Motility Disorders
In Diverticular Disease.

M. Kreis

Ludwig-Maximilians Universität München
Klinikum Großhadern,
Chirurgische Klinik
Pathophysiology

Diet ?  
Constipation ?  
Disposition ? 

Diverticula

Toxines ?  
(Mercury?)  

Age ?

Motility ?
Morphology of Sigmoid Diverticula

- Diverticula
- Muscle layer
- Mucosa

Pressure
Hypothesis for the pathogenesis of diverticular disease

„The formation of diverticula is triggered by a motility disorder with subsequent exceedingly high pressures in the sigmoid colon.“
Specific questions:

• Are there elevated pressure and / or altered patterns of motility in diverticular disease?
• If so, which are the specific conditions that are associated with this disturbed motility?
• Is there a generalized motility disorder or is it limited to the sigmoid colon?
• Is the motility altered following treatment such as surgery or modified diet?
• Are alterations in motility primary or secondary to diverticular disease?
Techniques to record colonic motility I
Parameters for the evaluation of colonic motility

1. Colonic motility index

2. High amplitude propagated contractions

Stimuli

a) Standard meal / gastro-colonic response

b) Cholinergic drugs, e.g. neostigmine
Definition of the colonic motility index

Colonic motility index = \( \left( \sum A/O \times (\text{width} \times \text{height}) \times C/B \right) \)
High amplitude propagated contraction (example)
Gastro-colonic reflex/ colonic motility after standard meal

Effect of neostigmine on colonic motility

Basal conditions: differences in motility index between diverticular disease and normal controls.

<table>
<thead>
<tr>
<th>Study</th>
<th>Controls (n)</th>
<th>Diverticular Disease (n)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parks and Connell 1969</td>
<td>528 (15)</td>
<td>470 (25)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Attisha and Smith 1969</td>
<td>151 (9)</td>
<td>343 (29)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Trotman and Misiewicz 1988</td>
<td>Not given (13)</td>
<td>Not given (6)</td>
<td>p&lt;0.02</td>
</tr>
</tbody>
</table>
Motility studies in patients with diverticula: subgroups*

<table>
<thead>
<tr>
<th>Disease</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asymptomatic diverticular disease (Diverticulosis / ADD)</td>
<td>Colon diverticula without symptoms</td>
</tr>
<tr>
<td>Symptomatic diverticular disease</td>
<td>Symptomatic colon diverticula (left lower quadrant abdominal pain)</td>
</tr>
<tr>
<td>Uncomplicated (SUDD)</td>
<td></td>
</tr>
<tr>
<td>Symptomatic and complicated (SCDD)</td>
<td>Complicated colon diverticula (hemorrhage, peridiverticulitis, fistulas, bowel obstruction)</td>
</tr>
</tbody>
</table>

Motility studies in subgroups of patients with diverticula under basal conditions


P<0.001

**Motility index (mean/SEM)**

- Controls: N=30
- ADD: N=30
- SUDD: N=30
- SCDD: N=55

*P<0.001*
Response to a meal (gastro-colic reflex): differences in motility index between diverticular disease and normal controls.

<table>
<thead>
<tr>
<th>Study</th>
<th>Controls (n)</th>
<th>Diverticular Disease (n)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attisha and Smith 1969</td>
<td>263 (9)</td>
<td>740 (29)</td>
<td>0.001</td>
</tr>
<tr>
<td>Trotman and Misiewicz 1988</td>
<td>Not given (13)</td>
<td>Not given (6)</td>
<td>p&lt;0.002</td>
</tr>
</tbody>
</table>
Motility studies in subgroups of patients with diverticula following a meal (gastro-colic response)

Response to the acetylcholine inhibitor neostigmine

<table>
<thead>
<tr>
<th>Study</th>
<th>Controls following neostigmine</th>
<th>Diverticular disease following neostigmine</th>
<th>P-value For Comparison of both groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attisha and Smith 1969</td>
<td>791 (p&lt;0.001 vs. before neostigmine)</td>
<td>2856 (p&lt;0.001 vs. before neostigmine)</td>
<td>0.001</td>
</tr>
<tr>
<td>Weinreich 1976</td>
<td>597</td>
<td>1996*</td>
<td>0.05</td>
</tr>
</tbody>
</table>

*526 in patients with asymptomatic Diverticulosis (n.s. vs. Controls)
Motility patterns in diverticular disease / controls

- patients: 10.3 ± 2.7 HAPC / subject / day
  controls:  5.5 ± 0.8 HAPC / subject / day  \[ P<0.05 \]

- patients: Amplitude 118 ± 3.4 mmHg
  controls: Amplitude 110 ± 7.0 mmHg  \[ n.s. \]

- patients: Duration 13.6 ± 0.5 sec
  controls: Duration 14.0 ± 0.9 sec  \[ n.s. \]

- but: 18.4% of HAPCs in patients with diverticular disease were abnormal i.e. showing retropropagation, while none occurred in controls.

Representative recording of HAPCs in a patient with diverticular disease

Alterations in motility are confined to the descending and sigmoid colon

<table>
<thead>
<tr>
<th>Overall Motility Index (24 hours)</th>
<th>Patients</th>
<th>Controls</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transverse</td>
<td>2481 ±1069</td>
<td>3389 ±1256</td>
<td>0.704</td>
</tr>
<tr>
<td>Descending</td>
<td>11129 ±4104</td>
<td>3570 ±1122</td>
<td>0.04</td>
</tr>
<tr>
<td>Sigmoid</td>
<td>11485 ±3155</td>
<td>5362 ±1259</td>
<td>0.04</td>
</tr>
</tbody>
</table>

Effect of *myotomy* on motility of the sigmoid colon in patients with diverticular disease

![Graph showing motility index before and after myotomy](image)

*Attisha and Smith* *Br J Surg*, 1969; 56: 891-894.
Effect of *myotomy* on sigmoid motility in patients with diverticular disease – representative recording following neostigmine

Effect of *high fiber diet* on motility of the sigmoid colon in patients with diverticular disease

Specific questions / answers I

• Are there elevated pressure and/or altered patterns of motility in diverticular disease?
  *Symptomatic diverticular are associated with increased intraluminal pressures, particularly following a meal and neostigmine, and retrograde HAPCs.*

• Is there a generalized motility disorder or is it limited to the sigmoid colon?
  *There is no generalized motility disorder, as motility in the transverse colon is unchanged.*
Specific questions / answers II

- Is the motility altered following treatment such as surgery or modified diet?
  
  Yes, it may be back to normal.

- Are alterations in motility primary or secondary to diverticular disease?
  
  Patients with asymptomatic diverticular frequently do not show any alterations in motility of the sigmoid colon which suggests that altered motility occurs secondary to diverticular disease.