

# Cancer Surgery in Low-Income Countries

## An Unmet Need

David E. Gyorki, MD; Arturo Muyco, MD; Adam L. Kushner, MD; Murray F. Brennan, MD; T. Peter Kingham, MD

**Objectives:** To describe the surgical oncology experience at a major regional hospital in Malawi and to identify barriers to improved outcomes.

**Design:** Retrospective review of operating logbooks from a single tertiary referral center.

**Setting:** Major tertiary referral center (Kamuzu Central Hospital) in Lilongwe, Malawi, in sub-Saharan Africa.

**Patients:** Patients were identified with a suspected diagnosis of cancer from January 1, 2004, through March 7, 2007.

**Main Outcome Measures:** Cancer cases were classified according to patient demographic characteristics, disease location, and therapeutic intent. The Malawi data

were compared with US data from the Surveillance Epidemiology and End Results database.

**Results:** A malignant diagnosis was suspected in 255 of the 1440 patients undergoing a major resection (17.8%) (mean patient age, 53 years). The most common cancers in males were prostate, esophageal, and gastric. In females, the most common cancers were breast, colon, and esophageal. Many of the procedures were performed with palliative intent.

**Conclusions:** Cancer surgery comprises a significant proportion of the surgical caseload in low-income countries. Patients often present with late-stage, inoperable cancer. The participation of the surgical community is critical for addressing barriers to effective cancer care.

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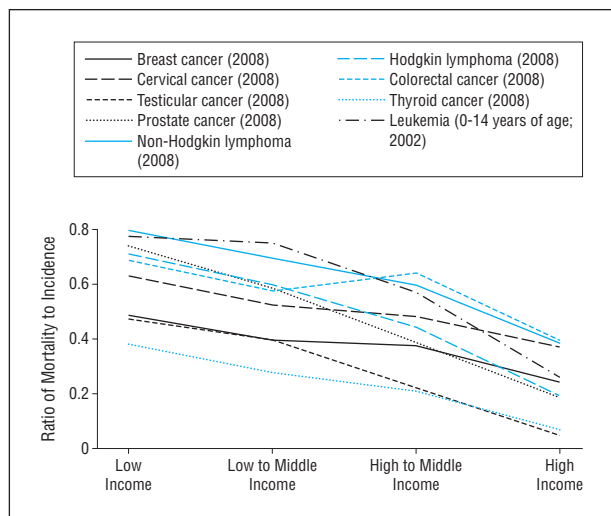
**T**HE GLOBAL BURDEN OF CANCER is increasingly borne by patients in the developing world. The International Agency for Research on Cancer predicts that by 2030, the global burden of cancer will reach 21.4 million and the annual number of cancer deaths worldwide will reach 13.2 million.<sup>1</sup> The World Health Organization (WHO) predicts that by 2020, approximately 60% of all new cancer cases will occur in the least developed nations.<sup>2</sup>

In wealthy countries, the paradigm for treating some cancers is changing because patients' cancers are diagnosed at an earlier stage and many of those with advanced disease are surviving for longer periods with the aid of systemic therapy. In contrast, in low- and middle-income countries (LMICs), patients with cancer often present late, and the mortality rates are sobering (**Figure 1**). These diseases are becoming a leading cause of death in patients older than 15 years.<sup>3</sup> Public health efforts are slowly beginning to emphasize cancer care as a global priority. For example, the Global Task Force on Expanded Access to Cancer Care and Control in Developing Countries was estab-

lished in 2009. This collaboration of the Dana Farber Cancer Institute, Harvard Global Equity Initiative, Harvard Medical School, and Harvard School of Public Health published a call to action for the global medical community in 2010.<sup>3</sup> The United Nations (UN) is also increasingly aware of the mortality in LMICs caused by noncommunicable diseases, including cancer. During the September 2011 meeting of the UN General Assembly, a high-level meeting was held for 2 days with a focus on noncommunicable diseases, analogous to the Declaration of Commitment to human immunodeficiency virus and AIDS that occurred a decade ago.<sup>5</sup> A declaration was formulated, with global leaders agreeing on a need for global monitoring targets and increased efforts to prevent and treat noncommunicable diseases and improve health care.<sup>6</sup> Recognizing that the burden of cancer is a global problem, we sought to identify surgically treated cancers in a major tertiary referral center in Malawi in order to expose a growing need for surgical involvement in global cancer efforts.

