

## A Comparison of Standard Anorectal Manometry and High Resolution Manometry Patterns in Dyssynergic Patients

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### ABSTRACT

**AIM:** To compare dyssynergic sub type patterns between SARM and HRM.

**METHODS:** Patients with dyssynergic defecation diagnosed by ARM that had maintained the same stool patterns and frequency were re-evaluated with HRM while on waiting list for biofeedback training. Anorectal resting and squeezing pressure on the bed and commode were analyzed and compared between the two modalities. Paired t-test was used to compare the pressures and sensations.

**RESULTS:** 25 dyssynergic patients diagnosed with SARM (F=21, age 41±12.9) underwent HRM. Twenty four patients had dyssynergia on HRM (96%). Twelve (48%) had similar patterns on ≥one position, and five (20%) had similar patterns in both positions. When comparing between HRM and SARM, the maximum resting pressure (70 vs 55.6 mmHg  $p<0.01$ ), anal straining on bed (73 vs 46.4 mHg,  $p<0.01$ ), rectal straining on commode (107.4 vs 71.8 mmHg,  $p<0.01$ ) and anal straining pressures on commode (76.3 vs 48.9 mmHg,  $p<0.01$ ) significantly deferred between the exams respectively.

**CONCLUSION:** HRM pressures tend to be higher than SARM. Although there is high consensus regarding diagnosis of dyssynergia, there is low correlation regarding pattern types. New diagnostic pressure criteria should be adopted in centers converting to HRM.

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**Key words:** Solid State Manometry; High resolution Manometry; Dyssynergia; Chronic Constipation

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### INTRODUCTION

The prevalence of Dyssynergic defecation (DD) in patients with chronic constipation approaches 50%<sup>[1-3]</sup>. Thus far, most referral centers had been using the Konigsberg standard solid-state anorectal manometry (SARM) catheter for anorectal motility testing. It represents a key diagnostic modality in the assessment of patients with suspected dyssynergic defecation, Hirschsprung disease, and fecal incontinence<sup>[4]</sup>. Although the evidence favoring the use of SARM as diagnostic test and therapeutic tool (through biofeedback therapy) is good, lack of standardization among institutions represents a noteworthy limitation<sup>[5-7]</sup>.

The new high resolution manometry (HRM) (Sierra Scientific Instruments, Los Angeles, CA) system allows interpolation of manometric recordings from 12 circumferential pressure sensors into an elaborate topographical plot. This system provides higher resolution of the intraluminal pressure changes with anatomical details that are more pronounced by SARM. As this novel system is currently being applied in more centers, normative data in healthy subjects is still limited, including diagnosis, classification and treatment of DD<sup>[8]</sup>. It has been suggested that HRM may better characterize dyssynergia and provide further insight into a complex disorder<sup>[7]</sup>. Currently, data

comparing the anorectal manometric parameters provided by SARM and HRM during attempted defecation in patients with dyssynergia is scarce.

Our aim was to evaluate the correlation and compare accuracy of these 2 modalities in patients with dyssynergic defecation

## METHODS

Patients with chronic constipation that were evaluated and diagnosed with dyssynergia by SARM were recruited to the study while on the waiting list for biofeedback therapy. All patients filled a stool diary for a week, followed by an HRM. Only patients that maintained the same stool patterns and frequency were included in the study. Patients were excluded from the study if they were found to have rectal prolapse or anal fissure on physical examination, underwent pelvic or recto-anal surgery or received pelvic radiation. Pregnant women were also excluded. Four patterns of dyssynergia have been described, and their identification helps tailor biofeedback therapy. **Type I** is characterized by a paradoxical increase in the residual anal pressure in the presence of adequate propulsive pressure, that is, increase in intrarectal pressure (45 mm Hg) **type II** is characterized by an inability to generate adequate expulsive forces, ie, no increase in intrarectal pressure, together with a paradoxical increase in residual intraanal pressure. **Type III** is characterized by generation of adequate expulsive forces, but absent or incomplete (<20%) reduction in intraanal pressure and **type IV** is characterized by an inability to generate adequate expulsive forces, that is, no increase in intrarectal pressure and absence of incomplete reduction in residual intraanal pressure<sup>[2]</sup>.

