

Telepathology in Developing Countries - The Cloud with Silver Lining

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Abstract

Developing countries face the dilemma of shortage of skilled physicians and pathologists on one hand and increased disease burden with limited resources on the other hand. Telepathology refers to electronic transfer of digital images for the purpose of diagnosis and education. Telepathology can be static, dynamic and virtual. Gradually evolving with time one needs to balance between need and availability of resources. The improvement in communication channels and high speed internet broad band will enable this technology to supplement routine health care in India. Telepathology has a bright future and health care professional need to be sensitized with it for its universal acceptance by all stake holders.

Keywords: Telepathology; Telemedicine; Developing countries

Introduction

Telepathology is an innovative digital imaging and telecommunication technology that is changing the health care delivery system around the globe. The paper is a brief insight to the hidden potential of telepathology. The response to this technology is sluggish in developed countries due to equipment cost, inadequate infrastructure and lack of trained pathologists. Technology like telepathology cannot be thrown into the process without accurate assessment of the need and resources available for its effectiveness. The aim of this short paper is to inculcate the usefulness of this new technology facilitating remote diagnosis, remote teaching, and remote training and quality control procedures. All these will eventually expedite the diagnostic workup, shortening the delay in diagnosis there by bridging the gap between availability and demand of pathologists. Telepathology refers to the practice of Pathology at a distance. It uses telecommunication facilities to facilitate the transfer of pathology data (images) between two different locations for the purpose of diagnosis, research and education [1]. The term was first coined by Weinstein et al in 1986, who is also known by many as 'Father of telepathology' [2]. Telepathology is one of the applications of telemedicine and in its present form is not only restricted to extraction of information from glass slide but also incorporates other vital information of patients including sex, age, history, clinical finding and radiological imaging data. The practice of Telepathology involves obtaining macroscopic and or microscopic images for transmission along telecommunication links for obtaining a remote interpretation (tele-diagnosis), second opinion or consultation (tele-consultation), quality assurance, education, teaching, self-study and research (tele-education). Telepathology was first demonstrated in space by National Air and Space Administration (NASA) in 1960 [3]. The first instance was that of a blood smear photograph which was sent successfully from Logan airport to Massachusetts General Hospital, Boston, USA [4]. Telepathology has been implemented in western world and in India it has been used in centers like AIIMS, New Delhi, PGI, Chandigarh, SGPGI, Lucknow and Tata Memorial Hospital, Mumbai.

Types of Telepathology

Telepathology can be classified primarily into three modes [5,6].

Static mode (Store and forward)

Static mode is the simplest mode of telepathology. It is characterized by presentation and digitization of representative image followed by transfer via e mail or internet to a remote pathologist for diagnosis [7]. It is a low budget, easy, simple set up that requires bare essentials like

microscope, camera and internet. Its major drawbacks are limited area of examination of glass slide, the lack of clarity of images and sampling error.

Robotic mode (Dynamic/real time)

In the robotic mode the microscopic slide image transmission is done by real time/live telecommunication [8]. It is advantageous as the remote pathologist has entire slide viewed with varying magnifications under his own control. Since it transfers high volume data the system requires a stable broadband width of telecommunication. Another limitation is the cost and high maintenance required for real time set up.

Robotic mode (Dynamic/real time)

The major development has been the introduction of digitization (scanning) of glass slide to generate a digital file that allows the entire slide to be viewed in a manner to simulate microscopy. The image acquisition of entire slide is done at all magnifications of microscope, using the software all fields of view and those images stitched in to single image. The virtual slides have large file size and their transmission at present network bandwidth is the major obstacle. These slides can be stored in a 'virtual slide box' and allow rapid interactive visualization at all magnifications. Hybrid mode is a combination of static and real time modes where series of images are stitched together in the software compressed to a single file and transmitted once dynamic session starts [5]. It requires less time than real time mode. It overcomes the major drawback of static mode i.e. inappropriate field selection by submitting pathologist Dynamic Telepathology using robotic systems has higher concordance rate and has been a major advancement [2,9]. The only constraint of this mode is the lack of cost effectiveness [10].

