Role of capsule endoscopy (CE) in Crohn’s disease (CD)

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## Current Data on IBD

<table>
<thead>
<tr>
<th></th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>Total</th>
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<td>30</td>
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<td>6</td>
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</table>
Role of Capsule Endoscopy in CD

- Added value over other tests
  - Suspected diagnosis
  - Established diagnosis

- Caveats:
  - Incomplete study
  - Scoring
  - Minimal lesions
  - Differential diagnosis
  - Strictures

- Effect on outcome
- Cost-effective calculation

- Conclusions
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CE vs. Small Bowel Follow Through

Susp. SB pathology
22 pts

Susp. SB stricture
2 pts

SBFT & CE
20 pts

SBFT
17 normal
3 ileal nodularity*

1 CD

CE
9 diagnostic*
8 suspicious
3 failures

3 CD

Costamagna G et al Gastroenterology 2002
CE in Pts Suspected of CD

Susp. CD
Negative studies
21 pts

CE

Diagnosis of CD
9 pts (43%)

No complications

Herreras JM et al Endoscopy 2003;35 564-8
Location of lesions:
- Distal ilium - 9
- Jejunum - 4
- Duodenum - 1
CE in Crohn’s Disease

- 17 pts with susp. CD
- UGI, LGI endoscopy and SBFT were normal
- Ileoscopy succeeded in 6 pts
- Mean Sx duration: 6.3 yrs
- 12/17 (70%) pts diagnosed as CD

Fireman Z et al Gut 2003
CE in Suspected CD

• 16 pts with suspected CD
• Exclusion of pts:
  - stricture on SBFT
  - inability to pass a colonoscope into the ileum
• SBFT and ileoscopy performed on all pts

Bloom PB, DDW 2003
CE and ileoscopy are similar for TI

Sensitivity of SBFT is poor

CE is best for proximal SI

Bloom PB, DDW 2003
CE vs Enteroclysis

- 3 pts with multiple small bowel ulcers detected by CE
- None was detected by the best enteroclysis

CE is the gold standard examination for detection of small bowel Crohn’s disease

Rex DK Am J Gastro 2003
## Retrospective Studies for CE vs SBFT for CD

<table>
<thead>
<tr>
<th>Published Study</th>
<th>Number of Patients</th>
<th>Yield of SBFT</th>
<th>Yield of CE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scapa 2002</td>
<td>13</td>
<td>0%</td>
<td>46%</td>
</tr>
<tr>
<td>Fireman 2003</td>
<td>17</td>
<td>0%</td>
<td>71%</td>
</tr>
<tr>
<td>Herrerias 2003</td>
<td>21</td>
<td>0%</td>
<td>43%</td>
</tr>
<tr>
<td>Hara 2004</td>
<td>17</td>
<td>0%</td>
<td>71%</td>
</tr>
<tr>
<td>Mow 2004</td>
<td>50</td>
<td>32%</td>
<td>60%</td>
</tr>
<tr>
<td>Caunedo 2004</td>
<td>88</td>
<td>--</td>
<td>70%</td>
</tr>
<tr>
<td>Dubcenco 2004</td>
<td>2</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Arquelles-Arias 2004</td>
<td>12</td>
<td>0%</td>
<td>59%</td>
</tr>
</tbody>
</table>
### Prospective Comparative Studies Reports for CE vs SB Studies for CD

<table>
<thead>
<tr>
<th>Published Study</th>
<th>N</th>
<th>Estab or Suspected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Costamagna 2002</td>
<td>3</td>
<td>Estab/Susp</td>
</tr>
<tr>
<td>Heigh 2003</td>
<td>17</td>
<td>Estab</td>
</tr>
<tr>
<td>Bloom 2003</td>
<td>19</td>
<td>Estab/Susp</td>
</tr>
<tr>
<td>Buchman 2003</td>
<td>23</td>
<td>Estab</td>
</tr>
<tr>
<td>Goelder 2003</td>
<td>5</td>
<td>Estab</td>
</tr>
<tr>
<td>Voderholzer 2003</td>
<td>8</td>
<td>Estab</td>
</tr>
<tr>
<td>Chong 2003</td>
<td>21</td>
<td>Estab/Susp</td>
</tr>
<tr>
<td>Eliakim 2004</td>
<td>35</td>
<td>Susp</td>
</tr>
<tr>
<td>Toth 2004</td>
<td>47</td>
<td>Estab/Susp</td>
</tr>
<tr>
<td>Dubcenco 2004</td>
<td>31</td>
<td>Estab/Susp</td>
</tr>
<tr>
<td>Marmo 2004</td>
<td>19</td>
<td>Estab</td>
</tr>
</tbody>
</table>
Studies Comparing CE to other Tests

