EEG Sedation for Children with Autism

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ABSTRACT. Seizures are reported to occur more frequently among children with diagnoses of autism and pervasive developmental disorder (PDD), and some reports indicate a frequency as high as 30%. Sedation is often necessary to perform diagnostic electroencephalograms (EEGs) in these children, who are known to be difficult to sedate with current available pediatric sedating agents, including chloral hydrate. We used clonidine as a sedative agent in children with autism and PDD, and our findings are presented. In a prospective study, 27 children with autism and PDD diagnoses underwent conscious sedation for EEG recording. Informed consents were obtained, and clonidine was administered orally as a sedating agent in a dose ranging from 0.05 mg to 0.2 mg. Subjects were monitored for pulse rate, respiration rate, blood pressure, and oxygen saturation on a continuous basis by a registered nurse. Study parameters included time to induction, time to recovery, changes in vital signs, and technical quality of EEGs. Sedation was achieved in 23 of 27 patients (85%) per our sedation criteria, and this included five patients who had previously failed to be sedated with chloral hydrate. Two patients did not satisfy the sedation criteria but cooperated enough to allow acceptable EEG tracings, increasing the success rate to 93% (25/27). The mean time to achieve sedation was 58 minutes, and the mean time to recovery was 105 minutes. Two patients (0.07%) experienced an asymptomatic heart rate reduction up to 40%, which was not sustained and recovered promptly without any intervention. Two patients (0.07%) experienced systolic blood pressure reductions of 30% and 40%. They remained asymptomatic, had no changes in other cardiorespiratory parameters, and required no intervention. All EEGs were of good technical quality without any “drug effect.” Clonidine is a viable alternative for sedation in children with autism and PDD. It is well tolerated without any significant side effects and is efficacious in children with autism and PDD. The advantages of clonidine include ease of administration, shorter duration of total sedation, lack of EEG drug effect, and high overall success rate. J Dev Behav Pediatr 25:102–104, 2004. Index terms: autism, EEG, sedation, clonidine.

OBJECTIVE

While prospectively studying the efficacy of clonidine as a sedating agent in children with neurodevelopmental disorders, we noticed its particular efficacy in children with neurologic disorders has been poor. Chloral hydrate also causes vomiting in 6% of children, which may expose younger patients to the risk of aspiration. Alternative agents for sedation include phenothiazines, barbiturates, and benzodiazepines, all of which increase the fast background activity, making EEG interpretation more difficult. Clonidine is a water-soluble compound with antihypertensive properties. It is a selective partial alpha-2 adrenergic agonist acting mainly on adrenergic receptors. Sedation is a well-described side effect of clonidine. The locus ce- ruleus in the brain stem is the principal site of action responsible for the sedative effect of clonidine. Clonidine has been used successfully to treat sleep disturbances associated with attention-deficit hyperactivity disorders in children. It provides dose-dependent sedation with cardiovascular stability and a noticeable lack of drug tolerance or withdrawal. It also has been effectively used as a preanesthetic medication in pediatrics.
We submit our experience with this group of children as a separate report because of its clinical significance and practice implications.

**METHOD**

All patients who met DSM-IV criteria for autistic spectrum disorders requiring an electroencephalogram (EEG) were eligible for the study during the 2-year period. Informed parental consent was obtained. Dietary restriction before sedation included no solids for 8 hours and no clear liquid or medicine for 2 hours before the procedure. Patients received between 0.05 mg and 0.2 mg of oral clonidine based on weight (Table 1).

A registered nurse continuously monitored pulse rate, respiration rate, blood pressure, and oxygen saturation every 15 minutes in accordance with the hospital’s conscious sedation protocol. A record was maintained for each patient with a sedation score (Table 2) that was recorded every 15 minutes on a maximal 5-point rating scale.

Successful sedation was defined for this study as completion of the test with a sedation score of at least 2 on a 5-point scale. Length of time to achieve sedation and time to recovery were calculated for each subject. Length of time to achieve sedation was defined as the time from clonidine administration to a sedation score of 2 or less. The time to recovery was defined as the time when the sedation score returned to baseline. Blood pressure, heart rate, oxygen saturation, and respiratory rate were recorded before, during, and after clonidine administration. The lowest sedation score was calculated for each subject. Any significant side effect was recorded. We followed Napoli et al.'s parameters and considered oxygen saturation changes significant if there was a change of 5% in either direction from baseline value and considered sedation failure to be an inability to sedate within 2 hours after the maximum dose administration.

