Women and Stroke: How Much do Women and Men Differ? A Review – Diagnostics, Clinical Differences, Therapy and Outcome

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A B S T R A C T

In this article, the authors have gathered data from epidemiological, observational, case-control and cohort studies to evaluate the differences between men and women in terms of ischemic events, mainly stroke. The authors are highlighting the differences that exist between men and women and play a role in terms of social diversities, and the pathophysiological differences that may be responsible at least in part for ischemic events. Studies show that male stroke patients are more likely to have a history of ischemic heart disease, smoking and alcohol consumption, whereas female stroke patients suffer from ischemic events at an older age, are more likely to have hypertension and atrial fibrillation. Women are more likely to arrive to an emergency room in a comatose state, with paralysis, aphasia, swallowing problems and urinary incontinence, which all indicates a more severe stroke. Also, women suffer from a higher level of disability than men, even though their survival rates are the same. Even though clear guidelines for the treatment of stroke exist, there are still differences in both diagnostic procedures and discharge destination between male and female patients.

Key words: stroke, women, gender differences, risk factors, treatment

Introduction

What are the differences between men and women? It is well known that the XX and XY combinations determine not just sexual features but also other characteristics which are not so easily detected. What is the extent of diversities between men and women that play an important role and may influence, for instance – the prevalence, severity and outcome of stroke?

In this article, authors have gathered data from epidemiological, observational, case-control and cohort studies to evaluate the differences between men and women in terms of ischemic events, mainly stroke. The objective of this article is to discuss which are the differences that exist between genders and play a role in terms of social diversities, and the pathophysiological differences that may be responsible at least in part for ischemic events. A PubMed (from January 1966 through January 2008) search of the literature in the English language was conducted using the terms »stroke«, »sex differences«, »risk factors«, »treatment« and »diagnostics«. Articles were selected on the basis of relevance.

Differences in Risk Factors

Stroke is the second cause of mortality in Croatia; in 2006 cerebrovascular diseases were the cause of death in 4706 of women (18.7%) and in 3369 of men (13.3%)[1]. It is a well known fact that genetic predisposition has great influence on risk for stroke and several genes for certain risks factors were identified. However lately a study has established that heritability of ischemic stroke is greater in women than in men: stroke in female family members was more frequent if other female family members previously suffered from it, while male family members were less likely to suffer from stroke. This difference was statistically significant even if traditional risk factors that could explain these gender differences were taken into consideration[2].

In some studies, women presented with a profile of higher baseline risk factors[3,4,5]. A study evaluating the prevalence of risk factors in patients with myocardial infarction and their association with recurrent ischemic events (including myocardial infarction, stroke and coronary death) showed that women have more risk factors,

and the risk of recurrent ischemic events in women increased with hypertension, diabetes and hypercholesterolemia, but for men, no increase in risk was detected with any risk factor[5].

Another study in patients undergoing coronary artery bypass graft surgery showed that risk factors significantly differ among sexes: women have hypertension and intracranial artery stenosis more frequently than men, while men are more likely to have hyperlipidemia, peripheral vascular disease, abdominal aortic aneurysm, severe carotid stenosis and severe aortic atherosclerosis[6]. (A study evaluating risk factors in middle aged (45–65 years) stroke patients showed that women had diabetes, hypertension and hypercholesterolemia significantly more often than men, while men had a history of ischemic heart disease, smoking and alcohol consumption more often than women[7]. Male stroke patients are more likely to have a history of ischemic heart disease, whereas female stroke patients are more likely to have hypertension and atrial fibrillation (AF); some studies found diabetes more commonly in women, others in men[4,8–12]. Men are more likely to smoke cigarettes, or to have been smokers previously in their lives than women[11].

A study designed to identify risk factors for cryptogenic stroke revealed that low levels of high density lipoprotein (HDL) cholesterol and high factor VII activity were more frequently present in women while low level of plasma folate, hypertension and current smoking were risk factors for crytpogenic stroke in men[13].

