PillCam® Capsule Endoscopy Course
Addis Ababa 29 September 2016
Overview
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Outline
- History
- The capsule endoscopy (CE) system
- Device assisted enteroscopy (DAE): Double balloon enteroscopy
- Indications
- Contraindications and risks and how to manage them
- How to read the CE study: Rapid 8 Software
- A few examples to test you

History
- 1997 Paul Swain and Gabi Idan
- 1999 First human use
- 2001 FDA approved PillCam
  - Given Imaging, Ltd, Yokneam, Israel
  - CE wins 2:1 in finding pathology when compared with push enteroscopy
- 2014
  - Covidien acquires Given Imaging
- 2015
  - Medtronic acquires Covidien

Wire-free Technology
On-board storage
No more radio interference
Increased patient comfort & convenience
Images are only taken when the Capsule is in motion
Future trends

• Entire GI screening with one capsule
• Moveable capsule
• Therapeutics

Device-assisted enteroscopy (DAE)

• Generic term: Endoluminal examination of the small bowel by an endoscopic technique that includes assisted progression
  • Balloon
  • Overtube
  • Stiffening device etc
• Double balloon enteroscopy (Fujinon Inc. Japan)

• Others
  • Single balloon enteroscopy (Olympus Optical Co. Japan)
  • Spiral enteroscopy (Spirus Medical, USA)
  • Balloon guided endoscopy: NavX by ABBotts (SMART medical systems’ Israel)
DBE background

- Yamamoto: First total enteroscopy 1999 with handmade prototype
- Yamamoto H et al. Gastrointest Endoscopy 2001
- Released 2003 (Fujinon)

DBE system

- System
  - Specialised enteroscope
    - 200cm working length
    - Outer diameter
      - 8.5mm (P5=diagnostic)
      - 9.4mm (T5=therapeutic)
  - Accessory channel
    - 2.2 mm (P5)
    - 2.8mm (T5)
  - Overtube 145cm
  - Air pump
  - 2 balloons: endoscope and overtube

Total enteroscopy

Provided by Dr. Yamamoto of Jichi Medical School
Other types of enteroscopy

- Single balloon enteroscopy (SBE) (Olympus)
- Endo-Ease Discovery SB (Spirus)

Foam grips provide a comfortable, ergonomic interface.

Gentle-Lock coupler quickly attaches EE with the scope. Can be disengaged and re-engaged as needed.

Vari-Flex shaft is designed to move with the scope. The proximal end is stiffer than the distal end.

Beveled tip seals and smoothes the transition from the EE to the scope.

Mouth guard protects the patient, scope, and EE. This accessory is conveniently included with each device.

Smooth, hollow spirals ease introduction. When positioned beyond the LOT, rotation gathers and pleats small bowel and counter rotation releases it.

Smooth inner liner provides a low friction interface with the scope when properly lubed.

Capsule endoscopy and Double balloon enteroscopy

- Complimentary
- CE
  - Diagnostic
- DBE
  - Diagnostic in selected cases
  - Therapeutic

CE Advantages

- Complete small bowel visualisation
- Painless
- Very low risk
- Outpatient procedure
- Cost effective

CE Disadvantages

- Poor with certain pathology
  - Masses vs bulges: can not reliably differentiate
  - Proximal lesions
  - Small bowel diverticulosis

- Poor localisation and extent of pathology

- No histology
- No treatment
- Cost
DBE advantages

- Deep-enteroscopy (seldom total enteroscopy)
- Biopsies for histology
- Therapeutic
  - Hemostasis, APC/Heater probe/clips
  - Polypectomy
  - Balloon dilation of strictures
  - Retrieval of FB (including capsules)
  - Marking: Tattoos
- Other's uses
  - ERCP in altered anatomy
  - Difficult colonoscopy

DBE disadvantages

- Technically demanding
- Staff
- Duration: 90-120 min
- Cost
- Risks

DBE complications

- Pancreatitis
- Bleeding
- Perforation
- Ileus
- Necrosis
- Sedation related: long procedure
- Overall rate
  - 1% Diagnostic
  - 3-4% Therapeutic

