Model based training for groin hernia repair in low-income settings

Study Team
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Background

To meet the need for surgical services, task sharing and task shifting is practiced to different extents in different countries. Sierra Leone and Ghana are two low-income countries in West Africa. The surgical human resource is very limited, especially in the countryside where most people live. Since 2011, a three-year training programme for Surgeon Assistant Community Health Officers (SACHO) is housed at Masanga Hospital in the Northern Region of Sierra Leone. This programme is run by a Norwegian Non Governmental Organisation, CapaCare, together with the Ministry of Health of Sierra Leone. To date, 31 SACHOs have completed the training programme. The impact on surgical volume in the country and also the safety of this practice has been documented for caesarean section, hernia repair and laparotomy (1).

Groin hernia is associated with a very large burden of disease globally and hernia repair is performed in all health care systems. It is the most commonly performed general surgical procedure in countries of all income levels but the volume of hernia repair is insufficient in low income settings. Human resource is a limiting factor and more healthcare personnel need to be trained to conduct surgical procedures to increase the volume of hernia repairs performed. This training must be effective and safe and result in surgical providers who can perform hernia repair with high quality even in places where resources are very scarce. Recent research shows that hernia repair can be performed by specialist surgeons, non specialist medical doctors as well as by Associate Clinicians with excellent outcomes in Uganda, Ghana and Sierra Leone (2)(3)(4). The next issue to be solved is how to train the large number of surgical providers that are required in order to meet the enormous need for hernia repair in LMIC.

This project is divided into several sub-studies which will evaluate the feasibility, effectiveness and costs-effectiveness related to model-based training for novice and future surgical providers. Innovative solutions to surgical training are needed both in low income settings where trainers are few and in high income countries where surgical volumes per trainee has reduced drastically over time.

Assessing the effectiveness of surgical training requires the measure of different indicators that correlate to the learning curve of a surgical procedure, one of those indicators is operating time (5)(6). Stabilization of operation time occurs when operating times seizes to vary significantly from procedure to procedure.

Question: Does the institution of a model-based simulation training in inguinal hernia repair influence time to stabilization of operating times when compared to an historical cohort?

Methods and materials

Method: Prospective cohort study

Study setting: This study will be carried out at the CapaCare Surgical Training Program (STP) from December 12, 2022-December 31, 2025. The STP is located principally at district hospitals to promote post-training retention in the provinces and avoid diverting resources from any informal training of MDs in the main teaching hospitals in the capital, Freetown.
The curriculum is based on the WHO Integrated Management for Emergency and Essential Surgical Care tool kit, developed by the Global Initiative for Emergency and Essential Surgical Care. The training lasts 3 years and the graduates are meant to be absorbed by the MoHS and posted to district government hospitals on completion of training. All associate clinicians (known as community health officers (CHOs) in Sierra Leone) and junior MDs who meet the minimum entry criteria are eligible for the STP. CHOs have 3-year basic medical diploma training to be in charge of community health centres.

Training intervention:
Video-based curriculum: Participants will be provided with visual (picture and video) teaching modules on inguinal hernia repair. The photos will be an overview of hernia anatomy and how to set up the inguinal hernia models. The photos will be given to the trainees in hard and soft copy at the time of the training. The video is available through Touch Surgery and shows, step-by-step, a typical sutured (modified Bassini) hernia repair. The trainees will be instructed how to access and use touch surgery.

Inguinal hernia simulation model: Participants will receive a simulation model to practice performance of sutured inguinal hernia repair. The model is a high fidelity anatomic scaffold printed from an Ultimaker 3-D printer. Attached to the scaffold are simulated anatomic structures for incision, dissection, and repair. The model was created with input from staff surgeons with experience in high- and low- income country settings. Prior to testing the model, we sought feedback from surgical trainees and educators.

Mastery-learning requirement: To assess the trainees progress during training on the models, an Observational Clinical Human Reliability Assessment (OCHRA) checklist will be used by the instructor. Once the instructor considers the trainee ready, two independent reviewers will assess the trainee readiness using the American College of Surgeons Operative Performance Rating System (OPRS). A passing score will be set to 4 or 5 to achieve mastery on the training model.

Outcomes
Primary outcome:
1. Stabilization of operating time
    a. Time to stabilization
    b. Number of procedures to stabilization

Secondary outcomes:
<u>Patient related outcomes:</u>
2. Postoperative complications in-hospital

Trainee related outcomes:

3. Ability to name anatomical structures
4. Trainee and trainer impression of the model based training
5. Number of attempts to passing score on the OPRS.
6. Time to passing score on the OPRS.
7. Score on the OPRS (attached).

Health economical outcomes:

8. Cost and cost effectiveness of the training intervention
9. Cost and cost effectiveness of hernia repair expressed in USD per DALY averted

Data Collection

Trainee data

Trainees will self-report demographic information in addition to information regarding their general surgical and hernia-specific experience before and after the training intervention. The experience will cover time of medical training and practice, time of surgical training, estimated number of operations performed, estimated number of inguinal hernia repairs observed and performed, and types of repairs performed/observed.

Testing data

1. A pre-test consisting of anatomical knowledge
2. A model-based test using OCHRA/OPRS tool will be filled by the instructors. Participants may have more than one attempt.

Survey (administered to participants and instructors)

1. A survey with qualitative and quantitative questions regarding:
    a. Video material, usage, and usefulness
    b. Difficulties in understanding video material
    c. Perceptions of video narrator
    d. Model experience, perception, and usefulness

Operative data

Trainees will report cases to the prospective registry. Logbook recording of roles during an operation builds upon the supervision definitions approved by the Joint Committee on Surgical Training (JCST) in the UK and Ireland. Observed is a procedure observed by an unscrubbed trainee. Assisted is where a trainer performs the key components of a procedure. Directly supervised (JCST category S-TS) is when the trainee performs key components of the procedure with the trainer scrubbed. Indirectly supervised (JCST category S-TU and P) is when the trainee completes the procedure from start to finish and the trainer is unscrubbed. Paper logbooks are signed and validated by trainers after each procedure and uploaded monthly (Microsoft® Excel format; Microsoft, Redmond, Washington USA) to a cloud server for review. The trainees will self-report operative cases, times, and complications.

Data analysis: Descriptive statistical methods will be used. Counts will be presented as number and percentage and continuous variables will be presented as mean and standard deviation. For comparison of groups, Chi square test will be used for counts and two-sided students t-tests will be used for continuous variables to assess superiority. Absolute differences with 95% confidence intervals will be calculated for the study endpoints.

Time to operative time stabilization curves will be represented using CUSUM charts, graphical presentation of the course of outcomes of a series of consecutive procedures performed over time. The charts will be compared to the historical cohort of trainees from CapaCare's program.

Ethical considerations

This is an educational intervention aimed at improving the quality of education trainees receive prior to operating on patients. Patients will not be at risk since the assessment and education is occurring on a hernia model. Patient data that is already being collected will be reviewed in order to assess the impact of the training on operative performance.

The proposed benefits to trainees and patients include decreased training on real patients, the opportunity to hone skills prior to operating on real patients, and opportunity to demonstrate technique prior to time in the operating theater. Possible benefits include fewer complications and decreased time to operative time stabilization.

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