Objectives

- What is Dyssynergic Defecation?
- Pathophysiology of DD?
- Advances in diagnosis and treatment
- RCTs for Biofeedback Therapy
  - Dyssynergic Defecation
- How does Biofeedback work?
- Insights from studies of Brain-Gut Interactions
### Constipation & Most Bothersome symptom

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Stewart et al</th>
<th>Pare et al, Canada</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straining during B.M</td>
<td>US Household</td>
<td>Self-Reported</td>
</tr>
<tr>
<td></td>
<td>n= 10,018</td>
<td>(27%), n=312</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rome II (15%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>n=171</td>
</tr>
<tr>
<td>Hard /Lumpy Stool</td>
<td>32.4%</td>
<td>20.4%</td>
</tr>
<tr>
<td></td>
<td>17.5%</td>
<td>11.1%</td>
</tr>
<tr>
<td>&lt; 3 B.M /week</td>
<td>9%</td>
<td>13.2%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12.3%</td>
</tr>
<tr>
<td>Sensation stool can’t be passed</td>
<td>24%</td>
<td>12.9%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.8%</td>
</tr>
<tr>
<td>Feeling of Incomplete evacuation</td>
<td>30%</td>
<td>12.4%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6.4%</td>
</tr>
<tr>
<td>A need to press around anus</td>
<td>12%</td>
<td>5.6%</td>
</tr>
<tr>
<td></td>
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<td>6.4%</td>
</tr>
</tbody>
</table>

#### Pathophysiology of Constipation

- **Dyssynergic Defecation**
  - Rectocele
  - Prolapse
  - Perineal descent

- Evacuation Disorders
- Primary Constipation
- Slow Transit Constipation
- Irritable Bowel Syndrome

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Stewart et al. Am J Gastroenterol 1999
Pare et al. Am J Gastroenterol 2001
What’s in a Name?

- Anismus
- Paradoxical puborectalis contraction
- Pelvic outlet obstruction
- Spastic pelvic floor syndrome
- Pelvic floor dyssynergia- Rome II
- Obstructive Defecation
- Dyssynergic Defecation-Rome III/IV

Case Study
48-year-old secretary

- Increasing constipation- 5 years
  - Began during college days
  - B.M once or twice a week
  - Hard, pellet-like stool, excessive straining, incomplete evacuation and occasional bleeding
  - Spends 30 mins on toilet
  - Occasional digital disimpaction
  - Tried OTC laxatives, lubiprostone, PEG-no relief
  - BM only after enema + suppository and laxatives
History Contd..

- Past Hx: Migraines, seasonal allergy, No back or pelvic injury, Gravida 1, para 1
- Drugs: HFD=30g/day, Senna=2/day, lubiprostone =24 mcg/bid
- O/E: lower abdominal fullness

What would you do next?

Who wants a Rectal exam?
Figure 2
Boxplot – Rank, Revised

Rectal Examinations Performed in Previous Year by Clinical Status (5% - 95%) *

* GI faculty and fellows had 18 outlier values ranging from 205 – 1600

3-step DRE-PROTOCOL

1) Inspection
2) Perianal sensation & anocutaneous reflex:
   • normal, impaired, absent
3) Digital maneuvers: mass, tenderness, stool
   • Squeeze x 2: normal, weak, increased
   • Bearing down x 2
     • push effort, sphincter relaxation, perineal descent

Clinically dyssynergia if ... any 2;
• inability to
  • contract abdominal muscles
  • relax anal sphincter
• paradoxical contraction of anal sphincter
• absence of perineal descent
Yield of rectal exam in dyssynergia, n=209

All patients had DRE and anorectal manometry and BET

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Sensitivity (%)</th>
<th>Specificity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dyssynergia from DRE</td>
<td>75</td>
<td>87</td>
</tr>
<tr>
<td>Balloon expulsion test</td>
<td>49</td>
<td>90</td>
</tr>
</tbody>
</table>

Pathophysiology of Dyssynergia

- 35 patients with chronic constipation,
  m/f = 5/30, x age = 44 yrs (21-81 yrs),
- 25 healthy controls

ASSESSMENTS:
- Anorectal manometry
- Simulated defecation with 50 cc balloon
- Defecography
- Colonic transit study

Manometric Changes during Attempted Defecation

Dyssynergic Defecation - Pathophysiology

Impaired Rectoanal coordination
- Paradoxical anal contraction
- Inadequate rectal contraction/pushing force
- Absent/Inadequate anal relaxation

Impaired Rectoanal sensation ~ 50%

Learnt = 67%
Yet to Learn = 33%
Can symptoms predict dyssynergia?

