MR/x-ray/operating suite developed at Tokai University Hospital
Tokai University Hospital has been operating a magnetic resonance/x-ray/operating suite (MRXO) since 2006. Developed with the support of Philips Healthcare, the MRXO is an operating suite equipped with radiological diagnostic systems.

Mitsunori Matsumae, M.D., is Professor of Neurosurgery and Chair of the Department of Neurosurgery at Tokai University School of Medicine (Tokyo, Japan), as well as Neurosurgeon-in-Chief at Tokai University Hospital. Before the hospital was built, he helped develop a system for the new hospital in which MR, CT and angiography systems are all housed within an operating theater that can accommodate advanced surgery such as neurosurgery. “We named this facility the MR/x-ray/operation suite (MRXO),” says Prof. Matsumae.

**Smartly designed concept**
The arrangement of the MRXO suite allows each machine to be used separately as a diagnostic device, or in combination to provide imaging for assisting a neurosurgical procedure. The system is located in the emergency department so that the emergency, radiology and neurosurgery departments can utilize radiological diagnostic systems efficiently. Its location allows the system to be used 24 hours every day; if it were in an operating theater, its use would most likely be limited to weekdays only.
The Tokai University Neurosurgery Department – in collaboration with Mizuho Ika Kogyo Co., Ltd – developed a new MR-compatible operating tabletop comprising three parts with four joints. “This operating table and tabletop make it easier to perform intraoperative MR and allow operations – especially neurosurgical operations where the head must be raised – to progress smoothly,” says Prof. Matsumae.

The MRXO system uses MR (Achieva 1.5T with modifications*), CT (Brilliance 40) and angiography (Allura Xper FD20). During the first month following the opening of the hospital and installation of the MRXO suite, each diagnostic system was used separately to train the radiology technologists. Once they had acquired the skills to use each system, neurosurgery and interventional radiology (IVR) simulations using volunteers were performed repeatedly.

**Intraoperative MR during neurosurgery**

“As a neurosurgeon, I was fully aware of the significance
of having an MR system in an operating room to
monitor the progress of surgical interventions,” says
Prof. Matsumae.

MR images that are updated during neurosurgery
enable a surgeon to see anatomical structures and
monitor changes occurring during the neurosurgical
procedure. “For instance, we are currently using
MR during tumor resections using craniotomy to
determine the location of important nerves or blood
vessels. By monitoring MR images that are updated
during surgery, we can remove cerebral lesions as
completely as possible.”

At present, one to two operations are routinely
performed for neurosurgery and for IVR in the
MRXO each week. A noteworthy point is that
the suite is located in the ER, and as a result,
approximately 40 CT scans, 16 MR scans and one
angiography are performed each day. This efficient
and routine use of the diagnostic machines illustrates
the features of the MRXO suite very well.

**Versatility of MRXO**
The MRXO suite is currently used for interventional
radiology procedures, intraoperative MR and
angiography for neurosurgery, but applications may
broaden in future. The MRXO suite has multiple
modalities that can be used individually, but can offer
combinations of modalities as well, namely, MR and
surgical function, surgical function and angiography,
surgical function and CT, MR and angiography,
angiography and CT, MR and CT and more. In addition,
the MRXO can be further developed into a high-end
suite by incorporating PET-CT and/or 3.0T MR.

*Not commercially available.*