Discussion Summaries

Effects of diaphragmatic breathing on the pathophysiology and treatment of upright reflux: a randomized controlled trial

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Abstract

Patients with upright reflux have predominantly nonerosive esophagitis and can be successfully treated with non-pharmacological treatments. In some studies, diaphragmatic breathing reduced acid exposure and improved gastroesophageal reflux disease (GERD) symptoms in reflux patients. Further investigation is needed to assess the mechanism of action and efficacy of Diaphragmatic breathing.

We summarize the @GIJournal discussion held on March 17, 2021 during which we discussed the article by Halland et Al titled “Effects of diaphragmatic breathing on the pathophysiology and treatment of upright reflux: a randomized controlled trial.” Key findings were reviewed by our expert Dr. Magnus Halland (MH) and the session was moderated by Dr Linda Nguyen (LN).

Introduction

The pathophysiology of upright reflux is not well defined. It might be due to an increase in intra-gastric pressure leading to transient relaxation of lower esophageal sphincter. In contrast to supine and bi-positional reflux which are due to decrease lower esophageal sphincter (LES) pressure, upright reflux does not lead to erosive esophagitis. For that reason, non-pharmacological treatments like diaphragmatic breathing (DB), seem to work in upright reflux as shown by two recent studies.

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Article Summary

Halland et Al, conducted a randomized controlled trial to determine the mechanism of action and the efficacy of DB in reducing gastroesophageal reflux (GER) events during concordant assessment of LES and gastric pressure after a standardized meal and during a prolonged ambulatory period.

The study enrolled adults with upright GER from the esophageal clinic and healthy controls by public advertisement. Inclusion and exclusion criteria were strict. The use of proton pump inhibitor within 7 days excluded any individual from the study. The duration of the trial was approximately two years (between March 2017 and February 2019).

There were two main steps in the trial.

First, both patients and healthy controls underwent esophageal high-resolution impedance Manometry (HRIM) to identify anatomy and esophageal motility disorder, to measure esophageal/gastric pressures and impedance and to observe for reflux events. HRIM was done chronologically at baseline, after a standard pH neutral “refluxogenic” meal eaten within 10 minutes, after repeated provocative maneuvers (Valsalva and abdominal hollowing) that induce reflux or increase diaphragmatic tone and finally after randomization to 10 minutes of DB then 10 minutes of observation versus 20 mins of observation (10 mins of sham intervention like listening to music included).

(Figure 1)

Figure 1. Overview of manometric experiments. DB, diaphragmatic breathing.

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The HRIM catheter was then removed and replaced 6 hours later by the pH-impedance catheter for the second step of the trial. This part was done during two successive days and patients had “refluxogenic” meal on both days. During the first 24-hour monitoring, standard instructions were given along with instructions to avoid any of the maneuvers performed during manometric study. During the second 24-hour monitoring, half of the patients and controls were randomized to DB for 30 minutes after each meal and the other half listened to music for 30 mins after each meal (sham intervention).

During the first step, similar mean baseline LES and gastric pressure were recorded with an increased postprandial gastric pressure between patients and controls. The provocative maneuvers lead to a statistically significant increase in gastric and LES pressure. Moreover, during manometry, LES pressure was higher with postprandial DB then with sham in patients and controls, but gastric pressure was similar. With per-protocol analysis, 20 mins postprandial impedance-detected reflux events in patients and healthy controls decreased with DB.

In the second phase of the study, DB in patients and controls on day 2 resulted in a decrease in total number of ambulatory reflux events. No statistically significant difference between upright and total acid exposure in patients and controls was noted. However, the percentage of esophageal acid exposure time in a 2-hour window after standardized meal decreased on day 2 compared to day 1 in patients in the DB group.

All in all, this study gave an insight on the mechanism of upright GER by showing that the only difference found between patients and controls at baseline was an increase in postprandial gastric pressure. It also showed DB effects: DB increases and restores EGJ pressure gradient and thus decreases postprandial reflux events in patients and controls in ambulatory and observed settings (increases LES pressure and decreases postprandial but not total esophageal acid exposure time).

Although the results of this study are very promising, the relatively small sample size and the absence of symptoms assessment are important limitations of the study.

Discussion

A pre-discussion poll by LN showed nearly half of the 75 respondents had either recommended diaphragmatic breathing or had used it personally. This highlights the need for this study to understand the mechanism and the efficacy of DB.

LN: Q1: There are different ways DB is taught. Do you think the method matters? How long do you think is enough?

