

# Ct- Colon – Oplæring af radiografer i Ct-colografi ved hjælp af E-learning og supervision via teleradiologi

Udarbejdet af Radiograferne :

Jeanette O. Ege

Mette Stove

Inge E. Hansen



# Ph.d. Projekt ved Professions højskolen Metropol lektor Carsten Lauritsen.

- Kan radiografer lære at beskrive Ct Colografier på niveau med erfarne Radiologer?
- Hvorfor?
- Uddannelsesforløb:
  1. E-learning
  2. Kursus i Belgien
  3. Teleradiologi - 75 Ct Colografier
  4. Eksamen - 20 Ct Colografier
  5. Beskrivelse af 87 Ct colografier
  6. Resultatet
  7. Fremtiden?



# 1. E-learning

Undervisningsprogrammet:

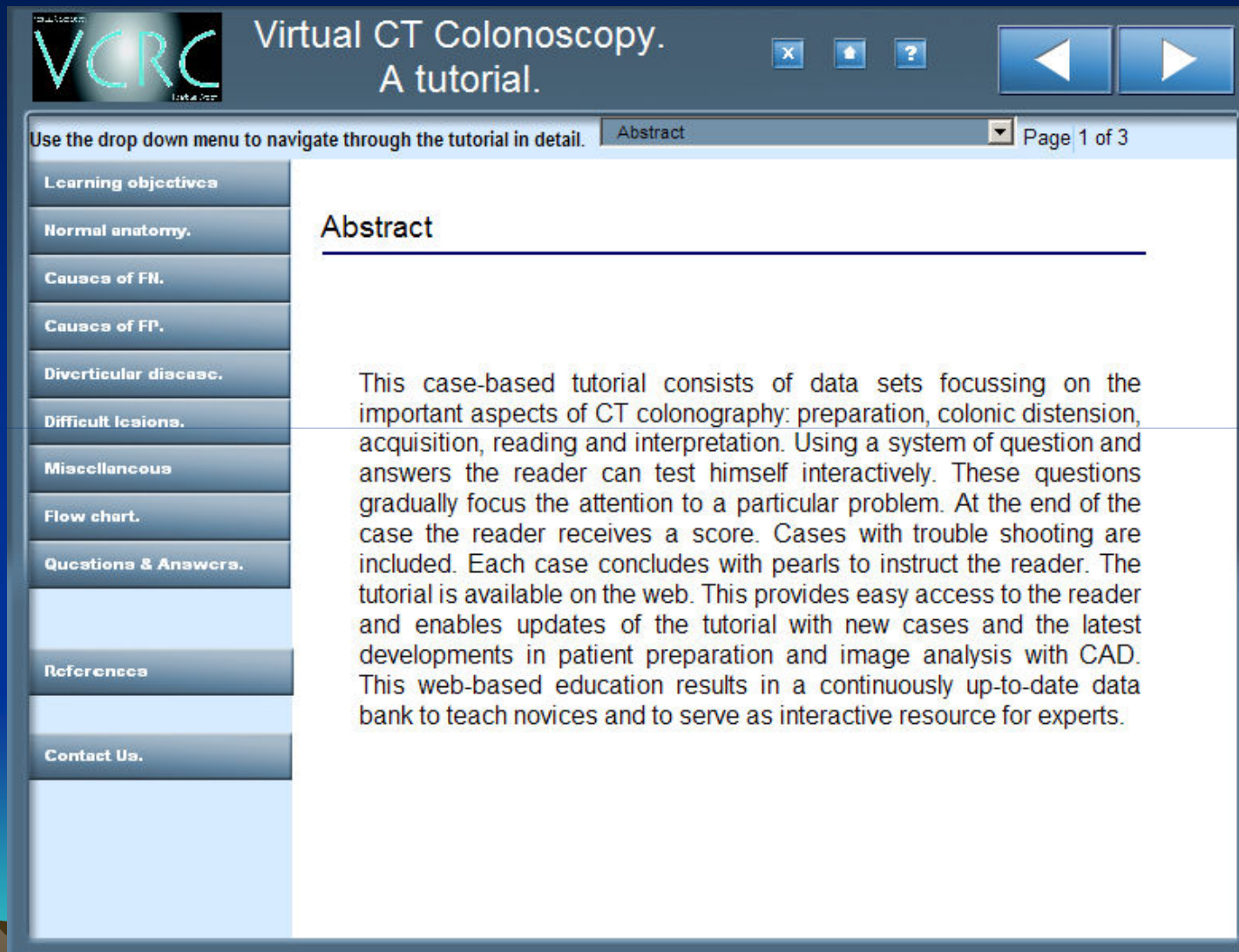
Virtuel Colonoscopy Teaching Centre

[www.vctc.eu](http://www.vctc.eu)

Radiologer med erfaring i over 6000 beskrevne Ct Colografier. Heraf over 800 verificerede af koloskopi.



# [www.VCTC.eu](http://www.VCTC.eu) E-learning



**VCRC** Virtual CT Colonoscopy. A tutorial.

Use the drop down menu to navigate through the tutorial in detail. Abstract Page 1 of 3

- Learning objectives
- Normal anatomy.
- Causes of FN.
- Causes of FP.
- Diverticular disease.
- Difficult lesions.
- Miscellaneous
- Flow chart.
- Questions & Answers.
- References
- Contact Us.

### Abstract

This case-based tutorial consists of data sets focussing on the important aspects of CT colonography: preparation, colonic distension, acquisition, reading and interpretation. Using a system of question and answers the reader can test himself interactively. These questions gradually focus the attention to a particular problem. At the end of the case the