CONCLUSION: HRM pressures tend to be higher than SARM. Although there is high consensus regarding diagnosis of dysynergia, 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


ABSTRACT

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

METHODS: Patients with dysynergic defeation 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 dysynergic patients diagnosed with SARM (F=21, age 41±12.9) underwent HRM. Twenty four patients had dysynergia 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 differed between the exams respectively.

CONCLUSION: HRM pressures tend to be higher than SARM. Although there is high consensus regarding diagnosis of dysynergia, 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


INTRODUCTION

The prevalence of Dyssynergic defeation (DD) in patients with chronic constipation approaches 50%[1-3]. 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 dysynergia, Hirschsprung disease, and fecal incontinence[4]. 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[5-7].

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[8]. It has been suggested that HRM may better characterize dysynergy and provide further insight into a complex disorder[7]. Currently, data
Patients (48%) had similar patterns on at least one position, and five
1). The mean interval between exams was 12 months. All but one
A total of 25 Dyssynergic patients (M/F=4/21, mean age: 41 years,
RESULTS
Statistics
The maximal anal sphincter resting and squeezing pressure and
anorectal pressures while straining on the bed and commode were
intraanal pressure
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 intrarectal pressure and type IV is characterized by
an inability to generate adequate expulsive forces, that is, no increase in
intraanal pressure and absence of incomplete reduction in residual
intraanal pressure[23].

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

Soudra M et al. Standard ARM vs HRM in Dyssynergia

Table 1 Patient demographics.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>SARM</th>
<th>Mean</th>
<th>SARM</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Resting Pressure (mmHg)</td>
<td>70</td>
<td>55.6</td>
<td>&lt;0.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Squeeze Pressure (mmHg)</td>
<td>131</td>
<td>122</td>
<td>0.46</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Straining Rectal Pressure Bed (mmHg)</td>
<td>37.6</td>
<td>24</td>
<td>0.09</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Straining Anal Pressure Bed (mmHg)</td>
<td>73</td>
<td>46.4</td>
<td>&lt;0.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Defecation Index Bed (mmHg)</td>
<td>0.6</td>
<td>0.8</td>
<td>0.03</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Defecation Pattern Bed (mode)</td>
<td>2</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Defecation Rectal Pressure Commode (mmHg)</td>
<td>107.4</td>
<td>71.8</td>
<td>0.003</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Defecation Index Commode (mmHg)</td>
<td>76.3</td>
<td>46.9</td>
<td>0.008</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Defecation Pattern Commode (mode)</td>
<td>1</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First sensation (cc)</td>
<td>15.3</td>
<td>20</td>
<td>0.13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Desire to defecate (cc)</td>
<td>94.7</td>
<td>82.9</td>
<td>0.24</td>
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<td></td>
</tr>
<tr>
<td>Urgency to defecate (cc)</td>
<td>161.8</td>
<td>164.7</td>
<td>0.42</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximal tolerable volume (cc)</td>
<td>207.6</td>
<td>195.9</td>
<td>0.26</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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[23].
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 [9,10].

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 [11]. 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](image1.png) Patient with different dyssynergic patterns on 2D and HRM.

![Figure 2](image2.png) 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 [12,13]. 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 [9]. 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 [12]. 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 dysynnergic 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 [13].

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 [8]. 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 [14].

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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