

# 心律失常射频消融图谱

## ATLAS OF CATHETER ABLATION OF ARRHYTHMIAS

主编 胡大一 马长生



中国医药科技出版社

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Dayi Hu Changsheng Ma

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### 内 容 提 要

作者在过去近 3 年里完成了经导管射频消融治疗心律失常 1000 余例, 该导管室为国际上数家完成千例以上射频消融术的中心之一。本图谱分十章, 420 余幅图。包括体表心电图旁路定位、消融靶点心电图、消融导管 X 线影像与导管操作等基本问题。对多旁路消融、合并器质性心脏病的消融和疑难病例等复杂现象亦作了具体分析。本图谱是从事心脏电生理工作, 特别是心脏介入工作医生更好了解和掌握射频消融技术, 克服实践经验不足这一难题的好教材。本图谱还包括了百余幅旁路定位和心律失常鉴别诊断的心电图, 对于临床心电图工作者亦是一本难得的参考书。

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封面设计 宣 力

### 心律失常射频消融图谱

胡大一 马长生 主编

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心脏起搏与电生理分会常委，导管消融治疗心律失常学组组长，中华心血管病学会中青年委员，心脏电生理学组副组长，介入心脏病学组成员，中国介入心脏病学杂志副主编，中华心血管病杂志、心脏起搏与电生理杂志，中国实用内科杂志等编委。为北美起搏与电生理学学会正式会员和国际动态心电图学会成员。积极开展国际民间学术交流。为培养和造就我国介入心脏病学和心脏电生理学跨世纪的学科带头人辛勤耕耘，甘为人梯。

## BIOGRAPHY

Professor Hu Da-Yi, (48 years old) graduated from the Department of Medicine, at the Beijing Medical University (formerly the Beijing Medical College) in 1970. He spent 2 years training in cardiac electrophysiology at the University of New York State and the Chicago University, Illinois (1985–1987). Dr. Hu has made remarkable contributions to the development of cardiac electrophysiology in China, especially AAI pacemaker applications in sick sinus syndrome patients, clinical and experimental researches in sudden cardiac death, thrombolytic therapy in acute myocardial infarction and catheter ablation in the treatment of cardiac arrhythmias. He was awarded second prize (twice) and third prize (once) of the Scientific and Technology Improvement Award by the Ministry of Health. He is recognized by the government as a distinguished scientist. He has had published over 280 medical papers, and three books as the Chief Editor, 8 books as an author, and four books as the main translator. He is a senior member of the Pacing and Electrophysiology Subcommittee and is the Vice Chairman of the Task force on Catheter Ablation of Cardiac Arrhythmia under the Chinese Biomedical Engineering Association. He is also a member of the Chinese Association of Cardiology, the Vice Chairman of the Cardiac Electrophysiology Subcommittee, a member of the Interventional Cardiology Subcommittee, an Associate Editor of the Journal of Chinese Interventional Cardiology, and a member of the Editorial Boards of the following: Journal of Chinese Cardiology, Journal of Cardiac Pacing and Electrophysiology (Chinese), Journal of Chinese Internal Medicine. Dr. Hu is also a regular member of the North American Society of Pacing and Electrophysiology and the Association of International Dynamic Electrocardiography.

## 作者简介



马长生，副主任医师，1963年11月生。1984年毕业于河南医科大学医疗系。1989年在北京医科大学获得临床硕士学位。曾工作于北京市心肺中心——北京安贞医院、北京医科大学第一医院。现任首都医科大学朝阳医院心脏中心导管室主任。近几年从事介入心脏病的临床实践与研究，独立完成心律失常射频消融术400余例、经皮球囊二尖瓣成型术300余例、经皮球囊冠脉成形术40例及其它心导管术500余例，在介入心脏病学领域有较深的造诣。曾帮助国内80余家医院开展经皮球囊二尖瓣成型术、心律失常射频消融术等项心脏介入治疗，为介入心脏病学技术的推广与

提高做出了突出成绩。发表论文20余篇，主编《实用高血压学》，《高血压和冠心病的防治》。是当代青年学者。

## **BIOGRAPHY**

Dr. Ma Chang—Sheng, vice—chief physician (born in November 1963) graduated from the Department of Medicine, Henan Medical University in 1984. After obtaining the degree of Master of Medicine at the Beijing Medical University in 1989, Dr. Ma started his cardiology career at the Beijing Cardiopulmonary and Vascular Centre / Beijing Anzhen Hospital as an attending doctor, and then moving to the First Teaching Hospital of the Beijing Medical University in 1992. He has performed more than 400 radiofrequency catheter ablation procedures and over 300 percutaneous mitral valvuloplasty procedures plus a large number of other cardiac catheterizations in the past five years. As the Director of the Cardiac Cath—Lab at Beijing Red Cross Chao Yang Hospital since November 1993, his diligence and talent has given the hospital a very high reputation for its cardiology. His medical consultations at over 80 hospitals nationwide reflect his outstanding contribution to the development of interventional cardiology in our country in the past five years. As Chief Editor of “ Practical Hypertensionology” and “Prevention of Hypertension and Coronary Heart Disease” and as the main author of dozens of papers, he has gained a high profile in cardiology throughout China.