Indications for CE

- Obscure GI bleeding
- Crohn's
- Possible indications (selected cases)
  - Polyposis syndromes
  - Tumours
  - Coeliac disease

Contraindications

- Relative contra-indications
  - Dysphagia
  - Obstructive stenosis of GI tract
  - Cardiac pacemaker/ICD
  - BMI
  - Pregnancy
  - Children < 2
- Too frail for surgery or if pts would not want surgery

Dysphagia and upper GI transit problems

- Oropharyngeal dysphagia
- Oesophageal dysphagia
  - Structural
    - Zenker's
    - Distal oesophageal diverticulum
  - Functional
    - Achalasia etc
- Gastric transit problems
  - Gastropeptasis
  - Structural
    - Pyloric stenosis etc
Dysphagia and upper GI transit problems

• Outcome
  • Capsule can't be swallowed
  • Capsule doesn't reach the small bowel

• Therefore important: Don’t let the patient go home until CE has reached the duodenum:
  • Check DR3
  • Have emergency endoscopy available

Direct endoscopic placement

• Who?
  • High risk patients
  • During the study
  • Motility issues
  • Gastric emptying

• Mechanisms of placement
  • Rush Net
  • Snares
  • AdvanCE™ capsule endoscope delivery device

Direct placement of video capsules...

The AdvanCE™ capsule endoscope delivery device allows for direct endoscopic placement of video capsules in patients who are unable to swallow or pass the capsule through the pylorus.

• Roth Net
• Snares
• AdvanCE™ capsule endoscope delivery device

Capsule retention

• 22,840 CE
• Pooled 1.4%
  • OGIB 1.2%
  • Neoplastic lesions 2.1%
  • Crohn’s (Definite or suspected) 2.6%

Title
Indications and Detection, Completion, and Retention Rates of Small Bowel Capsule Endoscopy: A Systematic Review
Liao Z, Gao R, Xu C, Li ZS. Gastrointest Endosc 2016; 84:923-946
• 22,840 CE
• Pooled 1.4%
  • OGIB 1.2%
  • Neoplastic lesions 2.1%
  • Crohn’s (Definite or suspected) 2.6%

FunnyOldPlanet.com
Capsule retention: who is at risk?

- Symptoms of small bowel obstruction
- High risk conditions
  - Multiple and complex abdominal surgery
  - Known adhesions
  - Radiation
  - Known Crohn’s disease

Preventing retention

- Prediagnostics
  - Symptoms
  - Poor prediction
  - X-rays, Small bowel follow through, MRI
- The patency system

The patency system

- Agile Patency Capsule
  - Agile Capsule stays intact in the GI for a minimum of 30 hours post ingestion
  - Then disintegrates and passes through structure
  - If capsule is seen within 30 hours = SAFE
- ± 100% predictive of PillCam passing successfully

Managing retention

- 90% pass conservatively
  - Delayed passing
  - Medical therapy
    - Steroids
    - Immuno-modulators
  - DBE
  - Surgery

Agile Patency Capsule

- Detects Patency Capsule by means of RF technology
- Agile Patency Capsule
- Before
- After
Pacemakers and ICD’s

Bandorski et al. Ann Gastr 2014

• Bottom line:
  • Individualise
  • Discuss with cardiologist
  • Consider admission/telemetry for high-risk patients
Obscure GI bleeding (OGIB)

- Bleeding from the intestinal tract with a normal gastroscopy and colonoscopy
  - Including
    - Duodenal biopsies
    - Terminal ileum intubation
- Two types
  - Obscure overt: Melena or haematemesis
  - Obscure occult: Iron deficiency anaemia
- OGIB accounts for ~5% of all cases of GI bleeding
  - Mostly in the small bowel

Causes

- Missed lower and upper GI pathology
- Mid small bowel bleeding
Mid small bowel bleeding

3 Groups of disorders
1. Vascular (Angiodysplasia, Dieulafoy etc)
2. Ulcers
3. Mass lesions
4. Other
  - Diverticulae
  - Meckels
  - Varices
  - Etc.

