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Challenges of Gastrointestinal Endoscopy in Resource-Poor Countries

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1. Introduction

Over the past 100 years, there has been a dramatic and explosive growth of information about and technology related to the science and practice of gastroenterology. Endoscopy services are the mainstay of diagnosis and treatment in gastroenterology. Endoscopies have undergone significant changes enabled by advances in information technology (IT). The ability to take video pictures onto the computer screen and to print them has enabled more effective image capture, image storage and retrieval as well as quality assessment.

The developed countries of the world have taken great advantage of these innovations and developments but the story is totally different for the developing or resource - poor countries. The developing countries are characterized by low measures of development such as income per capita, rate of literacy, life expectancy and other health indices. These countries have not achieved a significant degree of industrialization relative to their populations, and which have in most cases a low standard of living. Strictly speaking, the term developing implies mobility and does not acknowledge that development may be in decline or static in some countries, particularly African countries. It is for this reason that the World Bank classifies countries on the basis of Gross National Income (GNI) per capita (World Bank, 2010).

Digestive diseases impose a substantial burden on global health. In the United States, over 40 billion US Dollars was used for gastrointestinal disease in one year (Sandler et al 2002). Comparable information on the digestive health of people living in developing countries may not be available but it is known that diarrheal diseases account for 17.9% of deaths in low-income countries compared to 1.6% in high-income countries (World Health Organization, WHO 2008). *Helicobacter pylori* is a leading cause of gastrointestinal disease globally. Whereas the prevalence of this infection has declined considerably in the developed world, it is still very high in the developing countries (Torres et al 2000), with the majority of the global burden of infection found here (World Gastroenterology Organization, WGO 2006) because most of the risk factors for its transmission are rife in the developing countries. These include low socio-economic status, crowded living conditions, several children sleeping on one bed, large numbers of siblings and unclean water (Webb et al 1994, Malaty et al 1996, Lindkvist et al 1998, Dominici et al 1999, Nabwera et al 2000).

Because of the pivotal role of endoscopy in the teaching and practice of gastroenterology, various professional bodies in the developed countries have produced guidelines on what constitutes the minimum necessary facilities, equipment and staffing to deliver safe and effective endoscopy (Digestive Health Foundation, Australia, 2007, American Society of Gastrointestinal Endoscopy (ASGE) 2010). The training and qualification of endoscopists and nursing staff, the endoscopic equipment and accessories, the reprocessing of endoscopes, monitoring and resuscitation equipment must all be of globally accepted standards. Some of these standards will be highlighted in this article and compared with what obtains in developing countries using Nigeria as a typical example.

2. Location of services

An endoscopy unit may be hospital-based or free standing. For hospital-based endoscopy units, the location shall be in close proximity to acute emergency services. The location within the complex shall permit free access for out-patients and for the transport of in-patients by bed, trolley or wheel chair. Where the endoscopy unit is not located within the main hospital complex, provision for enclosed transfer of patients is advisable. Where the endoscopy service is in a free standing facility, it should be located within a 15 minute ambulance journey of an acute hospital that provides an intensive care or emergency service. There should be an agreed arrangement with this hospital to admit patients in a medical emergency.

The endoscopy services that are available in the developing countries do not meet the standards stated above. Very often there is a lot of improvisation in the siting of endoscopy suites. In some countries they are located in wards without any consideration for access to out-patients and transport of in-patients. The privately owned endoscopy services are even worse because in most cases, once the equipment is procured, it is installed in any existing facility. The absence of effective certification and accreditation of centres makes matters worse.

3. Facilities

An ideal endoscopy unit should possess the following areas as minimum requirements. (Digestive Health Foundation, Australia, 2007).

