

# Fisher revised scale for assessment of prognosis in patients with subarachnoid hemorrhage

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## ABSTRACT

The Fisher revised scale (FRS) presents an alternative for evaluating patients with subarachnoid hemorrhage (SAH). In this study, we compared the prognosis of patients with SAH and vasospasms (VSP). **Method:** This was a prospective study on patients with a diagnosis of aneurysmal SAH, 72 hours after the initial event. Sequential neurological examinations and Hunt and Hess (HaH) score were performed on the 1<sup>st</sup>, 7<sup>th</sup> and 14<sup>th</sup> days. Transcranial Doppler was used to assess vasospasms. **Results:** Out of the 24 patients studied, ten (41.66%) presented a delayed neurological deficit, such as diminished consciousness, decreased HaH score or death. The single patient classified as FS-1 did not have any delayed neurological deficit, while such deficits evolved in one patient out of five with FS-2 (20%); two out of seven with FS-3 (28.57%) and seven out of 11 with FS-4 (63.63%). **Conclusion:** Level three of the FS and FRS seemed to be compatible with regard to predicting the likelihood of progression to severe VSP.

**Key words:** subarachnoid hemorrhage, intracranial vasospasm, prognosis.

## Avaliação prognóstica com escala de Fisher modificada em pacientes com hemorragia subaracnóidea

## RESUMO

A escala revisada de Fisher (FRS) representa uma alternativa para avaliação de pacientes com hemorragia subaracnóidea (HSA). Neste estudo comparamos a evolução prognóstica referente ao vasoespasm (VSP) nos pacientes com HSA. **Método:** Estudo prospectivo em pacientes com diagnóstico de HSA, com 72 horas após o evento inicial. Escala de Hunt e Hess (HeH) foi realizada no 1º, 7º, 14º dia. Utilizamos Doppler transcraniano para avaliação de VSP. **Resultados:** Dos 24 pacientes estudados dez (41,66%) tiveram déficit neurológico tardio (DNT), como diminuição da consciência, grau de HeH ou morte. Um paciente de cinco classificados como FS-2 (20%), dois de sete pacientes com FS-3 (28,57%) e sete de 11 pacientes com FS-4 (63,63%) evoluíram com DNT. Para o FRS não encontramos piora neurológica precoce no paciente com FRS-0. **Conclusão:** O nível três da FS e FRS parecem ser comparáveis, quando se trata de prever a probabilidade de progressão para VSP grave.

**Palavras-Chave:** hemorragia subaracnóidea, vasoespasm intracraniano, prognóstico.

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Subarachnoid hemorrhage (SAH) due to ruptured aneurysm is a vascular disease that has been the target of several investigations and discussions because of its high

mortality and significant morbidity<sup>1-3</sup>. In 50 to 70% of patients with SAH, the presence of vasospasm (VSP) can be detected through cerebral angiography,

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which is closely related to worsening of cerebral ischemia in 19% to 46% of the patients<sup>4,5</sup>. According to the majority of studies, the maximum frequency of VSP can be seen between 6 and 8 days after the event. It rarely occurs more than 17 days after the event, with gradual resolution after around 2 to 4 weeks<sup>6</sup>.

The intensity of bleeding observed in the subarachnoid space on computed tomography (CT) has a strong relationship with the development of VSP and delayed neurological deficit (DND)<sup>5,7-9</sup>. The Fisher scale (FS), which correlates the amount of blood seen on CT and the risk of developing clinical VSP, is used extensively<sup>10</sup>. Its importance is evident in identifying patients at higher risk of developing clinical VSP, and indicates more aggressive and more accurate observation. It can be correlated with the presence of VSP detected by means of cerebral angiography or transcranial Doppler (TCD). This tomographic grading is divided into four groups, such that grade 3 is most related to the presence of VSP both clinically and through angiography. Despite identification of patients with dense SAH (FS-3), which has a high chance of progressing to worsened cerebral ischemia, FS does not provide differentiation between the prognoses for intraventricular hemorrhage (IVH) and parenchymal hemorrhage (IPH), which are both classified as grade 4. Although the presence of dense hemorrhage in the subarachnoid space is the best predictor of VSP, it is important to evaluate these two clinical entities (IVH and IPH) separately, since SAH associated with IVH is more related to worsening of VSP and cerebral ischemia than is SAH with IPH<sup>4,11</sup>.