MH: We don't know the ideal dose yet, but 15-30 mins after meals seems like a good starting point.

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@AllonKahn: After reading your work, that's what I've been telling patients. Most are motivated enough to do it and certainly symptom improvement can be reinforcing.

LN: All of my patients love the idea. Waiting to hear them report back. Breathing quietly for 15-30 mins seems tough (at least for me). How did patients feel about this dose?

MH: Patients who volunteer for RCTs are often motivated superstars! Whether acceptable and effective in a broader clinical setting remains uncertain and would be a great multicenter study to get going!

There are many ways to teach and no one knows the right "dose". How I do it:

1. Explain the rationale and pathophysiology.
2. Ask to perfect the technique in resting state away from meals etc. This is easiest done supine
3. Gradually build the ability to do more time.

@SultanMahmoodMD: Do you do the education yourself or refer to a behavioral specialist. Any online resources available?

LN: We don't have a behavioral specialist so I look to YouTube or teach myself (but can't do 15 mins). I've sent patients to @DrRiehl's DB video¹.

PerelmansPearls: How much time are you spending teaching? I do the seated hand on chest/hand on belly. Slow in to raise hand in belly, slow exhale to drop hand on belly 5-10min x 3/day. Haven't tried supine approach while teaching but have suggested they try that at home.

LN: I find teaching when supine or semi-supine easiest. I typically slouch in my chair. Not easy to do with TeleHealth though so I refer patients to YouTube.

LN: Did you ensure proper technique before the HRIM or pH testing?

MH: Teaching before the pH study was more prolonged and the rationale explained. Patients were not told what DB was before HRIM but we quickly instructed those randomized during HRIM and "hid" it among other maneuvers.

LN: Which DB technique was used for this study?

MH: We used similar methods to the description in the review article "Teaching diaphragmatic breathing for rumination syndrome" by Chitkara et Al. Patients are asked to sit or lay in relaxed position with one hand on upper chest and one on abdomen at the bottom of the sternum. The hand on the chest should stay still while the one on the abdomen should rise and fall with the diaphragmatic breath. Each inhalation and exhalation should be slow.²

@AndrewOngML: I use the standardized protocol shown in table 1 below taken from the study of Ming-liang Ong et al "Diaphragmatic Breathing Reduces Belching and Proton Pump Inhibitor Refractory Gastroesophageal Reflux Symptoms"³, but it is for belching, not GERD, though there is overlap. Securing buy in from patients by demonstrating efficacy in clinic is important,

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especially recognizing pre-belch "aura" & doing DB when the aura is felt. Not sure if we can do the same for GERD.

Supplementary Table 1. Standardized Protocol for Administering Diaphragmatic Breathing Exercises

1. Belching mechanism and the purpose of breathing exercises explained to patient.
2. Patients started the exercise in a supine position. One hand was placed on the chest and the other hand on the abdomen above the navel.
3. Instructions were given to inhale through the nose, and exhale with the mouth open, moving only the abdomen. The metaphor of inflating and deflating a balloon in the abdomen was given to aid patient in performing this maneuver.
4. The goal was to feel the abdomen rise and fall with each breath, while the chest and shoulders remained still. Importance was placed on complete inflation and deflation of the abdomen.
5. Inhalation and exhalation were made to be slow, with the patient counting to 4 with each inhalation and exhalation. Inhalation was then maintained at 4 counts, and exhalation gradually extended to 8 counts. If a participant had difficulty prolonging exhalation, breathing out was done through pursed lips instead.
6. When assessed by the speech therapist to be competent in performing the above maneuvers, participants progressed to doing the same exercise while sitting and then standing.
7. Patients were given homework to practice, and was recommended to perform 30 breaths or for 5 minutes 3 times daily, and for 5 minutes when symptomatic.
8. Each participant was seen for either up to 4 sessions, or until the speech therapist judged that the participant could perform diaphragmatic breathing as taught in supine and upright positions.

Table 1 Standardized protocol for DB, adapted from Ming-Liang Ong et Al. study "Diaphragmatic Breathing Reduces Belching and Proton Pump Inhibitor Refractory Gastroesophageal Reflux Symptoms".

@ijlalakbar: Are there other studies on the horizon comparing DB to other modalities?

LN: A Quick search of clinicaltrials.gov showed an ongoing randomized study comparing DB and standard care to standard of care only in patients with GERD. Outcome measures is change in the self-reported reflux disease questionnaire (RDQ)⁴.

