

Brain core temperature of mild head trauma patients as assessed by DWI

Jun Tazoe¹, Kei Yamada¹, Koji Sakai², and Kentaro Akazawa¹

¹Radiology, Graduate School of Medical Science, Kyoto Prefectural University of Medicine, Kyoto, Kyoto, Japan, ²Human Health Science, Graduate School of Medicine, Kyoto University, Kyoto, Kyoto, Japan

Purpose

Brain temperature is determined by the brain metabolism, cerebral blood flow and body core temperature. Head trauma causes direct destruction of brain parenchyma, metabolic dysfunction, and decrease in blood flow [1]. These will lead to brain cell damage. It is known that the patients with severe head trauma, with Glasgow Coma Scale (GCS) less than 8, will have brain temperature increases due to poor intracranial blood flow and/or inflammation. Brain temperatures in these cases are measured by the direct insertion of monitoring devices. Such invasive procedure is not usually applied to those with mild head trauma patients with GCS 14-15, and thus the changes in brain temperature has so far not been carried out. Recent studies have pointed out that in mild head trauma, brain metabolism would temporarily decrease [2]. We postulated that this decrease in metabolism might result in decrease of brain temperature. Based on this assumption, cerebral ventricle temperature of the mild head trauma cases were assessed by diffusion-weighted image (DWI) technique that has been recently proposed [3, 4, 5].

Materials and Method

The study period was from April 2008 to June 2011. There were total of 20 patients (15 men and 5 women) with mild head trauma cases with GCS 14 or 15, who underwent MR examination. These patients ranged in age from 21 to 85 (mean \pm SD 63.5 \pm 15.7) (Table 1). There was no patient in this study with overt intracerebroventricular bleeding on T2* weighted image. The normal control group consisted of 14 subjects (3 men and 11 women; mean \pm SD 56.4 \pm 15.3) who volunteered for brain examinations (Table 2). We compared the cerebral ventricular temperature of the trauma group with normal control. The follow-up MRI study was performed in 4 cases of trauma group of over-30-day and this data was also used for comparison.

Results

Ventricular temperature measurements were successfully performed in all patients and normal subjects. Total of 24 MR examinations were performed in the trauma group patients within-30-day from head trauma and total 5 MR examinations in 4 cases at the over-30-day period. The measured cerebral ventricular temperature in the group of within-30-day was 36.8 \pm 1.3°C (mean \pm SD), over-30-day was 38.3 \pm 1.7°C, and the normal control was 37.9 \pm 1.2°C. When within-30-day and normal control were compared, the temperature difference was found to be statistically significant (P <0.05, Fig. 1). There was, however, no statistically significant difference between the over-30-day and normal control, neither between the group of within-30-day and over-30-day.

Conclusion

There is temporally decline in ventricular temperature in cases with mild head trauma, possibly owing to decrease in metabolism.

Reference

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- 3) Kozak LR, Bango M, Szabo M, et al. Using diffusion MRI for measuring the temperature of cerebrospinal fluid within the lateral ventricles. *Acta Paediatr*. 2010;99:237-243.
- 4) Sakai K, Yamada K, Sugimoto N. Calculation methods for ventricular diffusion-weighted imaging thermometry: phantom and volunteer studies. *NMR Biomed*. 2011 Jul 31. [Epub ahead of print]
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Table 1

Patient in Mild Head Trauma

No.	Age	Sex	ER	MRI			Cause	
				GCS	Day	GCS		
1	69	M	15	1	15	37.0	37.5	Fall from bed
			-	25	15	36.5	36.6	
2	78	F	14	0	14	36.7	36.4	Fall down
			-	10	15	36.6	35.7	
3	49	M	14	1	15	36.2	36.0	Traffic accident
4	62	M	15	1	15	37.0	36.5	Drunk, Fall from height of about 1m
			-	8	15	36.5	36.8	
			-	43	15	-	37.9	
			-	288	15	-	37.0	
5	63	M	15	13	15	36.6	36.3	Drunk, Fall down on stairs
			-	63	15	-	39.3	
6	55	M	15	19	15	36.6	38.6	Drunk, Fall down
			-	131	15	-	36.7	
7	52	M	14	1	15	36.6	35.4	Fall down
8	60	M	14	2	14	38.0	36.2	Fall down
9	39	M	15	3	15	37.0	35.0	Drunk, Fall down
10	75	M	14	6	15	36.4	36.1	Fall down on stairs
11	69	M	14	1	14	37.0	36.9	Fall down
12	82	F	15	9	15	36.4	36.6	Fall down
13	85	F	15	0	15	36.8	36.4	Fall down
14	72	M	14	5	15	36.4	39.1	Fall down
15	80	F	15	11	15	36.5	40.1	Fall down on stairs
			-	200	15	-	40.8	
16	66	M	14	1	15	36.7	36.9	Drunk, Fall down
17	46	M	15	1	15	36.2	36.6	Hit by a softball on face
18	21	F	15	1	15	36.8	35.8	Fall down
19	64	M	15	8	15	37.2	40.2	Fall down
20	72	M	15	2	15	36.6	35.7	Drunk, Fall down
			-	19	15	-	36.8	

Note - ER: Emergency Room, GCS: Glasgow Coma Scale, Day: days after head trauma, Body TEMP: Body Temperature = axillary temperature, C.V.TEMP: Cerebral Ventricular Temperature, Fall down: place unknown

Table 2
Normal Control

No.	Age	Sex	Tympanic TEMP[°C]	C.V. TEMP[°C]
1	28	F	36.6	39.7
2	32	F	36.9	38.4
3	41	M	36.5	36.7
4	43	M	36.6	36.9
5	49	M	36.7	37.7
6	55	F	36.6	38.7
7	61	F	36.2	38.5
8	64	F	36.3	35.2
9	65	F	36.9	38.1
10	67	F	36.6	39.5
11	67	F	36.7	37.3
12	70	F	36.8	38.4
13	73	F	35.9	38.3
14	75	F	36.7	37.9

Note - TEMP: Temperature,
C.V.TEMP: Cerebral Ventricular

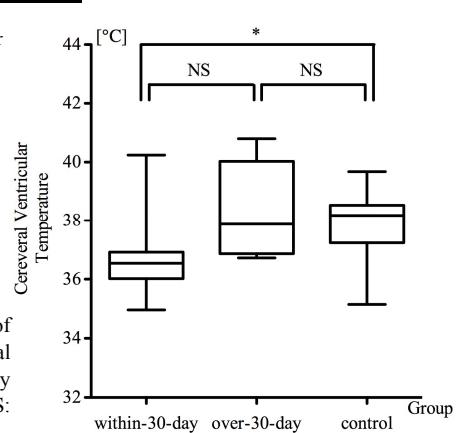


Figure 1: The group of within-30-day and normal control were statistically significant (P <0.05). NS: No Significant difference