



Figure 1

**Figure 1:** Operating theatre in Bugando Medical Center in Mwanza, Tanzania, performing a posterior thoracic fusion.

# Spine Surgery in Tanzania: A Neurosurgery Resident's Experience

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As a PGY-7 resident at Vanderbilt University Medical Center, I recently spent 2 weeks in Tanzania alongside our Chairman, Dr. Reid Thompson. The first week was spent at Bugando Medical Center, a 950-bed teaching hospital in Mwanza, Tanzania. The facility is staffed by one neurosurgeon and two registrars (the equivalent of a mid-level resident) with a catchment area of over 16 million, drawing patients from neighboring Kenya, Uganda, Rwanda, Burundi, and the Democratic Republic of the Congo. (**Figure 1**) In our second week, we operated at the Mnani Mmoji Hospital in Zanzibar with the Neurosurgery Education and Development (NED) Foundation.<sup>1</sup> Local neurosurgery teams included 4 registrars, 2 at each hospital. We preformed 20 surgeries, from degenerative and traumatic spine pathology to brain and spine tumor resections. I was incredibly fortunate to be offered this life-altering experience.

My interest in this area was sparked by the outstanding work of my colleagues at Vanderbilt. Dr. Christopher Bonfield started his international experience as a resident, and now, as an attending, regularly visits Peru to perform craniofacial surgery and Africa for general and pediatric neurosurgical care.<sup>2</sup> My co-resident, Dr. Michael Dewan, spent 9 months in Uganda under the mentorship of Dr. Ben Warf, both providing pediatric neurosurgical care and teaching the techniques of ETV/CPC. Michael also conducted impactful research that defined the burden of neurosurgical disease worldwide and identified the highest volume and lowest resourced developing countries.<sup>3</sup> Another Vanderbilt resident, Dr. Ahilan Sivaganesan, organized an Emergency Neurotrauma course in his homeland of Sri Lanka for over 200 nurses, medical students, residents, and attendings. The outstanding work and humble passion of my own colleagues was infectious.

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## Differences

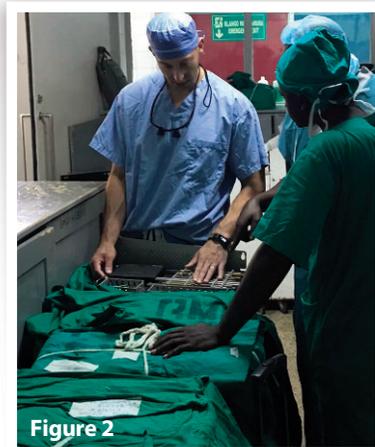
The greatest difference between spine surgery in the U.S. and developing nations is resources. Meticulous planning is required to perform successful surgery. Below are important differences:

### 1. Surgical planning.

Spine trauma often presents days to weeks after injury, and the conventional treatment is months of bedrest. The primary goal of surgery becomes stabilization for mobilization – any reduction is an added bonus. Forming a surgical plan that can be accomplished in a 2 to 3 hour surgery is imperative to avoid anesthetic and blood loss complications.

**2. Securing necessary equipment.** Without an experienced scrub technician or instrumentation representative, it is the responsibility of the surgeon to ensure that all instruments are present and sterilized. Pedicle probes, screws of appropriate size, rods that fit in the screws, set screws, and screw drivers for both screws and caps are the minimum required. (Figure 2)

**3. Instrumentation placement.** Without access to c-arm fluoroscopy, localization and instrumentation placement becomes reliant on local anatomy. Studying the posterior element fracture pattern, assessing location of paraspinal muscle damage, using



**Figure 2:** Ensuring adequate hardware is available for the upcoming posterior cervical at Bugando alongside the OR manager Luta.

adjacent structures such as iliac crest and scapula, and assessing in-vivo instability are all tools to localize the correct level. “Free-hand” pedicle screw placement is the standard method employed.

**4. Hemostasis.** Meticulous hemostasis is important in any spine case, yet even more important when access to blood may not be feasible. Peroxide soaked sponges take the place of thrombin-soaked cottonoids and surgifoam.

**5. Postoperative care.** Nursing staff are often not accustomed to drain management and pain control. Techniques such as drain stripping, maintaining suction, or dropping to the floor should be deliberately communicated, as should the importance of scheduled pain medication and postoperative ambulation.

## Cases

In total, we performed 10 spine surgeries during our trip – including posterior cervical and thoracic/lumbar fusions, degenerative lumbar decompression and fusion, and intramedullary spinal tumor resections. Below are some notable cases.

- **Case 1.** A 29-year-old male s/p MVC 2 weeks prior who suffered a T8/9 chance fracture with significant kyphosis. He was neurologically intact but confined to bedrest for 3 months until the fracture healed. We performed a T6-11 posterior spinal fusion and T7/8 laminectomy. He was able to ambulate on postoperative (POD) #1 and discharged on POD#3. These were some of the most satisfying cases, treating unstable fractures in neurologically intact patients that allowed them to return to work and contribute to their local communities. (Figure 3)
- **Case 2.** A 19-year-old male s/p MVC with an L2 burst fracture presented initially as ASIA D, but because no spine surgeon was available, regressed to ASIA B with 1-2/5 strength in BLE and



