Global Health and Disaster course at the Center for Global Health, University of Colorado

A brief view of the state of international neurosurgery

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Addressing surgical disease in the developing world

• “.....surgery may be thought of as the neglected stepchild of public health.”

Addressing surgical disease in the developing world

• Surgically treatable conditions account for approximately 11% of the global burden of disease and 15% of total disability adjusted life years lost worldwide. (Ozdgediz et al, 2008)

• Of the approximately 5 million deaths worldwide due to trauma, about 40% may be preventable with improved trauma care. (Mock, 2013)

• One report found that 6-12% of all pediatric hospital admissions in sub-Saharan Africa in 2002 required surgical services. (Bickler et al, 2000)
Addressing surgical disease in the developing world

Lancet Commission

Global Surgery 2030: Evidence and solutions for achieving health, welfare, and economic development

“Surgery is an integral, indivisible component of a properly functioning health system, and all people should have access to safe, high-quality surgical and anesthesia care with financial protection when needed.”
Global Origins
Modern Neurosurgery
The neurosurgeon is a rare breed in the developing world

Table 2. Distribution of Neurosurgeons in the World

<table>
<thead>
<tr>
<th>Region</th>
<th>Population (millions)</th>
<th>Neurosurgeons</th>
<th>Ratios (adjusted)</th>
</tr>
</thead>
<tbody>
<tr>
<td>World</td>
<td>6656</td>
<td>33,193</td>
<td>1:275,000</td>
</tr>
<tr>
<td>North America</td>
<td>570</td>
<td>6,546</td>
<td>1:81,000</td>
</tr>
<tr>
<td>South America</td>
<td>405</td>
<td>4,422</td>
<td>1:123,000</td>
</tr>
<tr>
<td>Central America</td>
<td>40</td>
<td>185</td>
<td>1:358,000</td>
</tr>
<tr>
<td>Europe</td>
<td>900</td>
<td>8,856</td>
<td>1:121,000</td>
</tr>
<tr>
<td>Asia</td>
<td>3800</td>
<td>12,288</td>
<td>1:336,000</td>
</tr>
<tr>
<td>Australia</td>
<td>56</td>
<td>162</td>
<td>1:205,000</td>
</tr>
<tr>
<td>Africa</td>
<td>800</td>
<td>700</td>
<td>1:1,238,000</td>
</tr>
</tbody>
</table>


African Neurosurgery, the 21st-Century Challenge, El Fiki, 2004
The neurosurgeon is a rare breed in the developing world

WHO Neurology Atlas 2004
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Table 1. Number of Reputable Hospitals in Different Continents

<table>
<thead>
<tr>
<th>Continent</th>
<th>Number of Countries</th>
<th>Number of Hospitals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>31</td>
<td>325</td>
</tr>
<tr>
<td>America</td>
<td>38</td>
<td>6907</td>
</tr>
<tr>
<td>Europe</td>
<td>48</td>
<td>7035</td>
</tr>
<tr>
<td>Asia</td>
<td>40</td>
<td>2826</td>
</tr>
<tr>
<td>Oceania</td>
<td>7</td>
<td>261</td>
</tr>
</tbody>
</table>


African Neurosurgery, the 21st-Century Challenge, El Fiki, 2004
Neurosurgical diseases are under-recognized as public health issues

Figure 1. Average annual number of traumatic brain injury-related emergency department visits, hospitalizations, and deaths, United States, 1995-2001.

Langlois et al, 2006
Neurosurgical diseases are under-recognized as public health issues

Every year, 250 to 500K people suffer from SCI around the world

http://www.who.int/mediacentre/factsheets/fs384/en/
Very little is known regarding the epidemiology of neurological disease in the developing world.
% born in developed nations who have the benefit of proper care.

% of the approximately 400,000 babies born this year with hydrocephalus will be born in developing countries with little or no access to neurosurgical care. Many will die.

https://cure.org/hydrocephalus/
Neurosurgical diseases are under-recognized as public health issues

Incidence of neural tube defects in the least-developed area of India: a population-based study

Anil Cherian, Siju Seena, Robyn K Bulock, Alcik C Antony

<table>
<thead>
<tr>
<th>Condition</th>
<th>Number (%)</th>
<th>Rate per 1000 livebirths (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Closed spina bifida (meningocele)</td>
<td>4 (40%)</td>
<td>3.3 (1.1–9.0)</td>
</tr>
<tr>
<td>Open spina bifida (meningomyelocele)</td>
<td>2 (20%)</td>
<td>1.6 (0.6–5.4)</td>
</tr>
<tr>
<td>Occipital meningocele</td>
<td>1 (10%)</td>
<td>0.8 (0.04–5.3)</td>
</tr>
<tr>
<td>Anencephaly</td>
<td>3 (30%)</td>
<td>2.5 (0.6–7.8)</td>
</tr>
<tr>
<td>Total</td>
<td>10 (100%)</td>
<td>8.2 (4.2–15.6)</td>
</tr>
</tbody>
</table>

