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ORIGINAL SCIENTIFIC REPORT

Acquisition of Surgical Skills by Final-Year Medical Students in State-Owned Medical Schools of Cameroon: Are We Doing Any Good?

Alain Chichom-Mefire[1] · Njel Gaby Keith[2] · Acho Abongwa[2] · Dickson Shey Nsagha[2] · Marcelin Ngowe-Ngowe[1]

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Abstract

Introduction World Health Organization recommends that basic surgical care be administered at the district level. In the absence of qualified surgeons, general practitioners are sometimes proposed to bridge the gap. Medical curricula in low- and middle-income countries must be designed accordingly. The aim of this study was to assess the achievements of training of undergraduate medical students in Cameroon towards meeting this objective.

Methods A descriptive cross-sectional study was carried out in the four state-owned medical schools in Cameroon. All students who had completed all clinical rotations were assessed with a self-administered questionnaire for their exposure and self-perceived comfort in conducting some selected basic surgical skills and procedures.

Results A total of 304 (87.6%) students returned filled questionnaires. Their self-perceived comfort in surgical skills ranged from 25% (manual node tying) to 86% (surgical scrubbing). Adequate exposure to selected surgical procedures was 87% for repair of perineal tear complicating vaginal delivery, above 80% for caesarean section and incision and drainage of abscess, 73% for cast immobilization of extremity fracture and just above 50% for hernia repair and appendectomy. It was as low as 3% for bowel resection and anastomosis. The choice to perform extra-curricular activity for skills improvement was significantly associated with adequate exposure ($p < 0.05$).

Conclusion Overall, the mastery of practical surgical skills and basic surgical interventions by final-year medical students in Cameroon is insufficient. There is need to reinforce the training and assessment by creating the conditions for an appropriate exposure of medical students during surgical rotations.

Introduction

Surgery is an important cornerstone in the provision of primary health care services. However, due to the decreasing rural general surgical workforce [1, 2] and the increasing workload [3, 4], surgery has been described as the neglected stepchild of global public health [5]. To meet the high surgical needs of populations [6], non-surgeons have to be involved in providing surgical care, especially in low- and middle-income countries [7].

General practitioners, particularly in sub-Saharan Africa, should thus be able at the end of their curriculum to perform a number of emergency and selected elective surgical operations [8, 9]. Prompt referral of cases that are beyond the physician's scope of practice must, however, not be delayed.

With the recommendation for certain surgical procedures to be performed at the district hospital [10], practical surgical skills acquisition has been included in the curriculum of government-run medical schools in Cameroon. As a result, medical students need to have appropriate

✉ Alain Chichom-Mefire
chichomefire@gmail.com

[1] Department of Surgery, Faculty of Health Sciences, University of Buea, Buea, Cameroon

[2] Faculty of Health Sciences, University of Buea, Buea, Cameroon

exposure to a defined range of surgical operations with the understanding that this orientation does not have any negative impact on patient outcome and quality of care [11].

In this view, final-year medical students in Cameroon are expected to be able to perform a number of surgical operations. Little is, however, known about the level of exposure of graduating general practitioners to surgical skills.

The aim of this research was to assess the level of exposure of final-year medical students in four state-owned Cameroonian medical schools to practical surgical skills including performance of surgical operations.

Materials and methods

Design and settings

This descriptive cross-sectional study which covered a period of five months (from December 1, 2017, to April 30, 2018) was conducted in the four state-owned medical schools in Cameroon. At the time of the study, medical training in Cameroon was offered by four state-owned institutions and two private medical schools. Since 2014, the medical curriculum has been harmonized and is identical in all medical schools. The duration of medical studies in Cameroon is 7 years, the last year being dedicated to research. Students must have completed all clinical rotations at the end of their sixth year. One single entrance examination is organized at the national level to select candidates eligible for medical training. At the end of the sixth year (once all clinical rotations are completed), candidates to the medical profession undergo a unique national graduating examination also organized at the central level. During this last year, all students must submit and defend an original research thesis.

