Canon

3D Roadmap-Assisted Procedures at Osaka Police Hospital: Effective Use of an Angiography System in Neuroendovascular Treatment – Biplane Neuroangiography System

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1. Medical services provided by Osaka Police Hospital

Osaka Police Hospital, which was founded in 1937, is located in the central district of Osaka City in Japan (Fig. 1).

It provides 24-hour medical services and is one of the key hospitals for neuroendovascular treatment in Japan.

Less-invasive surgical procedures such as endovascular surgery and minimally invasive direct surgery are performed at this hospital. Direct surgical procedures via small skin incisions and small craniotomies are also performed. Examples include cerebral aneurysm clipping and coiling, carotid endarterectomy (CEA) and carotid artery stenting (CAS), EC-IC bypass, AVM surgery, brain tumor preoperative embolization, and tumor resection.

Two clinical cases are presented in this section: a patient treated by combined cerebral aneurysm clipping and coiling and a patient treated by preoperative feeder embolization and AVM resection.

The first case is a 65-year-old woman with a large ICA aneurysm (Fig. 2A). Direct surgery was performed first. Then, the intracranial part of the aneurysm was clipped (Fig. 2B). After this procedure, the extracranial part of the aneurysm was coiled. This large ICA aneurysm was successfully treated by this combination of direct surgery with clipping and coiling (Fig. 2C).

The second case is a 48-year-old man who presented with seizures. Cerebral angiography revealed a left temporal AVM (Fig. 3A). Preoperative feeder embolization was performed with 40% NBCA before AVM resection, and an angiogram showed reduction of the AVM nidus (Fig. 3B). After surgical resection of the nidus, the red veins changed to normal veins. Postoperative angiography demonstrated complete elimination of the left temporal AVM (Fig. 3C).

Both surgical and interventional approaches are employed at our hospital.

Figure 1 Osaka Police Hospital, Osaka City, Japan.

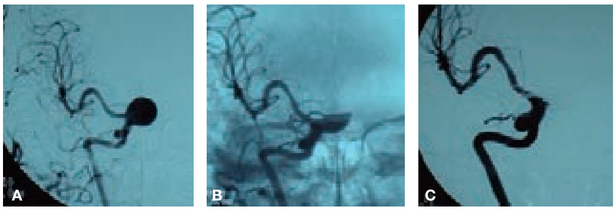

Figure 2 Cerebral aneurysm treated by combined clipping and coiling. (A) Large ICA aneurysm, (B) after clipping, (C) after coiling.

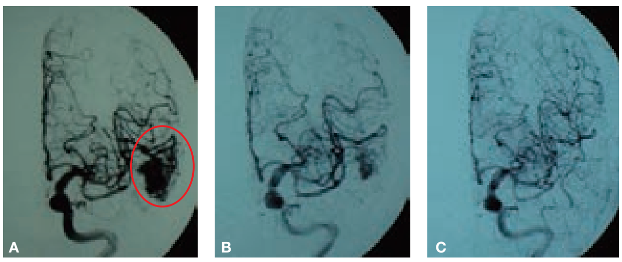

Figure 3 Preoperative feeder embolization and AVM resection. (A) Left temporal AVM, (B) after preoperative feeder embolization, (C) complete elimination of the left temporal AVM.

2. Benefits of the INFX-8000V

The Infinix™-i INFX-8000V, which is a multi-access biplane system (Fig. 4), has been used at Osaka Police Hospital to perform more than 700 cerebrovascular imaging studies, including 120 therapeutic procedures. The major benefits of the INFX-8000V are flexible access to the patient, ideal FPD sizes, excellent images for neurointerventions, high-resolution 3D angiographic imaging, and very useful 3D Roadmap functions.