Malawi is a small country in sub-Saharan Africa with a population of approximately 12 million. The annual per

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**Figure 1.** Ratios of cancer mortality to incidence stratified by a country's wealth demonstrate the clear disparity in outcomes related to income (calculated from International Agency for Research on Cancer data).<sup>3</sup> Reprinted from Farmer P, Frenk J, Knaul FM, et al. Expansion of cancer care and control in countries of low and middle income: a call to action. *Lancet*. 2010;376(9747):1186-1193. With permission from Elsevier.

capita expenditure on health care is one of the lowest in the world at approximately US\$25.<sup>7</sup> Approximately 60% of surgical care is provided in the public system, with the remainder provided in private and mission hospitals.<sup>8</sup> We compared data from a tertiary referral center in Malawi with data from throughout Africa and from the US Surveillance Epidemiology and End Results (SEER) database to characterize the surgical oncology patient population in a major Malawian treatment center.

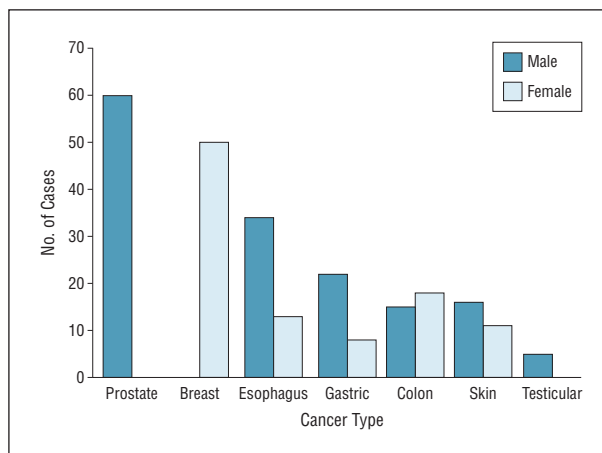
## METHODS

Data from the operating room logbooks dated January 1, 2004, through March 7, 2007, from Kamuzu Central Hospital (KCH) in Lilongwe, Malawi, were retrospectively collected. The logbooks dated November 23, 2005, through November 1, 2006, were unavailable for examination. Therefore, the total study period is 28 months. All cancer cases during this period were recorded and categorized according to subspecialty and body region. An attempt was made to classify the intention of treatment as curative or palliative. Follow-up data were not available because medical records are kept by the patient and not stored at the hospital. No histopathology services are available at the KCH. Some patients hand carried their specimens to the lone pathologist in the country, located in Blantyre, Malawi. Thus, many diagnoses of cancer are based on clinical impressions. Cases were only included in this survey if the clinical impression of the treating clinician was a diagnosis of cancer.

To compare age-standardized incidence between the KCH patients and patients in the United States, we queried the SEER database. The incidence data for 2006 (per 100 000 people) were multiplied by population data from the US Census Bureau for the same year. Population proportions were calculated from the sum of these age groups.

## RESULTS

The operating room logbooks at the KCH revealed that 1440 general and urologic operations were performed dur-



**Figure 2.** Number of cases by patient sex seen at Kamuzu Central Hospital.

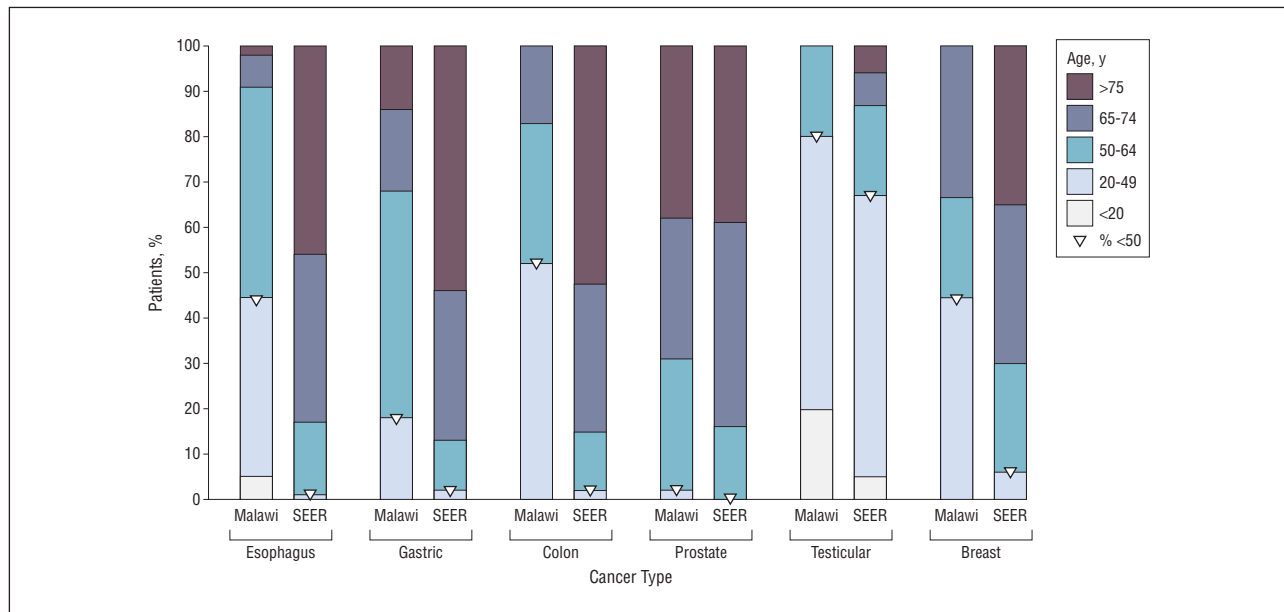
**Table 1. Demographic Characteristics by Tumor Type of 255 Patients Treated at Kamuzu Central Hospital**

