DETECTION OF AUTOFLUORESCENCE PHENOMENA FOR THE DIAGNOSIS OF EARLY BRONCHIAL MALIGNANCIES

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HISTORY (1)

- 1911 : fluorescence of body tissue (Wood's light)
- 1933 : tumor and healthy tissue behave differently (SUTRO-BURMANN)
- 1961 : preferential retention of HpD by tumor (LIPSON et al.)
- 80 's : fluorescence bronchoscopy using fluoresceing drugs (PROFIO-BALCHUM)
- 1982 : management of lung cancer with HpD (CORTESE - KINSEY)
- 1985 : « Fluorescence as a guide to bronchial biospy ». (HOMASSON et al).

HISTORY (2)

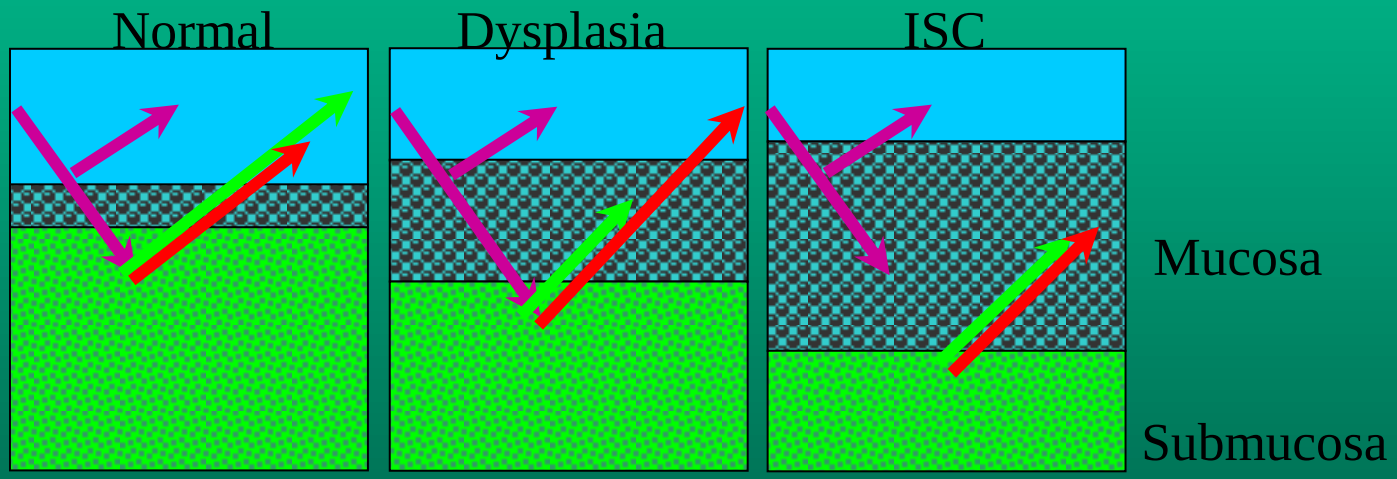
- Unsuccessful diagnostic aid of HpD :
  - Poor specificity
  - High cost
  - Complications
- Fluorescence in complete absence of HpD : LIFE system (LAM – 1993)
- Autofluorescence without laser illumination (HAUSSINGER- 1999)

BIOPHYSICAL PRINCIPLES OF AUTOFLUORESCENCE

- To evoque autofluorescence, an excitation light source in the near ultraviolet range up to blue light (250- 500 nm) is required.

- Various chromophores (embedded in cells and tissues structures emit fluorescence).

- Blue light excites green to red fluorescence originating from submucosa.



- The fluorescence is very week (not more than 1 % of the excitation light)

$\Rightarrow$ High-power light source

Filters and amplification of the signal

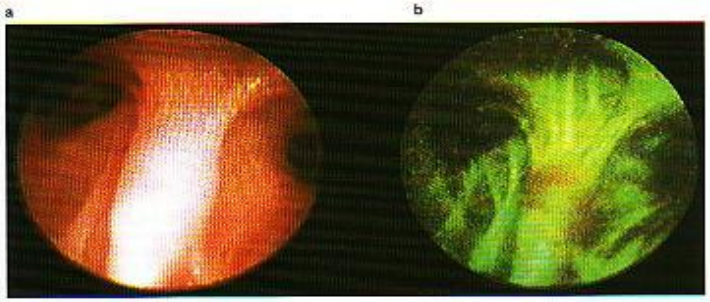


Fig. 4. Severe dyplasia. a White light mode. b Autofluorescence mode.

