

# 4K resolution

4K resolution, also called 4K, refers to a horizontal screen display resolution in the order of 4,000 pixels

There are several different 4K resolutions in the fields of digital television and digital cinematography. In television and consumer media, 3840 × 2160 (4K UHD) is the dominant 4K standard. In the movie projection industry, 4096 × 2160 (DCI 4K) is the dominant 4K standard.

The 4K television market share increased as prices fell dramatically during 2014 and 2015. By 2020, more than half of U.S. households are expected to have 4K-capable TVs, which would be a much faster adoption rate than that of Full HD (1080p).

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A 4K 3D video microscope is compact, and provides high-resolution images, contributing larger surgical space and facilitating a multi-team surgery <sup>1)</sup>.

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Advances in [video](#) and [fiber optics](#) since the 1990s have led to the development of several commercially available high-definition [neuroendoscopes](#). This technological improvement, however, has been surpassed by the [smartphone](#) revolution. With the increasing integration of smartphone technology into medical [care](#), the introduction of these high-quality computerized communication [devices](#) with built-in [digital cameras](#) offers new possibilities in [neuroendoscopy](#). The aim of a study of Mandel et al., was to investigate the usefulness of smartphone-endoscope integration in performing different types of [minimally invasive neurosurgery](#).

They presented a new surgical [tool](#) that integrates a smartphone with an [endoscope](#) by use of a specially designed adapter, thus eliminating the need for the [video](#) system customarily used for endoscopy. They used this novel combined system to perform minimally invasive surgery on patients with various neuropathological disorders, including [cavernomas](#), [cerebral aneurysms](#), [hydrocephalus](#), [subdural hematomas](#), [contusional hematomas](#), and spontaneous [intracerebral hematomas](#).

The new endoscopic system featuring smartphone-endoscope integration was used by the authors in the minimally invasive surgical treatment of 42 patients. All [procedures](#) were successfully performed, and no [complications](#) related to the use of the new method were observed. The quality of the images obtained with the smartphone was high enough to provide adequate information to the neurosurgeons, as smartphone [cameras](#) can record images in high definition or 4K resolution. Moreover, because the smartphone screen moves along with the endoscope, surgical mobility was enhanced with the use of this method, facilitating more intuitive use. In fact, this increased mobility was identified as the greatest benefit of the use of the smartphone-endoscope system compared with the use of the neuroendoscope with the standard video set.

[Minimally invasive](#) approaches are the new frontier in neurosurgery, and technological [innovation](#) and integration are crucial to ongoing progress in the application of these [techniques](#). The use of smartphones with endoscopes is a safe and efficient new method of performing endoscope-assisted neurosurgery that may increase surgeon mobility and reduce equipment [costs](#) <sup>2)</sup>.

Three commercially available [cameras](#) were tested: [GoPro](#) Hero 4 Silver, [Google Glass](#), and [Panasonic HX-A100](#) action camera. Typical [spine surgery](#) was selected for video recording; posterior [lumbar laminectomy](#) and fusion. Three cameras were used by one surgeon and video was recorded throughout the operation. The comparison was made on the perspective of human factor, specification, and video quality.

The most convenient and lightweight device for wearing and holding throughout the long operation time was Google Glass. The image quality; all devices except Google Glass supported HD format and GoPro has unique 2.7K or 4K resolution. Quality of video resolution was best in GoPro. Field of view, GoPro can adjust point of interest, field of view according to the surgery. Narrow FOV option was the best for recording in GoPro to share the video clip. Google Glass has potentials by using application programs. Connectivity such as Wi-Fi and Bluetooth enables video streaming for audience, but only Google Glass has two-way communication feature in device.

Action cameras have the potential to improve patient safety, operator comfort, and [procedure](#) efficiency in the field of spinal surgery and broadcasting a surgery with development of the device and applied program in the future <sup>3)</sup>.

Patients were operated on through [transnasal](#) transsphenoidal endoscopic approaches performed using [Olympus](#) NBI 4K UHD endoscope with a 4 mm 0° Ultra Telescope, 300 W [xenon](#) lamp (CLV-S400) predisposed for narrow band imaging (NBI) technology connected through a [camera](#) head to a high-quality control unit (OTV-S400 - VISERA 4K UHD) (Olympus Corporation, Tokyo, Japan). Two screens are used, one 31" Monitor - (LMD-X310S) and one main ultra-HD 55" screen optimised for UHD image reproduction (LMD-X550S). In selected cases, we used a navigation system (Stealthstation S7, Medtronic, Minneapolis, MN, US).

Rigante et al., evaluated 22 [pituitary neuroendocrine tumors](#) (86.3% [macroadenomas](#); 13.7% [microadenomas](#)). 50% were not functional (NF), 22.8% GH, 18.2% [ACTH](#), 9% [PRL](#)-secreting. Three of 22 were recurrences. In 91% of cases we achieved total removal, while in 9% near total resection. A mean follow-up of 187 days and average length of hospitalisation was  $3.09 \pm 0.61$  days. Surgical duration was  $128.18 \pm 30.74$  minutes. We experienced only 1 case of intraoperative low flow fistula with no further complications. None of the cases required any post- or intraoperative blood transfusion. The visualisation and high resolution of the operative field provided a very detailed view of all anatomical structures and pathologies allowing an improvement in safety and efficacy of the surgical [procedure](#). The operative time was similar to the standard 2D HD and 3D [procedures](#) and the physical strain was also comparable to others in terms of ergonomics and weight <sup>4)</sup>.

## References

1)

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