

Structured Hernia Training – A pilot Project.

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Background. The current surgical training of interns in Uganda consists of apprenticeship in surgery for 6 months, which in most cases offers inadequate training in surgical procedures. At the completion of this attachment, most interns are not capable of performing common surgical procedures including herniorrhaphy and Caesarean section. To address this inadequacy, a structured hernia course was designed and piloted at Mulago Hospital in Uganda.

Methodology. Six interns at the Mulago Hospital in Kampala Uganda volunteered to participate in the course pilot. Pre- and post-pilot written examinations, which included self-assessment of competency and knowledge of groin hernias and their repair, were compared using students' t-test. Both the surgical preceptor and the intern using a five-point ordinal assessment scale evaluated the surgical performance of each intern. The scores on the pre- and post-tests were evaluated using t-test. The median scores of the self-assessment questionnaires of interns were evaluated using Fishers exact test and the self-assessment and preceptor scores compared using a Wilcoxon signed rank test.

Results. There were no significant intra- or post-operative complications on the day of surgery. All inguinal hernia repairs, except for one, were repaired with local anaesthesia alone. All patients went home on the day of surgery. No postoperative complications were noted at four months. After the course all the six interns felt that they had adequate knowledge and skill to do those procedures (pValue = 0.18).

Conclusion. This pilot of a structured hernia course was found to be safe and a satisfactory means of training interns in inguinal hernia repair before they are posted to rural district hospitals.

Introduction.

The provision of surgical services and education is a great challenge in Africa¹. Professionals and institutions in Africa face the challenge of providing surgical care to their patients like surgeons everywhere, but they also face the problems of insufficient surgical supplies and drugs, a shortage of trained personnel, and an ever-increasing number of patients. Uganda with a population 24 million has only 57 fully trained general surgeons. Two-thirds of these general surgeons work in urban centres with 50% in the capital, Kampala. Eighty-five percent of the Ugandan population is rural and much of the rural Ugandan population does not have access to surgical care.

To address this problem, the Canadian Network for International Surgery (CNIS), in conjunction with 7 African medical schools including Makerere University, has been involved in undergraduate surgical education programs to enable generally trained doctors safely perform common surgical procedures². Mulago hospital administration approved the piloting of this hernia course focused

on interns. The purpose of the course was to increase surgical capacity so that competent hernia repair is available in rural communities. The focus of such training programs was to give primary care doctors the necessary skills to perform common procedures for life-threatening surgical conditions.

The two most important major operations required in rural Africa are Caesarean section and inguinal hernia repair. Strangulated hernias are the most common cause of small bowel obstruction in Africa. A study that compared surgical output to surgical need in East Africa showed that less than 15% of necessary inguinal hernias were repaired, including incarcerated hernias¹. In Zambia, it was estimated that over 85% of operations performed were not complex and could be taught to non-surgeons². A study from Ethiopia came to similar conclusions¹.

Due to the great need for inguinal hernia repairs the authors designed a 'Structured Hernia Course'. The course used three teaching modalities to facilitate and accelerate the learning process. Interns were recruited since many of them were expected to work in rural or

district hospitals soon after internship where hernia repair and small bowel resection and anastomosis are common surgical procedures done by medical officers.

The study objective was to determine if structured surgical education, which linked lectures, and simulation techniques directly with clinical training was safe for patients and an effective means of teaching inguinal hernia repair to interns. This study was similar to a Phase I drug trial where the primary objective is to assure that the intervention is safe for the patient. The secondary objective was to evaluate the efficacy of the course and validate the scoring system used to evaluate hernia repair.

Methods.

The course was directed at interns on a six-months attachment in general surgery at Mulago Hospital. Patients were recruited and screened by one of the authors (JF) a general surgeon and preceptor for the course. Patients were excluded if they were medically ill on pre-operative history and physical examination, if their hernia was recurrent or inguinal-scrotal. Patients volunteered to participate and all were informed that their repair would be done by an intern as an educational exercise. The procedures and all materials for the procedure were free of charge to the patients. On the morning of surgery the interns examined the patients and obtained informed consents. In the evening the interns examined their patients and wrote prescriptions prior to discharge.

This course linked three elements: interactive classroom teaching, practice at surgical technique on simulators, and supervised surgery on patients. The classroom teaching focused on embryology and anatomy of the inguinal region, signs and symptoms of groin hernias, pre-operative assessment, complications of hernia repair, informed consent, aseptic technique and material requirements. The details and principles of a Bassini repair, femoral hernia repair, small bowel resection, and regional block anaesthesia were reviewed^{2,3,4,5}. Emphasis was placed upon the anatomy of the groin region with the use of many anatomic pictures and diagrams. To facilitate learning the surgical techniques necessary to perform an inguinal hernia repair, students were given an opportunity to practice on simulators under direct supervision.