2.1. Ideal FPD sizes for neuroendovascular procedures

The INFX-8000V installed at Osaka Police Hospital is fitted with 30 cm × 40 cm (12″× 16″) and 30 cm × 30 cm (12″× 12″) rotating flat panel detectors (FPDs). The 30 cm × 30 cm FPD can provide full coverage of both the tip of the catheter in the cervical carotid artery and the distal branches of the cerebral arteries in a single image (Fig. 5). The 30 cm × 40 cm FPD also provides wide coverage, allowing both the aortic arch and the proximal cerebral arteries to be included in a single image, which improves safety during device delivery (Fig. 6).

Figure 4 The Toshiba Infinix VF-i biplane neuroangiography system installed at Osaka Police Hospital, with 30 cm × 40 cm (12″ × 16″) and 30 cm × 30 cm (12″ × 12″) rotating flat panel detectors (FPDs).

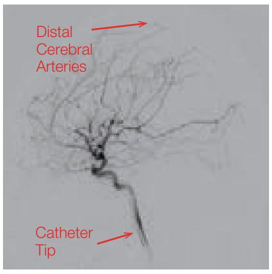

Figure 5 The 30 cm × 30 cm FPD provides full coverage of the brain and carotid artery.

2.2. Flexible access to the patient with multi-access C-arm movement

Multi-access C-arm movement provides ample space for anesthesiologists and other staff involved in emergency neurovascular treatment. In the standard position, the frontal C-arm is located at the patient's vertex (Fig. 7A). Positioning the frontal C-arm at the patient's left shoulder provides easy access to the right side of the patient's neck for ultrasound examination. Positioning the frontal C-arm at the patient's right shoulder provides the same benefit. Another impressive and attractive option is to position the frontal C-arm at the patient's lower left (Fig. 7B). This position provides a huge working space for clinical examination, observation, and emergency treatment while still supporting biplane imaging.

The multi-access C-arm also provides wide patient coverage without the need to reposition the patient. The C-arm movement shown in Fig. 8 ensures a comfortable procedure in all approaches, from a femoral artery approach to a radial artery approach.

2.3. Very useful 3D Roadmap functions

All system movements are linked to the fusion 3D and fluoroscopic display. A 3D Roadmap obtained from a single 3D-DSA acquisition supports a variety of suitable working angles during procedures and helps to ensure easy device delivery in neurointerventional procedures. The 3D Roadmap image precisely tracks rotation of the C-arm, the field of view (FOV), the source-to-imager distance (SID), and table lateral/vertical movement, permitting surgeons to perform procedures at various convenient working angles without the need for additional image acquisition. This reduces the risks associated with repeat 3D acquisitions during procedures, ensuring safer and easier interventions and more confident decision-making in challenging clinical situations.

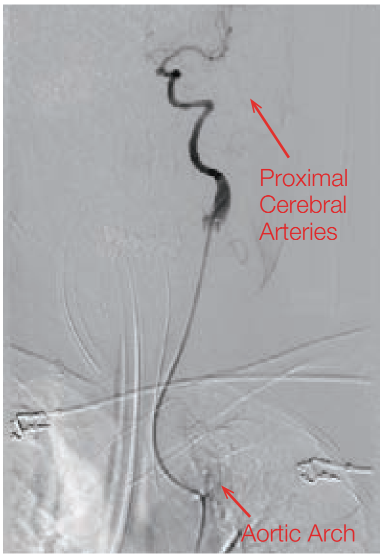

Figure 6 The 30 cm × 40 cm FPD provides full coverage of the aortic arch and carotid artery.