In addition to lectures on semiology (the science of symptoms and signs in medicine) and on surgery administered in the faculties, clinical rotations in surgery start on the third year and are conducted in dedicated teaching surgical units under the leadership of faculty lecturers. They include the following:

- A clinical and radiological semiology rotation of 2–3 weeks in third year during which basic signs and symptoms are discussed and demonstrated bedside.
- A junior rotation of 8 weeks in the fourth year during which students practice history taking and clinical examination. They are expecting to master this process at the end of this rotation and are usually authorized in the operative room as observers.
- A senior clinical rotation of 6–8 weeks in the fifth year during which students are expected to demonstrate mastery in clinical assessment, diagnostic discussion and principles of management. During this rotation, they are authorized in the operation room to serve as both observers and first or second assistant.
- A "housemanship" rotation of 4 weeks in their sixth year during which student are involved in patients management in a surgical department with broad responsibilities and the participation in the operative room as first assistant or main operator under supervision
- An "Integrated Medicine" rotation of 16 weeks designed in the spirit of a community-based problem solving and during which students are sent to preselected rural or a semi-rural hospitals under the supervision of qualified medical doctors. They are given the opportunity to practice the selected surgical procedures under supervision.

At the end of their training, graduates are considered "ready-to-serve" and posted in various health institutions in the country.

We opted to limit our analysis to state-owned medical schools for convenience. The medical schools concerned are the following:

1. The Faculty of Medicine and Biomedical Sciences (FMBS) of the University of Yaoundé 1 located in the capital city of Yaoundé which is considered as the mother of all medical schools because it was the first to open its doors in 1969. In addition to the training of general practitioners (180 admissions every year), this faculty also offers undergraduate and postgraduate training in various fields such as dentistry, pharmacy, biomedical sciences and public health and hygiene. This is also the only medical school offering a residency programme in the various fields of medical practice, including surgery.
2. The Faculty of Medicine and Pharmaceutical Sciences (FMPS) of the University of Douala, the largest city of the country, offers mainly undergraduate training in medicine (120 admissions per year) and pharmacy. It opened its doors in 2006.
3. The Faculty of Health Sciences (FHS) of the University of Buea is one of the institutions offering undergraduate medical training exclusively in English language. In addition to undergraduate medical training (85 admissions per year), this faculty proposes undergraduate and postgraduate training in nursing, medical laboratory sciences and public health and hygiene.
4. The Faculty of Health Sciences of the University of Bamenda located in the English-speaking north-west

region of the country offers undergraduate training in medicine (85 admissions per year), nursing and medical laboratory sciences.

Study population

We targeted all medical students from selected medical schools who had completed all clinical rotations. These included all students in seventh year and those at the end of the end of their sixth year. All eligible students were approached.

We excluded from this study all medical students who dropped out or suspended their studies after the sixth year; or had interrupted their studies for two or more academic years; or had repeated more than one level during their training.

Procedure

After obtaining an ethical approval from the Institutional Review Board of the University of Buea under number 713-12, a self-administered bilingual (English and French) pretested questionnaire was proposed to the study participants by either e-mail or face to face. This questionnaire assessed their involvement in ten surgical procedures extracted from the list of procedures included in the list of objectives of the Cameroon medical training curriculum (Table 1). The choice of these ten procedures was focused on surgical interventions considered priority by WHO [10].

The role of students in the procedure (either simple observer, first or second assistant or operators with or without supervision) was recorded. The questionnaire also assessed their participation to various theoretical lectures on basic surgical skills and their perceived self-confidence in performing basic surgical skills and interventions using a Likert scale. They were finally asked whether they followed other clinical rotations in addition to the ones programmed within their normal curriculum.

Adequate exposure for a given surgical procedure or skill was empirically defined as one or more of the following;

1. Having observed the procedure or skill 5 times or more AND served as first or second assistant at least twice AND performed it with or without supervision at least once.
2. Having observed the procedure or skill 5 times or more AND served as first or second assistant at least 5 times.

Data were analysed using EPI INFO version 7.2 computer software. The Chi-square (χ^2) test and logistic regression were used to test for associations. Statistical significance was set at $p < 0.05$.

