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ORIGINAL SCIENTIFIC REPORT

Quality of Surgery in Malawi: Comparison of Patient-Reported Outcomes After Hernia Surgery Between District and Central Hospitals

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Abstract

Background District hospitals in Africa could meet the essential surgical needs of rural populations. However, evidence on outcomes is needed to justify investment in this option, given that surgery at district hospitals in some African countries is usually undertaken by non-physician clinicians.

Methods Baseline and 2–3-month follow-up measurements were undertaken on 98 patients who had undergone hernia repairs at four district and two central hospitals in Malawi, using a modified quality-of-life tool.

Results There was no significant difference in outcomes between district and central hospital cases, where a good outcome was defined as no more than one severe and three mild symptoms. Outcomes were marginally inferior at district hospitals (OR 0.79, 95% CI 0.63–1.0). However, in the 46 cases that underwent elective surgery at district hospitals, baseline scores for severe symptoms were worse (mean = 3.5) than in the 23 elective central hospital cases (mean = 2.5), $p = 0.004$. Also, the mean change (improvement) in symptom score was higher in district versus central hospital cases (3.9 vs. 2.3).

Conclusion The study results support the case for investing in district hospital surgery in sub-Saharan Africa to increase access to essential surgical care for rural populations. This could free up specialists to undertake more complex and referred cases and reduce emergency presentations. It will require investments in training and resources for district hospitals and in supervision from higher levels.

Introduction

Awareness of the huge burden of surgical conditions in sub-Saharan Africa (SSA) is growing [1]. In many countries, elective and emergency general surgery is only available in the few urban tertiary hospitals that are equipped [1] and staffed by specialist surgeons [2, 3]. Lack of trained staff and/or capacity to do general surgery at first-level (district) hospitals, on which rural populations rely for essential hospital care, is inequitable [1]. Delays in surgery for hernias and hydroceles result in increased morbidity, disabilities or fatalities [4, 5]. The lack of evidence from patient outcome studies to show that common major elective surgical cases can be done effectively and safely at district hospitals (DHs), which often means by non-physician clinicians (NPCs), has undermined surgical task shifting in countries facing health workforce challenges [1]. Without outcome evidence, perceived threats to the autonomy of the medical doctor profession [6], as well as concerns about patients' safety [7], may determine national policies.

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The estimated need for inguinal hernia repair, a WHO priority procedure for developing countries [8], is 205/100,000 population, annually [4]. Untreated hernias reduce economic output, [9, 10] are disabling; and are a common cause of death, especially for rural dwellers with poor access to hospitals [11–13]. This study compared patient-reported outcome measures (PROMs) at baseline and after hernia repair, one of the most common surgical procedures in the region [14], between cases conducted at central level and those done at DHs in Malawi. PROMs are increasingly used and accepted for measuring effectiveness of interventions in treatment outcomes research [15, 16]. They measure the dimensions of treatment of most importance to patients [17], and while conceptually different to quality-of-life (QoL) approaches [15], in practice QoL tools are often used in PROMs research [18, 19].

Malawi (population circa 18 million, with 16% living in urban areas [20]) relies on a network of 50 DHs for meeting the safe surgical service needs of rural populations [21, 22]. DHs are understaffed and under-resourced [23]. Infrastructure and availability of trained healthcare specialists at tertiary level is generally better [23, 24], and complex surgical cases that cannot be dealt with at DHs facilities are referred to its four central hospitals (CHs) [25]. Malawi's 42 surgeons [26] are located in the main cities. District-level surgery is almost wholly undertaken through 'task shifting' to clinical officers (COs) [6, 27, 28], despite lack of systematic supervision from higher levels [11, 29]. While studies comparing NPCs and medical officers (MOs) have reported comparable outcomes in first-level and referral hospitals for major emergency obstetric surgery [30, 31], evaluations of outcomes for general surgery have been inconclusive [32].

This study was conducted as a part of evaluation of the COST-Africa project [33], funded by the European Union FP7 in 2011–2016. The project sponsored the establishment of a Bachelor of Science in general surgery at the University of Malawi's College of Medicine and funded the in-service training of the first cohort of 16 CO students at eight DHs. The aim of the project was to: (1) to establish, if it was feasible to deliver 'on-the-job' training at DHs to BSc level through two-weekly visits by teaching surgeons; and (2) to evaluate impact of surgically trained COs on the delivery of surgery at district level, looking at changes in numbers of selected cases of general surgery compared between intervention and control hospitals.

