Bell’s Palsy in Children: Relationship Between Electroneurography Findings and Prognosis in Comparison With Adults

*Shintaro Baba, *Kenji Kondo, *Kaori Kanaya, *Munetaka Ushio, †Hitoshi Tojima, and *Tatsuya Yamasoba

*Department of Otolaryngology, Graduate School of Medicine, The University of Tokyo, Bunkyo-ku, Tokyo; and †Tojima Ear-Nose-Throat Clinic, Hitachi, Ibaraki, Japan

**Objectives:** To investigate the correlation between electroneurography (ENoG) findings and the prognosis of Bell’s palsy in children compared with adults.

**Methods:** Twenty-two children and 92 adults with Bell’s palsy who underwent ENoG between 8 days and 4 weeks from the onset of symptoms were retrospectively enrolled. The time to maximal recovery and rate of favorable recovery (House-Brackmann grade I or II) was assessed. Children (C) and adults (A) were further subdivided into low (<10%) or high (≥10%) subgroups according to their ENoG values (affected versus unaffected side) at initial evaluation. The numbers in each subgroup were as follows: C-low (n = 8), A-low (n = 21), C-high (n = 14), and A-high (n = 71).

**Results:** Of the 22 children assessed, 2 of the 4 patients who showed a total loss of evoked potentials on the affected side (0% ENoG value) exhibited an unfavorable recovery. The remaining 20 patients achieved a favorable recovery eventually. Patients in group C-low reached a maximal recovery of facial movement significantly later than those in group C-high (p < 0.001). Time to maximal recovery of facial movement in group A-low was later than that in group C-low, although the difference was not statistically significant (p = 0.15). The patients in group A-high reached a maximal recovery significantly later than those in group C-high (p < 0.05).

**Conclusion:** Bell’s palsy seems to recover earlier in children than adults when matched for severity. The presence of an identifiable response in ENoG, irrespective of its amplitude, may indicate a favorable recovery of facial movement in children.

**Key Words:** Bell’s palsy—Children—Electroneurography.

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Facial paralysis in children, as in adults, is a serious problem, not only affecting facial function but also causing serious psychological problems in the child, as well as concern and confusion for the parents. Idiopathic facial paralysis (Bell’s palsy) is the most common cause of facial paralysis in children alongside infectious, traumatic, congenital, or neoplastic causes (1–4).

The greatest concern for children with facial paralysis as well as their parents is the prognosis, for example, when and how completely the condition will resolve. It is therefore important for physicians managing facial paralysis in children to obtain information to predict each patient’s recovery course. Electroneurography (ENoG) is considered to correlate well with the number of residual nerve fibers (5,6) and has been demonstrated to be useful for predicting the prognosis of Bell’s palsy (7–10). However, such studies usually focus on adult patients, and only a few have studied the prognostic value of ENoG in facial paralysis in children (11,12), although not in detail.

The aim of the present study is to investigate the correlation of ENoG findings and the recovery course of Bell’s palsy in children and to compare it with that in severity-matched adults.

**PATIENTS AND METHODS**

**Patients**

Data were reviewed from the records of patients attending the facial nerve outpatient clinic in the Department of Otolaryngology at the University of Tokyo Hospital between September 1995 and April 2010. During this period, 75 children (younger than 15 years) with facial paralysis visited our clinic. They included 39 boys and 36 girls, with ages ranging from newborn to 15 years. Of these 75 children, 39 patients (52.0%) were diagnosed with...
Bell’s palsy, 22 (29.3%) with congenital paralysis (including 8 with congenital unilateral lower lip palsy), 4 (5.3%) with traumatic paralysis, 3 (4.0%) with Hunt’s syndrome, and 7 (9.3%) with the other causes. The diagnosis of Bell’s palsy was made when the facial paralysis was peripheral, and no obvious cause was identified by history taking or physical examination or serologic or radiologic studies. Of the 39 patients with Bell’s palsy, 24 underwent ENoG examination within 4 weeks of the onset of symptoms. Of these 24 patients, 2 patients with House-Brackmann (H-B) grade II at initial examination and examined using ENoG at 21 days or later were excluded from the analysis because of the possibility that they had already made a significant recovery before ENoG examination. Previous studies regarding the time course of changes in ENoG values after the onset of facial paralysis demonstrated that, in such mild cases, the ENoG value at 1 month after the onset has already recovered to some extent from its lowest value (13,14). Therefore, the total number of the patients enrolled in this study was 22 (12 boys and 10 girls; age range, 1–15 yr; mean, 8.5 yr). The end point was determined as either the time at which the patient achieved complete recovery (see below) or when the grade of facial movement was assessed to be the same on 2 consecutive visits at least 2 months apart.

In the initial and follow-up visits, facial movement was evaluated according to the H-B grading system. When facial movement reached H-B grade I, we considered recovery to be complete. We defined a favorable recovery as the achievement of H-B grade I or II. It is more difficult to evaluate facial movement in an infant or a young child because they often are uncooperative. In such cases, our H-B grading was based on observation of the patient’s facial movements at rest, during motion, or while crying or laughing. After initial evaluation, the patients underwent follow-up examinations every month until 6 months after onset and every 2 or 3 months thereafter until the end point described previously.