Cancer Type	No. (%) of Patients	Male Sex, No. (%)	Age, Mean (Range), y
Esophageal	50 (19.6)	33 (66.0)	48 (20-68)
Gastric	29 (11.4)	29 (75.9)	59 (38-90)
Colon	34 (13.3)	16 (47.1)	47 (26-70)
Prostate	60 (23.5)	60 (100)	70 (53-94)
Testicular	5 (2.0)	5 (100)	31 (23-58)
Breast	49 (19.2)	0	39 (14-65)
Skin	28 (11.0)	15 (53.6)	51 (22-70)

ing the 28-month study period. (Minor procedures, such as debridement and abscess drainage, were excluded.) Of these operations, 255 (17.8%) resulted in a diagnosis suggestive of cancer. The most common cancer in males was prostate, followed by esophageal and gastric (**Figure 2**). In females, the 3 most common cancers were breast, colon, and esophageal.

Demographic data regarding patient age were available in 83.5% of cases. The mean (SD) age of patients was 53 (18.3) years (median, 52 years; range, 3-94 years) (**Table 1**). This number is an approximation, however, because in Malawi, patients often do not have birth certificates and therefore estimate their ages. Many patients presented before the age of 50 years. In patients with testicular, breast, and colon cancer, 80.0%, 77.8%, and 51.7%, respectively, were younger than 50 years (**Figure 3**). In comparison, in the United States, the proportions of patients 49 years or younger diagnosed as having testicular, breast, and colon cancer are 86%, 22%, and 9%, respectively, according to SEER data from 2006.

Many of the procedures were performed with a palliative or noncurative intent (**Table 2**), especially procedures for gastrointestinal cancers, which often presented at a late and inoperable stage. In patients with esophageal cancer, 76.0% of surgical interventions involved placement of palliative gastric feeding tubes. Similarly, for patients with gastric cancer, 58.6% of cases were palliative and involved a feeding tube (24.1%) or laparotomy without resection (34.5%). In colorectal cancer cases, only a few patients (29.4%) could be treated with curative intent.



**Figure 3.** Proportion of patients treated at Kamuzu Central Hospital compared with proportional incidence from the Surveillance Epidemiology and End Results (SEER) database (2006) for each cancer type by age.

We compared the proportion of cancer types seen at KCH with previously published global data (**Figure 4**). This comparison group reflects age-standardized cancer incidence in less developed countries as calculated for the year 2008 by the International Agency for Research on Cancer (GLOBOCAN).<sup>9</sup> There is strong concordance for many cancer types between the surgical caseload at KCH and the published cancer incidence in low-income countries. Lung and hepatocellular carcinomas, which make up 12% and 9% of new cancer diagnoses in less developed countries,<sup>9</sup> are not seen in the KCH surgical data set. This finding may reflect regional differences in the GLOBOCAN estimates, especially because calculations on cancer incidence in Africa were based on only 7 cancer registries, representing less than 6% of the African population.<sup>9</sup> Lung cancer has been previously shown to be underrepresented in sub-Saharan Africa, including in Malawi.<sup>10,11</sup> The absence of these tumor types in the surgical oncology caseload may also reflect a lack of surgical expertise in thoracic and hepatobiliary surgery or the fact that these cancers present at an advanced stage.

