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Prof. Yasuaki Arai is a leading interventional radiologist in Japan and is the pioneer and expert of Angio CT technology who has also developed several new techniques and other breakthroughs in medical devices over the years.

In addition he is the founder of the Japan Interventional Radiology in Oncology Study Group (JIVROSG), which gathers and analyzes clinical evidence in the field of interventional radiology. In 2017, he was honored by being named a Distinguished Fellow of the Cardiovascular and Interventional Radiological Society of Europe (CIRSE).

Prof. Arai is widely recognized as a medical expert both inside and outside of Japan, and he is frequently invited to speak at seminars at more than 30 international academic conferences annually. He also plays an instrumental role in supporting the Ministry of Health, Labour and Welfare of Japan in the development and approval of safety requirements for medical devices.

Expanding Use of Interventional Radiology in Clinical Practice

The National Cancer Center, which is one of the National Centers for Advanced and Specialized Medical Care, serves as a hub for cancer treatment and research as a member of the National Research and Development Agency of Japan. Its mission is to provide clinical care, conduct research, promote technological development, oversee clinical trials, perform investigations, formulate policy proposals, foster human resources, and issue accurate information concerning cancer and malignant tumors.

In the first five years of my career as a physician, I focused on the field of internal medicine. At that time, the medical treatment for patients with cancer was solely chemotherapy. In many cases, survival rates were not as high as today. I feel fortunate to be skilled in very intricate procedures, therefore I have made extra effort in ways to help patients using catheter-based interventional methods.

A major turning point in my Interventional Radiology career was when I was transitioning to a new hospital, I was unexpectedly assigned to the radiology department,

rather than staying in my field, further improving my internal medicine skillset. Around the same time Interventional Radiology (IR) was introduced and evolving in Japan, I had come to the realization what I had been seeking to pursue and achieve was in the field of IR specialty itself. This is how I ended up specializing in IR. I have always sought to challenge myself and achieve new things that have never been done before, or considered impossible in medicine, therefore my strong desire was a new field that offered many new challenges to be faced.

Development of the first Angio CT

When I started IR, various types of diagnostic imaging equipment, including X-ray angiography, ultrasound, MRI, and CT systems were already heavily used in many fields. IR procedures were performed and used in various imaging combinations relative to each clinical case setting. The imaging systems and therapeutic devices used in those early days were not as sophisticated and available today, however the basic concept of IR has not changed much in the current environment where Angio CT is available. In the 1980s, Professor Osamu Matsui (present Professor Emeritus) of Kanazawa University, demonstrated the effectiveness of selective contrast CT imaging for the diagnosis of hepatoma. As a result, CT imaging during angiography became indispensable for accurate diagnosis, treatment planning and the evaluation of therapeutic outcomes in patients with hepatoma. This allowed me to truly appreciate the clinical value of Angio CT.

"At that time, angiography systems and CT scanners were installed in separate rooms,

but I always wished that I could perform angiography and CT in the same room. I talked with a number of companies, including Toshiba Medical Corporation (present Canon Medical Systems Corporation) to see if they would be able to produce an Angio CT. At that time, only Toshiba Medical took my idea seriously, considering such an unusual request. As a result, the very first Angio CT was introduced in 1992 which was only two years after the start of development." My initial reaction when I used the Angio CT for the first time was, "It is absolutely amazing!" The entire system truly turned my dream into reality. Prior to the advent of the Angio CT, moving a patient between the angiography and CT rooms would take 30 minutes, in addition to the required assistance of countless hospital staff. On the other hand, with having both angiography and CT installed as one system in the same room, cases can now be performed in only a few minutes without moving patients from one room to another. I was extremely gratified to see that my requested vision, led to such great clinical advantages and benefits.

A Whole New World Awaits

What exceeded even my initial expectations, was the ability to acquire CT images during interventional procedures, which then began a whole new era of 3D visualization. With conventional 3D images frequently utilized today, we take for granted not fully appreciating the importance of this technology, until applying this functionality in clinical practice. The result of this significant clinical impact and innovation make it possible for improved accuracy during treatment, as well as significant expansion in the range of IR procedures. For example, when using conventional methodology, IR procedures are performed using catheters which are introduced into luminal structures such as blood vessels, the digestive tract, or the airways. However, with Angio CT, therapeutic procedures can easily be performed for lesions even though there isn't luminal access. For instance, such unique procedures include nerve blocks and tumor biopsies which are considered to be an indispensable process of cancer treatment today. Particularly, the greater accuracy of biopsy procedures has



Infinix-i 4D CT at National Cancer Center Hospital.



significantly enabled and improved the therapeutic outcomes of cancer patients.

Angio CT: A Breakthrough role in Oncology?

The most reliable imaging method during puncture procedures today, in my opinion, is X-ray fluoroscopy. However, X-ray fluoroscopic images only provide limited 2D information, hence there exists a critical need to obtain CT images to confirm and verify essential information, such as the direction and distance of the needle as it advances precisely to the exact location. The main advantage of Angio CT is that procedures can be performed while quickly switching between the X-ray fluoroscopic image and the CT image along with the requirement for confirmation. In addition, operability is much easier with Angio CT as compared to one of Cone Beam CT (CBCT). My experience is mainly in the field of oncology, but at the very least, the Angio CT has proven itself to be an extremely versatile device in this field.

My clinical opinion regarding the Angio CT's practical use is that interventional pro-



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cedures can now be performed accurately based on X-ray fluoroscopy, coupled with CT imaging, which plays an invaluable confirmatory role. However, this may depend on each individual operator, regardless whether fluoroscopy or CT is considered the primary modality. The most important advantage when using the Angio CT is that both the angiography and CT system can be used flexibly and simultaneously according to the operator's requirements. It is like the way we use both, our right and left hands together. The things we can do with only one hand are very limited, however the things we can do with both hands is quite infinite in comparison. This system allows us to use both modalities freely, seamlessly and interchangeably rather than placing a primary emphasis on one or the other at one time.

Furthermore, there is no limit on the range of applications with Angio CT in the field of IR. Instead of thinking in terms of what Angio CT can be used for, we should focus on the creative clinical possibilities of how we can help each individual patient outcome in the IR procedure. It is crucial for us to

maintain as clinical specialists to consider how Angio CT can be applied in IR. If we focus only on the Angio CT itself without considering furthering clinical possibilities, we limit our treatment capabilities and achievements.

The Future of Interventional Procedures:

My hope is the future of IR will utilize clinical practice more frequently. Contrary to popular belief, IR procedures are not typically the expensive therapeutic option. IR procedures are relatively less invasive and can significantly reduce medical costs. For these reasons, I hope that IR will be more widely employed and gain growing acceptance in emerging countries, as well as in developed countries.

As an interventional radiologist, I have always believed in the great potential of treating diseases better using IR procedures and have worked many years to achieve this goal. With IR, our ability to cure diseases is improving, and even though a cure is not always possible, we can often times mitigate symptoms and improve the patient's quality

of life regardless. The clinical challenges that now can be treated using Angio CT in IR procedures is only the tip of the iceberg. I am looking forward to learning more about the new and surprising possible IR applications that will be developed in the future, thanks to the new possibilities of widespread IR procedures around the world. //



Prof. Yasuaki Arai with Infinix-i 4D CT