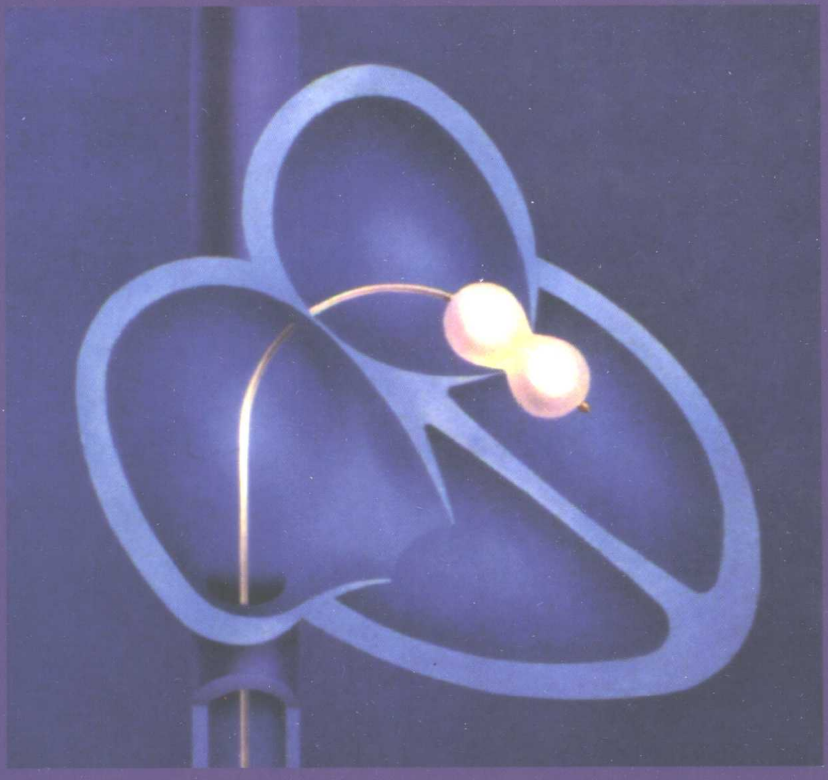
经皮穿刺

二尖瓣球囊扩张术

Percutaneous Balloon Mitral Valvuloplasty

主编　戴汝平



科学出版社

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2000

内 容 简 介

本书共分7章，插图近200幅，系统介绍了风湿性心脏瓣膜病理、二尖瓣球囊扩张术的器材、操作方法、诊断、治疗机制及治疗效果，是北京阜外心血管病医院15年近2000例临床经验及获奖科研成果的总结，并紧密结合了国内外的最新最全的进展。全书图文并茂，实用性强，适合心内外科医师、介入心脏病学医师、介入放射学医师及其他临床心脏介入治疗工作人员阅读、参考。

图书在版编目（CIP）数据

经皮穿刺二尖瓣球囊扩张术／戴汝平主编．－北京：科学出版社，2000.5
ISBN 7-03-008461-6

Ⅰ．经… Ⅱ．戴… Ⅲ．风湿性心脏病－心脏瓣膜疾病－人工心脏瓣膜手术 Ⅳ．R654.2

中国版本图书馆CIP数据核字（2000）第06693号

科学出版社 出版
北京东黄城根北街16号
邮政编码：100717
深圳美光实业股份有限公司 印刷
新华书店北京发行所发行 各地新华书店经售
*
2000年5月第 一 版 开本：787×1092 1/16
2000年5月第一次印刷 印张：11 1/4
印数：1－4 000 字数：269 000
定价：86.00元

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前　言

风湿性心脏病在发展中国家是常见病，我国约有300万风湿性心脏病患者。手术是治疗风湿性心脏瓣膜病的主要方法，其中包括闭式分离术、直视成形术及生物瓣膜或人工瓣膜置换术，治疗效果不断提高。1984年Inoue及1985年Lock先后开发了经皮穿刺二尖瓣球囊扩张术(percutaneous balloon mitral valvuloplasty, PBMV)，逐步取代了闭式分离术，15年的临床验证，其效果可靠、病人痛苦小、并发症低，已为心脏外科医生所接受。由于器械和技术的发展，PBMV技术业已成熟，并在全世界推广。

