DEFINING HYDROCEPHALUS AFTER ANEURYSMAL SUBARACHNOID HAEMORRHAGE

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SUMMARY

- A significant proportion of aSAH patients undergo CSF diversion without evidence of objective hydrocephalus.
- Bicaudex index hydrocephalus thresholds may aid in the clinical decision making in patient selection for CSF diversion.
- WFNS grade does not itself influence the degree of ventricular enlargement. However, poor WFNS grade is an independent factor associated with CSF diversion.

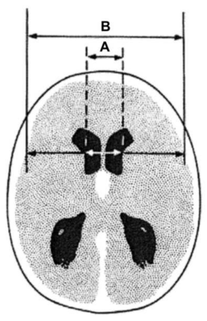
INTRODUCTION & AIM

- **There is no universally accepted definition of hydrocephalus in aSAH**.
- A number of patients may undergo CSF diversion **without clear indication**.
- CSF diversion is usually in the form of an **external ventricular drain (EVD)**.
- EVDs are associated with a **high morbidity** - 20% risk of infection, up to 13-40% risk of haemorrhage and 12-60% risk of misplacement [1,2].
- It is important to therefore consider the right patient for this procedure.
- A **simple imaging metric** to define hydrocephalus in aSAH would be useful.
- Previous efforts have used the **bicaudate index** - though with numerous limitations [3].

The aim of this study was to derive and test a threshold bicaudate index value above which CSF diversion should be considered.

METHODS

- **Review of prospective single-centre adult (≥16 years) aSAH database:**
  - **Derivation group (2009-2015):** WFNS grade 1-2 on referral, clinical deterioration, repeat CT brain, treatment with CSF diversion with 24 hours.
  - **Test group (2016):** WFNS grade 2-5 patients.
  - **Excluded**: previous SAH, ICH causing mass effect and ventricular distortion.
- **Bicaudate index (BCI) measurements:**
  - Two authors (MW, SM) measured the BCI to the nearest 0.5mm (A/B on right hand image) on axial CT brain scans on admission and post-deterioration.
  - The level of agreement was excellent ($p < 0.001$).
- **Definition of hydrocephalus**: the lower limit of the 95% confidence interval (CI) was taken to be the threshold for hydrocephalus.



RESULTS

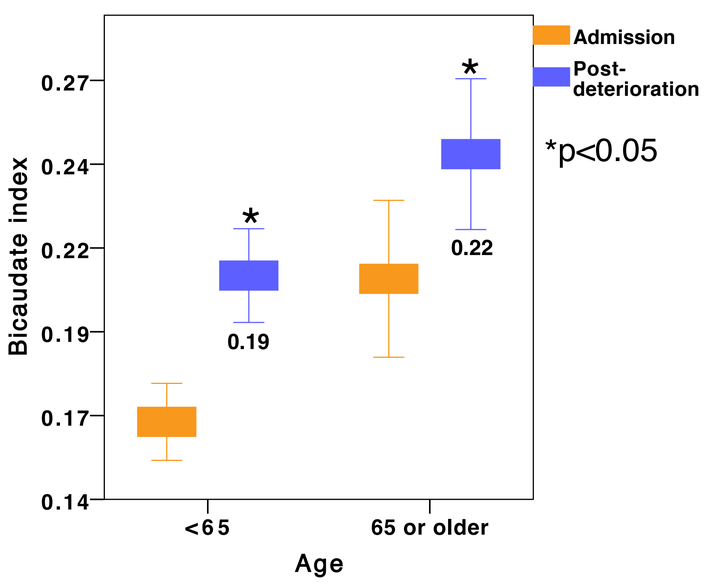


Figure 1. BCI thresholds to define hydrocephalus in aSAH (derivation group). 62 patients were included with a mean age of 56 years (range 25-84 years). There was a female excess (n = 42/62, 68%). The modal WFNS grade on referral was 2 (n = 44/62, 71%). The median time from admission to CSF diversion was 1 day (range 0-32 days). Post-deterioration, patients underwent an EVD (n = 57, 93%) or lumbar drain (n = 5, 7%). There was a significant increase in BCI for both age groups (p = 0.002, p = 0.001). The BCI thresholds for hydrocephalus were taken to be the lower limits of the 95% confidence intervals for BCI on the post-deterioration CT brain scans: **0.19 (<65 years) and 0.22 (≥65 years).**

