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Use of intra-arterial dantrolene for the treatment of refractory cerebral vasospasm secondary to spontaneous subarachnoid hemorrhage

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Introduction

Cerebral vasospasm is one the most clinically significant sequelae of aneurysmal subarachnoid hemorrhage given its significant effects related to morbidity and mortality in this patient population. Among the treatment options for cerebral vasospasm, dantrolene has been of interest given its well tolerated side effect profile and plausible biological mechanism. We present a case of intra-arterial dantrolene injection for the treatment of refractory vasospasm secondary to rupture of an anterior communicating artery aneurysm.

Methods

A 63 year old female presented to the ER 3 days after the ictus of the "worst headache of her life", nausea and vomiting, and an episode of loss of consciousness for approximately 8 hours. She was a Hunt and Hess grade II and a modified Fisher grade III (Fig. 1). She underwent coiling of an anterior communicating artery aneurysm. During the her ICU stay, she developed severe, symptomatic cerebral vasospasm needing four angiographic interventions for intra-arterial calcium blocker injection. During her last intervention, 15 mg of intra-arterial datrolene were injected into the left internal carotid artery over 20 minutes and then the same procedure was performed on the right internal carotid artery. Blood pressure, heart rate and intracranial pressure were recorded.

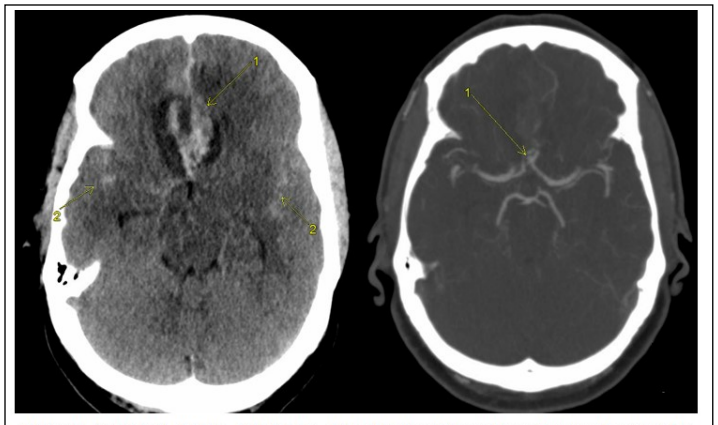

Figure 1: A) CT head showing a thick acute clot within the interhemispheric fissure with surrounding edema suggesting a subacute component to the bleed (Arrow 1). There is also evidence of subarachnoid blood within the bilateral sylvian fissures (Arrow 2). B) CT angiography demonstrating evidence of an aneurysm of the junction between the anterior communicating artery and the A1 segment of the left anterior cerebral artery (Arrow 1).

Results

Post-injection, significant improvement in vasospasm was observed (Fig. 2). There was resolution of vasospasms of the A2 and A3 branches as well as resolution of vasospasm of the superior division of the MCA and its branches. Mean systolic pressures were 130.36 mmHg, mean diastolic pressures were 74.69 mmHg and mean intracranial pressures were 26.72 (Fig. 3). Follow-up angiogram two days after the procedure showed sustained resolution of cerebral vasospasm. The patient did not develop cerebral vasospasm again.

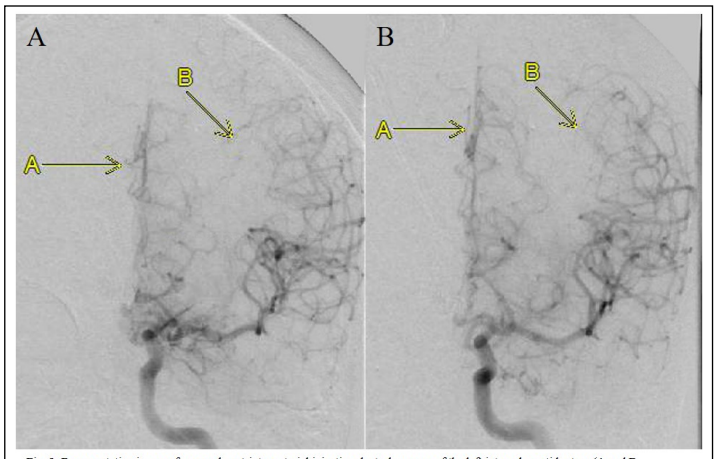

Fig. 2: Representative image of pre- and post-intra-arterial injection dantrolene runs of the left internal carotid artery (A and B, respectively). Notice the increase in diameter of the A2 and A3 branches (Arrow A) and of the superior division of the MCA branches (Arrows B) pre- and post-injection (A vs B).

Conclusions

Dantrolene's well-tolerated side-effect profile, plausible biological mechanism of action, and its demonstrated vasodilatory effects for the treatment of cerebral vasospasm secondary to subarachnoid hemorrhage make it a novel, promising agent for the treatment of cerebral vasospasm. This is another case to add to the extremely limited literature on this subject. More studies should be performed to study the role of intra-arterial dantrolene for the treatment of cerebral vasospasm.

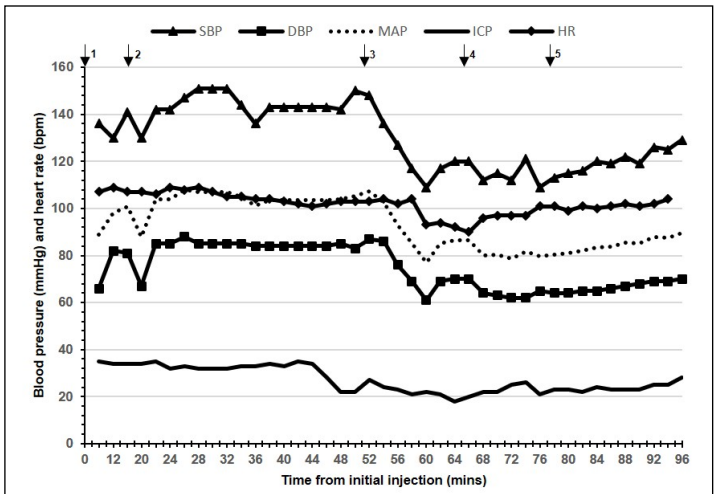

Fig. 3: Blood pressure and heart rate trends during intra-arterial vasodilator injections. Arrow 1 represents nicardipine injection to the left internal carotid artery. Arrow 2 represents dantrolene injection to the left internal carotid artery. Arrow 3 represents nicardipine injection to the left vertebral artery. Arrow 4 represents nicardipine injection to the right internal carotid artery. Arrow 5 represents dantrolene injection to the right internal carotid artery.

References

Majidi M, Grigoryan M, Tekle W. and Qureshi A. Intra -arterial Dantrolene for Refractory Cerebral Vasospasm After Aneurysmal Subarachnoid Hemorrhage. Neurocrit Care 92012) 17:245-249.

Learning Objectives

By the conclusion of this session, participants should be able to:

1) describe both the Hunt and Hess grade and the Modified Fisher scale and their clinical significance for aneurysmal subarachnoid hemorrhage.

2) discuss the mechanism of action of dantrolene and the basis for its role in cerebral vasospasm treatment

3) discuss a novel case report of the use of intra-arterial dantrolene in a patient with refractory cerebral vasospasm