reader receives a score. Cases with trouble shooting are included. Each case concludes with pearls to instruct the reader. The tutorial is available on the web. This provides easy access to the reader and enables updates of the tutorial with new cases and the latest developments in patient preparation and image analysis with CAD. This web-based education results in a continuously up-to-date data bank to teach novices and to serve as interactive resource for experts.

# [www.VCTC.eu](http://www.VCTC.eu) E-learning

Virtual CT Colonoscopy.  
A tutorial.

VCRC

Use the drop down menu to navigate through the tutorial in detail.

Learning objectives

Normal anatomy.

Causes of FN.

Causes of FP.

**Diverticular disease.**

Difficult lesions.

Miscellaneous

Flow chart.

Questions & Answers.

Table of Contents 1

Prediverticulosis

- scar after polypectomie
- appendiceal stump
- prolapsing rectal mucosa

Diverticular disease

Prediverticulosis


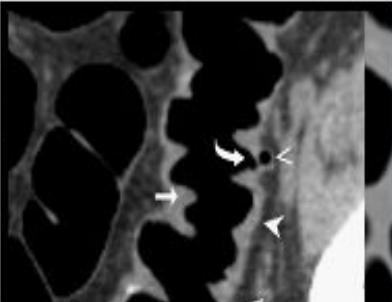
Diverticulosis

- Diverticulosis 2D
- Diverticulosis 3D
- Diverticular fecalith 1
- Diverticular fecalith 2
- Inverted diverticular fecalith 1
- Inverted diverticular fecalith 2
- Inverted diverticular fecalith 3
- Inverted diverticulum 1
- Inverted diverticulum 2
- Mucosal prolapse syndrome
- mucosal prolapse 1
- mucosal prolapse 2
- mucosal prolapse 3
- mucosal prolapse 4
- mucosal prolapse 5

Diverticular disease

Prediverticulosis is the early

- Thickening of the
- Shortening of the
- Luminal narrowing



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# Undervisnings eksempel:

**VCRC** Virtual CT Colonoscopy.  
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**Miscellaneous**

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**Questions & Answers.**

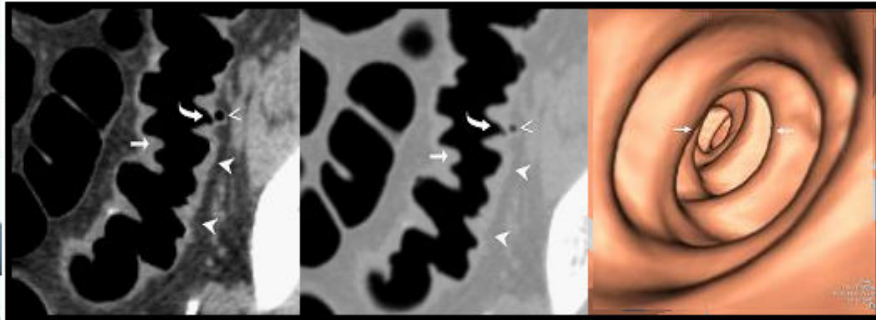
**References**

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## Diverticular disease. *Prediverticulosis.*

Prediverticulosis is the early stage of diverticulosis. It is characterized by myochosis:

- Thickening of the muscular layer.
- Shortening of the taeniae.
- Luminal narrowing.



There is global and regular thickening of the colonic wall (arrowheads) with prominent folds (arrows) and shortening of the haustrations (curved arrow). There is one diverticulum (open arrowhead). On 3D the prominent folds may hamper complete visualization of the haustral folds resulting in an increased amount of blind spots.

# Eksempel på falsk negativ:

**VCRC** Virtual CT Colonoscopy. A tutorial.

Use the drop down menu to navigate through the tutorial in detail. preparation 2 Page 3 of 17

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**Causes of false negative diagnosis. *-1/ Failure to detect***

**Preparation related false negative diagnosis.**

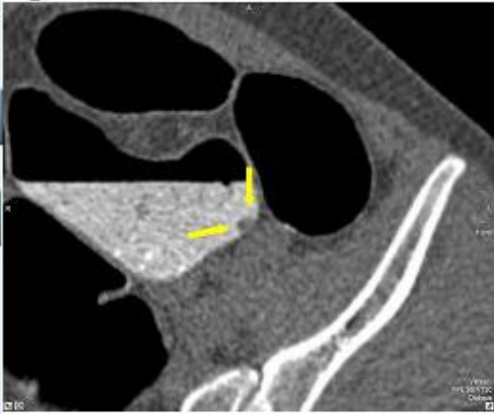
**pitfalls:** fluid levels may hide polyps

**solution:** b) tagging

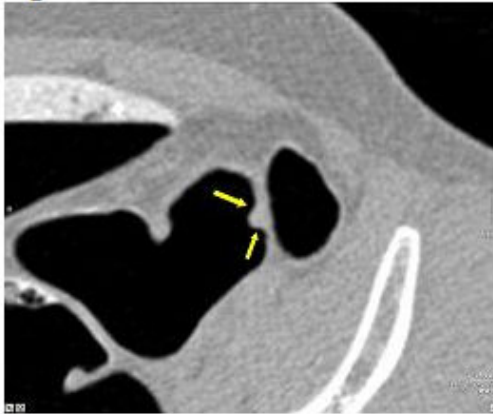
- on 2D images, polyps become visible as a hypodense structure in a tagged hyperdense fluid level

**Figure Legend**

**Fig 2 a**



**Fig. 2 b**



# Hvilket plan ses en polyp bedst i?

Virtual CT Colonoscopy.  
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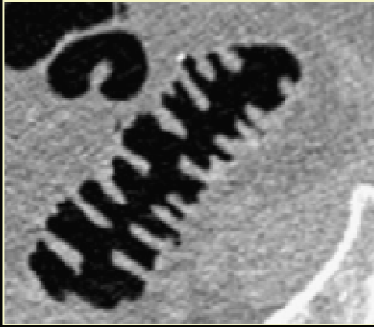
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Final Assessment

Rectangle



2 D oblique reconstruction: find the polyp

The image shows a 2D oblique reconstruction of a CT colonoscopy. A white rectangle is drawn over a polypoid lesion on the colonic mucosa. The polyp is a sessile, slightly lobulated mass protruding from the mucosal surface. The surrounding colonic lumen is dark, and the mucosal folds are visible as lighter, radiating lines.



