

CARDIOVASCULAR COMORBIDITY IN ACUTE ISCHEMIC STROKE

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Abstract

Nowadays acute ischemic stroke is the most common cerebrovascular disease. The objective of the present investigation was to outline the co-occurrences of nine cardiovascular diseases and pathological conditions in the patients with acute ischemic stroke. We examined 258 patients, 129 males and 129 females, aged 71 years (range, 49-92 years) and hospitalized in 2007-2013 in the Department of Neurology and Neurosciences, Medical University “Prof. Paraskev Stoyanov” of Varna, Bulgaria. Cardiovascular comorbidity covered the arterial hypertension (AH), hypertensive heart (HH), atrial fibrillation (AF), ventricular tachyarrhythmia (VTA), myocardial infarction (MI), ischemic heart disease (IHD), effort angina pectoris (AP), coronary atherosclerosis (CA) and heart failure (HF). AH occurred most commonly (in 246) followed by IHD (in 154) and HH (in 118 patients). There was a weak correlation between patients' age and the number of accompanying or preceding diseases (Pearson's coefficient $r=0,210$). There were 63 patients with four diseases but 51 with two ones. Cardiovascular comorbidity should be taken in consideration as a risk factor for worse acute ischemic stroke patient's outcome.

Key words: acute ischemic stroke; cardiovascular diseases; comorbidity; correlation analysis

1. Introduction

Acute ischemic stroke is the most common cerebrovascular disease worldwide. This disorder represents a severe burden for the patients themselves, their relatives, medical community and society as a whole. Nowadays there is rising evidence of a variety of cardiovascular, metabolic and neurological diseases in the adult and elderly patients with acute ischemic stroke. Numerous publications deal with isolated co-occurrences of such diseases in individual patients with acute ischemic stroke.

The purpose of the present study was to identify the simultaneous co-occurrences of nine cardiovascular diseases and pathological conditions in adult patients with acute ischemic stroke.

2. Material and methods

Our study covered 258 patients, 129 males and 129 females, aged 71 years (range, 49-92 years). They were hospitalized in 2007-2013 in the Department of Neurology and Neurosciences, Medical University “Prof. Paraskev Stoyanov” of Varna, Bulgaria. The co-occurrences of the following cardiovascular diseases and pathological conditions were analyzed: arterial hypertension (AH), hypertensive heart (HH), atrial fibrillation (AF), ventricular tachyarrhythmia (VTA), myocardial infarction (MI), ischemic heart disease (IHD), effort angina pectoris (AP), coronary atherosclerosis (CA) and heart failure (HF). Statistical data processing was done by means of variation and correlation analysis (Pearson’s coefficient).

3. Results

Our results are summarized in three tables. The counts and percentages of 258 acute ischemic stroke patients with nine co-occurring cardiovascular diseases and pathological conditions are demonstrated in Table 1. It is evident that AH, IHD and HH occupy the leading positions.

Table 1 Co-occurrences of cardiovascular diseases and pathological conditions in acute ischemic stroke patients

	AH	IHD	HH	AP	HF	CA	AF	MI	VTA
<i>n</i>	246	154	118	101	63	58	41	40	28
%	95,35	59.69	45.74	39.15	24.42	22.48	15.89	15.50	10,85

The counts and percentages of 246 patients with AH as the first disease missing or co-occurring with eight other cardiovascular diseases and pathological conditions as second disease in one and the same patient are demonstrated in Table 2.

It can be seen that AH occurs together with IHD in 147 patients, IHD is missing in the presence of AH in 99 other patients, AH is missing in the presence of IHD in 7 other patients, and both AH and IHD are missing in the rest 5 patients.

The counts of the acute ischemic stroke patients presenting with a various number of accompanying or preceding cardiovascular diseases and pathological conditions according to

patient's age are presented in Table 3. There is a weak correlation between patients' age and the number of these diseases and pathological conditions (Pearson's coefficient $r=0,210$).

