Smartphone-assisted Endoscopy in Neurosurgery

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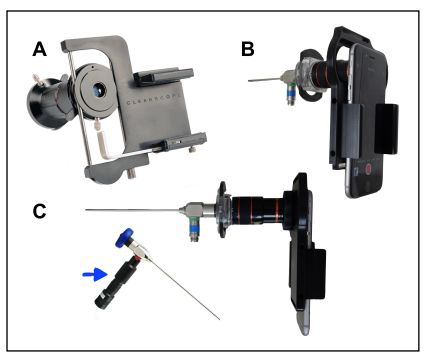
INTRODUCTION

Advances in video and fiber optics since the 1990s have led to the development of several commercially available high-definition neuroendoscopes. However, this technological improvement has been surpassed by the smartphone revolution. With the increasing integration of smartphone technology into medical care, the introduction of high-quality, built-in digital cameras offers new possibilities in neuroendoscopy.

METHODS

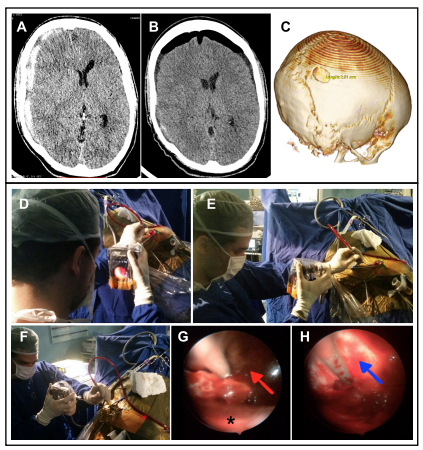
The authors present an adapter that integrates the smartphone with the neuroendoscope, thus eliminating the need for the classic video system. This novel video system has been used for surgery on patients with various neurosurgical pathologies, including hydrocephalus, subdural hematomas, and brain aneurysms.



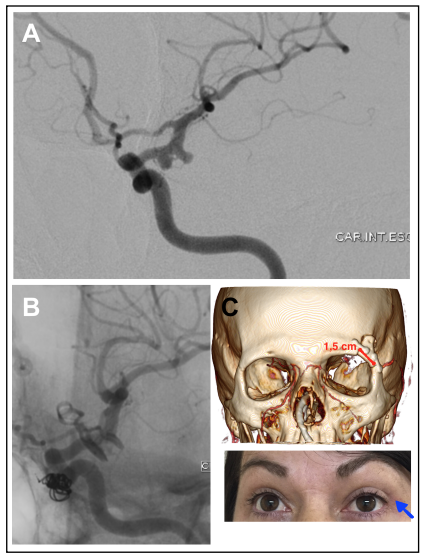
IPHONE + NEUROENDOSCOPE. (A) The ClearScope Smart Phone Adaptor ® allows the connection of a mobile device to almost any endoscope. The unit secures the smartphone in a rigid platform that connects to an adjustable telescope over the camera lens. (B) Scope Adaptor ® is an older version with the same functions. (C) We have used a range of endoscopes with different lengths, thicknesses and angles.

RESULTS

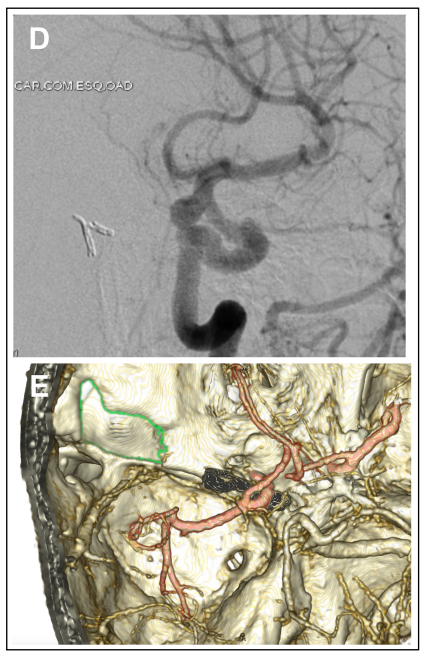
The new endoscopic system was used to treat 12 patients. All procedures were successfully performed, and no complications related to the use of the new method were observed. The quality of the observed image was appropriate as smartphone cameras can record images in high definition or 4K. Moreover, improved mobility facilitates more intuitive use, as the smartphone screen moves along with the endoscope; in fact, this has been identified as the greatest benefit when compared to the standard video set.



