

Improved Inter-rater Reliability for SAH CT Grading Scales through Application of a Formal Definition of Clot Thickness

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Background

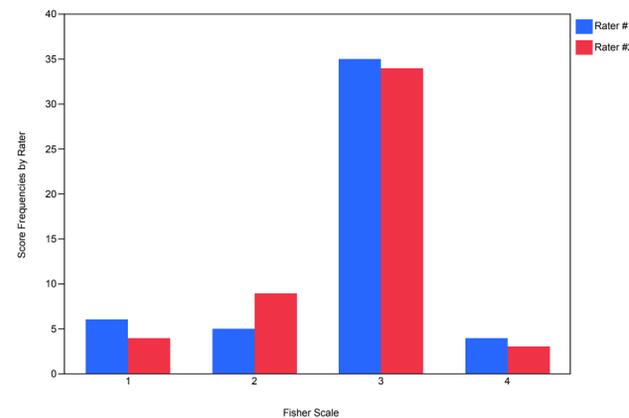
- Various scales have been devised for the prediction of vasospasm following aneurysmal rupture.
- Especially prominent in these scales is their reliance upon a subjective assessment of clot thickness which introduces variability in grading across raters.
- The current study seeks to compare the inter-rater reliability of the traditional Fisher and newer "Frontera" scale (Modified Fisher) when a rigid definition of thick clot is employed.

Methods

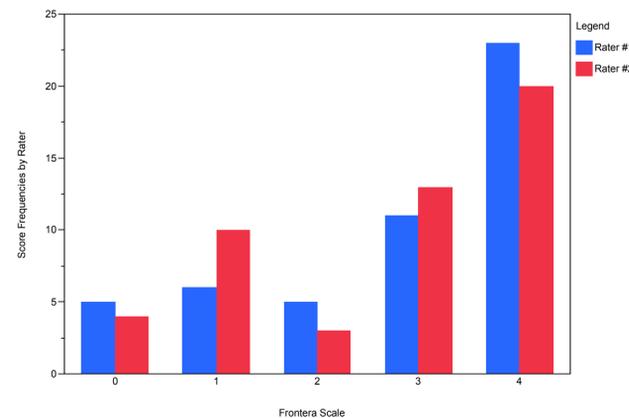
- 50 cases of subarachnoid hemorrhage were randomly selected from our radiographic archives.
- Initial head CTs were independently reviewed by two raters (neurocritical care fellows) and a score for both the Fisher and Frontera scale was assigned to each study.
- The following criteria were established to characterize thick clot:
 - hemorrhage in any major cistern appearing on two contiguous slices;
 - hemorrhage occupying > 50% of any major cistern on a single cut;
 - hemorrhage with a density approximating that of bone.
- Hemorrhage was scored as "thick" if any two of the three criteria were met.
- The degree of agreement in scores between raters was then assessed by way of Cohen's Kappa for inter-rater reliability.
- The Kappa statistic was applied to the data set recorded for each scale. These results were then compared to those of Kramer et. al.

Results

Score Frequencies for Fisher Scale



Score Frequencies for Frontera Scale



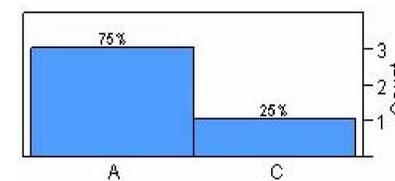
Fisher Scale	Frontera Scale
Study $\kappa = 0.84$	Study $\kappa = 0.72$
Historic $\kappa = 0.45$	Historic $\kappa = 0.59$

The Kappa statistic was applied to the data set recorded for each scale to measure inter-observer agreement. These results were then compared to the "Historic" results reported by Kramer et. al.

Rater discrepancy types & frequencies:

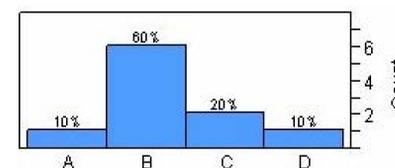
A	+/- SAH
B	+/- IVH
C	Thin vs. Thick SAH
D	Both thin vs. Thick SAH & +/- IVH

Fisher Scale

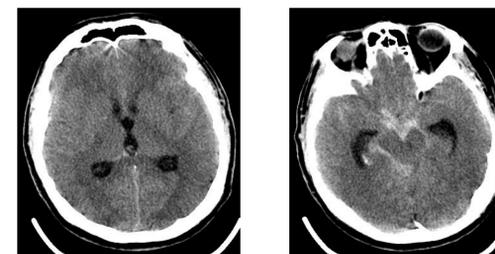


46/50 (92%) of responses were identical between raters

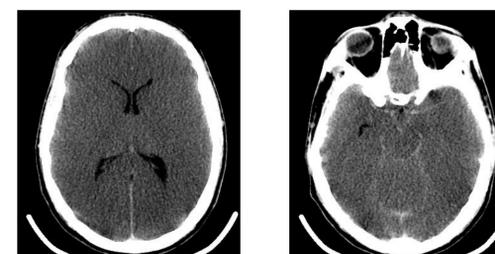
Frontera Scale



40/50 (80%) of responses were identical between raters



Example #1: SAH graded as Fisher 3, Frontera 4
 Note: clot occupies majority of basal cisterns



Example #2: SAH graded as Fisher 2, Frontera 1
 Note: clot outlines but does not fill cisterns

Discussion

- For both the Fisher and Frontera scales, a degree of inter-rater reliability superior to that reported by A.H. Kramer et. al. was demonstrated
- These kappa values reflect the use of a stringent definition for thick subarachnoid hemorrhage
- the majority of discrepancies between our raters involved the assessment of intraventricular hemorrhage as opposed to clot thickness.
- Inter-rater reliability observed for the fisher scale was markedly improved with use of our definition for subarachnoid clot.

Limitations

Limitations of the current study include a relatively small n (50 subjects) and the use of only two raters with similar training (TJUH) for CT evaluation.

Summary

With the use of a stringent definition for thick subarachnoid hemorrhage, an assessment of subarachnoid clot burden can be made that shows a high degree of reliability across observers. Further study will be necessary to confirm this finding over a greater spectrum of raters as well as to ensure that there is no unfavourable impact upon test specificity.

References

- Kramer AH, Hehir M, Nathan B, Gress D, Dumont AS, Kassell NF, et al: A comparison of 3 radiographic scales for the prediction of delayed ischemia and prognosis following subarachnoid hemorrhage. J Neurosurg 109:199-207, 2008
- Frontera JA, Claassen J, Schmidt JM, Wartenberg KE, Temes R, Connolly ES Jr, MacDonald RL, Mayer SA.: Prediction of symptomatic vasospasm after subarachnoid hemorrhage: The Modified Fisher Scale. Neurosurgery. 2006 Jul;59(1):21-7