CT Colonography and new logistics

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HELSE SØR-ØST

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CT Colonography

- Method
  - Preparation
  - Distention
  - MDCT protocole
  - 2D og 3D
- Logistics
  - patient flow
  - quality
  - security

Preparation – Easy kits for patients

- **1-day cleansing regime**
  - 1 dose Phosphoral® (FDA 2006, SLV 2009), PEG in case of renal failure
    - 2 cases of reported Phosphoral induced nephropathy in Norway
  - From Autumn 2010 we change in our institution to Magnesium citrate

- **Dual Tagging of residual fluid and liquid**
    - Gastrografin®. Jodine – liqiud tagging
      - Laxative effect
      - Homogenuos tagging of fluid
      - Emulgative effect on solid stool compared to iohexol
    - Tagitol®– stool tagging
- **Pure liquid before the examination**

10 cm

R

Distention

- Automatic power control under insuflation of CO_2
  - Low pressure - 20 mmHg reduce the tendency to pain
- **CO_2 passes easily the colon wall shortly after the examination**
- CT acquicsition in supine and prone position
  - Optimize distention of all colon segments.
- Betyl-Skopolamine-Bromide (Buscopan®) to minimize spasm

Symptomatic perforations

- **CTC – 0.03%**
  - » From 2005 until now - no colon perforation in our institution
- Colonoscopy - 0,13%
  - Halligan S. CT Colonography: results and limitions. Eur J Radiol 2007; 61:400-8.

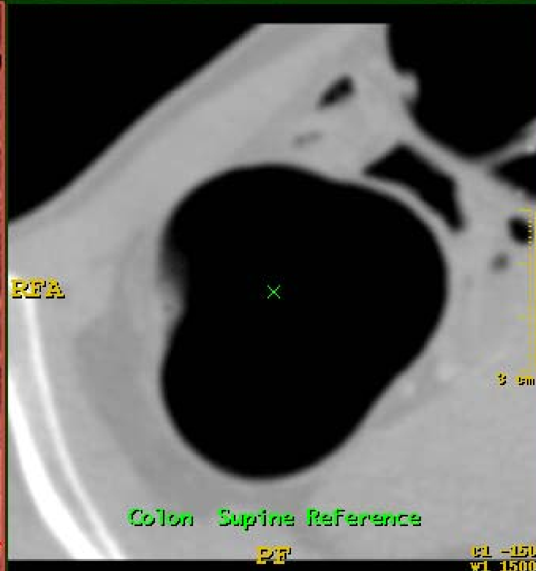
Intravenous contrast

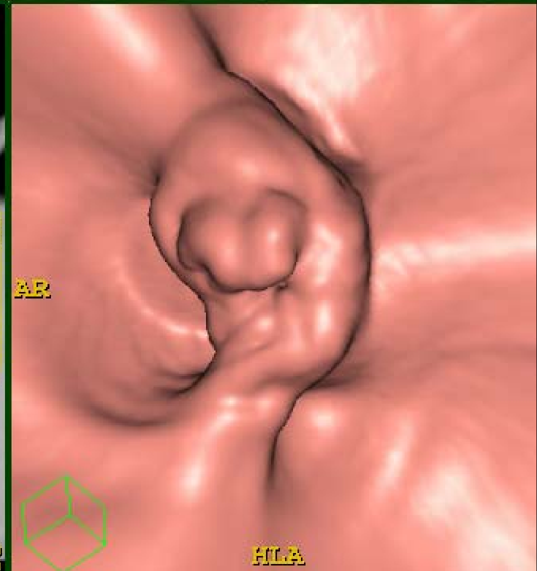
- Symptomatic patients
  - Intravenous contrast 4ml/sec
    - 2-phase for optimalization of mesentary vessels
      - 80cc/pause 23sec/30cc
      - Delay 35 sec thorax/70 sec abdomen
- **Asymptomatic patients**
  - **No intravenous contrast**
    - **No allergic potential og interference with renal function**
    - **Low dose 50 mAS**
- 64-detector CT

Polyps - Halligan S et al. Eur Radiol 2005

	Intermediate 6-9 mm	**Large ≥ 10mm**
Per pasient sens	86% (75-93%)	93% (73-98%)
Per pasient spec	86% (76-93%)	97.4% (95-99%)

A
F


RFA
3 cm
Colon Supine Reference
PF
cl -150
wl 1500


AR
HLA

Radiation dose

- Exposed dose from CTC < 2.5-5.0 mSV*
    - Double contrast enema 5 mSV
    - Annually background scattering is 4 mSV in Norway
    - Cabin personel <3 mSv
    - Upper limit for personel in radiology 20 mSV

- Risk for Colorectal cancer 5-6% in a 50-years old
  - Additional risk to develop cancer after one CTC examination
    - 50 years old 0,01%
    - 70 years old 0,007%

*

Virtual Colonoscopy can see behind folds

- Colonoscopy
  - A retrograd passage cover only 80% of colons inner surface
    - Endoskopists will miss 12-17% av polyps ≥1cm
      - » Pickhardt P et al. Ann Intern Med 2004
  - Potensial risk to miss pathology in the right colon because of prominent folds
    - – Estimated 4% missed invasive cancers with colonoscopy
      - » Bressler B et al. Gastroenterology 2004
- Solution
  - CTC with Virtual dissection
    - – 100% coverage