Four simulation stations were provided.

- The first station consisted of practicing knot tying using suture material or thread and a tying board².

- The second station consisted of a frame covered by different fabrics with each layer made to simulate one of 4 layers of the abdominal wall (skin, subcutaneous tissue, linea alba, peritoneum). This station was used to provide students with practice on how to open and close the abdominal wall³.
- In station three, the students had the opportunity to practice a small bowel resection. Animal small bowel obtained from the abattoir was used for this station. Students divided mesentery, performed the resection, and did a hand-sewn anastomosis⁴.
- The fourth station consisted of practicing a Bassini repair on a groin model developed specifically for this course. The frame for this model was a plastic human pelvis replica; the lower abdominal wall, inguinal canal, spermatic cord, inferior epigastric and femoral vessels and indirect hernia sac were attached to the pelvis, using materials locally available.

Each model had bilateral indirect inguinal hernias and each student had the opportunity to practice establishing a local block and both perform and assist on a Bassini repair. An anaesthesiologist participated in the lectures of Day 1 and the simulation exercises of Day 2 and was present continuously during the three clinical days to teach the interns how to perform the local blocks and to provide alternative anaesthesia if necessary.

To assess the student's knowledge of groin hernias and their surgical management, students were given a test prior to beginning the course. This test contained a combination of question types: multiple choice, matching, anatomic diagram labelling, and short answer. On the last day of the course, the students took a post-test, which was the same examination as the pre-test. The answers to the examination questions were reviewed with the students after the post-test.

Questions on the examination were divided into subcategories. These subcategories included questions pertaining to groin anatomy and different groin hernia types, general surgical knowledge and principles, as well as management and complications of inguinal hernia repairs. The pre- and post-test results were recorded as a percentage overall as well as the scores within the subcategories.

The surgical abilities of the interns were evaluated using the final hernia case as an examination. Both

the fully qualified surgical preceptor and the intern filled out a questionnaire evaluating the surgical skill demonstrated during the hernia repair. Thus the evaluation of surgical skill was done by an expert and by learner self-assessment.

The questionnaire consisted of ten items asking about how various steps or general surgical techniques were done through the course of the procedure with a range from 1-5. The median scores of the interns and preceptors on these ten items were compared using a Wilcoxon signed rank test.

Results.

Six interns, 3 male and 3 female, participated in the study. The patients were all male (N=18) with 13 unilateral and 5 bilateral hernias. Patients with bilateral hernias had only one side repaired. Four of the hernias were direct; the other 14 were indirect. The patients' ages ranged between 22 and 82 years with a mean of 39.5 years (SE ± 3.9).

All the patients were discharged on the day of surgery. All surgical procedures were done under local anaesthesia except in one who required a general anaesthetic due to failure of the local bloc. There were no significant complications on the day of surgery either intra- or post-operative. Sutures were removed on day 7 and at this time no haematomas or wound

infections were noted. No hernia recurrences were identified on repeat physical examination performed four months postoperatively.

The overall scores of the interns on the pre-test ranged from 33 - 64%. The post-test scores ranged from 69 - 90%. The test scores were sub-categorized into groups of questions: anatomy and groin hernia types, general surgical principles, and hernia repairs and their complications. The improvements in mean scores were highly significant in the overall evaluation and in two of the three subcategories (Table 1).

One of the interns scored a zero on the pre-test questions on general surgical principles; this resulted in a large SE in this subcategory thus the p-value only approached but did not reach significance.

The surgical preceptors ranked the students on surgical technique and key components of their final inguinal hernia repair. The scores ranged from 3 to 5 on a 5-point ordinal scale, which ranged from 1-5 with 5 being excellent. The interns completed the same evaluation as a self-assessment of their surgical performance. The median scores are summarized in Table 2.

Using the Wilcoxon signed rank test to compare the median scores of the preceptors to those of the interns, there was no significant difference between the median scores of the interns and their preceptors (p = 0.33).

Table 1. Pre and Post Course Objective Knowledge Evaluation.

Evaluation	Pre Course Test	Post Course Test	p-Value
Groin Anatomy	51 ±4.3	76%±3.25.	0.002
Hernia Types	57%±15.2	87%± 8.3.	0.068
Principles and Complications	51%± 4.4	87%± 8.3.	0.003
Overall Score	52% ± 5%	79% ± 3%	0.001.

