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An estimate of hernia prevalence in Sierra Leone from a nationwide community survey

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Abstract

Purpose—A large number of unrepaired inguinal hernias is expected in sub-Saharan Africa where late presentation often results in incarceration, strangulation, or giant scrotal hernias. However, no representative population-based data is available to quantify the prevalence of hernias. We present data on groin masses in Sierra Leone to estimate prevalence, barriers to care, and associated disability.

Methods—A cluster randomized, cross-sectional household survey of 75 clusters of 25 households with 2 respondents each was designed to calculate the prevalence of and disability caused by **groin** hernias in Sierra Leone using a verbal head-to-toe examination. Barriers to hernia repairs were assessed by asking participants the main reason for delay in surgical care.

Results—Information was obtained from 3645 respondents in 1843 households, of which 1669 (46%) were male and included in the study. In total, 117 males or 7.01% (95% CI 5.64–8.38)

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reported a soft or reducible swelling likely representing a hernia with four men having two masses. Of the 93.2% who indicated the need for health care, only 22.2% underwent a procedure, citing limited funds (59.0%) as the major barrier to care. On disability assessment, 20.2% were not able to work secondary to the groin swelling.

Conclusions—The results indicate groin masses represent a major burden for the male population in Sierra Leone. Improving access to surgical care for adult patients with hernias and early intervention for children will be vital to address the burden of disease and prevent complications or limitations of daily activity.

Keywords

inguinal hernias; groin masses; global surgery; Sierra Leone; disability

Introduction

Inguinal hernias are an extremely common condition that will affect 27% of males and 3% of females in developed countries throughout their lifetime [1]. In the United States, there are an estimated 800,000 hernia operations per year making it one of the most routine procedures performed [2]. This is largely in contrast to sub-Saharan Africa (SSA), where the incidence may be higher and an extremely large number of inguinal hernias go unrepaired, leading to late presentation with incarceration, strangulation with gangrenous bowel, or giant scrotal hernias [3]. Patients suffer from lack of access to hernia repair leading to an economic toll due to disability that has not been well quantified.

Based on rural hospital hernia repair volume and population size, it is estimated that a minimum of 175 in 100,000 individuals are in need of an operation annually and at least 30 strangulated hernias per 100,000 occur each year in Eastern Africa [4]. A systematic review estimated the total need for inguinal hernia repair at a minimum of 205 per 100,000 individuals, of which 175 per 100,000 individuals appeared unmet [5]. The prevalence of inguinal hernias in a survey of 50 Ghanaian villages was found to be 10 times higher than in high-income countries at 2.7% of the adult male population [6]. However, other estimates are higher still, from 7.7% in Ghana to over 30% of adult males in parts of Tanzania [7,8]. Based on these estimates and the disability resulting from inguinal hernias, Kingsnorth and others have advocated for hernia repair as a public health priority. Despite the concern, countrywide Demographic Health Surveys (DHS) and population (census) questionnaires continue to lack relevant questions to obtain nationally representative estimates.

A recently reported review of the surgical literature on inguinal hernias in Africa revealed an absolute dearth of information on the burden of inguinal hernias in Africa, especially in the sub-Saharan region [9]. According to the authors, population-based studies on the epidemiology of inguinal hernias were nonexistent, and published studies did not reflect the true disease burden in the African population to be able to estimate surgical need. In response to a need to investigate the burden of surgical conditions, including the burden of masses in the groin, a nationwide surgical survey was conducted in Sierra Leone. Sierra Leone is a small West-African country with 6 million people and 10 registered surgeons [10]. Surgical capacity is slowly increasing and, recently, free health care for pregnant

women and children under-five was instituted [11,12]. A corresponding steep increase in surgical procedures, especially hernia repairs, was noted in the population under 5 years of age [13]. Although this effort is to be applauded, surgical care is sparsely available for conditions unrelated to pregnancy or for the population older than 5 years of age.