- Reception and Administration
- Waiting Area
- Procedure Room(s)
- Consulting/Interview Room
- Nurses' Station
- Storage Areas
- Separate Reprocessing Area
- Staff Room
- Toilets and Change Rooms
- Waste Disposal Area
- Recovery Room(s)

Each of these areas should have proper supply of consumables and necessary equipment. For instance; a recovery area should be situated adjacent to the procedure room(s) and must be freely accessible by a normal recovery room trolley. The recovery room should also have

an oxygen supply dedicated to this area. Oxygen outlets will need to be provided so that each recovery bay is supplied. Wall mounted suction is desirable, however where unavailable, at least one dedicated mobile suction unit shall be provided.

The endoscopy units in the developing countries are not in any way near the specifications listed above. It is common to have reception and administration, waiting area, consulting/interview room and staff room all housed in one room. In some instances, doctors and nurses share rooms. Some facilities may have only one toilet for male and female staff and patients. Suction machines and oxygen delivery are often in short supply. What you find in an average endoscopy unit in a developing country is a reflection of what is available in an average hospital.

3.1 Procedure room

The procedure room should be at least 4 meters by 5 meters. Larger rooms are required for video endoscopy and if endoscopic retrograde cholangiopancreatography (ERCP) procedures are performed, a larger room of not less than 35 square meters is required. The procedure room must be equipped with at least the following:

- Light source/video processor
- Medical grade monitor/video
- Suction x 2 (patient and instrument)
- Oxygen and accessory equipment
- Pulse oximeter
- Non-invasive blood pressure monitoring
- Hand washing facilities
- Emergency drugs
- Intercom or emergency call system.

3.2 Power supply

The problem of power supply is a major one in resource-poor countries. The Nigerian energy industry has been described as one of the most inefficient in the world in terms of meeting the needs of its customers. This has had a devastating effect on business to the extent that most businesses have to rely on generators, which are very expensive to run. Endoscopy procedures are often interrupted or cut short by power outages. Such incessant outages have deleterious effects on the endoscopy equipment with the result that there is frequent breakdown. The generators that serve as alternative may not be big enough to power air conditioners thus it is common to see the endoscopist, other support staff and the patient sweating profusely during endoscopic procedure. The quality of work done in this type of environment is bound to be substandard. The commonest cause of inconclusive endoscopic procedure in Nigeria is power failure.

4. Equipment

Minimum equipment required for gastrointestinal endoscopy includes:

- Endoscopic light source/video processor
- High resolution medical standard monitor (CRT or LCD)
- Fully immersible endoscopes
- Gastrosopes - not less than 2

- Colonoscopes – not less than 2
- Valve buttons, biopsy caps and adaptors
- Electrosurgical equipment
- Forceps
- Snares
- Sclerotherapy needles
- Dilators and guidewires

Ancillary equipment

- Recovery Trolley and Chairs
- Pulse Oximeter
- Non-invasive BP Monitoring
- Stethoscope
- Access to ECG Tracing
- Glucometer
- Transportable Oxygen Cylinder with Portable Suction
- Standard resuscitation equipment: which must be readily available, maintained in good working order, function checked daily and maintained and checked according to manufacturer's directions.

Permanently sited in the endoscopy facility will be the following items:

- Air viva – masks, bags, airways
- Adequate intravenous access equipment
- Plasma expander
- Intravenous fluids including Normal Saline, Dextrose etc
- Full range of emergency drugs
- Portable Oxygen and Suction

Rapid access (within 1-2minutes) to the following equipment is also mandatory.

- ECG machine
- Cardiac defibrillator
- Two laryngoscopes
- Appropriate range of endotracheal tubes and accessories

These minimum requirements are not even available in some of the surgical theatres and intensive care units of hospitals in the developing countries and therefore it will be unrealistic to expect endoscopy facilities to have them. Some teaching hospitals in resource-poor countries do not offer gastrointestinal endoscopy. In centres where the service is available, there may be only one functional gastroscope and/or one functional colonoscope. Often a lot of accessories are improvised. Again, using Nigeria as example, therapeutic endoscopy is still at its infancy. Majority of the teaching hospitals in the country have no facility for therapeutic endoscopy. One or 2 centres may be able to do band ligation of esophageal varices albeit in an unsustainable fashion. In one of the centres the doctors modified the normal variceal banding technique by cutting size 14 Folley's urethral catheters to size and reloading them on previously used caps, all in an attempt to reduce cost (Ladep et al 2008). Infection control remains a challenge in such ingenuity. It is also common to find non-immersible endoscopes in developing countries with obvious implication for cross-infection. The newer techniques in endoscopy like capsule endoscopy

and endoscopic ultrasonography are yet to be available in most developing countries including Nigeria.