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We can not overemphasize the great contribution to the development of radiofrequency catheter ablation of arrhythmias in China made by Dr. Mark Wood, Dr. Karl-Henz Kuck, Dr. Delon Wu, Dr. Martin Borggrefe, Dr. Shian Chen, Dr. Xu Chen, and Dr. XunZhang Wang, who keep bringing fresh information and newest technology to us. Without their help it was not possible to publish this book.

# 序 言

射频导管消融治疗快速心律失常已使临床电生理的实践发生了革命性的变化。正如美国著名心电生理学家 Douglas P. Zipes 指出导管消融心律失常是所有心脏病学中唯一真正的根治性技术；该项技术自 1987 年用于临床以来，受到全世界的关注，取得巨大进展。

我国自 1991 年至今不到三年的时间，已有 60 余家医院陆续开展了射频导管消融，治疗病人 4, 500 余例，成功率达 95% 左右。本书的撰写者已积累千余例射频消融的实践经验。他们为了推动我国射频消融技术的进一步发展和普及推广，写成了这本图谱，收集了典型病例和疑难病例消融电极导管的 X 线影像和心内靶点心电图，并以体表 12 导联心电图为对照，直观地向读者介绍射频导管消融技术的细节。图解简明扼要，中英文对照，便于进行国际学术交流。

从事射频导管消融及心电生理专业工作者需要有深厚的电生理学学科的理论知识，心脏影像学的扎实基础和心导管操作的熟练技巧。必须进行严格的培训，才能进一步提高射频消融的成功率将并发症降至最低。本书将是进行这方面培训的一本好的教材，读起来生动实用。

本书的编者绝大多数是中青年医生。他们在老一代心脏病学学者的指导下，勤学苦练，勇于追赶和拼抢国际先进水平，为我国心脏电生理走向世界作出了贡献。这本图谱是他们拼搏奋斗精神的体现和实践经验的结晶，它的出版发行将对我国心脏电生理学学科的发展产生重要影响。

1994 年 9 月

## FOREWARD

The advent of radiofrequency catheter ablation (RFA) in the treatment of tachyarrhythmias has revolutionized the practice of clinical cardiac electrophysiology. As Douglas Zipes pointed out in his CATHETER ABLATION OF ARRHYTHMIAS, catheter ablation of arrhythmias provides the only truly curative procedure in all of cardiology; everything we do else is merely palliative. The techniques used in our country have been developing very quickly since 1991. There are more than sixty hospitals doing catheter ablation at present and the total number of patients has exceeded 4,500 with a success rate of above 90 percent. In order to further improve the understanding of cardiac electrophysiology and the techniques used in many hospitals especially district hospitals, the authors wrote this book based on their enormous experience in over 1,000 patients. Both typical and complicated cases were included and explicated in detail with a step by step approach including the localization of accessory pathway by body surface electrocardiograms, explaining radiology images, intracardiac mapping and target-site electrograms.

Comprehensive understanding of cardiac electrophysiology and imaging as well as proficiency in catheter manipulations are fundamental in successful catheter ablation and lower complications. This book emphasises those basic fields and give extensive materials to make those complicated simpler and understandable.

The authors in this book are mostly from new generations of cardiac electrophysiologists. They have been inspired by their predecessors in pursuing the career, which used to be far behind the state-of-the-art. They have made magnificent contributions to the progress of the cardiac electrophysiology in our country. The book reflects their constant effect in medical practice and brilliant results in cardiac electrophysiology and RFA. The publication of this book will prove to be in time and influential in the development of cardiac electrophysiology and RFA in our country.

Liu Lisheng Sun Ruilong

1994, 9.

