

# Misunderstanding of Fisher's grouping system for computed tomography evaluation of aneurysmal subarachnoid haemorrhage

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Since I was appointed as chief editor in November 2018, at least five manuscripts on aneurysmal subarachnoid haemorrhage (SAH) have been submitted to our journal in which Fisher's grouping system on computed tomography (CT) imaging of aneurysmal SAH was misunderstood by the authors, especially Fisher group 4.

Fisher et al.<sup>1</sup> published their paper on aneurysmal SAH and its relationship to vasospasm. Severe SAH (group 3) is likely to cause symptomatic vasospasm. This prospective paper was published in 1980 when CT images were not as good as those available today. Their CT scanner was an EMI 105 head scanner (EMI Ltd, Middlesex, UK) with a 160×160 matrix, 60-second scan time (for one slice) and 16 mm thickness. In Fisher's grouping system (Table 1), group 1 has no SAH, group 2 has thin SAH (<1 mm) and group 3 has thicker (>1 mm) SAH. Thus, amongst groups 1–3, the severity of SAH is graded in a stepwise manner. However, group 4 is defined as diffuse (thin) or no SAH with ventricular haemorrhage and/or intracerebral haemorrhage. Fisher et al.<sup>1</sup> used 'diffuse' to mean very thin and diffusely distributed SAH which might not cause symptomatic vasospasm. SAH in Fisher group 4 was also described as the absence of significant amounts of subarachnoid blood (Figure 1).

The aforementioned authors have misunderstood Fisher group 4 as those patients with diffuse, thick SAH and/or ventricular haemorrhage and/or intracerebral haemorrhage on unenhanced CT imaging. Because the severity of SAH is not graded from group 1 to group 4 in Fisher's grouping system, it is incorrect, for example, to analyse the differences between two separate cohorts (medical treatment and local drug infusion for anti-spasm) statistically. It is likewise incorrect to call the severity of SAH on CT as a lower or higher Fisher grade. In the original article by Fisher et al., the terms 'group' and 'grade' were used interchangeably, but it is more appropriate to use 'group'. Fisher group 4 usually comprises <10–15% of all SAH patients.<sup>1–3</sup> If group 4 comprises >30–40% in a given paper, a misunderstanding of group 4 is highly likely. This misunderstanding of Fisher group 4 has been pointed out previously.<sup>3,4</sup>

In 2006, Frontera et al.<sup>2</sup> reported the modified Fisher grading system (Table 2) to take into account

**Table 1.** Original Fisher grouping system for aneurysmal subarachnoid haemorrhage.<sup>1</sup>

Group	Fisher grouping system
1	No blood detected
2	A diffuse deposition or thin layer with all vertical layers of blood <sup>a</sup> <1 mm thick
3	Localised clots and/or vertical layers of blood <sup>a</sup> ≥1 mm in thickness
4	Diffuse or no subarachnoid blood, but with intracerebral or intraventricular clots

<sup>a</sup>Inter-hemispheric fissure, insular cistern and ambient cistern.

of ventricular haemorrhage for the development of vasospasm. It is important to be cautious when using this system instead of the original Fisher's grouping system because the two systems are not similar. The original Fisher's grouping system has four groups, and group 1 has no SAH, while the modified Fisher's grading system has five grades, and grade 0 has no SAH. Furthermore, in the modified Fisher's grading system, grades 1 and 2 have the same thin SAH, and grades 3 and 4 have the same thick SAH. The only differences are the presence or absence of intraventricular haemorrhage between grades 1 and 2, and grades 3 and 4. In the modified Fisher's grading system, pure intracerebral or intraventricular haemorrhage without SAH cannot be expressed. It is apparent that the original Fisher group 4 is completely different from the modified Fisher grade 4. I believe that to use the term 'Frontera grading system' is more appropriate than to use the modified Fisher's grading system to avoid confusions presented here.