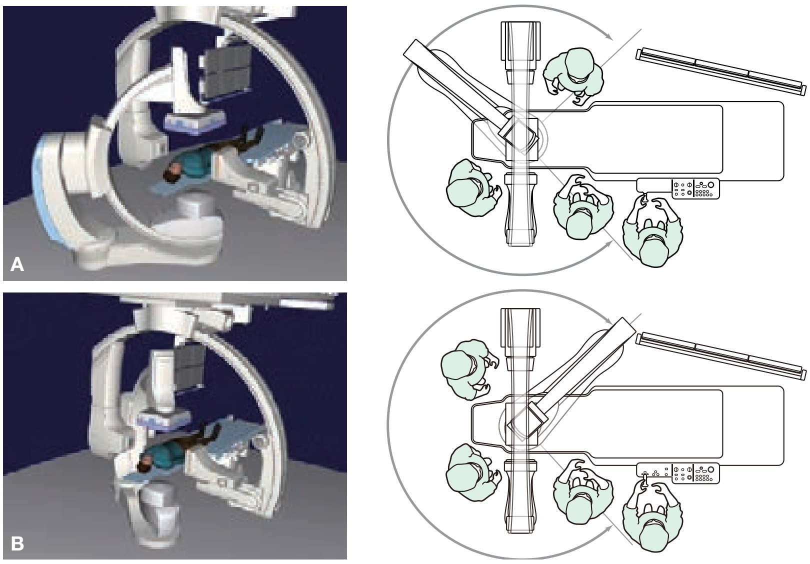

Figure 7 The wide range of frontal C-arm positions ensures ample space for anesthesiologists and other staff involved in emergency treatment. (A) The frontal arm positioned at the patient's vertex, (B) the frontal arm positioned at the patient's lower left.

3. Clinical cases in which 3D Roadmap was particularly useful

In this section, four illustrative cases in which 3D Roadmap was particularly useful are presented.

Case 1

This is a 75-year-old woman with a left ICA aneurysm, as shown in Fig. 9A. In the 3D Roadmap (Fig. 9B), microcatheter delivery with position markers for the catheter in the aneurysm could be clearly depicted with no visual obstructions in the 3D image. Figure 9C shows a high-resolution image for the first coil delivery. The framing coil in the aneurysm can be clearly visualized in the 3D Roadmap image. During such procedures, it can be difficult to observe the arrangement of the coils and to confirm optimal coiling of the aneurysm, and coil packing often requires changes in the working angle. 3D Roadmap is a convenient and reliable function that makes it possible to select various working angles during coil packing. The images of the left ICA aneurysm after coiling (Fig. 9D) confirmed complete embolization.

Case 2

This is a 65-year-old woman with multiple aneurysms, as shown in Fig. 10A. First, the two anterior circulation aneurysms were clipped. Then, coil embolization was performed. 2D and 3D Roadmap images can be observed simultaneously, making it easier to visualize the target vessels and the introduction of devices such as microcatheters into the aneurysm during the procedure (Fig. 10B).

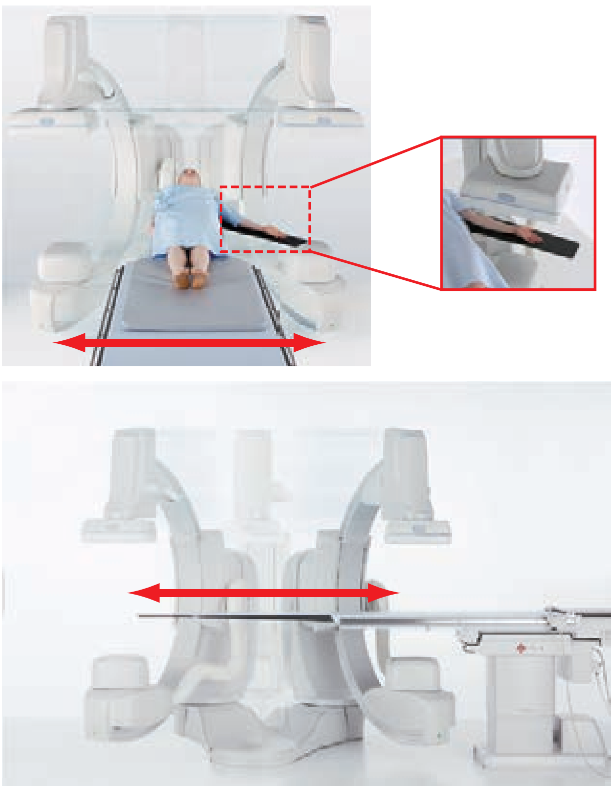

Figure 8 Wide patient coverage is provided by the multi-access C-arm, ensuring comfortable procedures in all approaches, from a femoral artery approach to a radial artery approach.

