Repetitive rectal painful distention induces rectal hypersensitivity in patients with irritable bowel syndrome

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Background. A reduced rectal perceptual threshold has been reported in patients with irritable bowel syndrome (IBS), but this phenomenon may be induced by a comorbid psychological state. We evaluated the rectal pain threshold at baseline and after conditioning (repetitive rectal painful distention: RRD) in patients with IBS or functional abdominal pain syndrome (FAPS), which is an abdominal pain disorder, and in healthy controls, and determined whether rectal hypersensitivity is a reliable marker for IBS. Methods. The rectal sensory threshold was assessed by a barostat. First, a ramp distention of 40 ml/min was induced, and the threshold of pain and the maximum tolerable pressure (mmHg) were measured. Next, RRD (phasic distentions of 60-s duration separated by 30-s intervals) was given with a tracking method until the subjects had complained of pain six times. Finally, ramp distention was induced again, and the same parameters were measured. The normal value was defined by calculating the 95% confidence intervals of controls. Results. Five or six of the seven IBS patients showed a reduced rectal pain threshold or maximum tolerable pressure, respectively, at baseline. In all patients with IBS, both thresholds were reduced after RRD load, but they were reduced in none of the patients with FAPS. RRD significantly reduced both thresholds in the IBS group (P<0.05), but it had no effect in the control or FAPS groups. Conclusions. Rectal hypersensitivity induced by RRD may be a reliable marker for IBS. Conditioning-induced visceral hypersensitivity may play a pathophysiological role in IBS.

Key words: visceral sensation, conditioning, irritable bowel syndrome, functional abdominal pain syndrome

Introduction

Functional gastrointestinal disorders (FGIDs) are characterized by chronic or recurrent gastrointestinal symptoms that are not explained by structural or biochemical abnormalities. Rome II criteria defined these disorders based on gastrointestinal symptoms and classified them as anatomical site-specific syndromes.¹ Irritable bowel syndrome (IBS) is one of the FGIDs, and several reports recently suggested that a visceral hypersensitivity plays an important role in the pathogenesis of this disorder.²-⁶ Moreover, Munakata et al.⁴ demonstrated that repetitive sigmoid colon distention induces rectal hyperalgesia in IBS patients, and this finding is considered to be a highly specific perceptual alteration in IBS. However, these altered visceral sensations in IBS patients may result from response bias,⁷ which is possibly induced by a comorbid psychological state such as anxiety or somatization.⁸ Functional abdominal pain syndrome (FAPS), which is also one of the FGIDs, is similar to the psychiatric diagnosis of Somatoform Pain Disorder in the DSM-IV.⁹ Although IBS and FAPS have a common clinical feature, chronic unexplained abdominal pain, their pathogenesis is thought to be different according to the disease concepts defined by Rome II criteria.¹

In this study, we examined rectal sensation in patients with IBS or FAPS and in healthy controls in order to test our hypothesis that visceral hypersensitivity is an important underlying mechanism in IBS in contrast to FAPS. It has been reported that visceral stimulation can be interpreted as stress by IBS patients, because it evokes daily symptoms and negative emotion.² Moreover, visceral stimulation is important in IBS pathophysiology because one criterion of IBS is that...
abdominal pain is relieved by defecation. Therefore, we evaluated the rectal perceptual threshold using a barostat not only under baseline conditions but also after visceral stimulation.

**Subjects and methods**

**Subjects**

**Controls**. Fourteen healthy subjects (eight women and six men) were recruited by advertisement to serve as controls. All had normal bowel habits, and none had known gastrointestinal disease, were taking medication, or had a history of gastrointestinal symptoms or of acute or chronic illness.

**Patients**. Seven patients with IBS (five women and two men) and six patients with FAPS (four women and two men) were recruited from the Department of Comprehensive Medicine, Hokkaido University Hospital. Selection criteria included a positive diagnosis by the Rome II criteria. No patients had evidence of organic disease by diagnostic studies, which included blood tests, urinalysis, plain X-ray film of the abdomen, abdominal ultrasonography, and colonoscopy. Verbal and written informed consent were obtained from each subject. This study was approved by the Hokkaido University Ethical Committee on Human Studies.

**Psychological status checklist**

All subjects completed the hospital anxiety and depression scale (HADS) questionnaire, which assesses current psychological status regarding anxiety and depression.

**Visceral stimulation device**

A computer-driven barostat device (Synectics Visceral Stimulator; Synectics, Stockholm, Sweden) was used for the evaluation of rectal sensation. It could be programmed to deliver distention according to various protocols by air inflation of the barostat bag in the rectum, to simultaneously record pressures and volumes (sampling rate once per second), and to log sensations (i.e., pain or maximum tolerance) by a push-button marker device onto a data file. The barostat bag (a thin-walled polyethylene bag) was attached tightly at both ends to a silastic tube (external diameter, 18F, MAK-LA; Los Angeles, CA, USA). The lumen of the tube was located within the barostat bag, and the open ends of the tube were connected to the inflation channel and pressure sensor port of the barostat device. The maximum capacity of the bag was 500 ml, its external diameter was 5 cm, and its length 9 cm. Before placement in the rectum, the bag was checked for air leaks by maintaining an intrabag pressure of 20 mmHg for 5 min in water.

**Thresholds**

Rectal perceptual thresholds of pain and maximum tolerance were determined during rectal distention as the intrabag pressure (mmHg) that induced pain or maximum tolerance, respectively.

**Experimental protocol**

All medications known to affect the gastrointestinal tract were discontinued 48 h before the procedure. After a 15-h fast, bowel cleansing was performed by warm water enema (250 ml). Subjects were placed in left lateral decubitus position on the bed, and the barostat bag, which was lubricated with olive oil, was inserted into the rectum. Then, subjects lay prone on the bed. The experimental rectal distention protocol started after a 30-min resting period. Although the examiner was always present, interaction with the subject ceased after initial explanation of the respective task.

First, subjects were given ramp distention (ramp distention #1). The barostat device was programmed to inflate the bag at an inflation rate of 40 ml/min. During ramp distention, we determined two sensory thresholds, pain and maximum tolerance. When the subjects felt that the distention was intolerable, they pressed the pushbutton (i.e., the threshold of maximum tolerance was obtained); then the bag was instantaneously deflated and this first session was finished. Ten minutes later, the second session, phasic distention with sensory tracking [repeated rectal distention (RRD) as conditioning] was started. The distention device was programmed to deliver intermitted phasic distention (60-s duration) separated by 30-s intervals at a resting pressure of 0 mmHg. Phasic distention consisted of rapidly inflating the bag at 14 ml/s until the target pressure was reached, maintaining it for 60 s, and finally rapidly deflating it at 14 ml/s. The target pressure was programmed as 5, 10, 5, 15, 20, 5, 10, 30, 35, 40, 45, and 50 mmHg (semi-randomly ascending protocol). This protocol was maintained until the subject complained of pain. When the subject indicated pain, the distention device mode changed to sensory tracking, that is, the pressure of distention was then randomized to stay the same or to be decreased by 3 mmHg. If the subject did not feel pain in the tracking mode, the distention was then randomized to stay the same or to be increased by 3 mmHg. The tracking mode distention lasted until the subject reported pain six times, and then the pain threshold was determined by calculating the mean value of the pressure inducing pain. All subjects