The University of Iowa Institutional Review Board approved the study protocol.

### Manometry protocol

Patients followed the same study protocol for both ARM and HRM. They were initially placed in the left lateral supine position. Baseline resting anorectal parameters were recorded for 5 minutes. While in the supine position, patients were then asked to contract their anal sphincter for 30 seconds. After 1 minute of rest they were asked to contract their anal sphincter for another 30 seconds. Patients were then asked to bear down for 30 seconds, rested for 1 minute and asked to bear down again for another 30 seconds. Patient then transitioned to the commode where they repeated the same maneuvers performed while in the supine position.

All manometric data was analyzed by 2 physicians (RS, JAD) who were unaware of the others diagnosis.

### Statistics

The maximal anal sphincter resting and squeezing pressure and anorectal pressures while straining on the bed and commode were analyzed and compared between the two modalities. Mean values for resting and squeeze pressures were compared using non-parametric statistics.

## RESULTS

A total of 25 Dyssynergic patients (M/F=4/21, mean age: 41 years, mean BMI: 24.6) underwent both SARM and HRM testing (Table 1). The mean interval between exams was 12 months. All but one patient were found to have dyssynergia on HRM (96%). Twelve patients (48%) had similar patterns on at least one position, and five patients (20%) had similar patterns in both positions (Table 2). When

comparing between HRM and SARM, the maximum resting pressure (70 vs 55.6 mmHg  $p<0.01$ ), anal straining on bed (73 vs 46.4 mHg,  $p<0.01$ ), rectal straining on commode (107.4 vs 71.8 mmHg,  $p<0.01$ ) and anal straining pressures on commode (76.3 vs 48.9 mmHg,  $p<0.01$ ) significantly differed between the exams respectively. (Table 3)

**Table 1** Patient demographics.

Patient demographics	
Total number	25
Gender (Male/Female)	4/21
Mean Age	41 years ( $\pm$ 12.9)
Age range	21-65 years
Mean BMI	24.5 ( $\pm$ 4.7)
Interval between exams	12 month ( $\pm$ 11.7)

**Table 2** Comparison of Dyssynergic patterns between SARM and HRM.

Patients (N=25)	Bed ARM	Commode RM	Bed HRM	Commode RM
1	4	2	4	1
2 <sup>1</sup>	3	1	1	1
3 <sup>2</sup>	2	2	1	1
4	3	1	3	1
5	1	2	3	1
6 <sup>2</sup>	2	2	1	1
7 <sup>1</sup>	2	2	1	1
8 <sup>1</sup>	4	4	4	1
9	4	2	3	1
10	4	2	4	1
11	4	2	4	1
12 <sup>1</sup>	2	2	3	1
13	2	4	2	1
14	4	2	4	1
15	4	1	2	1
16	3	1	3	1
17	4	2	3	1
18 <sup>1</sup>	4	4	2	1
19	1	4	1	2
20 <sup>1</sup>	4	4	4	2
21	1	4	2	4
22 <sup>2</sup>	1	1	1	1
23 <sup>2</sup>	4	4	1	1
24 <sup>2</sup>	4	4	1	1
25 <sup>1</sup>	1	1	1	2

<sup>1</sup> Similar pattern on at least one position (48%); <sup>2</sup> Similar pattern on both positions (20%).

