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MON CHÉRI HAITI: NEUROLOGY LESSONS LEARNED

Haiti is a country rich in revolutionaries and visionaries. It has faced countless hardships, most recently the devastating earthquake of 2010. In 2011, the population was estimated at approximately 10 million people. WHO estimates show a stark difference in the health of Haitians compared to other inhabitants of the region (table 1).¹

The Global Burden of Disease Study predicts that the burden of disease from neuropsychiatric disorders will increase 15% by 2020.² A measure of disability, the disability-adjusted life-year (DALY), was introduced to measure years of healthy life lost due to disability. Neurologic disease is estimated to account for over 220 million DALYs in 2014, compared to 185 million in 2000.³ It is clear from these studies that neurologists will be crucial to improving health, as neurologic disease has a substantial impact on a nation's productivity and economy. In Haiti, strokes were estimated to account for over 10,000 deaths in 2012; they accounted for over 200,000 DALYs.⁴

Currently, there is collaboration between the American Academy of Neurology and the St. Luke Foundation. This is a charitable organization that includes an adult hospital, a pediatric hospital, and a rehabilitation center. This organization treats over 200,000 patients per year and employs more than 800 Haitian workers and physicians.

In an effort to join and expand this work, the Boston University Department of Neurology developed the Global Health Initiative. This is an interdisciplinary team with the goal of caring for patients, educating physicians and other health care professionals, and identifying needed resources and system support in Haiti. Neurologic services were provided at St. Luke Hospital, in both the inpatient and outpatient departments (table 2). Over the course of 1 week, 37 adult and pediatric inpatient cases were evaluated. Patients received care free of charge. We present a case to demonstrate the type of patients encountered and the lessons learned.

Case report. A 19-year-old man presented after having 2 witnessed loss of consciousness events. He had been in a motor vehicle collision 1 year prior and sustained a severe concussion; subsequently, he fully recovered. More recently, he described 2 seizure-like episodes that were preceded by decreased sleep and increased stress. The events were immediately preceded by an aura of brightly colored lights floating in his visual field followed by a loss of consciousness. His sister described generalized tonic-clonic activity of all extremities lasting for 2–3 minutes. He was otherwise in his usual state of health.

His neurologic examination was nonfocal including detailed bedside visual field testing. Our concern was for encephalomalacia from head injury contributing to his seizure activity. A CT scan without contrast was performed, as no contrast was available at the time, and showed a well-circumscribed lesion in the right occipital lobe measuring 1 × 1.5 cm without significant edema. He was started on phenytoin 300 mg nightly for seizure treatment and was provided education on seizure precautions. He was scheduled in the clinic the following month for a repeat CT scan when contrast would be available. At the 1-month follow-up appointment with a collaborating neurologist, the patient remained seizure-free. A repeat CT scan with contrast was performed with no enhancement identified.

This case illustrates the barriers to care in resource-limited environments. In a health care system without financial constraints, the patient would have received an MRI with contrast and an EEG. He would have had routine bloodwork drawn and specialized laboratory testing. His medication management would have likely included a newer antiepileptic drug (AED) with fewer long-term side effects.

Strengths of the system. Due to the aggressive nature in which we practice neurology in the United States, at times the teams were surprised by the doses of medications that we prescribed. For example, loading a patient on IV phenytoin would require the use of

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Table 1 Haiti health statistics compared to regional averages

	Haiti average	Regional average
Gross national income per capita	\$1,200	\$25,000
Total health expenditure per capita	\$94 (8% of total gross domestic product)	
Life expectancy, y	63	76
Child <5 mortality ratio	70 per 1,000 live births	16 per 1,000 live births
Maternal mortality ratio	350 per 100,000 live births	63 per 100,000 live births

Regional countries include surrounding Caribbean Islands and Central America. Source: WHO fact sheet.

all the phenytoin in the hospital and an intensive by-hand infusion; therefore, this was an unacceptable option. In its stead, we changed over to a system of oral loading through nasogastric tube. The valuable lesson of conserving resources was something not previously encountered in our US-based health system and was a valuable learning point for our team.

