Acta Med. Okayama, 2017
Vol. 71, No. 2, pp. 179–180

Acta Medica Okayama
http://escholarship.lib.okayama-u.ac.jp/amo/

Short Communication

Intracranial Pressure Monitoring for Pediatric Acute Encephalopathy

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Newly published clinical practice guidelines recommend intracranial pressure (ICP) monitoring in critical care for the management of pediatric acute encephalopathy (pAE), but the utility of ICP monitoring for pAE has been poorly studied. We recently performed direct ICP monitoring for two patients. We observed that although the direct ICP monitoring had clinical benefits with less body weight gain and no vasopressor use in both cases, this monitoring technique is still invasive. Future studies should determine the utility of non-invasive ICP monitoring systems in pAE to further improve the quality of intensive-care management.

Key words: cerebral perfusion, encephalopathy, child, intracranial pressure, neurological intensive care

In August 2016, the Japanese Society of Child Neurology published clinical practice guidelines for pediatric acute encephalopathy (pAE) [1]. They recommended cerebral perfusion pressure (CPP)-targeted circulation management in intensive care, with intracranial pressure (ICP) monitoring if available. Direct ICP monitoring plays an important role in the pediatric management of severe traumatic brain injury [2]; however, the utility of ICP monitoring for pAE has not been well studied, and it merits further research.

We provided uniform treatment including targeted temperature management to 34°C for 48 h (Table 1) for seven pAE patients [3], and we recently performed direct ICP monitoring for the most recent two patients of these seven patients (Table 2). Compared with the five patients managed without ICP monitoring, the two ICP-monitored patients showed clinical benefits, with less body weight gain and no vasopressor use.

It is difficult to recognize changes in ICP without ICP-specific monitoring devices in sedated pAE patients managed in intensive care units. Thus, for management without ICP monitoring devices, it is ideal to maintain a CPP of ≥40 mmHg by controlling the mean arterial pressure vigilantly at approx. 60-70 mmHg as a precaution against high ICP [4]. Our study showed that management with ICP monitoring can prevent unnecessary interventions for pAE patients, including fluid overload and blind vasopressor use.

However, direct ICP monitoring is invasive, and the number of facilities with the capacity for ICP monitoring for children is limited. The cases of severe pAE patients with coagulopathy may warrant avoiding this useful monitoring. The utility of new, non-invasive ICP/CPP monitoring systems [5,6] in pAE should thus be evaluated to further improve the quality of intensive-care management.

Acknowledgments. This work was partly supported by Research Program on Emerging and Re-emerging Infectious Diseases of Japan

Received September 20, 2016; accepted October 28, 2016.
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Conflict of Interest Disclosures: No potential conflict of interest relevant to this article was reported.

Table 1 Intensive-care management of pediatric acute encephalopathy (pAE) at Okayama University Hospital, Okayama, Japan

Methylprednisolone pulse therapy (30 mg/kg/day for 3 days)
Intravenous immunoglobulin therapy (1 g/kg/day for 1 days)
Therapeutic hypothermia (34. 0°C for 48 h) followed by rewarming at the rate of 0.05°C for 40 h
Mannitol (0.5 g/kg/dose 4×/day)
Edaravone (0.6 mg/kg/dose 2×/day)
Anti-epileptic drugs (usually midazolam)
Anti-viral therapy if necessary
30°head-up with neutral head position
Normocapnia management (pCO2: 35–45 mmHg by pH stat)
High serum sodium management (serum sodium > 145 mEq/L)

Table 2 Patient summary

Patient:	1	2	3	4	5	6	7
ICP monitoring	+	+	–	–	–	–	–
Age in months	12	13	14	16	23	24	31
Sex	male	female	male	male	male	female	male
Etiology	HHV6	HHV6	HHV6	HHV6	N/D	N/D	Flu A
Intubation days	8	9	8	9	8	14	10
PCPC on admission	1	1	1	1	1	1	1
PCPC at discharge	1	3	1	1	1	4	1
Epilepsy as sequela	–	+	–	–	–	+	–
BW increase*	0.5 kg (6.0%)	0.8 kg (11.0%)	2.0 kg (20.2%)	1.4 kg (11.6%)	1.2 kg (12.1%)	1.8 kg (20.6%)	2.7 kg (27.4%)
Vasopressor use	–	–	+	–	+	+	+

BW, body weight; Flu A, influenza A virus; HHV6, human herpes virus type 6; ICP, intracranial pressure; N/D, not detected; PCPC, pediatric cerebral performance category.
*Increase from admission to completion of rewarming.

Agency for Medical Research and Development. This study was approved by our hospital's Ethics Committee (Ken1605-502-001).

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