11 studies identified (total n = 228)

- Small bowel radiography (SBR)
- Ileoscopy
- Push enteroscopy (PE)
- CT enterography (CTE)
- Small bowel MRI (SB MRI)
### Incremental yield (IY) of CE over other modalities in prospective trials in CD

<table>
<thead>
<tr>
<th></th>
<th>Yield CE (%)</th>
<th>Yield other modality (%)</th>
<th>% IY for CE (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vs. SB radiography</td>
<td>66</td>
<td>24</td>
<td>42 (0.30-0.54)</td>
</tr>
<tr>
<td>Vs. Ileoscopy</td>
<td>61</td>
<td>46</td>
<td>15 (0.02-0.27)</td>
</tr>
<tr>
<td>Vs. CT enterography</td>
<td>75</td>
<td>37</td>
<td>38 (0.23-0.54)</td>
</tr>
<tr>
<td>Vs. Push enteroscopy</td>
<td>51</td>
<td>7</td>
<td>44 (0.31-0.57)</td>
</tr>
<tr>
<td>Vs. SB MRI</td>
<td>60</td>
<td>40</td>
<td>20 (-0.41-0.81)</td>
</tr>
</tbody>
</table>

Leighton J
Patients Suspected as CD

Which symptoms are most predictive of a positive CE study?
Incidence of CD Based on Symptoms at Sheba Medical Center

Total No. capsules: 92

Excluded: 14

Sx compatible with CD: 78

- Diarrhea: 9
  - CD: 1 (11%)
  - CD: 4 (9.5%)

- Anemia: 42
  - CD: 4 (9.5%)

- Abd. pain: 11
  - CD: 0

- Combination of Sx: 16
  - CD: 6 (38%)
Unexplained Abnormal Pain

- 20 pts with unexplained abdominal pain
- Abdominal pain: 6-96 months
- Work-up was unrevealing

CE did not add to diagnosis

Bar-Meir S, Endoscopy 8/2003
Incidence of CD Based on Symptoms at Sheba Medical Center

Total No. capsules 92

Excluded 14

Sx compatible with CD 78

Diarrhea 9
  - CD 1 (11%)
  - CD 4 (9.5%)

Anemia 42
  - CD 0

Abd. pain 11
  - CD 0

Combination of Sx 16
  - CD 6 (38%)
CE in Patients with Occult GI Bleeding

• 8 studies in peer-reviewed journals
• Patients with occult GI bleeding
• All underwent CE
• 6-9% were diagnosed as CD

Role of Capsule Endoscopy in CD

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- Effect on outcome
- Cost-effective calculation

- Conclusions
CE in Established IBD

- 50 pts with IBD

Indications:
- evaluation of SB involvement in:
  pts with colitis or ileal pouchitis
- evaluation of SB extent in:
  pts with CD

Mow WS Clin Gastroenterol Hepatol 2004
CE in Established IBD

Small bowel involvement

Diagnostic of CD
Susp of CD
Normal

Mow WS Clin Gastroenterol Hepatol 2004
CE in Established IBD

- Management changed in half of the pts
- Retained capsule: 2 (4%) pts
  - one endoscopic retrieval
  - one operated
CE in Pts with CD

Consecutive CD
56 pts

Stricture on CT enteroclysis
15 pts

CT enteroclysis & CE
41 pts

Voderholzer WA Gut 2005;54:369-373
CE vs. CT Enterography in CD

Voderholzer WA Gut 2005;54:369-373
CE vs. CT Enterography in CD

- Ileoscopy:
  - confirmed CE findings
  - detected lesions in additional 4 pts

- CE:
  - lesions in stomach and duodenum in 14 pts

Voderholzer WA Gut 2005;54:369-373
CE vs. CT Enterography in CD

- Capsule retention in 2 pts:
  - passage with high dose steroids
  - retrieval by enteroscope

