

Table 3 shows that STEMI was significantly associated with increased mean values of Na level compared to NSTEMI and UA (142.1mEq/L, 139.11mEq/L, and 140.21mEq/L respectively). STEMI was significantly associated with young age (mean =48.5 years), compared to NSTEMI, and UA (54.3, and 52.5 respectively). NSTEMI was associated with increased value of random sugar level (201.1 mg/dL), Compared with STEMI and UA, UA was associated with increased mean values of systolic and diastolic blood pressures (155, and 94 mmHg respectively) and increased Uric acid level (6 mg/dL), compared to STEMI and NSTEMI.

Table 4 shows that chest pain was the most common complaint among patients with ACS (81.7%) particularly among those with STEMI (97%). Dyspnea was a presenting complaint in 24.7% of the patients with ACS, particularly those with UA (29%). Palpitation and headache were complaints among 7.5% of patients with ACS, mainly among those with UA (12.6% and 13.8% respectively).

Table 1: Multi-nominal logistic regression of different risk factors and ACS

Independent Variables	B	P- Value	Exp (B)	95% Confidence Interval for Exp (B)	
				Lower Bound	Upper Bound
Intercept	-.050-	.978			
Age (years)	-.011-	.394	.989	.965	1.014
Hypercholesterolemia	.000	.930	1.000	.997	1.003
Hypertriglyceridemia	.000	.878	1.000	.995	1.006
Smoking habit (1= no, 2=yes)	2.192	.000	8.950	4.022	19.914
Gender (1= male, 2= female)	-.881-	.026	.414	.190	.902
Area of residence (1= Ghulail, 2= El-Safa)	-.240-	.852	.787	.063	9.823
Having DM (1= No, 2= Yes)	.546	.108	1.726	.886	3.360
Having HTN (1= No, 2= Yes)	-.605-	.053	.546	.296	1.007
Having IHD (1= No, 2= Yes)	-.308-	.423	.735	.347	1.560

Table 2: Types of ACS and personal and medical disorders

Variables	ACS			X2 (p)
	STEMI (number 44)	NSTEMI (number 55)	USA (number 87)	
Gender				
Male	93.2%	90.9%	78.2%	7.1
Female	6.8%	9.1%	21.8%	(< 0.021)
Smoking				14.17
Yes	47.7%	43.6%	19.5%	(< 0.001)
DM				8.2
Yes	43.2%	40.0%	21.8%	(<0.016)
Hypertension				0.43
Yes	47.7%	41.8%	46.0%	(<0.821)
IHD				0.81
Yes	11.4%	14.5%	17.2%	(0.669)

Table 3: Analysis of variance for the blood chemistry and age among different types of ACS

Age and Blood chemistry		Mean	Std. Deviation	95% Confidence Interval for Mean		F-Ratio (*P*)
				Lower Bound	Upper Bound	
Cholesterol	STEMI	212.9259	47.53616	194.1212	231.7306	2.933 (<0.057)
	NSTEMI	191.7727	57.68877	174.2337	209.3117	
	UA	185.1739	46.69864	173.9557	196.3922	
	Total	192.6000	51.25319	184.0355	201.1645	
Systolic BP	STEMI	133.5814	25.56619	125.7133	141.4495	6.644 (<0.002)
	NSTEMI	144.8077	35.67228	134.8765	154.7389	
	UA	155.4070	33.61595	148.1997	162.6143	
	Total	147.1768	33.53840	142.2577	152.0958	
Diastolic BP	STEMI	82.0465	15.13110	77.3898	86.7032	6.003 (0.003)
	NSTEMI	89.6731	23.83910	83.0362	96.3099	
	UA	94.3837	17.58420	90.6137	98.1538	
	Total	90.0994	19.61550	87.2225	92.9764	
Na	STEMI	142.0741	3.12467	140.8380	143.3102	6.937 (<0.003)
	NSTEMI	139.2059	4.82907	137.5209	140.8908	
	UA	141.9516	3.20567	141.1375	142.7657	
	Total	141.2195	3.88468	140.5261	141.9129	
URIC ACID	STEMI	4.9513	1.37880	4.3551	5.5475	3.949 (<0.022)
	NSTEMI	5.9909	1.99270	5.2843	6.6975	
	UA	6.0434	1.46570	5.6394	6.4474	
	Total	5.7971	1.67085	5.4798	6.1143	
RBS	STEMI	190.6400	97.25734	150.4941	230.7859	4.303 (<0.016)
	NSTEMI	207.1457	129.85123	162.5403	251.7512	
	UA	145.4681	66.63262	125.9040	165.0322	
	Total	176.1972	101.29615	156.7823	195.6121	
Age	STEMI	48.5000	9.82995	45.5114	51.4886	3.326 (<0.038)
	NSTEMI	54.3091	12.28952	50.9868	57.6314	
	UA	52.5862	11.47449	50.1407	55.0318	
	Total	52.1290	11.50626	50.4646	53.7935	