5. Staff requirements

5.1 Global distribution of medical personnel

In Nigeria, doctor to population ratio is 3 per 10,000 compared to US which stands at 26 per 10,000. The gap is even much wider when one considers the gastroenterologist to population ratio. Nigeria has only about 60 gastroenterologists (registered with the Society for Gastroenterology and Hepatology in Nigeria, SOGHIN). Out of this number, there are some who do not practice gastrointestinal endoscopy because they work in centres that do not have facilities for it. This number is grossly inadequate for a population of over 140 million. The anatomical pathologist plays an essential role in the diagnosis of numerous digestive disorders. The number of pathologists in Nigeria is equally abysmally low for the population and only very few of them are trained specially for gastrointestinal diseases.

Some high-income countries such as Australia, Canada, Saudi Arabia, the USA and the United Arab Emirates and the UK have sustained their relatively high physician - to population ratio by recruiting medical graduates from developing regions, including countries in sub-Saharan Africa (Labonte et al 2006, Mullan 2006, Pond et al 2006). In contrast, over half of the countries in sub-Saharan Africa do not meet the minimum acceptable physician to population ratio of one per 5000 (WHO 2007). Several recent reviews of health workers employed in Australia, Canada, the UK and the USA have shown the extent of brain drain. An estimated 13272 physicians trained in sub-Saharan Africa are practising in Australia, Canada, the UK and the USA (Mullan 2006). Around a third of medical graduates from Nigerian medical schools migrate within 10 years of graduation to Canada, the UK and the USA (Ihekweazu 2005). Nurses, who commonly bear the brunt of health-care delivery in sub-Saharan Africa are also not left out in the brain drain (Labonte 2006, Mandeville 2009)

5.2 Minimum staffing requirements

Staffing requirements for the performance of GI endoscopy should be based on what is needed to ensure safe and proficient performance of the individual procedure. Currently, staffing may vary as determined by local practice requirements, patient characteristics, and the type of endoscopic procedure being performed. While the physician is performing endoscopic procedure, the endoscopy suite staff will concentrate on patient monitoring, documentation and technical assistance. The level of education and training of the staff can vary, including qualified nurses with training in endoscopy and qualified nurses trainable on the job.

Because objective evidence pertaining to the relationship between endoscopy unit staffing levels and patient outcomes is lacking, it is difficult to make concrete recommendations to the developing countries where there is an acute shortage of medical staff including trained endoscopists and support staff.

5.3 Staff training

The World Gastroenterology Organization (WGO), a Federation of 110 National Societies and 4 regional associations of gastroenterology representing over 50,000 individual members worldwide focuses on the improvement of standards in gastroenterology training and education on a global scale. It has been christened the "global guardian of digestive

health". In 2007 it published a document about the basic standards of a gastroenterology training program (WGO 2007). In drawing up the standards of training the WGO took into consideration the existing training programs in various countries. It is noteworthy that Egypt and Sudan were the only African countries that provided information about their existing training programs to the WGO Committee. The other countries in Africa, including Nigeria did not respond to the enquiry.

The WGO has training centres in the developing countries but these are very few and countries in the catchment areas of the centres have not taken adequate advantage of the institutions to develop their local digestive endoscopists. Prospective trainees usually find it difficult to secure funding from their countries.

