Journal of Pediatric Surgery (2007) **42**, 1486–1490

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Journal of Pediatric Surgery

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# Gastroesophageal reflux and behavior in neurologically impaired children

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**Index words:**
Gastroesophageal reflux disease;
Neurologically impaired children;
Behavior disorders

**Abstract**

**Objective:** This study aimed to evaluate a possible link between gastroesophageal reflux (GER) and behavior pattern indicating pain experience in a group of children with severe neurologic deficits.

**Patients and methods:** We prospectively evaluated 19 patients with severe neurologic impairment (10 males and 9 females; mean age, 12.7 years) suspected for GER before and after initial treatment. Repeated 24-hour pH monitorings were performed in 19 children, whereas additional repeated endoscopic investigations were carried out in 18. In these children a histologic examination of mucosal biopsies was performed. Behavior pattern was described by parents or caregivers. The level of activity was classified as no/occasional agitation, daily agitation, and autoaggressive behavior.

**Results:** The behavioral pattern of the children was most frequently (n = 24) described as "agitated" followed by "autoaggressive" behavior (n = 10). Neither autoaggression nor agitation was less frequent (n = 4). Children with autoaggressive behavior had a significantly higher reflux index compared with the neurologically impaired patients with agitation only ($P < .01$). The reflux index was significantly higher in children with behavioral abnormalities than in children without abnormalities ($P < .0004$). In children without agitation or autoaggression, the pH measurements were all normal. Biopsies of esophageal mucosa revealed inflammation in 27 cases (first degree in 9; second degree in 12, and third degree in 6). Patients with autoaggressive behavior and those with agitation only had a significantly higher degree of inflammation compared with children without behavioral abnormalities (1.77 and 1.35 vs 0.25, respectively; $P < .05$). The degree of inflammation did not differ significantly among children with behavioral abnormalities.

**Discussion:** The present study suggests that in children with severe neurologic impairment, autoaggressive behavior or considerable agitation may be a marker for reoccurring or first-time–diagnosed pathologic GER. The severity of reflux correlates significantly to the behavior pattern resulting from experiencing pain. Pathologic GER should be excluded in all neurologically impaired children with behavioral abnormalities to prevent reflux-related complications and improve health-related quality of life.



In patients with severe neurologic impairment, gastroesophageal reflux disease (GERD) is often diagnosed late. This is true especially when symptoms such as chronic pulmonary disease, recurrent pulmonary infections, and changes in behavior mislead the diagnosis. We analyzed the validity of behavioral changes such as autoaggressive behavior and extreme agitation as markers for pathologic gastroesophageal reflux (GER).

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0022-3468/$ – see front matter © 2007 Elsevier Inc. All rights reserved.
doi:10.1016/j.jpedsurg.2007.04.009

Mental retardation is a lifelong disability and affects approximately 1% of children from 6 and 17 years of age [1]. Because of improved perinatal management, more than 60% of patients with motor and cognitive disabilities live to age 35 years [2]. These neurologically impaired patients (NIP) are at increased risk to have gastrointestinal problems. Frequent associated conditions are GER (77%), swallowing disorders (60%), chronic pulmonary aspiration (41%), and chronic constipation (74%) [3]. The subgroup of patients with GER frequently has difficulties with oral nutrition, which may result in weight loss or failure to gain weight.

The diagnosis of GER is based typically on symptoms such as vomiting and regurgitation. This symptomatic GER presents as GERD and may be associated with esophagitis and pain, thus impairing health-related quality of life [4].

Gastroesophageal reflux–related esophagitis is often detected late because of severe deficits in communication, thus challenging the abilities of parents and caregivers to interpret behavior indicating pain experience. Pain related to reflux in neurologically impaired children may have a significant influence on the behavior of these patients, as it may lead to increased agitation with increased undirected movements, moaning, crying, and difficulties to pacify as well as to autoaggressive behavior.

