Virtual Microscopy Beyond The Pyramids,
Applications of WSI in Cairo University for E-education & Telepathology.

Dr. Essam E. Ayad
Prof. Of Pathology & Head of Telepathology Unit,
Faculty of Medicine, Cairo University
Consultant Pathologist, Italian Hospital In Cairo
Telemedicine in different Countries

The Developing World

Argentina, Australia, Bangladesh, Bhutan, Bolivia, Bosnia, Botswana, Canada, Chile, China, Colombia, Costa Rica, Denmark, Dominican Republic, Egypt, Finland, Germany, Greece, Haiti, Hungary, India, Indonesia, Ireland, Israel, Italy, Japan, Kazakhstan, Kenya, Korea, Kuwait, Malaysia, Mexico, Micronesia, Norway, Palau, Portugal, Russia, Samoa, Saudi Arabia, Senegal, Singapore, South Africa, South Korea, Spain, Sri Lanka, Sudan, Sweden, Switzerland, Thailand, Turkey, Ukraine, United Arab Emirates, United Kingdom, United States, Uzbekistan, Yemen, Yugoslavia, United Kingdom
Telemedicine in Egypt

Culture of 7000 years
The idea of applying telemedicine programs in the Italian hospital in Cairo was born ten years ago in the conference, organized by WHO in Cairo in Dec. 2001.
Telepathology Project
In The Italian Hospital
“Umberto I” In Cairo
(1903-2011)
The Italian Hospital
“Umberto I” In Cairo
(1903-2010)

- The Italian hospital in Cairo was built in 1903
- Surface area: 28000 square meter.
- N. Buildings: 15 separate buildings.
- N.beds: 300 beds.
- Departments: 13 Departments of different specialties
- With time more progress & advanced services in most departments & more recent equipment has been used
Italian-Egyptian Collaboration appeared in:

- Establishing Hemodialysis Dept. [1979]
- Establishing Cardiology & CCU [1986]
- Establishing Neonatology Dept. [1989]
- CBST project [2000]
- Telemedicine project in March [2003]
PILOT PROJECT BETWEEN ITALY AND EGYPT
The TELEMEDICINE project was divided into four phases:

1. TELEPATHOLOGY
2. Tele-echocardiography.
3. Tele-radiology.
4. Tele-endoscopy.
The first phase of our Telemedicine Program in The Italian Hospital In Cairo was TELEPATHOLOGY
The practical steps taken to make this idea true:

1. Initiating the idea of the cooperation between the CIVICO hospital in Palermo and the Italian hospital in Cairo.
2. Training of the IT-manager of the Italian Hospital in Cairo in Palermo for two weeks.
3. Sign a protocol of cooperation between the CIVICO hospital in Palermo and The Italian Hospital In Cairo.
Types of telepathology system

1) Static (store and forward).
2) Dynamic without robotic microscope.
3) Dynamic with a robotic microscope.
4) Combination of Static and Dynamic, Hybrid,
5) Whole slide imaging (Virtual slide imaging).
For the First phase *[Telepathology]*, these steps were taken:

1. Evaluation of the costs and find a fund for this.
2. Searching for the best instruments in the Egyptian market with the highest qualifications.
3. Downloading the same software, used in Pittsburg and Palermo.
4. Beginning of the connection.
The needs of this project for a complete set were:

1. A suitable place.
3. A full computer set:
   - Advanced computer.
   - Scanner
   - Printer.
4. A binocular microscope.
5. A digital camera for gross pathology.
6. A digital Camera, connected to the microscope for capture images from the microscope.
7. A video-camera connected to the computer for video-conferences.
8. A suitable software for image processing and image transferring to internet.
Static Telepathology In The IHC

Basic System Components
DYNAMIC TELEPATHOLOGY:

Advanced digital Camera

Video camera
The personnel needed for the project:

- Pathology team on each side of the connection.
- IT-manager on each side of the connection.
The transmitted images may be used for:

1. Primary diagnosis
2. Second opinion.
3. Quality assurance
4. Proficiency testing
5. Distance learning
The availability of this service:

This service can be provided to:

- Any pathology department in the Egyptian universities.
- Any research center.
- Any pathologist.
Technological Innovation
Hospital:
from Stethoscope to Telemedicine
L’Innovazione Tecnologica
in Ospedale:
dallo Stetoscopio alla Telemedicina

Centenary of Italian Hospital Umberto I
Centenario della costruzione
dell’Ospedale Italiano Umberto I al Cairo

March 10-11, 2003
Italian Hospital Umberto I
17 El Sayeda Street, Abbassia, Cairo
New participants:

- Pathology Department in *Ospedale S. Giovanni e Paolo Hospital, Venice, Italy* Venice since 2005.
Since the beginning of our telepathology program, many cases were consulted with the pathologists in: Palermo & Venice [Italy], Charing Cross Hospital in London and Pittsburgh [USA]
Essam Ayed * 03/21/03 * A female patient, 31 years old complaining of left axillary LNs. All were firm with homogenous greyish white cut surface. Micro. Exam.: effacement of the nodal architecture, with starry sky appearance and bizarre nuclei.