5.4 Minimum training standards

The WGO proposes a minimum number of each procedure that must be completed by the trainees in the training centres. The body differentiates between level 1 and level 2 endoscopists with a remark that level 1 might be sufficient for some developing countries. A level 1 endoscopist is expected to be proficient in esophagogastroduodenoscopy, treatment of non-variceal bleeding, treatment of variceal bleeding, esophageal dilatation, flexible sigmoidoscopy, colonoscopy, polypectomy, placement of percutaneous endoscopic gastrostomy, liver biopsy, abdominal puncture and foreign body removal. It is a sad truth that most endoscopy centres in developing countries such as Nigeria do not carry out any form of therapeutic endoscopy. It therefore follows that trainees in these centres will not acquire the competences required of a level 1 endoscopist. Training of endoscopists takes place in the teaching hospitals that are grossly ill-equipped to perform the function. There are 2 postgraduate medical colleges in Nigeria: The West African College of Physicians or Surgeons and the National Postgraduate Medical College of Nigeria. These colleges supervise the training of residents and eventually certify them after passing the requisite examinations. The current practice does not ensure adequate exposure for the trainees who hardly complete the minimum number of procedures before they present themselves for examination. Furthermore, the method of evaluation is such that one can pass without having completed the prescribed procedures. Sometimes incessant industrial actions make it practically impossible for trainees to complete the procedures during the training period. The evaluation has no practical endoscopy component. In the developed countries, methods used in the evaluation of trainee competence vary from place to place and may include observation during procedure, formal assessment of clinical skills, using a patient-based examination, formal in-practice examination, use of log books, annual assessments, final assessment and feedback from trainees. These evaluation methods are largely absent in the developing countries. Where they exist, the regulations are often not applied strictly for economic, social and political reasons. The regulatory authorities are sometimes faced with a situation where they have to decide between closing a health facility because it lacks basic equipment and staff; and allowing it to continue to function at a substandard level because of political interests.

6. Infection control

Over the course of endoscopic examination, the external surface and internal channels of flexible endoscopes and accessory equipment are exposed to body fluids and contaminants. Disinfection of these reusable instruments poses special problems. Given their relatively

delicate structure endoscopes cannot be autoclaved. Therefore processing is achieved by mechanical cleaning, followed by high level disinfection (HLD), rinsing and drying. Stringent guidelines are in place in most developed societies for the reprocessing of endoscopes (ASGE 2003 and the Gastroenterological Society of Australia 2003). If these guidelines are followed, virtually no cases of infection transmission are encountered (Ciancio et al 2005, McDonald et al 1976, Hanson et al 1990).

The ability to reprocess equipment efficiently and safely is one of the most important functions of an endoscopy facility. An area dedicated to the cleaning and disinfection of endoscopic equipment must be available and should contain at least two (2) large sinks plus a tank/container of disinfecting solution or an automatic flexible endoscope reprocessing machine.

Reprocessing should commence immediately following use of an endoscope to prevent the drying of secretions within the channels. The cleaning and disinfection of endoscopes should only be performed by staff that have been fully trained and certified to do so. Inexperienced staff may not be aware of the specific design of the instrument and may cause severe damage or inadequately clean and disinfect the equipment.

Automated endoscope reprocessors have become available in developed countries. These automated brushless systems are an important step in raising the standard of care for flexible endoscope reprocessing (ASGE 2008, Society of Gastroenterology Nurses and Associates, SGNA 2008). This innovation also allows facilities to utilize valuable staff resources in other patient-related activities and reduce occupational health problems associated with reprocessing.

The situation in resource-poor countries is totally different. In the first place, there are no local guidelines for equipment reprocessing. Something as basic as potable water supply is a big challenge in many hospitals in resource-poor countries and that is bound to affect the cleaning of equipment. The acute shortage of trained endoscopy staff further worsens the picture. Supply of substandard disinfecting solution is a frequent occurrence in developing countries. Therefore, it is likely that infection transmission in endoscopy facilities may be substantial. Unfortunately, there are no data on the magnitude of this challenge.