# Virtual CT Colonoscopy. A tutorial.



Use the drop down menu to navigate through the tutorial in detail.

1. Sessile Polyp g

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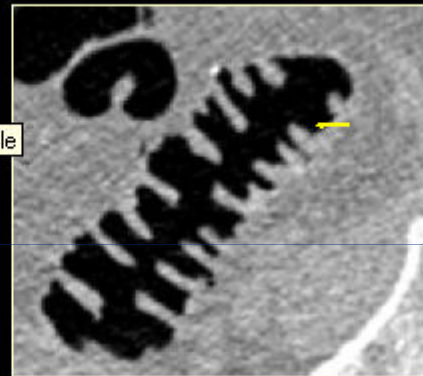
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Final Assessment

Rectangle



Arrow points towards the polyp:  
Do you discern the polyp?



# Virtual CT Colonoscopy. A tutorial.



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1. Sessile Polyp h

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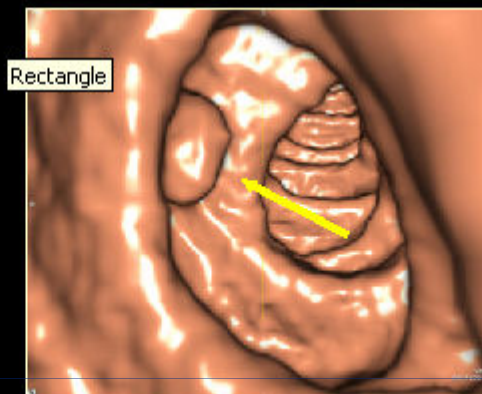
Flow chart.

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Final Assessment



Polyp is easily seen on 3D,  
Indiscernable on 2D





# Virtual CT Colonoscopy. A tutorial.



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1. Sessile Polyp i

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Normal anatomy.

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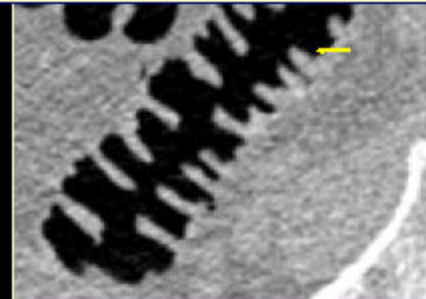
Contact Us.

Final Assessment



Lesson: **FN**

- *Sometimes better on axial 2D.*
- *Sometimes better on MPR's.*
- *Sometimes better on 3D.*
- *Try to combine.*
- *Time efficiency ?*



## 2. Kursus i Belgien

3 dages intensiv kursus i Belgien ved specialisterne Phillippe Lefere og Stefaan Gryspeerdt.

Erfaring med undervisning af Radiologer på deres undervisningscenter i beskrivelse af CT Colografier



## 2. Kursus i Belgien

- 3 dages workshop
  - Teoretisk præsentation
  - Work shop med forskellige cases af Ct Colografier
  - 50 cases blev gennemgået
  - Arbejdsstationen View forum



## 3. Teleradiologi

- 10 øve cases fra Belgien
- 75 Ct-colografier beskrevet, rettet og superviseret via teleradiologi.
- Blændet beskrivelser
- Tidsforbrug (34 uger)
- Software programmer (View forum/Brilliance)
- Problemer med software (måleunøjagtigheder)
- Eksempel på beskriverark
- Eksempel på rettelse



