Imaging Approaches to Mesenteric Ischemia

Frandics Chan, M.D., Ph.D.
Stanford University Medical Center
Lucile Packard Children’s Hospital
Mesenteric Ischemia

• Acute type (90%)
  – Arterial embolism
  – Arterial thrombosis
  – Nonocclusive form
    • Low flow state
    • Vasospasm
  – Venous occlusion

• Chronic type (10%)
Acute Mesenteric Ischemia

- Increasing incident
- Nonspecific clinical presentation
- Majority from arterial embolism
- 60% mortality
- Early intervention critical
  - Vasodilator (Papaverine)
  - Thrombolysis, thrombectomy, angioplasty, stenting
  - Infarct bowel resection, revascularization
Chronic Mesenteric Ischemia

• Atherosclerosis (95%)
• Proximal vessel stenoses
• Two or more vessels involved
• Collateral arteries
• Clinical triad
  – Bowel angina
  – Food aversion
  – Weight loss
• Treatment: revascularization, stenting
Diagnostic Test

- Acute Mesenteric Ischemia
  - CT Angiography
  - Catheter Angiography + Vasodilator Tx

- Chronic Mesenteric Ischemia
  - CTA and MRA
  - Physiologic Challenge Test
Acute SMA Thrombosis
Acute Aortic Dissection
Acute SMV Thrombosis
CT Diagnosis in AMI

- 1996 – 2009
- 6 studies: 3 prospective, 3 retrospective
- Pooled sensitivity: 93%
- Pooled specificity: 96%
Diagnostic Test

- Acute Mesenteric Ischemia
  - CT Angiography
  - Catheter Angiography + Vasodilator Tx

- Chronic Mesenteric Ischemia
  - CTA and MRA
  - Physiologic Challenge Test
Normal Response

Fasting State

Fed State
Ischemic Response

Fasting State

Fed State

SUMC  
LPCH  
Department of Radiology
Normal Flow Pathway

Fasting State

- Celiac
- SMA
- IMA

Small Bowel

SMV
Normal Flow Pathway

Fed State

Celiac

SMA

IMA

Small Bowel

SMV
Compensated SMA Stenosis

Fed State

Celiac

SMA

IMA

Small Bowel

SMV
Mesenteric Collateral Arteries
Chronic Mesenteric Ischemia

Fed State

Celiac

SMA

IMA

Small Bowel

SMV
Perfusion Measurement

• Velocity
  – Doppler ultrasound at
    • SMA
    • SMV

• Flow
  – MRI phase contrast at
    • SMA
    • SMV
Doppler US of SMA

Before Meal

After Meal

V1 = 1.56 m/s

V1 = 2.32 m/s
Doppler US of SMV

Before Meal

After Meal
Flow Area

Venous flow increases by increase in cross-sectional area.

Pre-meal

Post-meal
Perfusion Measurement

- **Velocity**
  - Doppler ultrasound at
    - SMA
    - SMV

- **Flow**
  - MRI phase contrast at
    - SMA
    - SMV
Pre and Postprandial Flow

Normal Subject

Flow (cc/min)

Pre-meal 10 min 20 min 30 min 40 min

SMA

SMV

SUMC ____ LPCH _____________________ Department of Radiology
Mesenteric Ischemia Protocol

- Fasting > 6 hrs
- Localize SMV
- Pre-meal PC
- 260 cal diet supplement
- CE MRA
- 30 min post meal
- Localize SMV
- Post-meal PC
- Flow Quantification
Normal Study

> 50% increase in post-meal SMV flow
Chronic Mesenteric Ischemia

< 50% increase in post-meal SMV flow
Limitations

• CE MRA is limited to proximal stenosis in the mesenteric arteries.
• Physiologic challenge is not sensitive to small segmental ischemia.
• Problems with inadequate fasting, poor GI motility, abnormal endocrine response.
• Physiologic challenge is not appropriate for acute mesenteric ischemia.