我国早在1985年就引进该项技术，并逐步推广，至目前，在全国已有数以万计的患者得到治疗。但是，按我国发病率计算，远远不成比例。现在，每年仅有千余例患者采用PBMV治疗二尖瓣狭窄，实不能适应广大患者的需要。随着器械国产化、医疗费降低，技术进一步推广，会有更多的患者受益，特别是“老、少、边、穷”地区患者受益。当前主要的任务是知识的普及和技术的规范和推广，这是本书的主要目的。

我们在开发PBMV技术的同时，也着手介入性治疗技术的普及和推广工作，于1990年举办了第1届“经皮穿刺二尖瓣球囊扩张术研讨会”，荣幸地邀请到“经皮穿刺二尖瓣球囊扩张术”的开拓者，日本Inoue教授；双球囊技术的代表，美国Francis YK Lau教授作专题讲座，使我国医生对该项介入性治疗技术有了深入了解。此后，在全国同道的支持和协助下，每两年举办一届“专题研讨会”，推动了PBMV技术在我国的普及与推广。

本书是根据我院12年来数千例PBMV临床经验及科研工作的总结。从实际应用出发，并参考国内、外学者经验，系统地对二尖瓣解剖、风湿性心脏瓣膜病二尖瓣病理、房间隔穿刺术、经皮穿刺二尖瓣球囊扩张术方法、特殊病例经皮穿刺二尖瓣球囊扩张术、疗效评价及二尖瓣球囊扩张术的机制，作深入阐述和探讨。我们也非常荣幸地邀请到美国心脏病学家Francis YK Lau撰写双球囊法二尖瓣扩张术及PBMV治疗效果等章节，并为该书作序言。

本书是集体劳动的结晶。我科自1982年开展心血管病介入治疗临床应用研究，20年来取得了丰富经验和重大成果，锻炼和培养了一大批青年专业人才，为此，获得了1998年国家科技进步二等奖。在这里应该感谢为心血管病介入治疗临床应用研究作出贡献的放射科、心导管室全体同志。对阜外医院各级领导、超声心动图科及心内、外科同志的大力支持表示衷心感谢。

2000年5月1日

于北京阜外心血管病医院

PREFACE

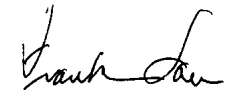
The presentation of atrial fibrillation, pulmonary edema, TIA's, or cerebral vascular accidents in young people, particularly women, should always alert a physician to the probability of mitral stenosis. Mitral stenosis is found in the younger population and more commonly in the recent emigrants in U.S.A. Mitral stenosis is a treatable disease and should be evaluated thoroughly particularly by a clinical cardiologist and the proper mode of treatment prescribed.

Although mitral balloon valvuloplasty is of recent origin, interventions on the mitral valve started just prior to the 19th century. Our surgical colleagues proposed various types of instruments to relieve the obstruction at the mitral valve via trans-ventricular and trans-atrial routes. The surgical treatment of mitral stenosis was first attempted by Eugen Doyen in 1912 by cardiotomy but was unsuccessful. Elliot Cutler, 5/20/23 used a Tenotome via the left ventricle with an improved patient until 4 1/2 years later when he died suddenly. Evarts Graham and Duff Allen were unsuccessful with a cardioscope inserted into the left atrium when the patient suddenly died. Dr. Graham remarked "unfortunately with any new procedure, the pioneers get only the patients who are the worst possible risks". Henry Souttar, 5/6/25, established the method of "finger fracture" through the left atrial appendage. Although the patient recovered nicely, he was unable to find a second patient and stated that "it's of no use to be ahead of one's time". It was almost 10 years later when Charles Bailey in June of 1946 performed his first digital commissurotomy. The patient died; autopsy showed an incomplete commissurotomy. Dr. Bailey in June 10, 1948 performed the first successful commissurotomy using a finger knife via the atrial appendage. Dwight Harken 6/16/48 performed the first successful commissurotomy using a trans-atrial valvulotome. Sir Russell Brock in September 1948 established the "Souttar" method of finger fracture in England. Charles Dubost in 1954 devised a two-bladed dilator to perform mitral valvuloplasties via the left atrium. Later in 1954, Andrew Logan and Richard Turner devised a trans-ventricular dilator which was subsequently improved by Dr. O. S. Tubbs and used throughout the world as the primary surgical instrument to open mitral valves to this date with a "closed heart" procedure. With the advent of "open heart" cardiopulmonary bypass machines, Dr. Albert Starr implanted a caged Silastic ball prosthesis in the mitral position 8/25/60. Henry Nichols popularized open mitral