Table 1 List of surgical interventions included in the objectives of undergraduate medical students in Cameroon

Serial number	Type of surgical intervention or skill
1	Tracheotomy
2	Endotracheal intubation
3	Circumcision
4	Incision and drainage of abscess
5	Resection of soft tissue benign tumours
6	Repair of episiotomy or simple perineal tear
7	Appendectomy
8	Hernia repair (groin and umbilical)
9	Reduction and cast immobilization of fractures and dislocations
10	Caesarean section
11	Salpingectomy for rupture ectopic pregnancy
12	Caesarean section
13	Explorative laparotomy
14	Intestinal resection and anastomosis
15	Chest tube placement

Results

Of the 347 medical students initially approached, a total of 304 final-year medical students returned properly filled forms, giving a response rate of 87.6%. As shown in Table 2, the participants' ages ranged from 22 to 29 years with a mean of 24.95 ± 1.6. Females were significantly younger than males ($p < 0.001$).

Table 2 Demographic characteristics and faculty of origin of students in state-owned medical schools in Cameroon

Characteristic	Number	Percentage
Age (years)		
22	18	5.9
23	37	12.2
24	136	44.7
25	75	24.7
> 25	38	12.5
Gender		
Male	162	53.3
Female	142	46.7
Faculty of origin		
Faculty of Health Sciences of University of Buea	84	27.6
Faculty of Health Sciences of University of Bamenda	52	17.1
Faculty of Medicine and Biomedical Sciences, University of Yaoundé 1	106	34.9
Faculty of Medicine and Pharmacy, University of Douala	62	20.4

Table 3 Proportions of final-year medical students who received lectures and declared self-confidence in some basic surgical skills

Basic surgical skill	Received lecture (%)	Perceived self-confidence (%)
Surgical scrubbing	260 (85.5%)	271 (89.1%)
Gowning and gloving	256 (84.2%)	264 (86.8%)
Handling instruments	243 (79.9%)	199 (65.4%)
Basic suturing	234 (77.0%)	186 (61.2%)
Instrumental knot tying	131 (43.1%)	180 (59.2%)
Manual knot tying	75 (24.7%)	180 (59.2%)

Table 4 Proportion of participants who had performed a procedure at least once and adequate exposure proportions to the ten selected surgical procedures

Procedure	Performed at least once (%)	Adequate exposure (%)
Hernia repair (all types)	126 (41.4)	166 (54.6%)
Appendectomy	101 (33.2)	157 (51.6%)
Bowel resection and anastomosis	10 (3.3)	32 (10.5%)
Perineal repair following vaginal delivery	253 (83.2)	263 (86.5%)
Caesarean section	139 (45.7)	247 (81.3%)
Salpingectomy for ectopic pregnancy	28 (9.3)	66 (21.7%)
Immobilization of fractures and plastering	219 (72.0)	222 (73.0%)
Circumcision	189 (62.2)	200 (65.8%)
Lump excision under local anaesthesia	156 (51.3)	152 (50.0%)
Incision and drainage of superficial abscesses	241 (79.3)	247 (81.3%)

Overall, a total of 172 (56.6%) of participants declared interested towards a future career in surgery. The odds of being interested in a career in surgery were very significantly greater for males (odds ratio 2.8795) than for females. Almost a third (31.58%) of participants admitted having been involved in extra-curricular activities (health campaigns, suture kits, etc.) to improve on their practical surgical skills.

As shown in Table 3, the majority of participants had received lectures on surgical hand washing and gowning/gloving. For other basic surgical skills, the majority (>50%) of participants felt confident in performing each of them. Those who received a lecture were significantly more likely to be self-confident in performing basic surgical skills ($p = 0.02$).

The exposure of students in ten selected surgical procedures is shown in Table 4. According to this table, over 70% of students had independently repaired a perineal tear, immobilized a fracture with a cast or incised/drained an abscess. The overall exposure rate ranged from 10.5% (intestinal resection with anastomosis) to 86.5% (repair of a perineal tear). The exposure rate for common procedures such as hernia repair or appendectomy was generally below 55%, and the proportion of those who had performed it independently was even lower. There was a statistically significant difference between students of different faculties for adequate exposure to seven of the ten surgical procedures ($p < 0.001$).

Logistic regression indicated that final-year medical students who had engaged in surgical health campaigns or any other extra-curricular activity to improve on surgical skills had significantly higher odds of having adequate exposure to surgical procedures ($p < 0.001$). This was particularly true for cast immobilization and incision/drainage of an abscess.

