

## **Where art and technology meet; development of neuroradiology in (around) France**

**Kittipong Srivatanakul, MD.  
Asahi General Hospital, Chiba, Japan**

### Searching inside the body

The discussion on how intervention neuroradiology developed cannot be done without mentioning the development of neuroimaging. The search for knowledge in neurovascular anatomy keeps going on after detailed anatomy description was exercised since 1500's. Interests in neurovascular anatomy were shown by illustrations of the vessels at the base of the brain, mainly done in the early 1600's. (Casserio (1627), Vesling (1647), Willis (1668)) First description of apoplexy with relation to cerebral vessel was published in this period also (Wepfer 1658). Breschet (1829) described in detail the vascular anatomy of the brain and skull with superb drawings in color. But not until after the discovery of X-ray that the vascular structures become more visible to us.

"Injections intravasculaires d'huile iodée sous contrôle radiologique." J. Sicard, J. Forestier, C.R.Soc.Bio.(Paris),1923

The first picture of vessels of a cadaver on X-ray was reported only weeks after Roentgen's report on discovery of X-ray. The first injection of any contrast into living human vessel (vein) was probably by Sicard and Forestier in France(1923). They used Lipiodol and observed the droplets having travelled in the vessels. Saito was the first to report the use of Lipiodol used in cerebral vessels. In 1930, he injected 20ml of emulsion of Lipiodol( Lipiodol, protalbin-albumin acid, lecithin and glucose) with no adverse effect. In this period various compounds were used as contrast agent. The well-known Egas Moniz used sodium iodine solutions after having done the first reported cerebral angiogram in 1926 with strontium bromide but lost the patient. Thorothium, a carcinogenic substance, was another agent used in the 1930's. The first decades of angiography required surgeon to expose the carotid artery as the leakage of contrast under the skin can be harmful in the early days making most of angiography done with help of neurosurgeons.

Structures inside the skull were not visualized by the contrast media at first. Luckett in 1913 reported a traumatic pneumocephalus demonstrated with skull Xray. Later on, Dandy made this a diagnostic technique as pneumoencephalography (1918).

### Development of tools and anatomy understanding

Further understanding of the disease and anatomy had to develop after maturation of angiography. More and more cases were observed than ever before. Legre and Bonnal published a book " L'angiographie Cérébrale" in 1958 as one of the first textbook on this field. Pierre Lasjaunias once quoted: "Padget may have made tremendous contribution to the work of anatomy but after angiography era, we learn with more samples." Functional anatomy description was explained in a case of carotid artery occlusion in Kraysenbuhl's textbook. But the concept of functional anastomosis was already known since the 17th century(Félix). Lasjaunias was the one to develop it fully and put it in practice while working with various colleagues, truly

joining radiology with knowledge of anatomy.

The first textbooks in the 1950's still tried to make sense of viewing through angiograms describing the projections in frontal and lateral views. The frontal view was not performed in the original Moniz study. In the first few decades, the angiography was mainly used to localize pathology in the skull. Salamon, in the 1960's did extensive work of micro-angiographic study of cerebral circulation with Lazorthes. With the growth of radiological knowledge linked with anatomy, angiography becomes the main tool in making diagnosis of cerebrovascular disease.

#### History of interventional neuroradiology

History of interventional neuroradiology(INR) in France might have begun with Djinjian. After being able to do 'super-selective' angiography, the intention is just not only to observe but to treat (embolize) also. He did the first embolization in the external carotid artery in 1968. But the first 'endovascular therapy' maybe dated back to for goat blood transfusion in France in 1693 (Ioannis Sculteti) or when Brooks embolized a CCF by 'embolizing' it with a piece of muscle in 1931 or Dawbarn's treatment of malignant tumor in the external carotid artery area in 1904. However, not only after the maturation and popularization of angiography did the real development of INR begin. In the 1970's, while Serbinenko was developing detachable balloon Debrun was too in France. Prior to that, the catheter is left inside the vessel after embolization with the balloon. From this period, the rush in development of tools and societies begun. While there are people who are persuading advances in the tools, at the same time functional vascular anatomy made progress since 1980's and a lot of work in this field was done by Lasjaunias. Labosière, Nancy and Rothschild were probably the three major INR centers in France in the 1970's. The 'contemporary' INR in France from this period will be discussed during presentation with pictures that will be also entertaining in artistic perspective.

#### *Interesting facts:*

- 1) The method of subtraction technique was introduced as far back as 1935 but put in to practice only after 1960's.*
- 2) Concept of stereoscopy was described beautifully in as early as 1838. But in fact, Leonardo da Vinci had these thoughts already in his era about 500 years ago. The first stereoscopic pictures with X-ray were done in 1896.*
- 3) The first embolization was done before the invention of angiography by Dawbarn in 1904, 22 years before Moniz succeeded in cerebral angiogram.*
- 4) French size (F) was first used by rubber urinary catheter company. A catheter of 15 F will have diameter of 5mm. This catheter is prepared by a sheet of rubber of 15mm width, rolled and their edges welded together. That is  $15\text{mm}(\text{circumference}) = \pi \times 5(\text{diameter})$  is 3.14. The 0.14 is glue to weld the rubber together, so F size divided by 3 is the mm size. This was first introduced by Charrière in 1842 and well accepted in the US.*

## Chronology of advances in neuroanatomy, neuroradiology and INR

Year	Advances
1600's	<ul style="list-style-type: none"><li>-Discovery of circulation of blood(HARVEY William)</li><li>- Circle of Willis, collateral circulation (WILLIS Thomas, 1622-1675)</li><li>- Description of dural sinuses(François DUBOIS, 1614-1672)</li></ul>
1700's	<ul style="list-style-type: none"><li>- Study of collateral circulation (Hunter,John, 1728-1793)</li><li>- Comparative anatomy, anastomosis in arterioles of brain (Vicq d'Azyr Felix, 1748-1794)</li></ul>
Early 1800's	<ul style="list-style-type: none"><li>- Study of pathology of cerebral circulation</li><li>- Books published on apoplexy(Cheyne,1812)</li></ul>
Late 1800's	<ul style="list-style-type: none"><li>- Discovery of X-rays(1895)</li></ul>
1895-1920	<ul style="list-style-type: none"><li>- Injection of vessels in cadaver</li><li>- Pneumoencephalography(1918)</li><li>- First "embolization" performed</li></ul>
1920-1930	<ul style="list-style-type: none"><li>- Start of cerebral angiography(1926)</li></ul>
1930-1950	<ul style="list-style-type: none"><li>- Search and development of contrast media</li><li>- Series angiography(1944), Development of vertebral angiography (1947)</li></ul>
1950-1960	<ul style="list-style-type: none"><li>- Popularization of diagnostic angiogram</li><li>- Subtraction angiography(1954-1961, Ziedes des Plantes)</li></ul>
1960-1970	<ul style="list-style-type: none"><li>-Selective angiography and embolization</li><li>-Attempts on treating aneurysms endovascularly</li></ul>
1970-1980	<ul style="list-style-type: none"><li>- Detachable balloons, liquid embolic materials</li><li>- Progress in the knowledge of neurovascular anatomy</li></ul>