Table 4: Presenting symptoms among patients with different forms of ACS

Symptoms	Acute coronary syndrome (Number 186)						X^2 (*P*- Value)
	STEMI (Number= 44)		NSTEMI (Number= 55)		UA (Number= 87)		
	No	%	No	%	No	%	
Dyspnea	7	15.9%	14	25.5%	25	28.7%	2.65 (0.272)
Orthopnea	0	0.0%	2	3.6%	3	3.4%	1.59 (0.450)
Chest pain	43	97.7%	45	81.8%	64	73.6%	11.42 (0.003)
Palpitation	0	0.0%	3	5.5%	11	12.6%	7.19 (0.027)
Cough	1	2.3%	1	1.8%	1	1.1%	0.25 (0.881)
Headache	0	0.0%	2	3.6%	12	13.8%	9.7 (0.008)
Vertigo	0	0.0%	0	0.0%	3	3.4%	3.4 (0.176)
Dizziness	1	2.3%	1	1.8%	7	8.0%	3.7 (0.160)
Sense of death	1	2.3%	1	1.8%	2	2.3%	0.04 (0.980)
Sweating	7	15.9%	6	10.9%	5	5.7%	3.5 (0.166)
Nausea	2	4.5%	2	3.6%	4	4.6%	0.08 (0.959)
Vomiting	2	4.5%	0	0.0%	0	0.0%	6.52 (0.038)
Restless	24	54.5%	25	45.5%	38	43.7%	1.44 (0.487)

Discussion

ACS encircles a wide range of clinical disorders that are shared by more than one physiologic derangement: an acute or sub-acute imbalance between the oxygen demand and supply of the myocardium. ACS includes UA and evolving MI which is usually divided into STEMI and NSTEMI. (5). Each year in the United States of America, approximately 1.36 million hospitalizations are required for ACS (9). The prevalence of ACS in the Middle East differs from one country to another. For instance, it was 6% in Saudi Arabia (in 2004), 8.3% in Egypt (in 2001) and 13% in Lebanon (in 2008). However, by 2030, this prevalence is expected to rise due to increasing rates of hypertension, DM, overweight, obesity, physical inactivity, smoking and dyslipidemia (10) Premature ACS remains a significant cause of morbidity and mortality worldwide. In 2012, CAD was the cause of death in 1894 Canadians younger than 55 years. Further, ACS remains a significant cause of lost work productivity, unemployment, and disability in this young age category (11). In this study, 28.2% were under the age of 46. This is in line with another study (12). Several previous reports have revealed the existence of gender differences in terms of presentation of symptoms, validity of diagnostic tests, in-hospital medication, drug side effects, clinical outcomes, complications, and management of ACS(13-16). The percentage of women diagnosed with ACS can range from 33% to 45% (17). This is in line with findings from the present study where the percentage of males was 85.5% while that of females was 14.3%; in addition male subjects were 2.14 times more likely to suffer from ACS compared with females. These sex differences in occurrence of ACS, might be explained by differences in anatomic, physiologic, biologic, and psychological characteristics among them(14, 18). In the present study smoking subjects were 9 times more likely to suffer from ACS (OR: 8.95; 95%CI: 4.022, 19.914, and $p < 0.000$) compared to non-smoking subjects, after allowing for other risk factors. Smoking is regarded as a strong risk factor for myocardial infarction. Numbers of studies have shown a strong positive correlation between atherosclerosis, smoking and myocardial infarction. Smoking leads to premature atherosclerosis and cardiac death. One in every 5 deaths in the United States each year is due to cigarette smoking. Risk is more in women who smoke and who are taking birth control pills (19-22). Chest pain was the most common complaint among patients with ACS (81.7%) particularly among those with STEMI (97%). Dyspnea was a presenting complaint in 24.7% of the patients with ACS, particularly those with UA (29%). Palpitation and headache were complaints among 7.5% of patients with ACS, mainly among those with UA (12.6% and 13.8% respectively). This is in line with other studies (23-26). The risk factors for coronary artery disease (CAD) include hypercholesterolemia, hypertension, and diabetes mellitus (DM). (9, 10). In the present study, when multivariate logistic regression was used to allow for different factors, diabetes mellitus, hypertension and dyslipidemia were not significant risk factors for ACS.

