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**ReachMD**
www.reachmd.com
info@reachmd.com
(866) 423-7849

Gravity & The Gut: Exploring a Key Hypothesis for IBS

**Dr. Buch:**
While our understanding of irritable bowel syndrome, IBS, continues to grow, the pathogenesis of this condition remains elusive. What do we need to know about this condition?

Welcome to *GI Insights* on ReachMD. I'm your host, Dr. Peter Buch. And joining me to explore clinical data from a study on IBS is Dr. Brennan Spiegel. Dr. Spiegel is the author of a compelling study, "Gravity and the Gut: A Hypothesis of Irritable Bowel Syndrome," published in The American Journal of Gastroenterology in December 2022. Dr. Spiegel is a professor of medicine and director of the Cedars Sinai Center for Outcomes Research and Education.

Welcome back to the program, Dr. Spiegel.

**Dr. Spiegel:**
It's great to be back. Thanks for having me.

**Dr. Buch:**
Dr. Spiegel, let's dive right in. How did you come to develop the theory of gravity related to the gut?

**Dr. Spiegel:**
Yeah. So, on the face of it, that sounds a little weird because we don't normally talk aboutlaws of physics when it comes to irritable bowel syndrome. But this idea that we'll talk about today first came to me because a family member who has been aging and experiencing cognitive decline has been in an assisted living facility, and she's been spending more and more time lying flat on her back in bed, and about the same time she started really lying down for prolonged periods, she started to develop abdominal pain that she discussed and bloating and constipation. And, of course, I'm a GI doctor, so, family members asked me what I thought, and I started thinking, well, for starters, we're not designed to lie flat on our back for long periods of time. We're bipedal organisms that stand upright, and I wonder if there's some relationship between the physical position that you find your body in and GI symptoms. And that led me down, well, a rabbit hole, several rabbit holes, only to discover this expansive literature across many different fields that highlight how our body evolved. Every strand in our body evolved to manage the force of gravity, and it only makes sense because gravity has been with us from the moment of our conception to the day of our demise. And, of course, it was here long before the first unicellular organisms and will be here long after the human species has left this planet, and so it only makes sense that as we moved from quadrupedal to bipedal position, that all those body systems had to manage this downward constant pull of gravity upon our body. And so that's sort of what got me thinking a lot more about the gut in particular and how it evolved and what can go wrong with our body if we are intolerant of gravity in many different ways, so that's what this paper is all about.

**Dr. Buch:**
Thank you. And as a quick follow-up to that, can you tell us about the relationship between IBS and hypermobility disorders?

**Dr. Spiegel:**
Yeah. So this is a great place to kind of enter the discussion because hypermobility disorders are a classic archetypal condition where gravity is a problem. So, for example, Ehlers-Danlos syndrome, or EDS, is a condition that most of our listeners are familiar with where there's a problem with collagen deposition throughout the body. The mesentery in the gut and, of course, tendons and muscles and so on are stretchier than they should be. And so you think about the mesentery for a second. When we stand up, our abdominal contents, I think of them like a sack of heavy potatoes that we are destined to port around our entire life. We have to hoist that sack of potatoes up against gravity through a series of different elegant mechanisms that we have all evolved, physical mechanisms to support that starting

from the chassis of the backbone itself, the diaphragm and its insertion points, and of course the mesentery, which is almost like a marionette that we're holding up with strings. Our gut is not haphazardly spooled in the bottom of a sack. It is a functional stack that through, like, embryological origami sort of folds into this beautiful three-dimensional array that hangs with gravity, but if the mesentery is too stretchy because of abnormal collagen deposition, for example, then the whole system stretches and falls down. And that's what happens with Ehlers Danlos syndrome where there's a condition called visceroptosis where the intestinal system drops below its natural level, and this can lead to kinking and pressurization and, of course, bacterial overgrowth as a consequence, gas formation, diarrhea, constipation and so on. So, many, many people with EDS actually have IBS symptoms. And more interesting than that, perhaps, is that one study in England looked at hyperflexibility or hypermobility of joints in a cohort of IBS patients and found in one study nearly half of IBS patients exhibit hypermobile joints, so it may be that it's not just EDS. There's a spectrum. And some people with IBS, actually, they may not have outright EDS, but they do have stretchy ligaments and tendons that cause them to be particularly susceptible to gravity.

**Dr. Buch:**
And how does gravity link both diverticulosis and IBS together?

**Dr. Spiegel:**
Yeah, this is really interesting to me because we know that diverticular disease is more common in IBS patients than in controls. And, in fact, I've been on with you in a previous session talking a lot about diverticular disease, and listeners may want to check that out if they're interested. But we know there's a condition called SUDD, symptomatic uncomplicated diverticular disease, which looks all the world like IBS with tics. And so, if you think about it, in essence, diverticulosis is a form of gravity intolerance because the colon itself has the suspension systems of the mesentery, but also it has suspension systems of the taenia coli that run along the length of the colon. Those are like suspension cables that allow the tube to sort of maintain its shape. But when stool backs up in the colon under the influence of gravity, particularly if there's dysmotility or if there is methanogenic archaea that are overgrowing in the gut and there's slow motility, well now we have pressurization occurring excessively in the colon, and those taenia coli can give out and blow out, and so maybe that diverticulosis is actually a biomarker of sorts indicating mechanical issues managing the force of gravity. And that's one way of thinking about that and other biomarkers that we could imagine in IBS looking for.

**Dr. Buch:**
For those just tuning in, you're listening to *GI Insights* on ReachMD. I'm Dr. Peter Buch, and I'm speaking with Dr. Brennan Spiegel about irritable bowel syndrome.