commissurotomies in 1962. With the improvements in cardiopulmonary support devices and the change over to low profile artificial valves, more of the patients in the older age group with severely diseased mitral valves had replacements with operative risks approaching 1-2% in the 1980's. Many of these historical surgical vignettes on mitral valve disease are related by HB Shumacher, Jr. In his book The Evolution of Cardiac Surgery.

In 1984, a cardiac surgeon, Dr. Kanje Inoue and his group devised and reported on mitral valvuloplasty using a special balloon catheter placed across the mitral valve from a trans-septal position. This unique balloon catheter was made of Silastic rubber with a fibrous mesh infra-structure, circumferentially placed in the longitudinal axis so that the wide gauge mesh was in the distal portion of the balloon, the most dense mesh in the center, and the median gauge mesh in the proximal portion of the balloon. This permitted this longitudinal balloon to expand first at the distal tip, second at the proximal portion to fix the dumbbell shape across the valve leaflets, and finally expanding the mid portion to split the commissures. These ingeneous balloon catheters were hand made by Dr. Inoue and generally could not be used repeatedly because of difficulty in re-sterilization, and deterioration of the balloon with ruptures on re-usage. Because of limited supplies of the Inoue balloon catheters, other investigators devised methods to use primarily MediTech peripheral vascular balloon catheters for "off-label use" to perform mitral balloon valvuloplasties. J. E. Lock and Associates reported on using a single balloon catheter in 1985 in Boston. In 1984, M. Zaibag devised with the assistance of C. Mullins and C. Ruiz a double balloon valvuloplasty method used at the Military Hospital in Riyadh, Saudi Arabia. M. Zaibag's double balloon method utilized transseptal sheaths #12F and # 14F to carry each of the balloon catheters, and to use the distal ends of the sheaths to keep the balloon catheters from migrating across the apex of the left ventricle and perforating the apex of the left ventricle. Drs. Ruiz and Lau devised a sheathless method by utilizing a Schneider 0.038 stiff wire with a long flexible distal end (8-10 cm.) without a stiff core that could be shaped into three distal circles to act as stabilizer in the apex of the left ventricle and to keep the balloon catheters from perforating the left ventricle. Palacios IF and associates reported on an alternative method of placing guide wires trans-septally across the mitral and aortic valves distally to the descending

aorta for their double balloon mitral valvuloplasties. Babic and Associates used retrograde wires trans-aortic and trans-mitrally with stabilization in the left atrium for placement of double balloons across the mitral valve for mitral valvuloplasties. Some of the earlier mitral double balloon catheter procedures were done at Fu Wai Hospital with Dr. Dai and at Second Provincial Hospital with Dr. C. R. Chen in 1985. It was the association of individuals who worked together and taught at Loma Linda University Medical School who shared teaching and research experiences in Saudi Arabia, Beijing, and Guandong, China where mitral stenosis is a common illness that the methodology became established. This experience benefitted the patients and those performing the procedures. As time progressed, this shared experience has pointed out that the young patients with commissural disease probably are the best candidates for the single Inoue balloon device and those with echo Class 10-15 would be better managed with double balloon valvuloplasty since the sub-valvular disease is expanded by a balloon with the same type of material and pressure as on the commissures. It is imperative that all patients have careful cardiac echocardiographic and possibly all have esophageal echo studies before choosing the particular balloon valvuloplasty catheter for the best results and to avoid problems of thromboembolism. Because the mitral valve with the subvalvular apparatus is frequently diseased, further studies are needed to design balloon catheters that anatomically fit the diseased valve and provide the proper results desired. It is of interest that the primary start of relieving mitral stenosis has been launched by our surgical colleagues whether it be by opening the chest for a direct approach or via the catheter method by the Inoue designed balloon. Our instrumentation is still relatively unsophisticated and much needs to be done to design equipment to fit the diseased valve and perhaps a change in methodology so that a cardioscope could be utilized. The current balloon valvuloplasties of mitral stenosis are for the young patient with primarily commissural disease and valve replacements for older patients with greater degrees of calcification and subvalvular involvement.



