

Assessment of transcranial Doppler indices after MgSO₄ administration in severe preeclamptic women with neurologic symptoms

- TCD indices after magnesium sulfate in patients with complicated PE

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Purpose

To investigate the effect of intravenous MgSO₄ on maternal cerebral hemodynamics as well as the association between altered Doppler indices of the ophthalmic arteries and ocular lesions in patients with preeclampsia.

Introduction

Neurological symptoms indicating preeclampsia (PE) include headaches, scotomata, visual disturbances, and convulsions. Transcranial Doppler (TCD) can be used to detect maternal brain involvement in PE, as it is non-invasive and offers high sensitivity. It has been suggested that MgSO₄ likely exhibits its neuroprotective effects by decreasing the CPP and increasing the resistance index (RI) and pulsatile index (PI). This study aimed to assess the changes in cerebral hemodynamics in patients with PE using TCD after the infusion of MgSO₄. Further investigation was conducted on the changes in the TCD indices of the ophthalmic artery (OA) and the effect of MgSO₄ in patients with PE with ocular lesions.

Methods

After each of the 15 included patients was diagnosed with preeclampsia, MgSO₄ was infused followed by transcranial Doppler tests of the indices of the ophthalmic, anterior, middle, posterior cerebral, vertebral, and basilar arteries, followed by a second MgSO₄ infusion. The peak, mean, diastolic velocity, and pulsatile and resistance indices of each artery were automatically measured during testing. Based on the emergent data, the cerebral perfusion pressure, resistance-area product, and cerebral flow index were calculated.

Results

The cerebral perfusion pressure of the posterior cerebral arteries significantly decreased following the infusion of MgSO₄ ($p < 0.05$). Before the infusion of MgSO₄, cerebral perfusion pressure and cerebral flow index of the ophthalmic arteries were significantly increased ($p < 0.05$) in the preeclamptic pregnant patients with ocular lesions compared those without ocular lesions. After the infusion of MgSO₄, the cerebral perfusion pressure and cerebral flow index of both ophthalmic arteries were slightly decreased, but the difference was not significant.

► TCD indices of OA among ocular symptoms

		No ocular symptoms (N=7)	Ocular symptoms (N=8)	
		Mean ± SD	Mean ± SD	P-value
Rt. OA	MCV (cm/s)	22.14 ± 4.74	27.12 ± 4.73	0.063
	PI	1.07 ± 0.22	0.88 ± 0.21	0.111
	RI	0.63 ± 0.07	0.55 ± 0.07	0.077
	CPP	44.97 ± 13.74	67.81 ± 18.66	0.020*
	RAP	5.44 ± 1.48	4.76 ± 0.88	0.292
	CFI	8.70 ± 2.92	14.65 ± 4.90	0.015*
Lt. OA	MCV (cm/s)	21.42 ± 4.31	27.75 ± 7.79	0.080
	PI	1.13 ± 0.18	0.89 ± 0.25	0.063
	RI	0.65 ± 0.06	0.56 ± 0.09	0.067
	CPP	42.98 ± 13.06	63.62 ± 7.90	0.002*
	RAP	5.55 ± 1.20	4.78 ± 1.05	0.209
	CFI	8.27 ± 3.44	14.28 ± 5.57	0.028*

Value are presented as mean ± SD (standard deviation). CFI; cerebral flow index, CPP; cerebral perfusion pressure, Lt; left, MCV; mean cerebral velocity, OA; ophthalmic artery, PI; pulsatile index, RAP; resistance-area product, RI; resistance index, Rt; right, TCD; transcranial doppler.

► TCD indices of before and after IV MgSO₄ among ocular symptoms

		Before IV MgSO ₄ (N=8)	After IV MgSO ₄ (N=8)	
		Mean ± SD	Mean ± SD	P-value
Rt. OA	MCV (cm/s)	27.12 ± 4.73	25.00 ± 3.70	0.364
	PI	0.88 ± 0.21	0.91 ± 0.20	0.781
	RI	0.55 ± 0.07	0.57 ± 0.06	0.625
	CPP	67.81 ± 18.66	61.42 ± 13.68	0.397
	RAP	4.76 ± 0.88	5.04 ± 0.77	0.476
	CFI	14.65 ± 4.90	12.42 ± 3.20	0.187
Lt. OA	MCV (cm/s)	27.75 ± 7.79	23.12 ± 2.75	0.163
	PI	0.89 ± 0.25	0.97 ± 0.12	0.498
	RI	0.56 ± 0.09	0.59 ± 0.04	0.467
	CPP	63.62 ± 7.90	62.43 ± 12.25	0.808
	RAP	4.78 ± 1.05	5.41 ± 0.69	0.188
	CFI	14.28 ± 5.57	11.67 ± 2.79	0.136

Value are presented as mean ± SD (standard deviation). CFI; cerebral flow index, CPP; cerebral perfusion pressure, Lt; left, MCV; mean cerebral velocity, MgSO₄; magnesium sulfate, OA; ophthalmic artery, PI; pulsatile index, RAP; resistance-area product, RI; resistance index, Rt; right, TCD; transcranial doppler.

Conclusions

Altered Doppler indices following the infusion of MgSO₄ suggest significant changes in the hemodynamics of the posterior cerebral and ophthalmic arteries that are particularly related to the neurological signs and symptoms of women with preeclampsia. These findings may improve the understanding of the mechanism of the cerebral complications of preeclampsia. Advancing comprehension of these underlying mechanisms is postulated to play a pivotal role in the mitigation of hypertensive encephalopathy associated with preeclampsia.