#### COMMENT

Since the declaration of the war on cancer in the early 1970s, vast resources have been committed to cancer research. Our understanding of the etiology and pathogenesis of malignant cancer has advanced and is reflected in improved patient outcomes. A new challenge is to translate these developments to resource-poor settings, which increasingly bear the bulk of the world's cancer burden.

Our data from a tertiary care center in Malawi demonstrate a different patient population from that in developed countries. Patients present at a younger age, and most patients described in this study presented at an ad-

vanced stage of disease. A variety of reports in the breast cancer literature from African institutions have identified key factors for delayed presentation, including low levels of awareness, barriers to health care accessibility, lack of early detection, and alternative health care models.<sup>12-14</sup>

Surgery is a central component of all aspects of cancer care, including biopsies for diagnosis, resections for definitive treatment, and procedures for palliation. Surgery remains the most effective therapy for the treatment of most solid tumors. Cancer surgery for many tumor types can be performed safely and efficiently with minimal resources and requires only basic surgical instruments. The small number of surgeons in most developing countries makes access to surgical care a major barrier to cancer care. A recent analysis of surgical resources in LMICs using a standardized WHO tool identified major infrastructure shortfalls in district hospitals.<sup>15</sup> For example, almost half (45%) of district hospitals in these countries do not have an anesthesia machine, and more than 52% lack a steady supply of sterile gloves. Beyond material resources, a small workforce is also a major obstacle. The KCH serves approximately 5 million people in the central district of Malawi and is staffed by only 4 or 5 fully trained surgeons, a variable number of clinical officers, and a fledgling surgical residency program. In addition, surgeons are underrepresented in the public health community, so surgery is often an overlooked component of public health efforts.<sup>16</sup>

We compared the patients with cancer who presented for surgery at KCH with recently published cancer registry data from Malawi.<sup>11</sup> The WHO publication describes the almost 19 000 patients recorded in the country's cancer registry between 2007 and 2010. These data reveal that in the younger than 60-year age group from the Malawi cancer registry (which makes up 84% of new cancer diagnoses), the 2 most common cancers are Ka-

posi sarcoma and cervical cancer, both of which are associated with viral causes. These 2 cancer types are not treated by surgeons at KCH, so they are not represented in this data set. In the older than 60-year group, esophageal cancer becomes the most frequent and prostate, bladder, and gastrointestinal tumors are seen far more commonly. The surgical oncology case mix at KCH more

closely resembles the older than 60-year cancer population in Malawi. This finding is reflected in the median age of the patient group, which is 52 years (range, 3-94 years), in a country where the overall median age is 17.2 years.

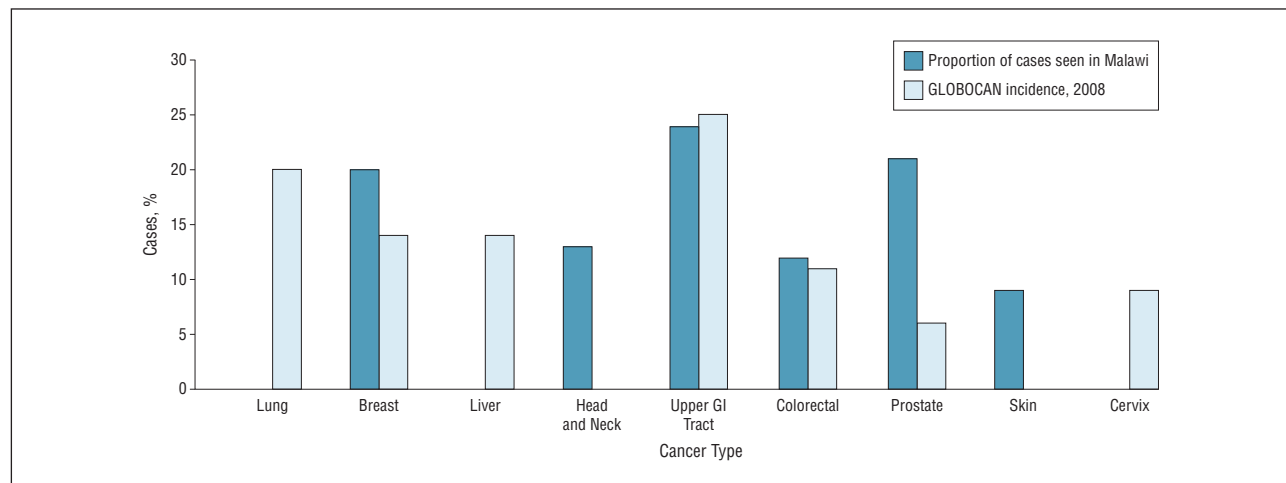
The intention of surgery for many of the patients was likely palliative from the outset. The surgeons at KCH are competent at resections for bulky cancers; therefore, it is likely that in many cases, the decision for palliative surgery was determined by tumor biology rather than technical deficiency. Palliative interventions have an important role to play in low-resource settings. In Malawi, KCH was a participating center in a study that demonstrated durable results with palliative interventions in a central hospital setting.<sup>17</sup>