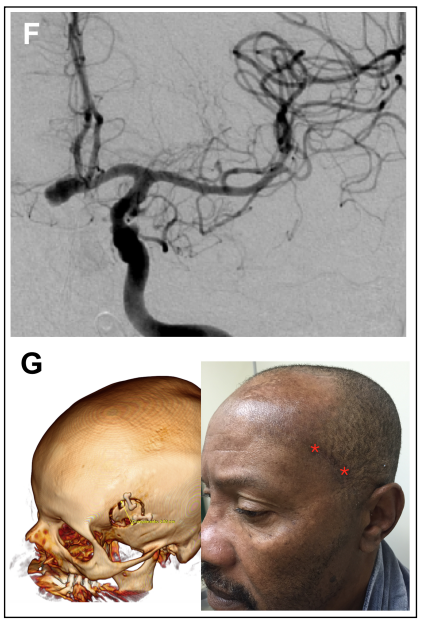
SUBDURAL HEMATOMA. A male patient of 47 years old was brought to the emergency department by relatives after a 2 meters fall two days before. (GCS of 14 with left hemiparesis with muscle strength grade IV). (A) Preoperative CT scans. (B) In patients with subdural hematomas without brain swelling, it is possible to perform a complete endoscopic resection. (C) However, an adequate entry point, adjacent to the hematoma, is essential. (D) (E) (F) During endoscopic resection. (G) and (H) Intracranial intraoperative images. Subdural hematoma (red arrow) is removed by the aspirator. Then, Duramater (blue arrow) and brain (*) are uncovered.



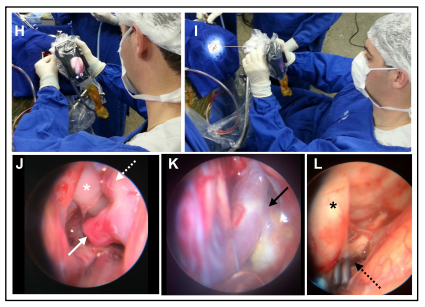
VASCULAR NEUROSURGERY. Vascular Case 1 (A-C and J). Transpalpebral Approach – Anterior Choroidal artery Aneurysm and Posterior Comunicating Artery Aneurysm. (A) Preoperative Angiography. (B) Post operative Angiography. (C) CT scan + results



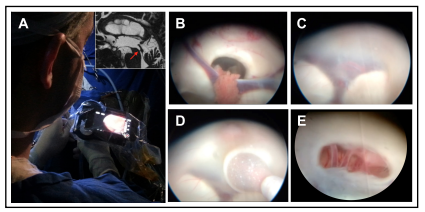
VASCULAR NEUROSURGERY – INCIDENTAL BRAIN ANEURYSMS. Illustrative cases. Vascular Case 2 (D, E and K) Transpalpebral Approach – Posterior Comunicating Artery Aneurysm. (D) Preoperative Angiography. (E) Post operative CT angiography (3D reconstruction). Vascular elements are displayed in red. The aneurysm clip is displayed in black. The green polygon demonstrates the boundaries of the orbital roof craniectomy.



VASCULAR NEUROSURGERY – INCIDENTAL BRAIN ANEURYSMS. Illustrative cases. Vascular Case 3 (F, G and L) Nanopterional Approach – Anterior Comunicating Artery Aneurysm. (F) Preoperative Angiography. (G) Post operative CT scan (3D reconstruction) showing de 2 cm craniotomy and the cosmetic result of the 2.5 cm incision.



INCIDENTAL BRAIN ANEURYSMS. (H, I) All aneurysm were inspected before and after clipping. (J) Vascular Case 1, white arrow points to the Anterior Choroidal artery Aneurysm and the white dotted arrow points to the Posterior Comunicating Artery Aneurysm. The third nerve is also shown (white *). (K) Vascular Case 2, The posterior communicating artery aneurysm neck is clearly displayed (black arrow). (L) Vascular Case 3, The aneurysm clip (black dotted arrow) is resting above the left optic nerve (black *), no residual aneurysm is noticed.



AQUEDUCTAL STENOSIS. (A) Magnetic resonance imaging of the brain. (B) Foramen of Monro. (C) and (D) Ideal spot for fenestration. (E) Final aspect.

CONCLUSIONS

Minimally invasive approaches are the new frontier in neurosurgery, and technological innovation and integration are crucial in this aspect. The use of smartphones with neuroendoscopes is safe and efficient, may represent a new method of performing endoscopic assisted neurosurgery, and can reduce equipment costs.