Ralapanawa et al in 2014 reported 25.7% ACS in Sri lanka to be STEMI, 36.7% to be NSTEMI, and 37.7% to be UA (23). Hersi et al.in 2007 reported 41.5% ACS in Saudi Arabia to be STEMI, 36.5% to be NSTEMI, and 22.1% to be UA (24); while our study in 2018 showed 23.7% of ACS to be STEMI, 29.5% to be NSTEMI and 46.8% UA.

Medagama et al, showed no significant difference in age distribution of patients with all groups of ACS, with the majority being between 51 and 70 years of age.(25) Sharma et al showed a higher mean age of 60.07±10.47 years amongst NSTEMI patients compared to 57.76±11.44 years for STEMI patients with no significant statistical difference. (26). Ralapanawa et al, showed a slightly higher mean age for UA (62.2 years) and NSTEMI (61.9 years) compared to STEMI (59.2 years) but without a statistical significance (P=0.246) (22). In line with these findings we found that mean age for STEMI (48.8 ±9.8 years) was significantly lower than the mean age for NSTEMI (54.3 ± 11.4 years) and mean age for UA (52.5 ± 11.47 years). In the present study we found that patients with STEMI and NSTEMI were more commonly males , smokers and having DM compared to the patients with UA; on the other hand females were significantly more encountered among the patients with UA.

Treatment for hypertension and IHD was similar in all groups with ACS. The patients with NSTEMI had increased value of random sugar level compared with the patients with STEMI and UA. These are in line with previous studies (23-26). Hyponatremia, defined as a serum sodium concentration ([Na+]) <135 mmol/L, is the commonest electrolyte disorder encountered in clinical practice. Previous studies had found that hyponatremia is closely related to the prognosis of heart failure (26), and stroke (27). In the present study we found that the patients with NSTEMI and UA had significantly decreased mean value of Na level compared to the patients with STEMI. The underlying mechanism may be relevant to the release of vasopressin, activation of the renin-angiotensin system and catecholamine production (28, 29). Recent epidemiological and clinical evidence suggests that hyperuricemia might be a risk factor for cardiovascular disease where enhanced oxidative stress plays an important pathophysiological role (30). It has been recently reported that serum uric acid is an independent predictor of mortality for patients with CAD and morbidity, including acute myocardial infarction or congestive heart failure (31). In the present study we found the patients with UA had increased Uric acid level compared to the patients with STEMI and NSTEMI.

Conclusion

Male gender, smoking and hypertension were significant risk factors for occurrence of ACS. The occurrence and effect of risk factors differed by type of ACS. Male gender, smoking, DM, and young age were significantly associated with STEMI. Old age, smoking DM, high RBS, and decreased Na+ level, were significantly associated with NSTEMI. Female gender, increased mean value of uric acid, systolic and diastolic blood pressures were significantly associated with UA. Patients with dyslipidemia do not have a preponderance for any type of ACS. More studies are required to understand epidemiology, presentation and risk factors of ACS particularly in regional levels as they can differ from one region to the other. This understanding would help to implement preventive measures including lifestyle modification and drug treatment optimizing risk factors.

Limitations of this study

It was based on a convenient sample. Some data were missing from files of the patients like family history and exercise activities. However, our results were very close to studies conducted in Saudi Arabia and in other parts of the world.

List of abbreviations

ACS: Acute coronary syndrome
STEMI: S-T elevation myocardial infarction
NSTEMI: Non-ST elevation myocardial infarction
UA: Unstable angina
CAD: Coronary artery disease
IHD: Ischemic heart disease
DM: diabetes mellitus
SPSS: Statistical package for Social Sciences
Od: Odds Ratio
CI: Confidence interval

Declarations

Ethics approval and consent to participate
Ethical clearance was obtained from the institutional review board (Protocol identifier 006MP25082019; Application of human ethics committee approval -2-, 17/12/2016). Permission was obtained from the directors of the outpatient clinics for collecting data from the records. Data collection procedure was anonymous.