Very often the recommended period of immersion of endoscopes in the disinfecting solution may be unwittingly shortened between procedures to reduce the waiting time of patients especially where there is only one endoscope that has to be reused on many patients the same day. This again has negative consequences for infection control.

Automated endoscope reprocessors are not yet available in most resource-poor countries. No centre in Nigeria has this equipment and I doubt if any is planning to acquire it soon. It may be more expedient for them to intensify adherence to the traditional methods of thorough manual washing, rinsing and drying.

7. Sedation

The provision of sedation and analgesia has been an important component of performing endoscopic procedure on the gastrointestinal tract. The different procedures can create pain and discomfort and are associated with anxiety for the patient. It is for this reason that sedation has become an essential component of endoscopy.

For routine diagnostic endoscopic procedures sedation is almost always used in North America and Australia. However in Europe, Asia and some African countries, the sedation

rate varies among countries and even among centres of the same country. The use of sedation improves the tolerance and acceptance of gastrointestinal endoscopy (Bell 2004) but increases the cost of the procedure and is responsible for about 50% of the GI endoscopy complication rates (Lazzaroni et al 2005).

Sedation for gastrointestinal endoscopy may induce central respiratory depression and/or airway obstruction. Early diagnosis and treatment of these complications is mandatory and this can only be accomplished by patient monitoring.

7.1 Monitoring

Current recommendations for monitoring include patient responsiveness, blood pressure, respiratory rate and oxygen saturation. Oxygen saturation is a critical vital sign, but there can be a significant delay between inadequate ventilation and desaturation. Supplemental oxygen can dangerously increase this disconnect. Thus one must monitor adequacy of ventilation by direct observation, auscultation and/or end-tidal CO₂ monitoring.

7.2 Training for sedation

Appropriate supervision and training is critical for developing skills necessary to perform conscious sedation. There is uniform agreement in the literature and all relevant societal guidelines agree that specific training is needed for both endoscopic procedure and any sedation associated with the procedure (America Society of Anaesthesiologists 2002, ASGE 2008, Cohen et al 2007).

7.3 Situation in developing countries

There are no published studies on the use of sedation in most African countries including Nigeria. This is partly because there are no guidelines in place to regulate the use of sedation in gastrointestinal endoscopy. Similarly the rate and type of sedation employed by endoscopists in these countries is not known. However, it is tempting to assume that endoscopists in developing countries either undersedate their patients or avoid sedation all together in order to avoid the attendant increase in cost and increase in complications. This is because the endoscopists do not have any special training in the use of sedatives and the centres where they work do not always have the basic facilities to monitor patients adequately during the procedures. One consequence of this situation is that patients who find the procedure seriously unpleasant because they were not sedated may not only refuse future examination but spread concern to others. A meta-analysis showed sedation to achieve better patient cooperation and satisfaction and willingness to have it repeated. (McQuaid et al 2008).

8. Quality assurance

8.1 Accreditation and certification

The development of quality assurance is a major task of the Health authorities in liaison with experts issued from the respective medical societies. It also applies to the hospital environment as well as to practitioners who have to be submitted to certification, after the report from expert visitors. Accreditation of gastroenterologists and certification of hospitals are done periodically to ensure that standards do not go below prescribed levels.

In Nigeria, the postgraduate medical colleges (West African College of Physicians/Surgeons and the National Postgraduate Medical College) undertake periodic accreditation visits to

the training institutions (Teaching Hospitals, Specialist Hospitals, Federal Medical Centres and some private hospitals). Because of funding constraints, these visits are not as regular as they should be. The Federal Government of Nigeria can make the regulatory colleges more efficient by improving the funding of their activities so that they do not depend on the hospitals being accredited for any financial assistance, a situation that may introduce conflict of interest.