# 前 言

进入 90 年代以来, 射频导管消融术治疗心律失常是心脏病学领域最引人注目的新技术, 成千上万的患者就此告别了病痛。射频消融因其创伤小、安全、成功率高迅速被临床电生理学界接受和推广, 并在整个抗心律失常治疗学中取得日益重要的地位。目前, 西方各国的医学中心纷纷建立或扩大电生理实验室进行射频消融治疗心律失常。射频消融治疗心律失常在我国的引进与开展是医学界赶超世界先进水平的一个成功例证, 在不到 3 年时间里, 国内已有 70 余家医院相继开展了此项工作, 累积治疗的病例达 4, 500 余例, 成功率在 90% 以上, 达到世界先进水平, 我国有 500 万左右的病人可望用射频消融予以根治, 而这些病人绝大多数为中青年, 做好此项工作有着重大的社会意义。

射频消融是临床电生理学 and 心导管术的有机结合, 需要心电生理的坚实的理论基础和熟练的心导管操作技术, 这就需要大量的临床实践。我们在过去近 3 年里完成了射频消融治疗心律失常 1,000 余例, 积累了一定的经验, 在此基础上编写了本书, 将我们有限的经验全面系统地作一介绍。书中所有资料均取自于我们自己的病例, 有关电生理分析和导管操作技术着重介绍我们自己的体会, 并给出充足的病例, 对普遍现象如体表心电图对旁路的定位、靶点图识别, X 光影像等作重点阐述; 对少见病例亦作具体分析。力求能够帮助从事这项技术的医师更好地了解和掌握射频消融术, 克服实践经验不足和未经“学习曲线”学习过程这一难题。如本书能为我国心脏电生理学的发展和射频消融技术的提高与推广起微薄的促进作用, 我们将感到无尚荣幸与欣慰。

著名心脏病学家刘力生教授和孙瑞龙教授在百忙中为本书作序, 本书编写过程中首都医科大学红十字朝阳医院金大鹏院长和闫梦兰院长给予热情的支持, 叶行舟、刘旭、庄少伟、尹荣秀等同志认真细致、废寝忘食的工作是本书以最快速度面世的前提, 本书资料的积累亦有赖于首都医科大学红十字朝阳医院心脏中心的诸位同事和进修医师尽职尽责的工作, 特别是商丽华、王乐丰医师勤奋工作和导管室李庆国、陶悦川技师赵惠丽、于静护师的默契配合, 在这里, 致以我们最深切的谢意。

在本书的编写过程中, 我们力求内容充实实用, 阐述准确无误, 但由于我们经验不足, 学识浅漏, 疏漏谬误之处在所难免, 尚望诸位老师及学界同仁不吝赐教。

胡大一 马长生

1994 年 9 月

## PREFACE

Radiofrequency catheter ablation (RFA) of cardiac arrhythmias has been the most remarkable achievement since late 1980's in cardiology. It has been widely used for its highly successful, less invasive and relatively safe. It has become more and more important in the management of cardiac arrhythmias. In west countries, many medical centres are expanding or setting up clinical electrophysiological laboratories in order to perform RFA procedures. RFA has also been very successful since it started 3 years ago in our country. More than 4,500 patients have undergone the procedures with a success rate of above 90 percent. Since our country has about 5 million patients having arrhythmias suitable for RFA it is essential to improve the understanding of cardiac electrophysiology and the techniques of RFA.

RFA is a combination of clinical cardiac electrophysiology and cardiac catheterization. Deep understanding of cardiac electrophysiology and good skill at catheterization are crucial in every procedure. By describing everything necessary for the inexperienced readers to learn the fundamentals of the technique, this book is intended for doctors who have had some basic knowledge want to progress their learning curve quickly. We hope that the doctors interested in cardiac electrophysiology and those trained cardiac electrophysiologist will also find the book useful.

It is honour to have distinguished cardiologist, professor Liu Lisheng and Sun Ruilong to write the foreward. We would like to thank the president and the vice-president of the Capital Medical University affiliated Red Cross Cao Yang Hospital, Jin Da-Peng and Yian Meng-Lan for their encouragement and support, and thank professor Yukio Ozawa and Dr. Ichiro watanabe for their contribution. We are in debt to our colleagues and fellows for their work and help in preparing figures, especially to Xingzhou Ye, Xu Liu, Shaowei Zhuang, Rongxiu Yin, Qingguo Li and Yuechuan Tao.

We hope the book is challenging and motivating. We welcome your advice and suggestions.

Dayi Hu      Changsheng Ma

1994, 9.