That is because CE is:
- Safe
- Well tolerated
- Complete enteroscopy
- Highly sensitive
- If positive: Directs subsequent DBE (DAE)
  - Start endoscopy within 24 hours of first capsule image
  - Lesion >70% in time from ingestion to first caecal image
  - Lesion >40% in time from first caecal image to first caecal image
- If negative:
  - Good prognosis
  - Only 5% rebleeds vs 50% rebleed rate for a positive CE

ESGE recommends small-bowel video capsule endoscopy as the first-line investigation in patients with obscure gastrointestinal bleeding (strong recommendation, moderate quality evidence).

- 10/11/16
- Pennazio Marco et al. Small-bowel capsule endoscopy and device-assisted enteroscopy for diagnosis and treatment of small-bowel disorders: European Society of Gastrointestinal Endoscopy (ESGE) Clinical Guideline

Screening
CE yield

- Overall: ±60%
- Depends on:
  - Ongoing overt bleeding (92.3%) vs occult bleeding (44.2%), vs previous overt (12.9%)
  - Transfusion requirements: higher yield the more severe
  - Timing

Timing

- 2 groups 32 pts each
  - <15 days of OGIB onset: 91% yield
  - >15 days of OGIB onset: 34% yield

In patients with overt obscure gastrointestinal bleeding ESGE recommends performing small-bowel capsule endoscopy as soon as possible after the bleeding episode, optimally within 14 days, in order to maximize the diagnostic yield (strong recommendation, moderate quality evidence).


**CE vs DBE yield**

- Similar diagnostic yield CE vs complete enteroscopy
- Different pathology
  - DBE better for
    - Proximal lesions – disadvantages of CE
    - More quickly in proximal small bowel
    - Pick up depends on the direction the camera is facing
    - Only 40% of papillas seen in one study
    - Flat lesions
    - Small polyps <10mm
- CE better for
  - Angiogenesis
  - Can disappear during enteroscopy (poor perfusion due BP and drugs)

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**What if capsule endoscopy is negative?**

- No further bleeding
  - Supportive management
    - Oral or IV iron
- Recurrent bleeding/ further transfusion requirements
  - Investigate at time of active bleeding
    - Repeat O and C
    - Oesophagogastric
    - Gastroscopy
    - CT if not done yet
  - Review the diagnosis: Exclude other causes of anaemia
    - Haemolysis
    - Thalassemia
    - Myelodysplasia
    - AD: Haeleys syndrome

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**Risk of re-bleeding**

- Obscure overt: 60%
- Obscure occult: 46%
- CE: +ve 48%
- CE: -ve 4.6%
- 30-40% rebleeding rate after APC for angiectasia

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**Case 1**

- 63 year old male
- Background medical history
  - Hypertension
  - Pre-Diabetes
  - Gout
  - Mother died of colon cancer age 62
- Presented over Easter 2016 to a colleague
  - Acute onset dark and bloody stools
  - 7kg weight loss
  - Hb 8.3
  - O and C
  - Gastric ulcer
  - Diverticulosis and haemorrhoids
  - C scope: Uncomplicated diverticulitis and haemorrhoids
  - Subsequently further admissions for blood transfusions
Case 1

- Referred to me for a small bowel capsule endoscopy May 2016
  - Normal

- Reviewing the case... and he had a dream
  - CT colonoscopy March 2014
    - Possible ascending colonic poly
  - Not taken any further
  - The colonoscopy was in fact not complete- only to ascending colon

- Readmit for colonoscopy and CT abdomen....
Tips

• Repeat colonoscopy if there is any doubt about whether the caecum was reached / quality

• Imaging is not an adequate substitution for an incomplete colonoscopy in obscure GI bleeding

• Always do a CT (or MRI) as part of your workup

Case 2

• 36 year old female

• No medical history

• Presenting July 2015
  • Iron deficiency since 2014 detected when tried to donate blood
  • Hb 13.2, Ferritin 7
  • Normal menses
  • No NSAIDS