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目　录

第一章　二尖瓣的解剖、病理与临床

第一节　正常二尖瓣的解剖与生理

二尖瓣位于左心室口的后半部，为纤维组织构成。其前面 1/3 段与主动脉瓣呈纤维性连接，为前叶附着部；其余 2/3 段为真正二尖瓣环，是后叶附着部。二尖瓣叶附着在瓣环上垂向左心室。二尖瓣分为前、后 2 叶，2 个瓣叶的面积相等而形状不同。前叶位于前内侧，略呈半月形，也称大瓣。其附着缘占二尖瓣环的 1/3，与主动脉瓣有纤维性连续。后叶位于后外侧，略呈长方形，也称小瓣。其附着缘占二尖瓣环的 2/3。瓣叶本身可分为基底部(附着于瓣环的部分)、粗糙部(边缘接触部)和透明部(中间部)。瓣膜房面光滑，心室面有许多腱索附着。瓣膜关闭时，闭合线呈弧形；开放时瓣口长径为横径的 2 倍。前、后瓣之间有前外及后内 2 个交界。后叶上有 2 个小切迹，将其分为前、中、后 3 个小叶。二尖瓣开口为卵圆形，面积为 4 ~ 6cm^2，周长 9 ~ 11cm。二尖瓣质地较软，主要由纤维结缔组织构成，其中无毛细血管，营养直接由血液渗入。二尖瓣环的口径是可变的，随心动周期的舒、缩而变化。二尖瓣环与三尖瓣环在中心纤维体处相连接。

二尖瓣前、后 2 个瓣叶均有腱索与前、后 2 组乳头肌相连。从功能上讲，二尖瓣由瓣叶、瓣环、腱索及乳头肌所组成。左心房与左心室也参与二尖瓣的舒、缩活动。前、后 2 组乳头肌均发出数量大致相等的腱索到两瓣叶的前、后 2 角。前叶腱索附着区限于两侧边缘，中间部分是游离的。由乳头肌尖端发出的腱索经多次分支，呈扇形与瓣叶相连。根据其与瓣叶相连的部位，分为边缘腱索、中间部腱索和基底部腱索 3 个部分。左心室入口被二尖瓣前叶分隔成两部分，前部为左心室的流入道，后部为左心室的流出道，此与左心室的舒缩和二尖瓣的功能有密切关系。当二尖瓣闭合时，两瓣叶接触缘有一闭合区(area of closure)以确保二尖瓣的正常功能(图 1-1、表 1-1)。

当心脏处于舒张期时，二尖瓣前叶开放，血流由于左心房室之间的压力阶差进入左心室，

表 1-1　正常二尖瓣测量数据(mm)

周径	116 ± 3.5	后扇叶高度	10 ± 1.2
前叶		中扇叶关闭区	8.0 ± 0.9
接触缘	32 ± 1.3	中扇叶	
高度	23 ± 0.9	腱索缘	14 ± 2.9
关闭区	14 ± 1.1	基底部	8.0 ± 1.7
主腱索		腱索裂	13 ± 3.7
前	19 ± 0.4	前联合小叶	
后	17 ± 0.2	接触缘	12 ± 3.3
副前联合	17 ± 0.3	高度	8 ± 1
副中联合	15 ± 0.5	联合腱索	13 ± 0.2
后叶		后联合小叶	
接触缘	55 ± 2.2	接触缘	17 ± 0.8
中扇叶高度	14 ± 0.9	高度	8
前扇叶高度	11 ± 1.0	联合腱索	15 ± 0.5