Of the 22 children with Bell’s palsy included in this study, 5 did not receive any medication, whereas 17 were given oral or intravenous administration of prednisolone (0.5–1 mg/kg per day) for 7 to 14 days. This difference in treatment was based on the decision made either by family pediatricians who provided initial treatment or by the parents. We compared the prognosis of facial paralysis in association with this difference in treatment.

We also reviewed the data of adult patients diagnosed with Bell’s palsy who attended our clinic during the same period and enrolled 92 patients (age range, 20–64 yr; mean, 44.1 yr) who had been evaluated using ENoG between 8 days and 4 weeks from the onset of symptoms.

The 22 children and 92 adults with Bell’s palsy were classified into 5 subgroups based on the ENoG values at initial examination (0%, 1%–9%, 10%–19%, 20%–39%, ≥40%). The time course of recovery was examined in each subgroup.

For the statistical analyses, children (C) and adult (A) patients were divided into 2 groups (high and low) on the basis of their ENoG values at initial evaluation. Patients presenting with an initial ENoG value of less than 10% were classified as “low” (C-low: n = 8, A-low: n = 21), whereas those presenting an initial ENoG value of 10% or greater were classified as “high” (C-high: n = 14, A-high: n = 71). The cumulative rate of favorable recovery and the period from paralysis onset to maximal recovery were compared among these subgroups.

The current study was undertaken with the approval of the research ethics committee of The University of Tokyo Hospital (no. 2487).

**Procedure of ENoG**

ENoG was performed in awake patients using a Viking IV electromyography system (Nicolet, Madison, WI, USA). Supramaximal stimulation of 0.2-ms duration at a rate of 1 Hz was provided through bipolar surface electrodes. The anode was placed just outside the stylomastoid foramen and the cathode in front of the ear lobe and manipulated to obtain the maximal compound action potential amplitude on the display. For recording, the surface disc electrodes were placed in the nasolabial fold. The ground electrode was placed on the lower jaw. The

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**Table 1.** The time after paralysis onset that electroneurography was performed, the time to maximal recovery, and the House-Brackmann grade of final recovery for each pediatric patient

<table>
<thead>
<tr>
<th>Patient no.</th>
<th>Sex</th>
<th>Age (yr)</th>
<th>Side</th>
<th>Electroneurography testing, time after onset (d)</th>
<th>Electroneurography value (%)</th>
<th>Time to recovery (mo)</th>
<th>Final House-Brackmann grade</th>
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<tr>
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percentage of peak-to-peak amplitudes of the ENoG response on the affected side to those on the unaffected side was designated as the ENoG value for the patient.

Statistical Analyses
Test results were statistically evaluated using SPSS statistical software (SPSS, Chicago, IL, USA). The cumulative cure rate and period from the onset to complete and favorable recovery were calculated using the Kaplan-Meier method, and the differences were analyzed using the log-rank test.

RESULTS
The time after paralysis onset that ENoG was performed, the time to maximal recovery, and the H-B grade of final recovery for each of the 22 pediatric patients with Bell’s palsy are described in Table 1. Of these patients, 4 had an ENoG value of 0% at initial evaluation. Two of these patients showed an unfavorable final recovery (H-B grade III). The remaining 20 patients, including the other 2 patients with a 0% ENoG value at initial evaluation, finally achieved a favorable recovery (Fig. 1). Among them, all the patients whose ENoG value was 10% or greater at initial evaluation achieved a favorable recovery within 3 months. There were 8 children younger than 5 years, all of whom achieved a complete recovery, including one presenting with an initial ENoG value of less than 10%.

In the adult patients, the proportion achieving a favorable recovery was 0% in those with an initial ENoG value of 0% (n = 4), 58.8% in those with an initial value of 1% to 9% (n = 17), 88.2% in those with an initial value of 10% to 19% (n = 17), and 100% in those with an initial value of 20% or greater (n = 54; Fig. 2). In contrast to the pediatric patients, 7 of the 80 adult patients whose initial ENoG value was 10% or greater had not achieved a favorable recovery at 3 months after the onset, whereas 2 of them never achieved a favorable recovery by the end point.

The patients in group C-low reached a favorable recovery significantly later compared with those in group C-high (p < 0.001, Fig. 3). The average period from paralysis onset to the time when the maximal recovery of facial movement was achieved was relatively later in group A-low compared with group C-low, although it was not statistically significant (p = 0.15). The patients in group A-high achieved complete recovery of facial movement significantly later than those in group C-high (p < 0.05, Fig. 3).

FIG. 1. Cumulative cure rate in child cases of Bell’s palsy. Data are shown for the 5 subgroups defined by the ENoG value at initial examination. The rate of achievement of an eventual favorable recovery was 50% in the group with an ENoG value of 0% (n = 4), 100% in the group with ENoG values of 1% to 9% (n = 4), and 100% in the group with values above 10% (n = 14). All the patients with an ENoG value of 10% or more achieved a favorable recovery within 3 months.