Some of the limitations to adequate cancer care identified at KCH are emphasized in the Malawi cancer registry.<sup>11</sup> Only 17.9% of cancers were diagnosed based on histologic analysis, cytologic testing, or laboratory values, with most diagnoses based on clinical or radiologic suspicion. These data demonstrate that beyond the availability of surgeons and basic supplies, there are additional barriers to providing basic cancer surgical services in low-income countries. Patients require an accurate cancer diagnosis and appropriate cancer staging to optimize surgical decision making.

Malawi has a single pathologist who serves a population of 15 million, and the approximate time for pathologic test result reporting is 3 months. Many specimens are not sent for analysis, and even if the specimens are sent, many patients are lost to follow-up in the intervening time. It is possible that some of the cases diagnosed as malignant in this series may actually have been benign. The converse is also true: tumors treated as benign may have actually harbored an undiagnosed malignant cancer. Similarly, Zambia, a country of 12 million people, has a single pathology laboratory. In an attempt to relieve this huge burden, the Italian Association of Pathologists (Patologi Oltre Frontiera) created a virtual pathology laboratory using telepathology to perform hematoxylin-eosin microscopy and cytologic testing of

**Table 2. Operations Performed at Kamuzu Central Hospital for Each Cancer Type**

Operation Performed	No. (%) of Operations
<b>Esophageal (n = 50)</b>	
Esophagectomy	8 (16.0)
Gastrostomy tube	38 (76.0)
Other	4 (8.0)
<b>Gastric (n = 29)</b>	
Gastrectomy	12 (41.4)
Gastrostomy tube	3 (10.3)
Jejunostomy tube	4 (13.8)
Bypass	3 (10.3)
Exploratory laparotomy	5 (17.2)
Biopsy only	2 (6.9)
<b>Colorectal (n = 34)</b>	
Resection	7 (20.6)
Abdominoperineal resection	3 (8.8)
Diverting colostomy	12 (35.3)
Diverting ileostomy	1 (2.9)
Exploration/bypass	4 (11.8)
Examination under anesthesia	7 (20.6)
<b>Prostate (n = 60)</b>	
Orchidectomy	59 (98.3)
Prostatectomy	1 (1.7)
<b>Testicular (n = 5)</b>	
Orchidectomy	5 (100.0)
<b>Breast (n = 49)</b>	
Modified radical mastectomy	23 (46.9)
Simple mastectomy	1 (2.0)
Lumpectomy	22 (44.9)
Bilateral oophorectomy	3 (6.1)
<b>Skin (n = 28)</b>	
Excision	24 (85.7)
Limb amputation	3 (10.7)
Digit amputation	1 (3.6)



**Figure 4.** Comparison of proportion of cancer types seen in Malawi with that reported by the International Agency for Research on Cancer (GLOBOCAN) for less developed countries in 2008. Upper gastrointestinal (GI) cancer refers to both esophageal and gastric cancers. Cervical cancer cases were not included in the Malawi analysis. Skin cancer and head and neck cancer were not included in the GLOBOCAN data.

surgical specimens.<sup>18</sup> This novel approach may allow for accurate diagnoses and guide the management of the growing burden of surgical disease.

Staging cancer is also a challenge in LMICs. Despite being among the biggest hospitals in Malawi, KCH does not have access to computed tomography, and therefore cancers cannot be preoperatively staged and some cannot even be diagnosed. Malawi's cancer registry contains staging information on a mere 0.7% of cancer cases.<sup>11</sup> As technology for cross-sectional imaging becomes cheaper, efforts should be made to have these services available at major treatment centers across the globe. Teleoncology initiatives have been implemented in many developing countries to aid in the interpretation of results and in education and are becoming increasingly available as Internet access becomes more affordable.<sup>19</sup> Furthermore, surgeons could be trained to use less expensive imaging tools, such as ultrasonography, as has occurred in many fields in modern medicine.<sup>20,21</sup>

Data collection is a difficult but crucial component of improving diagnoses and managing cancer in the developing world. A simple intervention would be the implementation of a basic data card containing information such as age, sex, date of suspected cancer diagnosis, treatment to date, and an estimate of tumor stage. This card would be held by each patient diagnosed as having cancer to ensure integrity and recall of data. Similar data cards have been used to improve adherence to childhood vaccination<sup>22</sup> and for other maternal and child health programs throughout the developing world.