Clinical Applications

Telepathology has its applications in various areas of medical practice.

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Diagnosis

Primary diagnosis can be rendered using static or dynamic telepathology mode. In static mode the judgment of sender pathologist is important whereas in dynamic mode the recipient pathologist can remotely control and rapidly view the entire slides in real time [11]. There are studies indicating that there is not always 100% concordance between digital versus glass slide diagnosis but such variations can occur even with glass slide to glass slide due to inter- intra observer variability [12]. Cytopathological cases are more challenging to interpret using digital imaging and whenever telepathology is used for cytological consultation pathologist has to be very cautious about making primary diagnosis [13,14].

Intraoperative consultation (Frozen section)

The assessment of frozen section can be done using telepathology consultation by pathologist in another location [15]. It will be prudent in intraoperative diagnosis to send gross specimen images [16]. It can enable surgeon to achieve tumor free margins in a tissue sparing manner even without a pathologist.

Rapid diagnosis

Quick cytological assessment of cytological samples for specimen adequacy can be accomplished provided proper image resolution is directed with patient management decision.

Special studies

Telepathology can aid an under resourced diagnostic facilities to have access to specialized services like IHC, CISH and FISH, that are otherwise not available.

Education

Digital imaging is getting incorporated in teaching of pathology students replacing traditional classroom teaching [17]. It has advantages such as the slide can be viewed by many persons at the same time, there is also no loss of color or fading of stain and no risk of breakage of glass slide [18]. It enables faster exchange of knowledge. The users can utilize a web based virtual slide library anytime from anywhere in world. Pathologists can share images with other pathologists in teaching and conferences.

Consensus Conference

Telepathology helps in review of cases from multiple sites in different geographic locations. It eradicates barrier in slide sharing and promotes clinopathological interactions adding to improved health care delivery.

Indian Scenario

In India the first glimpse of Telepathology was seen at a symposium organized in 50th Annual conference of the Indian association of Pathology and Microbiology in 2001, 'Telepathology: Today and Tomorrow' [19]. There after numerous efforts have been done to popularize telepathology among healthcare providers like symposiums, websites like (<http://telepathology.org.in>), online slide quiz [20]. In India static telepathology is used but it is limited to few Pathologists. The work by Desai et al. [21] in teleconsultation at tertiary cancer center (TMH) and Kanthraj [22] for mobile tele-dermatology gave learning lessons for telepathology. The shortage of pathologist and physicians in rural areas is a long standing problem. This problem can be addressed using telepathology which can expedite the diagnosis

[23]. There is no doubt that there are certain constraints in establishing telepathology network but it is still far easier to set up telepathology system in these areas than to place thousands of pathologist and clinicians. Telepathology is far more developed in developed nations in comparison to India. It is used for regular consultation in US and European countries and intraoperative consultations in Japan [24]. In India the most popular connectivity type is DSL [25]. The country is moving towards wireless communication infrastructure in rural areas and increased adoption of 3G wireless telecommunication and WIMAX technology. The promotion and utilization of WSI in India awaits better infrastructure and other issues.

Conclusion and Future Perspective

Telepathology is now evolving pathologist into a 'diagnostic expert'. The American Telemedicine association has established practical guidelines for telemedicine to help in the advancement of the science and to ensure uniform quality of services to patients [26]. The guideline covers clinical applications of telepathology and enumerates its scope, type, applications, clinical and facility responsibilities including referring-consulting individuals, standard of care, technical support, equipment verification, accreditation, privileges, licensure, validation, training, documentation and archiving (reporting, logs, retention policy, disclaimer status), quality management (technical, diagnostics), operations (maintenance technical support, physical facility, security and privacy regulatory compliance. Telepathology will become more popular over next decades and it is therefore important for young pathologists to be aware and get well versed in the art as it is going to be major development in the field of pathology in 21st century.

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