Now, Dr. Spiegel, how do yoga, body awareness therapy, and aerobic exercises in irritable bowel syndrome impact your theory?

**Dr. Spiegel:**
Yeah. You know, this is really fascinating because we know that those interventions that you just listed are effective, very effective in some cases, for IBS. And I've heard from so many patients even before I wrote this paper who say, 'You know, when I do certain yoga positions that like I sit on my head, I feel better,' or tilt tables. 'If I just get a little pressure off my belly for a while, I feel better.' Other people have told me when they scuba dive that the pressure of the water kind of bolsters their gut and they feel better, but then it hurts when they get back up to sea level. Of course, there are other examples of pressure changes that are gravity related like getting up in an airplane, which can cause abdominal pain in some people. And so we know that these different interventions like exercise, strengthening essentially the antigravity function of our body so to port that sack of potatoes around, we have to have a strong backbone. We have to have strong antigravity extensor muscles along our back. The intestines are pulling on the mesentery, which is anchored at about the level of the lumbar spine, and from that perspective, it's maybe not surprising that lower back pain is so common in people with IBS. In some cases it may be a physical problem managing this kind of gravitational force across the body, and strengthening your core, your anterior abdominal wall, the back muscles, can all help with IBS. And in addition to that, even neuropsychologically we've evolved to manage gravity, there are other benefits beyond just the physical strengthening. There's also the neuropsychological benefits of these activities.

**Dr. Buch:**
And how does the gravity theory tie in with other theories on the etiology of IBS?

**Dr. Spiegel:**
Yeah. So this is important because when I thought about gravity, I wasn't thinking of some brand new theory that's supposed to overturn all the other theories. In fact, I was trying to figure out how do we concurrently allow all these seemingly disparate theories to be simultaneously true. And there are so many theories about IBS, for example, the bacterial overgrowth theory, the microbiota or neuropsychological issues, or why is there comorbid anxiety and depression, postural tachycardia syndrome, fibromyalgia. So in the paper I go through all these theories, and each one of them I trace back to gravity and demonstrate how even serotonin seems to possibly have evolved as an antigravity substance, and I go in detail in the paper of how that is and why that is. And if that's true, then

our gut, where 95 percent of serotonin is produced, is sort of the center of our gravity management systems. And so, you know, you think about POTS, postural tachycardia syndrome, that's a form of gravity intolerance where the baroreceptor reflex is off. Vertigo dizziness, that's a gravity intolerance syndrome as well. All of these are serotonin related. And so, if you go through all these different theories, bacterial overgrowth certainly is explained. For example, we talked earlier about Ehlers Danlos syndrome. And if you have any kind of mesenteric issues, kinking, problems with the gut arraying correctly in the abdominal cavity, you can get bacterial overgrowth, and then that leads to a whole set of consequences.

Neuropsychologically, if you're not interested in the bacteria and you think this is a psychological problem, well, what are gut feelings if not a reaction to gravity? Think about when you're on a roller coaster and you go down the roller coaster. You literally fall. And what happens? Your belly lights up with butterflies. This is an archetypal human experience that is like a g-force accelerometer telling you that you're experiencing a potentially existential gravitational experience.

**Dr. Buch:**
Thank you. And, Dr. Spiegel, can you share clinical data on the GI tract from astronauts in the International Space Station? And how does this data play a role in the gravity theory and caring for patients with IBS?

**Dr. Spiegel:**
Yeah. This is fascinating because it turns out that the microgravity orbit in space does affect the GI tract and appears to affect microbiota and maybe even serotonin expression. And so we know that many astronauts do get GI issues. They get abdominal discomfort. They might get constipation or diarrhea, acid reflux disease. And this points out that we do need gravity. Right? We evolved on a planet with gravity. And it may be like a Goldilocks thing where too much gravity if your body is not designed for it well is a problem, but too little gravity is a problem too. And we know, for example, that even if you look on earth going from the bottom of a mountain to the top of a mountain and looking at immune function in IBD patients for a moment, immune function changes. If you look at a rat microbiota in microgravity orbit or under different g-force conditions, it can actually change the microbiota and their serotonin expression. So there's many different lines of evidence suggesting that changing g-forces can change, like, fundamental features of our body and even in mice and rat models as well.

**Dr. Buch:**
And before we close, where are you going to take this information? What are you going to do with it?

**Dr. Spiegel:**
So, in the paper, I lay out about 30 different experiments that people could do to see if this makes sense, because what I'm saying here is really just a hypothesis. I try to back it up with extensive literature, but it's a hypothesis, so it may all be true, it may all be false, or bits and pieces of it may be true. And so there's many different research studies one can do. And even in our discussion just today thinking about, you know, roller coaster tolerance, for example, or using tilt table therapy or some of these nonpharmacological approaches like certain yoga positions and so on, may end up being much more important than we thought as potentially even first-line therapies for IBS, whereas right now I think these are kind of adjunctive therapies that we consider. But normally, we're using medical therapy as first-line for our patients with IBS, although not everyone does. So I think this opens up some new ways of thinking about IBS. And check out the paper. You'll see a whole list of potential experiments.

**Dr. Buch:**
What an excellent insight into gravity and the gut. I want to thank my guest, Dr. Brennan Spiegel, for sharing his insights.

Dr. Spiegel, thanks so very much for joining us today.

**Dr. Spiegel:**
Well, thanks again for having me.

**Dr. Buch:**
For ReachMD, I'm Dr. Peter Buch. To access this and other episodes in this series, visit ReachMD.com/GIInsights where you can be Part of the Knowledge. Thanks for listening, and see you next time.