• G and C scope
Case 2

- Coeliac disease diagnosed
- Slightly duodenal mucosal atrophy and scalloping
- Histology: IEL and subtotal villous atrophy (Marsh 3b)
- Anti-TTG raised: 143 U/L
Case 2

- C scope
  - Normal colon
  - Submucosal tumour (1-2cm) in terminal ileum 5cm from the IC valve
  - Histology: Well differentiated neuro-endocrine tumour

- CT
  - 30 x 15mm submucosal T1 tumour
  - Also entero-enteric intussusception seen proximal from the lesion
Case 2

- Management
  - Surgical resection
  - Gluten free diet

Tips

- Always take random duodenal biopsies in OGIB/IDA
- Always intubate the terminal ileum
- Look out for dual pathology

Case 3

- 46 year old male
  - Background medical history
    - Obesity
    - Type 2 diabetes mellitus
    - Hypertension
    - Dyslipidaemia
    - Renal impairment
    - Sleep apnoea on nasal CPAP
    - Right heart failure
    - Chronic severe hypertension
    - Gout
    - Previous open cholecystectomy
  - Presenting November 2015
    - Decompensated heart failure
    - Non-dialysis renal failure (BUN 8.4, MCV 54, Ferritin 14
    - No overt GI bleeding
Tips

• Duodenscope to evaluate the ampulla in some cases

Case 4

• 68 year old lady

• Background medical history
  • Dilated cardiomyopathy and valvular heart disease
  • Hypertension
  • Scarred left kidney
  • Asthma
  • Acoustic neuroma
  • Arthritis/spondylosis
  • Gallstones
  • Family history of colon cancer

Case 4

• Presenting with
  • Iron deficiency anaemia with intermittent melaena since at least 1998
  • Numerous essentially normal gastroscopies and colonoscopies over the years
  • Numerous transfusions and iron infusions
  • Normal small bowel capsule endoscopy: 2013
Case 4

- Seen by me in 2014: Increasing transfusion requirements
- Per oral double balloon enteroscopy
  - 25% yield after previous negative capsule endoscopy
  - ± 50% success rate cauterising angioectasia
  - Actively bleeding duodenal angioectasia: cauterised with APC
- Problem persisted
- DBE: 2 (repeated x 1)
- G scope: 4
- Colonoscopy: 1
- CT angiogram: 1
- Multiple admissions: transfusions and intravenous iron
Tips

- Most small bowel vascular lesions occur in the duodenum and proximal jejunum. Careful evaluation ± “Push enteroscopy”
- Lift and tattoo the vascular lesion if it is in a fold

Case 5

- 60 year old lady
- Background medical history
  - Insulin dependent type 2 diabetes mellitus
  - Hypertension
  - Dyslipidaemia
- Presenting 2013
  - Recurrent iron deficiency anaemia and melena
  - Multiple admissions, transfusion and intravenous iron dependent
  - Multiple investigations normal
    - Gastroscopy 4
    - Colonoscopy 2
    - Duodenoscopy 1
    - Capsule endoscopy 1
  - Then...

- Effortil, Ephedrine to get systolic blood pressure > 120
- ... and Heparin 3000 IU IVI
Case 6

- 71 year old female
- Background medical history
  - Nil significant
- Presenting December 2014 (1 month after a course of NSAIDs)
  - Melaena, syncope, shocked and Hb of 5.6
  - Ongoing bleeding Hb 5.7 after 4 unit blood transfusion
  - Total of 11 units blood
  - 5 FFPs
  - CT angiogram followed by intervention

Tips

- Try and expose the culprit lesion
- Normalise Haemoglobin
- Normalise blood pressure
- ± Heparin
Case 6

- Stabilised and follow-up CT angio no further bleeding

- Subsequently referred to me for a capsule endoscopy: January 2015
  - Medical aid first wanted a G + C scope: Essentially normal

- Then visited Johannesburg
  - Melena and Hb 8.3
  - CT angiogram: apparent blush mid-jejunal loop adjacent to embolised jejunal vessel

