# Assessment of resource capacity and barriers to effective practice of laparoscopic surgery in training hospitals affiliated with the College of Surgeons of East, Central and Southern Africa (COSECSA)

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**Abstract**

Background: The adoption and accessibility of laparoscopy have been serious issues in countries with limited resources, and for varied reasons. This study assessed resource capacity and barriers to the effective practice of laparoscopic surgery in training hospitals affiliated with the College of Surgeons of East, Central and Southern Africa (COSECSA).

Methods: A multi-country survey was conducted from January 2021 to October 2021 using a questionnaire distributed to surgeons in COSECSA hospitals located in 16 different countries. Available resources and surgical volume were assessed, and the barriers to routinely performing laparoscopy were determined.

Results: Ninety-four surgeons working in 44 different hospitals from 16 countries participated in the survey. The majority of respondents were general surgeons (n=75, 79.7%). Other specialities included urology (n= 12, 12.8%) and paediatric surgery (n=7, 7.4%). Senior surgeons accounted for 60.6% of participants, more than 40% had a managerial position and approximately 20% were surgical trainees. Most respondents practiced in public hospitals (n=66, 70.2%). A median of three surgeons per hospital performed laparoscopic surgery with, on average of two laparoscopic towers and two sets of laparoscopic instruments available. A median of 10 procedures was carried out per month. Laparoscopic procedures and laparoscopic consumables were reported as being covered by some health insurance payments in 76.9% and 48.4% of cases, respectively. Cholecystectomy was the most commonly reported laparoscopic procedure performed. The five top barriers to performing laparoscopic surgery were lack of consumables, limited quantity of equipment, lack of skilled surgeons, high cost of laparoscopic procedures and complicated cases. In addition, skilled anesthesiologists and anesthesia equipment, carbon dioxide availability, consistent electric power supply and equipment maintenance were cited as important challenges.

Conclusion: The practice of laparoscopy is currently limited in COSECSA countries due to a scarcity of skilled staff and the lack of a funding plan to make laparoscopic services accessible. Therefore, policy makers and stakeholders should take strategic measures to respond to this need.

Keywords: Laparoscopic surgery, Global surgery, Sub-Saharan countries, resources capacity, barriers to laparoscopy

# Introduction

Global Surgery, as defined by the Lancet Commission, is universal access to safe, affordable surgical and anesthesia care when needed. Global surgery saves lives, prevents disability and promotes economic growth. However this is not the reality in Sub Saharan Africa where 93% of the population do not have access to safe, affordable surgical and anesthesia care when needed (1,2).

Laparoscopic surgery has revolutionized the practice of surgery in developed countries (3–5). In essence it represents a new era of technology-dependent surgical interventions, and to some extent its future progress depends on the development of interventional technologies and devices (3). Recent studies have demonstrated the adoption of laparoscopy in Low- and Middle-Income Countries (LMICs) to be safe, feasible, and clinically beneficial (6–8). However, worldwide it faces many constraints and several outstanding issues need to be addressed, including training of qualified staff, assessment of competence, limited resources and resource allocation, equipment and maintenance capacity, lack of safe procedural guidelines and quality assurance (3).

The effort to integrate laparoscopy into the delivery programs of surgical services in low-resource settings has produced varying effects resulting from the challenges inherent in a complex surgical program (9,10). Additionally, the widespread introduction of laparoscopic techniques in developed countries has emphasized the need for adequate training as operations that were straight-forward open procedures may require considerable laparoscopic expertise, and this has raised questions about trainee surgeons acquiring adequate training (4).

The College of Surgeons of East, Central and Southern Africa (COSECSA) is a professional organization, founded in 1999, that fosters surgical education and training. The college currently includes 139 accredited hospitals in 14 Sub-Saharan countries: Botswana, Burundi, Ethiopia, Kenya, Malawi, Mozambique, Namibia, Rwanda, South Sudan, Sudan, Tanzania, Uganda, Zambia and Zimbabwe. Accredited hopsitals are hospitals that are certified by COSECSA to sites of surgical training after capacity assessment to accomodate trainees for COSECSA membership and fellowship surgical training. The mission of COSECSA is to increase the accessibility of surgical services, especially to the rural populations of Africa, by standardizing and widening access to surgical training, skills and knowledge with a mandate to advance the science and practice of surgery in the region (11).

