changes on CT scans of acute stroke

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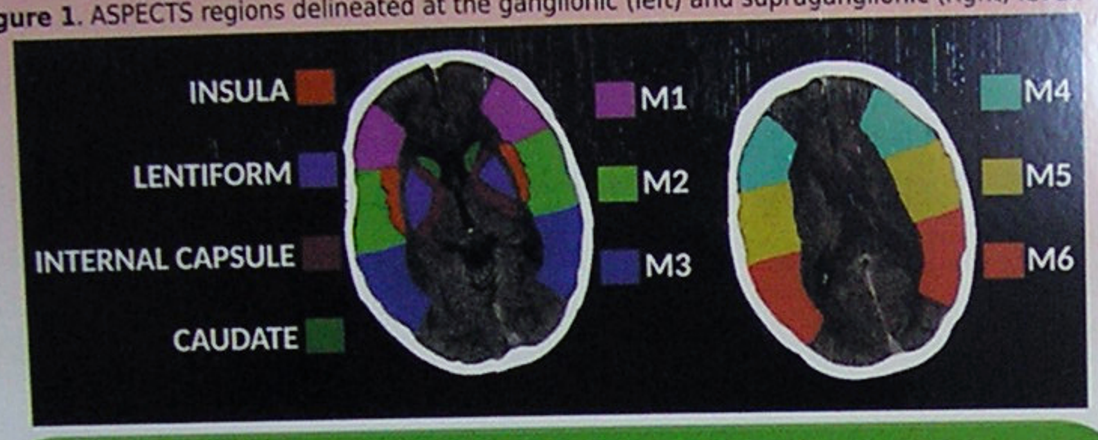
Background

The Alberta Stroke Program Early CT score (**ASPECTS**) is an established 10-point quantitative topographic CT scan score to reliably assess early ischemic changes (e.g parenchymal hypo-attenuation and focal swelling) on plain CTs of acute stroke patients (Fig. 1). ASPECTS is able to predict outcome and risk of symptomatic ICH following thrombolysis. However, the interpretation of a CT scan of acute ischemic stroke patients in an acute setting is challenging.
Here, we compare the performance of a standardised and fully automated algorithm **e-ASPECTS** (Brainomix, www.brainomix.com) with 3 stroke experts.

Figure 1. ASPECTS regions delineated at the ganglionic (left) and supraganglionic (right) level.



Methods

Patients :
- N = 132, acute stroke
- Baseline non-contrast enhanced CT

e-ASPECTS :
- Standardised, fully automated ASPECTS scoring tool
- Input: DICOM format CT scan
- 3D registration/segmentation (Fig. 1), machine learning techniques and scoring module
- Output: ASPECTS score and damaged regions (Fig. 2)

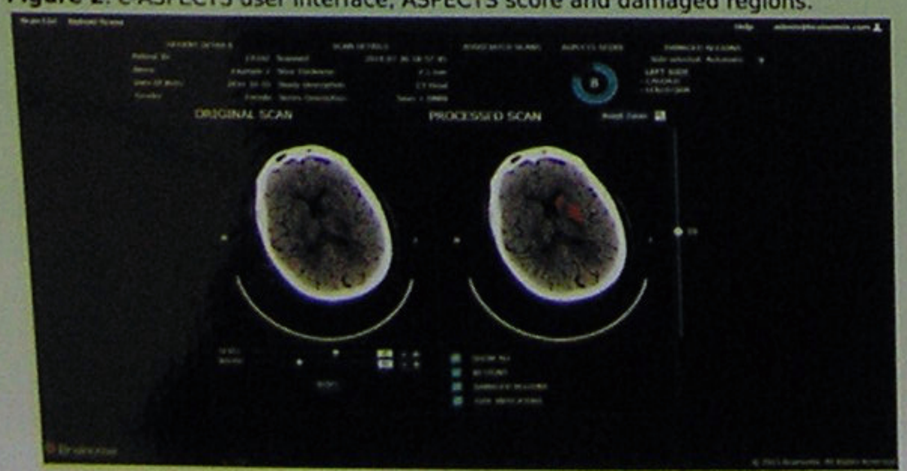
Stroke physicians :
- Blinded to any clinical information
- 3 stroke experts.
- Ground truth : follow-up CT scan (24 hours post baseline)

Analyses :
- Non-inferiority study
- Sensitivity and specificity were calculated over all regions for e-ASPECTS, and for the 3 experts.
- Mean error score = mean [e-ASPECTS - ground truth ASPECTS]

Table 1. Patient characteristics

Patient characteristic	N	Mean (SD) / n/N (%)
Age (years)	129	69.8 (12.9)
Admission mRS	130	3.9 (1.1)
Admission NIHSS	132	11.8 (6.8)
Time between onset and CT (minutes)	131	146.4 (124.3)
ASPECTS score ground truth	132	7.7 (2.0)
ASPECTS score eASPECTS	132	8.8 (1.6)
Male		71/129 (55.0%)
Type - PACI		58/119 (48.7%)
Side - Right		56/132 (42.4%)

Figure 2. e-ASPECTS user interface, ASPECTS score and damaged regions.



