Under Pressure: Do Volume-Based Measurements Define Rectal Hyposensitivity in Clinical Practice?

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Constipation and fecal incontinence are commonly encountered in gastroenterology practices worldwide. Though empiric therapy is recommended as the initial step in care, diagnostic testing to evaluate potential anorectal dysfunction is currently recommended by societal guidelines for cases refractory to lifestyle modification and medical therapy [1, 2]. While several modalities exist by which anorectal function can be evaluated, in practice, anorectal manometry is often the first study employed after the rectal examination—as it is commonly available (at least in comparison with other anorectal tests), less onerous than a barium defecography, and less expensive than a dynamic pelvic MRI. Although other less common testing options include barostat and impedance planimetry, these are offered less frequently than manometry and are usually limited to research centers.

While manometry equipment and protocols vary globally [3], the basic pattern of testing and reporting is relatively standard [4]. The catheter is inserted across the anorectal sphincter, resting pressures are measured, and the patient is then asked to squeeze and strain, while pressure changes are recorded. Reflexes such as the cough response and rectoanal inhibitor reflex are assessed, followed by balloon sensory and expulsion testing. During balloon sensory testing, an intrarectal balloon at the end of the manometry catheter is inflated, while sensory thresholds are measured. While some centers may use a gradual increase in balloon inflation and others may use either a plateau or more rapid inflation protocol, the fundamental concept of balloon sensory testing is similar. Namely, while the balloon volume is increased, the patient is asked to report when they can initially feel the presence of the balloon (first sensation), when they feel a sense of urgency to defecate (urge sensation) and when

they are unable to tolerate any further increase in intrarectal balloon volume (maximal tolerated volume). These volume thresholds are reported by the interpreting provider who then assesses whether the patient is hyposensitive, hypersensitive, or has normal intrarectal sensation based on these volume thresholds. Normal data vary based on the population studied, protocol employed (sitting, supine), and equipment utilized; however, most centers have a normal range to which they refer that are typically assigned based on the recorded volume parameters at each sensory threshold, a practice reinforced by the existing anorectal manometry commercial software that typically lists volume and not pressure at each sensory threshold.

Traditionally, rectal sensitivity has been defined based on direct measurements of intrarectal pressure and wall compliance as measured by barostat testing, with rectal hyposensitivity defined as weakened perception to rectal distention despite continued filling. Nevertheless, as alluded to above, since barostat testing is not widely available and generally limited to research laboratories, in practice, anorectal manometry is often employed in clinical assessment of symptomatic patients. The assumption most providers have made is that there is a fixed volume-to-pressure relationship and that patients who require more volume to achieve sensory thresholds likely have a rectum less sensitive to pressure. As a consequence, abnormal sensitivity is a common finding often reported in anorectal manometry reports. This finding is also believed to have clinical relevance as there is an observed association between decreased rectal sensitivity and 18–68% of patients experiencing chronic constipation and approximately 10% of patients with fecal incontinence [5]. Intrarectal sensation, often measured by anorectal manometry, is often used as an outcome measure in clinical investigation, and often therapeutic modalities such as neuromodulators and biofeedback are suggested based on these findings.

In this elegant and innovative study by Verkuijl published in this issue of *Digestive Diseases and Sciences* [6], the

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authors addressed the question as to whether altered volume thresholds in actuality translate to altered sensitivity. In other words, is it reasonable to infer altered sensitivity based on balloon sensory testing performed via anorectal manometry—or is this an erroneous assumption? Although rectal capacity may vary from patient to patient based on a variety of factors, if a patient does have a greater rectum volume, they may have a delayed volume-based threshold but not true altered rectal sensitivity, since the measurement of rectal sensitivity is defined by a sensation experienced in response to a certain pressure and not a certain volume. Accordingly, a larger rectal capacity may in and of itself lead to a larger balloon volume required to achieve a sensitivity threshold although pressure sensitivity may be unaltered.

During this study, the investigators retrospectively evaluated 100 patients with symptoms of anorectal dysfunction in comparison with 44 healthy controls. Their key finding was that while rectal volumes vary significantly in conjunction with sensory thresholds, rectal pressures revealed a normal distribution with no significant correlation between volume and pressure—in both symptomatic patients and controls. Surprisingly, they also found that normal subjects with no reported symptoms actually had higher intrarectal volumes than symptomatic patients—calling into question the use of rectal volume as a valid marker of pathology.

The suspicion that rectal volume does not correlate with rectal pressure, and therefore is not a marker of rectal sensitivity, is both convincing and plausible. These two measurements functioned independently in this study which is reasonable as patients with a more capacious rectum would not necessarily have alterations in sensitivity as higher capacity would translate to higher volume at the same pressure. These findings are also supported by prior investigation—in a study from 1994, the senior author of this study (Broens) found that pressure rather than volume triggered sensation in 12 healthy volunteers [7]. Gladman et al. [8] found that in patients with established hyposensitivity as measured by barostat, 53% had normal rectal compliance—supporting the argument that pressure and volume are either independent parameters or poorly correlated.

As in all studies, there are some limitations. Patients were evaluated by anorectal manometry with balloon sensory testing, but did not undergo barostat testing. The patients tested were symptomatic with a wide range of conditions, including constipation, incontinence, anal pain, and sundry other symptoms, rather than a homogenous population. There were demographic differences in age and gender between the patients and healthy controls. Nevertheless, the analysis was quite sophisticated, in particular, taking into account that in real-world settings many of these issues are unavoidable.

Do these data change the way intrarectal sensitivity is interpreted and how one interprets balloon sensory testing obtained via manometry? The authors believe that it alters

the discussion on both points. Although intraballoon sensory testing measures the volume at which sensory thresholds occur, this paper argues convincingly that these volume measurements do not define intrarectal sensitivity, exposing the fallacy of assessing sensitivity by measuring volume only—to do so would be not only erroneous but may also lead to unnecessary intervention. One can nevertheless assess intrarectal sensitivity by evaluating intrarectal pressure, which is available for analysis in existing software but not often reported. Perhaps, it is time to record this information as well as it is likely to be more clinically relevant and is easily obtained with existing equipment. Ultimately, further study will be needed to see whether there is clinical relevance to the pressure-derived threshold data. Certainly, recording pressure thresholds in addition to volume thresholds during balloon sensory testing makes sense physiologically as there is little rationale for recording volume-based thresholds alone given the current understanding of both anorectal physiology and published outcome studies.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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