CEUS in diagnosis and treatment of Inflammatory Bowel Disease

S.D. Yarmenitis
Department of Radiology
Hygeia Hospital
Maroussi, Athens
GREECE
Qualitative (b-mode) Activity Patterns

- Ulceration
- Edema
- Spasm
- Stricture
- Fistula
- Inflammatory Mass
- Lymph nodes
Semi-quantitative Activity Patterns

- SMA/PV
  - Resistance Index
  - Flow Volume

- Intramural/Mesenteric/Fistula/Abscess
  - Vascularity
  - Color Density
  - Resistance Index
Second Generation Contrast Agents (perfusion studies)

- Wall vascularity
- Mesenteric vascularity (vasa recta)
- Presence of phlegmon
- Lymph nodes vascularity
- Fistula/Abscess vascularity

CEUS
Baseline scan

Contrast enhanced US scan
Baseline scan

Contrast enhanced US scan
Mucosa-Submucosa Enhancement pattern
Full transmural enhancement pattern
Mucosa Enhancement pattern
Diffuse-Inhomogeneous enhancement pattern
Perfusion quantification studies in assessing disease activity
Current role of CEUS in IBD

- Activity assessment
- Evaluation of inflammatory masses
- Distinguish Phlegmon/Abscess
- Stenosis characterization
- Monitoring of drug treatment
- Detection of recurrences
The development of new capillary vessels in the lamina propria and submucosa, is an early pathological change occurring in patients with active IBD.

A high correlation has been found between signal enhancement at CEUS and MRI as an objective evaluation of the increase in vascularisation of the bowel wall.

Mural Hyperenhancement in CEUS

- Semiquantitative scoring for IBD activity
  - Sensitivity 81-93.5%
  - Specificity 63-93.7%


Quantitative analysis (Time-Intensity curves)

- The contrast agent enhancement of the bowel wall in patients with active endoscopic disease is significantly increased in comparison with the normal endoscopic bowel wall.
- A threshold brightness value of 45% increment shows an overall sensitivity of 95% and specificity of 78% in predicting moderate or severe endoscopic inflammation.
- Inflammatory activity has the best correlation with mural enhancement after contrast agent injection rather than with the assessed bowel wall thickness.

CEUS is highly effective in distinguishing these two entities since phlegmons show intra-lesional enhancement, while abscesses show enhancement only in the wall.


Assessment of disease recurrence


Classic ultrasound parameters (wall thickness >3mm and colour Doppler flow) revealed an accuracy of 88.3% for the diagnosis of recurrence.

Sonographic score 2, including thickness >5mm or contrast enhancement >46%, improved the results with a sensitivity, specificity and accuracy of 98%, 100% and 98.3%, respectively, in the diagnosis of endoscopic recurrence. The area under the ROC curve was 0.99, in remarkable agreement with endoscopy (k: 0.946).

Sonographic score 3, including thickness >5mm, contrast enhancement >70% or fistula identified 32 out of 34 (94.1%) severe endoscopic recurrences. The area under the ROC curve was 0.836, in good agreement with endoscopy (k: 0.688)
CEUS in IBD Literature

- Ripollés T et al Eur J Radiol. 2013  50 pts
- Paredes JM et al J Crohns Colitis. 2013  60 pts
- Ripollés T et al J Crohns Colitis. 2013  25 pts
- Malagò R et al Radiol Med. 2012  30 pts
- De Franco A et al Abdom Imaging. 2012 Review
- Goertz RS et al Ultraschall Med. 2012  45 pts
- Girlich C et al Eur J Radiol. 2012  45 pts
- Schirin-Sokhan R et al Digestion. 2011  18 pts
- Girlich C et al Clin Hemorheol Microcirc. 2010  14 pts
- Badea R et al J Gastrointestin Liver Dis 2010 Review
- Girlich C et al Ultraschall Med. 2011  20 pts
- Giangregorio F et al J Ultrasound. 2009  30 pts
- Girlich C et al Clin Hemorheol Microcirc. 2009  20 pts
- Quaia E et al Eur J Radiol. 2009  15 pts
- Ripollés T et al Radiology 2009  61 pts
- Migaleddu V et al Gastroenterology 2009  47 pts
- Schreyer AG et al Clin Hemorheol Microcirc. 2008  14 pts
- Serra C et al Eur J Radiol. 2007  48 pts
CONSENSUS/GUIDELINES

Imaging techniques for assessment of inflammatory bowel disease: Joint ECCO and ESGAR evidence-based consensus guidelines

ECCO–ESGAR statement 2B
US is a well-tolerated and radiation-free imaging technique, particularly for the terminal ileum and the colon. Examinations are impaired by gas-filled bowel and by large body habitus [EL 2].
US is also a technique to guide interventional procedures (e.g., abscess drainage) [EL 2].
CONSENSUS/GUIDELINES

Imaging techniques for assessment of inflammatory bowel disease: Joint ECCO and ESGAR evidence-based consensus guidelines

Contrast-enhanced US (CEUS) may improve diagnostic accuracy and diagnostic confidence in detecting inflammatory activity.\textsuperscript{8,9}

Ripollés T et al Radiology 2009
Migaleddu V et al Gastroenterology 2009
Conclusions

- CEUS in the assessment of IBD remains a method under investigation
- More case-control and cohort studies are needed
- A promising technique with the implementation of Quantitative analysis of perfusion studies