# Beskriverarket

## 1. side

Findings						
Segment	Seen on	Supine axial slice #	Prone Axial Slice #	CTC <sup>1</sup> Size (mm) Write in 2D	Confidence level that finding identified is a polyp.	Polyp Morphology
1. Rectum 2. Sigmoid 3. Descending 4. Transverse 5. Ascending 6. Coecum	1. Supine only 2. Prone only 3. Both supine and prone <b>The reason why it was not seen – (Write the position number e.g. 1.5 not seen on supine)</b> 4. Simply not visible despite good visualisation of the colonic wall. 5. Covered by non-tagged stool/fluid. 6. Hidden by collapse/spasm.				0. Not a polyp 1. Low confidence 2. Possible 3. Indeterminate 4. Probable 5. High confidence	1. <u>Sessile</u> 2. <u>Pedunculated</u> 3. <u>Subpedunculated</u> 4. <u>Flat</u> 5. <u>Mass</u>
[ ]						
[ ]						
[ ]						
[ ]						
[ ]						
[ ]						
[ ]						
[ ]						

<sup>1</sup> Measurements should be made of the maximum diameter of the polyp head, excluding the stalk, on either MPR or 3D views.

# Beskriverarket

## 2. side

Findings					
Polyp Location	Distance to anal margin (mm)	Orientation of colon at polyp site:	Location of polyp relative to colonic bend	Attenuation	Additional findings <sup>1</sup>
1. Between folds 2. On folds 3. Not Applicable		1. Straight 2. Bend 3. Not Applicable	1. Inside curve 2. Outside curve 3. Not Applicable	1. Soft tissue 2. Lipomatous tissue <sup>2</sup> 3. Air <sup>3</sup>	1. No 2. Yes "If yes complete next row"

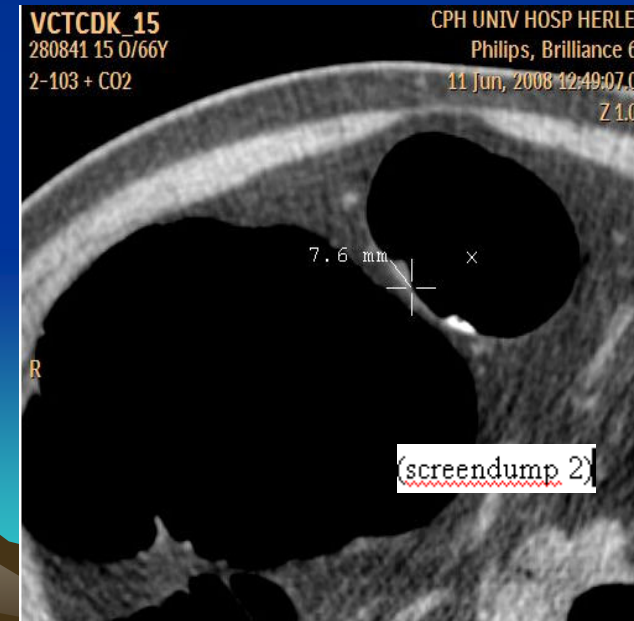
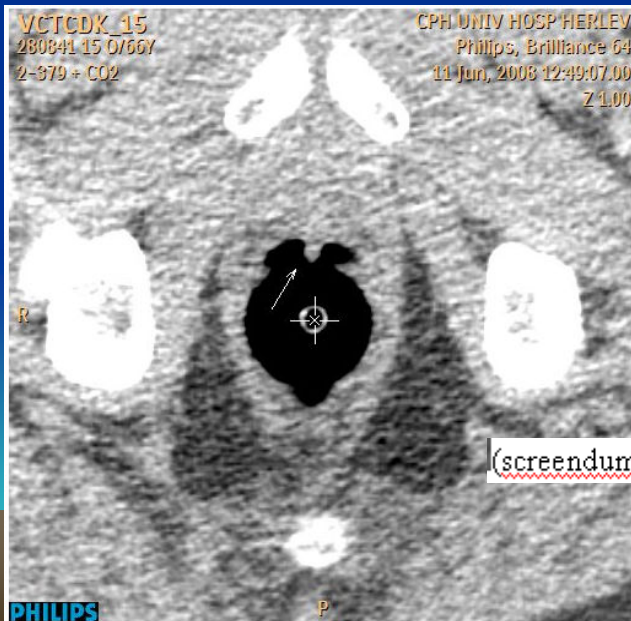