Figure 10C shows a framing check using a 3D Roadmap image after delivery of the first coil into the aneurysm. The cage can be observed by zooming in and rotating the image using the 3D Roadmap function, providing unprecedented traceability. After this procedure, packing coils were delivered into the aneurysm, with 3D Roadmap providing outstanding visualization (Fig. 10D). Complete embolization of the aneurysm was confirmed by 3D Roadmap (Fig. 10E).

Case 3

This is a 59-year-old woman with a left ICA aneurysm, as shown in Fig. 11A. The 3D volume image (Fig. 11B) shows the optimal working angle to be RAO 152.8°. However, it is not possible to set this angle. Therefore, 3D Roadmaps with rotation of the C-arm were used during the procedure to confirm that the microcatheter was positioned in the aneurysm. When a vessel moves in response to the catheter, manual repositioning of the vessel in the 3D Roadmap is possible based on the 2D Roadmap. The 3D Roadmap (Fig. 11C) provides an excellent image of the first coil delivery. After coiling was completed, the postoperative 3D volume image (Fig. 9D) confirmed successful embolization.

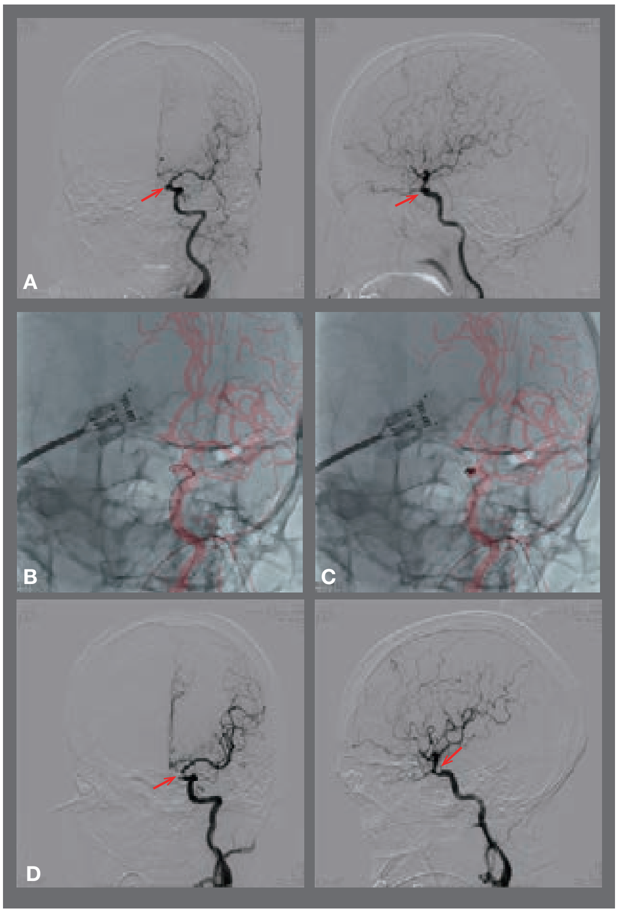

Figure 9 75-year-old woman with a left ICA aneurysm. (A) Left ICA aneurysm, (B) 3D Roadmap, (C) high-resolution image for the first coil delivery, (D) confirmation of complete embolization after coiling.

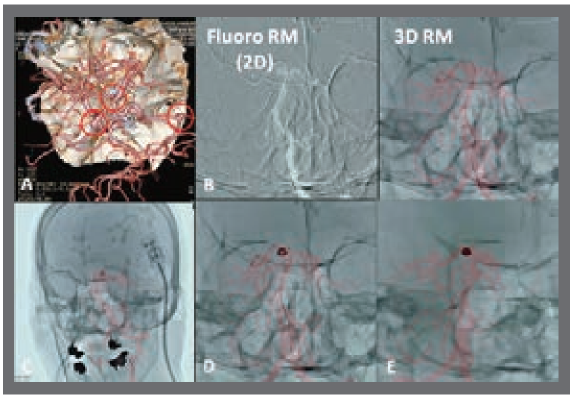

Figure 10 65-year-old woman with multiple aneurysms.
(A) Multiple aneurysms, (B) simultaneous display of 2D and 3D Roadmaps, (C) image for framing check during coiling, (D) image of packing coil delivery, (E) confirmation of complete embolization after coiling.

