Digital Pathology. From “in house“ experiment to global service.

Marius Nap MD PhD
Consultant for digital Pathology
NPC
Storage and information.

**Good diagnostic accuracy and reproducibility for digital microscopy of colon biopsies (n=295)**

- Overall concordance with the criterion standard: 89.5% for WSI versus 91.5% for LM
- Good intraobserver agreement for WSI (Kappa 0.78) and higher than the interobserver agreement for LM (Kappa 0.71)

*WSI: Whole slide images
LM: Light microscopy*
## External revision concordance

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Is there an effect of digital on diagnostic output and turnaround time?

![Graph showing turnaround time for convent and digit 2 over days after registration.](image-url)
Before going digital......PRI
Safe Process Integration

Remote Pathologist

VPN

HIS

sample

Registration and Reporting (LIMS)

Vendor Neutral Archive

Grossing: Images + annotations.

Local pathologist

Speech recognition or structured tekst.

Tissue processing and staining

Glass slides.

Scanning device

firewall

External VNA Panels, Expert consultation.
Scan to Server:
monthly network consumption 2013-14

![Graph showing network consumption](image)

- **Inbound**
  - Current: 35.22 k
  - Average: 10.64 M
  - Maximum: 43.22 M
  - Total In: 64.66 TB

- **Outbound**
  - Current: 2.31 k
  - Average: 625.30 k
  - Maximum: 5.69 M
  - Total Out: 3.81 TB
Scan to Server: Daily network consumption 2013

Green = Scan to Server. Black = Server to Workstation

Effect of scanning disciplin and hardware on total volume and turnaround time as part of the diagnostic process

Max 1Gb/s
Server to Workstation: daily network consumption 2013

Green = Server to workstation. Black = Workstation output.

2 different path
Same day.

Different network consumption profiles.

Same output volume.

Different download volume.

Max 1Gb/s
Server to workstation: daily network consumption Nov 2014
Logistic efficiency...
connected components.

Activate the link from the reporting system with the case center where the images are stored.
Logistic efficiency... connected components.

Click the thumbnail and open the image in the viewer. Start reporting. (either free text-speech recognition in background- or standard protocol)
Logistic efficiency... connected components.

Use the history, if available!

Increasing patient safety...
Comparing recent and historical images directly on screen.
Remote services and Gross images.
Galbladder + stone +....
Digital from gross to...
Reducing text and improving information
Breast lamellogram + annotations
What happened in the grossing room...

Patient safety, reducing risk factors.
Processing, embedding and sectioning Needle core biopsies.

How deep is deep enough?
Crossing borders in digital pathology.
Crossing borders in digital pathology.

- Why?
  - Disbalance between workload and workforce.
    - Both in volume and specialized areas

- What?
  - Volume
    - Neoplastic skin biopsies. (5878 cases in 2016) (3916 cases in 2017) (1.2 sections on average)
  - Specialized
    - Neoplastic lung resections (51 cases in 2016), (99 cases in 2017) (27 sections on average)
    - Inflammatory bowel biopsies and resections (261 cases from August – November 2017) (8 sections on average)

The % problematic cases has Stabilized in 2016 and 2017. 5-6% returned because of a more complex formulation or follow up. 6-7% deeper cuts HE next day.
Crossing borders in digital pathology.

- How? (Official registration with national health care authorities and individual license to.....)
  - Du har hermed pr. 07. oktober 2015 opnået autorisation som Læge
  - Du har hermed pr. 07. oktober 2015 opnået tilladelse til selvstændigt virke som Læge.
  - Du har med virkning fra 07. oktober 2015 opnået speciallægeanerkendelse i Patologisk anatomi og cytologi.
- Digital Pathology and Secure connection.
- Integrated report / image access (including gross images).
- Standard reporting
  - Volume: codes and fixed text blocks in <<Language>>.
  - Specialized: structured microscopy in <<Language>> / English, SNOMED indexing in <<Language>>.
- Teamwork
  - Logistic
  - Diagnostic.
Teaching reference images and Cytology.

Features of repair and atypical repair:

**Repair:**
- Flat, cohesive, 2 Dimensional sheets (School of fish appearance)
- Loose cells are usually not present

**Cell morphology:**
- The cells have characteristics of immature columnar cells, immature squamous cells or immature columnar cells.
- Nucleus shape: enlargement and variation in size is present. The nuclei have smooth nuclear outlines and are round- to- oval

**Image:**
- Flat, 2-Dimensional sheets of cells. Isolated atypical cells are rare.
- Nucleus shape: Nuclei are enlarged with pleomorphism of size and shape.
- Irregular nuclear envelopes.

References:
- Ex-pathyctology.com: cytology/gynaecological-cytology/repairative-changes
Digital cytology.

• Working toward consensus among professionals in the identification of classical cervical cytomorphological characteristics in whole slide images.
  • Odille Bongaerts e.a.
  • Journal of Pathology and Informatics. November 2015

• Conventional Microscopical versus Digital Whole-Slide Imaging-Based Diagnosis of Thin-Layer Cervical Specimens: A Validation Study
  • Odille Bongaerts e.a.
  • Journal of Pathology and Informatics. August 2018
Same specimen, different scanners. Scanning at 20x and / or 40x, Same viewer.
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To be continued.....