The interns were asked at the beginning and end of the course about their self-perceived competence to do inguinal hernia repairs and small bowel resections. Table 3 summarizes their responses. There was an increase in the adequacy of knowledge and skill in inguinal hernia repair and small bowel resection as determined by self-assessment.

This improvement approached significance and if a one sided test had been used would have reached

significance with exact p values of 0.0303. As noted in table 3, there was not a significant change in the intern's willingness to perform hernia repair or small bowel resection after the course as several indicated that they would perform these procedures even when they felt they did not have adequate knowledge and skill to do so.

Table 2. Self and Preceptor Evaluations of Technique using a 5-point Rating Scale (p= 0.33)

Specific Surgical Technique	Median Score Intern Self Assessment	Median Score Preceptor Assessment
Placement of skin incision.	4	4
Opening of inguinal canal	5	4.5
Cord structure mobilization	4	4.5
Skeletonization of indirect hernia sac	4	4
Ligation of an indirect hernia sac	5	5
Closure of posterior wall of inguinal canal	5	4
Reconstitution of deep inguinal ring	5	5
Maintenance of homeostasis	4.5	5
Tissue handling	4	4
How well hernia repair was done overall	5	4

Table 3. Student Perception of their Knowledge and Skill (N = 6)

Self Report Question	Yes Response Pre Course Survey	Yes Response Post Course survey	Fishers Exact Test p-value
I have enough knowledge and skill to do an inguinal hernia repair	2	6	0.0606
I have enough knowledge and skill to do a small bowel resection.	2	6	0.0606
I would do an inguinal hernia repair on my own with my present knowledge and skill.	4	6	0.4586
I would do a small bowel resection with my present knowledge and skill	3	6	0.1818

Discussion

When using a new method of surgical teaching that involves patients, it is crucial that patient safety is not compromised. The results of this pilot confirm that the patients had no complications and did as well or better than would be expected for patients who received routine care. This method of teaching has been demonstrated to be safe and it is therefore ethical.

Using objective evaluations, significant improvement in the knowledge of interns was demonstrated in groin anatomy as well as inguinal hernia surgery and its complications. The anatomy of the inguinal region is often described as being complex and difficult for trainees to understand. Part of this complexity is due to an abundance of confusing and sometimes redundant nomenclature. When attempts are made to simplify the anatomic detail to make it relevant to groin hernia repair, the ability to train non-surgeons in the necessary skills to do an inguinal hernia repair is tenable¹.

Surgical education research has been exploring alternative methods of teaching surgical skills that may

enhance or accelerate learning. One modality is the use of simulators.² Simulators seemed an effective step linking the theory of the lectures of the first day to the actual performance of hernia repair on day 3 to 5. Simulation provided a three-dimensional image of the groin region and also gave students time to practice the motor skills necessary by performing an inguinal repair prior to entering the operating room.

Previous studies have demonstrated the validity of learner self-assessment and in this study the results of the self-assessment by the interns was not different from the evaluation by their preceptors³. This finding validates the 5-point ordinal rating scale used to evaluate the surgical skill of the interns. There was agreement in these evaluations that following the course the interns performed hernia repair correctly.

There was no significant change demonstrated in the willingness of interns to perform hernia repairs or small bowel resections before and after the course. Even if interns felt that they did not have enough knowledge or skill to do these procedures, they indicated in the pre-course questionnaire that they would still perform these procedures. This may mean

that the interns feel obliged to repair inguinal hernias irrespective of their competency. It is therefore imperative that surgical educators assure that medical officers posted to centres where generalists are expected to repair hernias, can actually do so competently.

This study demonstrates that the interns improved in their knowledge and skills in herniorrhaphy. This structured hernia course may, therefore, be a means for surgical educators to achieve the objective of assuring competency of medical officers.

Medical and surgical education should meet the needs of the populations to be served. In situations where manpower and physical resources are reduced, the development and training of these skills may need increased creativity and ingenuity⁴. The structured hernia course was designed to meet training needs in such an environment.

Surgical educators should take note that hernia repairs will be performed even if the intern does not believe that they possess the appropriate level of skill. Interns in Uganda are expected to perform hernia repairs therefore surgical educators must assure their competency. Structured education is one alternative to this challenge.

Conclusion

The structured hernia course is a safe and effective means of teaching hernia repair to interns. As medical officers will perform hernia repair it is important that surgical educators assure that they are competent. We recommend this method as an alternative means of learning hernia repair. It cannot be recommended as a replacement to traditional training until it has been demonstrated to be more effective. A multi-centre clinical trial to assess this question is planned.

References

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