



Dr. Bharucha is the recipient of the **IFFGD 2003 Junior Investigator, Clinical Science Research Award**. His most recent research has focused on understanding epidemiology and mechanisms of fecal incontinence and obstructed defecation, specifically characterizing the multiple recto-ano mechanisms maintaining continence.

In this article, I will try to provide a flavor for our research activities and highlight what we understand about the mechanisms of fecal incontinence and constipation. Fecal incontinence is a relatively common symptom. Depending on the definition used, the prevalence of fecal incontinence in the U.S. ranges from 2.2% to 15%, and increases with age. While most attention has focused on fecal incontinence in women, the prevalence in men is comparable to women. In listening to patients, I realized that fecal incontinence could have a devastating impact on lifestyle, that our understanding of factors responsible for incontinence was limited, and that available therapies were of variable efficacy. Therefore, our studies are directed toward answering several important questions pertaining to “idiopathic” fecal incontinence, that is fecal incontinence not resulting from another underlying disease such as multiple sclerosis. The questions we are trying to address are as follows:

How is anal sphincter damage during vaginal delivery related to fecal incontinence?

Vaginal delivery, particularly an episiotomy, can damage the anal sphincters, which are responsible for holding stool in the rectum (i.e., continence). The anal sphincters are weak in a majority of people with fecal incontinence. A small proportion of women (0–10%) become incontinent shortly after a vaginal delivery, generally because the delivery was associated with a large tear to the perineal (around the anus) muscles, probably extending to anal sphincters. Ultrasound can identify small anal sphincter defects in up to one third of all women after a vaginal delivery. The significance of these small anal sphincter defects to fecal incontinence is unclear, because most women are not incontinent after a delivery. Indeed, fecal incontinence generally presents 2–3 decades after vaginal delivery. Therefore, in a large, ongoing study of 2800 women in the community, we are trying to understand the risk factors for fecal incontinence, including the patterns of anal sphincter injury associated with fecal incontinence.

In collaboration with our colleagues in Radiology, we have developed an *MRI* to visualize (see) the pelvic floor muscles at rest and when they move [Magnetic Resonance Imaging (MRI) is a diagnostic imaging technology that uses a strong magnet and radio frequency waves to produce pictures or “images” of internal organs and structures that can be viewed on a computer monitor]. In addition to clearly visualizing the pelvic floor muscles, MRI is also safe because it does not involve radiation exposure. Currently, pelvic MRI is predominantly a research test. Using the unique medical record linkage system in Olmsted County we hope to understand which factors during vaginal delivery, (e.g., type of episiotomy, baby’s weight) increase the risk of fecal incontinence. This study is very important because it avoids the bias associated with studies conducted in patients seen in a doctor’s office. In fact, most people with fecal incontinence are extremely embarrassed to discuss the symptom with a physician.

Does nerve damage contribute to anal sphincter weakness in fecal incontinence?

The internal (or inner) anal sphincter is made of smooth muscle. Like the muscle surrounding the gut, the internal sphincter is always contracted. The external (or outer) anal sphincter is made of striated muscle, which is supplied by the pudendal nerve. Similar to other skeletal (or striated) muscles (e.g., in the arms and legs), this muscle can be contracted voluntarily to preserve continence. Pudendal nerve function can be evaluated by measuring pudendal nerve latencies (the interval between stimulation and response). Pudendal neuropathy (nerve injury) may cause sphincter weakness. Regrettably, pudendal nerve latencies are relatively inaccurate for diagnosing pudendal neuropathy. Therefore, we use electromyography (EMG) to evaluate pudendal nerve function. We observed features of a pudendal neuropathy in about 20% of patients with fecal incontinence. Our data also suggest that anal temperature sensation is a non-invasive approach to identify pudendal neuropathy. These observations need to be confirmed in future studies.

Apart from anal sphincter weakness, what other factors can cause fecal incontinence?

A variety of factors work in concert to maintain stool continence. Though most attention has focused on anal sphincter weakness, people with incontinence often have severe urgency, or conversely, reduced awareness of stool

leakage. These symptoms suggest that rectal sensation and/or capacity may be abnormal in incontinent patients. By inflating a rectal balloon, we confirmed previous studies showing reduced or increased rectal sensation in incontinent patients. We also observed, for the first time, that rectal capacity was reduced in approximately 25% of patients with fecal incontinence. The symptom of urgency was associated with a reduced rectal capacity (i.e., the rectum was stiffer) and increased sensation of rectal balloon distention. It is possible to improve rectal sensation with biofeedback therapy. Additional studies are necessary to understand why rectal capacity is reduced in some people with incontinence, thereby guiding development of newer treatments.

What causes rectal urgency?

Many patients with IBS or fecal incontinence have marked urgency, i.e., they have little time to get to the toilet. Rectal urgency has been attributed to rectal hypersensitivity, i.e., an exaggerated perception of rectal distention. In addition to reduced rectal capacity, we and others find that the rate of rectal distention influences the perception of urgency. For example, you are more likely to feel the sense of urgency if 3 ounces of stool enter your rectum in 5 seconds, rather than 5 minutes. Recent studies suggest that it is the rectal muscle contracting in response to distention, rather than the distention itself which is felt. We have adapted a paradigm used previously in smooth muscle strips to understand how the colon and rectum respond to distention at different rates. We hope to apply this paradigm (i.e., sinusoidal oscillation) to characterize exaggerated neural irritability in IBS.

What is the effect of age on anorectal functions?

We and others have shown that anal resting pressure is lower in older, compared to younger women, suggesting that anal function can decline with age. Our studies suggest that anal squeeze pressure, which reflects external sphincter function, does not decline with age. We also observed that the rectum was stiffer (i.e., less compliant) in older, compared to younger women. Taken together, reduced anal resting pressure and reduced rectal compliance would be anticipated to predispose to fecal incontinence.

Do bladder and gynecological disturbances occur more frequently in women with bowel symptoms?

We study these problems with colleagues in Urology and Gynecology. We found that bladder emptying was also affected in some women with constipation due to pelvic floor dysfunction. Some women with fecal incontinence also have uterine prolapse or cystocele, suggesting generalized pelvic floor weakness. However, in general, the prevalence of cystocele or uterine prolapse is not significantly higher in incontinent women, compared to women who do not have the symptom. This indicates that fecal incontinence is generally

caused by conditions affecting the rectum, the anal sphincters, and bowel habits.

What are the implications of these studies on helping people who suffer with fecal incontinence?

Regulating bowel habits, and pelvic floor retraining (i.e., biofeedback therapy) are relatively simple, safe, and often extremely useful options for managing symptoms in incontinent patients. Surgery to repair anal sphincter damage is useful in some patients. However, the beneficial effects of surgery appear to deteriorate over time. The efficacy of sacral nerve stimulation for fecal incontinence is currently being studied. Sacral nerve stimulation may work not only by improving sphincter function, but also by improving rectal sensation. By understanding the factors contributing to incontinence, we hope to prevent this symptom, and devise newer approaches to help people who have this symptom in future.

Summary

These small steps were only possible because patients shared their symptoms with me and participated in these studies. I am fortunate to be supported by dedicated mentors, assisted and challenged by several talented individuals, and funded by the federal government. Ultimately, I hope my work will have a meaningful impact on the lives of people who suffer from these devastating disorders, and whose interests are the *raison d'être* for the IFFGD. I am particularly grateful to the IFFGD for spearheading efforts to enhance awareness of, and funding for functional GI disorders.

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