Endo-Myocardial Biopsy*

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The value and importance of any biopsy procedure is that it offers the opportunity of providing morphologic and histochemical information related to disease in tissues and organs which is not obtainable by other diagnostic methods.

Remarkable progress has been made in the diagnosis of heart disease in recent years, yet there remain instances where accurate diagnosis of the nature of the disease cannot be obtained prior to death, although all existing diagnostic procedures are exhausted. A group of heart diseases in question is that group designated by Mattingly¹ as primary myocardial diseases. This group of myocardial diseases, where the myocardium is the primary site of cardiovascular disorder, consists of, in addition to acute myocarditis, various forms of chronic myocardial diseases, such as endomyocardial fibrosis, idiopathic myocardial hypertrophy (probably healed myocarditis) familial cardiomegaly, myocardial sarcoidosis and similar lesions and primary tumors of the myocardium. In many of these lesions, there are combined myocardial and mural endocardial alterations.

The difficulties in clinical recognition of this important group of diseases have been stressed.² Although better understanding of the clinical features has resulted in a higher incidence of clinical diagnosis as instances of primary myocardial disease, the exact nature of the myocardial disease, if determined at all, is usually not ascertained prior to post-mortem study. A biopsy of the myocardium during life with careful histologic and histochemical studies offers the possibility of providing this information during life and in a period when specific therapy might be helpful in prolonging life.

Procedures for obtaining biopsy specimens have consisted of direct excision of tiny fragments of myocardial tissue during an open thoracotomy and pericardiotomy or by use of a biopsy needle, either at time of direct exposure of the heart at thoracotomy or by transthoracic puncture. In addition to the general disadvantage and limitations afforded by a needle biopsy in providing only a small plug of tissue, needle biopsy of the heart offers other problems. Being a hollow contractile organ filled with blood under high pressure, it provides problems not encountered in the biopsy of fixed solid organs such as the liver, kidneys, prostate gland, etc. Sutton and Sutton³ introduced a successful biopsy procedure for transthoracic puncture, using a modified Silverman needle. This paved the way for the development of other biopsy techniques for obtaining cardiac tissues. This was an important advance in this field as they demonstrated that such a vital organ as the contracting heart filled with blood and with its irritable myocardium could not only be biopsied without complications but likewise provided diagnostic information from histologic studies. The amount of myocardial tissue which can be removed by such a technic, however, is small in amount, comes from a very localized area of the heart and ordinarily does not contain endocardium. Recently one of us (S.K.) developed an instrument (Biop-tome) which is adapted to the intracardiac catheter and developed a technic for safely and securely excising biopsy material containing both endocardium and myocardium and in larger amounts than that obtained from needle biopsy. This procedure has overcome one of the blind spots in the diagnosis of endomyocardial disease and

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provides an additional method of establishing an antemortem histologic diagnosis in myocardial disease. A description of the instruments and the technic for its use is hereby presented, including a preliminary report of its use in patients with heart disease.

INSTRUMENT

The instrument (Fig. 1) consists of an ordinary intracardiac catheter to which there is adapted a cutting claw at the exploring end. It is so designed that when the instrument is inserted into a heart chamber by the way of a blood vessel, a wire on the operating end of the catheter can be manipulated which in turn operates the claw on the exploring end of the catheter, allowing the claw to open and then close, excising cardiac tissue in its bite (Figs. 2A and 2B). The fragments of tissue as excised are small, yet adequate for histologic study and most important of all, always contain a portion of endocardium (Fig. 3).

Biopsy procedures, using this instrument were initially performed in laboratory animals to perfect the technic and to determine safety factors. When the tip of the instrument was pressed against the ventricular wall of a dog, transient premature
contractions occurred similar to those observed to occur in routine intracardiac catheterizations. Using this instrument, we were successful in excising 0.5 gm. of endocardial and myocardial tissue from the heart of a 15 kg. mongrel dog. The dog remained active and healthy after the procedure. There should not be any concern

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Age</th>
<th>Sex</th>
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<th>Histologic diagnosis or finding</th>
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<tr>
<td>1</td>
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<td>Male</td>
<td>Primary myocardial disease</td>
<td>Endomyocardial fibrosis</td>
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<td>Normal endocardium and hypertrophy of myocardium</td>
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<td>Chronic endomyocarditis</td>
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<td>4</td>
<td>37</td>
<td>Male</td>
<td>Complete A-V block</td>
<td>Endocardium and myocardium normal</td>
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<tr>
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<td>22</td>
<td>Female</td>
<td>Premature beats</td>
<td>Endocardium and myocardium normal</td>
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<tr>
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<td>Endomyocardial fibrosis</td>
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<td>Normal endocardium and hypertrophy of myocardium</td>
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<tr>
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<td>Endocardium and myocardium are normal</td>
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<tr>
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<td>Complete right bundle branch block</td>
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<td>Primary myocardial disease</td>
<td>Chronic rheumatic myocarditis</td>
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</table>
about the possibilities of injury to the heart valves or the tendinous cords as the instrument is passed through the blood vessels and the heart chambers with the claw closed. The claw is opened for excision of tissue only after the tip of the instrument is pressed against the ventricular or atrial wall (Fig. 4). The position of the tip of the instrument can be determined by the intracardiac electrode of the electrocardiogram which is introduced through the catheter to the instrument tip. The experienced operator can determine the direction, movement and position of the catheter and the instrument at its tip by direct fluoroscopy. When it is desired to obtain biopsy of the right ventricle or right atrium, the instrument is inserted through the left basilic or axillary vein and when biopsy is desired for the left ventricle, the instrument is inserted through the left axillary or common carotid artery and thence into the left ventricle in a retrograde fashion. In our experience, we have not observed endocarditis or mural thrombosis as a complication of this procedure.