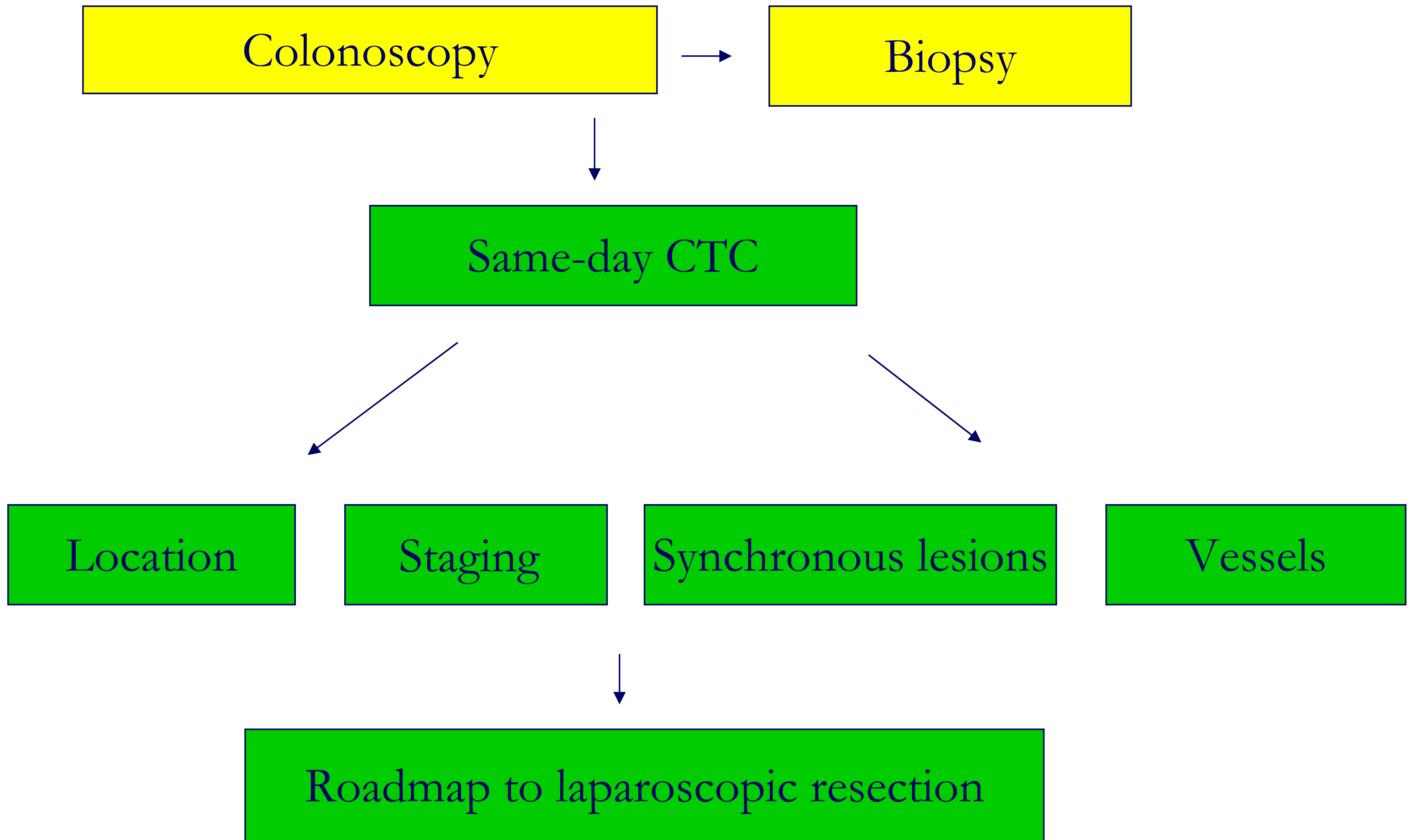
HP

L

H

A

RA



Colonoscopy
Biopsy
Same-day CTC
Location
Staging
Synchronous lesions
Vessels
Roadmap to laparoscopic resection

Optical Colonoscopy

- Incomplete 20%
  - Long angulated colon
  - Colon fixed secondary to inflammation
    - Diverticular
    - Genital
  - No passage due to tight stenosis

Optical Colonoscopy

- Significant findings before preoperative imaging
  - Singel tumour
    - Polyp to large for endoluminal polypectomy
  - Synchronous tumours - 5%
    - With synchronous significant polyps - 50%

Tumour biopsy- Any concern for same-day CTC?

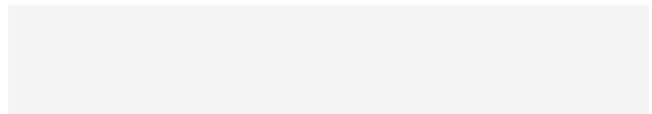
- Our surgeons wish to have biopsy before resection

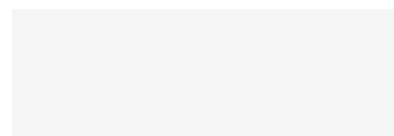
- Avoid CTC with gas insufflations after
  - Routine mucosa biopsy
  - Polypectomy
- No significant risk of perforation after tumour biopsy
  - Needle passes only into tumour, do not penetrate the wall

– In doubt – we call the endoscopist!

Same-day CTC Vessel display

- 64 MDCT
- Combined arterial and venous phase in one aqcuision
  - Optimal display of the mesenteric vessels
    - SMA, IMA, V Porta, SMV, IMV
- CT Thorax
  - Low dose acquisition for detection of lung metastasis





Same-day CTC – tumour location

- Endoscopist fails to depict the right segment

- Comparison of CTC vs conventional colonoscopy in mapping the segmental location of colon cancer befor surgery. **Neri E et al. Abdominal Imaging 2009**