**Figure 3a**



**Figure 3b**



**Figure 3c**



**Figure 3d**

**Figures 3a, 3b, 3c & 3d: Case 1.**

## Spine Surgery in Tanzania ■ Continued from page 5

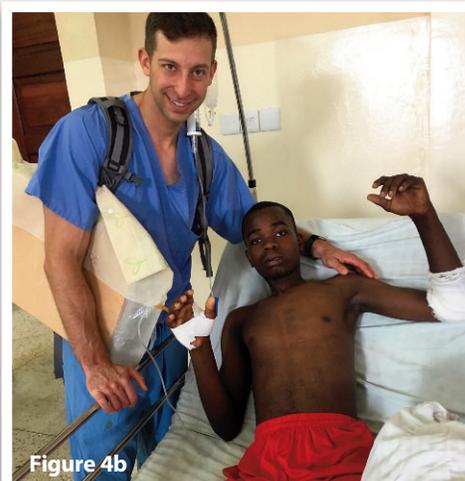


Figure 4a & 4b: Case 2.

urinary retention. Ten days after the injury, we performed a T12-L4 posterior spinal fusion and L2 laminectomy, with little hope for neurologic recovery. On POD#1, he was able to sit-up and his pain was improved. To our surprise, 3 weeks later he was able to walk with near full strength and void spontaneously. (Figure 4)

■ **Case 3.** A 46-year-old, wheelchair-bound male with significant leg weakness, long tract signs, and new upper extremity paresthesias was found to have an upper thoracic intramedullary spinal cord tumor with extensive edema. We performed a laminectomy and tumor resection to prevent ascending weakness and loss of function in his upper extremities. Though still unable to ambulate, his pain and paresthesias improved and he maintained use of his upper extremities. (Figure 5)



Figure 5a & 5b: Case 3.

### Future

Though we helped the patients on whom we operated, many were too complex or far from injury to benefit from surgery, such as this 25-year-old male with a T11/12 thoracic fracture dislocation and spondyloptosis. (Figure 6) We realized that the most meaningful opportunities for sustainable change was through teaching. Dr. Hans Mhagama and Dr. Misso Lubigisa were the two registrars at Bugando and both extremely talented despite not having entered a formal neurosurgical training program. As Dr. Thompson imparted cranial and skull base knowledge to Hans, I operated alongside Misso, teaching the principles of freehand pedicle screw placement and taking him through his first posterior cervical fusion (Figure 7).

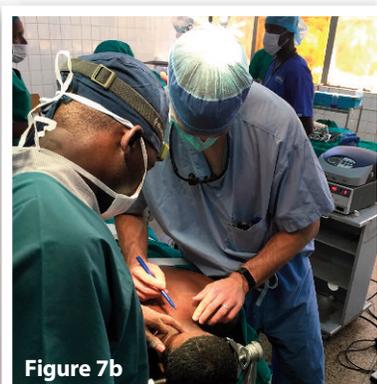
Along with the sage advice of those with extensive international experience, I would recommend the following ways to become involved, not all requiring significant time away from work:

- 1. Look to senior leaders.** We are fortunate to have some outstanding examples, such as the work done at Duke creating a residency in Uganda[4] and Cornell led by Dr. Roger Hartl in Tanzania[5]. Read about their work over the last decades and reach out with interest.
- 2. Listen.** Once a relationship is started, listen and gather information on how the surgeons and patients can be helped most. Something as



Figure 6: T12/L1 fracture dislocation and spondyloptosis. The patient was ASIA A and 6 weeks from injury, confined to 3 months of bedrest.

Continued from page 6



**Figure 7a, 7b & 7c:** Starting a C3-T2 fusion with Bugando Medical Center registrar, Dr. Misso Lubigisa (left) and Dr. Hans Mhagama (right).

simple as postoperative order sets or non-operative treatment of degenerative spine conditions may make an enormous difference in patient care, rather than an expensive microscope that cannot be used due to electricity constraints.

**3. Invest in trainees.** The path to becoming a fully trained neurosurgeon in Africa is complex, long, and expensive. Many young surgeons spend years as registrars, functioning as interns without an actual neurosurgery training program, before they start formal neurosurgical training. These registrars are often in need of senior mentorship and letters of recommendation to gain access to an accredited training program.

**4. Spinal instrumentation.** At Bugando, the registrars were well versed in thoracic and lumbar pedicle screw placement, yet patients with spine fractures stayed bed-bound for months. Why? No set screws were available. U.S. spine companies often have extra implant sets that can be put to great use in resource-limited markets. Ask your local spine reps for sets that can be donated.

**5. Educational materials.** During our trip, we brought several spine textbooks for the registrars. Furthermore, many texts are now available in PDF format, allowing easier exchange of educational materials.



**Figure 8:** Placing lumbar pedicle screws with Vanderbilt University Medical Center Chairman and skull base surgeon Dr. Reid Thompson.

This was a life-changing experience. After seven years of residency, the chance to use the acquired knowledge and skillset to help those without access to care was powerful. Placing pedicle screws with my skull base chairman was simultaneously exciting, nerve-racking and rewarding (**Figure 8**). The people of Tanzania were warm and incredibly appreciative. Conversely, one cannot ignore feelings of helplessness and sadness seeing patients who could not be helped with our services due to end-stage pathology, but may have been helped if seen earlier. We are left with a renewed sense of worth and meaning in the work we do.

While much of the burden of disease in neurosurgery globally rests in conditions such as hydrocephalus, spina bifida, and traumatic brain injury, there is a tremendous deficit in the provision of spine surgery in many countries. Personally, this trip ignited my own interest in continuing this work. At the conclusion of my residency, I will be spending a significant portion of next year back in Tanzania as a fellow in Dr. Roger Hartl's International Neurosurgery Fellowship, based in Dar es Salaam, Tanzania. I am grateful to be able to share my experience and welcome further discussion on the topic ([zuckerman.scott@gmail.com](mailto:zuckerman.scott@gmail.com)).

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