Crural Diaphragm Function Monitoring in the Lower Esophageal Sphincter Area

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Background: The crural part of diaphragm has the function of external esophageal sphincter. We monitored the activity of this part of the diaphragm during using esophageal manometry simultaneously with spirometry and gastroscopy in GERD patients.

Aim: To prove that facilitated physiological abdominal breathing increases the tone of the LES area and that the diaphragm plays a crucial role in the competence of the LES .

Materials and methods: A group of 26, aged 43.6 in average were examined by using spirometry and manometry in the same time and 1 patient was monitored by gastroscopy. All patients had verified GERD. The examination of pressure changes in the HPZ area of the esophagus using esophageal manometry (HRM) concurrently with the spirometric diaphragm examination by simultaneous measurement of maximum occlusal pressures (PI max and PE max) and during facilitated diaphragmatic (abdominal) breathing.

Results: In 26 patients inspiratory occlusal pressures (PI max) are reduced (p=2.77455 E-09) and expiratory pressures (PE max) decreased marginally (p= 0.01721567) in compare to calculated normal data. The mean rating of low esophageal pressure is 14.55mm/Hg.

- Manometry study during PI max and PE max maneuvers:

PI max maneuver: inspiratory phase: increased the LES pressure on average 62.47mm/Hg (p=0.000003) (fig. 1)

PE max maneuver: expiratory phase: increased the LES pressure on average 55.42mm/Hg (p=0.000003) (fig. 2)

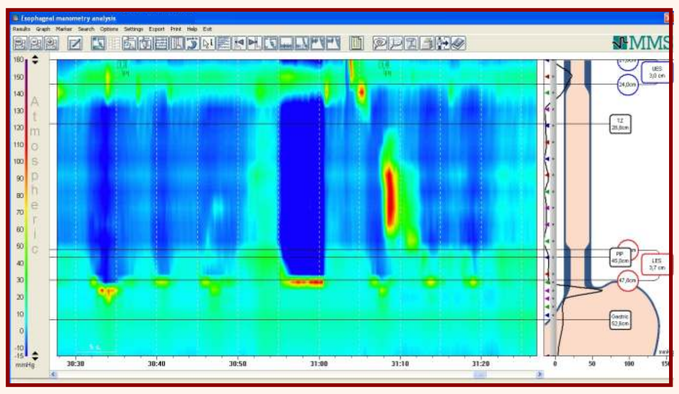
- **Facilitated abdominal breathing:** increased the pressure in the LES area from resting pressure 7mm/Hg on average to 42.32mm/Hg on the top of inspiration. (fig. 3)

- *We have noticed a paradoxical reaction (eccentric contraction of the diaphragm) during the PI max in 8 patients (fig. 4).*

The changes in the LES function can be also observed during gastroscopy. The facilitated diaphragmatic breathing regulates the sphincter incompetence in the expiratory phase.

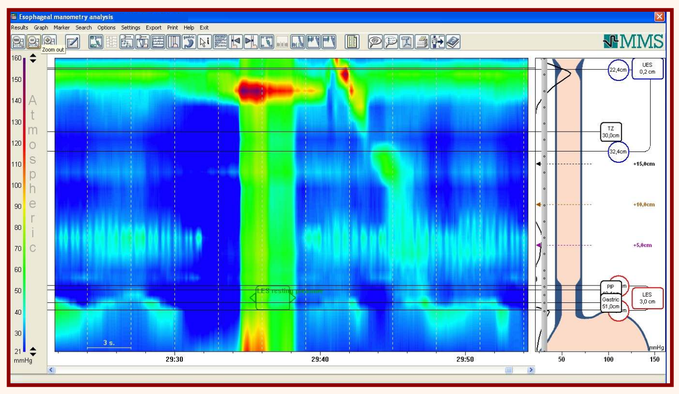
- Gastroscopy: We noticed the LES expiration incompetence during thoracic breathing (fig.5) and the normalization of this during facilitation abdominal type of breathing after rehabilitation therapy (fig.6).

Fig.1



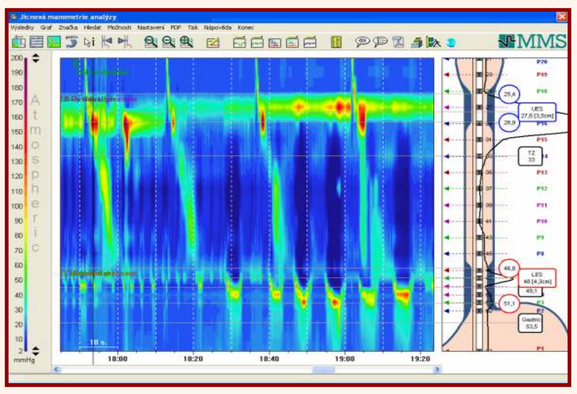
Legend: Normal type of diaphragm activity in low esophageal sphincter area during PI max maneuver.

Fig. 2



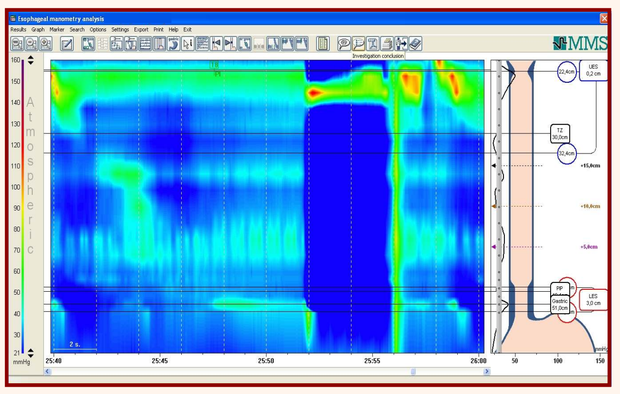
Legend: Classical type of diaphragm activity in low esophageal sphincter area during PE max maneuver.

Fig. 3



Legend: The facilitated abdominal tidal breathing in the right half of figure.

Fig. 4



Legend: Paradoxical (eccentric contraction) type of diaphragm activity in low esophageal sphincter area during PI max maneuver.

Fig. 5

legend fig 5: Les area during thoracic breathing (before rehabilitation therapy)
fig 5a) thoracic breathing - inspiration
fig 5b) thoracic breathing - expiration - incompetence of LES sphincter

Fig. 6

legend fig 6: Les area during abdominal breathing (after rehabilitation therapy)
fig 6a) - inspiration phase
fig 6b) - expiration phase

Conclusion: All our patients with GERD have a decreased diaphragm function. The facilitated physiological abdominal breathing increases the tone of the LES area. The reduction of PI max in many probandes with GERD could suggest the disorder of the diaphragm crural function. There was even found a paradoxical reaction of a diaphragm (an eccentric contraction) in some patients. Practicing the diaphragm function may play a role in treating GERD patients. The video performed during gastroscopy in the LES area demonstrating a difference between abdominal and thoracic breathing on the tone of the LES area was successfully used to motivate GERD patients to practice the facilitated abdominal breathing. Further research is needed.

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