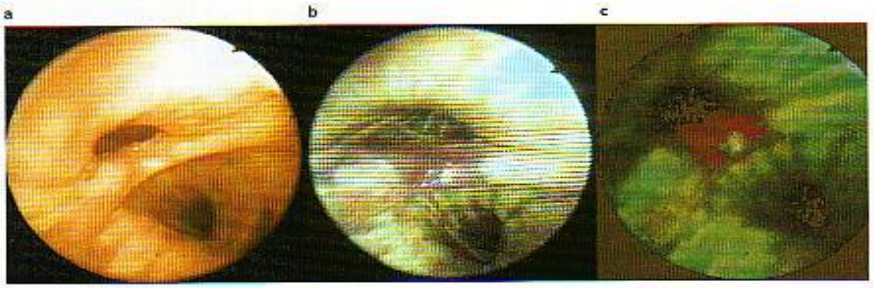


Fig. 5. Carcinoma in situ. a White light mode. b Autofluorescence mode. c Autofluorescence image analysis: blue color indicates low, red color indicates high reduction of autofluorescence.

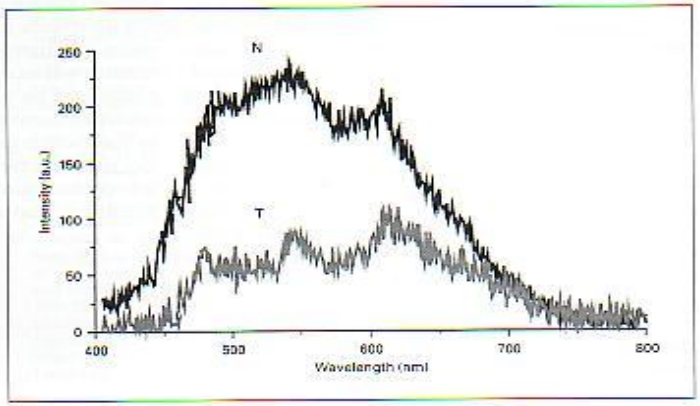


Fig. 6. Spectrum of normal (N) and neoplastic (T) epithelium.

In : Interventional Bronchoscopy. Bolliger , Mathur eds.
Autofluorescence Bronchoscopy.
The D.Light System – Haussinger et al.

