

IMSUT Hospital

Department of Cardiovascular Medicine

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Summary

Founded in February 2025, our department provides safe, high-quality cardiovascular care through collaboration with local medical institutions and close cooperation with other clinical departments, ensuring cardiovascular conditions do not limit advanced medical care or intractable disease treatments in IMSUT Hospital. Our research focuses particularly on developing clinical guidelines for hereditary aortic diseases and muscular dystrophy-related cardiomyopathy, alongside experimental studies of their underlying mechanisms.

1. Clinical activities

Koichi Kimura, Norifumi Takeda

As the population ages, cardiovascular diseases are becoming increasingly prevalent, particularly heart failure, valvular heart disease, ischemic heart disease (angina and myocardial infarction) and atrial fibrillation. The number of patients with these conditions has increased so dramatically that it has been described as a 'heart failure pandemic'. Additionally, while advances in cancer treatment have dramatically improved survival rates, the number of patients suffering from cardiovascular disorders caused by treatment has also increased significantly. IMSUT Hospital provides advanced medical care to many elderly patients and those with cancer and intractable diseases. As cardiologists, we work closely with other departments to ensure that our patients can continue to receive the best possible treatment.

The cardiovascular services offered at IMSUT Hospital include:

- General cardiovascular outpatient clinic
- Inpatient care
- Interdepartmental communication
- Perioperative management
- Specialty outpatient clinics for hereditary aortic dis-

ease and muscular dystrophy-related cardiomyopathy

- Circulatory function tests (echocardiography, 24-hour Holter electrocardiography, lower extremity venous ultrasound)

The diseases that required high medical attention at IMSUT Hospital in 2025 included unstable angina, paroxysmal atrial fibrillation, ventricular tachycardia, acute heart failure due to mitral regurgitation, severe pulmonary hypertension, severe aortic stenosis, cardiac tamponade following cord blood transplantation, and refractory hypertension due to bilateral renal artery stenosis. Many patients undergoing cancer treatment were found to have thrombosis and cardiac dysfunction.

2. Specialty outpatient clinic for hereditary aortic diseases

Hiroki Yagi¹, Hitomi Aono¹, Takayuki Morisaki^{2,3}, Norifumi Takeda^{1,3}

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In collaboration with Marfan syndrome center at the University of Tokyo Hospital, we manage over 1,000 patients with hereditary aortic diseases, including Marfan syndrome, Loeys-Dietz syndrome, vascular Ehlers-Danlos syndrome, and non-syndromic familial aortopathy. Through our activities to date, we have demonstrated that genetic testing for syndromic hereditary aortic diseases is useful not only for definitive diagnosis and differential diagnosis, but also for understanding the relationship between genotype and phenotype. These insights are beneficial for the long-term management of disease and are referenced in the guidelines. Conversely, treatment strategies and psychosocial support systems for asymptomatic carriers and non-symptomatic familial aortic diseases remain insufficiently established. We believe that, while treating many patients, we should promote efforts to build evidence for reducing their future risks.

3. Multicenter clinical and experimental studies of muscular dystrophy

Koichi Kimura

Multicenter clinical studies for patients with muscular dystrophy have been conducted in collaboration with NHO (National Hospital Organization) hospitals; Sendai-nishitaga National Hospital (Miyagi), Niigata National Hospital (Niigata), Matsumoto Medical Center (Nagano), Shimoshizu National Hospital (Chiba), Hakone National Hospital (Kanagawa), Osaka-toneyama Medical Center (Osaka), Iou National Hospital (Ishikawa), Hiroshima-nishi Medical Center (Hiroshima), Akita National Hospital (Akita), and Aomori National Hospital (Aomori). Furthermore, in collaboration with the Department of Veterinary Physiology at the University of Tokyo, we conducted several animal experiments using genome-designed muscular dystrophy rats with the CRISPR/CAS9 system. We also performed other animal experiments using dog, pig and mouse models with muscular dystrophy in collaboration with the National Center of Neurology and Psychiatry (NCNP, Tokyo). We continue to contribute to the publication of Japanese clinical guidelines on Duchenne muscular dystrophy, Becker muscular dystrophy, facioscapulo-humeral muscular dystrophy and Fukuyama muscular dystrophy.

4. Basic research in cardiovascular diseases

Hitomi Aono¹, Satoshi Ishii¹, Takayuki Fujiwara¹, Norifumi Takeda²

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We are interested in molecular mechanisms of he-

reditary cardiovascular diseases, such as Marfan syndrome, Loeys-Dietz syndrome, Shprintzen Goldberg syndrome, *MYH11*-related non-syndromic familial aortopathy, *BMP2*-related pulmonary arterial hypertension, and dilated cardiomyopathy. Our research combines genomics, cell biology, gene-engineered mice, single cell-omics, and spatial transcriptomics to determine the mechanism. Most recently, we have developed a new 3-dimensional (3D) visualization system at full depth and single-cell resolution in mouse tissues using CUBIC tissue clearing system combined with multiphoton microscopy, and using this system to study hypoxia-induced pulmonary hypertension enabled us to create a new mouse model presenting with spontaneous-onset, severe pulmonary arterial hypertension (PAH). In 2025, we performed a spatial transcriptome analysis of the lung with the support of the Platform for Advanced Genome Science (under analysis).

Specific research topics for 2025 include:

- identify critical therapeutic target molecules and signaling pathways of PAH using single cell multi-omics and 3D visualization system for a novel mouse model
- determine the role of the angiogenic response in pressure overload-induced cardiac hypertrophy and heart failure, and confirm this using 3D visualization system
- investigate how DNA damage and cellular senescence contribute to hereditary aortic aneurysms and dissections using mouse models

5. Preventive cardiology research

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In partnership with several universities, we conducted collaborative research into the prevention and epidemiology of cardiovascular, renal, and metabolic diseases. This research uses big data from health check-ups and insurance claims. Our aim is to encourage the use of real-world data in medicine and to overcome the challenges posed by an ageing population.

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