Angiographic Outcome of Intra-arterial Milrinone on Cerebral Vasospasm after Subarachnoid Haemorrhage

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Introduction

The goal of this study was to determine whether there is a change in arterial diameter after intraarterial milrinone infusion for cerebral vasospasm secondary to subarachnoid haemorrhage (SAH).

Learning Objectives

By the conclusion of this session, participants should be able to: 1.
Describe the pathophysiology of cerebral vasospasm. 2. The
morbidity and mortality associated with cerebral vasospasm. 3.
The standard treatment of cerebral vasospasm. 4. Resume and
critics the literature about cerebral vasospasm. 5. Describe the indications of angioplasty for cerebral vasospasm.

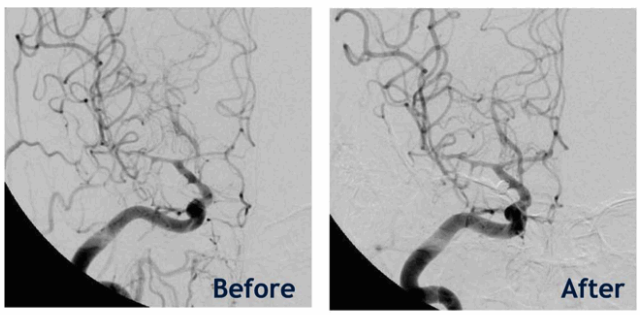
Methods

We retrospectively reviewed the procedure reports, clinical charts, CT and angiograms of patients with symptomatic cerebral vasospasm after SAH. Eight independent radiologists reviewed angiograms of cerebral vessels treated (or not) by intraarterial infusion of milrinone. The arterial diameter assessment was done in a blinded manner. . The study group included arteries that received milrinone with or without balloon angioplasty. Controls corresponded to arteries diagnosed with or without vasospasm and that did not receive milrinone. Changes in the arterial diameter were coded as 1. Changes in arterial diameter were pooled and compared for all reviewers.

Results

Twenty-one patients underwent angiograms for symptomatic vasospasm after SAH between October 2004 and August 2006. Nine cerebral arteries treated with intraarterial milrinone (Figure 1) and nine control arteries were assessed for the arterial diameter change. Improved arterial diameter was significantly more often seen ($p<0.0001$) in arteries after addition of milrinone (65/72, 90%) than in controls (8/72, 11%) (Figure 2).

Figure 1



Angiogram showed proximal and distal vasospasm. After intra-arterial injection of 10 mg of milrinone: improvement of vasospasm.

Figure 2

	Ob 1	Ob 2	Ob 3	Ob 4	Ob 5	Ob 6	Ob 7	Ob 8	Ob 9	Score total
Case 1	1	1	1	1	1	0	1	1	1	8
Case 2	1	1	1	1	1	1	1	1	1	9
Case 3	1	1	1	1	0	0	1	1	1	7
Case 4	1	1	1	1	1	1	1	1	1	9
Case 5	1	1	1	1	1	1	1	1	1	9
Case 6	1	1	1	1	1	1	1	1	1	9
Case 7	1	1	1	1	1	1	1	1	1	9
Case 8	1	0	0	1	1	0	1	0	0	4
Case 9	1	1	1	1	1	1	1	1	1	9
Control 1	0	1	1	0	0	0	0	0	0	2
Control 2	0	0	1	0	0	0	0	0	0	1
Control 3	0	0	0	0	0	0	0	0	0	0
Control 4	0	0	0	0	1	0	0	0	0	1
Control 5	0	0	0	0	1	0	0	0	0	1
Control 6	0	0	0	0	0	0	0	0	0	0
Control 7	0	0	0	0	0	0	0	0	0	0
Control 8	0	1	1	0	1	0	0	1	0	4
Control 9	0	0	1	0	0	0	0	0	0	1

Table of scores attributed by the 9 observers. 1= angiogram change and 0= no angiogram change.
The global inter-observer correlation assessed by Cronbach's alpha calculation is 0,95 (inferior limit of 95% Cronbach's alpha confidence = 0,92). The difference between the median score of the treated group and control group is 8 (CI 96% = 5 à 9, $p< 0,001$).

Conclusions

Intraarterial milrinone improves angiographic vasospasm after SAH. However, how long this effect persists is still unknown. Further prospective studies are warranted to asses the effect of milrinone on intracranial artery diameter as well as its clinical impact.

References:

1. Arakawa Y et al Milrinone for the treatment of cerebral vasospasm after subarachnoid hemorrhage: report of seven cases.Neurosurgery. 2001 Apr;48(4):723-8.
2. Khajavi K et al Prevention of chronic cerebral vasospasm in dogs with milrinone.Neurosurgery. 1997 Feb;40(2):354-62.
3. Haley EC Jr et al. A randomized controlled trial of high-dose intravenous nicardipine in aneurysmal subarachnoid hemorrhage. A report of the Cooperative Aneurysm Study. J Neurosurg. 1993.