Segmental location of tumour

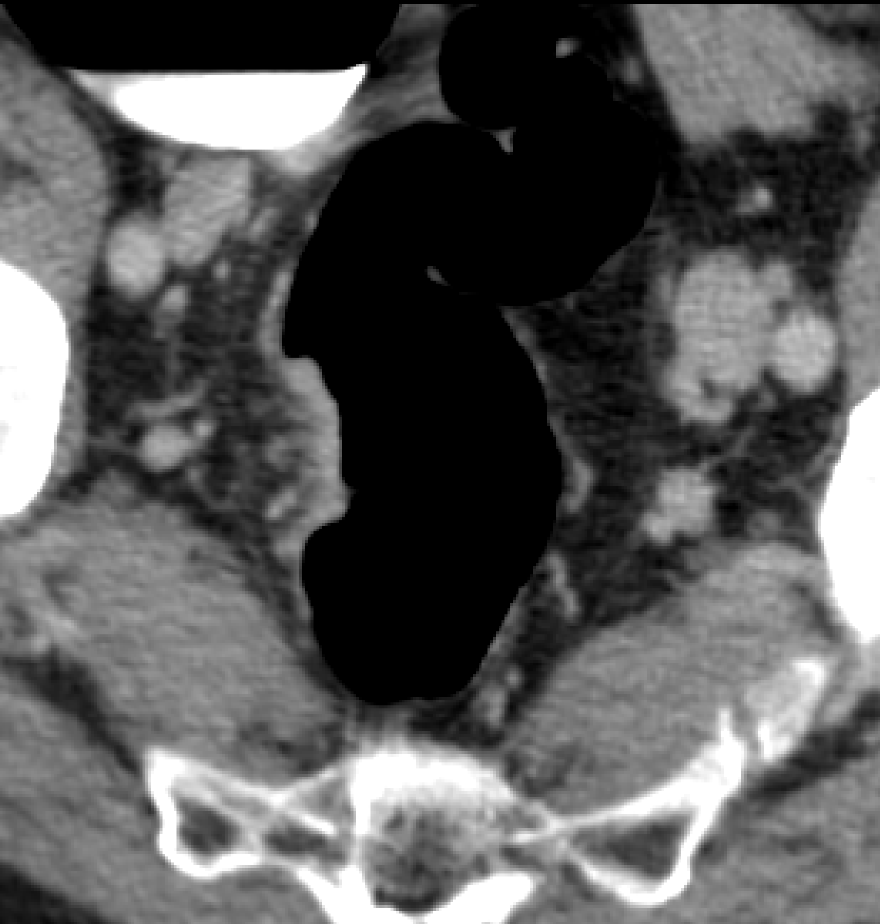
n=65

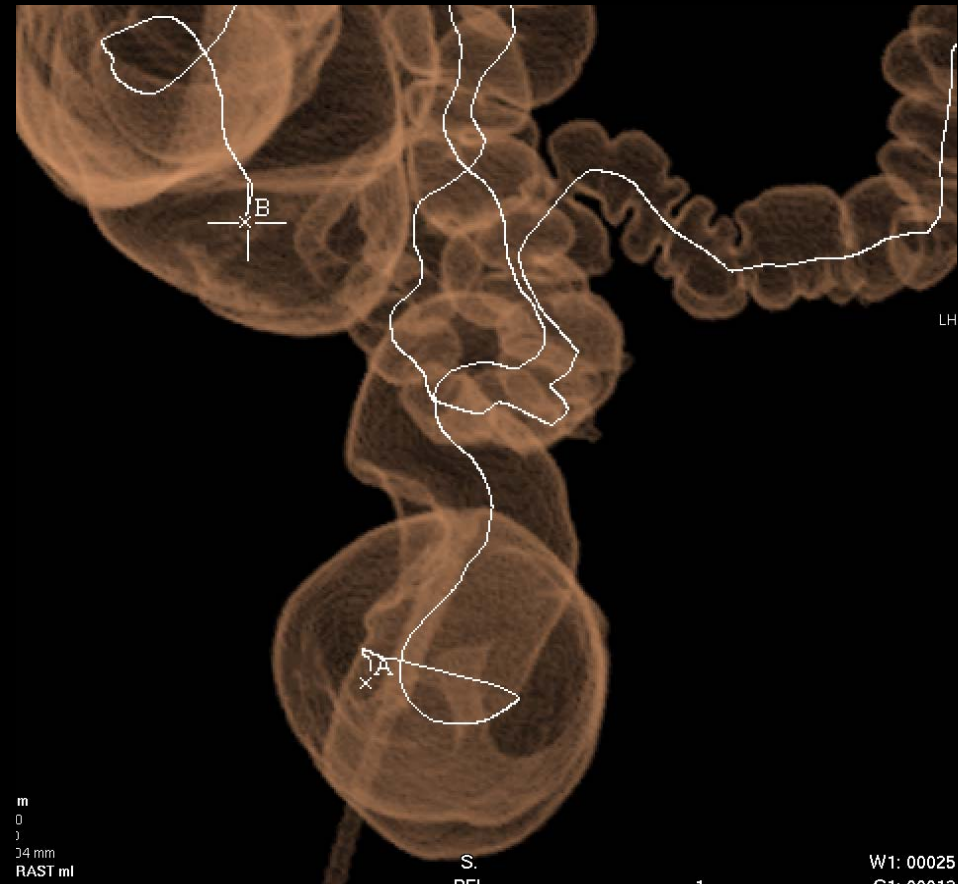
- All tumours located correctly by CTC
- 10/67 incorrectly located by colonoscopy
- Mismatch
  - rectum (n=3)
  - sigmoid (n=2)
  - descending (n=1)
  - transvers (n=2)
  - ascendens (n=1)
  - coecum (n=1)

- …CTC much more effective in the definition of segmental location…

Colonoscopy – tumour at 25 cm

Surgical strategy – laparoscopic sigmoid resection





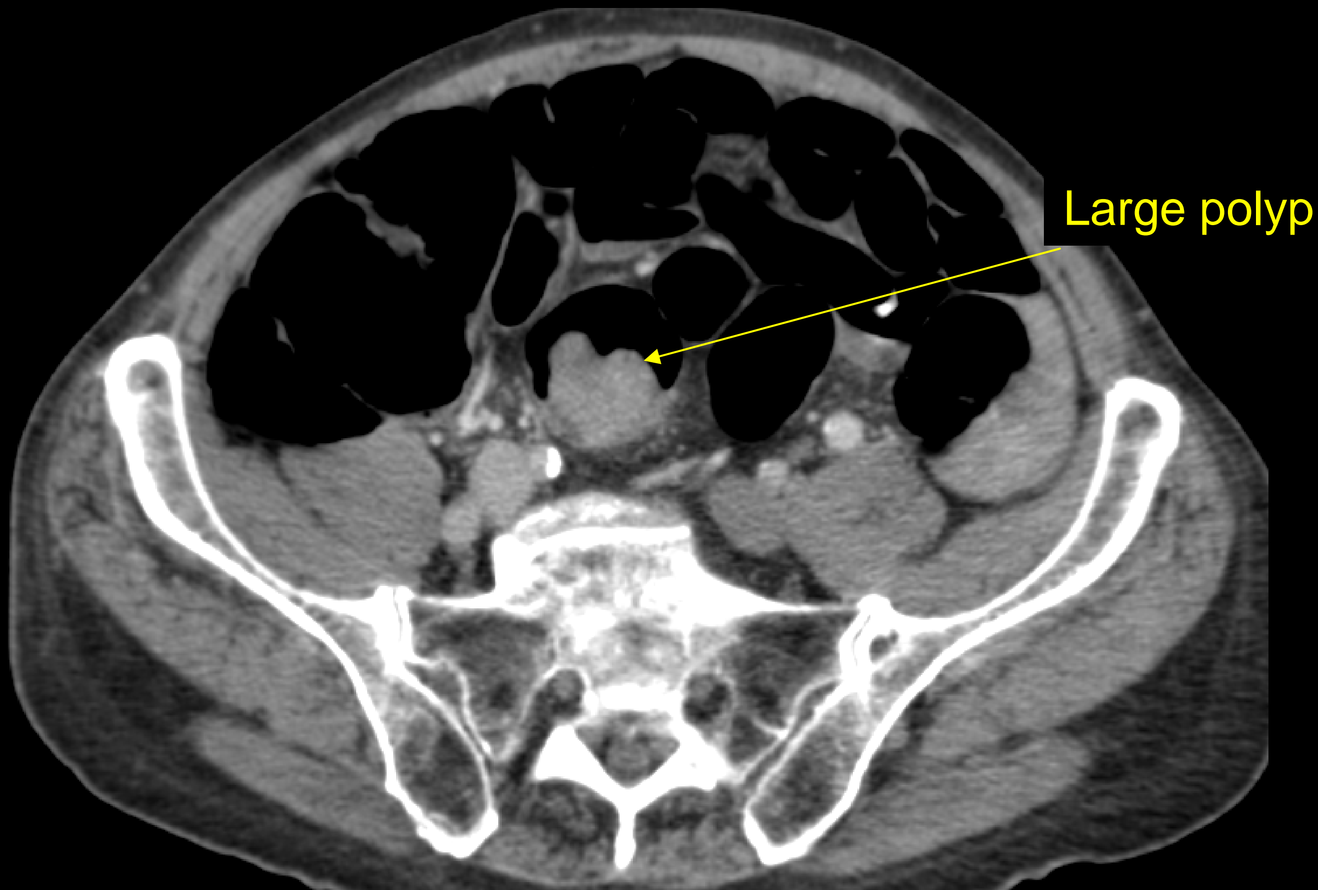
CTC-15 cm (centerline), MR-11cm from anal verge.