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References

1. Egred M, Viswanathan G, Davis GK. Myocardial infarction in young adults. Postgrad Med J. 2005;81(962):741–745.
2. Rosamond W., Flegal K., Furie K. Heart disease and stroke statistics – 2008 update: a report from the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. Circulation. 2008;117:e25–146. [PubMed] [Google Scholar]
3. Reddy K.S., Shah B., Varghese C., Ramadoss A. Responding to the challenge of chronic diseases in India. Lancet. 2005;366:1744–1749. [PubMed] [Google Scholar]
4. Lee J., Heng D., Chia K.S., Chew S.K., Tan B.Y., Hughes K. Risk factors and incident coronary heart disease in Chinese, Malay and Asian Indian males: the Singapore Cardiovascular Cohort Study. Int J Epidemiol. 2001;30:983–988.
5. Thankappan K.R., Shah Bela, Mathur Prashant. Risk factor profile for chronic non-communicable diseases: results of a community-based study in Kerala, India. Indian J Med Res. 2010; 131: 53–63. [PubMed] [Google Scholar]
6- Faisal A, Bander A, Ali A, Abadi M, Ahmed A , Alsubaie A, et al. Acute coronary syndrome among young patients in Saudi Arabia (Single center study). J Cardiol Curr Res. 2019; 12(3): 60-63. DOI: 10.15406/jccr.2019.12.00440
7. Elhadd T, Al-Amoudi A, Alzahrani A. Epidemiology, clinical and complications profile of diabetes in Saudi Arabia: a review. Ann Saudi Med. 2007;27(4):241–250.
8- Ezra A Amsterdam, Nanette K Wenger, Ralph G Brindis, et al. 2014 AHA/ ACC guideline for the Management of Patients With Non–ST-Elevation Acute Coronary Syndromes. A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. Journal of the American College of Cardiology 2014; 64(24) : e139 – e228.