Many of the limitations described in this article clearly render the implementation of the National Comprehensive Cancer Network guidelines impossible in low-income economies. The lack of patient follow-up in Malawi and many LMICs makes it challenging to determine optimal therapy, particularly when surgery is the only therapeutic option because of the absence of chemotherapy and radiotherapy. Although some procedures, such as orchiectomy for prostate cancer, are established with some benefit,<sup>23</sup> others, such as toilet mastectomy for metastatic breast cancer, are unlikely to improve outcomes for patients.<sup>24</sup> Because of the lack of data to support alternative treatment regimens in LMICs, working groups have been established to adapt these guidelines for the Middle East and Africa, as well as other regions of the world.<sup>25</sup> A good example of an existing program is the Breast Health Global Initiative, which is composed of a group of international breast cancer experts who have developed a consensus statement for the management of breast cancer in low-resource countries.<sup>24</sup> These guidelines are created with an awareness of the limited resources in these settings, such as difficulties of access to radiation therapy and limited access to certain chemotherapeutic agents.

This article has obvious limitations in the quality of the data collection and lack of patient follow-up. However, the data capture the demographic characteristics of patients with malignant cancer treated with surgery in Malawi and serve to highlight the major resource deficiencies in cancer care in low-income countries, which is particularly important because malignant disease is increasingly being appreciated as a disease burden in these countries. The surgical workforce in these countries is an

important resource for meeting this challenge. In addition, the need for prospective research endeavors is highlighted because disparities in age at presentation and tumor incidence because differences there may be differences in causes and biology that currently are not understood. Four key strategies that can be implemented in a low-resource setting are improvement of pathology services, improvement of radiology services, data collection, and modified guideline implementation. Without increased representation by surgeons in the global health arena of the UN, the WHO, and other global initiatives, the major modality used to cure patients with solid tumors will continue to be severely underused. General surgeons and surgical oncologists in the developed world can fill a major void by increasing awareness, collaborating globally, and supporting surgical colleagues in developing countries.

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**Author Contributions:** *Study concept and design:* Gyorki and Kingham. *Acquisition of data:* Kingham and Muyco. *Analysis and interpretation of data:* Gyorki, Kushner, Brennan, and Kingham. *Drafting of the manuscript:* Gyorki, Kushner, Brennan, and Kingham. *Study supervision:* Kingham.

**Conflict of Interest Disclosures:** None reported.

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### Announcement

**C**ongratulations to Evan M. Renz, MD, of the US Army Institute of Surgical Research in Fort Sam Houston, Texas, and the Uniformed Services University of the Health Sciences in Bethesda, Maryland; Geoffrey Ling, MD, PhD, of the Uniformed Services University of the Health Sciences in Bethesda, Maryland; Kevin J. Mork, MD, of Altru Health System in Fargo, North Dakota; and James Ecklund, MD, of the Uniformed Services University of the Health Sciences in Bethesda, Maryland, and Virginia Commonwealth University, Richmond; they coauthored the winning Image of the Year for 2012. Their Image of the Month article on a foreign body in the skull appeared in the April 2012 issue (*Arch Surg*. 2012;147[4]:391-392). This year was notable for the numerous correlations of interesting preoperative radiographic images with intraoperative or pathologic images. The winning images illustrate an interesting and, for American surgeons, rare mechanism of injury. Their appeal, however, goes beyond surgical interest. In recent decades, the media have given us many photographs from around the world of armed men firing their automatic weapons wildly into the sky in uninhibited group celebration of some event. When gravity finally overcomes the effect of muzzle velocity and these bullets return to earth, what is the risk to the crowd below? In addition to the interests of current events, this article provides a succinct summary of surgical management principles. We are rightly warned not to take a Kelly clamp in the emergency department and cavalierly extract a protruding foreign body that penetrates the skull. These are images of an unusual injury that also remind us that we live in a global village.

Please revisit our April 2012 issue to determine the most appropriate initial management.



Image of the Year for 2012.