One study showed that women are more prone to cardioembolic strokes and men to atherothrombotic and lacunar strokes[14]. A study conducted in the Croatian population has shown that stroke is more frequent in men at 55–74 years of age whereas in women the highest frequency of stroke was found between 65 and 84 years of age[15]. The study also showed that small-vessel diseases are the leading cause of stroke in both sexes; in women cardioembolism takes second place and large-vessel disease third, whereas in men large-vessel disease is in the second place and cardioembolism in third[15].

An USA study found no sex difference in stroke subtype, infarction size or location in patients with ischemic stroke[16].

In some studies traditional risk factors (hypercholesterolemia, smoking, obesity) for stroke were analyzed only in women. During an 11 year follow-up of 28000 women, over 45 years of age, scientists have established that total cholesterol, LDL cholesterol, and total cholesterol to HDL cholesterol ratio are significantly associated with increased risk of ischemic stroke, increasing it up to two times[17].

Summary of studies that evaluated the prevalence of risk factors for cerebrovascular and cardiovascular diseases among women and men are shown in Table 1.

Smoking

It is a well known fact that smoking is a serious risk factor for stroke. During 9 years of follow-up researchers

TABLE 1
PREVALENCE OF RISK FACTORS FOR CEREBROVASCULAR AND CARDIOVASCULAR DISEASES AMONG WOMEN AND MEN

Risk factor	Women	Men	Reference
Inheritance	+		2
Atrial fibrillation	+		8,11,21
Low HDL cholesterol	+		13
Factor VII high activity	+		13,25
Hypercoagulable state	+		23
Migraine with aura	+		40,41
Intracranial stenosis	+		2,6
Peripheral artery disease		+	2,6
Ischemic heart disease		+	7,8,11
Smoking		+	6,7,11,13
Alcohol consumption		+	7
Carotid stenosis		+	2,6
Abdominal aortic aneurysm		+	2,6
Low folate		+	13
D-dimers		+	25
Diabetes mellitus	+	+*	5,7,8*
Hypertension	+	+*	5,6,7,8,11,13*
Hyperlipidemia	+*	+	2,6,5*

have found that smokers who smoked less than 15 cigarettes a day had a 1.93 times greater risk of stroke including a 2.15 times higher risk of intracerebral haematoma and a 1.7 times higher risk of subarachnoidal haemorrhage (SAH). In women who smoked more than 15 cigarettes a day, compared to women who never smoked, the risk was 3.39; 2.67 and 4.02 respectively[18].

Body mass index

Studies have shown that arterial wall stiffness index differs according to body mass index (BMI). Compared to women, men had higher arterial wall stiffness which can probably be attributed to the protective effect of female sex hormones since most of the examinees were of fertile age[19]. One study established a connection between BMI and ischemic but not hemorrhagic stroke in women: BMI higher than 30 kg/m² carries 1.5 times higher risk for any type of stroke, namely 1.7 times for ischemic and 0.8 time for hemorrhagic, in comparisons to women whose BMI was lower than 25 kg/m². However a satisfactory management of a patient's hypertension, diabetes and high cholesterol significantly lowers that risk[20].

Atrial fibrillation

Out of patients with atrial fibrillation, women have higher annual rates of ischemic stroke than men (3.5% women, 1.8% men); however, there was no significant difference in sex in 30-day mortality or annual rates of hemorrhage (1% of both minor and major hemorrhage within one-years follow-up)[21]. The authors of this study have concluded that the female sex is an independent risk fac-

tor for thromboembolism which goes in favour of introducing anticoagulant therapy in women with AF[21].

Another study has shown gender-related differences in patients with AF. Women were older, had a lower quality of life, more often had heart failure with preserved left ventricular systolic function, less frequently underwent electrical cardioversion and achieved rhythm control, and had a higher level of risk for stroke. However, prescription of oral anticoagulants was identical in both genders (65%) and so was the mortality[22]. Yet another study, which examined gender-related differences in warfarin treatment of patients with AF, showed that women were older than men, had more risk factors, experienced more overall (major and minor) hemorrhages and had a higher rate of thromboembolism[3].