100 patients with difficult defecation

<table>
<thead>
<tr>
<th>Symptom prevalence</th>
<th>Normal pattern (n=30)</th>
<th>Dyssynergia (n=70)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excessive straining</td>
<td>92%</td>
<td>89%</td>
</tr>
<tr>
<td>Abdominal fullness</td>
<td>80%</td>
<td>84%</td>
</tr>
<tr>
<td>Incomplete evacuation</td>
<td>72%</td>
<td>95%</td>
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<td>Abdominal discomfort</td>
<td>88%</td>
<td>77%</td>
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<tr>
<td>Digital maneuvers to defecate</td>
<td>28%</td>
<td>51%</td>
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</tbody>
</table>


Tools for Evaluation

History

Physical Examination
- Digital Rectal Examination

Stool Diary-Bristol Stool Scale

Diagnostic Tests
- Physiological
- Morphological
- Structural

# Stool Diary - Constipation; Rao ©

Record your stool habit for one week

<table>
<thead>
<tr>
<th>Date</th>
<th>Time of Bowel Movement</th>
<th>Straining Yes/No</th>
<th>Feeling of incomplete BM Yes/No</th>
<th>Stool Consistency (1-7)</th>
<th>Urge Yes/No</th>
<th>Digital Yes/No</th>
<th>Drug</th>
<th>Comments</th>
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# Evaluation of Colonic and Anorectal Function

- Balloon Expulsion Test
- Anorectal manometry
- Colonic Marker Study
  - Day 1 - Bisects
  - Day 2 - Rings
  - Day 3 - Trisects
  - Day 6 (120 hrs)
  - Plain abdomen x-ray

Name:     
Hosp. No:  
Normal Bearing Down

Types of Dyssynergic Defecation
Dyssynergic patterns: Phenotypes

I
- P. Puborectalis
- EAS
- D. Diffuse

II
- P. Puborectalis
- EAS
- D. Diffuse

III
- P. Puborectalis
- EAS
- D. Diffuse

IV
- P. Puborectalis
- EAS
- D. Diffuse

S. Rao et al DDW 2016

Dyssynergia Type 1 - Subtypes

Type I - EAS

Type I - Puborectalis

Type I - Diffuse

S. Rao et al DDW 2016
Effect of Body Position on Defecation Patterns

48-yr old Secretary

Bearing Down Lying

Bearing Down on Commode

Rectal pressure
Anal pressure

Courtesy of S.Rao
Diagnostic Criteria-Dyssynergic Defecation

1. The patient must satisfy diagnostic criteria for functional constipation-Rome III
2. During repeated attempts to defecate must demonstrate Dyssynergic pattern of defecation
   - Manometry
   - EMG
3. Patient must demonstrate one other abnormal test:
   a. Abnormal balloon expulsion Test (> 1 minute)
   b. Prolonged Colonic Transit Time (radioopaque markers or SmartPill or Scintigraphy)
   c. Abnormal Defecography (>50% barium retention)

Bharucha et al, Gastroenterology 2006; 130: 1514

How to Treat Dyssynergic Defecation?

- General Measures
  - Diet, exercise, fluids & habit training
  - Laxatives/Prokinetics
- Specific Treatment
  - Botox injection
  - Biofeedback therapy
  - Cognitive Behavioral Therapy
  - Surgery
    - Myectomy- 30% improvement
    - Colostomy

**Botox-Dyssynergia**

### 3 Uncontrolled trials

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>25(15)</td>
<td>4</td>
<td>7</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>ARM + B. Defecation</th>
<th>EMG + Defecography</th>
<th>EMG</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Botulinum Toxin A</th>
<th>20 u</th>
<th>6-15u</th>
<th>3 ng</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>F.up</th>
<th>1,4,12,24 wks</th>
<th>10 mo</th>
<th>4 wks</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Success</th>
<th>30%</th>
<th>50%</th>
<th>57%</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Complications (pain, incont.)</th>
<th>12.5%</th>
<th>5.6%</th>
<th>29%</th>
</tr>
</thead>
</table>

---

**Biofeedback Therapy**

- A technique of conditioning and/or retraining the mind and body to normalize bowel movement.

