Effect of bending exercise on gastroesophageal reflux in symptomatic patients

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Background: Recumbency and bending are thought to provoke symptoms of reflux in patients with gastroesophageal reflux disease (GERD). The effect of exercise which involved bending and abdominal contractions was evaluated in symptomatic patients of GERD using continuous 24-hour ambulatory esophageal pH test.

Methods: Twenty-five patients with GERD, confirmed by abnormal 24-hour esophageal pH study, performed exercise for 30 minutes consisting of 5 sessions of 6 minutes each. The exercise involved toe touching from supine, sitting and standing position of 2 minutes’ duration each. Each 2 minutes’ period included 8 repetitions of the same exercise of 15 seconds’ duration. 24-hour esophageal pHmetry was done on day 1 without exercise and on day 2 with 30-minute exercise. Reflux time percent (RT%) pH <4 was compared between days 1 and 2 and 30 minutes before and during exercise.

Results: Fourteen patients were upright refluxers and 11 patients were combined refluxers, which included 4 patients with supine reflux and 7 patients who refluxed both in supine and upright positions. The median (range) 24-hour RT% on day 1 and day 2 was 7 (5-40) and 7 (4-46), respectively (p=0.15). RT% during 30 minutes exercise compared with 30 minutes before exercise was 6.6 (0-60) and 0.0 (0.0-80) (p = 0.02), respectively. In combined and upright refluxers, RT% during and before exercise was 13 (0-53) and 0.0 (0.0-42) (p=0.008), respectively and 0.0 (0-60) and 0.0 (0-80), (p=0.71), respectively. RT% between upright and combined refluxers during exercise was 0.0 (0-60) and 13 (0-53), respectively (p=0.004). The mean (SD) LES pressure in mmHg in combined and upright refluxers was 7 (2.9) and 19.6 (6.8), respectively (p=0.008). Esophagitis in combined and upright refluxers was seen in 8 patients (72.7%) and 2 patients (14.3%), respectively. Two patients (8%) developed symptoms during exercise.

Conclusion: Exercise which involves bending precipitates reflux in patients with moderate-to-severe GERD.

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Methods

Patient population
A patient was diagnosed as having GERD on the basis of symptoms of reflux and abnormal 24-hour esophageal pH test. Patients who had biliary tract surgery, peptic ulcer, pregnancy or any systemic disease were excluded. All subjects gave consent for the study. The study was approved by the ethical committee of the institute.

In the primary assessment of each patient, symptoms were graded by assigning a point according to frequency, duration and severity of each symptom as suggested by Jamieson et al. Upper gastrointestinal endoscopy was done to look for esophagitis, peptic ulcer or hiatus hernia. Esophagitis was graded as per the Los Angeles system.

Esophageal manometry
Esophageal manometry was done using multilumen esophageal polyvinyl catheter system (Narcobiosystem Healthdyne Company, Texas, USA). The catheter had 3 recording ports at 5 cm intervals. LES pressure was obtained using slow-pull through method. Normal values for esophageal manometry were taken as by Benjamin et al.

24-hour ambulatory pH test
Intra-esophageal pH monitoring was done using glass pH electrode (Ingold, AGE industrie, Switzerland) which was placed trans-nasally 5 cm above the upper margin of the manometrically determined LES. An ambulatory recorder (Proxima light 2, Proxima Electronicus, Montova, Italy) was used to obtain pH data.

24-hour esophageal acid exposure was taken as percent time pH <4 for total, supine and upright time. Abnormal 24-hour esophageal pH was considered if the values of reflux time percent (RT%) were 2 SD above the mean values obtained in healthy subjects.

Patients were categorized into following groups:
(a) Upright refluxers – reflux in upright position only
(b) Supine refluxers – reflux in supine position only
(c) Reflux in both upright and supine positions.

Patients with supine reflux plus patients who refluxed in both supine and upright position were combined into one group and called combined refluxers.

Study protocol
Four meals were given during 24 hours; other than meals the patient could take only water. Aerated drinks, alcohol, coffee and smoking were excluded. Patients did not take any drugs 3 days before the study.

Patient remained upright during day time from 5 a.m. to 10 p.m. During this period, the patient could sit, stand or walk, but was not allowed to bend or stoop except during the exercise time. Patient would go for sleep and would remain in lying down position from 10 p.m. to 5 a.m. Each patient had a 24-hour esophageal pH study on day 1 to confirm GERD. On day 2, a 24-hour esophageal pH test was done along with 30 minutes exercise.

Exercise protocol
Exercise was performed in the morning, after an overnight fast. The 30-minute exercise (Figure 1) involved 5 ses-
sessions of 6 minutes duration each. Each 6-minute session included 3 exercises which included toe-touching from supine, sitting and standing position of 2 minutes each. Each 2-minute period included 8 repetitions of the same exercise of 15 seconds. Between each session there was a rest period of 2 minutes. Patients were asked to note any symptom during exercise and inform the attendant who noted it in the diary. Before starting exercise the patient remained in the sitting position and at rest for a period of 30 minutes (control period). Patients were asked to touch their toes by using maximum effort.