Tips

- Angiography for life-threatening small bowel bleeding

- Consider multicentric pathology
Case 7

- 55 year old female
- Background medical history
  - Lap chole for acalculous cholecystitis 2011
  - Hysterectomy
  - Arthritis: Methotrexate and NSAIDs
- Presenting 2012
  - Severe intermittent abdominal pain
  - Transfusion and intravenous iron dependent IDA, progress over 10 years

Case 7

- Investigations
  - Normal G + C score
  - Normal MRE
  - Normal MRCP
NSAIDs and GIT

- Oesophagitis
- Gastritis and PUD (GU > DU)
- Small bowel ulcers
- Colitis
- Colonic webs
- Worsening IBD and diverticulosis

Tips

- Always use maintenance PPI therapy
- Always stop NSAIDS
  ...But remember PPI's don't protect against non-gastric NSAID injury

Case 8

- 22 year old female
- Background medical history
  - Crohn’s ileocolitis 2007 age 15: Ileocaecal resection
  - Further surgery November 2012
  - Optimal medical therapy: Immunomodulators and several biologics
- Presenting 2015
  - Ongoing symptoms suggestive of intermittent small bowel obstruction
  - Faecal calprotectin > 600 ug/g
  - Iron deficiency anaemia: IV iron dependent
  - Colonoscopy: minimal disease only at anastomosis
  - MRE: Normal
  - SBFT: Normal
**Tips**

- SBFT and MRE don’t exclude obstructive small bowel lesions
- Obstructive symptoms relative contra-indication for CE

### Case 9

- 35 female
- Background medical history
  - RA diagnosed age 26
    - Methotrexate + Folic Acid
    - Chloroquine
    - Sulphasalazine
    - Prednisone
    - Diclofenac rarely
- Presenting with anaemia since childhood
  - No overt GI bleeding
  - No menorrhagia
- Multiple normal gastroscopies and colonoscopies over the years... referred for another G and C

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Case 9

- What is the next investigation?

Case 9

Management
- Reassured
- Stopped iron
- Cancelled repeat G + C scope
- Continue on Folate
- Haematology referral

Thalassaemia

- Autosomal recessive
- Decreased formation of globin chains of Hb
- Complications
  - Anaemia
  - Bone deformities
  - Iron overload
  - Cardiovascular

Thalassaemia

- Alpha-Thalassaemia
  - Alpha chain: 4 genes (Chromosome 16)
  - Number of alleles affected determines severity
  - Alpha thalassaemia intermedia (2 genes)
  - Haemoglobin H disease (3 genes)
  - Hydrops fetalis
Tips

- Make sure you are dealing with an iron deficiency anaemia!

Summary Tips

1. Make sure you are dealing with an iron deficiency anaemia: Thalassaemia etc.
2. Good quality G and C scope
   - Duodenal intubation
   - Caecal intubation (imaging is not a substitute)
   - Terminal ileum intubation
3. Duodenoscope to evaluate some lesions
4. Most small bowel vascular lesions occur in the duodenum and proximal jejunum. Careful evaluation ± Push enteroscopy
5. Always do a CT (or MRI) as part of your workup
6. Angiography for life-threatening small bowel bleeding

7. Possible small bowel obstruction sometimes an indication rather than a contraindication to use capsule endoscopy
8. Consider multicentric and dual pathology

Summary Tips

9. Try and expose the culprit lesion
   - Normalise Haemoglobin
   - Normalise blood pressure
   - ± Heparin

10. Lift and mark the vascular lesion if it is in a fold
11. Always use maintenance PPI therapy
12. Always stop NSAIDS
   - But remember PPI’s don’t protect against non-gastric NSAID injury

Background

- ± 2/3 of patients with Crohn’s disease has small bowel involvement at diagnosis
- In ± 90% of those with small bowel involvement have involvement of the terminal ileum
- Colonoscopy with terminal ileum intubation (ileoocolonoscopy) is therefore the first-line investigation in suspected Crohn’s disease
- But a minority of patients might have more proximal small bowel Crohn’s disease is isolated mid small bowel Crohn’s
- There might therefore be a potential role for capsule endoscopy in the diagnosis and management of small bowel Crohn’s disease
Background