Methods

The study reported here was conducted prospectively between April and December 2015 in four government DHs—Mwanza, Nsanje, Nkhotakota and Dedza; and in two CHs: Kamuzu Central Hospital in Lilongwe and Queen Elizabeth Central Hospital in Blantyre. Two data collectors in each hospital were recruited from operating theatre staff and trained to administer a survey post-operatively, while patients were on admission, to measure the impact of the hernia on their pre-operative daily activities. A follow-up survey with the same set of questions was conducted by phone, 2–3 months post-discharge. All emergency and elective repairs of femoral, epigastric, incisional and inguinal hernia cases were included in the study, with inguinal hernias accounting for 76% of cases at DHs and 47% at CHs. The exclusion criteria were: age < 18 years and inability of patients to understand the questions. All patients interviewed at baseline who provided a contact mobile phone number were included in the follow-up study. Of the 138 baseline cases surveyed in DHs, 50 cases had follow-up phone surveys. Of the 94 central hospital baseline cases, 48 were successfully followed up. One patient died prior to follow-up due to an unrelated cause. Ethics clearance for this study was obtained from University of Malawi and Royal College of Surgeons in Ireland Ethics Committees.

Tool

A literature search located no PROM tool for measuring health outcomes pre- and post-hernia repair in the SSA region; hence, we modified the Hernia-Related Quality-of-Life Survey (HerQLes) tool consisting of 12 questions, developed in the USA [34]. Modifications took into account that a large proportion of study participants would have low levels of literacy [35], requiring the use of a simple, understandable tool. Modifications included: (1) the term 'abdominal wall' was replaced with the locally used term for 'hernia'; (2) two activities—'taking a shower' and 'climbing stairs'—were removed as not applicable to rural Malawi; (3) the past tense of verbs was used at baseline, as the first opportunity to administer the tool was in the immediate post-operative period asking about impact of hernia in the period prior to the operation; and (4) the original five-point response option (ranging from 'strongly disagree' to 'strongly agree') was replaced with a simpler 3-point scale ('Yes', 'Yes, sometimes', 'No'), reflecting the limited ability of individuals from communities with low levels of literacy and numeracy to make fine distinctions on functionality, as has been argued by others [36]. The modified HerQLes tool was piloted in March 2015 and translated into Chichewa—the Malawi local language.

Statistical analysis

Scores on the adapted HerQLes (range 0–2) tool were used to define outcomes a priori, due to the unknown properties and lack of validation of the scale. We defined 'good outcome' as no severe symptoms and at most three mild symptoms on self-report. Since the scale allows the participant to both, identify symptoms and classify these as mild or severe, we present results for mild and severe symptoms separately. We compared patient outcomes in three ways, using: (1) our adapted HerQLes scores, (2) counts of severe symptoms and (3) counts of mild symptoms. We examined each severe and mild symptoms separately, because we could not conclude that the patient-reported symptom count, expressed on the combined index score [34], reflected the actual severity of symptoms. The total score on the scale, which awards 1 point for a mild symptom and 2 points for a severe symptom, is less informative because it does not allow differentiation and different possibilities of combinations of mild and severe symptoms. Data were analysed with Stata Release 14.1.

Results

The casemix differed substantially between CHs and DHs. There were similar proportions of emergency and elective cases undertaken at CHs, while only 4 (8% of) cases at DHs were emergencies (Table 1). A separate analysis was conducted for these case categories, presenting baseline and then outcome results.

Baseline

The Wilcoxon Mann–Whitney test measured differences between cases presenting at district and CHs in patients' self-reported pre-operative symptoms. Cases presenting at CHs had higher level of mild symptoms ($p = 0.002$) with no significant difference in levels of mild symptoms between elective and emergency procedures ($p = 0.344$)—Fig. 1.

