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MINIMAL INVASIVE SURGERY (MIS) ARES 2016-TRAINING CURRICULUM PROGRAM IN CAMEROON: ASSESSING ITS APPLICATION IN GYNAECOLOGY TWO YEARS AFTER IMPLEMENTATION AT DGOPH

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Background: Limited centers perform minimal invasive surgery (MIS) in Cameroon despite known benefits. A Masters in Laparoscopic Surgery is currently offered thanks to a partnership between the University of Douala and UniversitéLibre de Bruxelles (ULB) supported the Belgian Government through ARES (Académie by de Rechercheetd'EnseignementSupérieur) in an attempt to bridge this gap. We sought to assess the first two years of training, then compare the 2018(first 12 months) performance with the 2019(last 8 months) performance of students on the practice of MIS in the Gynecology unit of the Douala Gyneco-Obstetric and Pediatric Hospital(DGOPH). Objectives: 1) evaluate the change in the proportion of procedures by MIS; laparoscopy (LAP) and hysteroscopy (HYS) since training was introduced; 2) evaluate progress made in MIS carried out with students as main operators, 3) plot a graph of the evolution in duration of surgeries. Methodology: It was a descriptive study with data obtained from theatre records, entered into a pre tested questionnaireand analyzed. Ethical clearance was obtained from the hospital ethics board and threshold for statistical significance put at p less than 0.05. Results: The proportion of gynecologic MIS with students as main operators was 27.6% in 2018 and 78.2% in 2019. There was a linear tendency towards increase in overall duration of surgery as training

progressed.**Conclusion:**Introducing the Masters program increased the proportion of MIS in gynecology, a 3 fold increase in MIS performed by students, though with a tendency of increase in duration of surgery.

Key words: MIS, gynecology, ARES-training, performance.

INTRODUCTION:

Limited Centers are available for laparoscopic surgery in Cameroon, with just about 7 percent of overall surgeries being done by laparoscopy in those centers [1]. The demand will keep rising as awareness increases on the benefits of this type of surgery. These include short duration of admission, non distortion of anatomic planes during surgery, minimal tissue damage and reducedlong term risk of adhesion, reduced duration of post operative analgesia, rapid resumption of activities for patients, and the overall economic benefits of speedy recovery [2]. Vulgarizing the training will increase the number of centers and surgeons and eventually reduce the cost of surgery which is also a handicap for patients [3, 4]. Minimal Invasive Surgery (MIS) is not routinely taught in post graduate training in Low and Middle-Income Countries (LMIC) like Cameroon. It would be more cost effective to do on the ground training. In addition, immediate familiarity with instruments and local environment will be achieved alongside continuous coaching as some foreign trained surgeons often find difficulties in settling in upon returning and eventually lose the skills acquired [5]. A Masters in Laparoscopic Surgery is currentlyoffered by the University of Douala, thanks to a partnership with UniversitéLibre de Bruxelles (ULB) supported by the Belgian Government through ARES (Académie de Rechercheetl'EnseignementSupérieur) in an attempt to bridge this gap. The Douala Gyneco-Obstetric and Paediatric Hospital (DGOPH) is a category 1 hospital (Highest level of referral in Cameroon) referral hospital for Gynecologic and pediatric pathologies. Prior to this training there was only 01 surgeon trained in MIS. This hospital was one of the approved training sites and in the first cohort of trainees, 04 specialists (03 gynecologists and 01 general surgeon) were enrolled from DGOPH. The department of gynecology in DGOPH was privileged to have one of the training facilitator working in the hospital. Prior to this program MIS was already being practiced on a small scale in the hospital. The overall duration of training was 02 years, with the first year being theoretical and practice on box trainers, with minimal clinical roles; and the second year reserved almost exclusivelyfor the clinical phase. We thought it necessary to assess the effects of the training on the practice of MIS in the department of gynecology.

OBJECTIVES

Research Hypothesis: With time, the trainees become more autonomous and the duration of surgery decreases.

General Objective: Our overall goal was toassess the qualitative and quantitative impact of the Masters program on the practice of MIS as applied to gynecology in DGOPH.

Specific Objectives:

- 1. Compare the proportion of gynecologic MIS with previous statistics and describe the trend.
- 2. Evaluate the number of MIS done with student Gynecologists as main operators as study period evolved.
- 3. Plot a learning curve for the students as the study period evolved
- 4. Obtain baseline data for future evaluation of the improvement in efficiency and efficacy of the young graduates in
- 5. METHODS

Study design: It was a cross sectional retrospective Initial descriptive study at DGOPH

Study period: January 1, 2018 to August 31, 2019. The students began their training in October 2017 and ended in September 2019. The first year of training ended in July 2018, and the second year in September 2019.