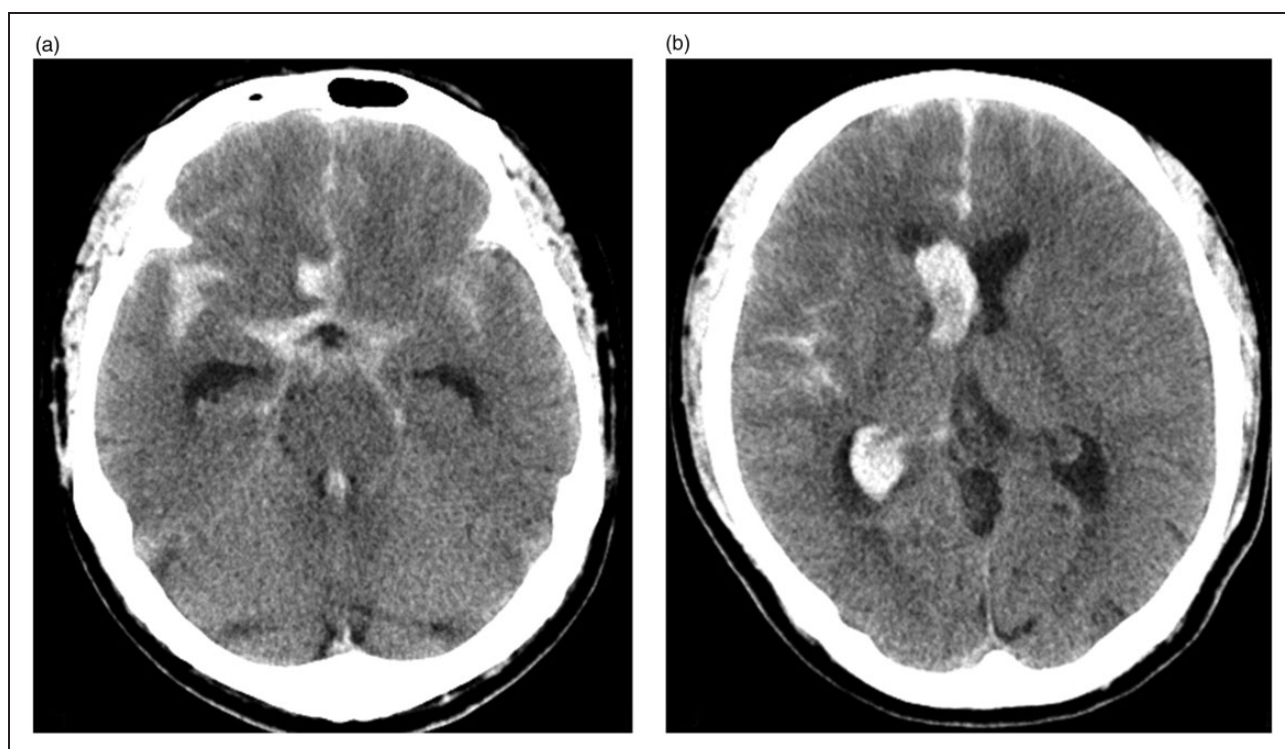
In order to compare the clinical results of the different treatments, proper use of Fisher's grouping system is mandatory. We have to recognise again that the severest SAH in Fisher's grouping system is group 3, not group 4, which is defined as diffuse (thin) or no

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**Figure 1.** A 49-year-old man with a ruptured anterior communicating aneurysm on day 2. Hunt and Kosnik grade 2<sup>6</sup> and Fisher group 3. (a and b) Plain computed tomography (CT) images show basal diffuse, thick subarachnoid haemorrhage with intraventricular and intracerebral haemorrhage. These CT images are often misunderstood as Fisher group 4.

**Table 2.** Modified Fisher grading system for aneurysmal SAH.<sup>2</sup>

Grade	Modified Fisher grading system (Frontera grading system)
0	No SAH or IVH
1	Focal or diffuse thin SAH, no IVH
2	Focal or diffuse thin SAH, with IVH
3	Focal or diffuse thick SAH, no IVH
4	Focal or diffuse thick SAH, with IVH

IVH: intraventricular haemorrhage; SAH: subarachnoid haemorrhage.

SAH with ventricular haemorrhage and/or intracerebral haemorrhage.

Before ending this editorial commentary, I would like to pay respect to Professor Fisher, a great neurologist. He was born in 1913 and passed away in 2012 at the age of 98. Surprisingly, this means that his seminal paper was written when he was 67-years old. He developed an interest in cerebral aneurysms and vasospasm only in his later career, whereupon, needless to say, he contributed vastly to the field of neurology.<sup>5</sup>


#### Funding

The author received no financial support for the research, authorship and/or publication of this article.

#### Declaration of conflicting interests

The author declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

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