The aim of this study was to assess the resource capacity and barriers to effective practice of laparoscopic surgery in the COSECSA accredited hospitals, to determine the gaps and challenges, and to provide recommendations for the improvement of the system for future laparoscopic surgery programs.

# Material and Methods

# *Research method and setting*

This was a cross-sectional study based on the experience of health professionals. The authors conducted a multinational survey from January 2021 to October 2021 using a structured questionnaire containing numerical scoring and close-ended questions. Open-ended questions were asked to reveal the challenges and solutions for the practice and safety of laparoscopic surgery in LMICs. The questionnaire was distributed to surgeons in different accredited training hospitals in 16 countries using an online survey form. Implied consent was obtained from all the study participants when they registered on the web-based survey. The COSECSA Institutional Review Board (IRB) (IRB Registration Number: 00011122) approved this study.

*Data collection*

Questions focused on the capacity of the hospitals in terms of trained staff, equipment, instruments and surgical activities in laparoscopic surgery. The shortfalls solutions and recommendations were identified to fully embrace the present practice of laparoscopic surgery in the respective hospitals.

# *Data analysis*

Data were recorded using Microsoft Excel spreadsheets and exported to International Business Machines (IBM) Statistical Product and Service Solutions (SPSS) software platform version 25 for analysis. Descriptive data were used to generate frequencies and percentages for categorical variables. The median and interquartile range (IQR) was used to describe the central tendency and dispersion of continuous data, respectively.

# Results

*Demographic characteristics*

A total of 94 surgeons working in 44 hospitals located in 16 countries participated in the survey (Fig 1). Table 1 shows that the majority of respondents were general surgeons (n=75, 79.7%), other specialties included urology (n= 12, 12.8%) and paediatric surgery (n= 7, 7.4%). Senior surgeons accounted for 60.6% of participants, more than 40% had a managerial position and approximately 20% were surgical trainees. In terms of the status of the hospital, the majority of respondents practiced in public hospitals (n=66, 70.2%) including 46.8% in university teaching hospitals and 39.4% in referral hospitals.

*Hospital resources capacity and surgical volume*

According to the respondents, the COSECSA hospitals had a median per hospital of 3 (1-15) surgeons practicing laparoscopic surgery, 2 (1-10) laparoscopic towers, and 2 (1-10) sets of laparoscopic instruments. An average of 10 (1-65) laparoscopic procedures per month was reported (Fig 2). Regarding the laparoscopic procedures performed within the COSECSA hospitals, the majority of participants (n=95.6%) reported that cholecystectomy is the commonest procedure performed. Considering the other procedures frequently performed, diagnostic laparoscopy (90.1%), appendectomy (80.2%), adhesiolysis (70.3%) and hernia repair (51%) completed the top 5 (Fig 3). The participants declared that (n=70, 76.9%) of laparoscopic procedures are covered by health insurance, while it only covers (n=44, 48.4%) of laparoscopic consumables (Table 2).

*Challenges and barriers to routinely performing laparoscopic surgery*

Figure 4 shows the perceived barriers reported by the participants that prevent the routine performance of laparoscopic surgery. The five top barriers cited included lack of consumables (n=75, 79.8%), limited availability of equipment (n=70, 74.4%), lack of skilled surgeons (n=64, 68%), patients unable to afford laparoscopic surgery (n= 40, 42.5%) and complicated cases (n=34, 36.2%). However, participants agreed or strongly agreed, that a skilled anesthesia team (n= 29, 30.9%,), anesthesia equipment (n=19, 20.2%), CO2 availability (n=15, 16%), electricity power supply (n =14, 14.9%) and equipment maintenance (n=34, 45.7%) were among the most important challenges when performing laparoscopic surgery (Table 3).