**RESULTS**

During the 24-month study period, 27 outpatients of a hospital-based practice were sedated with clonidine for electroencephalograms (EEGs) in a prospective trial to study its efficacy. Patients were aged between 2.2 and 16.9 years (median of 6 years), and all children satisfied the DSM-IV criteria for the diagnosis of autism. The patients had no history of cardiovascular, hepatic, respiratory, or gastrointestinal diseases. Five of the patients had previously failed to be sedated with adequate doses of chloral hydrate. Of the 27 children with autism who were sedated with clonidine, 25 (93%) successfully completed the test with a satisfactory EEG recording. Twenty-three children (85%) achieved a sedation score of 2 or less, including five who had previously failed to be sedated with chloral hydrate. All EEGs were of good technical quality without any drug effect. The mean time to achieve sedation (sedation score of 2) was 58 minutes with a range of 15 to 135 minutes (SD 32.7), and the mean time to recovery was 105 minutes with a range of 20 to 195 minutes (SD 40.9). The average reduction of pulse rate during the procedure was five, and all patients remained asymptomatic (Fig. 1).

Two patients experienced an asymptomatic heart rate reduction of 40% from baseline, which was not sustained and recovered promptly without intervention. Two other patients experienced asymptomatic systolic blood pressure reduction of 40% and 30% from baseline lasting less than 5 minutes and recovering without any intervention (Fig. 2). No oxygen desaturation occurred. We found that the clonidine dose for sedation ranged from 2 to 7 μg/kg with a median dose of 5 μg/kg.

**CONCLUSIONS**

Our study suggests that clonidine, with a success rate of 93%, is an effective sedating agent for children with autism. We submit our experience with this group of children as a separate report because of its clinical significance and practice implications.

**Table 1. Clonidine Dosage for Sedation**

<table>
<thead>
<tr>
<th>Weight of Children</th>
<th>Clonidine Dosage</th>
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<tbody>
<tr>
<td>&lt;10 kg</td>
<td>0.05 mg (1/2 tablet of clonidine 0.1 mg each)</td>
</tr>
<tr>
<td>10–30 kg</td>
<td>0.1 mg (1 tablet of clonidine 0.1 mg each)</td>
</tr>
<tr>
<td>&gt;30 kg</td>
<td>0.15–0.2 mg (1 1/2–2 tablets of clonidine 0.1 mg each)</td>
</tr>
<tr>
<td>Maximum dose = 0.2 mg (2 tablets of clonidine 0.1 mg each)</td>
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**Table 2. Sedation Score (Levels of Consciousness)**

<table>
<thead>
<tr>
<th>Score</th>
<th>Eyes</th>
<th>Response to Voice</th>
<th>Response to Touch</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Closed</td>
<td>None</td>
<td>Not arousable</td>
</tr>
<tr>
<td>1</td>
<td>Open</td>
<td>Incoherent</td>
<td>Sleepy, arousable</td>
</tr>
<tr>
<td>2</td>
<td>Coherent</td>
<td>Awake</td>
<td></td>
</tr>
</tbody>
</table>

Sedation score = eyes + response to voice + response to touch
autism who are undergoing encephalogram (EEG) testing. We found that clonidine was well tolerated, although mild and asymptomatic reduction in blood pressure and pulse rate occurred in 4 of the 23 successfully sedated patients (17%). Clonidine seems to be a superior sedating agent compared with the traditionally used chloral hydrate in patients with autism because of the lack of EEG drug effect, shorter duration of sedation, and prompt recovery after sedation. Clonidine did not cause any clinically significant side effects requiring intervention.

Our 93% success rate with clonidine compares favorably with Napoli et al’s12 reported 84% efficacy with chloral hydrate in children aged more than 3 years who underwent cardiac echocardiography and Weir et al’s19 reported 80% success rate with chloral hydrate as a sedative agent in children. It also exceeds the 73% rate of successful sedation with chloral hydrate in children with neurologic disorders reported by Rumm et al.11 Clonidine should be considered as a principal sedating agent for children with autism who are undergoing conscious sedation.

REFERENCES