The goal of the present analysis is to estimate the prevalence of untreated hernias based on groin swellings and masses reported in a nationally representative sample, which qualitative observations indicate is expected to represent a significant backlog. Furthermore, we describe the disability and health care-seeking behaviors in Sierra Leone as well as reasons for delay in surgical care. These figures will aid health system strengthening activities.

Methods

The Surgeons OverSeas Assessment of Surgical need (SOSAS) survey was designed to calculate the prevalence of surgical conditions and resulting disability in developing countries including **groin** hernias [14]. Implementation of SOSAS in Sierra Leone has been previously described [15]. Nationwide, 75 clusters proportional to population size were randomly chosen. Twenty-five households within each cluster were randomly selected for participation, and in each household two members were randomly assigned to undergo a verbal head-to-toe exam with the questionnaire. Masses in the groin were differentiated based on whether they were hard such as “testicular cancer or hydrocele/cystocele” or soft or reducible indicating “**groin** hernia.” Disability was assessed in the following categories: no disability; I feel ashamed; I'm not able to do the work I used to do; I need help with transportation; and I need help with daily living activities. Barriers to obtaining a hernia repair procedure were assessed by asking the participant for the main reason for delay in surgical care.

Nursing and medical students administered the household survey using handheld tablets after a one week training on interview techniques, random sampling of households, proficiency in iPad® use, and extensive debriefing on the questionnaire content. Data was collected from January to February 2012 with close supervision of all the enumerators from a supervisor from both the College of Medicine and Allied Health Sciences and Statistics Sierra Leone. FileMaker Pro® software was used for programming with data exported to Microsoft® Excel® 2010, STATA® (STATA Corp, College Station, TX), and IBM SPSS® (SPSS Inc, Chicago, IL) for further analysis. The sample was self-weighted by sampling the same number in each cluster [16]. Prevalence is presented as a percentage ($\pm$ 95% confidence interval (CI)). Continuous variables were compared using Student's *t* test and categorical variables using χ^2 tests for exploratory data analysis with significance was set at a two-sided $p < 0.05$.

Informed consent was obtained from all participants, and the study was approved by the Sierra Leone Ministry of Health and Sanitation. Ethical approval was obtained from the Ethical and Scientific Review Committee of Sierra Leone, Stanford University Institutional Review Board, and the Research Ethics Committee of the Royal Tropical Institute in Amsterdam, Netherlands.

Results

From January to February 2012, all selected clusters were visited and information from 1843 (98%) of 1875 targeted households was included in the analysis with a total of 3645 (99%) respondents of 3686 expected interviews due to only one member being interviewed in 41 households. There were 1669 (46%) males with 8.63% (95% CI 7.17-10.09) having any type of mass or swelling in the groin at the time of interview with a smaller proportion of females reporting similar concerns at 2.23% (95% CI 1.69-2.77) (Table 1). Four men had two masses. A greater proportion of males had a soft or reducible swelling compared to females (81.2% vs. 59.1%, $p<0.01$).

The age distribution and temporal onset for the 117 (7.01% (95% CI 5.64-8.38)) men with soft or reducible swellings likely representing hernias is given in Table 2. The majority of the prevalence was concentrated among men >25 years old, and 91.9% of these men reported that the onset of their hernias was over a year ago. While 22.2% of men received some type of care, most (59.0%) reported lack of money to afford health care as the main barrier to surgical repair for their condition (Table 3). Traditional medicine was sought by a sizeable fraction (43.2%) and, notably, only a small proportion (6.8%) felt that there was no need for surgical attention. Of men with two masses, three men received care for both, and the fourth received care for one.

The disability assessment resulted in a prevalence of 27.7% of males with hernias feeling ashamed and 20.2% not being able to perform work that they previously could (Table 4). Among the 19 (20.2%) not able to work, 7 (36.8%) had actually received some type of care, 9 (47.4%) were unable to afford care, and 3 (15.8%) stated care was not available. Needing help with transportation or with daily living were not significant concerns, and about half reported no current disability due to their condition.