- Management changed in 10 pts based on CE findings
Role of Capsule Endoscopy in CD

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• Effect on outcome
• Cost-effective calculation

• Recommendations
Incomplete Study

• Ileocecal valve is not reached in 20-30%

• False negative interpretation is obtained
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• Recommendations
How can SB lesions be described? The Lewis Score

- Location: duodenum, jejunum, proximal ileum, distal ileum
- Number, shape, size, distribution
- Evaluate for:
  - Erythema
  - Edema
  - Nodularity
  - Ulcer
  - Stenosis
Distal Ileal
5 + 5 + 3 + 3
Few, patchy, short, circular

Distal Ileal Stricture
10 + 10 + 10
Single, traversed, ulcerated

Debinski H.
Lewis v CDAI

P > 0.05/ NS

Debinski H
## Capsule Scoring Index

<table>
<thead>
<tr>
<th>Category</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>0</td>
</tr>
<tr>
<td>Red spots</td>
<td>1</td>
</tr>
<tr>
<td>1-4 erosions</td>
<td>2</td>
</tr>
<tr>
<td>&gt;4 erosions</td>
<td>3</td>
</tr>
<tr>
<td>Large erosion/ ulcer</td>
<td>4</td>
</tr>
</tbody>
</table>

Graham D et al CGH 2005
Scoring for Clinical Studies
Ulcerated Stricture Responsive to INFX

Debinski H.
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• Conclusions
Finding in healthy subjects

- Prospective, double blind, placebo controlled - effect of NSAID’s
- 413 screened volunteers
- None took NSAID’s for the last 2 weeks
- 57 (13.8%) had abnormalities
- Lesions: petechiae, erosions and mucosal breaks
  Mean No. : 4 (range 1-20)

- 7% of controls developed SI lesions after 2 wks

What is normal?

Goldstein JL et al Clin Gastroenterol Hepatol. 2005
Findings in Control Subjects

- Controls: pts with arthritis who did not use NSAIDs
- 10% had lesions

Graham D et al CGH 2005

- Controls: 0%

Maiden L et al 2005
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Differential Diagnosis

- NSAID’s
- Lymphoid hyperplasia
- Lymphoma
- Radiation enteritis
- HIV with opportunistic infection
- Intestinal tuberculosis
- Bechet’s disease

40 diagnoses responsible for increased SB permeability
NSAID Induced Lesions

Ileal ulceration
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Complications

Can it be prevented by a prior SBFT/CT?
Stricture in CD

- Pt with 4 SBFT and 3 CT
- All were normal
- CE was retained
- At operation: 10 strictures
  3 passed

Capsule Retention

- 937 capsules ingested
- 7 pts (0.75%) retained capsule
- Acute intestinal obstruction in one patient
- 6/7 pts had previous normal SBFT
- In all pts: pathology identified and resected and as a result symptoms resolved

Barkin J, GI Endos 2003
## CE Retention in Pts with suspected or Known* CD:

<table>
<thead>
<tr>
<th>Study</th>
<th>Capsule retention/pts</th>
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<tbody>
<tr>
<td><strong>Fireman et al.</strong> Gut 2003</td>
<td>0/17</td>
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<tr>
<td><strong>Herrerias et al.</strong> Endoscopy 2003</td>
<td>0/21</td>
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<td><strong>Liangpunsakul et al.</strong> Am J Gastro 2003</td>
<td>0/3</td>
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<tr>
<td><strong>Ge et al.</strong> World J Gastro 2004</td>
<td>3/20*</td>
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<tr>
<td><strong>Reddy et al.</strong> Digest Endosc 2004</td>
<td>2/11*</td>
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<tr>
<td><strong>Mow et al.</strong> Clin Gastro Hepatol 2004</td>
<td>2/50*</td>
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<tr>
<td><strong>Buchman et al.</strong> Am J Gastro 2004</td>
<td>2/30*</td>
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<tr>
<td><strong>Eliakim et al.</strong> Dig Liver Dis 2004</td>
<td>0/35</td>
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<tr>
<td><strong>Argüelles-Arias et al.</strong> Endoscopy 2004</td>
<td>0/12</td>
</tr>
<tr>
<td><strong>Voderholzer et al.</strong> Gut 2005</td>
<td>2/41*</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>11/240 (4.6%)</strong></td>
</tr>
</tbody>
</table>
Retained Capsule

