Pediatric Neurology 49 (2013) 397–400

Contents lists available at ScienceDirect

Pediatric Neurology

journal homepage: www.elsevier.com/locate/pnu

Original Article

Prognostic Indicators of Acute Transverse Myelitis in 39 Children

Long Chen MD [a], Jie Li MD [b], Zhichao Guo MD [c], Shuang Liao MD [c], Li Jiang PhD MD [c,*]

[a] *Department of Pediatrics, Daping Hospital and Research Institute of Surgery, Third Military Medical University, Chongqing, People's Republic of China*
[b] *Department of Obstetrics and Gynecology, The First Affiliated Hospital of Chongqing Medical University, Chongqing, People's Republic of China*
[c] *Department of Neurology, Children's Hospital of Chongqing Medical University, Chongqing, People's Republic of China*

ABSTRACT

BACKGROUND: The Transverse Myelitis Consortium Working Group has proposed new diagnostic criteria for acute transverse myelitis. The purpose of the present study is to evaluate the relations between clinical variables and functional prognosis using new criteria. **METHODS:** We reviewed 39 Chinese cases meeting the new criteria, recorded clinical epidemiological data, and followed activities of daily living measuring scale (Modified Barthel Index). **RESULTS:** Thirty-nine children met new criteria for definite acute transverse myelitis in the past 14 years between 1995 and 2008. Mean follow-up time was 102.7 months. Conversion to multiple sclerosis occurred in two patients (5.1%). Those children with a short time to maximal deficits, long time of peak neurological impairment and initial time of treatment, increased protein levels of the cerebrospinal fluid, and secondary infection were more likely to have residual neurological deficits, resulting in lower qualities of life ($P = 0.005$, $P = 0.003$, $P = 0.011$, $P = 0.0012$, $P = 0.000$, respectively). **CONCLUSIONS:** A short time to maximal deficits, long time of peak neurological impairment and initial time of treatment, increased protein levels of cerebrospinal fluid, and secondary infection played important roles in predicting poor prognosis.

Keywords: children, acute transverse myelitis, prognostic marker, Modified Barthel Index

Pediatr Neurol 2013; 49: 397-400

Introduction

Acute transverse myelitis (ATM) is a rare but often severe disorder that typically injures sensory, motor, and autonomic nerve tracts of the spinal cord; incidence has been estimated between 1.34 and 4.6 per million people each year.[1,2] It is characterized by acute, symmetric paraplegia or tetraplegia, decrease or loss of sensation, and sphincter disturbance. Evaluation and comparison of various clinical studies conducted were hindered by a lack of uniformity in diagnostic criteria.[3] One-third of patients make a good recovery with mild residual sequelae, one-third have a moderate degree of disability, and the remainder are severely incapacitated.[4,5] Back pain, rapid progression of symptoms, a high level of deficit, and spinal shock are poor prognostic factors,[6,7] accordingly leading to a bad quality of life.[6,8] Many patients experience improper treatment because of a difficult differential diagnosis that includes spinal cord compression, ischemia, hemorrhage, neuromyelitis optica, early stage of multiple sclerosis (MS), and acute disseminated encephalomyelitis.

The Transverse Myelitis Consortium Working Group from John Hopkins University proposed new diagnostic criteria for ATM in 2002.[9] Rare studies have reported the relationship between earlier clinical data and prognosis in China according to the new criteria. We reviewed patient data using the new ATM criteria and evaluated whether this information could be used to predict functional prognosis in Chinese children.

Patients and Methods

We reviewed children admitted to the Children's Hospital of Chongqing Medical University (Chongqing, China) and diagnosed with ATM between 1995 and 2008 and selected patients with definite ATM

L.C. and J.L. contributed equally to the study.

Article History:
Received 27 April 2013; Accepted in final form 20 August 2013

* Communications should be addressed to: Dr. Jiang; Department of Neurology; Children's Hospital of Chongqing Medical University; 136 Zhongshan 2 Road; Chongqing, 400014; People's Republic of China.
E-mail address: neuroclong@126.com

0887-8994/$ - see front matter © 2013 Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.pediatrneurol.2013.08.022

according to the new criteria. Twelve patients were excluded using the new criteria. Of these, there was no imaging data in seven patients and cerebrospinal fluid (CSF) data in five patients. Thirty-nine patients (17 boys, 22 girls; mean age ± standard deviation, 85.6 ± 46.4 months) fulfilled the new criteria and had no histories suggestive of previous spinal injuries, neuromyelitis, optica MS, or acute disseminated encephalomyelitis. Patients with a serological or clinical history suggestive of myelopathy resulting from connective tissue disease or infection were excluded. The CSF examination was performed again if the patients relapsed or if they suffered from secondary infection or bad recovery.

