Awareness about Whole Slide Imaging and Digital Pathology among Pathologists - Cross Sectional Survey

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Abstract

Aim: To assess awareness of pathologists on whole slide imaging and digital pathology

Method: An online, structured questionnaire was sent to pathologists of various dental and medical colleges in Chennai. The data was collected using Microsoft excel version 2011 and statistically analyzed using SPSS software.

Results: 28.6% of pathologists were only aware of the fact that whole slide imaging can perform a live scanning of digital images. 81% said the magnification produced by WSI were greater than conventional microscopy. 52.4% agreed on the time taken to perform the whole slide scanning to be one minute. 85.7% were convinced that diagnostic difficulties could be best consulted through the digital slides. 52.4% agreed integrated automated image analysis increased the diagnostic efficacy of WSI in routine histopathology. 62.5% of them felt that the high cost of the equipment and infrastructure was the major impeding factor in usage o f WSI.

Conclusion: Whole slide imaging and digital pathology is a promising future of pathology as it can significantly reduce the workload and enhance the diagnostic efficiency in various aspects. There was a reasonable awareness among the pathologists. Until hospitals collaborate and take initiative to bring whole slide imaging into practice, its difficult to make the best of its advantages.

Key words: *Pathologists, Digital pathology, virtual slides, whole slide imaging*

Introduction

As digitalization embracing through any and every known field, Pathology is no exception. Time and again, many digital technologies have been introduced into pathology starting from digital photomicrographs (1900s) to Telepathology (1980s) to Digital pathology involving whole slide imaging (2000s). Whole slide imaging refers to scanning and storage of entire histopathological glass slide into set of high-resolution digital files that can be interpreted using image viewers on computer workstations.

The complete digitalization of slides has the potential to transform practice of diagnostic pathology – safety, quality and efficiency of histopathological diagnosis. Despite the promise of digital pathology to offer huge benefits, its uptake in clinical practice has been slow. One of the main reasons was considered to be the unfamiliarity with the viewing software and perceived inefficiency of digital diagnosis. Clearly cannot change instantaneously.

The present study forms the first step in bridging the gap between the pathologists and digitalization. It aims to assess the awareness level of Pathologists on whole slide imaging and its advantages as future of pathology.

Materials and Method

The study was designed to be a cross-sectional survey since it aimed to evaluate the awareness of pathologist on given point of time. An online questionnaire was designed to assess the knowledge, attitude of pathologists towards the whole slide imaging technique and digital pathology and its future perspectives.

The questionnaire was prepared using Google forms and distributed online to general pathologists and oral pathologists of various dental and medical colleges in Chennai. The pathology postgraduates and lectures of pathology department were randomly selected and invited to participate in the study. The questionnaire had sections, which gave a brief introduction about scope of the study, email address was collected and the questions with multiple choices had been provided. Explanations were given if the any of the participants could not understand the items.

The data was collected and analyzed through the Google forms using Microsoft excel version 2011.

Results

Forty-two completed responses were collected online. Four out of ten questions evaluated the awareness on the technical aspects of WSI and DP. Three questions were on the applications of WSI and DP. Three were questioned to assess the knowledge on practical aspects of WSI and DP.

66.7% pathologists were aware Whole slide imaging utilizes the advantages of digital images and live cameras. 81% said the magnification produced by WSI were greater than conventional microscopy. 52.4% felt the whole slide scanning can be done with one minute. 47.6% pathologists opined that high speed scanners are major indispensible need to put DP and WSI to daily use while 35.4%felt the need to be high resolution display monitors. The major hindrance in adopting widespread practice of WSI and DP were felt to be the High cost involved by 62.5% pathologists and technical factors by 27.5% pathologists. 85.7% pathologists were convinced that digital slides achieved faster consultations at its best. The promising role of DP and WSI in forming next-generation education were felt to be because of the scalable nature of digital file & availability to numerous students at a time by 33.3% pathologists, due to the incorporated annotations, videos, sound clips by 33.3 % and due to whole 3D picture of the specimen provided by DP by 33.3% pathologists. 59.5% pathologists were aware that the digital files of WSI consumed several gigabytes to terabytes. 48.8% pathologists felt that integration o WSI to pathology reports while 36.6% felt it was accessibility of WSI on iPads and PDA.

Discussion

Our study was based on data from online questionnaire and rate of return of these questionnaire reflect maximum amount of interest in whole slide imaging and digital pathology. Research into whole slide imaging ad digital pathology has been in progress for a decade. [1,2] All have inherent problems yet interest continues to increase worldwide with a growing consensus regarding acceptable applications, [3,4] particularly those related to teaching and quality assurance.

