

## Rheumatism and the History of Mitral Valvotomy\*\*

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### Introduction

A description of acute arthritis was credited to Hippocrates by Chomel (1813), although Galen may have introduced the term rheumatism<sup>1</sup> to designate pain caused by one of his four cardinal humours—which constituted the human organism—being in faulty combination with the others and being eliminated or discharged from the blood into the cavities of the body, including the joints. This same notion of humour dripping into a joint gave rise to the word gout by way of gutta—a drop; but Guillaume de Baiilou (1538-1616) was the first to use the term rheumatism to describe acute polyarthritis and attempted to distinguish it from gout.

Mitral stenosis as such was noted by John Mayow in 1669 and was, incredibly, fully described, both clinical picture and pathology, by Raymond de Vieussens (1705) in his patient Thomas d'Assis at Montpellier.

Thomas Sydenham in 1676 gave an excellent and full description of acute rheumatism and a few years later described Sydenham's chorea. Lettson (1786-87) described the disease in a 6-year-old boy, and at the necropsy reported enlargement of the heart among other manifestations of the disease. Pitcairn (1788) noted that subjects with rheumatism were attacked more frequently than others by organic heart disease and in 1789 Pitcairn and Jenner reported on 'Disease of the heart following acute rheumatism' to the Fleece Medical Society.

The invention of the stethoscope by Laennec in 1816 was a great aid to the accurate diagnosis of cardiac conditions, and Bouilland in 1835 was among the first to establish the exact relationship between rheumatism of the joints and heart disease; but the murmur of mitral stenosis was first described by Fauvel (1843) in France and by Gairdner (1861) in Britain.

### Experimental cardiac surgery

In 1876 Klebs started his experimental surgery on the heart of animals, perhaps provoking

the outburst from Billroth:

'Let no man who hopes to retain the respect of his medical brethren dare to operate on the human heart'.

Despite this, in 1898 Samways said: 'I anticipate that with the progress of cardiac surgery, some of the severest cases of mitral stenosis will be relieved by slightly notching mitral orifice and trusting to the auricle to continue its defence'; and in 1902 Sir Lauder Brunton, a physician, suggested that mitral stenosis in humans should be treated surgically. He described a procedure for which he suggested a needle big enough to be called a tenotome and the transventricular route; he warned that after surgery the pericardium must not be closed for fear of tamponade. This was not heeded by Cutler (1923) at first—with poor results.

There followed a period of active research in experimental cardiac surgery—MacCallum and McClure (1906), Cushing and Branch (1908), Bernheim (1909), Schepelmann (1912)—and in 1913 the stage was set for Doyen to operate on a woman of 20 years diagnosed as having pulmonary stenosis. He used a tenotome knife to split the pulmonary valve, but she died several hours later. Necropsy showed a subvalvar stenosis with a ventricular septal defect and what was described as incomplete development of the lungs.

In 1914 Tuffier operated on a young man with aortic stenosis. He was going to use a tenotome knife to split the valve but he changed his mind and used his finger to dilate the stenotic aortic valve—the man was said to have improved after the operation and lived for another 10 years.

### Pioneers of mitral valvotomy

Experience in traumatic cardiac surgery was increased during the First World War, and the experimental work of Alien and Graham (1922) on the mitral valves of dogs through a transatrial cardioscope set the stage for Cutler and Levine who, on 20th May 1923, operated for the first time on a case of mitral stenosis and incompetence in a girl aged 11 years who had suffered from dyspnoea on exertion for 3 years and had been confined to bed for the last 8 months with 'alarming attacks of haemoptysis'. Ether was used as the anaesthetic and a median thoracoabdominal incision was employed to expose the heart. A tenotome knife was introduced into the left ventricle and 'an attempt

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<sup>1</sup> Rheumatismus (Gk) = that which flows Rheumic (Rheum)  
= catarrhal discharge or watery flow from a membrane.