- Roth basket / snare
- Corticosteroids
- Prevention (patency capsule)

Barkin J, GI Endos 2003
M2A® Patency
Product Description

11mm X 26mm
M2A® Patency Capsule

- Timer plug
- RF tag (Polyimide coating)
- Lactose body (+10% barium)

Scanner

12mm
Patency Procedure

0
Capsule ingestion

Days

2
~95% excreted

3
Scanning

5
Capsule disintegration

- Normal
- Abnormal—Management e.g. X-ray
Patency Capsule Disintegrated
Patency CE in CD

- CD pts: 63 patency capsule ingested
  - 54 pts had strictures on radiography
- Patency capsule: excreted intact in 36* pts dissolved in 27 pts
- 15 pts developed abdominal pain
- One capsule became impacted
  Pt underwent surgery

* 15/36 conventional capsule with no problems

Costamagna G et al  DDW 2004
Patency CE in CD

- 12 CD pts with strictures
- Patency capsule ingestion
- 4/12 considerable pain
- Additional pt had to be operated for an entrapped capsule
- 7/12* uneventful excretion

* 4/7 conventional capsule with no problems

Boivin ML. DDW 2004
Capsule Retention - Clinical Outcomes -

Two patients have chosen not to undergo surgery

- Patient 1: capsule has remained in situ for 21 months
- Patient 2: capsule in situ for 5 months

Kornbluth A
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### Can CE Change the Management of Patients with Crohn’s disease?

<table>
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<tr>
<th>Published Study</th>
<th>Indication</th>
<th>Yield</th>
<th>Results of Tx</th>
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<tbody>
<tr>
<td>Eliakim 2003; 20 pts</td>
<td>Suspected CD</td>
<td>12 (60%)</td>
<td>12/12</td>
</tr>
<tr>
<td>Fireman 2003; 17 pts.</td>
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<td>12 (71%)</td>
<td>10/12</td>
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<tr>
<td>Herrerias 2003; 21 pts.</td>
<td>Suspected CD</td>
<td>9 (43%)</td>
<td>9/9</td>
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<tr>
<td>Mow 2004; 50 pts.</td>
<td>Suspected CD</td>
<td>20 (40%)</td>
<td>17/20</td>
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<tr>
<td>Ge 2004; 20pts.</td>
<td>Suspected C</td>
<td>13 (65%)</td>
<td>11/13</td>
</tr>
<tr>
<td>Arguelles-Arias 2004; 12 pts.**</td>
<td>Suspected CD</td>
<td>7 (85%)</td>
<td>7/7</td>
</tr>
<tr>
<td>Sant Anna 2005: 20 pts.**</td>
<td>Suspected CD</td>
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Cost Effectiveness of CE in CD

- Pts suspected has having CD
- Two diagnostic arms:
  - SBFT + enteroclysis
  - SBFT + CE
- Remained undiagnosed:
  - SBFT + enteroclysis: 26%
  - SBFT + CE: 12%

Goldfarb NI et al. DDW 2004
Cost-Effectiveness of CE in CD

Employing CE after SBFT would most likely be less costly than SBFT followed by enteroclysis.

CE could reduce diagnostic cost if used as the first diagnostic test.

Goldfarb NI et al DDW 2004
Should CE become the first test in susp. CD pts?

Diagnostic yield of first line:

CE- 70%

colonoscopy and SBFT- 54%

Goldfarb N et al Disease Management 2004
Conclusions

- CE is the most sensitive test to diagnose CD
- Yield increases with number of symptoms
- A negative study should include ICV
- Its use is cost-effective
- It contributes for a better outcome
Conclusions

✓ Retained capsule occurs: more frequently, but……. at a site of significant pathology

✓ NSAIDs intake should be excluded

✓ Diagnosis of CD should not be based on few minute lesions!!!
Alice in wonderland
Worms

Nematodes

Ascaris

Taenia
CE retention in CD

- summary -

- Altogether 240 patients with known or suspected CD ingested CE.
- Capsule retention occurred in 0/88 (0%) of pts. with suspected CD.
- Capsule retention occurred in 11/152 (7.2%) of pts with known CD.
- None had signs of intestinal obstruction.
Worms

Nematodes

Ascaris

Taenia