Results

- Mean error score for e-ASPECTS was +0.84 (see Fig. 4)
- Mean error score for the three experts were +1.24, -0.73 and +1.13

Figure 3. ROC analyses for e-ASPECTS and stroke experts

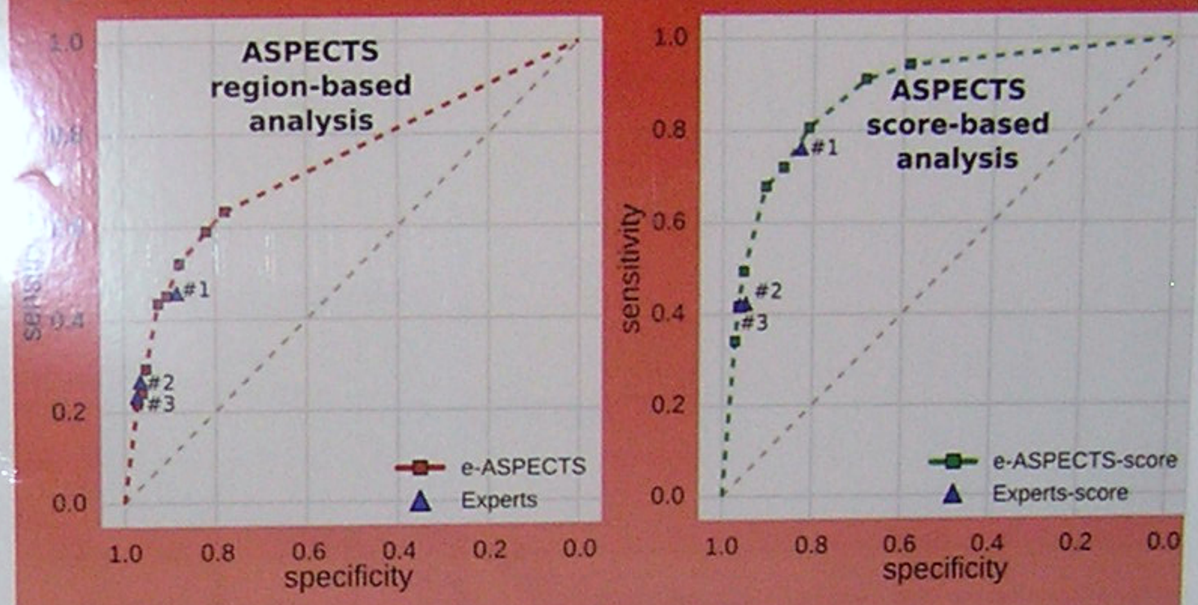
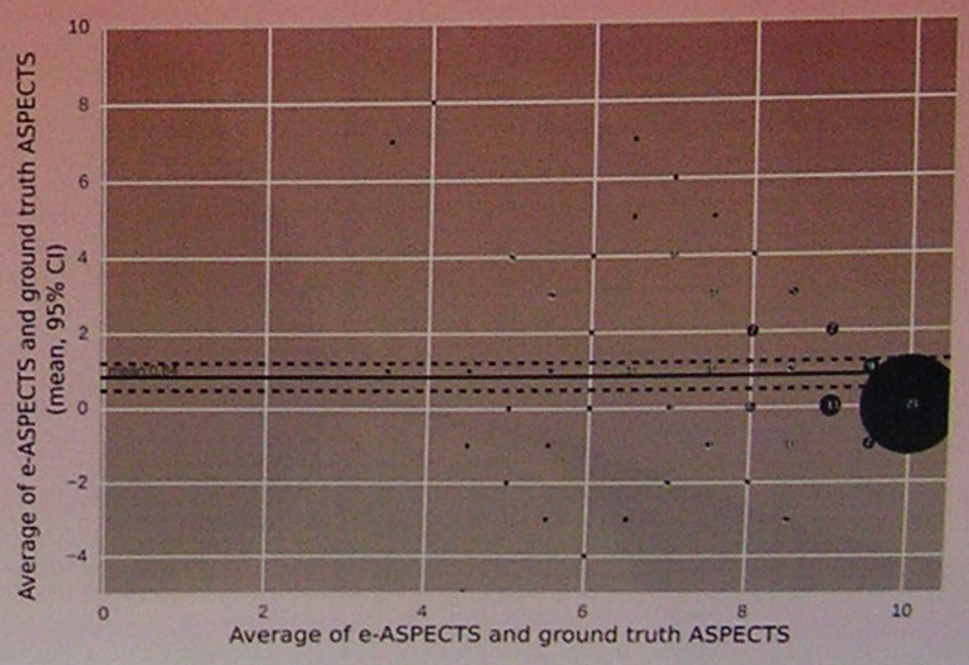


Figure 4. Bland-Altman plot



Conclusion

- e-ASPECTS is statistically non-inferior and equivalent to three neuroradiology experts.
- e-ASPECTS shows 88% precision for identifying acute ischemic stroke on CT scan.

References

1- AJNR, 22:1534-1542, September 2001
2- The Lancet, Volume 355, May 13 2000
3- CMAJ, 172 (10), May 10 2005