Table: Types of neural tube defects in babies born between Oct 1, 2002, and Sept 30, 2003, in two areas of Balrampur District, Uttar Pradesh, India
Neurosurgical diseases are under-recognized as public health issues

Wu et al, 2013

Fig. 2. Sensitivity analysis for burden of disease (in DALYs) from selected congenital malformations.
The practice of neurosurgery presents significant challenges in resource poor settings.
Challenges of providing neurosurgical care in the developing world
Challenges of providing neurosurgical care in the developing world
Challenges of providing neurosurgical care in the developing world

http://www.all-crna-schools.com/
Challenges of providing neurosurgical care in the developing world
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Developing training programs VS. Medical mission trips
“....for ethical reasons, we should abandon the body count mentality. Twenty operations performed perfectly for the purpose of teaching are better than 100 amateurish ones performed by volunteer plastic surgeons. The future lies in the substitution of smaller teams of two or three competent visiting surgeons staying longer on par with their local colleagues....”

Dupuis, 2004
Ethical considerations in targeted paediatric neurosurgery missions

Samuel A Hughes,\textsuperscript{1} Rahul Jandial\textsuperscript{2}

Seven guiding principles in outlining a model for sustainable short-term international medical trips\textsuperscript{4}

1. Mission: by establishing a common sense of purpose
2. Collaboration: with the community and its infrastructure
3. Education: for the community and volunteers
4. Service: of the community’s health needs
5. Teamwork: among team members of diverse specialties
6. Sustainability: by working to build capacity in the local community
7. Evaluation: of outcomes and whether goals are being met
“It may be helpful to evolve from the ideas of “neurosurgical humanitarian aid” toward the concept of global neurosurgical partnerships....”

Warf, 2009
Sustainable neurosurgery in the developing world

• Train candidates from the developing countries abroad
• Basic training in home country with final training abroad
• Neurosurgeons devote time to training surgeons in the developing world

Fairholm, 1986
Twinning

• The partnering of two organizations in the goal of developing sustainable, high quality healthcare.
  – Long term goals should ensure that this system persists in the absence of the mentoring institution.
International Endeavors

- FIENS
- CURE
- International Foundation for Spina Bifida
- Project Medishare
- Neurosurgery, Education and Development Foundation
- Mission:Brain
- Madaktari
- Duke East Africa Neurosurgery program
CURE Hydrocephalus

- Mbale, Uganda
- Since 2000:
  - >5000 operations
  - 10 fellowship trained surgeons
  - Significant research in non-shunting treatment for hydrocephalus
CURE Hydrocephalus

- Presentation, pathology, and treatment outcome of brain tumors in 172 consecutive children at CURE Children's Hospital of Uganda. The predominance of the visible diagnosis and the uncertainties of epidemiology in sub-Saharan Africa.
- Rainfall drives hydrocephalus in East Africa.
- Long-term outcome for endoscopic third ventriculostomy alone or in combination with choroid plexus cauterization for congenital aqueductal stenosis in African infants.
- Costs and benefits of neurosurgical intervention for infant hydrocephalus in sub-Saharan Africa.
- Five-year survival and outcome of treatment for postinfectious hydrocephalus in Ugandan infants.
- Hydrocephalus associated with neural tube defects: characteristics, management, and outcome in sub-Saharan Africa.
Duke East Africa program

• Collaboration b/w Duke University and New Mulago Hospital
• Donation of >21 tons of essential equipment
• 3 training camps over a 2 year period
Surgical Capacity Building in Uganda Through Twinning, Technology, and Training Camps

Michael M. Haglund · Joel Kiryabwire ·
Stephen Parker · Ali Zomorodi · David MacLeod ·
Rebecca Schroeder · Michael Muhumuza ·
Michael Merson
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Conclusion

• Much of the world is severely lacking in adequate neurosurgical care.

• Neurosurgically treated diseases represent significant public health problems in the developing world.

• Forming global partnerships between institutions or “twinning” may be the next step forwards in providing sustainable neurosurgical care in developing nations.
Key References

- Neurology Atlas©WHO, 2004
- Hughes SA, Kandial R. Ethical Considerations in targeted pediatric neurosurgery missions. *J Medical Ethics*. 2013