The practical experience of Whole slide imaging and Digital pathology are uncommon among histopathologists in India. Consequently there is an understandable skepticism with regard to technology and its ability to enhance conventional method of practice. Capital costs of installing DP and WSI are really high (particularly the image scanners). [4]

Many of the fears regarding DP and WSI have arisen through unfamiliarity with technology and can be overcome by onsite technical assistance combined with protocol driven referral pathways. [5] 66.7% of the pathologists perceived the virtual pathology to be a set of digital images only, although it involves recording digital images of the pathology slides with live scanning. This predicts the bird's view, not a detailed understanding of the technology.

Although several reports of enhanced teaching experiences had been witnessed through digitalization in western countries, [6,7,8] less cumbersome software along with adequate training of teaching faculties in them, and more easier identification of structures with clarity can help increase the level of acceptance in India. 85.7% of pathologists felt the unanimous solution on difficult diagnostic cases would be through digital consultations with their distant colleagues. Rapid remote initial diagnosis is possible as is consensus diagnosis for problematic cases. [9] The human resources can be maximized by remote participation.

52.5% felt the automated analysis of histopathology slides could help reduce their work burden give an accurate diagnosis in a quick time interval especially when it comes quantitative measurement of increased mitosis and other prognostic factors in cancers. [1,10] 52.5% of the pathologists the scanning speed to be under 1 minute. The latest technology scanners offer to complete the whole slide scanning in just <50 seconds. Al-Janabi et al has documented a success rate of 82% for primary reporting with digital slides. [11] Snead et al had

reported 97.7% complete concordance between glass and digital slide diagnosis. [12]

47.6% of the pathologists believed the high speed "slide scanners" are the major requirement to keep digital pathology in day-to-day diagnosis. These scanners provide the high-resolution images of the entire tissue section but at a outrageous cost. This can hinder its application in practice particularly in developing countries with limited resource. Attempts at developing substitutes for these scanners at negligible cost have been showing promising results with their own disadvantages. [13] However the technical advances would help overcome these problems in the future.

Conclusion

There is a reasonable level of awareness among pathologists on whole slide imaging and digital pathology. The practical hindrances in adoption of this technique should be overcome to achieve the huge advantage it holds. Innovations on production of low cost, efficient slide scanners are the need of the hour. Government should take initiative in collaboration with private organizations to install Digital set up for whole Slide Images.

Conflicts of Interest – Nil

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A: QUESTIONS ON THE TECHNICAL ASPECTS OF WSI AND DP.

QUESTION	RESPONSE RATE	ANSWER CATEGORIES	RESPONSE (IN NO.)	RESPONSE (IN %)
Principle behind WSI/DP	100%	1.Digital images 2. Live video scanning 2. combines Digital images and live scanning	28 2 12	66.7% 4.7% 28.6%
Magnification produced by digital slides	100%	1.Equal to conventional slides 2. Greater than conventional slides 3. Lesser than conventional slides	7 34 1	16.7% 81% 2.3%
Time taken to perform WSI	100%	1. <1 minute 2. <5 minutes 3. <50 seconds	22 11 9	52.4% 26.2% 21.4%
Full size of WSI	100%	1.Megabytes 2.Kilobytes 3.Few megabytes to several gigabytes	12 5 25	28.6% 11.9% 59.5%

1B: QUESTIONS ON THE APPLICATIONS OF WSI AND DP.

QUESTION	RESPONSE RATE	ANSWER CATEGORIES	RESPONSE (IN NO.)	RESPONSE (IN %)
Digital slides for next generation teaching	100%	1.Functions as scalable microscope for unlimited students 2. Possibility of annotations, videos & sound clips 3. Provides 3-D stacks of sections	14 14 14	33.3% 33.3% 33.3%
Best consultations for difficult/ rare cases	100%	1. By regular mail 2. By shipping slides 3. By digital slides	4 2 36	9.5% 4.8% 85.7%
Diagnostic efficacy of DP in histopathology	97.6%	1. Automated image analysis 2. Constant quality of images 3. Integrating WSI to pathology report	22 11 9	52.4% 26.2% 21.4%

1C: QUESTIONS ON PRACTICE OF WSI AND DP

Question	Response Rate	Answer Categories	Response (In No.)	Response (In %)
Major requirement to place DP in daily diagnosis	100%	1.High speed scanners 2. High resolution display monitors 3. Ultra fast storage hard disks	20 15 7	47.6% 35.7% 16.7%
Hindrance to wide spread adoption of DP	95.2%	1. Technophobic mind set 2. High cost involved 3. Technical factors	4 25 11	10% 62.5% 27.5%
Future perspective of WSI	97.6%	1. Access of WSI on apple iPads or PDAs 2. Incorporation of z plane scanning 3. Integration of WSI with laboratory workflow	15 8 18	36.6% 19.5% 43.9%