New surgical strategy – Low anterior resection, PME

Tumour location

- Laparoscopic technique
  - not possible to palpate manually
- Intrinsic lesions have to be correctly localised.
  - Endoscopic colour mapping
    - possible technical failures
      - Diluted colour across a long segment
      - No detected colour
        - » extended resections
      - Perforation
        - » Risk for microabscesses

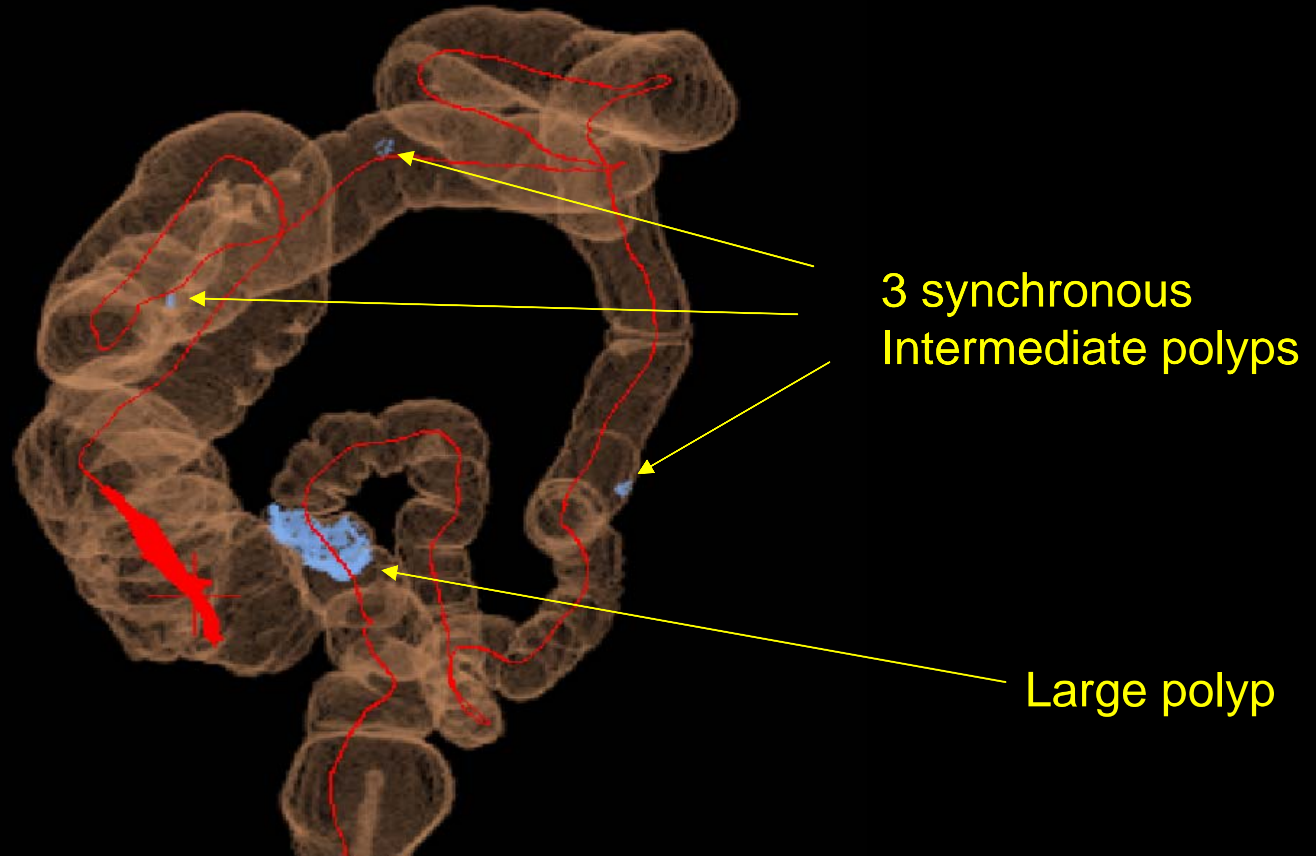
OC 3cm rectal polyp. Rectoscopy normal to 20 cm