Coagulation

It has been observed that women are more prone to a hypercoagulable state than men early after injury[23]. Possibly an underlying mechanism such as coagulation status is an important factor in patients with stroke as well. Differences in coagulation parametes have been observed between men and women: women with diabetes mellitus have abnormalities in euglobulin clot lysis time and increased plasminogen activator inhibitor-1[24]. Elevated levels of factor VIIa are associated with an increased risk of recurrent cardiac events in postinfarction women but not in men while D-dimers are more predictive in men for cardiac events[25]. These observations indicate possible gender-related differences in the pathophysiologic mechanisms of recurrent cardiac events.

Environmental factors

There is an interesting study that analyzed the effect of air pollution on stroke incidence in women in menopause. During a 4 year follow-up scientists monitored air pollution in 36 urban areas in the USA and they concluded that an increase in air pollution of 10 micrograms per cubic meter increased the risk of stroke 1.24 times and cerebrovascular and cardiovascular mortality rate 1.76 times[26].

Female hormones

In the past decade, HRT at menopause has been a subject of great debate, and many studies have dealt with the correlation between hormones, especially estrogen, and stroke. One study showed that the risk of stroke caused by non-cardioembolic etiology was increased in women with hypertension, diabetes, hyperlipidemia, a lifespan of ovarian activity that exceeded 34 years and the onset of menarche at 13 years of age or younger; and yet women with obesity were found to have a lower risk of stroke[27].

WHI (Women's Health Initiative) study examined the effect of combined HRT (estrogens plus progestins) and just estrogen therapy in women at menopause[28]. The segment of the study in which women received combined HRT was prematurely terminated (after 5.2 years) due to the fact that combined HRT showed a positive correla-tion with an increased risk for stroke, coronary heart disease, venous thromboembolism and breast cancer compared to women who were receiving placebo. The remaining segment of the study (women who were receiving only estrogen) did not show a positive correlation with an increased risk of cardiovascular diseases or breast cancer. The study also showed that HRT decreases the risk of bone fractures and rectal carcinoma. The study concluded that there is a need for individual approach in HRT, which should be given at early menopause and discontinued after a maximum of 5 years, and that special attention and more intense follow-up should be given to women with a positive family history of breast cancer, diagnosed coronary disease or a predisposition to deep venous thrombosis[28]. However, the authors of this study were criticized because the women in this study were relatively old, and the risk was calculated as relative rather than absolute, hence critics suggest that different results would have been obtained had younger, healthier women with a generally lower risk of stroke been included. Furthermore, this study did not take into consideration vasomotor symptoms, which cause a considerate number of postmenopausal women severe everyday difficulties. These menopausal symptoms can be aleviated by use of HRT, which can outweigh the relative long-term risks found in the WHI study[29]. This was tested and confirmed in a group of postmenopausal women: even though they have been well informed about the results of the WHI study and it's implications on their health, a number of women, especially those with risk factors for coronary disease, refused to terminate their HRT[30]. Another study showed that 87% of women discontinued their HRT after the publication of results from the WHI study, but due to various vasomotor symptoms (which occured in 85% of examinees) 26% of women restarted HRT[31].

Caution is necessary considering the fact that yet another double-blind randomised study found that estrogen is without benefitial effect in postmenopausal women who have suffered stroke, in fact women who were randomly assigned to receive estrogen therapy had a higher risk of fatal stroke and their nonfatal strokes were associated with slightly worse neurologic and functional deficits[32].

When all of these studies dealing with the correlation between HRT and stroke have been combined, it was concluded that HRT increases the relative risk of ischemic stroke and coronary incident as well as venous thromboembolism, but decreases the risk of fatal stroke[28,33]. It seems like female hormons play a significant protective role in women's life in their fertile age, since studies have shown that women aged 45 to 54 years have significantly higher odds of experiencing a stroke compared to men of the same age[34].

There was no increase in risk of either stroke or myocardial infarcton found in younger women which use oral contraceptives, regardless whether they used pills or contraceptive patches[35]. However, another study showed that women who used transdermal patches had a twice

increased risk of venous thrombombolism when compared to women who used contraceptive pills[36].