Discussion

The first medical school in Cameroon opened its doors to training in 1969, and the curriculum was just like many other African countries tailored to adapt this training towards meeting the needs of local populations. However, the training has never been assessed to verify whether this strategy was successful. This report is an attempt to fill this gap. It has the advantage of providing a gross general view of medical training in Cameroon as far as surgical skills and mastery of basic surgical procedures as recommended by WHO are concerned. Currently in Cameroon, it is highly debated whether medical schools' graduates should be placed in positions where they are given the opportunity

to further reinforce their skills before being posted in independent positions.

The expressed interest of graduates towards future surgical postgraduate training is probably influenced by the fact that they were informed of the fact the work was initiated by the department of surgery of one of the faculties involved in the study.

The findings seem to indicate that while lectures and bedside teaching providing access to the basic knowledge of these skills and procedures are relatively well covered, the overall exposure to the most basic surgical skills considered as priority such as appendectomy, hernia repair and caesarean section is still limited. Students apparently need to get involved into extra-curricular activities to improve their exposure and mastery.

The need to increase the number of surgical interventions carried out in Africa (and the world at large) [3, 4, 12, 13] and many countries is well established, and many countries fail to meet the basic surgical needs of their populations due to low surgical workforce [1, 6, 14, 15]. Thus, general practitioners and other non-specialist staff need to perform a range of surgical procedures in order to help meet the surgical needs of the population of less developed [8, 9, 16] and even developed societies [17]. As a result, graduating physicians, particularly in a low- and medium-income country like Cameroon, should be able to perform a selected number of surgical procedures in order to be able to provide surgical care at the district level. The coverage of teaching of skills observed in our study was comparable to those described in countries such as the UK [18]. This coverage was however lower than the one described by Davis et al. [19] who used an indirect method of assessment.

The range and variety of surgical procedures performed (3.3–83.3%) by final-year medical students in Cameroon were slightly narrower than those obtained in a study conducted in a similar setting [20] probably due to our differences in the selection of procedures to be assessed.

Being able to carry out a minor surgical procedure at the district level is a good base upon which further operative skills can be built with repeated exposure and practice [21]. More importantly, it also reduces patients' waiting time [22–24]. Similar to findings of existing literature [25], we noted that a sizeable proportion (over 60%, $n = 182$) of final-year medical students had adequate exposure to three out of four minor surgical procedures we assessed for. Half of our participants had adequate exposure to lump excision.

Caesarean section rate is often used as a metric of the level of coverage of access to surgery. Every graduating general practitioner from a medical school in Cameroon and other similar countries should be able to perform a caesarean section at the end of medical training [25]. Our exposure rate for caesarean section is concordant with that of a previous study [25]. In contradiction to findings in a previous study, a fairly good proportion of our students had achieved adequate exposure to fracture immobilization and casting. This is probably related to the presence of an orthopaedic surgeon in most teaching hospitals. The low exposure to hernia repair and appendectomy is probably explained by the overall low rates of performance of these procedures in low-income countries as compared to high-income countries [2, 26-28] and is probably explained by the overall poor level of provision of surgical services [4]. Comparable rates of exposures have been reported previously for these two procedures of critical importance [25]. Salpingectomy and bowel resection and anastomosis had the lowest adequate exposure levels (Table 3). The low proportion of participants with adequate exposure to salpingectomy approves the prediction made in a previous study [25].

The need to rely on extra-curricular activities is rare in developed countries just as Finland [20].

The gender difference towards interest in surgery as a worldwide problem [29–31] and probably explains the likelihood of adequate exposure females mostly to minor surgical procedures.

Conclusion

The current situation of surgical workforce in low- and middle-income countries such as Cameroon imposes the need for task shifting on undergraduate medical staff to perform a sizable number of basic surgical procedures. The harmonization of curricula of medical schools in Cameroon towards meeting this orientation is an asset which needs to be converted in terms of effective and appropriate exposure to surgical interventions intended to relieve the burden of conditions which have been recognized as priority. While the exposure to some procedures and the mastery of some surgical skills is encouraging, there is still much room for improvement in the mastery of essential lifesaving procedures such as hernia repair and appendectomy as caesarean section by all undergraduate medical scholars during their surgical rotations. This implies reinforcement of classroom and bedside teaching and a reorganization of rotations. Students should not need to rely on non-organized extra-curricular activities to achieve these objectives. Assessment also needs to be adjusted accordingly, and only students who have proven full mastery of these essential skills and procedures should be authorized to graduate.

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Compliance with ethical standards

Conflict of interest None.

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