Essam Ayed * 03/21/03 * Burkitt's lymphoma
Alleanza degli Ospedali Italiani nel Mondo
Segretariato di Assistenza Tecnica

Roma, 22 febbraio 2007

Classifica dei teleconsulti lavorati per Stato
Classifica dei medici richiedenti

Ad oggi, 102 medici hanno richiesto 353 teleconsulti ritenuti validi.

<table>
<thead>
<tr>
<th>Medico Richiedente</th>
<th>Consulti richiesti</th>
</tr>
</thead>
<tbody>
<tr>
<td>PADOVESE VALESKA</td>
<td>18</td>
</tr>
<tr>
<td>MARELLI PAOLO</td>
<td>17</td>
</tr>
<tr>
<td>OMASSI BERNARDA</td>
<td>17</td>
</tr>
<tr>
<td>TERRANOVA MARGHERITA</td>
<td>17</td>
</tr>
<tr>
<td>PIGNATELLI SALVATORE</td>
<td>15</td>
</tr>
<tr>
<td>ALOUI THAMI</td>
<td>13</td>
</tr>
<tr>
<td>LASIO FRANCESCA</td>
<td>13</td>
</tr>
<tr>
<td>GAIDO GIUSEPPE</td>
<td>11</td>
</tr>
<tr>
<td>MAURO ALEJANDRO</td>
<td>11</td>
</tr>
<tr>
<td>FERRARIS VERONICA</td>
<td>10</td>
</tr>
<tr>
<td>AFONSO MARCOS VINICIUS</td>
<td>9</td>
</tr>
<tr>
<td>SHAMMAS KHALID</td>
<td>9</td>
</tr>
<tr>
<td>TRINCONTE SILVANA</td>
<td>8</td>
</tr>
<tr>
<td>BIINI PIERO</td>
<td>6</td>
</tr>
<tr>
<td>FACCELLI ELISA</td>
<td>6</td>
</tr>
<tr>
<td>IRISO MONICA</td>
<td>6</td>
</tr>
<tr>
<td>RICHARD GERRI MARCO TERT</td>
<td>2</td>
</tr>
<tr>
<td>AWABDEH FAWAZ</td>
<td>2</td>
</tr>
<tr>
<td>AYAD ESSAM</td>
<td>2</td>
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<tr>
<td>BENITEZ SONIA</td>
<td>2</td>
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<tr>
<td>BAZGUI KHEFNI</td>
<td>2</td>
</tr>
</tbody>
</table>
The benefits of Telepathology:

- Better medical service.
- More specialization.
- Saving money.
- Saving time.
- Teaching and learning.
- Exchange knowledge.
Financial Evaluation of the Project

- In the Department of Pathology, IHC, the number of cases examined annually exceeds 1500 [5 cases daily].
- 10% to 25% of these cases cannot be easily diagnosed.
- One case weekly needs higher level of external consultation with highly specialized consultants.
- So the expected number of difficult Department of Pathology, IHC was around 50 cases annually.
Financial Evaluation of the Project

- The average cost of sending physical slides to only one American or European center [approximately US$100] plus the average fee for the consultation [approximately US$150] implied that the total costs for consulting on our specialized complex cases for this one center was US $12,500 annually.

- As we usually consulted our cases in two or three centers to get more opinions, this figure will be multiplied two to three times up to US $37,500 annually.

- The exact costs was approx US $187,500 for the five years which was the duration of our project, corresponding to low costs [US $5,000] of the establishment of the whole telepathology unit.
<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
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<tbody>
<tr>
<td>No. of Problematic cases weekly per week</td>
<td>1</td>
</tr>
<tr>
<td>Fee for Transportation</td>
<td>100 $</td>
</tr>
<tr>
<td>Fee for consultation</td>
<td>150 $</td>
</tr>
<tr>
<td>No. of centers</td>
<td>3</td>
</tr>
<tr>
<td>Duration of the project</td>
<td>5 Years</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>187,500 $</strong></td>
</tr>
</tbody>
</table>
Whole slide imaging  
(Virtual slide imaging) 