Discussion

Burden

The SOSAS nationwide surgical survey in Sierra Leone indicates that groin masses present a major burden of disease to the male population with an estimated prevalence of 7.01% (95% CI 5.64-8.38) for **groin** hernias, which corresponds to a rate of 7,010 per 100,000 men and extrapolates to over 200,000 males in the country. Hernias are thought to be related to both anatomic factors and working conditions. The majority of groin hernias are inguinal hernias, especially among men, as femoral hernias are a more common finding among women. Using the U.S. Bureau of Labor Statistics Annual Survey of Occupational Injuries and Illnesses, rates of hernia diagnosis were found to be significantly higher in jobs involving manual labor and strenuous lifting [17]. Almost 70% of employed individuals in Sierra Leone work in agriculture, an industry frequently associated with strenuous manual labor, which may help explain the higher burden of disease compared to other countries [18].

The age distribution within Sierra Leone, as well as other SSA nations, deserves mention as it is skewed toward younger ages. The recently updated 2013 life expectancy is about 57 years with a median age of 19 years. An astounding 60.9% of the population is <25 years of

age [19]. A Danish study using the national register to look at age of inguinal hernia repair found a bimodal age distribution peaking at the 0-5 years and 75-80 years age groups [20]. As the overall health and economic status of Sierra Leone improves, an increasing incidence and prevalence of hernias is expected with the aging population.

To our knowledge, the present study is the first population-based assessment of the epidemiology of masses in the groin in a low-income country [9]. A recent study reiterates that the literature is limited on inguinal hernia epidemiology even in the United States and Western Europe with no representative household survey being conducted in any country [21]. Because of this, Beard et al applied a modeling approach to estimate the prevalence of hernias in Ghana using data from the National Health and Nutrition Examination Survey in the United States and obtained an estimate of 7.0% among men. The statistic agrees with a study in Ghana from the late 1970s and is also similar to our household survey results for Sierra Leone [7].

Historical cohorts of male American soldiers in World War II provide another interesting point of comparison. They exhibited an inguinal hernia prevalence in the range of 6.5 to 8% [22]. The comparable estimates exemplify the need to build surgical capacity in low and middle-income countries to address diseases which are highly treatable and often preventable. For example, a case series in Sierra Leone showed one-third of patients with strangulated hernias requiring bowel resection died, and these are patients who made it to the rural hospital [23]. No good documentation on mortality secondary to hernias in the general SSA population exists.

Delay in Health Care

The major reason for not seeking surgery for hernias in Sierra Leone was the cost of health care. An uncomplicated hernia repair in Sierra Leone costs between 100,000 and 200,000 Leones (23 to 46 US dollars; gross national income per capita was \$351.70 in 2010) and must be paid in full by the patient or family as no health insurance structure exists in Sierra Leone. Most hernia repairs in SSA are done using a primary tissue repair with the Bassini-technique. Tension free repairs using mesh are not common and likely limited by the cost of the prosthetic and availability of mesh. The availability of proper anesthetic care is yet another concern. Surprisingly, cost remains a barrier across age groups including the under 5-year old population where health care has been covered by the government since 2010. However, the free health care scheme is still a work in progress and costs for transportation and lodging for mothers is not covered [24].

Innovations and alternatives to mesh may make the tension free hernia repair, which is an easier to master procedure with a lower recurrence rate in the general surgical community, more accessible in low resource settings [25]. The sterilized mosquito net has been proposed and shown to be a low cost alternative to mesh at a cost of <US\$0.01 for a 10cm × 15cm net mesh and US\$1.46 for sterilization compared to ~US\$100 for a commercial mesh in India, Ghana, and Burkina Faso [25-27]. Short-term outcomes and surgeon comfort handling either mesh variant were comparable in a small randomized, double-blind study in Burkina Faso, but the net mesh remains an underutilized option in SSA and similar settings [27]. Furthermore, hernia repair can be performed under local anesthesia with notable benefits in

terms of length of hospital stay and pain [28]. A significant proportion of hernia repairs in SSA occur as acute abdominal emergencies, which underscores the importance of overcoming the delay in health care in Sierra Leone and performing repairs as a prophylactic measure to reduce mortality, preferably before hernias become symptomatic [29].