9. Kumar A., Cannon C.P. Acute coronary syndromes: diagnosis and management. Part I. Mayo Clin Proc. 2009;84:917–938. [PMC free article] [PubMed] [Google Scholar]
10. Ahmed M.H., Awadalla H., Elmadhoun W.M., Osman M., Noor S.K., Almobarak A.O. Prevalence and risk factors for acute coronary syndrome among Sudanese individuals with diabetes: a population-based study. Cardiol Res. 2017;8:184–189. [PMC free article] [PubMed] [Google Scholar]
11. Sedlak T.L., Izadnegahdar M. Outcomes in premature acute coronary syndrome: has the sex gap closed? [Editorial] Can J Cardiol. 2016;32:1375–1377. [PubMed] [Google Scholar]
12- Alhabib KF, Kinsara AJ, Alghamdi S, Al-Murayeh M, Hussein GA, AlSaif S, et al. The first survey of the Saudi Acute Myocardial Infarction Registry Program: Main results and long-term outcomes (STARS-1 Program). PLoS ONE 2019; 14 (5): e0216551. https://doi.org/10.1371/journal.pone.0216551
13. Goldberg R, Goff D, Cooper L, Luepker R, Zapka J, Bittner V, et al. Age and sex differences in presentation of symptoms among patients with acute coronary disease: the REACT Trial. Rapid Early Action for Coronary Treatment. Coron Artery Dis. 2000;11:399-407.
14. DeVon HA, Zerwic JJ. Symptoms of acute coronary syndromes: are there gender differences? A review of the literature. Heart Lung 2002;31:235-45.
15. Patel H, Rosengren A, Ekman I. Symptoms in acute coronary syndromes: does sex make a difference? Am Heart J. 2004;148: 27-33.
16. Kosuge M, Kimura K, Ishikawa T, Ebina T, Hibi K, Tsukahara K, et al. Differences between men and women in terms of clinical features of ST-segment elevation acute myocardial infarction. Circ J.2006;70:222-6.
17. Norris C, Dasgupta K, Kirkland S. Differences in cardiovascular presentation in women and men. CMAJ. 2007;176 (6):S22-3
18. DeVon HA, Zerwic JJ. The symptoms of unstable angina: do women and men differ? Nurs Res. 2003;52:108-18.
19. Yagi P, Komukai K, Hashimoto K, Kawai M, Ogawa T, Anzawa R, et al. Difference in risk factors between acute coronary syndrome and stable angina pectoris in the Japanese: Smoking as a crucial risk factor of acute coronary syndrome. Journal of Cardiology 2010; 55 (3): 345-353
20. Panagiotakos DB, Rallidis LS, Pitsavos C, Stefanadis C, Kremastinos D. Cigarette smoking and myocardial infarction in young men and women: a case-control study. Int J Cardiol. 2007;116(3):371–5. doi: 10.1016/j.ijcard.2006.04.051. [PubMed] [CrossRef] [Google Scholar]
21. Pyrgakis VN. Smoking and cardiovascular disease. Hellenic J Cardiol. 2009;50(3):231–4. [PubMed] [Google Scholar]
22. Berndt N, Bolman C, Mudde A, Verheugt F, de Vries H, Lechner L. Risk groups and predictors of short-term abstinence from smoking in patients with coronary heart disease. Heart Lung. 2012;41(4):332–43. doi: 10.1016/j.hrtlng.2012.03.001. [PubMed] [CrossRef] [Google Scholar]
23.Ralapanawa U., Kumarasiri P, Jayawickreme K, Kumarihamy P, Wijeratne Y, Ekanayake M, et al. Epidemiology and risk factors of patients with types of acute coronary syndrome presenting to a tertiary care hospital in Sri Lanka. BMC Cardiovasc Disord 2019; 19: 229. doi:10.1186/s12872-019-1217-x
24 .Hersi A, Al-Habib K, Al-Faleh H, Al- Nemer K, AlSaif S, Amir Taraben A, et al. Gender inequality in the clinical outcomes of equally treated acute coronary syndrome patients in Saudi Arabia Ann Saudi Med 2013; 33(4): 339-346 DOI: 10.5144/0256-4947.2013.339.
25. Medagama A, Bandara R, De Silva C, Galgomuwa MP. Management of acute coronary syndromes in a developing country; time for a paradigm shift? An observational study. BMC CardiovascDisord. 2015;15:133. https://doi.org/10.1186/s12872-015-0125-y.
26.Sharma R, Bhairappa PSR, Manjunath CN. Clinical characteristics, angiographic profile and in hospital mortality in acute coronary syndrome patients in south Indian population. Heart India. 2014;2(3):65–9.
26. Lee SE, Choi DJ, Yoon CH, Oh IY, Jeon ES, Kim JJ, et al. Improvement of hypernatremia during hospitalization for acute heart failure is not associated with improvement of prognosis: an analysis from the Korean Heart Failure (KorHF) registry. Heart (British Cardiac Society). 2012; 98(24):1798–804. Epub 2012/11/06. doi: 10.1136/heartjnl-2012-302334 . [PubMed] [Google Scholar]
27. Huang WY, Weng WC, Peng TI, Chien YY, Wu CL, Lee M, et al. Association of hyponatremia in acute stroke stage with three-year mortality in patients with first-ever ischemic stroke. Cerebrovascular diseases (Basel, Switzerland). 2012;34(1):55–62. Epub 2012/07/05. doi: 10.1159/000338906 . [PubMed] [Google Scholar]
28. Latini R, Masson S, Anand I, Salio M, Hester A, Judd D, et al. The comparative prognostic value of plasma neurohormones at baseline in patients with heart failure enrolled in Val-HeFT. European heart journal. 2004;25(4):292–9. Epub 2004/02/27. doi: 10.1016/j.ehj.2003.10.030 . [PubMed] [Google Scholar]
29. Palmer BR, Pilbrow AP, Frampton CM, Yandle TG, Skelton L, Nicholls MG, et al. Plasma aldosterone levels during hospitalization are predictive of survival post-myocardial infarction. European heart journal. 2008;29(20):2489–96. Epub 2008/09/02. doi: 10.1093/eurheartj/ehn383 . [PubMed] [Google Scholar]
30. Lippi G, Montagnana M, Franchini M. The paradoxical relationship between serum uric acid and cardiovascular disease. Clin Chim Acta 2008;392:1-7.
31. Bickel C, Rupprecht HJ, Blankenberg S. Serum uric acid as an independent predictor of mortality in patients with angiographically proven coronary artery disease. Am J Cardiol 2002;89:12-7.