## 目 录

第一章 体表心电图显性旁路定位 .....	1
第二章 房室结折返性心动过速和房室折返性心动过速的体表心电图表现 .....	55
第三章 心脏 X 线投影 .....	93
第四章 右侧房室旁路的射频消融 .....	98
第五章 左侧房室旁路的射频消融 .....	177
第六章 房室结折返性心动过速的射频消融 .....	251
第七章 心脏正常室性心动过速的射频消融 .....	287
第八章 心房扑动的射频消融 .....	318
第九章 特殊病例 .....	333
第十章 射频消融治疗心律失常 1000 例回顾 .....	416

## Contents

Chapter 1	Electrocardiogram algorithm for accessory pathway localization. ....	1
Chapter 2	Differentiation of AVRT from AVNRT by surface electrocardiogram. ....	55
Chapter 3	Radiograph of the heart. ....	93
Chapter 4	Radiofrequency ablation for right-sided atrioventricular accessory pathway. ....	98
Chapter 5	Radiofrequency ablation for left-sided atrioventricular accessory pathway. ....	177
Chapter 6	Modification of atrioventricular node for treatment of AVNRT. ....	251
Chapter 7	Radiofrequency ablation for ventricular tachycardia with normal heart. ....	287
Chapter 8	Radiofrequency ablation for atrial flutter. ....	318
Chapter 9	Special cases. ....	333
Chapter 10	Results of 1,000 cases of radiofrequency ablation for cardiac arrhythmias ...	416

# 第一章 体表心电图显性旁路定位

射频导管消融前能够准确地确定旁路位置具有重要意义,可减少标测时间,帮助选择适应症和消融途径,如左前游离壁旁路可直接选择穿间隔途径,左后间隔和右前侧游离壁旁路消融难度较大,希氏束旁路消融发生完全房室传导阻滞的危险性高等不同情况。根据我们对显性房室旁路的消融体会并结合其它作者的经验设计出图 1-1 体表心电图显性房室旁路定位流程图,可大致确定旁路的位置。

$\Delta$  波的极性在旁路定位具有重要价值。有预激时, QRS 综合波前 40ms 激动定义为  $\Delta$  波,若  $\Delta$  波在基线以上持续达 40ms 规定为正  $\Delta$  波,用 (+) 表示;若在基线下持续达 40ms 则规定为负  $\Delta$  波,用 (-) 表示;不能看到  $\Delta$  波或  $\Delta$  波在等电位线、 $\Delta$  波呈正负双向或负正双向均用 ( $\pm$ ) 表示。旁路位置定义见图 1-2。右侧房室旁路分为右前间隔旁路(希氏束旁路)、右中间隔旁路、右后间隔旁路、右前侧游离壁(沿三尖瓣环 9:30~12 点)、右侧游离壁(三尖瓣环 8:30~9:30 点)、右后侧壁(沿三尖瓣环 8:30~6 点)。其中右前间隔旁路包括位于希氏束上下 5mm 以内的旁路,又称为希氏束旁路(Para-Hisian AP);前间隔下方至冠状窦口上缘的旁路为中间隔旁路。这两条定义与其它作者的定义不同,一般规定只要在希氏束下即为中间隔旁路,但是从影像上确定希氏束下方与上方 5mm 以内的旁路均靠近希氏束,消融时损伤希氏束的危险性相同,体表心电图亦类同并明显地有别于中间隔旁路,所以我们将其统称为前间隔旁路或希氏束旁路。左前间隔没有房室旁路,左中间隔也极少见。左侧房室旁路多位于二尖瓣环左前侧(沿二尖瓣环距冠状窦口 5cm 以上)、左侧壁(距冠状窦口 3~5cm)、左后侧壁(距冠状窦口 1.5~3cm)及左后(间隔)(距冠状窦口 1.5cm 以内)。


按照图 1-1 流程图首先根据胸前  $V_1$  导联 QRS 综合波主波方向确定旁路是位于左侧或右侧。若  $V_1$  导联 R 波占优势,  $R > S$ , 则为左侧旁路,具有很高准确性。若  $V_1$  导联 S 波占优势,  $R < S$ , 则为右侧旁路。但是不排除左侧旁路预激程度不够大,对 QRS 向量影响较小,从而 QRS 综合波表现为 rS 形态,这种情况下肢体导联 I 和 avL 具有重要价值。若 I 和 avL  $\Delta$  波为-或  $\pm$ , 则为左侧旁路。ATP 试验具有重要鉴别诊断价值,一般情况下我们在右心室导管放置后(以备长时间阻断房室传导时立即做心室起搏), ATP 20mg 经静脉快速注射,完全或部分阻断房室结,使预激程度加大,对 QRS 波的影响充分表现出来。ATP 试验在消融前对旁路定位往往具有重要帮助。 $V_1$  导联  $R < S$ , I 和 avL 导联  $\Delta$  波直立则为右侧房室旁路,有作者还强调 I 和 avL 导联主波要向上,实际上右侧显性旁路 I 和 avL 导联几乎全为主波向上。