FIG. 2. Cumulative cure rate in adult cases of Bell’s palsy. Data are shown for the 5 subgroups defined by the ENoG value at initial examination. The rate of achievement of an eventual favorable recovery was 0% in the group with an ENoG value of 0% (n = 4), 58.8% in the group with ENoG values of 1% to 9% (n = 17), 88.2% in the group with values of 10% to 19% (n = 17), and 100% in the group with values above 20% (n = 54).

FIG. 3. Cumulative cure rates in subgroups C-low (black dotted line; n = 8, ENoG < 10%, children), C-high (black solid line; n = 14, ENoG > 10%, children), A-low (gray dotted line; n = 21, ENoG < 10%, adults), and A-high (gray solid line; n = 71, ENoG > 10%, adults). The patients in group C-low reached a favorable recovery significantly later than those in group C-high (p < 0.001). The average time to maximal recovery of facial movement in group A-low was relatively later than that in group C-low, although it was not statistically significant (p = 0.15). The patients in group A-high reached complete recovery of facial movement significantly later (p < 0.05) than those in group C-high.
Of the 22 children with Bell’s palsy, the proportion achieving H-B grade I was 100% in those who did not receive any treatment with steroids (n = 5) and 88.2% (15 of 17 patients) in those given steroids (n = 17). There was no statistical difference in the recovery rate between these 2 groups (p = 0.94, χ² test).

DISCUSSION

The current study, to our knowledge, is the first to examine in detail the association of ENOg values with the prognosis of Bell’s palsy in children and to compare it with that in adult patients. Our results demonstrate that the initial ENOg value of pediatric patients is correlated with the time course of recovery of facial movement. This finding confirms the conclusion of earlier studies that ENOg provides useful information to predict the prognosis of Bell’s palsy in pediatric patients, as well as in adult patients (11,12). More importantly, the comparison of child data with adult data in this study further suggests that the recovery of facial paralysis may be better in children than in severity-matched adults.

All children with an ENOg value of 10% or greater achieved a favorable recovery within 3 months. All patients younger than 5 years achieved a complete and favorable recovery, including 1 patient with an initial ENOg value of less than 10%. In contrast, 7 of the 71 adult patients with an ENOg value of 10% or greater had not achieved a favorable recovery at 3 months after onset. Moreover, 2 of these adult patients had not achieved a favorable recovery by the end point. The period from paralysis onset to maximal recovery of facial movement in children whose ENOg value was less than 10% tended to be shorter compared with severity-matched adults. The pediatric patients in the group with an ENOg value of 10% or greater reached maximal recovery of facial movement significantly earlier than adult patients did. These results suggest that Bell’s palsy in children is cured earlier and more favorably than in severity-matched adults. As far as we know, the present report is the first to directly demonstrate this information.

The earlier recovery of facial movement in children may be simply due to the shorter length of their facial nerve (15). It also may be associated with the faster regeneration of damaged axons and functional recovery of the facial nerve at younger ages than older ages. Studies investigating the rate of axonal regeneration of the facial nerve in cases of cross-face nerve grafts have shown that axonal regeneration is faster in younger patients (16,17). The same studies also have demonstrated that the magnitude of axonal regeneration also is better in younger cases (16). This may explain the better final recovery of facial function in children compared with severity-matched adult cases in our study.

In the current study, 20 (90.9%) of 22 children with Bell’s palsy achieved a favorable recovery. Of note is that there was a comparable rate of favorable recovery between the children treated with steroids and those who received no steroid treatment. This observation is in good agreement with previous reports regarding pediatric Bell’s palsy (2,4), suggesting that the initial damage to the facial nerve itself in children with Bell’s palsy also may be less severe than that in adults. This may be explained by a histologic finding in the temporal bone in children; the facial nerve in children younger than 5 years occupies a smaller percentage of the fallopian canal than that in adults (2,18). Therefore, the facial nerve may be less vulnerable to damage caused by pressure.

Our results revealed that all of the pediatric patients in whom the evoked ENOg response was identifiable (n = 18), irrespective of its amplitude, achieved a favorable recovery of facial movement, although the period from the paralysis onset to maximal recovery depended on the initial ENOg value of each patient. Considering these findings, one option is to perform ENOg on the involved side at least, if the patient is tolerant of the neurophysiologic tests. The presence of an evoked response on the involved side indicates that the pediatric patient may expect to eventually achieve a favorable recovery of facial movement, which can provide reassurance to both the child and their parents. On the other hand, given that the achievement of a favorable recovery in children is much higher than that in adults, if the patient is intolerant to the tests, another option is to defer the tests because they are not necessary for treatment decisions.

CONCLUSION

Bell’s palsy seems to recover earlier in children than in adults when matched for severity. Irrespective of its amplitude, the presence of an identifiable ENOg response may indicate the favorable recovery of facial movement in children.

REFERENCES


