

The Effect of Packed Red Blood Cell Transfusion on Cerebral Vasospasm Associated with Aneurysmal Subarachnoid Hemorrhage

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Learning Objectives

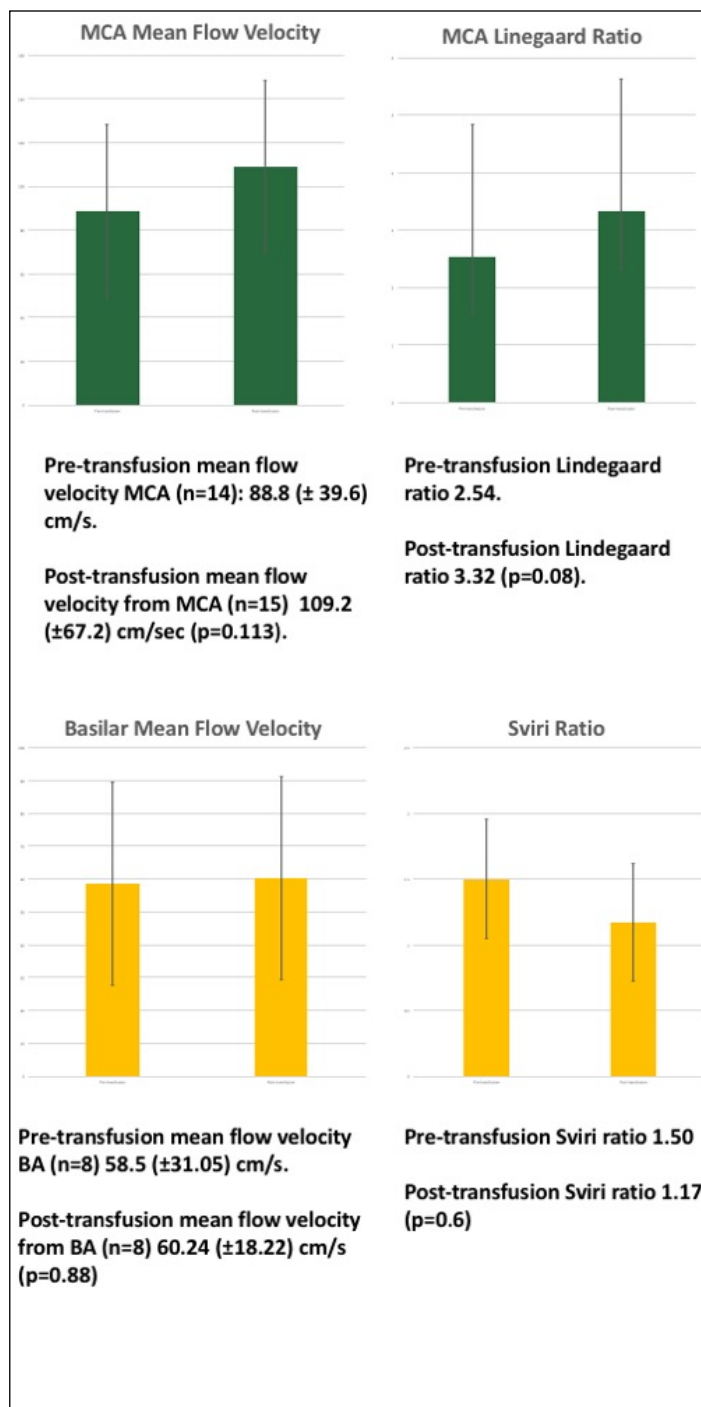
- 1) Describe the effects of transfusion on cerebral oxygen delivery
- 2) Explain how transfusion may exacerbate cerebral vasospasm by altering nitric oxide signalling
- 3) Understand that more liberal transfusion may not exacerbate vasospasm and may improve cerebral oxygen delivery.

Introduction

Anemia is common in patients with aneurysmal subarachnoid hemorrhage (SAH) and is associated with compromised cerebral oxygen delivery and metabolism (1,2). Despite historical liberal transfusion targets, there is no established evidence that transfusion improves outcome in anemic patients with SAH. Furthermore, conservative transfusion thresholds have been shown to be equivalent to more aggressive regimens in other disease states (3). Transfusion has been proposed to worsen cerebral vasospasm after SAH by disrupting the nitric oxide signalling pathway (4). Worsening oxygen delivery after transfusion has been noted in vasospastic arterial territories despite global improvement in cerebral oxygen delivery (5). Vasospastic vessels may be particularly prone to alterations in the nitric oxide signalling pathway provoked by transfusion.

Methods

Fifty-five patients between 19 and 70 years with aneurysmal SAH diagnosed by CT angiography and/or digital subtraction angiography were enrolled. Patients with the following were excluded: moribund prognosis, prior severe neurologic injury (severe TBI, prior stroke), non-aneurysmal source of hemorrhage, and shock or cardiac failure requiring inotropic support. Patients were transfused based on clinical grounds by the treating neurosurgeon. Transcranial Doppler ultrasonography was performed and mean flow velocities were obtained both immediately prior to transfusion and two hours after transfusion. Mean flow velocities were compared using the paired Student's t-test.



Results

Mean age was 59 years (range 44-72) and 88% of patients were women. Eight patients were transfused between days 4 and 22 post-hemorrhage (average 13.6 ± 7.7). Vasospasm worsened in six arteries in four patients receiving transfusion. Average pre-transfusion mean flow velocity (MFV) and from 14 MCAs was $88.8 (\pm 39.6)$ cm/sec. Average post-transfusion MFV from 15 MCAs was $109.2 (\pm 67.2)$ cm/sec. Paired t-test revealed no significant difference ($p=0.113$). Average pre-transfusion MFV from eight BAs was $58.5 (\pm 31.05)$ cm/sec. Average post-transfusion MFV in eight BAs was $60.24 (\pm 18.22)$ cm/sec. This difference was not statistically significant ($p=0.88$).

Conclusions

A trend towards progression of vasospasm was noted in the MCAs, though not statistically significant in this limited sample. The effect size, if present, is small. Overall, few patients (14.5%) require transfusion after SAH when compared to historical practice patterns.

References

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