Cases presenting at DHs had higher level of severe symptoms ($p = 0.007$) than those at CHs (Fig. 2). We also found that patients who underwent elective surgery had higher counts of severe symptoms ($p = 0.004$) with a mean of 3.2, compared with 1.7 in the emergency group. The Wilcoxon Mann–Whitney analysis of elective patients with severe symptoms at central and DHs district hospitals showed no statistical difference at baseline ($p = 0.312$).

Table 1 Elective and emergency hernia repair cases in central and district hospitals

Hospital type	Surgery type (*n*)		
	Emergency	Elective	Total
Central	25	23	48
District	4	46	50

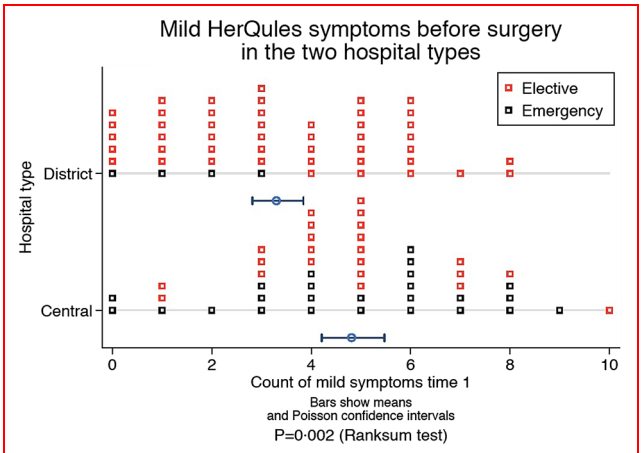

Fig. 1 Mild HerQLes symptoms before surgery in district and central hospitals for emergency and elective hernia repairs

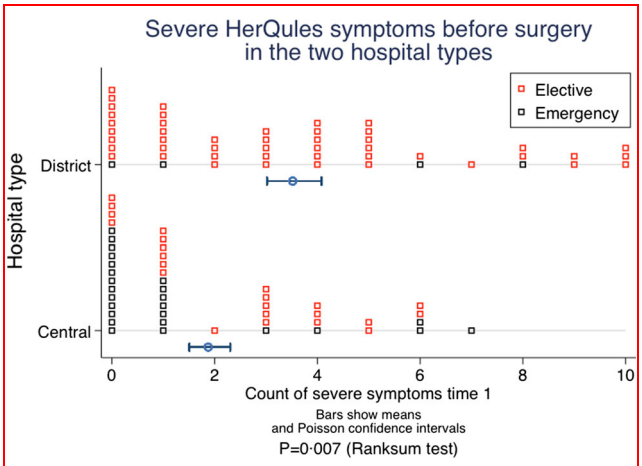

Fig. 2 Severe HerQLes symptoms before surgery in district and central hospitals for emergency and elective hernia repairs

Outcome

Overall there was no significant difference in the good outcome of hernia repair surgery (defined here as no severe symptoms and up to three mild symptoms) between CHs and DHs ($p = 0.260$) (Table 2).

When the analysis was restricted to elective cases only, a good outcome in DHs was less likely, though the difference was not statistically significant: risk ratio 0.79,

Table 2 Elective and emergency hernia repair cases in central and district hospitals

Hospital type	Good outcome	No good outcome
District ($n = 50$)	37 (74%)	13 (26%)
Central ($n = 48$)	40 (83.3%)	8 (16.6%)

$p = 0.260$

95% CI 0.63–1.0, $p = 0.06$. However, district hospital elective cases tended to have higher mean baseline counts of severe symptoms, 3.5 at district versus 2.5 at central level, and lower mean baseline counts of mild symptoms: 3.5 versus 4.8.

In the next step of the analysis, we compared changes in outcomes between DHs and CHs, to test the hypothesis that changes were comparable and the outcome depends on counts of symptoms at baseline. The small number of cases of emergency surgery in DHs ($n = 4$) precluded a two-way analysis. Therefore, analysis of change was restricted to elective cases, where there were sufficient numbers to compare DHs and CHs. The mean change (reduction or improvement) in severe symptoms following elective surgery at DHs was 2.9, compared to a mean change of 2.3 in CHs; the mean change in mild symptoms was 2.1 at DHs versus 4.0 at CHs.