Claassen et al.<sup>12</sup> proposed a new scale to assess CT on patients with SAH and identify patients with higher risk of VSP and DND. Moreover, they evaluated whether the presence of blood in both lateral ventricles had any significant value in predicting occurrences of clinical VSP. The proposed scale is divided into five grades, with a progressive increase in the chance of developing worsening of cerebral ischemia in each subsequent grade. This was named the Fisher revised scale (FRS) (Table 1). In this paper, we evaluated the CT findings from patients with SAH according to FS and FRS and correlated them with neurological worsening and VSP.

**Table 1.** Fisher Revised Scale.

Grade 0	No SAH or IVH <sup>1</sup>
Grade 1	Minimal/thin SAH, no IVH in either lateral ventricle
Grade 2	Minimal/thin SAH, with IVH in both lateral ventricles
Grade 3	Dense SAH,* no IVH in either lateral ventricle
Grade 4	Dense SAH,* with IVH in both lateral ventricles

<sup>1</sup>Intraventricular hemorrhage; \*Completely filling  $\geq 1$  cistern or fissure. SAH: subarachnoid hemorrhage; IVH: intraventricular hemorrhage.

## METHOD

We conducted a prospective study on patients admitted to our Emergency Unit between January and December 2008. We included in the study all patients diagnosed with non-traumatic SAH (determined using CT or CSF) for whom the diagnosis was given not more than 72 hours after the hemorrhagic event. We excluded from the study all patients who were treated more than 72 hours after the event because the sensitivity of the CT examination reduces to less than 80% after this period.

To compare the effectiveness between the two proposed scales, the first CT scan was evaluated by the same examiner, with grading according to FS and FRS. Sequential neurological examinations were performed using the Glasgow Coma Scale (GCS) and the Hunt and Hess (HaH) score on the 1<sup>st</sup>, 7<sup>th</sup> and 14<sup>th</sup> days, or when there was worsening of neurological status, in order to confirm the presence of DND. In such cases, a CT scan was always performed to rule out other complications (rebleeding or hydrocephalus) and a TCD was done to confirm the relationship between symptoms and VSP.

## RESULTS

We studied 24 patients, consisting of five males (20.83%) and 19 females (79.16%), with a mean age of  $53.75 \pm 11.21$  years and minimum and maximum of 37 and 83 years. Among this total of 24 patients, ten (41.66%) had DND (decreased level of consciousness, decreased HaH score or death) by the fourteenth day of hospitalization. Of these, one patient was graded as FS-1, five as FS-2, seven as FS-3 and 11 as FS-4. Regarding FRS, we found one patient graded as FRS-0, six patients as FRS-1, no patients as FRS-2, 11 patients as FRS-3 and six patients as FRS-4.

Our second step was to observe the number of patients with early clinical deterioration in each subgroup, graded according to FS and FRS, and patients who presented diminished GCS, worsening of Hunt & Hess score or death over the first 14 days of hospitalization. We then evaluated each subgroup of the scales, in order to better evaluate the risk of clinical VSP with DND. From observation of these subgroups of the two scales, the numbers and percentage of subjects who developed worsening of neurological symptoms were as follows: no patient classified as F1-1 (0%), one patient out of five graded as FS-2 (20%), two out of seven patients graded as FS-3 (28.57%) and seven out of 11 patients graded as FS-4 (63.63%) evolved with DND (Table 2). For the FRS, we did not find any early neurological worsening in the patient graded as FRS-0. DND was found in one patient out of six with FRS-1 (16.6%), four out of 11 with FRS-3 (36.6%) and five out of six with FRS-4 (83.3%) (Table 3).

**Table 2.** Distribution of patients according to subgroups in Fisher Scale with Delayed Neurological Deficit (DND).

Fisher	Criteria	Patients % (n)	Frequency % (n)
			DND
1	No blood detected	4.1% (1)	0% (0/1)
2	Diffuse deposition of thin layer with all vertical layers of blood less than 1 mm thick	20.8% (5)	20% (1/5)
3	Localized clots and/or vertical layers of blood 1 mm or more in thickness	29.1 (7)	28% (2/7)
4	Intracerebral or intraventricular with diffuse or no subarachnoid blood	45.8 (11)	63% (7/11)
Total number of patients		100% (24)	41.6% (10/24)

**Table 3.** Distribution of patients according to subgroups in Fisher Revised Scale with Delayed Neurological Deficit (DND).