Migraine

Studies have shown that there is a correlation between headaches, namely migraine with aura, and stroke which is of great importance if we take into consideration the fact that the prevalence of migraine is far greater in women than in men[37,38]. One population based study examined the correlation between chronic unspecified headache and stroke and found that the risk of stroke in men who have had headaches during the past year is 4 times higher than in those without headaches, whereas that risk was only 2 times higher in men with headaches during the past 5 years. Among women, there was also a direct but statistically nonsignificant association between headache and the risk of stroke, thus the authors have concluded that chronic headache is an independent predictor of stroke among men and that it may be a marker of the underlying disease process leading to acute stroke seeing how the connection was strongest during a 1-year follow-up[39].

In a study including 3610 women with active migraine, 39.7% had migraine with aura; compared with women with no migraine history, these women had increased hazard ratios for stroke: 1.91 for ischemic stroke, 2.08 for myocardial infarction, 1.74 for coronary revascularization, 1.71 for angina, and 2.33 for death due to ischemic cardiovascular disease[40].

A similar study failed to find a correlation between migraine without aura or ordinary headache and ischemic or hemorrhagic stroke, but found a connection between migraine with aura and stroke; these women had a 1.71 times increased risk of ischemic stroke, even in women 55 years of age and younger. However, this is an increase in relative risk; in terms of absolute risk this means only 3.8 additional cases per year per 10000 women[41].

Women aged 15 to 49 years with probable migraine with aura have a 1.5 increased risk for stroke, and women who use oral contraceptives or smoke have even a 7 fold increased risk for stroke compared with women with probable migraine with aura who are non-smokers or do not use oral contraceptives[42]. Sub-analysis from the Women's Health Study revealed that women who have active migraine without aura do not have an increased risk for any cerebrovascular events, but women with active migraine with aura have a 2 fold increased risk for major cardiovascular disease and stroke compared with women with no migraine[43]. Since migraine has a complex pathophysiology, especially migraine with aura, which includes vascular mechanisms, the connection between migraine and stroke may have similar background[44,45].

Awareness of Stroke

Whether there are significant differences between males and females in terms of stroke is difficult to say.

However, studies have shown some really interesting and sometimes unexpected results.

First of all, studies have proved that general knowledge of stroke risk factors is rather poor. Epidemiological population studies in the USA which examined the knowledge of stroke risk factors and early signs of stroke have shown that the understanding of stroke has improved in the last decade: only 11% of women reported feeling uninformed about stroke compared to 23% of women in 1997. This change is more prominent in ethnical minorities (Hispanics and African American), which shows that the education about stroke should be directed primarily toward ethnical minorities[46].

Another study conducted in the USA in 2003 showed that only 26% of women, aged 65 and older, consider themselves well informed about stroke, even though that age group has the highest risk of stroke; very few women were able to properly identify signs of stroke: 39% mentioned one sided palsy and 29% stated speech disorder and inability to understand speech[47]. Twenty percent of women in that study reported being constantly worried that stroke could happen to them. A survey in the Croatian population showed that over 50% of examinees are aware that speech disorder, paresthesias in the limbs as well as weakness of the extremities and body parts are signs of acute stroke. Accordingly more than 50% of them stated stress, hypertension, smoking, high blood lipids and adiposity as stroke risk factors[48].

Diagnostics, Clinical Differences, Therapy, Outcome

Although there are clear guidelines for treatment of stroke[49,50], certain studies revealed that there are still differences in both diagnostic procedures and discharge destinations between male and female patients. A Canadian study found a statistically significant differences in hospital discharges of patients after having suffered a stroke[8]. Male patients were more likely than women to be discharged home, while female patients were more likely to be discharged to chronic care facilities. This study does not specify the physical state of the patients at the time of hospital discharge, still it leads us to believe that women were left with a greater neurological deficit and required constant care in an institution[8]. The observation in some studies that women seem to receive health care later than men (studies conducted in developed countries) seemed astonishing, however, this might be due to social differences which are still not eradicated in some countries, perhaps in more rural regions, but detailed epidemiological data in these studies are not available. The observation that women are not treated equally to men should be taken coutiously; certain epidemiological studies have posed this question, however, recent studies have proven the opposite, may we say fortunately for women. The fact that women are more often instutionalized after stroke, could also be partly due to social circumstances, since the data reagarding the disabilty after stroke are inconsistent.