Inclusion criteria:

- All gynecologic MIS done during the study period were considered. These included procedures performed during organized internship in whom the gynecologists of DGOPH participated, or routine hospital MIS procedures in DGOPH, be they laparoscopy (LAP), hysteroscopy (HYS) or a combination (LAP+HYS).
- 2) The procedure must have been performed by a DGOPH Masters student and supervised by any Tutor of the program.

 Complete information from inpatient records and surgery registers on the MIS procedure was mandatory

Exclusion criteria:

- 1) Cases performed by non tutors (visiting laparoscopic surgeons).
- 2) Cases performed by Tutors without DGOPH Masters students as assistants
- 3) Cases with poorly recorded data in hospital register.
- 4) Cases conducted outside the study period

Data collection, analysis and presentation:

Theatre registers and patient files were consulted and data on the date, diagnosis, hospital structure, type of procedure, surgical team composition, complication/incident, and duration of surgery were entered into a pre filled and tested questionnaire. The data was entered into a computer and analyzed with the EPI INFO version 3.0 software and EXCEL charts for presentation and trends. With respect to the timing of procedures, we considered all gynecologic MIS procedures performed in 2018 as those performed in first year of training, and those performed from January 1 to August 21, 2019 as those performed during second year of training. The surgical teams were subdivided into 05 groups:

- **Group 1**: Tutor assisted by student(s). The tutor and one or more students scrubbed for the procedure but the student's role was that of an assistant.
- Group 2. Student(s) assisted by tutor. One or more students and a tutor would scrub but the tutor's role would be that of an assistant.
- Group 3: students with on the field tutoring. Two or more students including the tutor would scrub. One student will be the main operator while the other assists. The tutor will guide the students, intervening only to correct or re position the operators.
- Group 4: Students with off field tutoring. In this case the tutor does not scrub in but watches the students perform the procedure, with external coaching, often on the screen.
- Group 5: Student, then taken over by Tutor. These were initially group 2, 3, or 4 procedures which became complicated, technically difficult or risky for the patient, causing the tutor to step in as main operator and complete the procedure.

The results were analyzed with respect to number of surgeries, main operators, and duration of surgery. The 2018 performance was matched with the 2019 performance, with bar charts and trend curves used to evaluate evolution of the DGOPH students.

Ethical consideration:

Vetting was obtained from the Ethics committee of DGOPH.Patient Names were not entered into the questionnaires.

RESULTS

In all, 122 MIS procedureswere performed during the study period, with 113 involving at least a student of the program. This represented 20.5% and 23.6% of all gynecologic procedures in 2018 and 2019 respectively. <u>Table 1</u> shows the progression in MIS procedures in DGOPH over the years.

Table 1: Evolution of MIS procedures in DGOPH: N=237

The 113 procedures with students as part of the team are shown in Figure 1.

Figure 1 : Distribution of type of MIS procedure involving students by year of training. N=113

During the 02 year study period, 52% of all MIS procedures were performed with students as main operators. This witnessed a 3 fold increase from the first year (27.6%) to the second year (78.2%)as shown in <u>figure 2</u>. Thus, there was a noticeable increase in 2019, of the number of surgeries done with tutoring (red circle) and decrease in number of surgeries carried out with tutors as main surgeons (dark circle).

Figure 2 : Evolution of surgical teams over the 02 years of training

The biggest change noticed was in the subgroup of laparoscopy, with a 6 fold increase (12.5% to 75.8%). As shown in <u>figure 3</u>, only 03 out of the 24 cases of laparoscopy were performed by the students in 2018 (with tutor as surgical assistant), while 22 of the 33 cases in 2019 were done by the students with tutoring (red circle).

Figure 3 :Laparoscopy with respect to surgical teams. N=24 in 2018, N=33 in 2019

We then took into consideration the impact of training on the duration of surgery, generally, and the learning curve with respect to duration of surgeries performed by the students. Duration of surgery was defined in minutes as the time from incision to dressing. Figure 3 shows a plot of the duration of surgery against date of surgery, from January 2018 to august 2019.

Figure 4 shows the scatter plot, and trend line which represents the evolution in number and duration of all MIS procedures from January 2018 to august 2019. The positive gradient of 0.345 shows progressive increase

Figure 4 : Evolution of duration of surgery with time. N=113

When the subgroup of all MIS procedures in which students were the main operators (59/113) was considered, the gradient was even steeper (0.436) as shown in <u>figure 5</u>.

Figure 5 : Evolution of overall number and duration of surgery with time; Trend line. N=113

The scatter plot in figure 6 also reveals an increase in the dot density during the last year of training (red circle) for surgeries performed with students as main operators.