was made to incise each cusp of the obstructing ring. The wound in the heart was sutured with silk and the pericardium was closed tightly without drainage'. Cardiac tamponade occurred; the postoperative period was stormy and the patient was critically ill—but she survived. The diastolic murmur was somewhat changed and the systolic murmur was prolonged postoperatively. She lived for 4.5 years—a restricted life in and out of the hospital several times for rest in bed. She died of bronchopneumonia on 17th November 1927. Necropsy showed a stenosed and thickened mitral valve which admitted a bougie 40 mm in circumference, and the site of the incision made in the mitral valve at operation was easily recognized.

In his fourth case Cutler used the cardiovalvulotome through the left ventricle and excised a segment of the mitral valve. This time he did not close the pericardium tightly for fear of tamponade.

On 7th August 1923 Alien and Graham operated on a woman of 32 for mitral stenosis. It was a three-stage operation. First, under local anaesthesia (procaine hydrochloride) the costal cartilages of the first, second, and third ribs were removed. At a later date, under nitrous oxide, the 'incision' was opened and the pericardium exposed, but the pleura was opened. Respiration became embarrassed and the operation was discontinued. In the third stage the 'incision' was opened under gas and oxygen. The pericardium contained 500 ml of clear fluid. The left atrium was distended but there was no thrombus. A 'cardioscope' was inserted in the left atrium. At that stage the embarrassed respirations ceased and the heart stopped beating. Adrenaline was injected into the heart, but the patient died.

On 6th May 1925 Souttar operated on a woman of 19 years who had a history of chorea and had suffered from cyanosis, congestive cardiac failure, dyspnoea, and haemoptysis for 4 years. Her praecordium was deformed and she had signs of mitral stenosis and mitral incompetence. She was intubated and ether was used as the anaesthetic. A U-shaped osteoplastic flap over the second, third, and fourth left ribs was used. Souttar performed the atriotomy in the same manner as would be used now, put his finger in, and examined the mitral valve methodically and without difficulty despite the breaking of an atrial stay suture and some haemorrhage. He gained all the knowledge that there was to be gained; he felt the stenosis, he felt the jet of the incompetent valve, and would have split the valve with his

finger or with the hernia bistoury which he had close at hand but, thinking that this might increase the incompetence, he decided against it. The importance of this decision was later reiterated by Geoffrey Bourne (1927). Souttar concluded that 'the problem as such is to a large extent mechanical and should already be within the scope of surgery'.

Pribram in 1926 operated on one patient who died on the sixth postoperative day. Ten patients had been operated on up to this time with 2 survivors—the first of Cutler's patients and Souttar's patient. Cutler was undaunted and wrote: 'It is our conclusion that the mortality figures alone should not deter further investigation both clinical and experimental, since they are to be expected in the opening up of any new field for surgical endeavour'. He even suggested 'a dilator like Kollman's dilator of the urologist, only with a suitable curve' to split the valve.

Further historical milestones included the creation of an atrial septal defect to protect the lungs in mitral stenosis (Jarotzky, 1926); the production and treatment of mitral stenosis in animals (Powers, 1929, 1932); the introduction of the concept of extracorporeal circulation as an aid to cardiac surgery by Gibbon in 1937 (after von Frey and Gruber in 1885); and the research of Murray (1938) on the reconstruction of the valves of the heart for the treatment of mitral regurgitation.

A number of extracardiac procedures were designed to alleviate the pulmonary oedema of mitral stenosis and included anastomosis of the inferior pulmonary vein to the azygos (Bland and Sweat, 1948; d'Allaines, Lenegre, Dubost, Mathivat, and Scebat, 1948), the creation of an atrial septal defect (O'Farrell and Harken, 1948), and denervation of the heart to slow the rate for improvement of diastolic filling, with or without ligation of the inferior vena cava (Harken, 1948; Pedro Cossio, 1949).