初步确定为左侧房室旁路者,根据肢体导联 avF 及 I 导联  $\Delta$  波的极性及 I 导联 QRS 波的形态确定房室旁路在左侧的具体位置。若 avF  $\Delta$  波直立,则为左前侧壁或左侧壁旁路,其中 I 导联 QRS 综合波呈 QS 型者为左前侧壁旁路而 I 导联 QRS 综合波呈 qR 型者为左侧壁旁路, I 导联 Q 波越深大,旁路越偏左前。若 avF 导联  $\Delta$  波倒置或为  $\pm$ , 则为左后侧壁或左后间隔旁路。I 导联为正向  $\Delta$  波者旁路位置偏后,位于左后间隔;若 I 导联为负向  $\Delta$  波或



$\Delta$ 波极性为 $\pm$ 则为左后侧壁旁路。文中左侧旁路分区属人为规定，各区之间可有较大重叠。

对于初步确定为右侧旁路患者，我们习惯于首先将其分为右侧游离壁和右侧间隔部旁路。这主要是根据胸前 $V_1$ 导联QRS综合波有无小r波，即QRS综合波是呈rS型或QS型，也就是根据 $V_1$ 导联QRS综合波前 $\Delta$ 波的极性，一般正向 $\Delta$ 波时QRS综合波呈rS型，而负向 $\Delta$ 波时QRS呈QS型。若 $V_1$ 导联QRS呈rS型则为右侧游离壁旁路，若呈QS型则为右侧间隔部旁路，具有很高的准确性。无论位于间隔或位于右侧游离壁，均根据avF导联判断旁路位置偏前或偏后。 $V_1$ 导联QRS综合波呈rS型，I、avL为正向 $\Delta$ 波者初步确定为右侧游离壁旁路。凡avF导联 $\Delta$ 波直立者为右前或右前侧游离壁，否则为右侧或右后侧游离壁旁路，此时要结合肢体II导联 $\Delta$ 波极性确定，II导联 $\Delta$ 波直立者为右侧壁旁路，II导联 $\Delta$ 波倒置或极性为 $(\pm)$ 者为右后侧游离壁旁路。 $V_1$ 导联QRS综合波呈QS型者为右侧间隔部旁路，若avF导联 $\Delta$ 波直立则为右前间隔旁路（希氏束旁旁路），包括位于希氏束上外侧的右前间隔及希氏束下koch三角前尖部的旁路，在图1-1及图1-2中均用RAS表示，这一点与其它作者定义不一致。根据我们的实践，利用体表心电图把位于希氏束稍偏上外（通常称作右前间隔）和稍偏下（通常属中间隔）的旁路区别开几乎是不可能的，因此我们把这两个部位的旁路统称为希氏束旁旁路（Para-Hisian accessory pathway）。本书第四章和第九章所指的右前间隔旁路即指希氏束旁旁路。间隔部旁路若avF导联 $\Delta$ 波极性为 $(-)$ 或 $(\pm)$ ，则为中间隔旁路（从koch三角中点到冠状窦口上缘之间的旁路）或右后间隔旁路，其中II导联 $\Delta$ 波倒置者为右后间隔旁路，II导联 $\Delta$ 波直立者为右中间隔旁路，但其中仍有部分属右后间隔旁路，也就是说右中间隔旁路的II导联 $\Delta$ 均直立，但II导联 $\Delta$ 波直立者可以不是中间隔旁路。在胸前导联上，右后间隔及右后侧近间隔部旁路最突出的特点是R/S比值的迅速移行，即 $V_1$ 导联QRS综合波呈rS或QS型，而 $V_2$ 导联都呈R型或Rs型。随着旁路位置自右后侧壁向右侧游离壁、右前侧游离壁的前移，胸前导联R/S移行变慢。在肢导联 $\Delta$ 波的极性与胸前导联R/S移行不符合时，以肢导联为准。如avF及II导联均为负向 $\Delta$ 波，即使胸前导联R/S移行晚也可判断为右后范围的旁路，这种情况可见于Ebstein畸形及其它右室扩大的情况；另一方面，如果肢体导联判断困难时胸前导联R/S移行突然，则支持旁路位置偏后，如移行缓慢则支持旁路偏前侧。

书中各图下方的「」表示为10mm，如图注中未标出记录纸速时均为25mm/s记录纸速。