Figure 6 : Evolution of duration and number of MIS procedure by students with time; Trend line. N=59

DISCUSSION

The increase in percentage of MIS with respect to all gynaecologic procedures didn't come as a surprise. The more surgeons are trained for a procedure, the more patients can be recruited. Prior to the training only one surgeon could do MIS and surgeries were programmed with respect to his availability. In a retrospective analysis including more than 4000 surgical cases by Dominguezand collaborators, the percentage of total cases performed by laparoscopy increased from 12.1% to 48.3% after integrating a fellowship-trained surgeon into an

established practice [6]. In this study, the surgeons felt that mentoring by a colleague with laparoscopic training was the most effective method for adopting minimally invasive surgery into their practice. The presence of a mentor in our team, in addition to visiting mentors alsohelped to raise the number. Such increases are also noted even during short term training [7]. This also explains the 3 fold increase in the number of procedures performed with students as main operators. Box training has been proven to speed up adaptation to life cases[7, 8]and the students only started box training by March 2019.We believe the increase was much more important for laparoscopic procedures because the potential risks involved in laparoscopic surgery for a beginner are more varied and life threatening than for hysteroscopy. The untrained surgeon is therefore more reluctant during the early years of training. This fear however is unproven as studies comparing complication rates often reveal identical figures in surgeries performed by beginner surgeons and those performed by experienced surgeons. Mán et al, in a cohort of 600 cases found no statistically significant complication rates in laparoscopic appendectomies done by residents or consultants [9].

The definition of "learning curve" remains controversial. The learning curve can be defined as the number of procedures needed for an average surgeon to successfully carry out a procedure [10]. When Wright introduced the concept in 1986 he was referring to the time taken to carry out an aircraft manufacturing procedure which will decrease by a constant factor as the number of procedures doubled[10].Progress can be evaluated by either statistical analysis or by a graphical representation [11, 12]. The choice of graphic representation was order to get a trend as time moved on. The students tripled the number of procedure performed by the end of their training. Though there was a linear increase in duration of surgery, we believe it was linked to the progressive participation of trainees as main operators in place of tutors as the training evolved. Furthermore, most learning curves are plotted on single procedures [6, 9, 10]. We however, included all gynecologic laparoscopies and hysteroscopies. As time goes by, the student takes on more daring surgeries hence increase operating time. The values at the end of the training can then be used as baseline values for subsequent statistical analysis of learning curve of young graduates.

CONCLUSION

Introducing the Masters program increased the proportion of MIS in gynecology, a 3 fold increase in MIS performed by students, though with a tendency of increase in duration of surgery. This clearly shows the effect of training additional surgeons on the number of procedures, even when they are still in training. This might not have been the case if the training was not done in the trainees' hospital of practice. Such training modules should be encouraged in other LMIC. The positive gradient of the slope of surgery time for trainees will take its full meaning when the trainees become autonomous, then their true learning curve can be appreciated.

What is already known on this topic:

- The percentage of total cases performed by laparoscopy increases after integrating a fellowship-trained surgeons into an established practice
- Facilities for the training and practice of surgical techniques have enormous impacts on the learning curve,
- Foreign trained African surgeons often find difficulties in settling in upon returning and eventually lose the skills acquired

What this study adds:

- Learning curve can be measured using the evolution in proportion of surgeries performed independently or with distant tutoring, not just overall number of procedures
- Duration of surgery during the training period can be used as baseline value to evaluate subsequent performancefor laparoscopic surgeons with no previous formal training

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Authors' contribution:HumphryNeng designed, collected data and wrote the manuscript. Alphonse Ngalame corrected the protocol and data collection sheet, and co wrote the manuscript, Inna rakya collected data, and corrected the manuscript alongside Augustin Limgba, and Robert Tchounzou. JB Ebimbe assisted in data entry and statistical analysis, while Jacob Souopgui and, Emile Mboudou supervised the work

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LIST OF TABLES AND FIGURES

Table 1:Evolution in the number of MIS procedures in DGOPH over 4 years. N=237

Year	Number of MIS procedures	Percentage of MIS in Gynaecology (%)
2016	63	15.1
2017	52	14.8
2018	71	20.5
2019	51(By August 31)	23.6



Figure 7 : Distribution of type of MIS procedure involving students by year of training. (N=113)



Figure 8 : Evolution of surgical teams over the 02 years of training N=113



Figure 9 : Laparoscopy with respect to surgical teams. N=24 in 2018, N=33 in 2019



Figure 4 : Evolution of duration of surgery with time. N=113



Figure 5: Evolution of overall number and duration of surgery with time; Trend line. N=113





Figure 6 : Evolution of duration and number of MIS procedure by students with time; Trend line. N=59