

# Impact of early brain injury on the outcome in patients with subarachnoid hemorrhage

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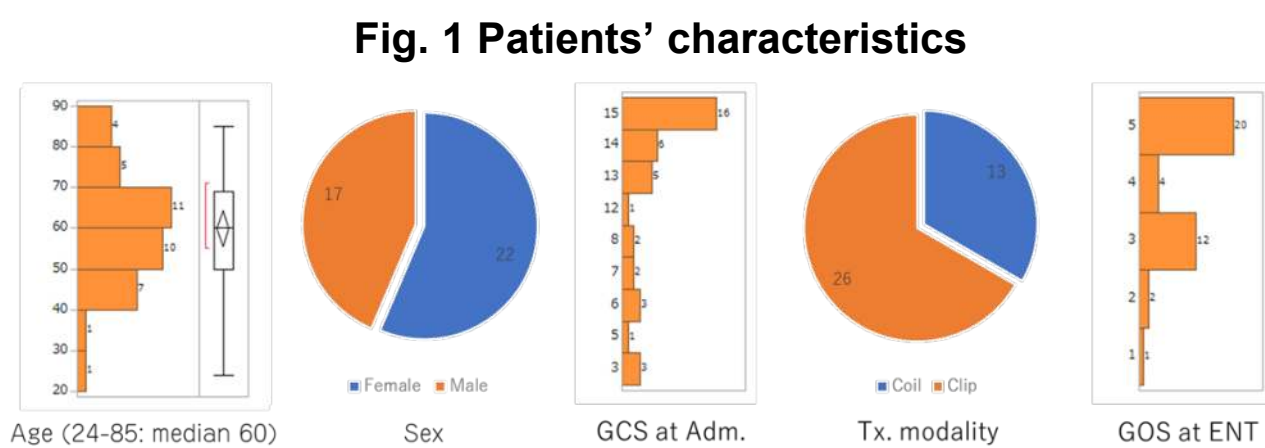
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**Aims:** To evaluate the impact of EBI on prognosis of SAH patients.

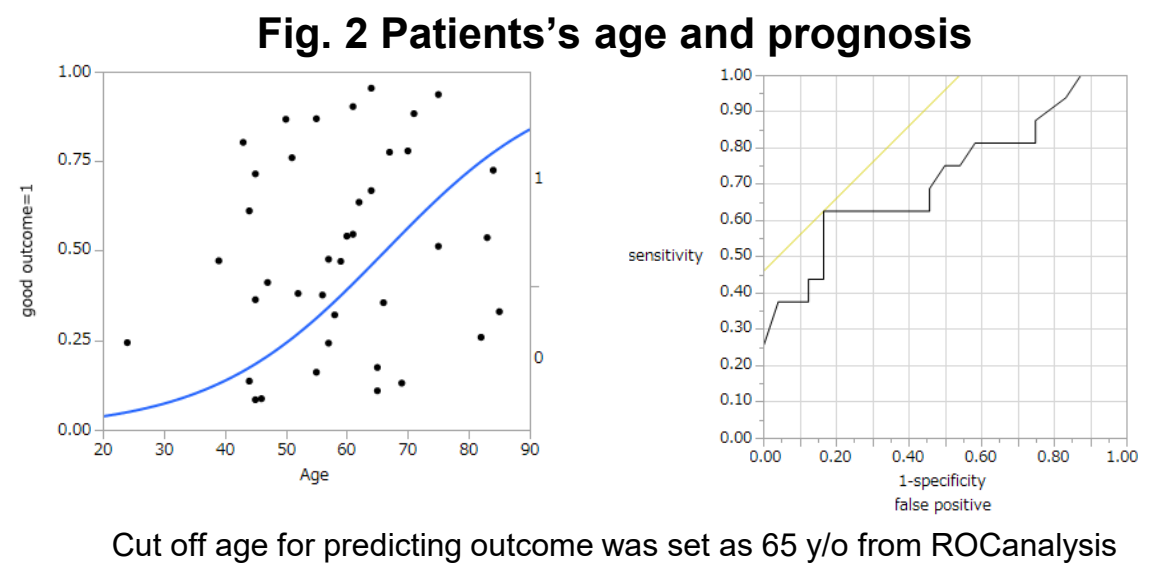
**Main findings:** LOC (loss of consciousness) at the time of ictus and/or poor initial WFNS grade (3-5) at ER is proved to be a useful surrogate marker of EBI and can predict poor prognosis of SAH patients.

**Background and Aims:** The incidence of delayed cerebral ischemia (DCI) due to major cerebral artery stenosis in patients with subarachnoid hemorrhage (SAH) decreases along with the development of modern treatment strategies. On the contrary, poor clinical outcome in patients with SAH due to early brain injury (EBI) has been noticed recently. In the present study, we evaluated the impact of EBI on prognosis of SAH patients.

**Patients and Methods:** Data of 39 patients with SAH due to rupture of saccular aneurysm treated at our institution during the periods of 3.5 years from January 2015 was retrospectively analyzed (Fig.1). Baseline characteristics were compared using  $\chi^2$  test for nominal variables and using logistic regression analysis for continuous variables (i.e. age and diameter of aneurysm). Multivariate logistic regression analyses were performed to account for patients' characteristics and clinical parameters.