Fisher Revised	Criteria	Patients % (n)	Frequency % (n)
			DND
0	No SAH or IVH	4.1% (1)	0% (0/1)
1	Minimal/thin SAH, no IVH in either lateral ventricle	25% (6)	16.6% (1/6)
2	Minimal/thin SAH, with IVH in both lateral ventricles	0% (0)	–
3	Thick SAH,* no IVH in either lateral ventricle	45.8% (11)	36.6% (4/11)
4	Thick SAH,* with IVH in both lateral ventricles	25% (6)	83.3% (5/6)
Total number of patients		100% (24)	41.6% (10/24)

\*Completely filling  $\geq 1$  cistern or fissure; SAH: subarachnoid hemorrhage; IVH: intraventricular hemorrhage.

## DISCUSSION

We observed that DND occurred in 41.66% of the patients, which is in accordance with published data in the literature, which ranges from 19% to 46%<sup>5,6,9,10</sup>. For data assessed using FS, we observed that there was a high frequency of patients graded as FS-4, which evolved with DND up to the fourteenth day (63.63%). This finding conflicts with the original work developed by Fisher, who showed a low risk of developing VSP. Thus, we question whether the IVH (without specifying the type and location of IVH) assessed by Fisher as having a low association with DND would not be a factor contributing to VSP and DND, as seen in the revised scale of Claassen et al.<sup>12</sup>.

Differences in results may occur because the FS-4 does not specify the type of IVH or IPH. We graded a patient with mild bleeding in one of the lateral ventricles in the same way as we graded another patient with bilateral hemorrhage. FS-4 does not specify the associations between HIV and the presence of blood in the cerebral fissures and cisterns: we classified one patient with dense SAH in the same way as another patient with thin SAH, just because they had IVH or IPH.

When we assessed the FRS, we observed a correlation with the data obtained by Claassen et al.<sup>12</sup>. Among the six patients graded FRS-4, five (83.33%) had DND. This finding shows that there is a basic difference between the two scales: the FRS correlates the presence of dense SAH with bilateral IVH or not. Thus, the FRS clarifies the worsening of the prognosis according to the in-

creasing grade. Claassen et al.<sup>12</sup> had a lower frequency (40.42%) of patients with DND classified as FRS-4 than we found in our work. These lower values may be due to achieving a greater number of serial CT scans, with a greater chance of excluding patients who developed neurological worsening for reasons (rebleeding or hydrocephalus) other than the VSP.

Making an analogy between two grades that are relatively similar, we compared FS and FRS grade 3. In our study, two out of seven patients graded as FS-3 (28.57%) progressed with DND and four out of 11 patients graded as FRS-3 (36.36%) progressed with DND. From these data, it can be seen that the FRS may be better at identifying patients who are at risk of developing clinical VSP and neurological worsening. This finding is possibly due to the greater capacity of FRS-3 to detect patients with dense SAH with some degree of IVH that is not bilateral but is more likely to develop DND, while FS-3 excludes any possibility of the presence of blood in the lateral ventricles. If there was blood in the ventricles, even if there was dense SAH, a grade of FS-4 would indicate a lower chance of VSP, in comparison with FS-3. However, this association seems stronger than dense SAH alone for indicating greater risk of DND. In another study on another change in the Fisher scale, there was higher incidence of vasospasm in patients with diffuse cisternal and ventricular hemorrhage, while mortality was higher among patients with ventricular hemorrhage and intracerebral hematoma<sup>13</sup>. These studies on changes to the

Fisher scale indicate that there is a need for adjustments in order to achieve greater clinical correlation.

The FRS is a simple classification method that appears to have greater correlation with DND than does FS up to the fourteenth day. This statement is most consistent when comparing grades 3 and 4 of the two scales. The presence of blood in both lateral ventricles was important for diagnosing these patients with poor prognosis especially when we have a thick SAH.

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