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Opinion

Low Microbial Isolation Rate in Developing Countries; Need for Urgent Global Attention and Action

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Abstract

This paper draws attention of the international community to a dire need to urgently address a long standing problem of poor microbial yield in the laboratories in developing countries. In view of persistent high disease burden in these countries, microbial detection in the laboratory is fundamental in addressing prevention, control, detection and management of infectious disease. If disease burden must be drastically reduced, low microbial isolation rates must be addressed and this is better addressed at a global scale.

Keywords: *Microbial; Bacterial; Isolation rates; Developing countries; Infectious disease; +/- surveillance; Laboratory*

Introduction

It is an established fact that the burden of infectious diseases is unacceptably high in developing countries [1-3]. This has been the case over many years now. With the advent of anti-microbial agents and environmental control, as well as introduction of many vaccines against vaccine preventable diseases, the burden of infectious diseases dropped throughout the globe. While a tremendous drop in global disease burden has been documented, disaggregating the drop into developing and developed countries shows that most of the difference occurred in developed countries with sub-optimal improvement in developing countries. Today, infectious diseases still remain a major cause of under-five mortality, accounting for more than 76% of under-five mortality [3]. The pivot on which control and elimination of infectious disease stands is detection/isolation of the microbial agents responsible for infectious disease. But the paucity of quality data on the burden of infectious diseases due to low microbial isolation rates slows down prevention and control measures [4,5].

Progress so far

Tremendous progress made in combating infectious diseases can be partly attributed to the following:

Rational use of antibiotics: Since the discovery of penicillin in 1928 by Alexander Fleming, Professor of Bacteriology at St. Mary's Hospital in London, dramatic results have been achieved in terms of reduction of morbidity and mortality from microbial agents [6].

Many more antibiotics have continued to be discovered and added onto the global antibiotic armoury. Rational use of these drugs cannot happen without appropriate microbial isolation in the lab [7]. In addition to antibiotics, antifungals as well as antivirals have been introduced into the market

Environmental Control: This has been shown to significantly reduce disease burden by eliminating factors that enhance transmission. Environmental control such as good housing, good urban planning and development, portable water, electricity, elimination of air pollution and urban slums as well as over-crowding, all minimize transmission of communicable diseases [8].

Personal and Food Hygiene: Singular promotion of regular hand washing has been shown to reduce infectious disease burden [9,10]. Additionally proper observance of personal and food hygiene results in drop in infection transmission.

Vaccination: The advent of vaccination severally described as one of the most cost-effective interventions in human existence has undoubtedly had a tremendous impact on infectious disease burden globally [2,11].

Prompt and appropriate case management: While instituting preventive measures against infectious diseases, breakthrough cases require prompt and appropriate management measures. To achieve this, microbial isolation rate in the laboratory is very critical.

Disease Surveillance: This is fundamental for control of both vaccine and non-vaccine preventable diseases. Surveillance for communicable disease requires laboratory microbial isolation. It enhances disease burden estimation/trends, prompt detection of outbreaks, diseases control/elimination/eradication, vaccine impact assessment and detection of emergence of new strains.

The Problem

Laboratory microbial detection and isolation is monumentally fundamental to any meaningful progress in the diagnosis, management, control, elimination and eradication of infectious diseases. This is so because accurate microbial detection/isolation is necessary;

1. To correctly arrive at a definitive diagnosis
2. Determine antimicrobial susceptibility/resistance
3. To appropriately treat cases
4. Monitor response to treatment or treatment failure
5. Carry out surveillance to determine disease burden
6. Develop effective vaccines and antimicrobial agents
7. Detect outbreaks and plan outbreak response
8. Monitor vaccine impact, etc.

In my few years of experience in Bacteriology and Virology, the magnitude of the problem is becoming more glaring with passage of time. Disease surveillance to accurately determine the burden of diseases and antimicrobial resistance patterns has particularly been hampered by poor microbial isolation rates in Developing Countries.

For instance: a systematic review by Huynh., *et al*. [3] of burden of neonatal bacterial infections and antibiotic resistance in Developing Countries revealed that there is"insufficient data" to draw valid conclusions as isolation rates were low. Of the 20 countries that reported bacteremia rates, isolation rates ranged from 5.8% to 48% with median of 22.4% (This is excluding one study from Georgia with isolation rate of 67%). The only CSF culture study reported in literature from Developing Countries had 4% isolation rate. Also, "less than one-fifth of the studies reviewed were based on active surveillance".