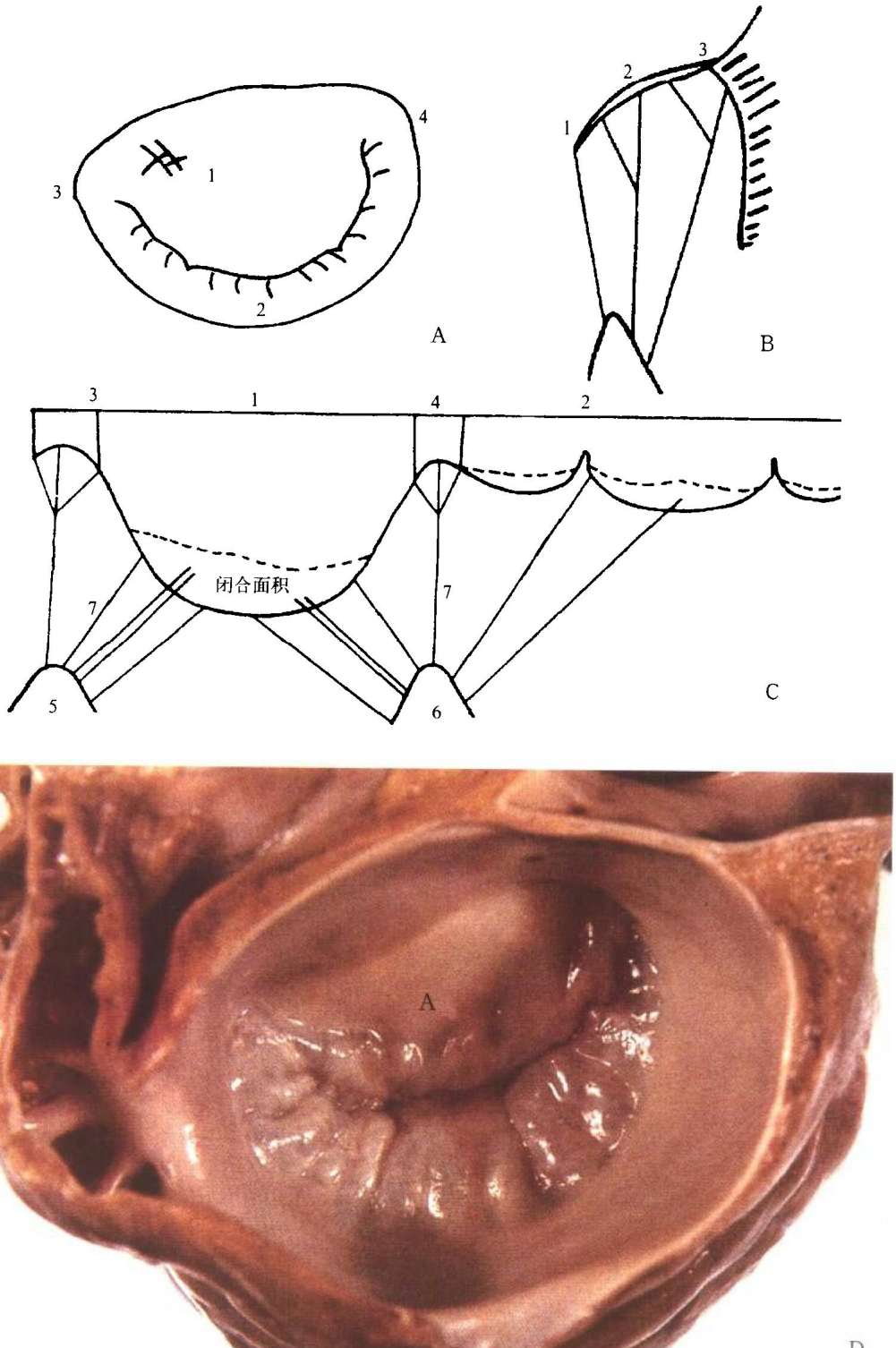


图 1-1 二尖瓣正常解剖示意图

A. 左心房观: 1. 前叶; 2. 后叶; 3. 前联合; 4. 后联合
B. 瓣叶的剖面: 1. 边缘部; 2. 中间部; 3. 基底部
C. 平面示意图: 1. 前叶; 2. 后叶; 3. 前联合; 4. 后联合; 5. 前乳头肌; 6. 后乳头肌; 7. 腱索
D. 正常二尖瓣标本(A 为前瓣)、左心房侧观、瓣缘闭合良好

