ULTRASONOGRAPHY IN INFLAMMATORY BOWEL DISEASES

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US TECHNIQUES IN IBD

• Transabdominal
• Transrectal
• Endoscopic
• Hydrocolonic
• Doppler
• Contrast media

TRANSABDOMINAL US IN IBD

Method commonly employed
Doppler and Color-Doppler

Probes: 3.5 – 5 - 7 MHz linear-convex

TRANSABDOMINAL US IN IBD

• Patient preparation: fasting conditions (8 hrs)

• Examination technique: to move the probe in relation to the anatomical configuration of the intestinal tract
CROHN’S DISEASE (US FINDINGS)

- transmural wall thickening
- mesenterial thickening
- luminal narrowing, abscesses, fistulas
- dilated, fluid-filled, fixed and packed bowel loops

CROHN’S DISEASE (US FINDINGS)

TARGET
SANDWICH

HIGH RESOLUTION ULTRASONOGRAPHY IN IBD

7 MHz LINEAR - CONVEX PROBES
CROHN’S DISEASE (US FINDINGS CORRELATION)

- Natural History
- Disease Activity
- Complications

CROHN’S DISEASE (NATURAL HISTORY - I)

INITIAL BWT

TRANSMURAL BWT

CROHN’S DISEASE (NATURAL HISTORY - II)

DEEP ULCERS

FIBROSIS

CROHN’S DISEASE (DISEASE ACTIVITY)

- ACTIVE IBD
  - Portal flow velocity and RI of SMA
  (Bolondi et al, 1992)

- ACTIVE CROHN
  - SMA flow
  (Van Oostayen et al. 1994)

DOPPLER
CROHN’S DISEASE
(DISEASE ACTIVITY)

US in Crohn’s disease
DETECTION RATE OF SURGICALLY DRAINED ABSCESSES

<table>
<thead>
<tr>
<th>Site of abscess</th>
<th>US-true positive</th>
<th>US-false negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdominal wall</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Intra-abdominal</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Retroperitoneal / perianal</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>21</td>
<td>17</td>
</tr>
</tbody>
</table>

Schwerk et al., 1992

CROHN’S DISEASE
(COMPLICATIONS: ABSCESS)

CROHN’S DISEASE
(COMPLICATIONS: FISTULAS)

• ENTERO-ENTERIC: difficult to visualise
• ENTERO-VESICAL: easily recognisable
CROHN’S DISEASE
(COMPLICATIONS: FISTULAS)

ENTERO-ENTERIC
ENTERO-VESICAL

CROHN’S DISEASE

US Diagnostic accuracy 90%

Diagnostic role of US in Crohn’s disease

- Identification of the affected tracts
- Assessment of the extent
- Detection of possible complications
- Follow-up of patients
  - Response to medical treatment
  - Detection of post-surgical recurrences

ULCERATIVE COLITIS
(US FINDINGS)

- Superficial, continuous bowel wall thickening
- Moderate luminal narrowing
- Thin bowel wall, reduced haustra, meteorism (toxic megacolon)
ULCERATIVE COLITIS
(PATHOLOGICAL CORRELATION)

US FINDINGS

SPECIMEN

ULCERATIVE COLITIS
(TOXIC MEGACOLON)

US

PLAIN FILM

Management of Severe Ulcerative Colitis with the Help of High Resolution Ultrasonography

Vincenzo Arietti, M.D., Marco Crippa, M.D., Luigi Bertoni, M.D., Paolo Gavazzi, M.D.,
Gelis Collina, M.D., Stefano Guercio, M.D., Adriano Forneri, M.D., and Giovanni Gaudenzi, M.D.

Parma Hospital, Italy. Received for publication: October 10, 2006.
Revision accepted: November 28, 2006.

High Resolution US in Ulcerative Colitis
RELATIONSHIP WITH ACTIVITY SCORE
### Diagnostic value of High Resolution US in Ulcerative Colitis

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>93/104</td>
<td>(89%)</td>
</tr>
<tr>
<td>Specificity</td>
<td>24/24</td>
<td>(100%)</td>
</tr>
<tr>
<td>PV positive</td>
<td>93/93</td>
<td>(100%)</td>
</tr>
<tr>
<td>PV negative</td>
<td>24/35</td>
<td>(69%)</td>
</tr>
<tr>
<td>Overall accuracy</td>
<td>117/128</td>
<td>(91%)</td>
</tr>
</tbody>
</table>

*PV = predictive value*  
*Arienti V. et al, Am J Gastroenterol 1996*

### High Resolution US in Ulcerative Colitis

#### SENSITIVITY AND SITE OF INFLAMMATION

<table>
<thead>
<tr>
<th>Site</th>
<th>Ultrasonography</th>
<th>Scintigraphy</th>
<th>US Sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rectum-sigmoid</td>
<td>30 2</td>
<td>32 0</td>
<td>30/32 (94%)</td>
</tr>
<tr>
<td>Descending</td>
<td>28 4</td>
<td>31 1</td>
<td>28/31 (90%)</td>
</tr>
<tr>
<td>Transverse</td>
<td>21 11</td>
<td>24 8</td>
<td>21/24 (88%)</td>
</tr>
<tr>
<td>Ascending</td>
<td>14 18</td>
<td>17 15</td>
<td>14/17 (82%)</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>93 38</strong></td>
<td><strong>104 34</strong></td>
<td><strong>93/124 (74%)</strong></td>
</tr>
</tbody>
</table>