LN: Q2: More on methods. For rumination, we commonly recommend DB 5 mins before and 5 mins after meals. Thoughts on if this could work for GERD?

MH: Might help - but I think a bit longer will be required in GERD to prevent reflux and remodel the LES long term. In rumination DB works due to reduction in gastric pressure -not so in GERD.

LN: Q3: During the HRIM, there was clear physiologic changes. There were no differences in the total Acid Exposure Time (AET) during the ambulatory pH study. Thought? 30 mins DB too hard to do? DB only helps in the immediate postprandial period?

MH: Our study looked at DB in the acute setting, and post-prandial acid exposures did reduce. Eherer looked at 1 month of training - and total acid exposure did fall- but there was no robust assessment of LES pre/post⁵. We need to learn if long term intervention is effective!

LN: Q4: In both groups, there appears to be a "rebound" effect where the number of reflux events increased during the 2nd 10-min observation period. Is this something to worry about?

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MH: Excellent point. It seems that the stomach "vents" for a while after meals, and in upright reflux patients stomach contents follow. I think longer than 10 mins might be needed for contents to "sink" and gastric accommodation to fully kick in. Would have loved a way of checking compliance during ambulatory study: a pneumo-belt or something similar. An app may have been helpful too.

LN: BellyBio is a great app I often tell patients to use for DB⁶. Got this tip also from @DrRiehl.

LN: Q5: More on mechanism. There is a significant difference in postprandial intra-gastric pressure in GERD patients compared to controls. Is this a potential mechanism to target? Can this be done with DB?

MH: Increased intra-gastric pressure may be part of pathophysiology of upright GERD (LES pressure was normal) and DB reduces gastric pressure, but other inventions could help as well.

LN: I was surprised that in your paper, DB did not seem to reduce intra-gastric pressure.

@AllonKahn: Really important distinction. Upright reflux seems like a completely distinct disorder and that's why this study is so exciting. If it's not TLESR and rather a pressure phenomenon, it needs a different approach.

LN: Thoughts on DB for NERD vs. erosive esophagitis? Esophageal hypersensitivity?

MH: I think the most potential is for GERD, Rumination and functional disorders where the mechanical defect in the GE-junction is minimal. I doubt it will work in large hiatal hernia, Barretts esophagus and severe esophagitis.

@AllonKahn: I agree with Magnus and from your list I would say it may have a role in esophageal hypersensitivity though it isn't very well-studied. I don't see we have much to lose in that situation.

LN: I agree. One of the things I find lost in video visits is that I can see how pts breathe. Many breathe shallowly. I use that as an opportunity to teach and encourage DB.

@AndrewOngML: The mechanism as to why DB works for supra-gastric belching is distractibility. I've found intentional distraction during symptoms works for globus, so I've tried & noticed it works for some. Perhaps reducing the sympathetic arousal may also be another mechanism since DB activates the Vagus.

LN: Q6: Given the safety, of DB do you think it's ready for "prime time"? Should we be recommending DB to patients despite the lack of impact on total AET and unknown effects on symptoms?

MH: DB is ready for primetime because:

1) 3 RCTs show promising results.

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2) It is free and easy to learn.

3) No adverse events.

4) Potential other benefits including anxiolytic effects/relaxation benefits.

But yet we still need more data on efficacy.

@muddasir_ayazMD: In your opinion, is this a scenario where some is better than none or where insufficient technique = insufficient results? Or both?

MH: We don't know whether there is a dose threshold, but for long term results I suspect consistent practice is key.

LN: I typically encourage patients to practice in the AM and/or before bed when they are more relaxed to build "muscle memory" when they need to do it before or after meals.

@SultanMahmoodMD: You may have covered this already but where does this fall into the management algorithm of GERD? After failure of PPI, as a way of getting off medication? Would a particular type of patient benefit who have more post prandial symptoms?

LN: I typically work with patients who have failed conservative management. 1st line if they don't want to use PPI or augmentation in those with NERD.

LN: Q7: Final thoughts? Knowing what you know now. What would you have done differently?

MH: It is always easy to see new opportunities in retrospect - would have loved a follow up pH study in "responders" 6-8 weeks down the road but it is very difficult to do in the Mayo Clinic setting.

Conclusion

In this randomized controlled trial, diaphragmatic breathing showed potential as a possible non-pharmacological treatment of upright reflux. Even if DB is easy and safe to use, larger studies are still needed to ascertain the results and to further investigate the role of DB in certain GER patients.

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