Change scores were analysed using ordered logistic regression, with hospital type as a binary predictor and baseline score entered as a covariate. Change in mild score count was associated with baseline mild score count ($p < 0.001$) but was not associated with hospital type, adjusted for baseline scores count ($p = 0.147$). Likewise, change in severe score count was similar in DHs and in CHs ($p = 0.246$) when adjusted for initial symptom counts. Figures 3 and 4 present the symptom counts and illustrate similar rates of reduction, before and after hernia repair.

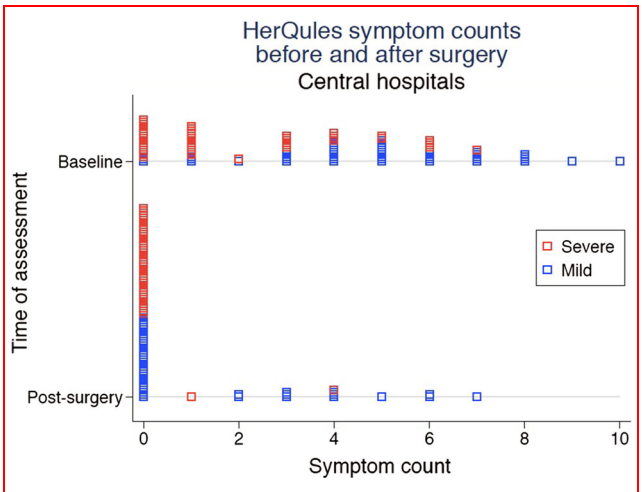

Fig. 3 Counts of symptoms before and after hernia repair at central hospitals

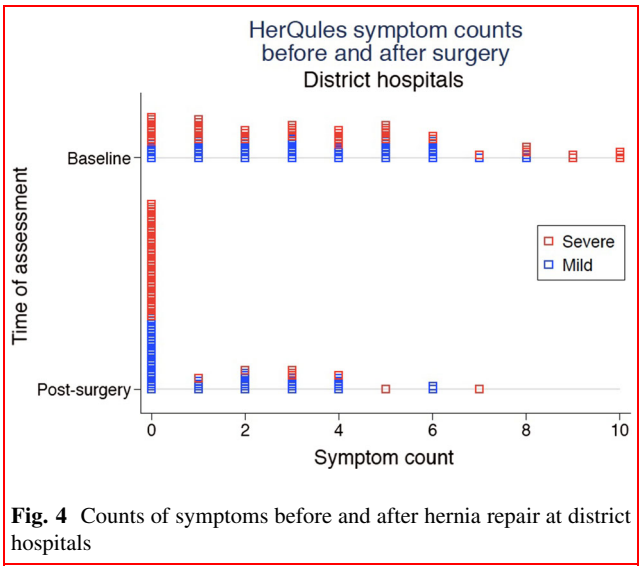

Fig. 4 Counts of symptoms before and after hernia repair at district hospitals

Discussion

DHs in SSA are under-resourced, understaffed and in many countries rely mainly (or wholly in the case of Malawi) on NPCs for delivering a surgical service [1]; some commentators have questioned the effectiveness and safety of this response [7]. However, essential emergency and elective surgery should be available for rural dwellers at the district level [37]. This article helps to fill the evidence gap for one of the most common general surgical procedures undertaken at DHs in Africa, with respect to the comparative effectiveness of surgery undertaken at district or referral hospitals. Patient-reported outcomes, 2–3 months after hernia repairs, showed no significant differences. Final outcomes following elective surgery were marginally better after central hospital surgery, whereas patients presenting to DHs had more severe symptoms and reported somewhat higher levels of improvement following surgery, while based on a small sample, the findings support the case for investing in district hospital surgery in Africa.

The patterns of hernia cases that underwent surgery were interesting. Firstly, almost all hernia repairs at DHs were elective, whereas, like others [38], we found that a high proportion (over half) of hernias repaired at CHs in Malawi were emergency procedures. This trend may reflect healthcare-seeking behaviour, where patients bypass (or are referred from) district to CHs, when needing emergency general surgery [27]. More importantly, poor access

or other (e.g. financial) barriers in rural areas may result in a failure to meet the need for surgery locally. As a result, life-threatening incarcerated hernias present centrally, strengthening the case for a district hospital surgical response. Secondly, elective hernia cases at DHs had higher levels of severe symptoms, perhaps because of financial or other barriers. Other studies have reported more complications in emergency versus elective procedures [11, 39], which was not the case in this sample. Possible reasons include: our study measured long-term PROMs which may be different to short-term outcomes such as wound infections. Hernias that impact more on quality of life may be longstanding and less likely to incarcerate and present as emergencies.