A study performed in 7 European countries investigated demographic factors, risk factors, clinical presentation and 3-month outcome in patients with a first-in-a--lifetime stroke[9]. The study showed that, clinically, women in the acute stage were more likely to present with coma, paralysis, aphasia, inability to swallow and urinary incontinence, which would suggest a more severe stroke type. Amazingly brain imaging, Color Doppler of extra and intracranial arteries, echocardiogram and angiography were significantly less frequently performed in women than in men. After a 3-month follow-up women showed higher levels of disability and handicap than men, although no significant gender effect was observed on survival.

A study from Spain showed that women suffered from aphasic disorders, visual field disturbances and dysphagia more often than men, and women who survived stroke were more disabled at discharge[14]. Study from Israel showed no gender differences in clinical presentation or imaging studies, but the in-hospital mortality rate among women was higher as compared with men[7].

In a Canadian study, stroke symptoms at presentation were similar in women and men, except that women were more likely to present with headaches and were less likely to have brain stem or cerebellar symptoms; in this study, there were no sex differences in the use of neuroimaging, thrombolysis, antithrombotic therapy or consultations[51]. However, in studies analyzing vascular surgical mortality, unadjusted, all-cause 30-day mortality was higher in women than in men following coronary artery bypass graft procedure and primary stenting for acute myocardial infarction; on multivariate analysis female gender was not an independent risk factor[52,53]. Independent determinant of overall adverse outcomes and higher mortality rate in women after interventional treatment for acute myocardial infarction was observed, which was explained with a greater prevalence of traditional risk factors such as diabetes, hypertension and hyperlipidemia in women[12].

A study from Germany found no differences in diagnostic procedures performed at baseline and in follow-up management between men and women, there were also no differences in regard to the need for nursing support[54]. Analysis of stroke recovery and stroke-specific quality of life in USA showed that female stroke survivors had lower functional recovery and poorer quality of life three months post-discharge compared to men; these differences could not be explained by older age at stroke onset or other demographic or clinical characteristics[55]. In a Canadian study, mortality was similar in men and women but women were more likely to be discharged to long-term care facilities and had greater disability after 6 months[51].

An USA study found that a greater proportion of women presented with weakness than men but no difference was observed in presentation of other stroke symptoms such as numbness, visual deficits or language[16].

Differences also exist in stroke treatment and use of medication. When evaluating 90-day postdischarge use of aspirin and ticlopidine in stroke survivors aged 85 years or more, men were more likely than women to receive both drugs, however use of warfarin was similar for both sexes[8]. A German study revealed that women were significantly more likely to receive hypoglicemic drugs in the acute management period[54].

Early arrival to an emergency facilty is one of the major requirements for treatment with thrombolysis, yet a study from Germany found that women have a 10% lower chance of being admitted within the first 3 hours than men and this chance is further decreased in older women; however, there was no sex differences in the chance of being treated with thrombolysis if the patients were admitted within this time window[56]. In the time window between 0 and 3 hours, men had elevated mortality as compared with women but were approximately three times as likely to have good functional outcomes[57]. However, women were significantly more likely to benefit from rtPA compared with men in a therapy window between 0 and 6 hours[58]. Similarly, the PROACT-2 study of intra-arterial stroke thrombolysis with prourokinase has shown that women have 20% absolute benefit compared with men (10% absolute benefit)[59]. In contrast to these studies, a study from Switzerland has shown no differences between sex and recanalization or outcome after 3 months in patients treated with intra-arterials thrombolysis[60]. Observations from these studies need to be proved in future studies; sex may be an important factor for selection for thrombolysis especially in patients presenting at later time from symptom onset.

Women have worse survival and mortality rates compared with men in some studies[7,12,53,54] while in other studies men have worse mortality rates[8,23] and in some studies rates show no significant difference[10,52,61]. Consistent data are shown for disability: women are more disabled after suffering a stroke or other ischemic event[10,14,52,56].

Case fatality (deaths caused by cerebrovascular diseases among cases of acute stroke) for both ischemic stroke and all types of stroke combined was higher in men than in women, as was case mortality (deaths attributable to any cause among cases of acute stroke); however there was no difference in mortality caused by SAH[61].