**Table 3** Comparison of Variables between HRM and SARM.

Variable	Mean HRM	Mean SARM	<i>p</i> value
Maximum Resting Pressure (mmHg)	70	55.6	<0.01 <sup>1</sup>
Maximum Squeeze Pressure (mmHg)	131	122	0.46
Straining Rectal Pressure Bed (mmHg)	37.6	24	0.09
Straining Anal Pressure Bed (mmHg)	73	46.4	0.002 <sup>1</sup>
Defecation Index Bed (mmHg)	0.6	0.8	0.03 <sup>1</sup>
Defecation Pattern Bed (mode)	2	4	
Straining Rectal Pressure Commode (mmHg)	107.4	71.8	0.003 <sup>1</sup>
Straining Anal Pressure Commode (mmHg)	76.3	48.9	0.008 <sup>1</sup>
Defecation Index Commode (mmHg)	1.6	1.9	0.16
Defecation Pattern Commode (mode)	1	4	
First sensation (cc)	15.3	20	0.13
Desire to defecate (cc)	94.7	82.9	0.24
Urgency to defecate (cc)	161.8	164.7	0.42
Maximal tolerable volume (cc)	207.6	195.9	0.26

## DISCUSSION

Our study is the first to compare SARM with HRM in patients with DD. Thus far only one study compared SARM and determined normal values for HRM in healthy women<sup>[8]</sup>.

We found significantly higher maximum resting pressure, straining rectal and anal residual pressures on the commode on HRM compared with SARM. Similarly, Jones *et al* noted higher values with respect to resting and squeeze pressure measurement. However, they compared HRM with water perfusion manometry. Although the comparison of solid state HRAM with water-perfused manometry indicates a good correlation in pressure data between the two techniques, it has been noted that patients with DD are less likely to be detected by the water-perfused technique due to its poor anatomical resolution<sup>[10,11]</sup>.

Unsurprisingly, HRM reconfirmed dyssynergia in all but one patient. This result was largely predictable since patients did not receive any therapeutic intervention (i.e. biofeedback therapy) prior to undergoing HRM testing<sup>[9]</sup>. We observed a low correlation regarding dyssynergic defecation patterns between the two testing modalities. Most patients were reclassified into a different subtype using HRM (76% of patient on the commode and 52% in supine position). This discrepancy could be explained by the increased details provided by HRM possibly leading to a more accurate representation of the defecation process and thus resulting in a different dyssynergia subtype (Figure 1 and 2).

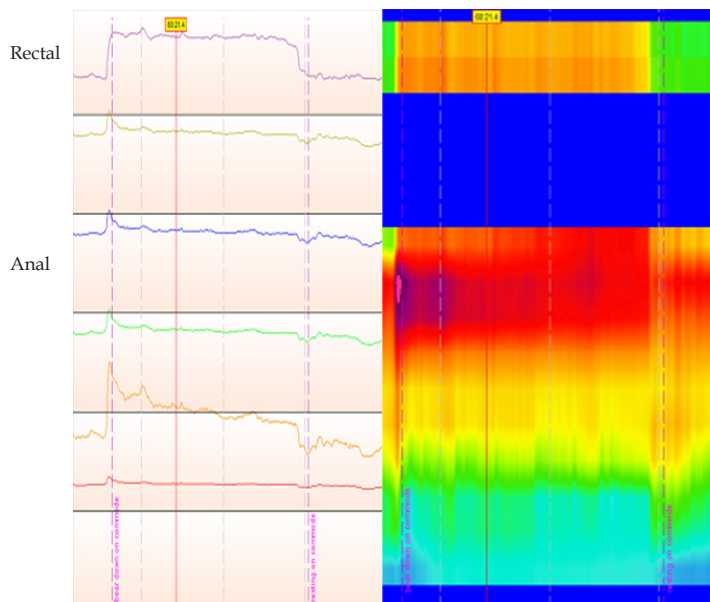


Figure 1 Patient with different dyssynergic patterns on 2D and HRM.