并形成左心室的流入道。当心脏处于收缩期时，前瓣呈滚动性与后瓣闭合，形成左心室的流出道。左心室的舒张是由能量参与的主动过程，其主要取决于静脉回流、瓣膜之间的压力阶差及左心室的顺应性。典型的舒张期包含等容舒张期、快速充盈期、缓慢充盈期和心房收缩期。在等容舒张期，心脏虽开始舒张，但二尖瓣尚未开放。此时左心室的容量未发生变化，但左心室压力已开始下降。随着心室的进一步舒张，左心室压力呈指数式下降。当心室压力低于心房压力时，二尖瓣开放，血液由左心房进入左心室。此期即心脏的快速充盈期和缓慢充盈期。在左心房收缩期，左心房的收缩使心室压力进一步暂时上升并超过左心房压力，二尖瓣得以关闭。二尖瓣依此维持其正常的生理功能。

（吴 遐）

第二节 二尖瓣狭窄的病理

一、二尖瓣狭窄的病理基础

二尖瓣的狭窄绝大多数是由于急性风湿热的反复发作，在二尖瓣上发生炎症的渗出与增生，使瓣叶逐渐增厚及瓣叶之间的粘连所造成。单纯性风湿性二尖瓣狭窄约占风湿性心脏瓣膜病(简称风心病)患者的25%～40%。风心病患者中仅约60%有确切的链球菌感染病史。早期常在二尖瓣上出现微小的风湿性赘生物，在瓣叶的边缘呈串珠状排列。除二尖瓣叶的增厚、前后两瓣之间的粘连外，腱索也由于风湿性病变的损害而逐渐发生增粗或相互融合粘连，并可与瓣叶黏着，使一部分腱索瓣膜化。瓣叶增厚和瓣叶联合处的粘连、融合可发生在一侧，亦可发生在两侧。若仅一侧联合部粘连，则狭窄的瓣口偏向一侧；若两侧均融合，则瓣口仍位于中央。单纯的瓣叶联合部粘连、融合在年轻患者中较为常见。但由于风湿热的反复发生，瓣叶可进一步增厚或病变进一步发展使瓣叶上的瘢痕组织增多，瓣叶因而增厚、变形及变硬，甚至发生钙化。瓣叶上的钙盐沉积可沿闭锁线呈线条状分布，或形成坚硬的钙块，使瓣叶更为狭窄或变形。瓣膜上钙盐进一步沉积可使瓣叶呈结节状钙化，并可以发生破溃及血栓附着，呈漏斗状狭窄。光镜下可见瓣膜明显增厚，瓣膜的心房面有一厚层与瓣膜表面平行的纤维组织同时增生，且常发生玻璃样变，也可见局灶的黏液变性。瓣膜原有的各层结构均可消失。瓣叶基底部出现较多肌弹力型血管，且常伴有不等量的以淋巴细胞为主的慢性炎症细胞浸润。瓣叶的表面常有血小板及纤维素聚集，其中也可见肥大的组织细胞和阿少夫(Aschoff)细胞。以后可逐渐形成风湿性炎症肉芽肿或阿少夫结节。阿少夫结节常位于瓣叶边缘的心内膜下，呈与心内膜垂直方向的栅栏状排列。随着炎症的逐渐机化或纤维化，形成瘢痕状结节。二尖瓣狭窄在不断加重的同时，即可引起二尖瓣口血流动力学的障碍，出现明显的狭窄症状。此时腱索和乳头肌也可见纤维组织增生和炎症细胞浸润，并可相互融合。被覆乳头肌的心内膜也可呈纤维性增厚(图1-2、1-3、1-4)。当瓣口面积达1～1.5cm^{2}以下时，狭窄的症状会明显加重。近年来由于防治工作的加强和多种抗生素的应用，尸检中常不易查见典型的风湿性结节。

阿少夫小体是风湿性心脏病病理上惟一具有特征性的形态变化。风湿小体的部位常在心内膜下、心肌间质或冠状动脉小分支附近，一般呈圆形或卵圆形。镜下风湿细胞成群分布或略呈水平排列。胞浆多，呈轻度嗜碱性；胞核大而深染。其周围常夹有纤维素样坏死和单核细胞、中性白细胞、嗜酸白细胞、浆细胞和淋巴细胞浸润。通常，风湿小体在组织内保持3～6个月或更长时间。近年的研究表明，风湿小体的存在并不能证明新近有风湿活动。Roberts(1978)在543例严重