Carotid Endarterectomy in Women and Differences in Plaque Composition

The existing literature provides conflicting evidence concerning the risks of carotid endarterectomy (CEA) in women as compared with men. The initial NASCET and ECST[62] studies have found that asymptomatic women benefit, in terms of postoperative results, from CEA less than asymptomatic men or symptomatic patients in general, however recent studies have shown that these differences are not clear enough to suggest that women shouldn't be surgically treated.

A recent study on 3422 CEA patients has shown that women were at higher risk for a postoperative TIA or stroke and for postoperative stroke or mortality[63]. This difference was visible only in asymptomatic women while there was no gender association for postoperative stroke or mortality for patients who were symptomatic. The authors of this study have concluded that although the combined TIA or stroke and stroke or mortality rates are higher in asymptomatic women as compared with men in the postoperative period, CEA is still appropriate in both women who are asymptomatic and women who are symptomatic but only if the postoperative TIA, stroke, and mortality rates are appreciably lower than in the natural history of medical management of these patients. Subgroup analysis in a study evaluating CEA in asymptomatic patients showed that women had a lower risk of ipsilateral ischemic stroke on medical treatment and a higher operative risk than did men, whereas CEA was beneficial in symptomatic severe carotid stenosis[64]. Another study found no difference in 30-day surgical mortality after CEA[52].

A study done on a sample of 6038 CEA patients (out of which 35% were women), showed that there was no significant gender difference in the perioperative risk of stroke or death, however, after a 2-year follow-up, women were more likely to have a stroke yet less likely to die[65]. Another study, which evaluated the perioperative risks of over 1200 CEA patients (out of which 39% were women) during a 21-year period, found that survival rates at 1.5 and 8 years were higher for asymptomatic and symptomatic women compared with men, thus concluding that CEA does not carry a higher level of risk for women[10]. Yet another study, examined the data collected over a period of 8 years, evaluating the outcome of 1298 CEA patients, and found that women were more likely to be asymptomatic than men but that there was no gender-difference in the frequency of postoperative cardiac (2.5% women, 1.5% men) or neurological events (1.6% women, 2.1% men); the postoperative stroke rate was 1.5% with no significant difference between men and women, and late recurrent stenosis developed in 1.5% of women and 0.8% of men, once again showing no significant gender-difference[11].

One other study, evaluating the arteriotomy closure after CEA, found that primary closure was significantly gender related (Dacron patch, 35 men and 30 women; venous patch, 108 men and 63 women; primary closure, 72 men and 11 women), as was the occurrence of microemboli during wound closure (women 2.5±0.6; men 1.0±0.2)[66]. Dacron patches were associated with significantly more microemboli than venous patches and venous patch closure had the lowest restenosis rate, thus the authors suggest that venous patch closure may be preferred for CEA[66].

One study found that women who have previously had stroke or a TIA have a somewhat increased perioperative risk (although not significantly), the stroke-free survival rate was not significantly different between genders and neither was the restenosis rate, but the use of hormone replacement therapy (HRT) showed a trend towards increasing 30-day and 5-year stroke rates[67]. These results go in favour of discontinuing HRT in case of stroke.

Based on all of this recent evidence, we could say that there are no gender-differences in perioperative risks of CEA.

Some studies have attempted to find an explanation for clinical differences in postoperative outcome between men and women in atherosclerotic carotid plaque phenotype. In women, atheromatous plaques (>40% fat) were less frequent (22% in women, 40% in men), contained less macrophages (11% women, 18% men) but more smooth muscle cells (38% women, 24% men)[68]. Also, compared with men, women had a lower plaque concentration of IL-8 and lower metalloproteinase-8 activity. The observed differences were most pronounced in asymptomatic women, who showed the most stabile plaques. Generally, a large proportion of plaques found in asymptomatic women had high smooth muscle cell content and high collagen content[68].