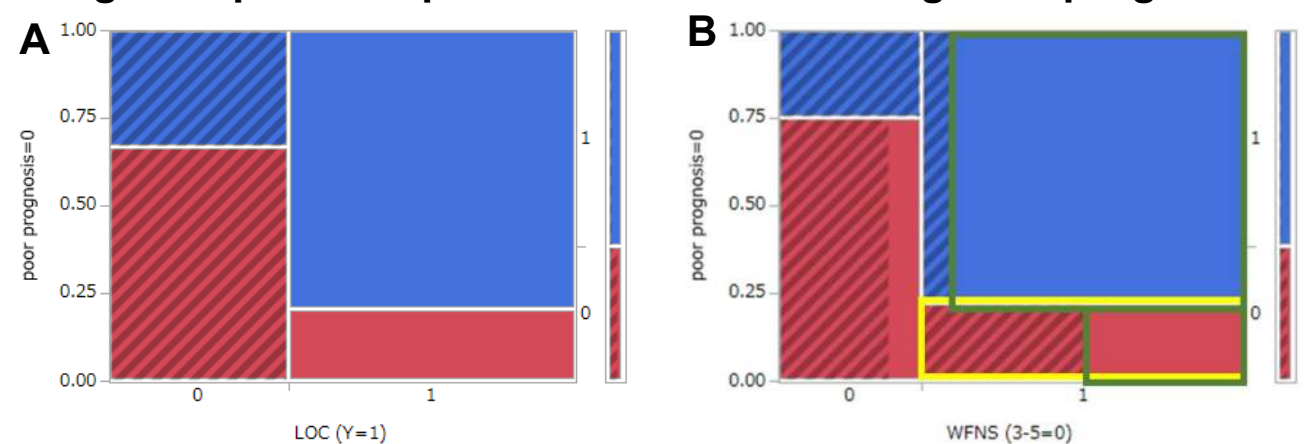
**Results:** In univariate analysis, older age (>65) (Fig.2), loss of consciousness (LOC) at ictus, initial WFNS poor grade (3-5), and DCI were associated with poor outcome (GOS 3-5) (Table1). Mosaic plots showing the relationships between LOC and poor prognosis (Fig.3A) and that showing the relationships between poor initial WFNS grade and poor outcome (Fig.3B) showed ① 50% of patients (3/6) from poor outcome group whose initial WFNS grade at ER was 1 or 2 experienced LOC at the time of ictus ② 86.4% of patients (19/22) from good outcome group whose initial WFNS grade at ER was 1 or 2 did not experienced LOC at the time of ictus. These facts suggested SAH patients who did not suffer from LOC at ictus as well as arrived at ER with good WFNS grade tended to show good prognosis. In other words, LOC at the time of ictus and/or poor initial WFNS grade (3-5) at ER is proved to be a useful surrogate marker of EBI and can predict poor prognosis of SAH patients. Odds ratio for poor outcome of the group was higher than that of LOC+ group and that of poor WFNS grade at initial presentation group. Multivariate logistic regression analyses revealed older age, EBI, and DCI were independently associated with poor outcome.



**Table1. Results of univariate analysis**

	Total N=39 (100)	GOS=4, 5 N=24 (100)	GOS=1, 2, 3 N=15 (100)	P value	Odds ratio (95% CI)
Age, mean±SD (range)	59.8±13.6 (24-85)			0.0034***	
Age over 65, n (%)	14 (35.9)	4 (16.7)	10 (66.7)	0.0024***	10 (2.2-45.6)
Female sex, n (%)	22 (56.4)	14 (58.3)	8 (53.3)	1.0000	
LOC at the time of ictus, n (%)	15 (38.5)	5 (20.8)	10 (66.7)	0.0069**	7.6 (1.8-32.6)
Seizure, n (%)	7 (17.9)	3 (12.5)	4 (26.7)	0.3955	
SEBES score 3, 4	10 (25.6)	6 (25)	4 (26.7)	1.0000	
Size of AN, mean ±SD (range)	5.1±2.1 (1.4-11.4)			0.198	
Clipping	26 (66.7)	15 (62.5)	11 (73.3)	0.730	
Poor WFNS grade (3-5)	12 (30.7)	3 (12.5)	9 (60.0)	0.0035**	10.5 (2.1-51.5)
Radiological Vasospasm	13 (33.3)	5 (20.4)	8 (53.3)	0.0790	
DCI	6 (15.38)	1 (4.2)	5 (33.3)	0.0236	11.5 (1.2-111.5)
LOC+ and/or poor WFNS gr	17(43.6)	5(20.4)	12(80.0)	0.0006***	15.2 (3.1-75.5)

**Fig. 3 Relationships between LOC- WFNS grade- prognosis**



**Table2. Results of multivariate analysis**

	P value
Age over 65	<0.0001***
LOC+ and/or poor WFNS gr	<0.0001***
DCI	0.0226*

**Conclusions:** LOC (loss of consciousness) at the time of ictus and/or poor initial WFNS grade (3-5) at ER is proved to be a useful surrogate marker of EBI and can predict poor prognosis of SAH patients. The influence of EBI on outcome in patients with SAH emerges along with the development of modern treatment strategies those prevent vasospasm. Finding out the pathologic clarification of EBI as well as developing new therapeutic strategies to prevent EBI seems to be important in the future.