- CE highly sensitive for detection of small bowel Crohn’s
  - 96-100%
  - Definitely superior to CT and small bowel follow-through
- May be superior to MRI enterography especially for:
  - Early lesions
  - Proximal small bowel disease

Limitations of CE in Crohn’s

- Retention
- Poor specificity
- No histology
- Only luminal examination

CE retention in Crohn’s

- Two scenarios
  - Suspected but unconfirmed Crohn’s
    - With obstructive symptoms or known stenosis
    - Without obstructive symptoms, known stenosis or surgical resections
  - Confirmed Crohn’s disease
    - High risk of retention: up to 13%

CE specificity in Crohn’s

- Poor specificity
  - Only luminal examination
  - No histology
  - Many other causes of ulcers
    - NSAIDs
      - Up to 60-75% incidence of small bowel erosion or ulceration
      - Disregard NSAIDs
      - Traditional NSAIDs, COX inhibitors and Aspirin
      - Remember PPIs don’t protect against deep small bowel injury
      - Stop all 1-2 weeks prior to CE study
    - Healthy individuals: minor mucosal breaks in up 5-10% (up to 20%)
    - Many others

Two main indications for CE in Crohn’s disease

- Suspected isolated mid-small bowel Crohn’s disease after a negative ileocolonoscopy

  - Why would you suspect it
    - Diarrhoea atypical for IBD
    - Difficulty with conventional therapy
    - Positive fecal calprotectin
    - Evidence of inflammation on imaging
    - Symptomatic (stomach and bowel pain)
    - Caustic strictures
  
  - ESGE
    - First investigation after a negative ileocolonoscopy
    - If obstructive symptoms or known stenosis
    - Do colonoscopy sparing ileum and MRI

- Confirmed Crohn’s disease

  - High risk of retention: up to 13%
Two main indications for CE in Crohn’s disease

- Established Crohn’s disease at ileocolonoscopy
- Next investigation is cross-sectional imaging: CT or MRE
- Extent
- Location
- Extra-luminal disease
- CE next step if:
  - Cross-sectional imaging unremarkable or non-diagnostic AND
  - Findings will influence management
- Always do PillCam Patency capsule before CE

ESGE does not recommend routine small-bowel imaging or the use of the PillCam patency capsule prior to capsule endoscopy in these patients (strong recommendation, low quality evidence). In the presence of obstructive symptoms or known stenosis, ESGE recommends that dedicated small bowel cross-sectional imaging modalities such as magnetic resonance enterography/enteroclysis or computed tomography enterography/enteroclysis should be used first (strong recommendation, low quality evidence).

Scoring systems for CE in Crohn’s

- Monitoring of Crohn’s is a possible future indication for CE
  - Especially if a single capsule study can evaluate the entire GI tract
  - Objective
  - Standardized terminology (CEST)
- Evaluate the following parameters
  - Extent of involvement
  - Severity
- Type of involvement: Inflammatory, strictureing
- CECDAI and Lewis scores

CECDAI

ESGE recommends ileocolonoscopy as the first endoscopic examination for investigating patients with suspected Crohn’s disease (strong recommendation, high quality evidence). In patients with suspected Crohn’s disease and negative ileocolonoscopy findings, ESGE recommends small-bowel capsule endoscopy as the initial diagnostic modality for investigating the small bowel, in the absence of obstructive symptoms or known stenosis (strong recommendation, moderate quality evidence).
Lewis Score

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<td>Non/single/low/multiple</td>
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<tr>
<td>Structure</td>
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Lewis Score: A useful clinical tool for patients with suspected Crohn’s Disease submitted to capsule endoscopy

Bruno Roos*, Maria João Norriez, Ana Rebelo, José Cotter

- Performance:
  - Positive Predictive value: 82.6%
  - Negative Predictive value: 87.9%
  - Sensitivity: 82.6%
  - Specificity: 87.9%

- 3 bands:
  - Magnificent disease: 135
  - Mild disease: 135-790
  - Moderate and severe disease: >790
10/11/16

Thank you

World Record 10k 29:17.45