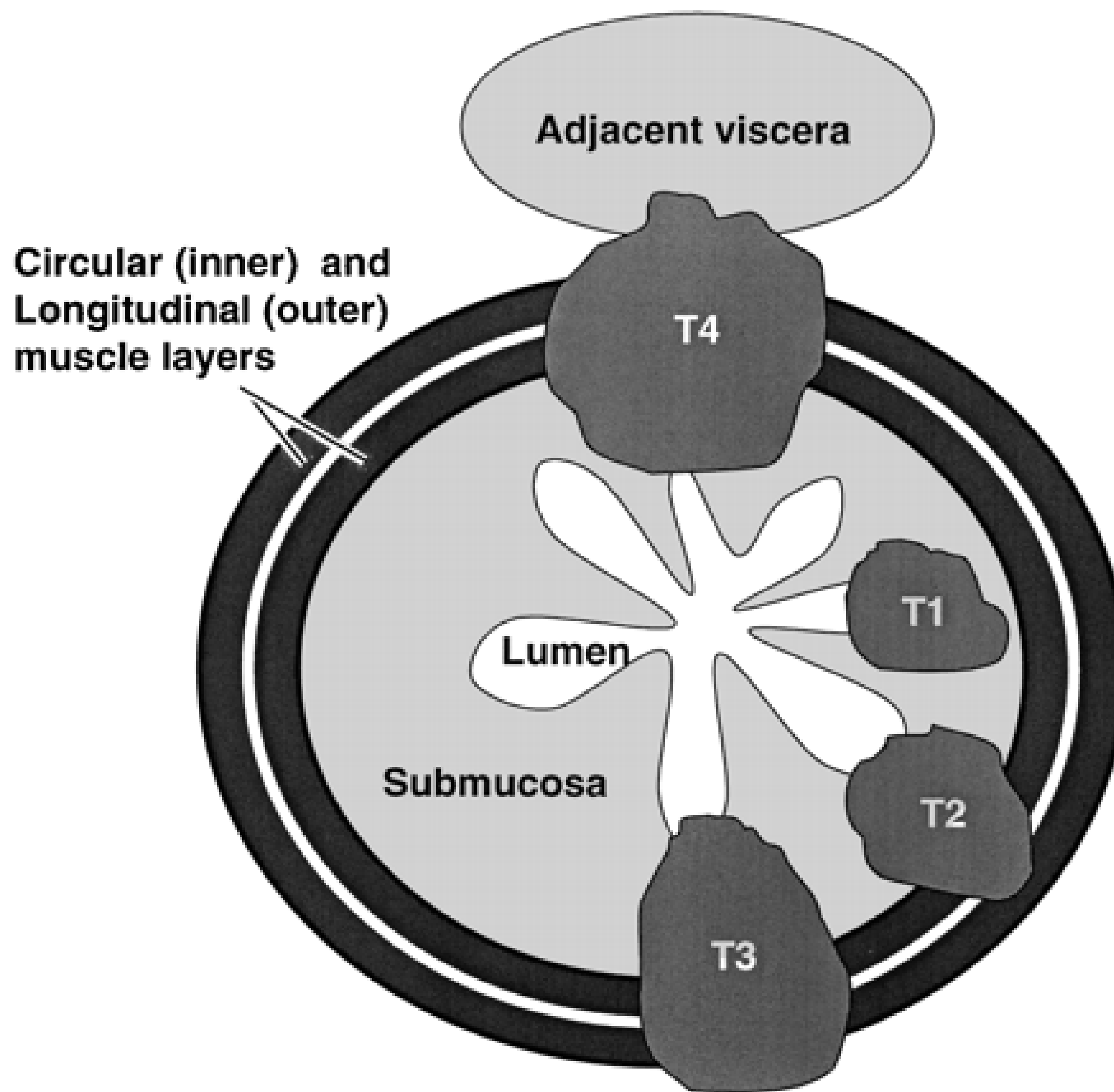
CTC polyp at 22-25 cm.

Surgical strategy: rectosigmoid resection

CTC – roadmap for surgery



Operation strategy: laparoscopic resection
Alternative to CTC – intraoperative colonoscopy


Adjacent viscera
Circular (inner) and
Longitudinal (outer)
muscle layers
T4
T1
Lumen
Submucosa
T2
T3

T-staging

- T1 and T2
  - Considered as a group since CT cannot differentiate between T1 and T2 tumours. G. Brown 2007 80% accuracy for T3-T4.

- CTC has potential to increase accuracy
  - MPR in standard planes, axial MPR perpendicular to centerline through tumor stenosis, 3D surface display *

