Application of modern neurosurgical technologies in low and middle-income countries

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INTRODUCTION

In the last 10 years, the neurosurgical practice has seen an exponential growth that has shattered all the imaginary borders of its predecessors. From tremendous advancement in neuroendovascular care to treat stroke patients that have sustained symptoms more than 24 hours ago, to minimally invasive robotic spine surgery that dischargers patients' homes on the same day - all these advancements have drastically improved patient outcomes in the developed world.

OBJECTIVES

To identify the plausibility and economic savings of implementing modern neurosurgical technology in LMIC regions.

METHODS

In this publication, we performed research on highly effective neurosurgical technologies that have drastically improved neurosurgeon's experience in the operating room. To quantify the quality of this paper we narrowed down our search to the years 2009-2022. The criteria for inclusion of researched papers were based on novelty, applicability, feasibility and active usage in surgical fields. The literature search was conducted in February 2022 and yielded in total 303 results for "augmented reality in neurosurgery" and 448 results for "modern technology in Neurosurgery". The sum of (n=751) search queries was screened.

RESULTS

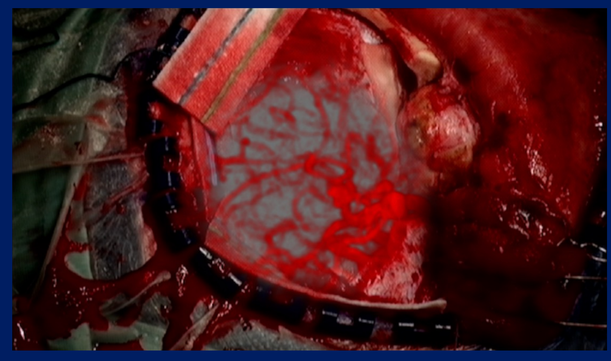
In this paper, we demonstrated how the latest technological advancements in neurosurgery, could play a vital role in the improvement of patient care in LMICs. Our findings have shown how the latest imaging technology of portable MRI, AR Neuronavigation, Telerobot, and Endovascular Robots have a tremendous advancement in improving care and could save money for local government and healthcare systems. The comparison of acquiring new technology versus the cost of traditional treatment has shown favorably toward technology.

CONCLUSIONS

The advantages of modern technology in neurosurgical specialty play a vital role in patient survival. Technology that has proven a positive outcome for neurosurgical patients, must be seriously considered for implementation in LMIC hospital systems. The only logical setback of the mentioned technologies - is the financial upfront cost to the facility or government.

Picture 2. Application of Augmented Reality without losing focus on the operating site.

Picture 3. Example of 3D headset and joystick.



Picture 1. Example of The Intraoperative Brain Imaging System (Ibis) navigation.

	MRI Machine		Neuronavigtion	
	Average Traditional Cost	Hyperfine Portable MRI Cost	AR Navigation System Cost	Traditional Neuronavigation Cost
	≈ $1 million	≈ $50,000	≈ $10,000	≈ $483,000
Total Savings	**$950,000**		**$473,000**	

Table 1. Imaging technology cost comparison for traditional vs. new technology.

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Average cost of Telerobot	Average cost of CorPath GRX Robot
≈ $46,000	**≈ $650,000[31]**

Table 2. Representation of prices for robotic technology in vascular neurology/neurosurgery

The following price range models were identified:

Fluoroscopy imaging: $250,000 - $500,000

Intraoperative CT: $600,000 – $1.2 million

Neuronavigation system: $250,000 - $700,000

MRI Scanners: $200,000 - $3 million

AR Navigation System (P.e HoloLens 2) + a set of 4 digital cameras: $7,000 - $10,000

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