# Eksempel på rettelse

Findings						
Segment	Seen on	Supine axial slice #	Prone Axial Slice #	CTC <sup>1</sup> Size (mm) Write in 2D	Confidence level that finding identified is a polyp.	Polyp Morphology
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[ 1 ]	3	381	382	S:7,2mm	0	Hemorrhoid? <u>agree</u>
[ 4 ]	1,4	103	<b>83</b>	S:7.6mm	4 <b>to my opinion &lt; 5 mm</b>	1
[ 5 ]	3	116	94	P:6.9mm	5 <b>agree</b>	1
[ 5 ]	3	80	171 <b>60?</b>	S:6.1mm	4 <b>agree</b>	1
[ ]						
[ ]						
[ ]						
[ ]						

# Eksempel på rettelse

Findings					
Polyp Location	Distance to anal margin (mm)	Orientation of colon at polyp site:	Location of polyp relative to colonic bend	Attenuation	Additional findings <sup>1</sup>
1. Between folds 2. On folds 3. Not Applicable		1. Straight 2. Bend 3. Not Applicable	1. Inside curve 2. Outside curve 3. Not Applicable	1. Soft tissue 2. Lipomatous tissue <sup>2</sup> 3. Air <sup>3</sup>	1. No 2. Yes "If yes complete next row"
3	1 cm	1	3	1 (screendump 1)	
2	183 cm	1/2	1	1 (screendump 2)	
2	198 cm	2	2	1 (screendump 3)	
1	211 cm	2	3	1 (screendump 4)	



## 4. Eksamen

- 20 nøje udvalgte Ct colografier valideret med koloskopi.
  - 5 patienter uden fund og 15 patienter med polypper
  - 27 polypper  $\geq 6\text{mm}$  og 15  $\geq 10\text{ mm}$ , heraf
    - 10 sessile polypper
    - 11 pedunculated polypper
    - 3 flade polypper
    - 3 masses med malignt karakteristika
    - 1 lipoma
- Succeskriterie: 80% sensitivitet og specificitet for polypper  $\geq 6\text{mm}$
- Høje krav, også anvendt til ACRIN 6664



# Resultatet fra eksamen: Sensitiviteten

- Per polyp sensitivitet  $\geq 6$  mm = 81,5 %
- Per polyp sensitivitet  $\geq 10$  mm = 94,7 %
  
- Per patient sensitivitet  $\geq 6$  mm = 97,1%
- Per patient sensitivitet  $\geq 10$  mm = 95 %



# Resultatet fra eksamen: Specificiteten

- Specificiteten for polypper  $\geq 6$  mm = 85,5 %
- Specificiteten for polypper  $\geq 10$  mm = 80 %
  
- European journal of Radiology : Effect of a tele-training programme on radiographers in the interpretation of Ct –colonography.

## 5. Beskrivelse af 87 Ct colografier

- 87 Ct colografier beskrevet (40 lesions)
- 39 cases blev kasseret
- Radiograf beskrivelser sat op imod Radiologens og koloskopiens resultater.



## 6. Resultatet

- Radiologerne og radiograferne havde samme resultat:
  - Sensitivitet per patient med polypper  $\geq 6$  mm = 76,2 %
  - Specificiteten per patient med polypper  $\geq 6$  mm = 81,4% (radiograferne) 81,1% (radiologerne)



# Fremtiden?

- Screening for coloncancer fra 2014
- Screenings metode koloskopi
- Inkomplette koloskopier - Ct colografi
- Hvem skal beskrive disse undersøgelser?



Tak for opmærksomheden.

