

Public Health and Policy Issues of Hernia Surgery in Africa

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Abstract Inguinal hernia repair has been overlooked as a public health priority in Africa, with its high prevalence largely unrecognized, and traditional public health viewpoints assuming that not enough infrastructure, human resources, or financing capacity are available for effective service provision. Emerging evidence suggests that inguinal hernias in Ghana are approximately ten times as prevalent as in high-income countries, are much more longstanding and severe, and can be repaired with low-cost techniques using mosquito net mesh through international collaboration. Outcomes from surgery are comparable to published literature, and potential exists for scaling up capacity. Special attention must be paid to creating financing systems that encourage eventual local self-sustainability.

Introduction

In Africa, untreated inguinal hernias have a serious economic impact and high burden of unnecessary disease and mortality. Much of this burden is preventable with low-cost surgery. However, not enough evidence exists to provide functional recommendations on policy or research and development objectives [1]. Costs and clinical outcome data have been sparse, with evidence on the cost-effectiveness of interventions limited to expert opinion [2]. As infrastructure and capacity improve within the health system, resources must be allocated efficiently, and consideration given to the feasibility of addressing the burden of disease caused by hernia.

Emerging public health priority

Hernia surgery is not traditionally considered a public health priority in developing countries, because many perceive that the costs, training, and resource requirements exceed what is feasible in resource-poor environments [3–6]. As a result, it often is outside the scope of traditional public health planning initiatives, in which donors focus on infectious disease, maternal health, and child health—are sometimes forced to displace funding to current crises, such as HIV/AIDS [7]. Indeed, mention of hernia surgery is neglected in the Gates Foundation’s “Grand Challenges for Global Health”, the Millennium Development Goals, and the Commission on Macroeconomics and Health Report for Ghana [8–10]. The Bulletin of the WHO does not have hernia repair listed as a categorization option in its article submission form.

However, recognition of surgery as a public health priority is building. The Disease Control Priorities Project and Copenhagen Consensus have added surgery to be

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considered alongside other investment priorities designed to make the world a better place in their most recent editions [11, 12]. Further recognition of its importance in international health agendas is acknowledged with the creation of the Bellagio Essential Surgery Group, the WHO Global Initiative for Emergency and Essential Surgical Care (GIEESC), and the Burden of Surgical Disease and Access Working Group [13–15]. In recent months, the growing global support for surgery as a public health priority has been publicized in several journal articles [15–19].

Burden of disease

The initial Global Burden of Disease (GBD) study suggested that large numbers of hernias are left untreated; however, the actual burden of hernia has been largely unstudied [20]. ‘A near total lack of relevant data’ on surgical conditions was recognized by the Disease Control Priorities Project, Second Edition (DCP2), with estimates based on a questionnaire sent to 32 surgeons in different parts of the world [1]. This study concluded that 25 million Disability Adjusted Life Years (DALYs), or 7% of those in Africa, are the result of conditions correctable by surgery, which is approximately twice that of the Americas.

To initiate estimates of the burden of disease as a result of hernia in Africa, medical assistants associated with Operation Hernia (<http://www.operationhernia.org.uk/>), a nongovernmental organization working in Ghana, collected data in 2008 on hernia prevalence in the Bole District [Kingsnorth AN, unpublished data, 2008]. The investigation found that there were at least 1,400 hernias per 100,000 people in a survey of 50 villages, or 2.7% of the adult male population. This estimate is approximately ten times higher than the levels normally found in high-income countries (150–200 per 100,000) [21], and much lower than other prevalence estimates in Africa (7.7% to over 30%) [22]. In addition, the proportion of these that are indirect in Ghana (82.9%) is much higher than in high-income countries (60%), indicating that juvenile-type indirect hernias have been left untreated for many years [23]. Relative to the prevalences of other priority public health conditions in Ghana, it is clear that hernia repair is a priority. The prevalence of tuberculosis is 0.4%, HIV is 2.2%, tobacco use among adults is 5.5%, tobacco use among adolescents is 11.7%, and malaria is 15.3% (notified cases) [24, 25].

Leaving this burden of disease unaddressed is dangerous. Waiting for surgery is associated with a higher incidence of hernia morbidity and mortality, and many patients require expensive emergency care [26]. If they survive, patients may develop large, long-standing hernias that limit their ability to live a normal life (Fig. 1).