WSI
ADVANTAGES OF WHOLE SLIDE IMAGING

1. Reading **barcodes** on slides
2. Can **automatically capture & compress** an image of a slide.
3. WSI devices are becoming very fast.
4. To provide the digital view of the complete slide in context.
5. Allows users to **view entire microscopic images at any magnification** on their monitor.
6. WSI allows pathologists to **control the image during examination**.
7. Given the **large number of slides** generated by pathology laboratories, one of the most essential features of a clinical WSI system is slide capture speed (or throughput).
Nowadays we have established our **Digital Pathology Unit [DPU]** in the **Department of Pathology, Faculty of medicine, Cairo University** using the latest techniques of virtual slide Imaging, Whole Slide Imaging **WSI**
Faculty of medicine, Kasr El-Eini Hospital [1823-2011]
WSI Applications

1) Scanning of all our Teaching Students Slides to create a Teaching Digital Pathology Library which will be available on the Website of the Faculty of Medicine Cairo University. The material of this *Digital Pathology Library* will be used for:

   a) Routine Learning in the histopathology classes.

   b) E-learning of our undergraduate students to be seen at home or in the new highly-equipped new Student Library [replacing the slide boxes given to the students].
WSI Applications

2) Routine Scanning of all our interesting cases [Recent & archive] to create a huge Digital Pathology Library which will be available on the Website of the Faculty of Medicine Cairo University.

The material of this Digital Pathology Library will be used for e-learning of our Post Graduate students.

This valuable material can be divided into levels to be suitable for Master & MD candidates.

We have a plan to make this material to extend Post Graduate students outside our University.
WSI Applications

*) Another application of scanned slides that we already changed our technique of pathology teaching to be virtual through the Computer either for Under- & Post Graduate Students.

Even our professors became more acquainted with the new technology dealing with the digital file rather than the ordinary microscopes.

Changing Pathology Environment
3) During establishing our Digital Pathology Library, Faculty of Medicine Cairo University, we faced some problems concerning the quality of the slides produced for routine pathology examination. So we improve the quality markedly [especially the scanner can discover many minute technical errors that could not be detected during the routine analogue microscopic examination.]

**Quality Assurance**
WSI Applications

4) **Telepathology**, Second opinions [Expert-to-Expert consultations].

We made a provisional agreements with different highly specialized pathology centers in developing countries [like Italy, UK, USA] to consult our cases. We are trying nowadays to increase the number of centers of expertise that can cooperate with us in this promising fields.

*We usually face marked acceptance from everybody.*
5) Another channel of **Telepathology we are establishing for** Second opinions [Expert-to-Expert consultations] is that we are aiming to make some agreements with different pathology centers in different surrounding Arabic countries with limited number of specialized pathologist [like Palestine, Sudan, Yemen & Libya] to consult their cases.

So we may play as a pivot center between these countries and the more advanced western countries.

*And also we usually face marked acceptance from everybody*
DPU Project
<table>
<thead>
<tr>
<th>ITEM</th>
<th>TOTAL PRICE $</th>
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</thead>
<tbody>
<tr>
<td>A) Software:</td>
<td>35.000</td>
</tr>
<tr>
<td>B) Agreements:</td>
<td>188.000</td>
</tr>
<tr>
<td>C) Maintenance &amp; Staff Cost [annual]</td>
<td>252.000</td>
</tr>
<tr>
<td>D) Documents &amp; Printouts</td>
<td>1.000</td>
</tr>
<tr>
<td>E) Relationship &amp; Communication [travels &amp; Visits]</td>
<td>24.000</td>
</tr>
<tr>
<td><strong>TOTAL US$</strong></td>
<td><strong>500.000</strong></td>
</tr>
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</table>
Financial Evaluation of the Project

- In the Department of Pathology, Cairo University, the number of cases examined annually exceeds **20,000** [>60 cases daily].
- 10% to 25% of these cases cannot be easily diagnosed.
- **1-2% of the cases** need higher level of external consultation with highly specialized consultants.
- The expected number of difficult *Kasr El Eini Hospital* is around **400 cases annually**.
Financial Evaluation of the Project

- The average cost of sending physical slides to only one American or European center [approximately US$100] plus the average fee for the consultation [approximately US$150] implies that the total costs for consulting on our specialized complex cases for this one center will be **US $ 100,000 annually**.

- If we want to review the same cases in two or three centers to get more opinions, this figure will be multiplied two to three times i.e.: **US $ 300,000 annually**.

- The estimated cost of approx US $ 900,000 for the three year pilot corresponds to total cost of the project which is **US $ 500,000**.
<table>
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<th>Description</th>
<th>Value</th>
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<tr>
<td>No. of Problematic cases weekly per year</td>
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<tr>
<td>Fee for Transportation</td>
<td>100 $</td>
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<tr>
<td>Fee for consultation</td>
<td>150 $</td>
</tr>
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<td>No. of centers</td>
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<tr>
<td>Duration of the project</td>
<td>3 Years</td>
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<tr>
<td>Total</td>
<td>900,000 $</td>
</tr>
</tbody>
</table>
The first microscope was built by Zacharias Janssen, in Middleburg, Holland, around the year 1595.
THANK YOU