Disability

Disability due to hernias is a concern for both the individual in Sierra Leone as well as society in general. It affects an individual's ability to work in the community as well as the daily life of a family that experiences a reduction in household income. Half of men reported no current disability due to their hernia, but only 6.8% reported they felt no need for surgery demonstrating a general awareness that they required care. One in five reported that they could no longer work while one in four stated feeling ashamed was the most significant disability. As the survey was a cross-sectional point estimate, the cumulative incidence of disability is likely much greater as these individuals continue to live without receiving appropriate care.

A hospital-based cohort comparing consecutive patients undergoing inguinal hernia repairs in Ghana to those in the United Kingdom found that Ghanaian hernias were significantly larger and the majority indirect (83%) [30]. The Ghanaian patients were younger (34 years vs. 62 years) and had a greater proportion of hernias extending into the scrotum (67% vs. 6%) compared to patients from the United Kingdom. The resulting disability was similar to our findings for Sierra Leone with 85% of hernias present for **longer than one year**, 64% of men having limited daily activity, and 16% being unable to work. If the prevalence is also high in other countries in SSA, as we expect, the economic implications for the region are vast.

The cost-effectiveness of hernia repair and associated disability adjusted life years (DALYs) averted have been calculated in the nearby country of Ghana. Surgical repair using sterilized mosquito net averted 9.3 DALYs per person at a cost of \$12.88 per DALY averted [31]. Notably, 60.5% of the hernias repaired were inguinoscrotal (reducible or irreducible). This data on DALYs averted is remarkably similar to quality adjusted life years (QALYs) in the United States associated with laparoscopic repair (9.04 QALYs), open mesh repair (8.975 QALYs), and open non-mesh hernia repair (QALYs 8.546) [32].

Limitations of the Study

The limitations of the present study deserve mention. Although the survey was conducted with medical personnel (nurses and medical students), a physical examination was not a component of the survey due to ethical and logistical concerns. Therefore, it is possible some of the indicated masses in the groin may not be hernias but perhaps testicular cancers, hydroceles, or another mass. The survey distinguished soft/reducible masses from solid/hard masses to minimize contamination and provided specific instructions to the enumerators that the former was intended to target “**groin** hernia” and the latter “testicular cancer or hydrocele/cystocele”. Also, a comparison of a community survey for inguinal hernias to physical examination results showed that there was underreporting with the survey, suggesting the prevalence of hernias may be even higher than verbally reported [33].

However, regardless of a verbal assessment, all of these masses deserve assessment by a skilled medical doctor for potential surgical treatment. Another potential limitation includes sampling both men and women when more resources could have been devoted to surveying only men. Although the prevalence of groin masses, as expected, was lower among women than men, they do contribute to the overall burden of disease. Furthermore, SOSAS Sierra Leone was also designed to calculate the prevalence of other surgical conditions [15]. Lastly, 23 (19.7%) individuals, most of whom were <15 years old, did not respond to the disability question causing an uncertain impact on the distribution of responses.

Conclusions

Inguinal hernias will affect over a quarter of all men during their lifetimes, and while care is readily available in most developed countries, a significant backlog of patients with hernias is expected in Sierra Leone and SSA in general. Our results provide a nationally representative estimate for the prevalence of **groin** hernias in Sierra Leone as well as insights into cost as a major barrier to care and the resulting physical and emotional disability. Increasing surgical capacity and improving access to appropriate care for hernias, for both the backlog of adult patients and early intervention for children, will be vital to address the burden of disease. Future DHS efforts should include questions on surgically treatable conditions such as hernias to capture the broader picture between countries in a standard fashion without needing to repeat SOSAS.

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Abbreviations

CI	confidence interval
DHS	Demographic Health Surveys
SOSAS	Surgeons OverSeas Assessment of Surgical need
SSA	sub-Saharan Africa

Distribution of groin masses by sex and type. Surgeons Overseas Assessment of Surgical Need, Sierra Leone 2012.