Microemboli can be found in various clinical cases, and more than 70% of symptomatic patients with carotid stenosis have positive embolic signals which can be detected by means of transcranial Doppler (TCD)[69]. Clinical studies have shown that, intraoperatively, microemboli are more common in patients with fibrous plaques but that the risk for cerebrovascular complications is greater in patients with atheromatous (lipid) plaques[70]. One study found that atheromatous plaques were more prevalent in patients with stroke and TIA compared with asymptomatic patients or patients with amaurosis fugax, also plaques of patients with TIA and stroke showed significantly higher levels of MMP-8, MMP-9 and interleukin-8[71].

Other studies have shown that the morphology of atherosclerotic plaques changes with aging; metalloproteinase-2 (MMP-2) activity was negatively and metalloproteinase 9 (MMP-9) activity positively related with age, furthermore plaques become more atheromatous and contain less smooth muscle cells with increasing age, and local inflammation and MMP-9 levels are increased with age in patients suffering from haemodynamically significant atherosclerotic lesions[72].

MMP-2 and MMP-9 levels were significantly higher in symptomatic patients with carotid artery stenosis who underwent CEA (the study included 67.5% symptomatic and 32.5% asymptomatic patients) as well as in patients with unstable plaques compared with those with stable plaques[73]. In addition, a strong association between elevated MMP-9 concentration (greater than 607 ng/mL) and the presence of macrophages in plaque was found. Measuring the concentration of these metalloproteinasas can help in identifying patients with an increased risk for stroke, especially in women, considering the fact that one study had found that the risk of postoperative microembolic signals was greater in women, patients not receiving antiplatelet therapy, and patients undergoing left-sided CEA[74].

Conclusions

Studies show that women are older when they suffer from stroke, myocardial infarction or other ischemic event. The distribution of risk factors such as hypertension, diabetes and hyperlipidemia between genders is inconsistent; men have a history of ischemic heart disease, vascular peripheral disease, carotid artery stenosis, aortic atherosclerosis, smoking and alcohol consumption more often than women while women more frequently suffer from cardioembolic strokes and men from atherothrombotic. Inconsistent are the data regarding the performance of diagnostic procedures: some studies have found no difference between sexes, and others found less procedures being performed in women. Recent studies found no gender difference whether CEA is appropriate in asymptomatic women therefore CEA in women is recommended equaly as in men. Differences observed between men and women regarding thrombolysis up to date still need further evaluation. Although data from observational or case control studies are appreciated as well, only large cohort studies can give us answers which can be implemented into treatment guidelines.

Finally we can conclude that gender differences do exist, and that they are not shaped soley by genetic factors but also by environmental and social influences.

R E F E R E N C E S

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MOŽDANI UDAR KOD ŽENA: KOLIKO SE ŽENE I MUŠKARCI RAZLIKUJU? PRIKAZ LITERATURE – DIJAGNOSTIKA, RAZLIKE U KLINIČKOJ SLICI, TERAPIJA I ISHOD

SAŽETAK

U ovom članku autori su prikupili podatke iz epidemioloških, opservacijskih, kontroliranih i kohortnih studija s ciljem utvrđivanja razlike između žena i muškaraca u odnosu na učestalost ishemijskih incidenata, uglavnom moždanog udara. Autori naglašavaju razlike koje postoje između žena i muškaraca u sociološkim i patofiziološkim značajkama a koje barem djelomično imaju ulogu u razvoju ishemijskih incidenata. Studije pokazuju da muškarci češće imaju ishemijsku bolest srca i češće su pušači i konzumenti alkohola dok žene obolijevaju od ishemijskih incidenata u starijoj dobi, češće imaju hipertenziju i fibrilaciju atrija. Žene se u akutnoj fazi moždanog udara klinički češće prezentiraju u komatoznom stanju, s plegijom, afazijom, poteškoćama gutanja i urinarnom inkontinencijom što sve upućuje na teži moždani udar. Žene također imaju težu razinu invalidnosti i onesposobljenosti u odnosu na muškarce, iako je stopa preživljavanja je ista. Premda postoje jasne smjernice za liječenje moždanog udara zapanjujuće je da postoje razlike u dijagnostičkim postupcima te mjestu upućivanja na daljnje liječenje ili smještaj nakon otpuštanja iz bolnice između žena i muškaraca.