Gender and Hormonal Factors in Relation to the Risk for Delayed Cerebral Ischemia After Subarachnoid Hemorrhage

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Introduction

Delayed cerebral ischemia (DCI) after aneurysmal subarachnoid hemorrhage (SAH) is associated with a worse outcome **1, 2**. In addition to WFNS grading and Fisher score, several new risk factors for the development of DCI have recently been identified **3**. Females, especially those who are postmenopausal, have a higher risk for aneurysm rupture and there is limited data on the role of sex and hormonal status in DCI. We investigated the relation between sex, menopausal status, DCI and delayed cerebral infarction.

Methods

Data on sex, menopausal status, DCI and delayed cerebral infarction were obtained from the SAHIT database (SAH International Trialists repository) **5**. Relationships between the above mentioned variables were examined with a generalized linear model. Risk differences for DCI and delayed cerebral infarcts between males and females were calculated. An additional model was examined in which women were split into two groups according to age

Results

Six prospective databases were selected with a total of **8,388 patients**. In the **univariate analysis, sex and postmenopausal status were significant predictors** for DCI and delayed cerebral infarction. **Adjusted analysis showed that postmenopausal females were at significant higher risk of DCI than males**. Also WFNS grade, hydrocephalus and treatment modality were associated with the risk of both DCI and delayed cerebral infaction.

Conclusions

Females who are older than 50 years have a higher risk of DCI than males. Other predictors that are associated with both DCI and delayed cerebral infarction are WFNS grade, hydrocephalus and treatment modality. These results can be used to optimize clinical prediction models.

Table 1: uni and multivariate analyses of predictors of DCI from the pooled data of six cohorts

Parameter	Univariate	Multivariate
Female gender	1.30 (1.13-1.49)	3.81 (0.60-24.39)
premenopausal	0.87 (0.74-1.02)	1.14 (0.76-1.72)
postmenopausal	1.69 (1.46-1.95)	1.51 (1.05-2.17)
Poor WFNS grade	1.28 (1.12-1.46)	2.08 (1.32-3.30)
Modified Fisher grade		
0	0.46 (0.24-0.87)	n/a
1	Reference	Reference
2	1.42 (1.18-1.70)	0.46 (0.16-1.28)
3	1.56 (1.26-1.95)	0.92 (0.33-2.56)
4	1.13 (0.93-1.38)	0.77 (0.27-2.17)
History of smoking	1.08 (0.84-1.40)	0.94 (0.68-1.29)
Hypertension	196.14 (154.04-249.73)	6.87 (4.61-10.25)
Hydrocephalus	1.50 (1.33-1.69)	1.52 (1.09-2.14)
Treatment modality		
surgery	Reference	Reference
endovascular	0.56 (0.46-0.68)	0.55 (0.37-0.82)
none	0.50 (0.35-0.71)	0.54 (0.20-1.45)

Table 2: uni and multivariare analyses of predictors of delayed cerebral infarctions from the pooled data of six cohorts

Parameter	Univariate	Multivariate
Female gender	1.21 (1.07-1.38)	1.24 (0.42-3.63)
premenopausal	1.10 (0.95-1.28)	1.03 (0.74-1.42)
postmenopausal	1.30 (1.14-1.50)	1.16 (0.87-1.54)
Poor WFNS grade	2.56 (2.27-2.89)	5.56 (4.21-7.35)
Modified Fisher grade		
0	0.44 (0.22-0.85)	n/a
1	Reference	Reference
2	1.35 (1.13-1.61)	1.27 (0.71-2.27)
3	0.91 (0.75-1.11)	1.18 (0.67-2.08)
4	1.53 (1.26-1.87)	1.98 (1.10-3.56)
History of smoking	1.14 (0.92-1.40)	1.17 (0.87-1.44)
Hypertension	1.31 (1.16-1.47)	1.10 (0.86-1.41)
Hydrocephalus	1.60 (1.42-1.79)	1.30 (1.00-1.69)
Treatment modality		
surgery	Reference	Reference
endovascular	2.60 (2.14-3.16)	1.73 (1.28-2.34)
none	0.83 (0.63-1.10)	0.39 (0.26-0.61)

Data are expressed as odds ratios (95% CI). Ref. reference, WFNS World Federation of Neurosurgical Societies, n/a not applicable

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