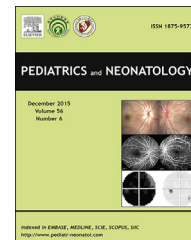


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ORIGINAL ARTICLE

The Correlation between Endoscopic Reflux Esophagitis and Combined Multichannel Intraluminal Impedance-pH Monitoring in Children

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Key Words

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Background: Gastroesophageal reflux (GER) is the retrograde flow of gastric contents into the esophagus and may induce a variety of complications. Endoscopically visible breaks in the distal esophageal mucosa are the most reliable evidence of reflux esophagitis. Combined multichannel intraluminal impedance and pH-metry (MII-pH) is a technique that enables monitoring of GER independent of its acidity. The aim of this study is to investigate the GER patterns in children with the aid of MII-pH monitoring and determine the correlation between endoscopically proven reflux esophagitis and reflux types by MII-pH monitoring.

Methods: One hundred and twenty children were enrolled from January 2010 to October 2011 for MII-pH monitoring. We studied the GER patterns by means of pH (acid and nonacid reflux) and composition (liquid, mixed, and gas reflux) by the esophageal MII-pH signals. Meanwhile, 34 (28.3%) patients received esophagogastroduodenoscopy examination at the same time. The severity of reflux esophagitis was graded with Los Angeles classification.

Results: MII-pH monitoring significantly increased the detection of numbers of reflux compared with traditional 24-hour pH monitoring ($p < 0.001$). The significant cutoff value of MII-pH parameters including DeMeester score ≥ 21 , duration of longest acid reflux ≥ 17 minutes, and occurrence of acid reflux for more than 5 minutes showed good correlation in the prediction

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of the presence of endoscopic reflux esophagitis. The odds ratios of the above mentioned parameters were 12.6, 8.94, and 7.5, respectively ($p = 0.02$, $p = 0.01$, and $p = 0.01$). Furthermore, ≥ 3 episodes per day of acid reflux for more than 5 minutes can predict the occurrence of severe reflux esophagitis (odds ratio 12.78, $p = 0.009$).

Conclusion: MII-pH monitoring not only raised the diagnostic yield in identifying GER, but it also showed significant correlation with the presence of endoscopically proven reflux esophagitis in children.

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1. Introduction

Gastroesophageal reflux disease (GERD) in children has been defined as troublesome symptoms and/or complications caused by reflux of gastric contents into the esophagus.¹ It affects as much as 30% of the pediatric population and is by far the most common disease caused by abnormality in esophageal motility.² Clinical features of GERD in infants and children are quite variable. The gastrointestinal and extraesophageal symptoms vary among individuals and may change by age. Reflux esophagitis, represented with endoscopically visible breaks in the distal esophageal mucosa, is the most common consequence of esophageal injury caused by acid reflux.³

Combined multichannel intraluminal impedance and pH-metry (MII-pH) is a relatively novel technology to detect intraluminal bolus movement and is considered the best method that can achieve high sensitivity for detecting all types of reflux episodes regarding acidity (acidic, weakly acidic, weakly alkaline) and composition (liquid, gas, mixed).⁴ Previous studies did not provide a distinct parameter of MII-pH results to predict esophageal mucosal injury in children.⁵ The aim of the present study is to investigate the GER pattern in children with the aid of MII-pH monitoring and to determine the correlation between reflux esophagitis proven by endoscopy and reflux patterns by MII-pH monitoring.

2. Patients and method

2.1. Study participants

From January 2010 to October 2011, 120 consecutive patients recruited from the Departments of Pediatrics and Otolaryngology, National Taiwan University Hospital were prospectively enrolled. The mean age of this study population was 4.6 years, ranging from 6 days to 18 years at the time of investigation. The patients were referred for evaluation due to either respiratory symptoms/signs (cough, asthma, hoarseness, stridor) or gastrointestinal diseases (nausea, vomiting, regurgitation, dysphagia, heartburn sensation). None had gastric outlet obstruction, small bowel obstructive lesion, or gastrointestinal tract malrotation. In addition to the evaluation of GERD, upper gastrointestinal tract anatomical lesion, and associated esophageal motility disorder, 34 (28.3%) patients received

esophagogastroduodenoscopy (EGD) for macroscopic examination, histologic specimen confirmation, and standard operating procedure before performing percutaneous endoscopic gastrostomy. All of the endoscopic findings were recorded including the appearance of endoscopic esophagitis. The severity of reflux esophagitis was graded according to the Los Angeles (LA) classification.⁶ The study protocol was approved by the Institutional Review Board of the National Taiwan University Hospital, and the patients themselves or their guardians provided signed informed consent for clinical data analysis.

2.2. Twenty four-hour MII-pH investigation and analysis procedure

All patients received 24-hour combined MII-pH monitoring with a single pH and eight-ring electrodes catheter (Z61A pHersaflex Disposable Internal Reference Impedance + pH Catheters, Sierra Scientific Instruments, CA, USA) and tolerated it well. Before the procedure, the catheter was calibrated using buffered solutions of pH 4.0 and 7.0 as specified by the manufacturer (MMS, Enschede, The Netherlands). The catheter was introduced transnasally through the esophagus and the pH sensor was placed about 3 cm above the gastroesophageal junction, which was confirmed with esophageal manometry, radiography, or transnasal EGD. Patients were on a regular diet during the investigation period. The frequency of meals, body position, and related symptoms were recorded. Impedance and pH data were stored in a digital data-logger (Ohmega, MMS, Enschede, The Netherlands) using a simple frequency of 50 and 1 Hz, respectively.⁷

An acid reflux was defined as a drop in intraesophageal pH ≤ 4 for 5 seconds or more. DeMeester score was calculated.⁸ DeMeester score greater than 14.72, upper limit of normal (95th percentile), was defined as abnormal. The parameters obtained from pH monitoring included the total number of reflux episodes, the number of reflux episodes lasting > 5 minutes, the duration of the longest reflux episode, and the reflux index (RI), which means the percentage of the entire record that esophageal pH is < 4.0 . An RI $> 7\%$ was considered abnormal, an RI $< 3\%$ as normal, and an RI between 3% and 7% as indeterminate.⁹

Each MII tracing was automatically analyzed using the package analytic software (MMS software 8.19, MMS, Enschede, The Netherlands) and was then reviewed manually. A liquid reflux was defined as a fall in impedance

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