CORRESPONDENCE

Extended analysis of the spot sign score's performance

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We have read with great interest Becker and Tirschwell's commentary (Stroke: 'Spotting' patients at the highest risk of hematoma growth. *Nat. Rev. Neurol.* **5,** 526–528; 2009)[1] on our work relating to the use of the CT angiography spot sign and the 'spot sign score' in the selection of patients with primary intracerebral hemorrhage for early hemostatic therapy.[2] Here, we provide answers to the questions raised in their commentary regarding the sensitivity and specificity of each spot sign score group in our study for the prediction of hematoma expansion and, in addition, poor clinical outcome (Table 1).

Becker and Tirschwell's group was the first to recognize that the presence of contrast extravasation on CT angiography was a strong predictor of mortality in patients with primary intracerebral hemorrhage,[3] which has been corroborated by other groups.[4,5] Moreover, subsequent studies have also associated the presence of contrast extravasation on CT angiography with hematoma expansion and poor clinical outcome.[2,4–10]

Interestingly, receiver operating characteristic analysis performed on the data from our study demonstrates that the maximum operating point is reached at a spot sign score ≥1 for the prediction of both hematoma expansion and poor clinical outcome. This finding suggests that all patients with spot signs might merit treatment with early hemostatic therapy, regardless of the spot sign score. However, we believe that the role of the spot sign score in the selection of patients for early hemostatic therapy needs to be fully explored in future randomized clinical trials.

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Table 1 | The spot sign score in primary intracerebral hemorrhage

Spot sign score*	Hematoma expansion (95% CI)‡		Poor clinical outcome (95% CI)§	
	Sensitivity	*Specificity*	*Sensitivity*	*Specificity*
≥0	100 (93.6–100)	0 (0–1.2)	100 (98.8–100)	0 (0–1.4)
≥1	87.5 (75.9–94.8)	92.9 (89.5–95.5)	33.7 (28.4–39.2)	89 (84.6–95.2)
≥2	76.8 (63.6–87)	96.8 (94.2–98.4)	26.9 (22–32.2)	93.2 (89.4–95.9)
≥3	60.7 (46.8–73.5)	99.7 (98.2–100)	15.2 (11.4–19.7)	97 (94.1–98.7)
≥4	30.4 (18.8–44.1)	100 (98.8–100)	6.5 (4–9.8)	99.2 (97.3–99.9)

*A score of zero indicated that no spot sign was identified on the CT angiogram. ‡Hematoma expansion was defined as an increase >30% or >6 ml of the initial intracerebral hemorrhage volume. §Poor clinical outcome was defined as a modified Rankin Scale score ≥4 at 3 month follow-up.