The aim of the present study was to evaluate a possible link between GERD and behavioral pattern indicating pain experience in a group of children with severe neurologic deficits in order to diagnose GER or recurrent GER before the occurrence of severe complications.

## 1. Patients and methods

From 1999 to 2002, 658 patients underwent diagnostic investigations for suspected GER according to the local treatment standards. A total of 4111 investigations included 725 pH monitorings. Of 87 patients with neurologic impairment, we excluded 37 children because of preexisting anomalies such as esophageal atresia, omphalocele, or gastroschisis. Of the remaining 50 NIP without preexisting gastrointestinal anomalies, 19 consecutive NIP with a history of behavioral changes were included to this prospective evaluation. Inclusion criteria were suspected gastroesophageal reflux, a history of autoaggressive behavior or extreme agitation, and tolerance to 24-hour pH monitoring.

Gastroesophageal reflux was suspected in patients presenting with acid halitosis, difficulties in oral nutrition, weight loss or failure to gain weight, and/or a history of recurrent respiratory tract infections. Patients with symptoms obviously related to GER such as frequent regurgitation or recurrent aspiration of reflux were excluded to determine the viability of behavioral changes as a possibly new marker for pathologic GER. Recurrent aspiration of the reflux was suspected in those patients with proven reflux and recurrent pulmonary infections without signs of aspiration during the act of swallowing.

None of the patients had nutrition related allergies.

Patients (10 males, 9 females) were aged from 1.5 to 19 years (mean age, 12.7 years) at initial presentation. None of the patients had any verbal communication. GER was proven by 24-hour pH monitoring using antimony 3-point pH catheters (Synectics, Skovlunde, Denmark). A single event of reflux was defined as a decrease in the distal esophageal pH of less than 4 for at least 15 seconds measured 3 to 5 cm proximal of the esophagogastric junction. Pathologic reflux was considered, if the total time of esophageal acid exposure was more than 4% of total reflux time (RI). Values of pH were analyzed over the total 24 hours of investigation including prandial and postprandial periods. Caregivers were asked to document the amount and kind of food and the time of intake as well as the occurrence of behavioral changes or GER-related symptoms during this investigation. In addition, endoscopy was performed under general anesthesia using flexible endoscopes (Olympus, Vienna, Austria). At least 3 biopsies were taken 1.5, 3.0, and 5.0 cm proximal to the z line routinely; additional biopsies of mucosal changes were taken if necessary. All specimens were analyzed histologically according to Leape et al [5].

Barium swallow and gastric-emptying studies were routinely performed in sufficiently cooperative patients but were not analyzed in this study because of the small number of these investigations.

Initial therapeutic approaches consisted of the introduction of a special diet in addition to medication of omeprazol, cisapride, or sucralfate or, if necessary, a combination of these drugs. According to the standards of our institution, effectiveness of medication was assessed in all patients after 2 to 4 weeks using pH monitoring. Indication for fundoplication was (1) persistent severe GER despite medication, (2) GER in combination with a large hiatal hernia, (3) repeated episodes of GER-related pulmonary aspiration, or (4) complicated GER with ulceration/stenosis.

Follow-up was routinely performed after 6 months including pH monitoring and endoscopy as well as after 12 and 18 months and additionally when needed.

The results of the initial and the follow-up investigations were linked to the behavioral pattern.

The level of activity indicating pain experience reported by caregivers or parents was graded as no/occasional agitation, daily agitation, or autoaggressive behavior. *Agitation* was defined as increased movements, decrease in cooperation and sleep, moaning, crying, and difficulties to pacify. Autoaggressive behavior was recorded if the caregivers or parents described acts of self-violence such as scratching, biting, or hitting.

The results of medically treated and operatively treated patients were displayed together to emphasize the behavioral changes unrelated to the way of treatment.

To determine the statistical significance of group differences, Student's paired $t$ test and Wilcoxon's test