How many of you perform Biofeedback?
Goals of Therapy:

A) Teach Diaphragmatic breathing exercise
B) Teach anal sphincter & pelvic floor relaxation
C) Improve Rectal Sensation
D) Eliminate Sensory Delay
E) Improve Recto-anal Coordination

Visual, Audio & Verbal Feedback

Doctor/Therapist
RCT of Biofeedback Therapy
Effects on CSBM & Dyssynergia- ITT Analysis


Long Term Outcome of Biofeedback- CSBM/week

Rao et al Am J Gastro 2010
Home vs Office Biofeedback-Responder Analysis

RESPONDER = > 1 CSBM/wk + > 20 mm Change in VAS

TOST = p = 0.006

Biofeedback Therapy-RCTs

- Biofeedback Vs PEG 14.6 g for Dysynergia
  - Chiarioni et al, Gastroenterology 2006; 130: 657-64

- Biofeedback vs Diazepam for Dysynergia
  - Heymen et al, Dis Col Rectum 2007

- Biofeedback vs Sham Therapy vs Standard Therapy
  - Rao et al CGH 2007

- Biofeedback vs Standard Therapy-One Year outcome
  - Rao et al Am J Gastroenterol 2010

- Home vs Office Biofeedback Therapy- Efficacy & Cost Effectiveness
  - Rao et al, DDW 2011 & Go et al, DDW 2011

Evidence Level: Type 1; Recommendation Grade : A

Biofeedback Bowel Retraining

Advantages:

- Safe
- Effective
- Painless And Well Tolerated
- Inexpensive

Stimulation Parameters
- Sample frequency 2000 Hz
- Epoch duration 300 ms
- Amplifier gain 100,000 Hz
- Artifact rejection = On
- Band pass filter 1-500 Hz
- Stimulus frequency 0.2 Hz
- Number of stimuli : 200 (50 x 4)

Recto-Cortical and Ano-Cortical Evoked Potentials
(Afferent Brain-gut interaction)

1. Electrical Stimulation
2. Rectal EMG electrode: 10 cm from anal verge
3. Anal EMG electrode: 1 cm from anal verge

Fig. 1 Anorectal Probe (Koningsberg Ltd., Pasadena, CA)
Recto-Cortical Evoked Potentials (CEP) -
Grand average of 200 electrical stimulations

Normal

Dyssynergic -
Before BF

Dyssynergic -
After BF

Onset to P1: 48.1 milliseconds
Amplitude: 4.96 µV

Onset to P1: 66.62 milliseconds
Amplitude: 1.04 µV

Efferent Brain-Gut axis Assessment

1. TMS stimulation
2. Efferent pathway
3. MEPs recording
4. Computer system analysis

Stimulation Parameters
- Stimulation intensity 85-100%
- Good response = MEP amplitude >10 µV
- 3-6 consecutive trials

Coss Adame E, Rao S et al NGM 2012
Results

Trans-cranial magnetic stimulation

<table>
<thead>
<tr>
<th></th>
<th>Left</th>
<th>Right</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anal</td>
<td>(ms)</td>
<td>(ms)</td>
</tr>
<tr>
<td>Rectal</td>
<td>(ms)</td>
<td>(ms)</td>
</tr>
</tbody>
</table>

Before Treatment

<table>
<thead>
<tr>
<th></th>
<th>Anal (ms)</th>
<th>Rectal (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>26 ± 12</td>
<td>4 ± 0.7</td>
</tr>
</tbody>
</table>

After Treatment

<table>
<thead>
<tr>
<th></th>
<th>Anal (ms)</th>
<th>Rectal (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>22 ± 0.5*</td>
<td>21 ± 0.4*</td>
</tr>
</tbody>
</table>

Healthy Controls

<table>
<thead>
<tr>
<th></th>
<th>Anal (ms)</th>
<th>Rectal (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>22 ± 1†</td>
<td>21 ± 1†</td>
</tr>
</tbody>
</table>

* p<0.05, Before vs After Treatment; Pair t test, values expressed mean ± SEM
† p<0.05, Before Treatment vs Healthy Controls

CONCLUSIONS

• Biofeedback therapy modulates the neurobiologic brain-gut axis and thereby improves bowel function in patients with DD

• Our study provides a mechanistic basis for biofeedback therapy in DD
Take Home Points

Dyssynergic Defecation causes Constipation in ~40%
HRAM increases sensitivity but body position is critical
Biofeedback is mainstay treatment & not Experimental
RCTs have established short term and long term
efficacy of biofeedback in dyssynergic defecation
– -Grade A Evidence- Rao et al Neurogastro Motil 2015
Gut-Brain-gut axis is deranged in Dyssynergic patients
& Biofeedback Therapy restores altered function
Home Biofeedback is efficacious and cost-effective