*Scintigraphy: 16/16 (100%), 14/16 (88%), 12/16 (75%)*  
*US: 16/16 (100%)*  
*Arienti V. et al, Am J Gastroenterol 1996*

#### SENSITIVITY AND EXTENT OF INFLAMMATION

<table>
<thead>
<tr>
<th>Extent</th>
<th>Specimen</th>
<th>X-ray</th>
<th>US</th>
<th>SC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left Colon</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Transverse Colon</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Right Colon</td>
<td>12</td>
<td>9</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>16</strong></td>
<td><strong>12/16 (75%)</strong></td>
<td><strong>14/16 (88%)</strong></td>
<td><strong>16/16 (100%)</strong></td>
</tr>
</tbody>
</table>

*True Positive Diagnosis*  
*Arienti V. et al, Am J Gastroenterol 1996*
Ulcerative Colitis Surgical Procedures

History - II

Endorectal ileal pouch-rectal anastomosis following colectomy and mucosal proctectomy

Ileo-pouch anal anastomosis (IPAA) following proctocolectomy (mechanical suture: 3 cm)

Different ileal pouch configurations

Results

PDAI-US correlation

<table>
<thead>
<tr>
<th>PDAI score</th>
<th>US score</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>14</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>-</td>
<td>1</td>
</tr>
</tbody>
</table>

Total: 17 12 6 2 37

Females: T=0.93, p<0.001

*Kendall T correlation test*

Pouch

normal findings

US  Endoscopy

Pouchitis

US  Endoscopy
Diagnostic value of US detection of bowel wall thickening in IBD (232 patients)

- Sensitivity 90.3%
- Specificity 88.4%
- Accuracy 90.5%

Schwerk et al, 1992

US BOWEL WALL THICKENING (DIFFERENTIAL DIAGNOSIS)

- Crohn’s disease
- Ulcerative colitis
- Colitis (non IBD)
- Tuberculosis
- Actinomycosis
- Amyloidosis
- Diverticulitis
- Vasculitis
- Tumour
  - primary/metastatic
  - lymphoma/sarcoma
  - carcinoid
- Bowel wall oedema
- Bowel wall bleeding

US BOWEL WALL THICKENING (DIFFERENTIAL DIAGNOSIS)

BENIGN / MALIGNANT DIFFERENTIAL DIAGNOSIS

(“Target” analysis)

**BENIGN**
- gradual thickening
- symmetric layers
- central lumen

**MALIGNANT**
- abrupt thickening
- asymmetric layers
- eccentric lumen

Di Candio et al AJR, 1981

EXCEPTION: lymphoma

DIFFERENTIAL US DIAGNOSIS BENIGN vs MALIGNANT LESIONS

(“TARGET” ANALYSIS)

**BENIGN**

**MALIGNANT**
CROHN’S DISEASE

• Wall thickening (++)
• Transmural thickening
• Ileum, segmental lesions
• Fistulas, abscess, mesenteric fibro-fatty proliferation

ULCERATIVE COLITIS

• Wall thickening (+ -)
• Superficial thickening
• Rectum, continuous lesions

DIFFERENTIAL DIAGNOSIS

CROHN’S DISEASE

IMAGING TECHNIQUES

US

CT

CT99m-LEUKOSCAN

Digestive Diseases and Sciences, 1993

BWT in Crohn’s disease
**Duodenal bulb stenosis in Crohn’s disease**

**ENDOSONOGRAPHY**
- Detection of perianorectal abscesses and fistulas
- Evaluation of anal sphincters
- Differential diagnosis: Crohn’s disease vs UC?
- Assessment of severity?

**HYDROCOLONIC SONOGRAPHY (HCS) vs COLONOSCOPY AND TRANSABDOMINAL US IN THE DIAGNOSIS OF IBD**

<table>
<thead>
<tr>
<th></th>
<th>Crohn’s Disease</th>
<th>Ulcerative Colitis</th>
</tr>
</thead>
<tbody>
<tr>
<td>HCS</td>
<td>39/41 (95%)</td>
<td>33/36 (91%)</td>
</tr>
<tr>
<td>Colonoscopy</td>
<td>41/41 (100%)</td>
<td>36/36 (100%)</td>
</tr>
<tr>
<td>Abdominal US</td>
<td>29/41 (71%)</td>
<td>22/36 (62%)</td>
</tr>
</tbody>
</table>

**CONCLUSIONS**
- **TRANSABDOMINAL US**
  - Established diagnostic role in CD
  - Useful in management of moderate/severe UC
- **ENDOSONOGRAPHY**
  - Important role in detection of perianorectal complications in CD
CONCLUSIONS

- Doppler and color-doppler US
  - Seem to offer a non-invasive means of assessing disease activity
  - Need further investigations

- Hydrocolonic US
  - Promising but rather complicated

US in IBD: www.arienti-v.com (Didattica e Formazione)

AIME: www.aime.it

IV° Corso di Ecografia Clinica: www.animeiasrl.com/ecografia

Scuola SIUMB: www.arienti-v.com/ecografia