In terms of recommendations that could improve laparoscopic practice, the participants proposed to improve three specific areas: infrastructure and equipment (85%), training of the surgical team (80.2%), and cost with health insurance cover of laparoscopic consumables (24.2%) (Fig 5).

**Discussion**

The introduction of laparoscopic surgery in developed countries has revolutionized surgical practice with its superior advantages over open surgery in many surgical disciplines, however its adoption in developing countries has been sporadic and minimal (4). Although commonly cited challenges include the apparent lack of resources and trained personnel (4,5,9,10), recent studies have shown that these reported challenges might not be the only significant barriers and further investigations are recommended. The aim of this study was to estimate the resource capacity and identify obstacles to the effective practice of laparoscopic surgery in the COSECSA region. The findings from this multi-country and multicentre survey showed that the resource capacity is insufficient, that the practice of laparoscopy is limited to basic procedures and that the laparoscopic procedures and consumables are not fully covered by health insurance in different COSECSA-accredited hospitals. Five key barriers emerged from the data: 1) lack of consumables, 2) limited amount of equipment, 3) unavailability of skilled surgeons, 4) unaffordable laparoscopic surgical services and 5) absence of practice in complicated and advanced cases. Additionally, this study also identified important challenges that have not been adequately addressed in previous research writing on the barriers to the implementation of laparoscopic surgery in LMICs. These include: lack of skilled anaesthesia teams and anaesthesia equipment, the reliable availability of CO2, control of the electricity power supply and equipment maintenance. While the practice of laparoscopic surgery is quite limited in the COSECSA region, in some countries, especially in Kenya, minimal access surgery is acceptable to the patients and significantly favourable outcomes have been established in all cases undertaken (12).

Unavailability of skilled surgeons and a limited amount of equipment have been cited as barriers in this study, and these findings have also been reported by many authors citing the fact that lack of appropriate personnel and the high cost involved in acquiring modern equipment are some of the challenges faced by laparoscopic surgery in developing countries (13,14). Others studies have reported that the lack of resources and education are only two of the potentially numerous challenges in the complex problem of the adoption of laparoscopic surgery in LMICs (15,16).

In literature, some surgeons have reported that laparoscopic surgery is not done routinely in complicated cases, as they prefer to perform open surgery due to the lack of expertise in advanced laparoscopic surgery. According to other reports, laparoscopic surgery is a time-consuming approach and surgeons are less willing to practice more technically complicated cases (16), and only a limited number of surgeons perform complex and advanced laparoscopic surgery (17). It has been reported that, the expertise and skills associated with a change in practice were found to play a greater role in the adoption of laparoscopy than has been reported in the current literature (16).

The high cost of laparoscopic services and the lack of availability of laparoscopic consumables are among the top five barriers cited by the participants in this study, and these findings are similar to many studies that have been carried out in LMICs (18,19), with some authors questioning whether the benefits are justifiable when even basic supplies are scarce (16). However, the economic situation of these countries is not homogeneous and several powerful incentives exist to encourage LMIC hospitals to adopt laparoscopic surgery (10,16). Farrow et al. also found that poor access to training, laparoscopic equipment, equipment maintenance and consumables were among the obstacles barring access to laparoscopy in developing countries (17).

Laparoscopic consumables are prohibitively expensive and unaffordable for many patients in developing countries. The results of this study have shown that laparoscopic services and consumables are not fully covered by health insurance, and a significant number of COSECSA countries do not have community health insurance to cover these expensive procedures and consumables. Even in countries where health insurance covers the services provided, this is done through private health insurance that is equally inaccessible to patients from lower socio-economic classes. This situation requires adaptation strategies for financing including the implementation of policies for community health insurance cover and also strategic partnerships with pharmaceutical firms for cost reduction, thus allowing easier access to services.