Fig. 1 Large inguinoscrotal hernia

There is reason to think that the burden of disease might increase as populations move through stages of development and epidemiologic and demographic transition [27, 28]. With potentially longer life spans [24], increased levels of smoking [29], proliferation of heavy machinery [30], and significant advances in the management of infectious diseases, the importance of hernia in the public health agenda can be expected to increase [31, 32].

Interventions

The burden of hernia disease can be addressed using low-cost approaches if African health systems are willing to change their policy and practice. Currently the Bassini technique is used in most hospitals, because of the low associated cost, with African surgeons favoring general anesthetic [33]. However, the tension-free Lichtenstein method using prosthetic mesh is recommended as an alternative to minimize short- and long-term recurrence, reduce hospital stays, and enable earlier return to work [34–36]. This method is easily learned by surgeons and has comparable health outcomes to Shouldice and laparoscopic techniques [37]. Recent evidence indicates that inexpensive polyester or nylon mosquito net mesh is a suitable material for use in the African setting, with costs further minimized by performing operations under local anesthetic as day surgery [22, 38–42].

Effectiveness of interventions

The effectiveness of using mosquito net mesh for hernia repair in developing countries is well-documented. Among 359 patients treated at four Indian hospitals, Tongaonkar and colleagues found only one recurrence, no mesh rejections, and minor infections in only 4.7% of patients when using locally produced nylon mesh [39]. Freudenberg and colleagues found no mesh rejections, severe complications, or grade 1 infections among 18 patients who received nylon mesh compared with a cohort of patients who received commercial mesh (Ultrapro®) [40]. No recurrences were observed after 6 months among 95 patients operated on in Ghana by local and European surgeons using polyester mosquito net mesh, and wound complications occurred in only 7% [38].

Cost-effectiveness of interventions

Cost-effectiveness evidence is helpful to inform decisions from a wide range of interventions when planning changes to the health sector [2, 43–46]. This type of analysis compares the costs and expected health outcomes of an intervention relative to its status-quo alternative, based on primary or modelled evidence, and modelled eventualities [47, 48]. Clinical outcomes are appealing to physicians for measuring effectiveness but are of limited use when policy makers face choices between investments in very different programs, such as malaria control, community-based neonatal care, or hernia repair. Therefore, DALYs have been introduced to facilitate public health decision making [20, 49, 50].

Recent evidence indicates that hospital-based interventions have much better cost-effectiveness than has been assumed previously [51, 52]. Evidence on the cost-effectiveness of hernia repair has been based purely on expert opinion [2], and has recently been evaluated for the first time using clinical data [Shillcutt et al., unpublished work]. In this study, operations were performed by a team of European and African surgeons at a hernia treatment ward in western Ghana. Polyester mosquito net mesh was used in 86% of operations, with the remainder corrected by herniotomy ($n = 15$), reinforcement of previous mesh ($n = 1$), or without mesh ($n = 1$). The cost of an individual 10-cm x 15-cm mesh was estimated at US\$0.0072 or \$0.014 for single-sided or double-sided mesh, respectively. The cost of sterilization and packaging in the United Kingdom was US\$1.46 per mesh. Cases were performed under local anesthesia in 72% of patients [38, Shillcutt et al., unpublished work].

Based on DALYs calculated with a 3% discount rate and without age weighting, the program cost of \$636.65 per patient from a provider perspective, averting 9.32 DALYs

per patient. These figures give a cost-effectiveness of \$68.31/DALY averted, comparing very favorably with other neglected low-cost opportunities in sub-Saharan Africa according to DCP2 evidence [46, 53], and a host of interventions evaluated by the WHO-CHOICE project [54]. Expanding capacity for elective hernia repair is clearly a public health priority based on this evidence.

Impact

The key to understanding, encouraging, and monitoring progress in reducing the burden of hernia in Africa will be the development of functional health metrics [16]. The analysis of Operation Hernia used DALY parameterizations based on expert opinion, in accordance with precedent from other studies of secondary care interventions [51, 52, Shillcutt et al., unpublished work]. Empirical research is needed on parameterizations for DALY calculations associated with longstanding inguinal hernias.

