

Cytopathology in Low Medical Infrastructure Countries

Why and How to Integrate to Capacitate Health Care

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KEYWORDS

• Cytopathology • FNA Cytology • LMIC • Teaching

KEY POINTS

- Cytopathologic assessment, particularly fine-needle aspiration cytology (FNAC), is a rapid, accurate, minimally invasive, inexpensive biopsy technique that requires minimal laboratory infrastructure and proceduralist costs.
- Cytology provides infectious and noncommunicable disease diagnoses and will play an essential role in the establishment of cancer services in low-income and middle-income countries (LMICs).
- All cytology specimens need to be handled using well-established protocols, FNAC biopsy requires specific training in the technique, and interpretation requires rigorous training.
- The use of ancillary tests on cytology material, including molecular tests, is established and rapidly expanding in high-income countries in the era of personalized medicine and will spread to LMICs.
- To establish cytology services and strengthen health services there must be a rapid increase in the training of cytopathologists and cytotechnologists, as well as increased education of clinicians in the roles and utility of diagnostic cytopathology and a commitment from governments and specialist training groups and funding.

INTRODUCTION

The major current problems with providing high-quality pathology diagnostic services in low-income and middle-income countries (LMICs) are the lack of infrastructure in pathology laboratories and equipment, as well as the lack of trained technical and medical practitioners.^{1,2} There is a lack of funding for the establishment and

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ongoing running costs of laboratories and for the ongoing costs of maintaining a pathology laboratory workforce, and for training pathologists and technologists for diagnostic work and teaching.³ This is particularly so for cytopathologists and cytotechnologists.

There are also problems related to current clinical practice in which cytopathology and other pathologic tests are not integrated into the management protocols for patients who have cancer, are undergoing surgery, or have infectious disease because pathologic assessment has not been available up to this time. This affects the management of infectious diseases, which have traditionally been the main causes of morbidity and mortality in developing countries, and noncommunicable diseases (NCDs), which are increasingly becoming the most important causes of disease in LMICs.⁴ There needs to be a strengthening of health systems. This will require political commitment and significant increases in funding to build up human resources, infrastructure, and data collection systems, and to invest in new technology and research, which will inform the best and most productive application of funding as countries attempt to reach their sustainable development goals.⁵

HOW CAN CYTOPATHOLOGY HELP?

Cytopathology covers a broad range of diagnostic and screening tests, including the cervical Papanicolaou (Pap) smear, sputum, urine, pleural and ascitic fluids, cerebrospinal fluid, and fine-needle aspiration cytology (FNAC). Cytopathology requires minimal laboratory infrastructure and, in the case of FNAC, is often able to replace more expensive core and surgical pathologic assessment.

Traditional cervical cancer screening programs using the cervical Pap smear provided a major tool to diagnose and ultimately greatly reduce the incidence of cervical cancer through screening programs in developed countries. Cervical cancer remains a significant cause of cancer-related deaths in the developing world. In LMICs there are few if any formal cervical cancer screening programs but the simple Pap smear is used in an ad hoc, mainly user-pay, system to screen and diagnose cervical cancer and its precursors. Of the exfoliative cytology tests, only examination of sputum is widely used, mainly to attempt to diagnose mycobacterial lung infections. FNAC is variably but increasingly used across LMICs and has become a major diagnostic tool in India. It can be performed in hospital inpatient and outpatient settings, as well as in doctors' surgeries and rural clinics. It has a potentially crucial role in the diagnosis of both NCDs and infections in LMICs, including adult and pediatric tuberculosis.⁶⁻⁸ FNAC is routinely performed without local anesthetic, quickly and easily, using 22-gauge to 27-gauge needles and a simple alcohol skin preparation. The material is directly smeared onto slides that, through a specimen splitting process, can produce multiple slides for routine alcohol-fixed Pap and air-dried Giemsa staining, as well as specialized stains, such as the Ziehl-Neelsen stain for mycobacterial infection.⁹ Rinsed material from the needle can then be placed into cell blocks, fixed in formalin, and paraffin-embedded for the full range of immunohistochemical and even molecular testing if available. The FNAC material can be used in rapid polymerase chain reaction (PCR)-based testing, such as GeneXpert, for the diagnosis of tuberculosis, or directly inoculated into culture bottles or handled in a more traditional manner by a microbiological laboratory for cultures and drug-sensitivity studies.¹⁰ The range of targets can be extended from palpable lesions to impalpable and deep seated lesions by the use of relatively inexpensive ultrasound guidance.

The use of FNAC is greatly facilitated by rapid on-site evaluation (ROSE) in which a pathologist or a cytotechnologist attends the FNAC procedure and is able to direct the

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