**Statistical analysis**
Statistical analysis was done by using SPSS for Windows (release 11.5). Data were expressed as mean (SD), median (range) and percentages. Appropriate tests were used for comparing data which included chi square test, Wilcoxon’s signed rank test and Mann–Whitney’s test. Differences with *p* < 0.05 were accepted as significant.

**Results**
Thirty patients of GERD were taken for the study. Five patients were excluded because of lack of compliance in performing exercise. Finally, 25 patients (mean [SD] age 35.2 [5.5] years; 12 men) underwent the complete 30-minute exercise and 24-hour esophageal pH study. Two patients had mild symptoms, 18 had moderate symptoms and 5 had severe symptoms of GERD. Fourteen patients had upright reflux, 4 had supine reflux and 7 had reflux both in supine and upright positions. Ten patients (40%) had esophagitis; 8 patients had grade B, 1 had grade C and 1 had grade A esophagitis. In upright and combined refluxers, esophagitis was seen in 2 patients (14.2%) and 8 patients (72%), respectively. The mean (SD) LES pressure of all patients was 11.6 (8.5). In combined and upright refluxers, the LES pressure was 7.0 (2.8) and 19.6 (6.8) mmHg (*p* = 0.001), respectively.

**Effect of exercise on reflux (Figure 2)**
Twenty patients could touch their toes with maximum effort. The median (range) 24-hour RT% on day 1 and day 2 was 7 (5–40) and 7 (4–46), respectively (*p* = 0.15). On day 2, the RT% during the 30-minute exercise and 30 minutes before the exercise was 6.6 (0–60) and 0.0 (0–80), respectively (*p* = 0.02) (Table).

Among upright refluxers, RT% during and before exercise was 0.0 (0–60) and 0.0 (0–80), respectively (*p* = 0.71). In combined refluxers, RT% pH<4 during and before exercise was 13 (0–53) and 0.0 (0–42), respectively (*p* = 0.008). The total RT% pH<4 in upright and com-
bined refluxers during exercise was 0.0 (0–60) and 13 (0–53), respectively (p=0.004). Two patients developed symptoms during exercise. One patient of upright reflux developed nausea and water brash and another patient of supine reflux had belching post-exercise.

**Discussion**

In this study, we assessed the effect of physical exercise which involves bending on reflux in patients of GERD using continuous esophageal pH monitoring. The mode of exercise involved toe-touching from supine, sitting and standing position. These maneuvers involve bending and stretching. Bending causes abdominal muscle contractions with transient increase in intra-abdominal pressure. These factors are thought to provoke reflux.11,12

We observed a significant increase in acid reflux during exercise in patients of GERD which was significantly more in combined refluxers compared with upright refluxers. We also observed that patients who had combined reflux had low LES pressure compared with upright refluxers. Esophagitis was seen more in combined refluxers (72%) compared with upright refluxers (14%). There was poor correlation between exercise and symptoms as only 2 patients developed symptoms during exercise. We presume that raised intra-abdominal pressure precipitated acid reflux under the setting of low LES pressure. These factors are thought to provoke reflux.11,12

A majority of reflux episodes occur during transient LES relaxations in both normal subjects and in patients of GERD.13 Reflux induced by abdominal straining is less common, and is important when sphincter pressure is also low. Various studies have shown that stress maneuvers such as leg raising or abdominal compressions raise intra-abdominal pressure. Dent et al14 evaluated the interrelationship between reduction of LES pressure and elevation of intra-abdominal pressure in induction of GER in healthy subjects. Leg raising or abdominal compressions were used as stress maneuvers to increase intra-abdominal pressure either alone or in combination with stimuli that concurrently lowered LES pressure, namely multiple rapid swallows or intra-esophageal balloon distention. They observed that in healthy subjects, in the presence of competent LES, these maneuvers did not increase GER, but reflux increased when LES pressure was low.

It has been seen in previous studies that under physiological conditions there is an adaptive and protective increase in LES pressure in response to increase in intra-abdominal pressure due to maneuvers such as straight leg raising or by graded compression of abdominal wall by sphygmomanometer.15,16 This response is deficient in patients of GERD and is probably mediated by a cholinergic vagal reflux. Vagal dysfunction has been demonstrated in previous studies especially in patients of severe reflux esophagitis. Esophagitis is thought to damage adjacent vagal trunks.16,17 Since in our study patients of combined refluxers had low LES pressure and esophagitis, we presume that possibly there was deficient adaptive increase in LES pressure due to vagal dysfunction.

This study reveals that exercise caused more acid reflux in patients of GERD especially those having moderate to severe reflux. These patients should have some lifestyle modification to avoid such physical activity which involves bending; however, larger studies are required with continuous 24-hour pH and manometry for further clarification.

**References**


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