NHK of Japan has worked on the development of 8K broadcasting technologies for the past 15 years and successfully achieved a series of devices specific for 8K imaging (an image sensor, camera, display and so on). Accordingly, Japan has been playing a leading part in the development of the next generation 8K ultra-high definition (UHD) broadcasting system which offers panoramic images with as many as 33 million pixels. In this context, the medical imaging consortium (MIC) has embarked on its medical application as early as a couple of years ago and successfully developed a compact camera for 8K endoscope. In addition, based on the outcome of experimental works including those using animal models, MIC succeeded in clinical 8K endoscopic surgery for the first time in the world, and demonstrated definite advantages of 8K application for medical use.

MIC and Nihon University believe that it is crucially important that physicians, researchers and engineers constantly discuss those on-the-spot medical issues and share the concept of future medical devices from the starting time point of their trial manufacture. And, we also believe that an introduction of the 8K imaging into the endoscopic surgery will probably spread 8K UHD technologies as an upcoming global medical standard.

Today, putting every constituent of the 8K UHD endoscopy together, we will demonstrate our current 8K UHD endoscopic system and some of the 8K UHD videos captured by animal experiments and clinical laparoscopic cholecystectomy as well.

1) 8K UHD camera head mounted on rigid endoscope

Our 8K UHD camera head has a CMOS imaging sensor with a resolution of 7680 x 4320 pixels based on the dual-green method with a red, two greens and a blue picture elements. We employed here a “rigid” endoscope for an initial medical application. The rigid endoscope could be 8K-friendly as it has a series of built-in relay lenses of high quality and a specific camera which can be mounted on the eyepiece. As an individual size of the 8K imaging sensor and the relay lens system substantially differ each other, a newly developed lens adaptor was absolutely required to adjust their range of view when the 8K camera and endoscope were connected.
2) 8K liquid crystal display (LCD)

Operating room (OR) where 8K laparoscopic cholecystectomy was clinically performed

This 85-inch/55-inch display can present an 8K resolution with 7680 x 4320 pixels. This quite a large display is preferable to surgeons and OR staffs because most favorable viewing distance off the 8K display has been estimated around 0.75 times the display /screen height.

3) 8K Recorder

We used an 8K recorder (ASTRODESIGN Inc.,) to keep and reproduce 8K endoscopic images of live animal surgery and a clinical laparoscopic cholecystectomy. 8K image recording systems should be requested to have a very high access speed and extremely large volume of SSD (solid state drive). At the moment, we can store the 8K motion pictures just for 50-minutes using 8TB SSD.

Our ongoing challenges:

a) Improving sensitivity of the 8K image sensor and designing brighter optical lens system of the 8K rigid endoscope.

b) Development of plastic optical fiber for transmitting considerably large data of 8K imaging without causing any electromagnetic noises in OR (Prof. Yasuhiro Koike, Keio Univ.)

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