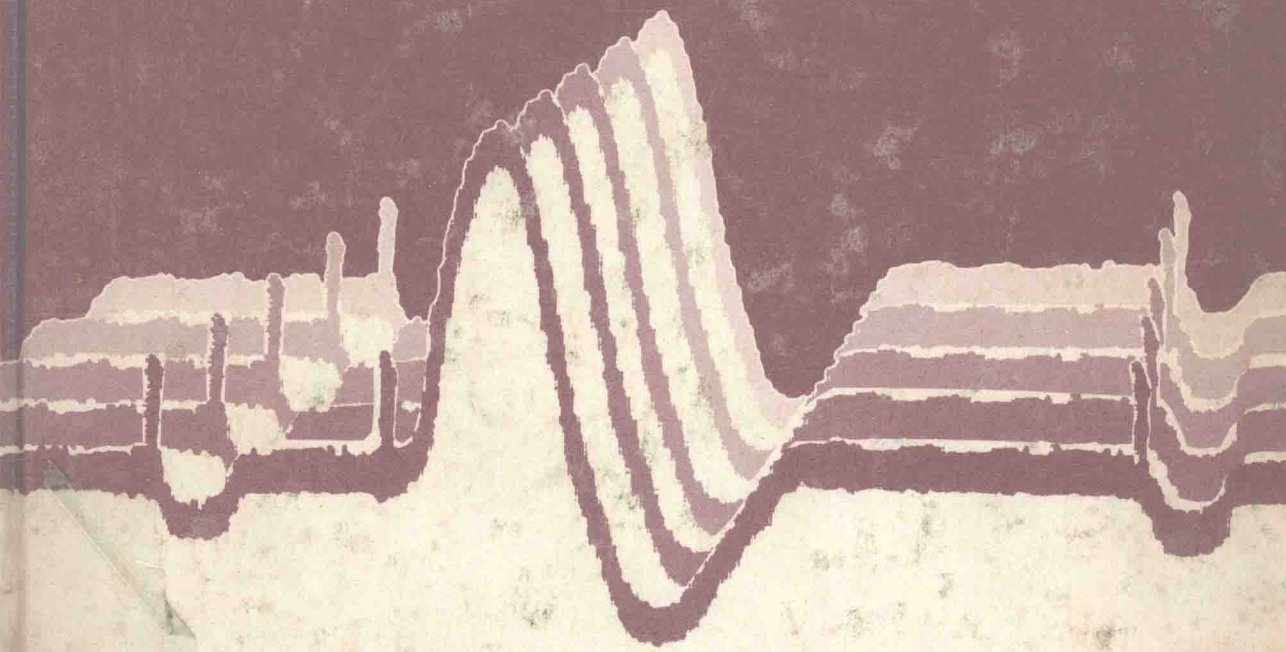
Cardiac Pacing and Electrophysiology Today

A New Era of Therapeutic Arrhythmology



APSPE '93

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A New Era of Therapeutic Arrhythmology

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Preface

It is our pleasure to present you with the proceedings of the Vth Asian-Pacific Symposium on Cardiac Pacing and Electrophysiology, entitled "Cardiac Pacing and Electrophysiology Today – A New Era of Therapeutic Arrhythmology." The symposium was held in Makuhari, Japan, from August 1 through 4, 1993. The success of the previous three symposia, in Jerusalem, Melbourne, and Singapore, was the impetus behind our efforts to enlarge the scope of the Vth symposium and to make it truly Asian-Pacific in character.

Reflecting this, a total of more than 1,300 medical scientists and associated professionals participated in the symposium, from thirty-seven countries. The number of presentations was approximately 500, including plenary lectures (Tawara Memorial Lectures), symposia, free papers, luncheon panels, and programs for associated professionals. Due to limited space, only the plenary lectures and the symposia are included in the proceedings.

We believe that these proceedings are the most up-to-date and comprehensive review – from the standpoint of both basic science and clinical application – of cardiac pacing and electrophysiology in 1993, the year which marks the centenary of His' report on the atrioventricular muscular connection in the mammalian heart.

Hiroshi Matsuo
Chair of the Proceedings Committee
Saichi Hosoda
Chair of the Scientific Program Committee
Motokazu Hori
President
Kozo Suma
Chairperson of the Organizing Committee
Toshio Mitsui
Secretary General

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Sunao Tawara (1873–1952)

Tawara's Contribution to the Discovery of the Conduction System of the Heart

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Just 100 years ago, that is, in 1893, His reported on the atrioventricular bundle in the human heart. This bundle is now called the bundle of His. Ten years after this monumental year, Tawara went from Japan to Germany to study medicine. Three years later, he published his historic monograph[1], in which he presented the results of the research he conducted in Ludwig Aschoff's laboratory in Marburg. At that time, controversy still existed as to whether the conduction of excitation of the heart is neurogenic or myogenic. However, Tawara used the term "Reizleitungssystem" to describe the specialized myocardial tissue. Reizleitungssystem means stimulus or excitation conduction system.

There are two important words that Tawara was first to use with regards to the specialized myocardial tissue. One is "coduction" and the other is "system". By using the term "conduction", Tawara definitely indicated that the specialized myocardial tissue is responsible for conduction of excitation, that is, that conduction is myogenic. Now, please pay attention to the second term, "system". System means an integrated group of several components that perform a certain function. Prior to Tawara, however, only one component of the conduction system, this is, the atrioventricular bundle of His had been known. Only one component is not a system. Tawara also described two other components. These are the atrioventricular node and the left and right bundle branches. In addition, he indentified yet another component, the Punkinje fibers, as the terminal component of the system. Although Purkinje fibers were first described by Purdkinje in 1845, their function was not known until Tawara identified them as the termination of the conduction system.