The results of this study also show that there are still other challenges that prevent surgeons from embracing laparoscopic surgery in their routine surgery; this includes insufficient anaesthesia staff and anaesthesia equipment, and the maintenance of medical equipment. It is crucial that the whole surgical team including surgeons, anaesthesiologists, and nurses, should be trained in the principles and practical aspects of laparoscopic surgery. The practice of laparoscopic surgery requires specialized knowledge and skills for surgeons and nurses both to work directly with this technological approach and to interact effectively on an interprofessional level with other members of the surgical team (20). Additionally, the maintenance of laparoscopic equipment, which requires both additional time and knowledge, discourages surgeons from committing to this technology (16).

Knowledge of the instruments used is essential when performing laparoscopic surgery, therefore the training and practice of laparoscopic surgery in LMICs could be improved and made more widely available through postgraduate medical education (10).

Pneumoperitoneum using CO2 is known to be common and very essential as a prerequisite to operate safely in laparoscopic surgery. The lack of accessibility to CO2 has not yet been sufficiently discussed in the literature as being a common obstacle to laparoscopy; it is a costly undertaking in LMICs, and some authors proposed the development and use of “gasless” laparoscopy in LMICs as an alternative for countries with a shortage (10,21).

Although sub-Saharan countries face many surgical challenges, laparoscopic surgery is particularly beneficial and can be feasible and safe. However, innovation and coping strategies are required to sustain the practice of laparoscopy in these countries (22) while local adaptation techniques have facilitated cost reduction (23). There has been an improvement in the acceptance of laparoscopic procedures among patients (23) and surgeons have shown a real need and interest in increasing the implementation of laparoscopic practice in the COSECSA region (17).

**Limitations**

Two COSECSA countries were not represented in our study, notably Sudan and South Sudan; conversely, Rwanda was over-represented, undoubtedly due to the geographic location f the principal investigator. The accuracy of responses cannot be verified as the survey was carried out online. It involved a limited number of hospitals, namely 44, but given that COSECSA has 139 accredited hospitals this is a significant proportion.

**Conclusion and recommendations**

The practice of laparoscopic surgery in the COSECSA region is currently limited. Common barriers to laparoscopic surgery include unaffordable services and consumables, unavailability of skilled surgeons, a lack of access to appropriate equipment, inaccessibility of CO2 and the need for maintenance of laparoscopic equipment. Considering the above issues, the best initial targets for intervention to improve access to laparoscopy in these countries will be the following:

1. Capacity building in terms of surgical workforce, including surgeons, anesthesiologists, nurses and biomedical engineers by creating specific laparoscopic training programs and a progressive integration of laparoscopic training in existing postgraduate surgical studies but also in the routine surgical practice

2. Policy makers and hospital administrators should put in place innovation and adaptation strategies to support the practice of laparoscopy by creating a collaborative framework with manufacturers and pharmaceutical companies to facilitate the acquisition of low-cost laparoscopic equipment, instruments and consumables to allow affordable access to services but also a clear plan for the maintenance of medical equipment.

3. Awareness of the procedure by the public or patients could also be a driver for the policy makers if there is demand for the service.

These strategies may improve patient acceptance of laparoscopic procedures and encourage surgeons to adopt laparoscopic practice.

**Comments to Figures and Tables**

Table 1. Hospital and Professional profile of the participants

Table 2. Health insurance cover of laparoscopic procedures and consumables

Table 3. Perception of respondents to laparoscopic surgery challenges at their Hospital

Figure 1. Number of responders of Hospitals affiliated to COSECSA

Figure 2. Resources and performance at the Hospitals of respondents

Figure 3. Percentage of procedures performed using laparoscopy

Figure 4. Barriers to the routine performance of laparoscopic surgery

Figure 5. Aspects to improve laparoscopic surgery in Hospitals

**Disclosures**

Dr. Martin Nyundo, Dr. Nathalie Umugwaneza, Dr. Abebe Bekele, Dr. Laston Chikoya, Dr. Julien Gashegu and Dr. Olivier Detry declare that they have no conflicts of interst or financial ties to disclose.

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