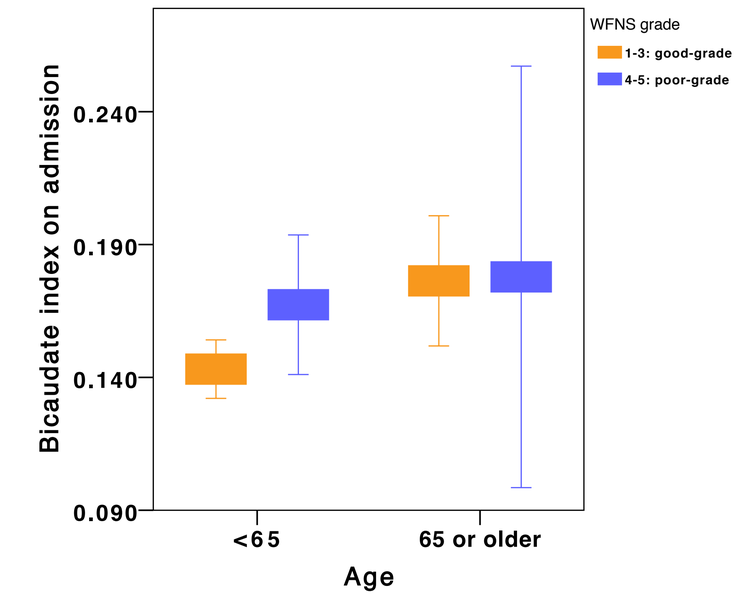


Figure 2. Differences in the BCI between different good and poor grade aSAH patients (test group). We compared BCI between good and poor-grade aSAH patients in the test group. There was no significant difference in admission BCI between these two groups for age <65 years (0.14 ± SD 0.04 vs. 0.17 ± SD 0.06, t = 1.77, p = 0.09) and age ≥65 years (0.18 ± SD 0.06 vs. 0.18 ± 0.08, t = 0.05, p = 0.96).

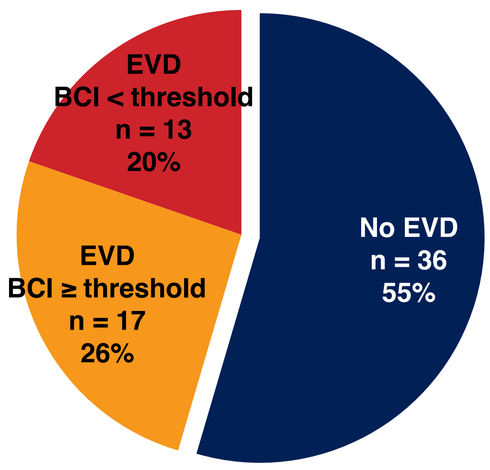


Figure 3. CSF diversion in the context of BCI thresholds for hydrocephalus (test group). We analysed patients in the test group and found that a substantial proportion (13/30, 43%) of CSF diversions were performed without objective evidence of hydrocephalus.

	CSF diversion within 48 hours		Univariate analysis	Multivariate analysis
	No	Yes		
Number of patients	36	30		
Age stratified				
<65 years	25 (69%)	19 (63%)	Fisher's Exact p = 0.61	Excluded
≥65 years	11 (31%)	11 (37%)		
Gender				
Male	8 (22%)	8 (27%)	Fisher's Exact p = 0.78	Excluded
Female	28 (78%)	22 (73%)		
WFNS grade stratified			Fisher's Exact p = 0.01	OR = 3.44 95% CI = 1.03-11.50 p = 0.045
Good (1-3)	27 (75%)	13 (43%)		
Poor (4-5)	9 (25%)	17 (57%)		
Fisher grade				
2	0 (0%)	1 (3%)	Chi-squared = 5.35 p = 0.07	OR = 1.08 95% CI = 0.32-3.66 p = 0.905
3	13 (36%)	4 (13%)		
4	23 (64%)	25 (83%)		
Exceeds BCI threshold for hydrocephalus			Fisher's Exact p < 0.001	OR = 13.11 95% CI = 3.07-55.94 p = 0.001
No	33 (92%)	13 (43%)		
Yes	3 (8%)	17 (57%)		

Figure 4. Factors predictive of CSF diversion in multivariate analysis (test group). Forward stepwise binary logistic regression showed that poor WFNS grade at presentation and exceeding the BCI threshold for hydrocephalus were predictive of CSF diversion within 48 hours.

CONCLUSIONS

- A significant proportion of aSAH patients undergo CSF diversion without objective evidence of hydrocephalus. BCI thresholds for hydrocephalus could aid clinical decision making and aid appropriate patient selection.
- WFNS grade appears to bias CSF diversion such that a high proportion of poor-grade aSAH patients undergo such treatment, even without evidence of hydrocephalus.
- Future multicentre studies are required to validate our findings and BCI thresholds.

References

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