Data from existing programs are showing the potential for major success in addressing the hernia burden through international partnerships. During the last several years, Operation Hernia has treated more than 1,000 hernias, trained both European and Ghanaian surgeons (Fig. 2), and recently opened its second Hernia Treatment Centre in Carpenter Ghana [55, Kingsnorth and Yunis, unpublished work]. Next year, Operation Hernia plans to expand capacity to provide treatment centers in the Ivory Coast and Nigeria. Globally, the recently formed Global Burden of Surgical Disease group has enlisted more than 100 similar organizations to coordinate objectives and increase effectiveness, principally through the American College of Surgeons (ACS) and Giving Back [56]. Medical schools, such as Brown University and University of California at San Francisco, are setting up residency rotation programs



Fig. 2 Teaching in the operating room

in Africa [57, 58]. The degree of interest among residents has been encouraging, and the sustained success of Operation Smile during the past 25 years provides promising precedent for similar initiatives to address the hernia burden [58–62]. Developing research capacity between international institutions will further strengthen their ability to address the burden of surgical disease [63, 64].

Beyond cost-effectiveness estimates

Surgical facilities in Africa can be used to treat a wide range of elective and emergency procedures, particularly injuries, obstetric complications, malignancies, congenital abnormalities, and perinatal conditions [18]. Indeed, it has been argued that it is more relevant to evaluate the cost-effectiveness of surgical facilities rather than individual interventions [1]. Although we agree that this position is reasonable, evaluating hernia surgery alone has other advantages. It makes fewer assumptions, and it may be realistic to expect that specialized hernia treatment centers will be practical given their high prevalence. A next step may be to compare our results to the cost-effectiveness of hernia repair at a community clinic and develop research on the optimal balance of surgery provision across levels of the health system [1].

International partnerships can be expected to have considerable positive effects in the long term. Africa is facing dramatic shortages in its surgical workforce, and as local surgeons develop the capacity to operate at a standard similar to their European counterparts, programs will be able to perform surgeries throughout the year and address a much larger proportion of the burden of disease due to hernia [19, 65, 66]. Where fully qualified surgeons are not available, cadres of health workers with less training have been shown to be effective, and may be preferred where the alternative is an absence of surgery [13, 67]. Ultimately, effectiveness and cost-effectiveness will be contingent on patient demand, which may take time to stimulate in sub-Saharan African populations accustomed to years of sub-standard hospital care from government health centers [68].

Financing

Financing hernia surgery will be challenging. Special attention to equity will be vital, particularly because most people with hernias in Ghana are farmers or manual laborers living in impoverished conditions (Fig. 3) [69, Shillcutt et al., unpublished work]. Hernia repair is an excellent candidate for publicly financed insurance, meeting the criteria defined by Musgrove: a public good with constraints to patient demand, a cost-effective intervention



Fig. 3 Typical living conditions in Carpenter, Ghana

with preferential benefit to the poor, and a form of protection against catastrophic costs where private insurance systems are inadequate [70]. Ghana has a National health insurance system for people in both the formal and informal sectors, and all residents are required to subscribe to it or an alternative source, and would be well served to add hernia repair to its list of priority services [10]. Other countries, such as Zimbabwe and Nigeria, are developing similar strategies, and should give sufficient consideration to elucidating and addressing their hernia burden [71].

Conclusions

Surgical care was cited as an “exceptional buy” relative to a long list of health intervention opportunities evaluated in the DCP2 [1]. Results from Ghana confirm that inguinal hernia repair is highly cost-effective relative to DCP2 results, and those evaluated in WHO-CHOICE [12, 54, Shillcutt et al., unpublished work]. The traditional assumption that surgery is not cost-effective or affordable leads to inefficiencies in that existing surgical facilities remain underused and poorly maintained, local surgeons have little incentive to stay in their home country, little attention is paid to the cost and feasibility of expanding services, and most importantly, the previously unrecognized disease burden remains largely unaddressed. However, a new application of old mosquito net technology, combined with large-scale collaboration between rich and poor countries, has the potential to make significant gains in addressing this burden. Political and other contextual factors will have a major impact on the direction of change, and as success stories build, such as the experience in Ghana, support for international surgical partnerships can be expected to increase [72]. As developing countries pass through the demographic and epidemiologic transition, it will be vital that their health systems evolve accordingly to address the double burden of infectious and noninfectious disease.

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