8.2 Quality measurement

There are inherent difficulties of measuring quality in gastrointestinal endoscopic procedures. This is particularly so because complications are rare. Because mortality is negligible, rates do not vary greatly among physicians. Also there is a lack of surrogate measurable outcome measures in GI endoscopy. Measuring the process is the alternative but, again, there has not been any significant progress in process measurement.

Quality measurement is even more problematic in developing countries because of a general lack of baseline. There are no guidelines in place that reflect the peculiar economic realities in these countries.

9. Cost of endoscopic procedures

The cost of endoscopic procedures in developing countries is often out of the reach of many patients. Poverty is a major problem that militates against access to health care. Poverty exacerbates poor health while poor health makes it harder to get out of poverty. In Nigeria, most patients have to make out-of-pocket payments at the point of service and this has adversely affected service delivery. The Federal Government of Nigeria recently introduced the National Health Insurance Scheme but the coverage is still very low and does not cover all medical procedures and treatments. Catastrophic expenditure is more frequent when health care has to be paid for out-of-pocket at the point of service.

10. Conclusions and recommendations

The problems that face the teaching and practice of gastrointestinal endoscopy in developing countries are protean and generally reflect the low level of human and infrastructural development in these countries:

- There is an acute shortage of trained endoscopists, gastrointestinal pathologists, nurses and other support staff. This situation is daily compounded by the continuing brain-drain.
- Inadequate budgetary allocation to health and poor implementation of health programs and budgets.
- Inadequate and unsteady power supply.
- Lack of modern gastrointestinal endoscopic equipment and consumables for effective service delivery and training.
- Lack of guidelines for the practice and teaching of gastroenterology.
- Health service delivery is characterized by a high rate of out-of-pocket payments and a low rate of prepayment schemes, a situation that deprives many families of needed care because they cannot afford it.

The health care system in the developing countries needs a radical reorganization. The budgetary allocation to health and the implementation of policies related to health need radical improvement.

The governments should work in liaison with various medical societies to come out with firm guidelines that will take into account the financial capabilities of these obviously poorer countries without unduly compromising the health of their citizens and ensure strict compliance by all stakeholders.

It is no longer realistic to talk about global standards because of the problem of resource allocation. The available resources and technologies differ from country to country. For example, the ability to use narrow-band imaging, ERCP or procedures that are considered standard components of endoscopy in the United States may not be possible in developing countries and the guidelines must reflected these differences. It is essential to be cognizant of the local resources and to identify quality within their constraints.

The funding of health services should tend towards prepayment strategies rather than out-of-pocket payment and health insurance is a veritable tool for achieving this.

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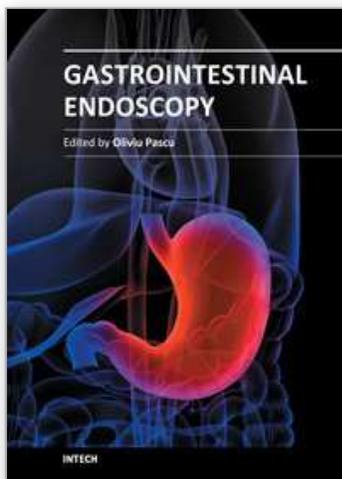
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Endoscopy has had a major impact in the development of modern gastroenterology. By using different data it provided a better understanding of pathogenic mechanisms, described new entities and changed diagnostic and therapeutic strategies. Meanwhile, taking advantage of many technical advances, endoscopy has had a developed spectacularly. Video-endoscopes, magnification, confocal and narrow-band imaging endoscopes, endoscopic ultrasounds and enteroscopes emerged. Moreover, endoscopy has surpassed its function as an examination tool and it became a rapid and efficient therapeutic tool of low invasiveness. InTech Open Access Publisher selected several known names from all continents and countries with different levels of development. Multiple specific points of view, with respect to different origins of the authors were presented together with various topics regarding diagnostic or therapeutic endoscopy. This book represents a valuable tool for formation and continuous medical education in endoscopy considering the performances or technical possibilities in different parts of the world.

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