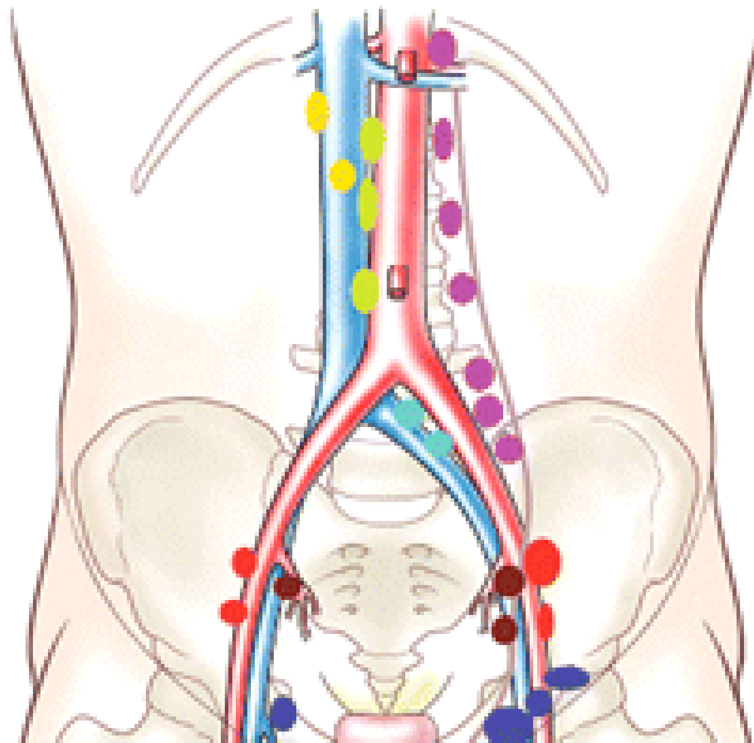
* K. Utano et al. DOI 2010

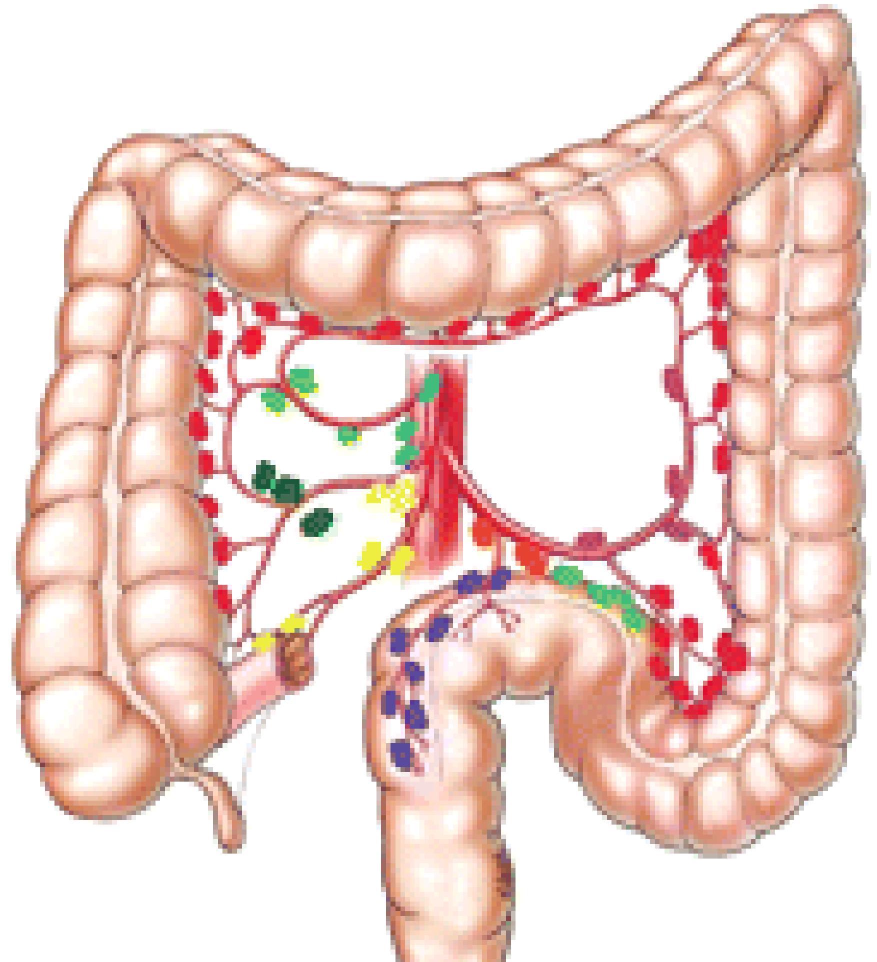
N-staging

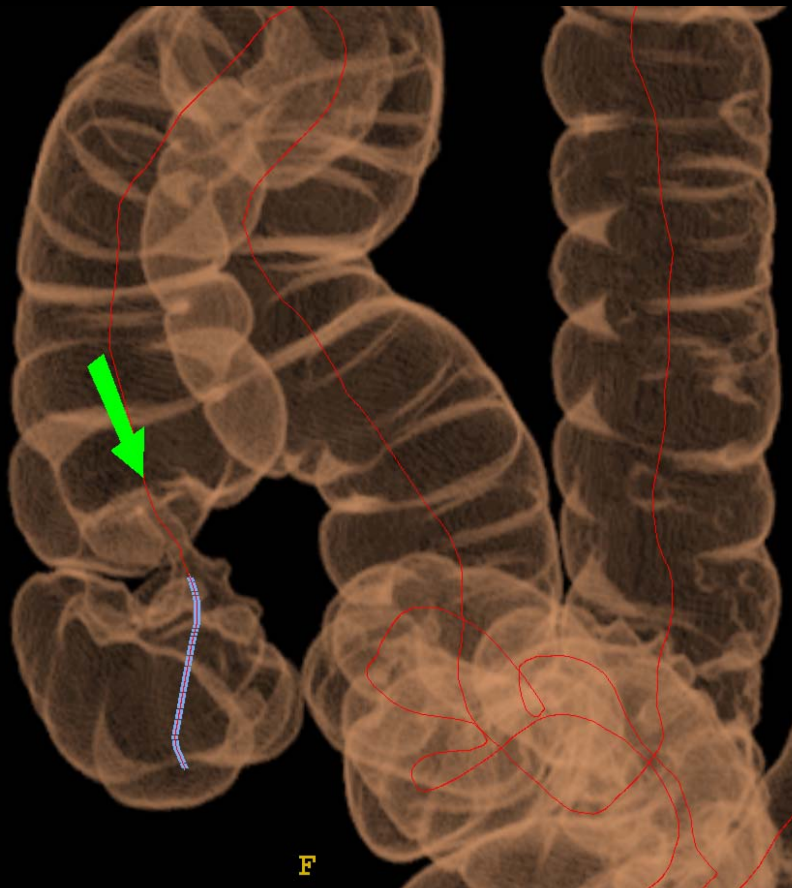
- Malignt nodes traditionally based on size - cut off 1 cm
  - Nodes < 1 cm may have micrometastasis
  - Nodes > 1 cm benign secondary to inflammation

- Several studies include pathological gathering, morphology, contrast enhancement, calcium, fat of nodes and infiltration in vessels as new markers for malignancy.

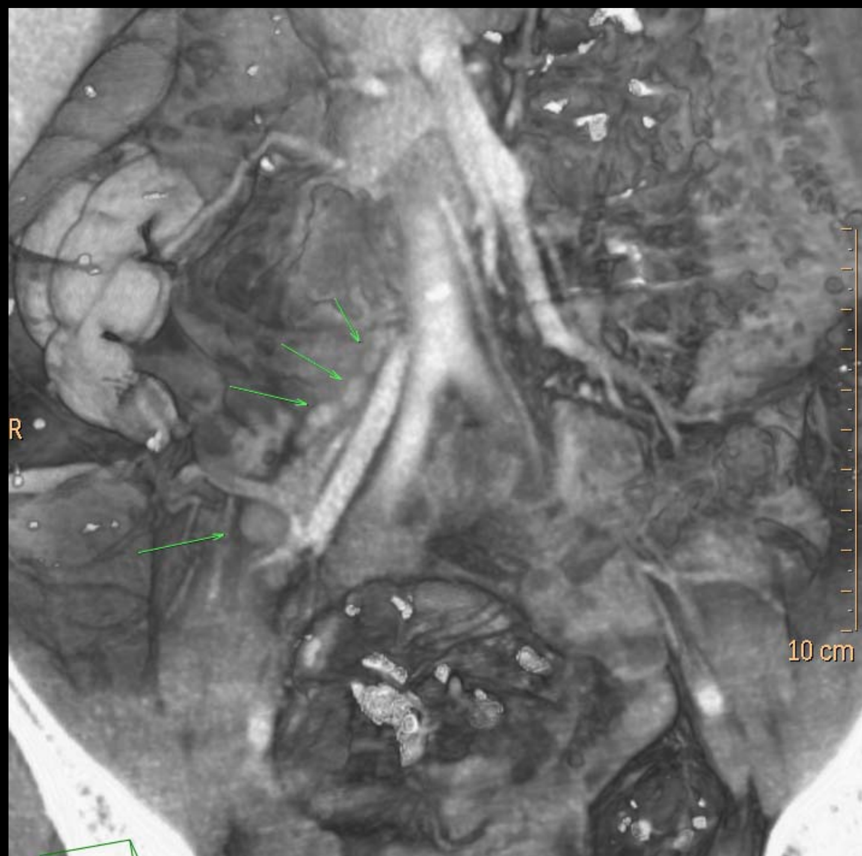
- Fillipone et al 2004 accuracy N0 85%, 83% N1, 93% N2