Table 1

	Males		Females		Overall	
	N	% (95% CI) ^a	N	% (95% CI)	N	% (95% CI)
All Individuals	1669	-	1976	-	3645	-
Type of Mass/Swelling						
<i>Soft or Reductible</i>	117	7.01 (5.64 - 8.38)	26	1.32 (0.77 - 1.86)	143	3.92 (3.14 - 4.71)
<i>Solid or Hard</i>	29	1.74 (0.97 - 2.51)	18	0.91 (0.51 - 1.31)	47	1.29 (0.85 - 1.73)
<i>Any Type</i>	144	8.63 (7.17 - 10.09)	44	2.23 (1.69 - 2.77)	188	5.16 (4.35 - 5.96)

^aCI = confidence interval

Timing for the onset of hernias among males by age groups.Surgeons OverSeas Assessment of Surgical Need, Sierra Leone 2012.

Table 2

Age Group	Last month			1-12 Months Ago			>1 Year Ago		
	Overall	N	% (95% CI) ^a	N	% (95% CI)	N	% (95% CI)		
<5 years	11	1	9.09 (0.00 - 26.28)	5	45.45 (17.71 - 73.20)	5	45.45 (18.26 - 72.65)		
5-10 years	9	0	-	1	11.11 (0.00 - 32.13)	7	77.78 (54.34 - 100.00)		
10-15 years	10	0	-	2	20.00 (0.00 - 42.72)	8	80.00 (57.28 - 100.00)		
15-25 years	13	0	-	5	38.46 (20.33 - 56.60)	8	61.54 (43.40 - 79.67)		
25+ years	74	1	1.35 (0.00 - 4.05)	6	8.11 (2.04 - 14.18)	68	91.89 (85.87 - 97.91)		
Total	117	2	1.71 (0.00 - 4.12)	19	16.24 (9.31 - 23.17)	96	63.25 (54.93 - 71.56)		

^a CI = confidence interval

Reasons for not seeking hernia repair among males by age group. Surgeons OverSeas Assessment of Surgical Need, Sierra Leone 2012.

Table 3

Reasons for Not Seeking Hernia Repair	Number of Individuals in Age Group						Overall	% (95% CI)
	< 5 years	5 - 10 years	10 - 15 years	15 - 25 years	25+ years			
No money for health care	5	5	5	11	43	69	58.97 (49.24 - 68.70)	
No (money for) transportation	0	0	0	0	1	1	0.84 (0.00 - 2.55)	
No time	0	0	1	0	1	2	1.71 (0.00 - 4.11)	
Fear for an operation / Lack of trust	0	0	0	1	1	2	1.71 (0.09 - 3.33)	
Not available (facility/personnel/equipment)	1	0	0	0	8	9	7.69 (2.40 - 12.98)	
No need for surgery	0	1	2	1	4	8	6.84 (2.62 - 11.05)	
Received care	5	3	2	0	16	26	22.22 (14.52 - 29.92)	
Total	11	9	10	13	74	117		

^aCI = confidence interval

Disability associated with hernias among males by age group. Surgeons Overseas Assessment of Surgical Need, Sierra Leone 2012.

Table 4

Disability from Hernia	Number of Individuals in Age Group							Overall	% (95% CI)
	< 5 years	5 - 10 years	10 - 15 years	15 - 25 years	25+ years				
No disability	2	2	4	4	36		48	51.06 (40.77-61.36)	
Ashamed	1	1	2	7	15		26	27.66 (18.44-36.87)	
Not able to work	3	0	0	2	14		19	20.21 (11.94-28.48)	
Need help with transportation	0	0	0	0	0		0	-	
Need help with daily living	1	0	0	0	0		1	1.06 (0-3.18)	
Missing	4	6	4	0	9		23	Excluded	
Total	11	9	10	13	74		117		

^a CI = confidence interval