图 1-2A、1-2B　正常二尖瓣的解剖

二尖瓣分前后 2 个瓣叶(↑)，前瓣略似半月形，后瓣叶似长方形，分别与前、后乳头肌及腱索相连。LA：左心房，LV：左心室，AO：主动脉

风湿性瓣膜病的尸检病例中发现，11 例(2%)心肌内查见有风湿小体。上海医科大学在 281 例风湿性二尖瓣狭窄或同时兼有二尖瓣关闭不全的手术中，271 例施行二尖瓣置换术。经病理检查，27 例在二尖瓣或乳头肌内查见风湿小体(10%)。Virmani(1977)等认为在晚期慢性风湿性心脏病尸检中，风湿小体较少见；但在施行二尖瓣分离术的患者中，风湿小体却很常见。在 191 例切除左心房耳部的患者中，40 例(21%)查见风湿小体，而在 273 例手术切除的左心室乳头肌内仅有 4 例(2%)

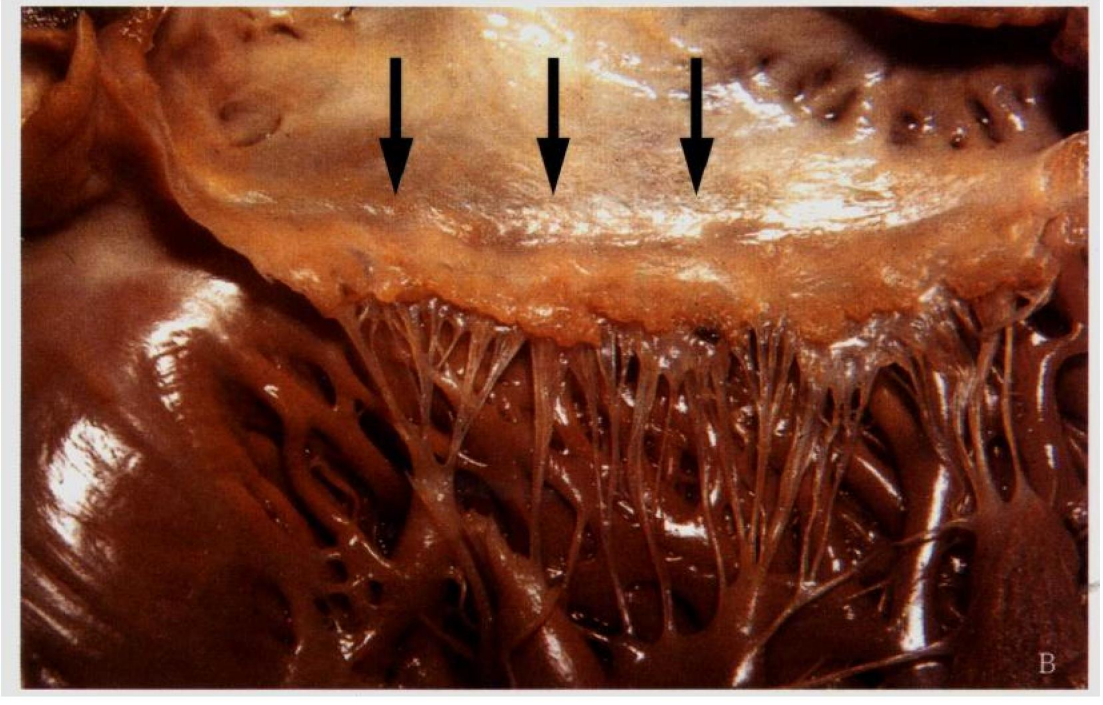
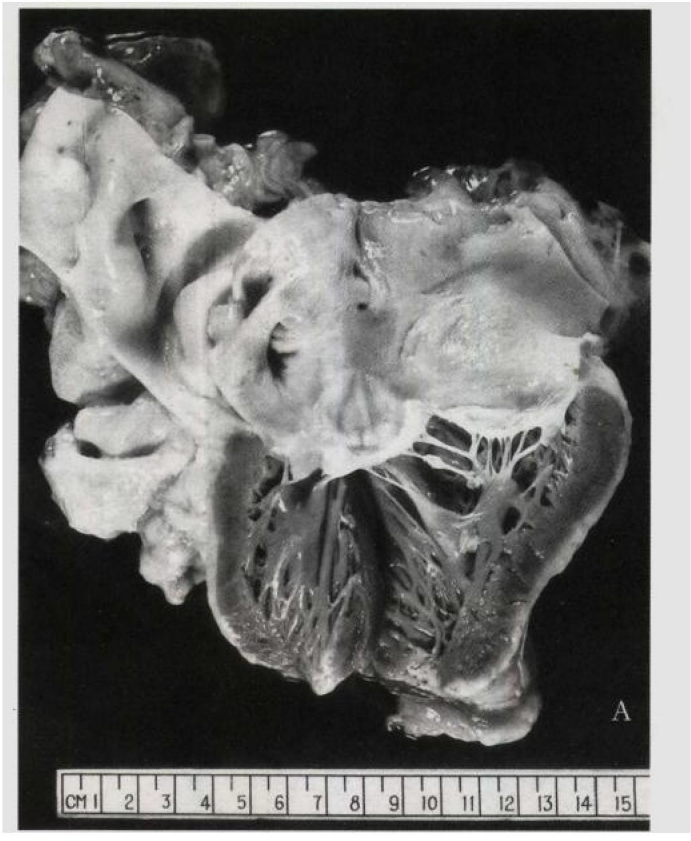