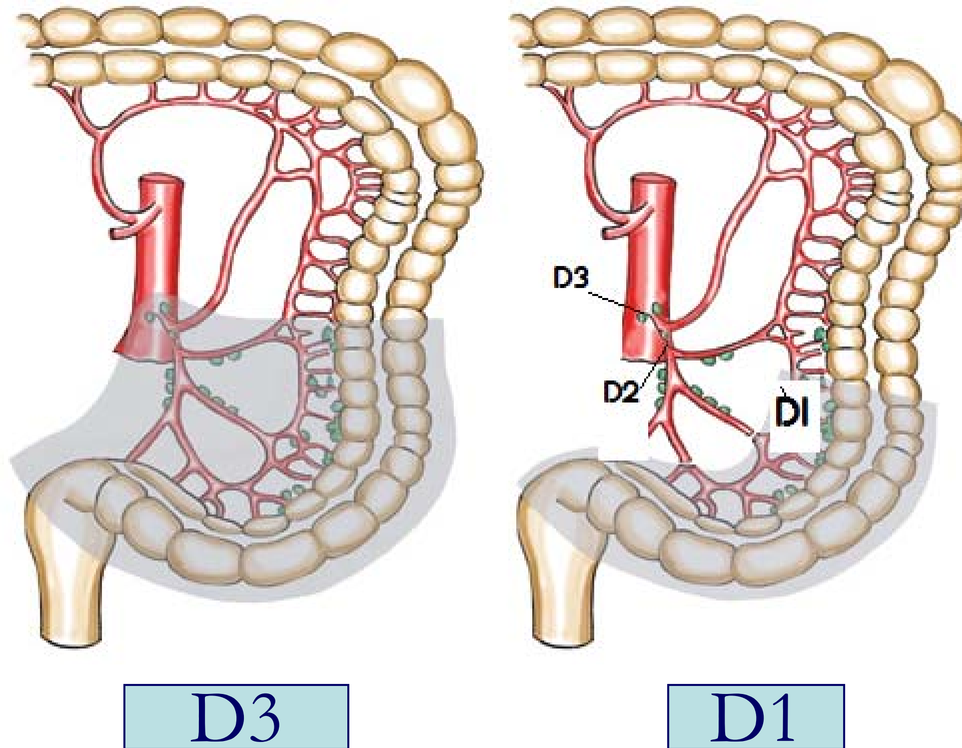




RA



Tumour i sigmoid
Recommended lymph node resection D3.



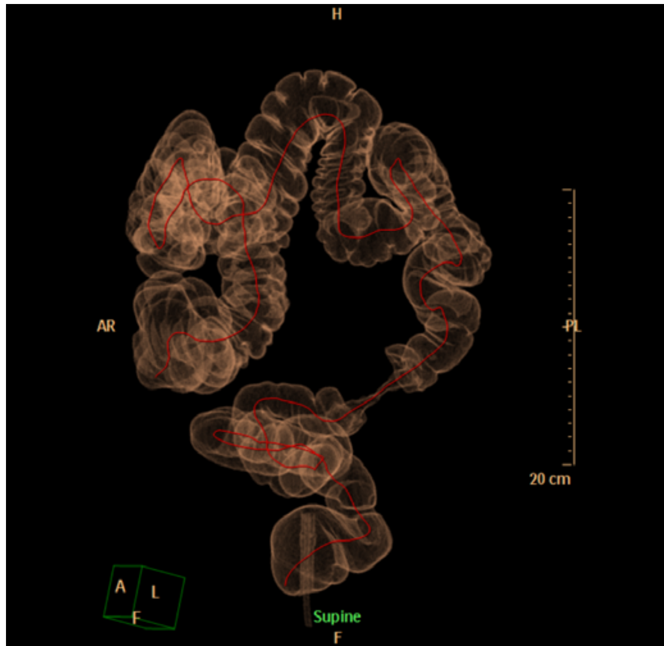
Nesbakken A og Gaard M. Tidsskr Nor Lægeforen 2007; 127: 2942-5

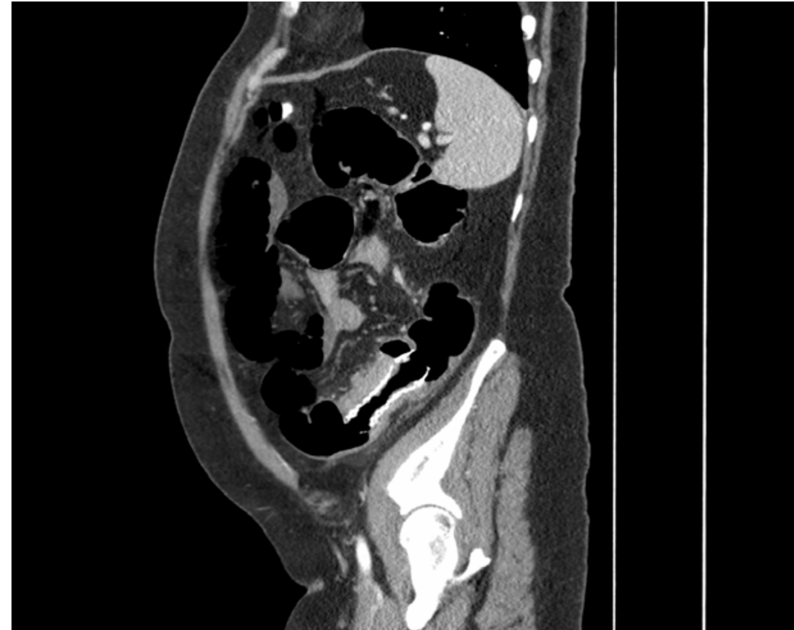
M-staging

- Liver metastasis
  - Mixed arterial and venous phase in same acquisition
    - Potential problem to characterize a lesion
    - So far not a problem
      - Undefined lesions further characterized with contrast-enhanced Ultrasound (CEUS) or MR