In addition, there was a much higher level of family involvement in patient care. In the pediatric unit, a family member was by each child's bedside, day and night. In all units, families were responsible for changing, bathing, and feeding their loved ones. They were instructed on the proper diet and exercises for each patient. In our US institution, many patients have little to no social support and navigate our complicated medical system alone.

Limitations of care. It is clear that there are simple medical interventions that could markedly decrease the morbidity and mortality of the patients we evaluated. Early identification and treatment of infection has the potential to prevent a number of neurologic complications seen. In addition, optimization of the available medications and improved delivery systems

for those medications would have markedly reduced the lengths of stay of many patients.

The following major limitations highlight areas of potential improvement.

The antiepileptic agents available were older medications, which were effective but had significant side effects.

There is currently no ability to consistently provide IV continuous infusions; the only option is IV push. This limits the ability to IV load AEDs or to give continuous infusions of antihypertensive medications, antibiotics, or normal saline.

All laboratory data are sent out to another facility and often require days before results are finalized. Furthermore, the hospital frequently runs out of collecting tubes. Procedures such as lumbar punctures are impossible without equipment, screening laboratories, and a sterile environment. This was a major impediment to care, as there were a number of patients who could have benefited from even basic laboratory studies run on CSF fluids.

Imaging by CT can be improved by having readily available contrast. Additionally, there are no onsite or offsite radiology reads, unless a visiting physician is present.

There is no access to neurosurgical care available at St. Luke, which limits the appropriate management of certain neurologic cases.

Continued efforts. A patient database was started to maintain a record of patients for continuity of care. The database will allow a record of patients seen and provide a reference for future neurologic care. It will also serve to identify trends in diseases and in the needs of the patient and the hospital system.

Education targeted to health care providers on topics including the identification of nonconvulsive status epilepticus and basic clinical management of hemorrhagic vs ischemic stroke is ongoing. Other issues for future discussions include the upfront costs the families incur for laboratory testing, imaging, and outpatient medications, and improving coordination of care between departments.

Discussion. Substantial amounts of aid poured into Haiti after the earthquake in 2010. Approximately \$5.2 billion was pledged and raised, equal to almost 80% of Haiti's total yearly economic output. To date, only \$1.6 billion was sent to Haiti (equal to about 25% of the total yearly economic output).⁵ The allocation of these funds to medical care, medical education, public health infrastructure, and governmental stabilization remains inadequate.

The average age of patients seen was 34 years; therefore the years of productive life lost will have a meaningful impact on the patients' families, who carry the immediate burden of their disabilities.

Table 2 Diagnoses and number of cases seen

Diagnosis	
Hemorrhagic stroke	6
Ischemic stroke	8
Seizure	8
Status epilepticus	5
CNS infection	2
Tumor	3
Headache	3
Autoimmune (multiple sclerosis)	1
Psychosomatic	1
Total inpatients seen	37
Adults	21
Pediatrics	11
Intensive care unit level	5

Likewise, there is an undeniable impact on Haiti's economy and its sustainability when evaluating this population. It is imperative we work to decrease the number of lives lost to mortality and the quality of life lost to disability. We promote our Global Health Initiative as a component to help achieve this goal.

AUTHOR CONTRIBUTIONS

Dr. Malveeka Sharma: study concept and design, acquisition of data, analysis and interpretation, critical revision of the manuscript for important intellectual content. Dr. Veronica Santini: study concept and design, acquisition of data, analysis and interpretation, critical revision of the manuscript for important intellectual content. Marie Auguste: study concept and design, acquisition of data. Dr. Anna Hohler: study concept and design, acquisition of data, analysis and interpretation, critical revision of the manuscript for important intellectual content, study supervision. Dr. Anthony Alessi: critical revision of the manuscript for important intellectual content. Dr. Elaine Jones: critical revision of the manuscript for important intellectual content. Dr. Mill Etienne: critical revision of the manuscript for important intellectual content.

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