Our study contributes to the literature on outcomes of surgery done by different cadres at the district level [6, 28, 40], extending the work done on emergency obstetrics to a 'must do' common general procedure [1]. The findings can help shift the debate from the type of professional to the location where the surgery is undertaken, and the need for a surgically trained and supervised cadre of clinicians [41]. Some SSA countries have established training programmes to enable NPCs to undertake a broader range of common surgical procedures, beyond the caesarean section, which is a core procedure for surgically active NPCs at district hospitals. Training can cover a range of clinical specialties including surgery, such as the Medical Licentiate higher diploma and degree courses in Zambia [42], or specific advanced surgical training, such as the COST-Africa-funded BSc in surgery for COs in Malawi. Once trained and deployed to a DH, surgically active COs should be supervised by trained surgical specialists, both remotely and through regular supervisory visits. However, surgical supervision and interactions between DHs and CHs in SSA are sporadic at best [1] and more likely to happen through externally funded and supported initiatives. The COST-Africa project developed a DH supervision model in Zambia [42] in years 2011–2016 and is now being evaluated in a follow-up project: Scaling Safe Surgery for District and Rural Populations in Africa (SURG-Africa).

In Malawi, DHs have the capacity to deliver major surgery, but more hernia cases are done in the four CHs than in the 21 DHs [27]. The results of our study show that the use of the scarce resource of specialist surgeons and referral institutions [26] for elective hernia operations is not appropriate, if an equally effective service can be provided by trained NPCs at DHs. The failure to invest in district surgery crowds out CHs theatre space and diverts specialist surgeons to undertake avoidable emergency surgery. Evidence of the effectiveness [28, 43] and cost-effectiveness of surgical services delivered at DHs, often by NPCs, is growing [44, 45]. However, stakeholder resistance may persist [46–48], until there is a compelling body of research evidence to demonstrate what procedures can be delivered safely—and under what conditions—at district level in Africa [1]. This study was conducted under such conditions through the provision by the COST-Africa project of in-service training and supervision to COs based at eight DHs, including the four study hospitals. The follow-up implementation research project—SURG-Africa—aims to expand the evidence base on the comparative impact and cost-effectiveness of district-level surgery, utilising PROMs to evaluate the outcomes of other common surgical procedures.

Limitations of the study

Our modified tool has not been validated, and its psychometric properties are yet to be established. Therefore, it was not possible to quantify the magnitude of improvement in relation to clinically confirmed recovery. As the aim of our study was to compare outcomes rather than to validate the tool, studies are needed to validate this adapted HerQLes scale against other standardised tools [49].

This study assessed the outcomes of surgery by phone follow-up, as it was not feasible, affordable or ethical to recall patients for research purposes alone. The mobile phone follow-up approach used to reduce the common problem of losses to follow-up [50] was only partially successful, as it was probably negatively affected by power shortages in Malawi during the data collection period. However, while biases were possible—through failure to obtain a phone number at baseline and losses to follow-up, we see no reason to conclude that these cases were systematically likely to have better or worse outcomes.

The follow-up time period of 2–3 months for post-operative PROMs assessments, while providing an advance on current knowledge, was still relatively short for determining whether or not there was a successful surgical outcome. A longer follow-up period, if feasible, might identify other outcomes such as hernia recurrences. However, the absence of recurrences at the 2–3-month time point does not support the hypothesis that significant differences were likely to be found in a longer-term follow-up.

Finally, the sample size was relatively small. However, the overall trends in PROMs support the conclusion that the result—similar outcomes following hernia repair at DHs and CHs—was not because of the small sample size. Further studies are needed that will include larger sample sizes in different country contexts and will incorporate lessons on minimising losses to follow-up. These will also enable more detailed analyses of risk factors associated with post-operative outcomes at district and central levels.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflicts of interest.

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