Several studies on isolates from suspected pneumonia and meningitis case in children ranged from zero isolation rates to 23% [12-15]. Majority of studies where moderate yields have been documented received a form of foreign support. These include technical assistance, capacity building, Laboratory equipment and reagents, External Quality Control and External Quality Assurance.

Recently WHO initiated a Global (and Regional) surveillance network for Paediatric bacterial meningitis and rotavirus diarrhoea. This is one major global move towards addressing the problem of near- absence quality locally generated data on disease burden in Developing Countries [16].

While the antigen based detection of rotavirus by ELISA in Developing Countries is high [17,18], it is the opposite in (paediatric bacterial meningitis) PBM. The PBM isolation rates have been reported to be as low as 7% [9]. This is in spite of technical and financial support from WHO and other organizations. Although, the target organisms in the surveillance are fastidious (Streptococcus pneumoniae, Haemophilus Influenzaeb, Neisseria meningitis), isolation rates from CSF is still at a low range. Attempts to increase the yield by use of antigen tests and PCR seem to have only marginally improved the detection rates and require much more to be done.

The WHO surveillance network has no doubt had a significant impact on improving laboratory capacity, clinical practice and generation of better quality data. For instance, before the commencement of the surveillance networks, most labs in Developing Countries used human blood for culture media preparation and Clinicians sent CSF to the lab for culture after several hours of delay. This has changed, at least in participating hospitals. However, non-participating hospitals and even some non-participating sections of the laboratory in participating hospitals have not improved their capacity.

Contributing factors

Factors that contribute to low microbial isolation rates in DCs are many some of which include:

Resistance: There is easy availability of over-the-counter (OTC) antimicrobials including anti-TB drugs due to weak regulatory systems. This has led to miss-use and even where prescribed, over prescription of antimicrobials. As a result, the proportion of patients whose blood cultures are done after antibiotic consumption is usually high. Poor access to health also encourages self-medication and indiscriminate use of antimicrobials. This is compounded by illiteracy, poverty and low awareness. The high rate of fake and substandard drugs, and poor prescription patterns all help to enhance development of antimicrobial resistance.

Poor access: The high burden of poverty and malnutrition [19], weak infrastructure and weak health systems are major contributors to low microbial yield in DCs. Many areas of the community are underserved with no health facilities, no electricity and where available, very expensive and unaffordable. Laboratories lack appropriate equipment, supplies, training and personnel; thereby resulting in poor physical and economic access [20].

Low lab Capacity: Where laboratories exist, the capacity in most hospitals for microbial isolation is low, even in some teaching hospitals. There is still wide-spread use of human blood, high level of contaminant yield, high level of no growth, poor lab supplies, lack of constant power supply, portable and distilled water, poor lab environment, near absence lab policies, non-availability of services during weekends and public holidays, poorly motivated staff without updated skills and training.

Weak political commitment: There appears to be poor ownership and government commitment towards investing in well-equipped and maintained health facilities with adequate laboratory capacity. This could be traced to poor awareness and perception of its importance.

Weak advocacy: Addressing poor ownership requires strong advocacy. But this is also low and there is lack of advocacy tools such as quality data.

Way Forward

This paper is an urgent call for a global attention and action towards addressing head-on, the perennial problem of low microbial isolation rates in DCs. It will enhance prompt detection and management of disuses, prompt detection and response to disease outbreaks, control and elimination/eradication of disease, help monitor and improve disease surveillance data.

There is need for strong coalition of World Health bodies, agencies and organizations together with governments to develop strategic and concerted effort, not just against antimicrobial resistance (which is only a small part of the whole), but against poor microbial isolation rates.

The efforts and strategies should include:

1. Global needs assessment
2. Setting of goals, targets and performance indicators
3. Adoption and ratification by governments (including ownership encouragement measures)
4. Periodic monitoring and evaluation by monitoring and evaluation bodies
5. Review of progress periodically
6. Operational research in areas of yield-enhancement of laboratory methods in developing country settings, integration of surveillance into health system, health information system studies, etc.

Conclusion

Antimicrobial isolation rates are unacceptably low in may developing countries. This has a global effect on development, morbidity, mortality, case detections and management, epidemics and outbreak detection, disease surveillance and quality of epidemiological data. There are many contributing factors. This paper is a strong call for urgent global attention and action. It is expected that if given global attention, the picture will change significantly within the next 5-10 years. Future operational research should focus at increasing laboratory antimicrobial isolation rates in a developing country setting.

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