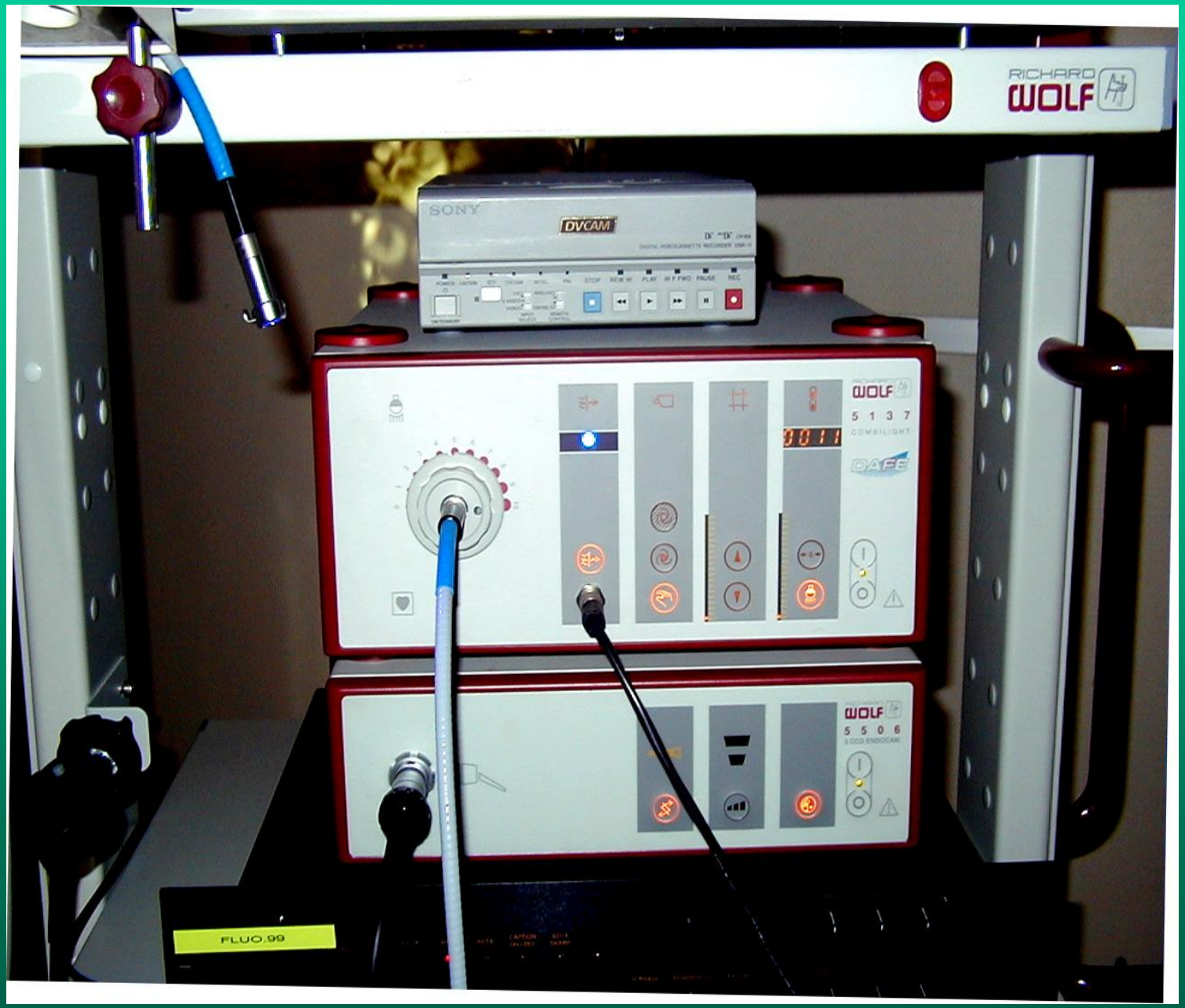
MATERIAL (1)

- LIFE (Light Induced Fluorescence Endoscope). XILLIX.
- During a routine F.O.B. (W.L.B.) the light source is changed to a low-energy helium – cadnium laser light.
- A CCD camera is connected to the optical lens of the F.O.B.
- The camera picks-up the fluorescent light.
- A real time video image is displayed on a monitor
  - Technically complex system
  - Uncomfortable handling
  - No immediate comparison WL/Fl.
  - High cost

MATERIAL (2)

- SAFE 1000/ D-LIGHT/DAFE.
- Xenon source and F.O.B.
- Switching between WL and AF mode is possible without changing the light source and camera.
- No photosensitizers.
- Lower cost (≃ 30 000 €)
- Identical results.
- Examination time = + 10 mn.


STORZ
telecam SL pal
202120 20
STORZ
D-light AF
201333 20


RICHARD WOLF
SONY
DVCAM
WOLF
5137
COMBILIGHT
DAFB
WOLF
5506
3 CCD ENDOCAM
FLUO.99

MATERIAL (3)

- ONCOLIFE (XILLIX)
- SAFE 3000 (PENTAX)

BRONCHIAL CARCINOGENESIS (1)

Slow process from normal tissue to carcinoma.

Low grade : hyperplasia

metaplasia

dysplasia : minor without metaplasia

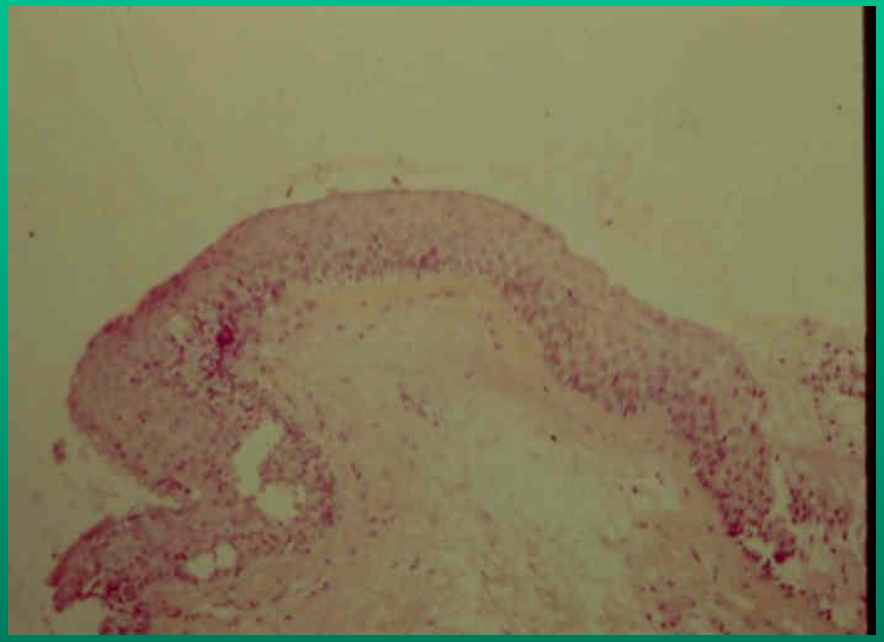
minor with metaplasia

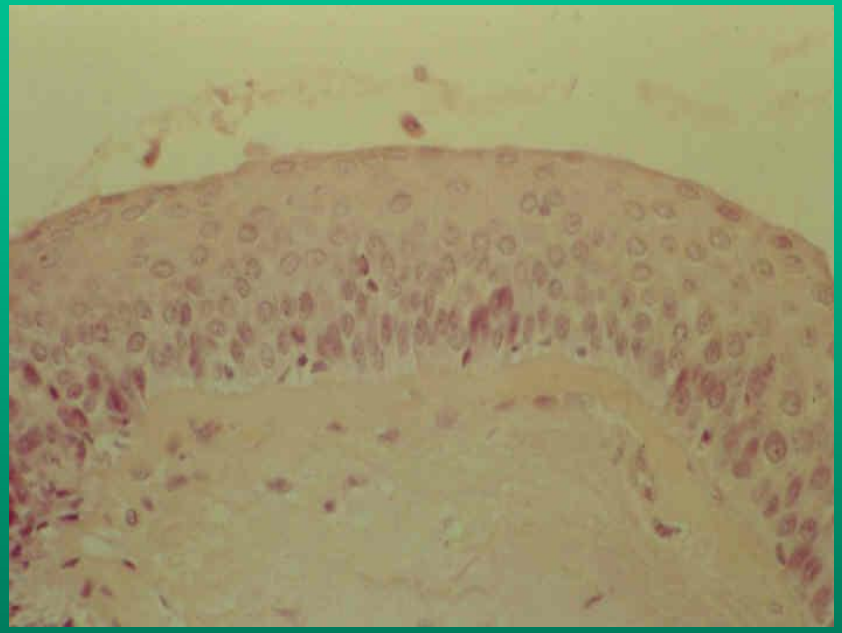
moderate without metaplasia

moderate with metaplasia

angiogenesis

DYSPLASIA

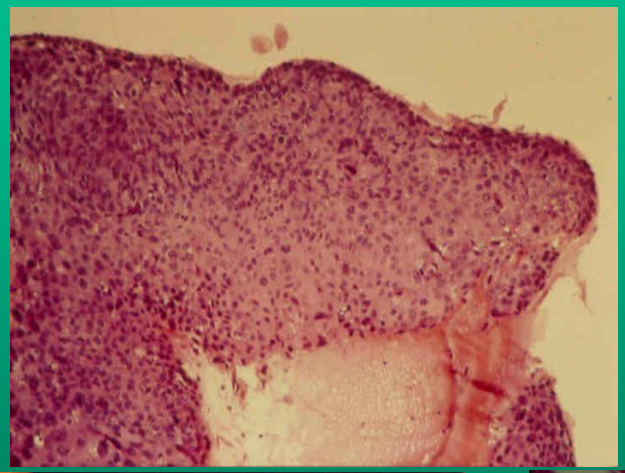


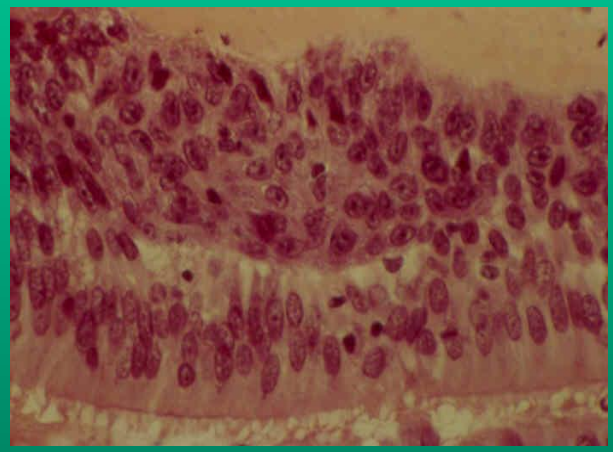


BRONCHIAL CARCINOGENESIS (2)

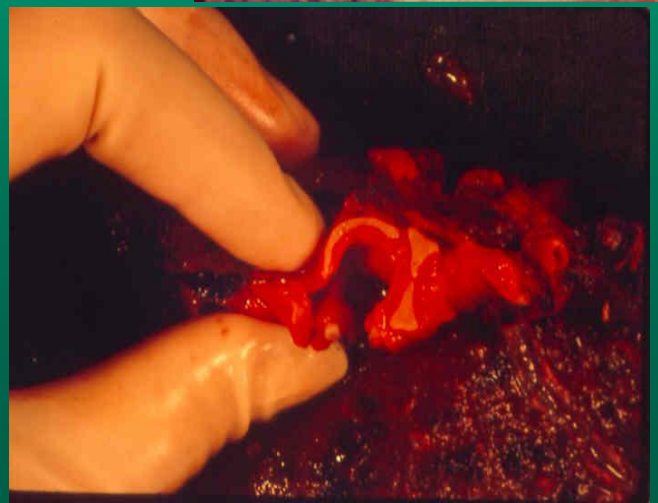
High grade : dysplasia : severe without metaplasia.

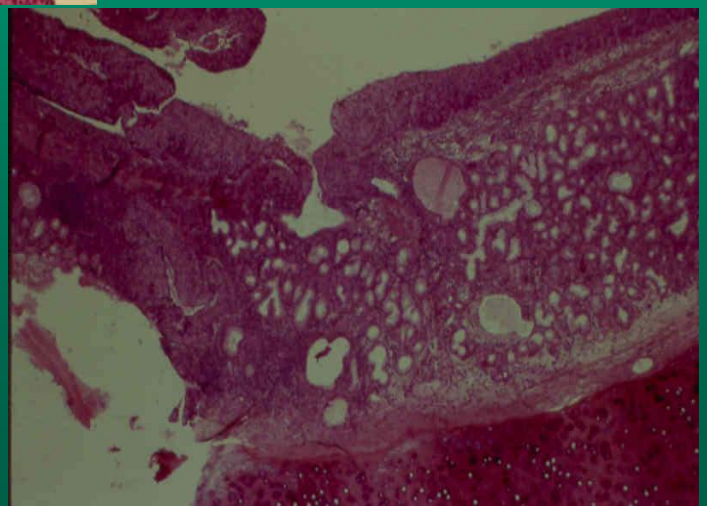
Severe with metaplasia.





In situ





Micro invasive

PREVALENCE OF PRE-CANCEROUS LESIONS IN HIGH-RISK PATIENTS

- S.D. and I.S.C . : 9 – 10 %
- Low grade dysplasia : 60 %
- Normal or inflammation : 30 %

EVOLUTION OF PRE-CANCEROUS LESIONS (1)

- Previous study (Luc THIBERVILLE)
- 104 patients
- Autofluorescence (LIFE system)
- Follow up : 2 years

EVOLUTION OF PRE-CANCEROUS LESIONS (2)

- To higher grade
  - Metaplasia = 2 %
  - Minor ; moderate dysplasia = 3,5 %
  - Severe dysplasia = 37 %
  - In situ carcinoma = 87 %

GENERAL INDICATIONS OF A.F.

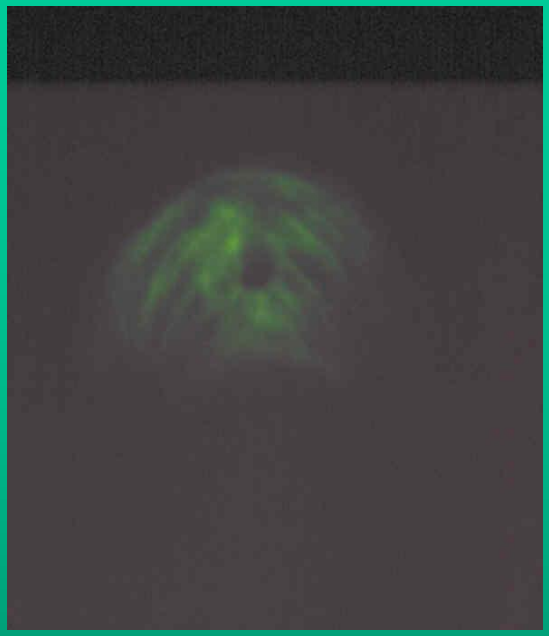
- Radiological or clinical suspicion of bronchial or esophagal carcinoma.
- Post operative care (resected bronchial carcinoma).
- Positive cytological findings.
- Previous positive findings of dysplasia ; ISC.
- Staging of bronchial carcinoma.
- Heavy smoker (> 30 P/y).
- Occupational exposure.

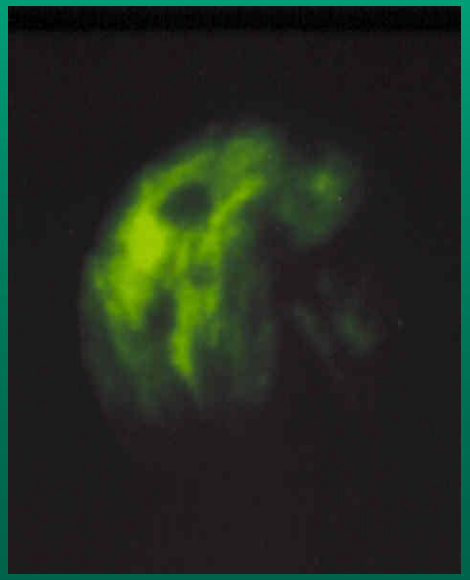
PATIENT'S BENEFIT

- Early diagnosis → early treatment
- better staging
- Severe dysplasia – ISC → interventional endoscopy
  - Cryo
  - HDR brachy
  - Electrocautery / APC
  - PDT
  - Focalized radiotherapy
- Moderate dysplasia ?

LIMITS (1)
(False-Positives)

- Granulation tissue
- Hypervascularization
- Previous biopsy sites
- Previous radiotherapy (alteration of vascularization)
- Cryotherapy
- Retinoids – chemotherapy
- Tangential shadowing
- Angioma





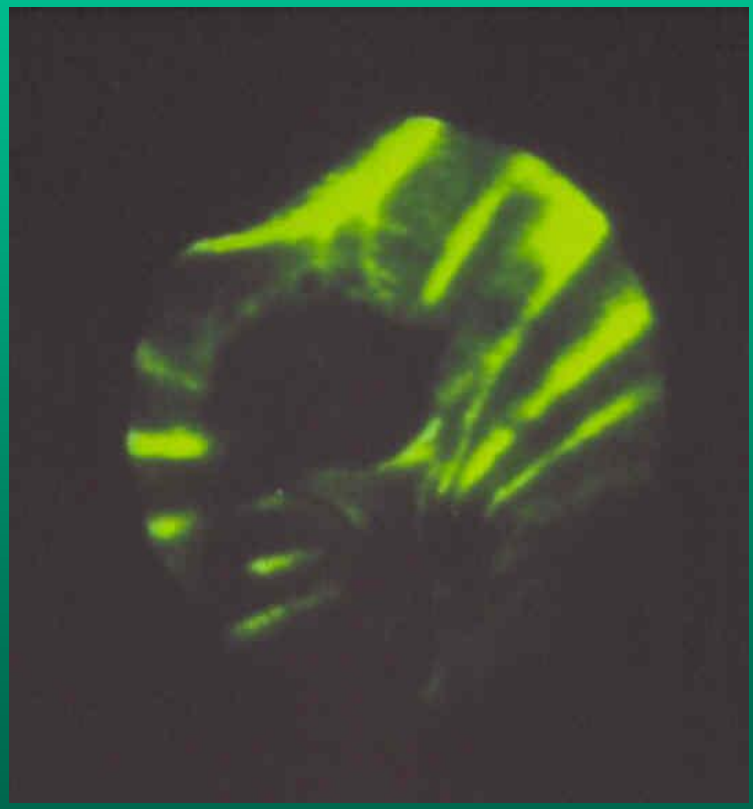
LIMITS (2)
(False-Negatives)

- Malignant changes at the subepithelial level (SCC).

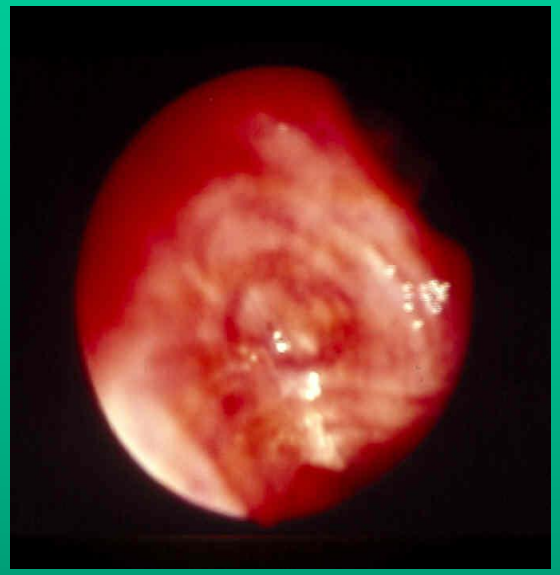
. Necrosis may mask overt tumor.

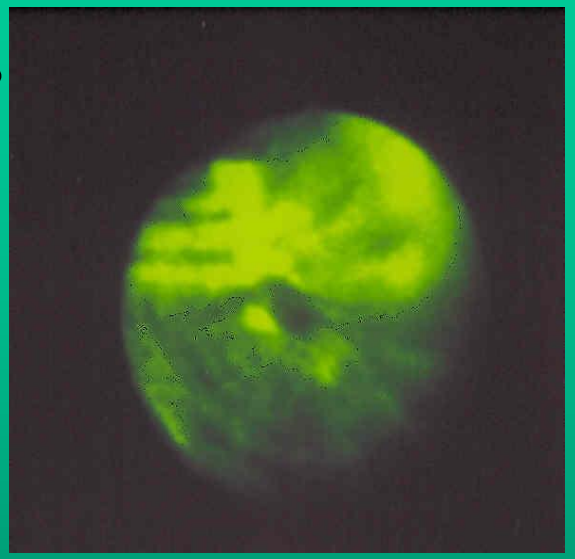
- Adenocarcinoma ?

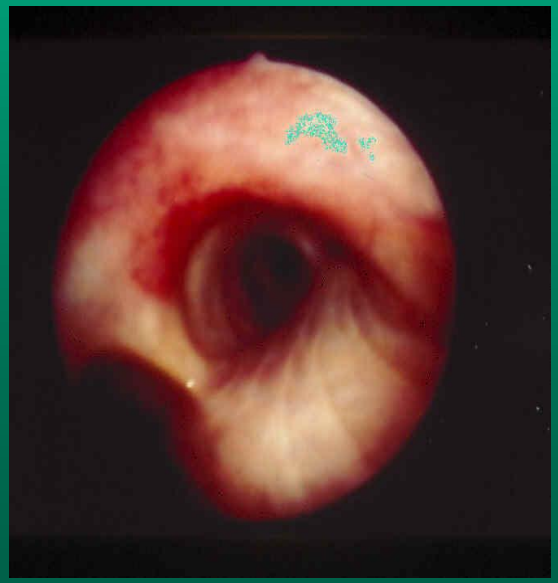
Visible Bronchial Carcinoma

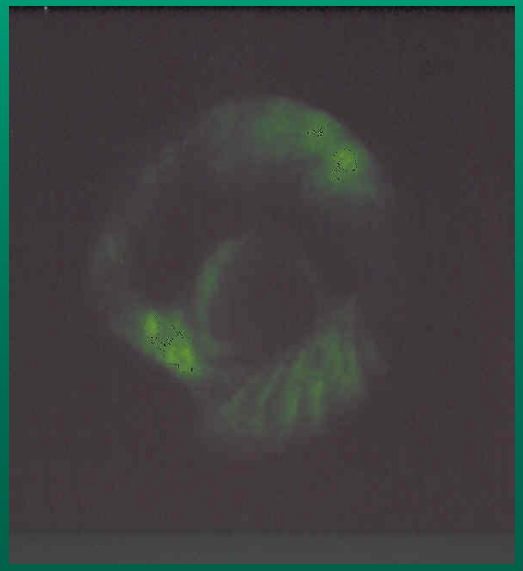


R.O.C.









C H S P

Chevilly-Larue

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Chevilly-Larue