- Lung metastasis
  - Low dose technique

CTC after initial endolumninal stenting





Positive or inconclusive CTC

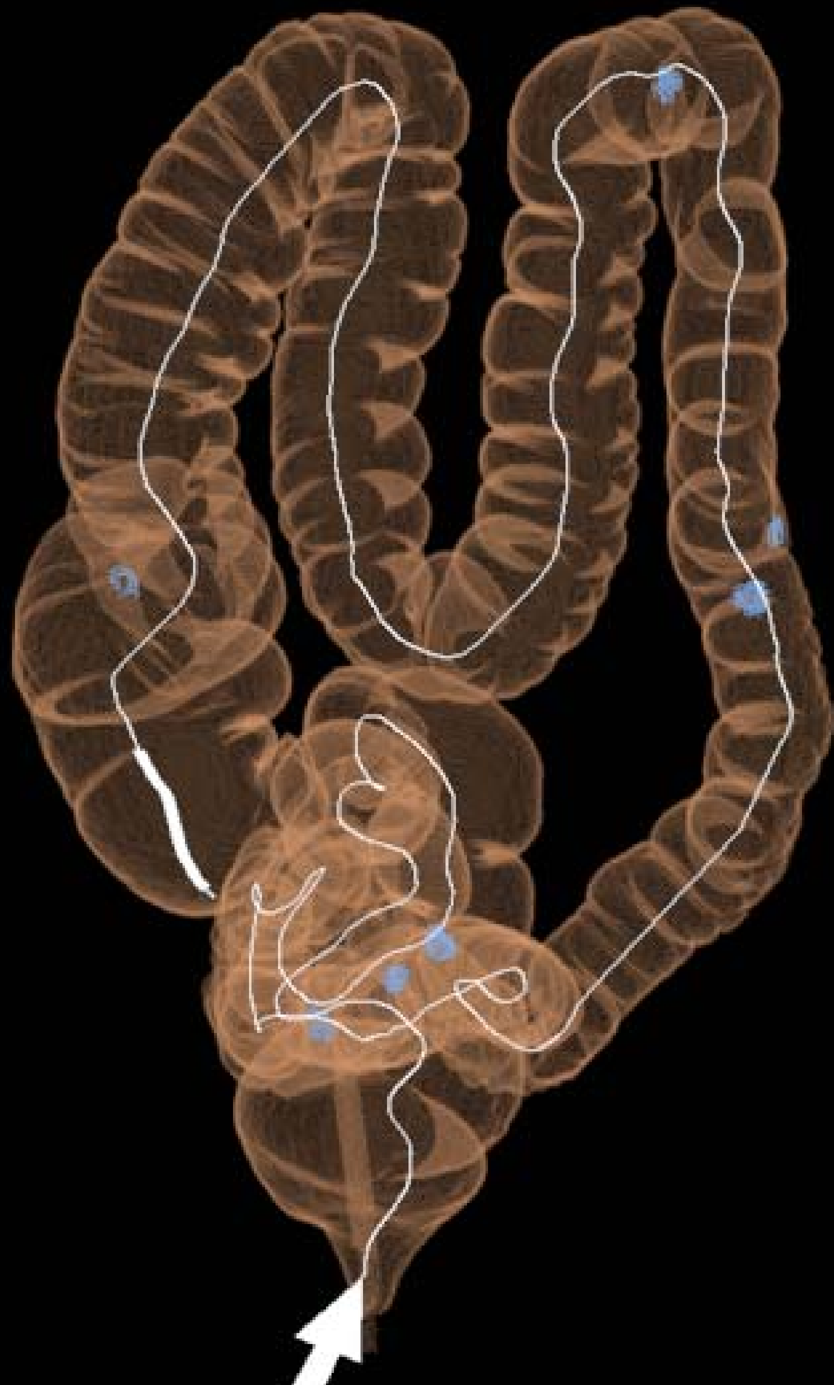
Staging - Localisation

Same-day Colonoscopy

Biopsy Polypectomy

Reporting

- Standard report scheme
  - Technical
  - Colonic findings
    - C1- C4
  - Extra colonic findings
    - E1-E4
- Confidence level 1-3



CTC Ullevål US

Dato	ID		Navn	
App op		1.grads slekt		<60
Funn skopi				

1;2;3

Kode	Beskrivelse
C0	**Ikke adekvat undersøkelse/avventer tidligere undersøkelse for sammenligning**
	ikke adekvat tømning: kan ikke ekskludere lesjoner >10 m.m pga av væske/faeces
	ikke adekvat insufflasjon: en eller flere colonsegmenter er sammenfallen på begge projeksjoner
	avventer tidligere colonundersøkelse for sammenligning
C1	**Normal Colon eller benigne lesjoner: Ingen planlagte kontroller***
	ingen påvisbare forandringer
	ingen polypp > 5mm
	lipom eller invertert diverticulum
	ikke neoplastisk funn - som divertikler
C2	**Intermediær polypp eller uavklart funn: henv coloskopi****
	intermediær polypp 6-9 mm, <3 i antall
	uavklart funn; kan ikke utelukke polypper > 6 mm i teknisk god us
C3	**Stor Polypp. Sannsynlig avansert adenom: henv coloskopi ****
	polypp>= 10 m.m
	>=3 polypper, hver 6-9 mm
C4	**Colon mass(> 3cm): Sannsynlig malign: Anbefaler kirurgisk konsultasjon*****

Segment	
Rectum(1)	
Sigmoideum (2)	
Descendens (3)	
Transversum (4)	
Ascendens (5)	
Cecum (6)	

Confidence data, 1-3, der 1 betyr lav sikkerhet, 2- moderat sikkerhet, 3 - høy diagnostisk sikkerhet
* Polypper 5mm etter mindre lagres i database for prosjekt
** gå direkte til coloskopi
***Avhengig av lokale retningslinjer

B-S-F	Polypper kan være bredbasede, stikede eller flate (definert som < 3mm vertikal elevasjon)
1_5 6_9	Størrelse: største enkeltmål av polypphode i ortogonale MPR evt VR, stilken ekskluderes.
_>10	Målingen utføres med WL/WW -150/1500 for å skille polypp fra fettet i mesenteriet
1-2-3-4-5-6	Lokalisasjon i colon: 6 segmenter: rectum, sigmoideum,descendens, transversum, ascendens og coecum
	Attenuasjon: Polypper kan variere i tetthet, men det typiske er homogen bløtvevs attenuasjon

Kode	Beskrivelse
E0	**Begrenset us. Pga artefakter; evaluering av ekstracoliske bløtdeler er sterkt begrenset**
E1	Normalt funn eller anatomiske varianter: Ingen ekstracoloiske patologiske funn
	anatomisk variant: f. eks retroaortisk venstre nyrevene
E2	Klinisk ikke viktig funn: Ingen oppfølgning påkrevet
	a. Lever, Nyre: enkle cyster
	b.Galleblære: Gallesten uten cholecystitt
	c. Vertebra: hemangiom
E3	Sannsynlig ikke viktig funn. Ikke fullstendig karaterisert.Oppfølgning avhengig av lokal praksis
	Oppfølgning kan bli aktuelt.
	a. Nyrer: Minimalt komplekse cyster eller hyperattenuerende cyster
E4	Potensielt viktige funn.
	Nyrer: solid nyre tumor
	Lymfadenopathy
	Vasculært: AAA
	Lunge: ikke -uniform forkalket parenchym nodul >1cm.

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CTC School May 2011

3-days intensive course

Radiologist and Radiographers

CTC and multidisiplinary logitics

In collaberation with VC vendors

Norsk radiologisk forening

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WARNING!