Despite all this, the interval between 1926 and 1948 was a 'quiet' period for the surgery of mitral stenosis. Many factors contributed to this. Although the clinical consequences of mitral stenosis and regurgitation had been understood for some time (De Vieussens, 1705; Osier, 1912; Gallavardin, 1921), the part played by the stenosed mitral valve was not appreciated. Mackenzie and Orr (1923) pointed out that myocardial damage and atrial fibrillation were very important in mitral stenosis. Carey Coombs (1924) wrote: 'It seems logical to regard every

case of mitral stenosis as one of advanced cardiac rheumatism' and proceeded to say that 'the operation can never become a general method of treatment for a disease of which the mitral lesion is only one factor'. This and the results of the unsophisticated surgical methods of that time cooled interest. No cases were offered for surgery. As late as 1946 Sir Thomas Lewis viewed the surgical approach with: 'I think it will continue to fail, not only because the interference is too drastic, but because the attempt is based upon what, usually at all events, is an erroneous idea—namely, that the valve is the chief source of trouble'. As always, Sir Thomas's views carried great weight in the medical world.

#### **The modern operation**

A resurgence of interest in the surgery of mitral stenosis followed Smithy's pioneer work (1948). He himself suffered from aortic stenosis and died in 1948 at the age of 34. He used the transventricular approach and operated on 7 patients, 5 of whom died. He was followed by many surgeons in America and Great Britain—Harken of Boston (1948), Bailey of Philadelphia (1948), Blalock of Baltimore, Brock of London (1948), Longmire of Los Angeles, Brantigen of Baltimore, and Bland of Boston. They used the transatrial route with 'finger fracture', and on occasions a cutting instrument through the atrium to accomplish the commissurotomy. By May 1951 they had done 352 valvotomies between them, with a mortality of 15% and postoperative embolism in 6%. Approximately 70% of the patients were improved (Bland, 1952).

In 1951 Sellers and Bedford recorded 50 mitral valvotomies without a death. There followed the development of Harken's knife, Brock's grooved finger ring and valvotome, and the guillotine of Bailey as adjuvants to transatrial finger fracture of the valve. In 1953 Logan guided a transventricular tenotome by a finger into the left atrium to accomplish the commissurotomy. This was a great step forward, as many valves could not be split fully with the finger and all the knives cut in the direction they were held, not always along the commissures.

Dubost (1954) introduced the concept of a dilator to split the valve in the line of the commissures without distorting the mitral ring by

digital pressure from the atrium. This established the principle of opening the commissures by applying force in two opposite directions. It was a 'blind' procedure without simultaneous digital guidance.

The final development in the technique of closed mitral valvotomy came from Logan and Brown of Edinburgh and was used successfully on 17th June 1954. A Dubost-type dilator was used through the transventricular route, guided by a finger in the atrium. It was a logical combination of Logan's 1953 procedure and Dubost's dilator. This Logan-type transventricular dilator is the basis of the transventricular dilators now in use, such as Tubbs's.

Treatment of mitral incompetence received less attention for reasons of technique in that it had to await development of cardio-pulmonary bypass, but experimental attempts were made to reduce regurgitant flow by a circular suture around the atrioventricular ring (Murray, Wilkinson, and McKenzie, 1938; Carter, Gould, and Mann, 1953; Borrie, 1955). Glover and Da Villa in 1955 used the purse-string suture in the human to correct mitral insufficiency. Lillehei (1957) and others started the repair of the incompetent mitral valve under direct vision, using cardiopulmonary bypass.

Meanwhile, aortic valve surgery was developing. Turner (1914) performed the first recorded aortic valvotomy in which he dilated the valve digitally, Brock (1954) split the stenosed aortic valve with a tenotome or dilator, and the dramatic work of Hufnagel and Harvey (1953) subsequently led to valve replacement by prosthesis (Starr and Edwards, 1961).

*A full list of references will be supplied on application to the author.*

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