Table 2. Co-occurrences of AH with eight cardiovascular diseases and pathological conditions in acute ischemic stroke patients

<i>Second disease</i>	two diseases		no second disease		second disease only		no cardiovascular disease	
	n	%	n	%	n	%	n	%
<i>IHD</i>	147	59.76	99	40.24	7	2.84	5	2.03
<i>HH</i>	117	47.56	129	52.44	1	0.41	11	4.47
<i>AP</i>	97	39.43	149	60.57	4	1.63	8	3.25
<i>HF</i>	61	24.80	185	75.20	2	0.82	10	4.06
<i>CA</i>	55	12.91	191	77.64	3	1.22	9	3.66
<i>AF</i>	41	16.67	205	83.33	0	0	12	4.88
<i>MI</i>	38	15.45	208	84.55	2	0.82	10	4.06
<i>VTA</i>	27	10.98	219	89.02	1	0.41	11	4.47

Table 3 Patients' distribution according to their age and the number of accompanying or preceding cardiovascular diseases and pathological conditions

Age groups/ diseases	0	1	2	3	4	5	6	7	8	9
<i>≤ 60 years</i>	1	3	3	1	3	2	0	1	0	0
<i>61-70 years</i>	3	12	25	18	31	14	9	5	0	0
<i>71-80 years</i>	1	11	19	11	23	16	10	10	2	1
<i>≥ 81 years</i>	0	1	4	2	6	5	4	1	0	0
<i>total</i>	5	27	51	32	63	37	23	17	2	1

4. Discussion

Recent publications worldwide convincingly indicate the presence of cardiovascular comorbidity in adult patients with acute ischemic stroke. However, most often, only single diseases and pathological conditions accompanying or preceding the ischemic stroke have been analyzed in one and the same paper.

We identify a different degree of comorbidity of single cardiovascular diseases and pathological conditions in our patients' contingent. In our opinion, further research covering a greater sample is needed to better illustrate the mutual relationships between these common disorders in acute ischemic stroke and to stratify the cardiovascular risk associated with them.

In a nationwide population-based cohort study using the Danish National Registry of Patients during 1994-2011, the 30-day, one-year, and five-year mortality of acute ischemic stroke was analyzed [14]. Comorbidity categories were defined by Charlson Comorbidity Index. The 30-day mortality rate ratio adjusted for age, sex, and comorbidity decreases by

approximately 45% while the five-year one decreases from 56.4% in 1994-1998 to 46.1% in 2004-2008. Comparing very severe comorbidity with no comorbidity, these rate ratios increase approximately 2.5-fold.

The retrospective assessment of the validity of the modified Charlson Comorbidity Index as a predictor of the short-term outcomes in a cohort of 297 patients with first-ever ischemic stroke, older than 60 years shows a significant association with poor outcome and mortality with higher point estimates of odds ratio (2.74; 95% CI 1.64-4.59) and hazard ratio (2.73; 95% CI 1.51-4.94) [3]. However, this association is dependent on stroke severity and premorbid disability, too.

Among 300 Japanese patients with ischemic stroke and 21 ones with transient ischemic attack, 225 males and 96 females at an mean age of 67.3 years, the comorbidity includes the following: hypertension - in 260 (81.00%), dyslipidemia - in 249 (77.57%), atrial fibrillation - in 47 (14.64%), diabetes mellitus - in 102 subjects (31.78%), and chronic kidney disease - in 98 patients (30.53%) [5].

During a follow-up period of 89,468 person-years, ischemic stroke rate is higher in patients with than in those without atrial fibrillation (5.79 per 100 person-years versus 2.25 per 100 person-years) [2]. The higher prevalence of CHA2DS2-VASc comorbidities (heart failure, hypertension, diabetes mellitus, coronary artery disease, and peripheral artery disease) in atrial fibrillation patients further increases the stroke risk. Combination of data from the nationwide stroke register Riks-Stroke and from the Patient Register in Sweden shows that 31428 (33.4%) ischemic stroke patients present with previously known, or newly diagnosed atrial fibrillation [4].

Among 204 patients with acute ischemic stroke, there is atrial fibrillation in 31 patients (15,20%) and paroxysmal atrial fibrillation PAF - in 15 patients (7,35%) [15]. Multivariate analysis reveals that age of ≥ 70 years (odds ratio 3.52, 95%; CI 1.68-7.35; $p=0,001$) and heart diseases (odds ratio 4.26; 95% CI 1.14-15.95; $p=0,031$) are associated with these arrhythmias.

Of 4806830 eligible patients, 14121 (0.29%) are diagnosed with paroxysmal supraventricular tachycardia (PSVT) and 14402 (0.30%) experience an ischemic stroke [7]. The cumulative rate of ischemic stroke after PSVT diagnosis (0.94%; 95% CI 0.76%-1.16%) significantly exceeds the rate among patients without a diagnosis of PSVT (0.21%; 95% CI 0.21%-0.22%). A 56-year-old female with a rapidly changing supraventricular tachyarrhythmia including sinus tachycardia, atrial fibrillation, and atrial flutter that quickly

interchanging to another, without any hemodynamic instability, due acute ischemic stroke without structural heart disease has recently been reported [11].

Between January 2001 and July 2010, acute ischemic stroke has been diagnosed in 106 out of 8485 patients (in 1.25% of the cases) with acute myocardial infarction in a cardiology intensive care unit in France [6]. Between 1998 and 2008, 7185 of 173233 acute myocardial infarction patients in Sweden (4.15% of the cases) have presented with ischemic stroke within one year [16]. ST-segment-elevation myocardial infarction, previous ischemic stroke, atrial fibrillation, heart failure at admission, ACE-inhibitor treatment, age, female sex, and previous diabetes mellitus are independent predictors of ischemic stroke. In the national sample of Medicare in the United States from 1999 to 2010, there are 57848 subsequent hospitalizations for ischemic stroke aged ≥ 65 years after acute myocardial infarction [17]. The one-year rate of ischemic stroke decreases from 3.4% (95% CI 3.3%-3.4%) to 2.6% (2.5%-2.7%; $p < 0.001$). Among the 1924413 patients from the Nationwide Inpatient Sample in the USA, admitted for acute myocardial infarction in 2006-2008, the incidence rate of ischemic stroke is 1.47% [10].

A total of 207 out of 580 chronic heart failure patients at a mean age of 63 ± 13 years have died due to cardiovascular reasons [9]. Multivariable Cox regression analysis shows that history of ischemic stroke (hazard ratio 2.48, 95% CI 1.14-5.37, $p = 0.022$) is one of the independent predictors of cardiac death.

The prevalence of hippocampal infarction in 1245 subjects (at a mean age of 79 ± 1 years) is 12% [12]. There are large hemispheric brain infarctions in 31% of the cases. They are strongly associated with cardiovascular risk factors such as hypertension (43%), coronary disease (32%), myocardial infarction (22%), atrial fibrillation (20%), and heart failure (20%).

Between 2006 and 2007, hypertension is the main cardiovascular risk factor for ischemic stroke, either alone or in combination with other risk factors, among 175 patients aged over than 65 years in Greece [8].

There is a decompensated heart failure in 17% of 566 acute ischemic stroke patients at a mean age of 73 years [1]. Such patients are older and more frequently suffer from hypertension, atrial fibrillation, myocardial infarction and diabetes mellitus. The decompensated heart failure is a strong, independent predictor of worse functional outcome after ischemic stroke (OR 2.34, 95% CI 1.12 - 4.89, $p = 0.02$).

Long-term excess mortality after ischemic stroke in young adults aged 18 to 50 years is mainly attributable to a cardiovascular disease and most pronounced in men in Nijmegen, the Netherlands, between 1980 and 2010 [13].

5. Conclusion

Our results reveal the different extent of cardiovascular comorbidity in single patients with acute ischemic stroke and emphasize the role of timely diagnosis and regular control of this common pathology for the adequate prevention of the cerebrovascular diseases in adult individuals.

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