In describing this system, Tawara made good use of analogies. He said that the conduction system is a closed system, like that of a tree. This anatomical tree is rooted in the atrial septum, the stem and the main branches penetrate the fibrous septum and the ventricular septum, their peripheral branches reach the papillary muscles and the parietal walls, and finally the smallest twigs spread as the terminal ramifications of the conduction system. Tawara compared this architecture to those of the respiratory system, the circulatory system and the nervous system. Although those stystems have a tree-like architecture, they convey, respectively, gases, fluids and impulses. In a ductal pathway, transportation of gases or fluids takes place. On the other hand, in a parenchymatous pathway, transportation of impulses takes place. Based on his observation that the Reizleitungsystem is parenchymatous, Tawara concluded that the function of this system is to conduct impulses.

Tawara estimated the conduction velocity very accurately. Prior to Tawara's research, the pathway was considered to be very short, because the bundle of His was believed to connect with the ordinary ventricular muscle at the top of the ventricular septum. Because the time interval between the atrial and ventricular contractions, that is, PR interval, is relatively long, and because the pathway is short, Tawara's contemporaries believed that the conduction velocity is slow. However, Tawara discovered that the system extended from the a–v node to the Purkinje fibers, and thus found that the pathway is longer than was believed. He consequently concluded that the velocity must be faster than had been believed. However, from the histrological characteristics of the a–v node, he admitted that the node retards conduction.

Tawara said that this characteristic architechture, by which the impulse is transported to the remotest segments of the ventricular wall through closed pathways, serves to convey the excitation impulse as effectively and as simultaneously as possible to all sites of the ventricular wall. For this reason, the velocity of an impulse wave in the connecting bundle must be faster than in ordinary ventricular muscles.

The present-day data reveals that Tawara's estimation was very accurate. Velocity is slow in the a–v node, but is very fast in the His-Purkinje system, being much faster there than in ordinary myocardium.

During the 1970 or 1980, a controversy arose concerning the concept of hemiblock, which had been proposed by a school in Buenos Aires. This concept was based upon an understanding of the left bundle branch as being bifascicular. However, Tawara had many years earlier indicated the left bundle branch as being relatively broad at its origin and spreading like a fan, or as being trifascicular. Our present understanding accords with Tawara's illustraction. It is said that if more attention had been paid to Tawara's work, much controversy could have been avoided.

Tawara included several questions and suggestions in his monograph. I will cite two of them. He asked, for instance, "What is the physiological function of the nerve bundles accompaning the conduction stystem ?" He suggested, for instance, that each segment of the system is histologically varied and that each segment performs somewhat different function. Further experimental and physiological studies will clarify what significance each segment has in conducting excitation. Nowadays, these question and suggestion are very important in the understanding the genesis of arrhythmias.

Almost ninety years have passed since Tawara published his monograph. His descriptions and illustrations of the conduction system are so complete and so perfect that it is very difficult to improve on them even today. The monograph is still new and suggestive even now. I wish to conclude my talk with a saying of Confucius, "On-Ko-Chi-Shin" (温故知新) This means "Exploring the Old, one becomes able to understand the New".

Reference

1. Tawara, S : Das Reizleitungssystem des Säugetierherzens. Eine anatomisch-histologische Studie über das Atrioventrikularbündel und die Purkinjeschen Fäden. 1906 Verlag von Gustav Fischer in Jena.

Future Directions in Cardiac Pacing – Training and Certification

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With advancing complexity of pacemaker device hardware and combinations of defibrillators, pacemakers, and multi-sensor technology, the era when implantation technique could be self taught is over. The widespread practice of unskilled, untutored and often unscrupulous physician implanters whose annual procedure rate was often little more than a handful of cases contributed to the public perception of fraud, waste, and abuse in device usage. A proposal has been previously offered[1] to stratify the training of pacemaker physicians into those who prescribe and follow (Track I) and those who also implant devices (Track II). With the growing restriction on third party carrier reimbursement of hospital and professional fees, it is expected that a move toward regionalization of device implantation will occur. So too, declining hospital reimbursement will create more emphasis on regional buying groups and contract purchases.

The optimal plan would be for those who follow either Track I or Track II to obtain their training in a Pacemaker Center of Excellence. Such an institution may be characterized as 1.) performing in excess of 100 procedures annually by 2.) a limited number of implanting physician implanters, each of whom performs a *minimum* of 12 procedures annually. The program will have a recognizable service director who has a predominant commitment to pacing, teaching, and who performs at least 50 device implantations per year and who has the requisite sub-specialty boards in his or her specialty including the NASPE Examination of Special Competency in Pacing. Trainees will follow a prescribed course of instruction as enumerated below and at the conclusion of such training, will be certified by the program director as having successfully completed the course.

Track I

Those who prescribe and follow patients with cardiac pacemakers, but do not implant devices should have a thorough knowledge of cardiac anatomy, electrophysiology, and cardiac pharmacology including the effects of various drugs on the cardiac conduction system. He or she should be familiar with the comparative benefits of available devices as well as the technical nuances of device implantation. They should understand concurrent anatomic and surgical anomalies (i.e. congenital venous anomalies, prosthetic valves, AICD etc.) that may impede or alter device insertion. Finally, they should be comfortable with the use of standard programmers and understand the implications and clinical benefit of such interactions on device performance and longevity.