

Chapter 96

From Telecytology to Mobile Cytopathology: Past, Present, and Future

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ABSTRACT

Cytopathology is a popular discipline since George Papanicolaou proposed the famous test pap about 60 years ago. Today modern cytopathology laboratories still use the microscope as the primary diagnostic device and additionally they host modalities performing medical tests and exchange data via networks and have imaging systems producing pictures and virtual slides; the volume of produced data nowadays is enormous. Simultaneously mobile phones and tablets have evolved; their capabilities compete desktop computers and have the advantage of being always connected and at the side of users. Despite there are rather limited applications relevant to cytopathology for the mobile device, there is potential for uses in numerous activities of the cytopathology laboratory, including and not limited to: training, reporting, diagnosis and consultation, laboratory management, whole slide imaging, interactions between patient-doctor, doctor-doctor and within the laboratory personnel, quality control and assurance. Mobile devices can offer important benefits to the modern cytopathology laboratory.

DOI: 10.4018/978-1-7998-1204-3.ch096

INTRODUCTION

Mobile Health (mHealth) is the practice of medicine and public health supported by mobile devices. The use of mobile computing and communication devices, such as mobile phones, tablet computers and personal digital assistants (PDAs), by health professionals, is nowadays rapidly growing. The mHealth applications are mainly used for collecting community and clinical health data, delivery of healthcare information, real-time monitoring of patient vital signs, and direct healthcare provisioning. In more detail, handheld computing has applications such as ambulatory medicine (K. Banitsas et al., 2005; K. A. Banitsas et al., 2006; Kiselev et al., 2012; Pavlopoulos et al., 1998; Rosales Saurer et al., 2009; Zerth et al., 2012), diabetes management (Quinn et al., 2011; Ribu et al., 2013; Skrovseth et al., 2012; Spat et al., 2013), asthma management (Finkelstein et al., 1998; Gupta et al., 2011), control of obesity (Patrick et al., 2009), smoking control (Ghorai et al., 2014; Ybarra et al., 2014), seizure management (Pandher et al., 2014), stress management (Clarke et al., 2014) and treatment of depression (Burns et al., 2011) among others. In the field of mHealth the majority of applications are for fitness (43%) followed by health resource (15.0%) and diet/caloric intake (14.3%), while the user engagement has the form of self-monitoring and training (74.8%) (Sama et al., 2014); in contrast, despite there are applications targeting patients, currently, there are rather limited applications targeting physicians and doctor-patient interactions (T. Martin, 2012). Pioneering field seems to be radiology consultation for X-rays and mostly Computer Tomography (Choudhri et al., 2012; Choudhri et al., 2013; Johnson et al., 2012; Toomey et al., 2010) and ECG transmission (Vaisanen et al., 2003). The applications are very limited in the fields of pathology and even less in cytopathology despite both specialties deal with images. In relation to pathology, the most reported uses of handhelds, are limited to experimental endeavors in education and telemedicine (Park et al., 2012). For cytopathology, even after a thorough search, there were not found published articles or reports. However, pathology and cytopathology share many common characteristics. Actually, in most countries, cytopathology is considered as a subspecialty of pathology. Thus concepts and ideas can be useful to both specialties; therefore applications can be transferred from one domain to the other.

Cytopathology is a medical sector/discipline that gained popularity when George Papanicolaou proposed the famous test Papanicolaou (known as Pap Test), about 60 years ago. Nowadays Pap Test is the most valuable tool for cervical cancer screening and prevention. Therefore, it is the reason that cytopathology is so popular. Additionally, cytopathology has the advantage of obtaining biological material using minimally invasive or not invasive at all methods. Cytopathology is a discipline that the diagnosis is mainly based on the examination of cells via the microscope, histopathology (or pathology) does the same; however using complete tissues (obtained via biopsy). The routine cytological examinations are performed, since the invention of the microscope, via the utilization of a glass slide and subsequent visual analysis. Today, the modern cytopathology laboratory is continuously changing. Nowadays, cytopathology laboratories perform additional examinations based on molecular techniques and immunocytochemistry methods. The modern cytopathology laboratory is equipped with a lot of modalities, these are capable of performing medical tests, as well as to exchange data via networks, there are available as well imaging systems, capable to create digital pictures of the slides or even virtual slides, which are complete slides in electronic format. The volume of data, in a cytopathology laboratory, nowadays is enormous; there are many applications that are available, and others that can be envisioned for the benefit of cytopathologists and the patients. The recent advances in handheld hardware and software; in parallel, with concurrent advances in whole slide imaging (WSI) and cloud computing, offer new opportunities

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