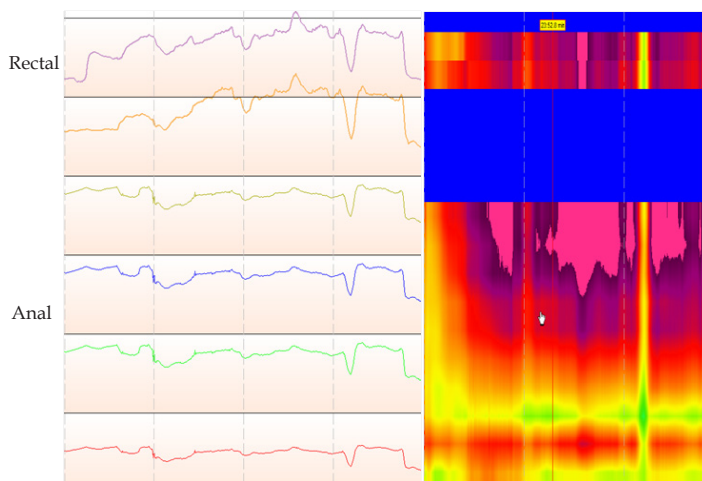


Figure 2 Patient with same Dyssynergic patterns on 2D and HRM.

Jones *et al* corroborate this notion. Their report showed that patients with obstructive defecation due to poor relaxation or paradoxical contraction of the puborectalis muscle are not reliably identified with water perfusion manometry due to lower physiologic and anatomic resolution<sup>[10]</sup>. Moreover, whether patterns recorded using SARM and HRM are entirely comparable remains unknown.

Currently, dyssynergic defecation classification using SARM relies on an expert-based pattern-recognition process proposed by Rao *et al*<sup>[2]</sup>. Recently, Ratuapli *et al* set out to determine whether HRM could identify DD phenotypes using principal components logistical modeling (PC) in patients with chronic constipation<sup>[12]</sup>. Their results revealed three PC scores associated with abnormal BET. Only two PC scores; high anal phenotype and hybrid phenotype (inadequate rectal pressure and less anal relaxation) corresponded to dyssynergic subtypes 1 and 2 respectively as described by Rao *et al*. None of the phenotypes identified using PC analysis corresponded to the type 3 pattern described by Rao. In our study, all patients with type 3 DD on SARM were reclassified as type 1 by HRM. This finding appears to corroborate the results of Ratuapli *et al*. However, neither phenotype pattern classification based PC analysis nor dyssynergic subtypes classifications developed by Rao *et al* have been known to predict response to biofeedback training. Furthermore, current biofeedback training protocols do not depend on the dyssynergia subtype<sup>[13]</sup>.

We hypothesize that these higher pressures reflect increased sensitivity provided by the greater number and close spacing of pressure sensors found in the HRM probe. In the absence of established normative values, and large comparative studies, the pathophysiologic relevance of higher pressures is unclear. One study used HRM to determine normal anorectal parameters in healthy women. The investigators showed that anal resting pressure was lower in elderly patients. Anal squeeze pressure and duration and rectal sensory threshold did not vary with age<sup>[8]</sup>. We could not verify these findings as we enrolled patients with dyssynergia.

To the best of our knowledge, there have been no reports directly comparing DD patterns using both SARM and HRM. Lee *et al* recently concluded that 3-D high definition anorectal manometry(HDAM) and HRAM are not just new gadgets but constitute a significant and novel diagnostic advance. However, more prospective studies are needed to better define anorectal disorders with these techniques and to confirm their superiority<sup>[14]</sup>.

Our study is not without limitations. Applying DD subtype classification developed with SARM to patients studied using HRM inherently limits the potential application of this new technology. We also acknowledge that our small patient number, selection bias constitute limitations.

In summary, our study is the first to prospectively compare DD patterns, and confirms that HRM reliably detects manometric patterns consistent with the currently accepted DD classification model. The higher resolution offered by HRM may provide for an enhanced representation DD leading to a more accurate classification.

Further studies are needed to establish standardized anorectal parameters and reconcile expert pattern recognition with data based statistical analyses. Ultimately, HRM should refine the current classification model and possibly identify predictors of response to biofeedback therapy.

**CONFLICT OF INTERESTS**

There are no conflicts of interest with regard to the present study.

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