Case 4

This is a 75-year-old woman with a right parietal tumor. 3D angiography showed a tumor with a high-flow shunt such as a cerebral AVM (Fig. 12A). In this case, preoperative embolization of the tumor feeders was performed. A microcatheter was advanced into the M1 segment of the right MCA. With 3D Roadmap, C-arm rotation provided additional working angle views, allowing the microcatheter to be easily and safely delivered to the distal MCA segment near the tumor. First, the feeders of the tumor were embolized with NBCA (Fig. 12B). After feeder embolization, direct surgery was performed. Postoperative MR images demonstrated that the tumor (a glioblastoma) was completely eliminated (Fig. 12C). As shown above, 3D Roadmap is an effective tool for preoperative embolization as well as coiling.

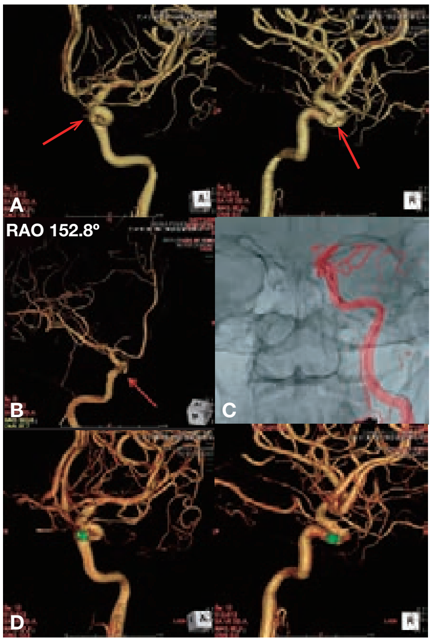

Figure 11 59-year-old woman with a left ICA aneurysm. The manual repositioning function in 3D Roadmap was used. (A) Left ICA aneurysm, (B) image requiring a 3D Roadmap, (C) 3D mapping image of the framing coil in the aneurysm, (D) postoperative 3D volume image.

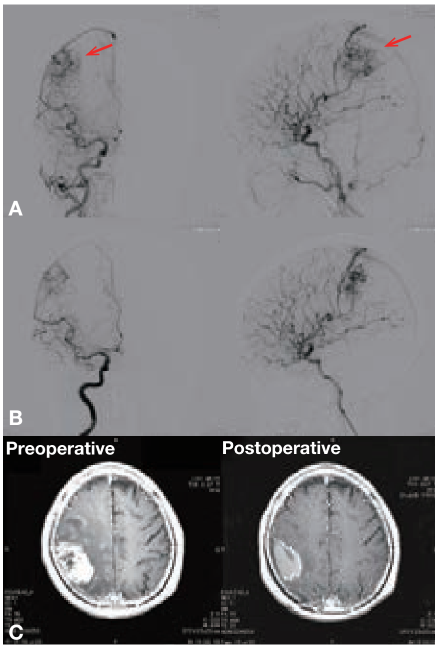

Figure 12 75-year-old woman with a right parietal tumor. (A) Right parietal tumor, (B) after TAE with NBCA, (C) preoperative and postoperative axial MR images.

Summary

As clearly illustrated by the above clinical cases, the Toshiba INFX-8000V angiography system provides reliable visualization in all types of images as well as unprecedented traceability in 3D Roadmaps. The outstanding performance capabilities of this system make it suitable for a wide range of neuroendovascular procedures.

This article presents the highlights of a symposium lecture delivered by Dr. Shuta Aketa at the Scientific Meeting of the Radiological Society of China in April 2011.

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