图 1-3A、1-3B 早期二尖瓣风湿性病变

瓣叶有轻度增厚和粘连(↓)，狭窄不明显，心房扩大不明显

查见风湿小体。由此可见心耳活检对风湿小体的检出率远较二尖瓣或乳头肌内为高。Tedeschi (1955)等观察 400 例风湿性二尖瓣病变的左心房耳部切除标本中只查见 8 例(2%)有风湿小体。因此，认为发现风湿小体并非为风湿活动的一个可靠指标。综合文献所见风湿小体的检出率在各家报告中差异很大，风湿小体的查见目前尚不能说明这是风湿活动的依据。

（吴 遐）



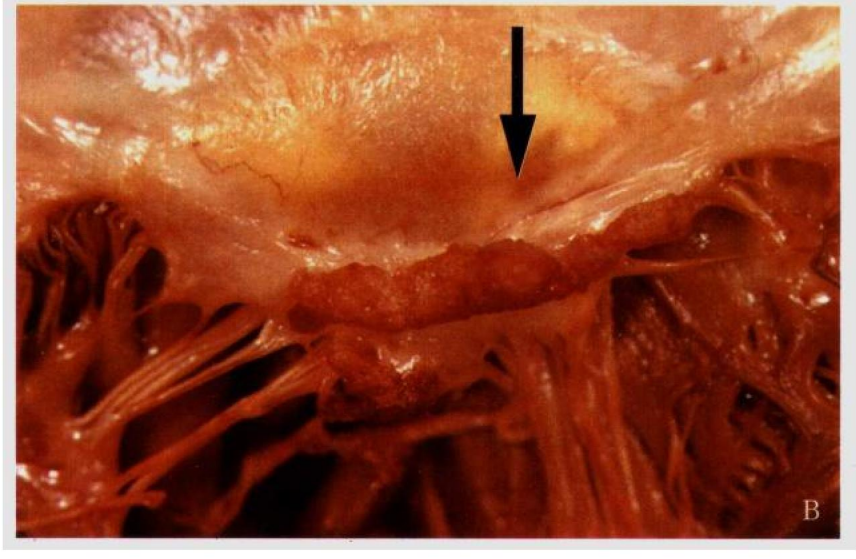


图 1-4A、1-4B 风湿性二尖瓣狭窄、轻度增厚

二尖瓣边缘有增厚(↓)，与腱索有轻度粘连，左心房面心内膜呈灰白色增厚(隔膜型)

二、二尖瓣狭窄的病理类型

风湿性二尖瓣狭窄依其病程的发展以及病变的粘连、增厚、变形等的程度和部位的不同，可出现不同的类型。二尖瓣狭窄的主要病理改变是风湿性病变在瓣叶交界处的相互粘连和融合，但瓣叶的增厚、粗糙、瘢痕、收缩、硬化以及腱索的短缩和相互粘连也是造成二尖瓣口狭窄的重要因素。综合各方面情况，我们认为兰锡纯(1982)将风湿性二尖瓣狭窄分为隔膜型与漏斗型二型的分类比较更有实用价值，现介绍如下: