Digital Pathology in Asia

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August 4, 2011

Quebec city
Digital pathology:

Pathology diagnosis & Telepathology
Daily surgical pathology
CAP validation of digital pathology
Image Analysis
Frozen section diagnosis
Consultation

Teaching
Archiving the cases

Research

Vilppu J. Tuominen and Jorma Isola: Journal of Digital Imaging, 2010
Application

Tele-Pathology

Education

Pathology informatics

CPC Conference

HAMAMATSU
Digital Pathology

Digital Data Set/Whole slide image
Content rich data sets

1. Virtual microscopy
2. Telepathology
3. Imaging & Archiving
4. Image analysis & CAD
5. Reporting Links to images
6. Digital archive
7. PACS signout
8. Virtual IHC
9. Consultation
10. Diagnosis Consultation
11. Targeted therapies
12. Image based searches
13. Undergraduate TMA
14. GME/CME
15. Comparative analysis
16. Research

Pathology Visions 2010
Virtual microscopes (Whole Slide Imaging: WSI)

HAMAMATSU  Olympus  Claro….. Aperio  Omnyx  Philips  Ventana  Leica  Zeiss  … and more
Two trials with digital pathology

1. Quality of images and diagnostic feasibility study using Internet 2011
   International survey

2. Telepathology using digital images by satellite “Kizuna”
   Iwate(north) Tokyo(central) Okinawa(south) 2010
International Survey of Digital Pathology of Neuroendocrine tumors (NETs) 10 cases

Greece Korea Malaysia Thailand USA
Dr. George Kongogeorgos
Dr. Insun Kim
Dr. Norain Karim
Dr. Pongsak Wannakrairot
Dr. Ronald DeLellis

http://219.120.113.131/
Username = ncc21
Password = 12ccn
My questions are as follows,
Q1 Was it (easy, hard) to assess the website?
   Your comments: easy
Q2 Is the image sharp? Yes  No
   Your comments: Yes  Recommend scanning at X40
Q3 Is the color acceptable? Yes  No
   Your comments: Yes
Q4 Is the image usable for remote diagnosis? Yes No
   Your comments: Yes (able)

Interobserver variation in diagnosis:
Minimal NET/NEC:100%  Terminology (WHO 2010):90%
Telepathology by satellite  July 2010

Satellite “Kizuna”

Japan Aerospace Exploration Agency (JAXA).

IUHW Mita Hospital

Ryukyu University
Okinawa

Its function in the Asia is expected.
Virtual microscope: Aperio
Image: acceptable
Interobserver variation: minimal
Time lag: when we change the fields or magnification

FV papillary thyroid carcinoma
Intranuclear inclusions

BC HER2 3+
Digital Pathology in Canada

Toronto  Ontario

Quebec project

When we think about DP in Asia, we refer to the networks in Canada.
Connection of pathologists by digital pathology (DP) to cover the shortage of pathologists. Ontario, Canada.

Remote hospitals in Ontario.

In order to cover the shortage of pathologists, DP has been used among the hospitals by centerizing pathologists.

100th JSP Annual Meeting
GE HealthcareOmnyx
Regional Medical Care- Quebec Project

Quebec Canada

East Quebec

RUIS Area

RUIS-Laval Area

Regional collaboration

Telepathology System

NanoZoomer 21 sets

Applications

- Remote frozen section Dx
- Pathology Consultation
- QC for Pathology Dx
- QC of immunohistochemistry
- Education for doctors

Dr. Bernard Tetu  Laval University

HAMAMATSU
Vilppu J. Tuominen and Jorma Isola: Linking Whole-Slide Microscope Images with DICOM by Using JPEG2000 Interactive Protocol
**JPEG** Joint Photographic Experts Group
静止画像のデジタルデータを圧縮する方式

**Virtual Private Network**
Internet VPN
IP-VPN (ISP network)

**DICOM** *(Digital Imaging and Communications in Medicine)*
Standard for distributing and viewing any kind of medical image regardless of the origin (radiology, dermatology, pathology, endoscopy etc.).
Vilppu J. Tuominen and Jorma Isola: Linking Whole-Slide Microscope Images with DICOM by Using JPEG2000 Interactive Protocol
Tampere University Hospital, Finland.

Fig 5. A model system for linking whole-slide images (WSIs) with DICOM by using JPEG2000, JPIP, and the JVS software. The WSI scanner produces raw image data, which JVSdicom Compressor processes. The resulting DICOM and JPEG2000 WSI files are moved into the PACS to JVSdicom Server and JVSserv, from which they are queried with JVSdicom Workstation and viewed with JVSview.
Applications of digital pathology

1. Image analysis
   ER  PR  HER2

2. Automated diagnosis

3. Teaching and consultation
Computer assisted Image Analysis

Immunohistochemistry

Automated immunohistochemistry  ER, PR, HER2

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Medical Payment***</th>
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<tbody>
<tr>
<td>88361</td>
<td>Morphometric analysis, tumor immunohistochemistry (eg, Her-2/neu, estrogen receptor/progesterone receptor), quantitative or semiquantitative, each antibody; using computer-assisted technology</td>
<td>184.62 184.62</td>
</tr>
</tbody>
</table>

immunohistochemistry  123.36
Quantitative Image Analysis
NEC e-Pathologist System

- NEC e-Pathologist detects tissue and cell features and makes quantitative measurements of key structures in digitized images of pathology slides.
- It assists pathologists in making decisions that may contribute to the clinical management of cancer.

Method for image extraction of cancerous areas using image recognition technology

Courtesy of NEC
PathXchange

History

- Started in December 2008
- Sneak-preview at USCAP 2009 (March 2009)
- Launched at CAP Futurescape 2009 (June 2009)
- Explosive growth since launch
  - 10,000+ users (12/10)
  - 2100+ cases, thousands of images
  - 100+ groups
- Users from 160 countries, 1000 institutions
The 2020 Paradigm

- Comprehensive pathology reports
  - Incorporation and integration of radiologic, biochemical, morphologic, molecular, cytogenetic, and epigenetic data

Dr. Sylvia Asa  Pathology Visions  2010
Digital Pathology in Asia
Digital Pathology in Japan

Frozen section diagnosis
Teaching

Whole Slide Image (WSI)
Live image
Telepathology in Japan
For frozen section diagnosis

WSI
Live image

140 Nanozoomer systems in Japan
HAMAMATSU
Telepathology by Virtual Slides

Karatsu Red Cross Hospital ➔ Saga Medical School

Karatsu Red Cross Hospital

Saga Medical School

Virtual slides

Diagnosis

HAMAMATSU
WSI Implementation by Claro, Inc.

300～500 cases / year
Rapid diagnosis during surgery performed at following institutions

Iwate Medical Univ.
Iwate Prefectural Kuji Hospital

Louis Pasteur Center for Medical Research
Yamashiro Public Hospital

Kyoto Univ. Hospital
Hirakata Kohsai Hospital

Kyoto Univ.
Shimada-municipal-hospital

Kagoshima Univ. Medical and Dental Hospital
Oshima Hospital (Amami Oshima Island)

etc.
Current situation of digital pathology in Asia

Inquiries to
China  Hong Kong India Korea Malaysia Singapore Taiwan Thailand
Inquiries on Digital Pathology in Asia

Acknowledgement
China: Mulan Jin 金木蘭
Hong Kong  Dr.Gary Tse
India: Dr.Francisco Couto
Korea: Dr.Insun Kim 金人信
Malaysia: Dr. Norain Karim
Singapore: Dr.Angela Chong  Dr.Puay Hoon Tan
Taiwan: Dr.Shih-Ming Jung 容世明
Thailand: Dr.Pongsak Wannakrairot

Do you do digital pathology?
Do you communicate with other institutions?
What virtual microscope do you use?

In you country,
Is digital pathology popular?
What are the most popular virtual microscope?
Do you get re-imbursement for digital pathology?
Do you do digital pathology for telepathology (remote diagnosis)?

**YES**
- Singapore (diagnosis, teaching others)
  - Malaysia: Frozen section diagnosis
  - India: very widely

**NO**
- Korea (teaching for med students & conference)
- Taiwan (teaching)
- Thailand (teaching and archiving)
- HK

Do you communicate with other institutions or internationally?
- Singapore: US, Malaysia, UK, Canada
- Korea: Domestic and International
  - (Japan for consensus diagnosis of clear cell carcinoma)
- China: A reference lab in Guangzhou 連接 US (consultation)
- India: Asia, Africa, United Kingdom, European Counties and USA

Do you use digital pathology for diagnosis?
- Singapore: 2nd opinion/ expert opinion/ consultation:
- Malaysia: Frozen section diagnosis
How often do you perform digital telepathology in your institution?
Singapore: When required. Images are uploaded everyday for teaching and multidisciplinary boards.
Taiwan: seldom

What is the manufacturer of Virtual microscope you use?
Aperio: Singapore HK Korea Taiwan
Olympus: Korea
Hamamatsu: China

Comments:
Korea: It is useful, but we need some experience.
Taiwan: Our institution will perform remote diagnosis in the next year for daily surgical pathology, frozen section diagnosis, consultation to the branch hospital in mainland China.
Thailand: It is a very useful service in many circumstances, especially in remote areas that are shortage of pathologists. However, this needs time for pathologists to get used to diagnose on screen.
In next 15 years, young pathologists will work in front of the screens instead of microscopes.
In your country, is digital telepathology popular?

Yes: India
Korea
Malaysia
In public hospital - not used at all except in the hospital with liver specialty in Selayang, Kuala Lumpur - Nikon
The private teaching hospitals are using them, mainly Olympus
One private hospital connects with Harvard University, Singapore: Just starting

No: HK Taiwan Thailand
What is the popular Virtual microscopes?
Aperio  Philips:Singapore
Aperio  HK
Olympus  Aperio  India
Aperio  Korea
Aperio  Taiwan
Aperio. Most use Aperio. One center Olympus: Thailand
Olympus  Ziess has been introduced: Malaysia
Motic(148)  Aperio  Hamamatsu: China

Do you get insurance reimbursement for digital telepathology?
NO: Singapore  HK
No DP Dx Taiwan
## WSI system in Asian Countries

<table>
<thead>
<tr>
<th>Countries</th>
<th>Numbers of Aperio</th>
<th>Usage #1</th>
<th>Usage #2</th>
<th>Usage #3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>approximately 400</td>
<td>Conference</td>
<td>Supply images</td>
<td>Education Lab</td>
</tr>
<tr>
<td>China</td>
<td>approximately 160</td>
<td>Conference</td>
<td>Education Lab</td>
<td>Research</td>
</tr>
<tr>
<td>Korea</td>
<td>approximately 30</td>
<td>Conference</td>
<td>Supply images</td>
<td></td>
</tr>
<tr>
<td>Singapore</td>
<td>approximately 20</td>
<td>Conference</td>
<td>Research</td>
<td></td>
</tr>
<tr>
<td>Taiwan</td>
<td>approximately 10-20</td>
<td>Conference</td>
<td>Research</td>
<td></td>
</tr>
<tr>
<td>Thailand</td>
<td>approximately 20</td>
<td>Conference</td>
<td>Research</td>
<td></td>
</tr>
</tbody>
</table>

![Aperio Map](image)
Examples of Digital Pathology network

Zhejiang University

Internet

UCLA Medical Center

Singapore General Hospital

Sloan Kettering Cancer Center

Aperio
NanoZoomer Series

Beijing Union Hospital

http://virtualslide....

- Beijing Pathology Cases of The Month
- Slides for Medical Students
- IHC_Demo
- IHC_Her2_DEMO

Japan 140 sets
China Korea 20 sets
Several hundreds units
Digital Pathology in Asia- Project Vietnam-Japan

- Project: Consortium for the development of international remote diagnosis system
Supported by the Ministry of Economy, Trade and Industry (METI)
“Investigation of overseas operations of Japanese medical services”

Consortium:
International University of Health and Welfare (IUHW)
Sakura Finetek Japan
Hamamatsu Photonics
Panasonic System Solutions
Toshiba Medical Systems

HCMC---Tokyo
Research on the remote pathology diagnosis: Cho Ray Hospital-IUHW

Key issues: Connection of digital images of best quality
Diagnostic concordance  Technical quality control
Diagnostic terminology English-WHO  AFIP  Education
Key issues:

Technical Components
1. Scanning and connection of digital images
2. Technical quality control

Diagnostic components
3. Diagnostic concordance
4. Diagnostic terminology
   - English-WHO
   - AFIP Classification
   - SNOMED

Education is very important for both technical and diagnostic components--IADP
Summary
1. Practical digital pathology has just started in Asia.
2. It is anticipated to grow very rapidly
   in daily surgical pathology
   consultation
   frozen section diagnosis
   cytopathology
3. In order to make the network universal, close cooperation among
   manufacturers is inevitable.
4. For the international development of the DP networks,
   the terminology should be shared among the users,
   WHO, AFIP..... classification SNOMED
   Education is very important--IADP
5. Financial aspects are also important to encourage the networks
   among the remote medical facilities
Thank you very much for your kind attention

10th Annual Meeting of the Japanese Society of Virtual Microscopy and Telepathology  September 9.10  2011  Kyoto