We also investigated the activities of daily living (ADL) measuring scale (Modified Barthel Index)[10-13] by telephone, letter or face-to-face talks. The study was approved by the medical ethics committee of the Children's Hospital of Chongqing Medical University (Chongqing, China). Informed parental consent was obtained. The Modified Barthel Index includes 10 items: feeding, transfer (from bed to chair or back), bathing, toilet use, grooming, mobility, down/up stairs, dressing, bowel, and bladder. The score of each item was based on whether help was needed and what to extent needed. The ranks of recovery score were classified into five grades (Table 1) with a total score of 100. The Modified Barthel Index score was categorized (categorical ranking) into two groups: poor prognosis group (<75) and good prognosis group (≥75).

Statistical analysis

Continuous variables, expressed as mean ± standard deviation, were compared using one-way analysis of variance. Pairwise comparisons were evaluated by the Student–Newman–Keuls procedure. Other clinical epidemiological data were compared using Fisher's exact probabilities. All analyses were carried out using computer software (SPSS 16.0 for Windows). *P* value less than 0.05 was considered statistically significant.

Results

Thirty-nine patients fulfilled the new diagnostic criteria for definite ATM. Of these, 31 had a good outcome and 8 showed a poor outcome. The mean follow-up period was 102.7 months. No children died in the acute phase. There were no differences in clinical characteristics at age, sex, preceding infection, fever, back pain at onset, muscle weakness, sensory disturbance, sphincter dysfunction, Babinski sign, and spinal shock between the two groups (Table 2). Secondary infection (0% vs 75.0%; $P = 0.000$), increased protein levels of CSF (0.19 ± 0.18 vs 0.75 ± 0.71; $P = 0.012$), short time to maximal defects (7.2 ± 5.2 vs 1.7 ± 1.9; $P = 0.005$), long time of peak neurological impairment (5.6 ± 4.6 vs 12.0 ± 6.8; $P = 0.003$), and initial time of treatment (4.4 ± 2.3 vs 7.3 ± 3.9; $P = 0.011$) significantly increased the risks of poor prognosis.

TABLE 1.
Dependency needs

Categories	Modified Barthel Index Total Scores	Dependency Level	Hours of Help Required per Week (Maximum)
1	0-24	Complete	27.0
2	25-49	Severe	23.5
3	50-74	Moderate	20.0
4	75-90	Mild	13.0
5	91-99	Minimal	<10.0

Categories, 1, 2, and 3 stand for poor prognostic function; 4 and 5 mean good function recovery.

TABLE 2.
Main clinical characteristics of patients with acute transverse myelitis

Clinical Data	Good Prognosis Group (31)	Poor Prognosis Group (8)	*P* Value
Age (months)	84.0 ± 43.2	91.8 ± 60.2	0.680
Male:female	17:14	5:3	0.291
Preceding infection (yes:no)	18:13	6:2	0.230
Fever (yes:no)	17:14	5:3	0.291
Back pain at onset (yes:no)	11:20	3:5	0.314
Muscle weakness (yes:no)	26:5	8:0	0.295
Sensory disturbance (yes:no)	21:10	6:2	0.318
Sphincter dysfunction (yes:no)	25:6	8:0	0.226
Babinski reflex (yes:no)	17:14	6:2	0.199
Spinal shock (yes:no)	12:20	6:2	0.232
Secondary infection (yes:no)	0:31	6:2	0.000
Protein levels of cerebrospinal fluid (g/L)	0.19 ± 0.18	0.75 ± 0.71	0.012
Time up to maximal defect (days)	7.2 ± 5.2	1.7 ± 1.9	0.005
Time of peak neurological impairment (days)	5.6 ± 4.6	12.0 ± 6.8	0.003
Initial time of treatment (days)	4.4 ± 2.3	7.3 ± 3.9	0.011

After admission, a spinal magnetic resonance imaging (MRI) scan was performed in all 39 patients (immediately in 35 patients [89.7%] and 2 weeks later in four patients [10.3%]). Gadolinium enhancement was used in 25% (5/18) of patients with spinal shock; it was not performed in the other 75% of patients with spinal shock because of financial constraints. A brain MRI was also performed in 27 patients (69.2%), and a computed tomography scan was performed in five patients (12.8%). If the brain MRI was not completely normal, the patient was excluded. Patients who suffered from further symptoms suggestive of neurological impairment during the follow-up periods had another neuroimaging examination. These MRI findings included increased signal intensity on T2-weighted imaging in 66.7% (26/39) of patients with three or more segments involving both the cervical and thoracic cords, of which the lesions in three patients (11.5%) extended even to the medulla oblongata, although the three patients had functional recovery.

CSF examination was performed in all 39 children. All had normal cytology, oligoclonal bands, and immunoglobulin G index in the first examination. All 39 patients had normal protein levels in the first CSF examination (Table 2). Eight patients, including the two patients suffering from secondary infection in the poor prognosis group, showed elevated protein levels in the second CSF examination.

Glucocorticoids were administered to all patients: high-dose methylprednisolone was used in 31 patients (79.5%), prednisolone in two patients (5.1%), hydrocortisone in one patient (2.6%), hexadecadrol in five patients (12.8%), and gammaglobulin in nine patients (23.1%).