CLINICAL CASES

At the time of the preparation of this report, this procedure has been used in 15 patients. The results are compiled in Table 1. The procedure, as applied to this small group of patients has been demonstrated to be quite safe and without any serious complications. The most marked changes occurred in case 2 where two premature contractions were observed during excision of the cardiac tissue. Additional ECG changes or other complications did not occur in case 5 where frequent premature contractions were present before biopsy and in case 9 in which there was a slow ectopic ventricular pacemaker with a rate 40 to 50 per minute and without atrial activity, thus demonstrating that a successful intracardiac biopsy can be performed in patients with arrhythmia and conduction defects. Local anesthesia suffices except in children. The procedure is comparatively simple and can be made as part of the routine intracardiac catheterization.

Two cases of interest are briefly described below.

CASE 1

This was a 30-year-old man who had been quite healthy up to the time he was advised of a dilatation of the heart of unknown origin two years before. He suffered from an episode of pyrexia and arthralgia a year ago and since that event, his condition has worsened, with the development of bouts of cardiac insufficiency accompanied by cough, dyspnea and orthopnea. A cardiac murmur was not observed when he was hospitalized and no abnormalities were detected by cardiac catheterization. An angiogram demonstrated dilated right and left ventricular chambers with thinned muscular walls. The electrocardiogram presented features of complete left bundle branch block. These findings induced us to suppose that a primary disease might exist in the myocardium and an intracardiac biopsy was performed. The instrument was inserted into the left basilic vein and then to the right ventricle where tissue was excised from two points of the apex of this cham-

FIGURE 5: (A) Tissue as obtained from the right ventricle in Case 1. Hematoxylin-eosin stain. Highly magnified. (B) Same as above. Masson's stain. Low magnification.
study of primary myocardial diseases. Our final
evaluation, however, was similar to that of others
who have reported these cases in that we could
not determine the etiology despite our detailed
histologic examinations.

CASE 9

This was a 26-year-old woman who had sur-
vived severe diphtheria at the age of seven years.
Directly after leaving the hospital after recovery
from the diphtheria, she felt ill, turned pale and
experienced an episode of unconsciousness. Since
then, she has been under a physician's care and
had been observed to have a heart rate of 20
to 40 per minute and to experience repeated
episodes of unconsciousness. Two years prior to
present admission, cardiac hypertrophy was ob-
served. When admitted to the hospital, a cardiac
murmur was not present, the pulse was 44 per
minute and irregular. The thoracic roentgeno-
gram showed a heart shadow indicating remark-
able right and left chamber dilatation. The elec-
trocardiogram revealed an irregular R-R inter-
val and absent P-waves. The QRS was of 0.08
second duration. Electrocardiograms from esoph-
ageal leads likewise failed to identify P-waves
and electrocardiometrically considered to have
atrial arrest. An intracardiac biopsy was then
performed to confirm the morphologic basis of
the atrial arrest. The biotome was inserted
through the basilic vein and passed into the
right cardiac chambers. Cardiac tissue was ex-
cised from the septal and lateral walls of the
right atrium and from the apex of the right
ventricle. Histologic studies (Figs. 6A and 6B)
revealed loose myocardial fibers due to diffuse
and yet highly developed proliferation of fibrous
tissue. Similar proliferation of fibrous tissue,
slight in degree was noted in the biopsy specimen from the right ventricle. No histologic changes of acute inflammation were seen in any of the tissue studied. The biopsy diagnosis was replacement fibrosis of the right atrial myocardium as a residual of degeneration due to diphtheria toxin.

**Conclusions**

1. An instrument (Biop tome) developed for the purpose of performing intracardiac biopsies of the endocardium and myocardium is described. The technic for the excision of cardiac tissues by the use of this instrument as developed in our laboratory is outlined.

2. A preliminary report of our experiences and results in the use of this technic in a study of a small group of 15 patients with clinical features of primary myocardial diseases or other abnormal clinical findings is reported.

3. From a continuation of similar studies, it is hoped that a useful and safe diagnostic procedure will be established for the determination of histologic changes and etiologic background in primary endocardial and myocardial diseases.

**Resumen**

1. Se describe un instrumento (Biop tom) para hacer biopsias de miocardio y de endocardio. Se detalla la técnica para la exicción de tejidos cardiacos como se realiza en nuestro laboratorio con ese instrumento.

2. Se hace un informe preliminar sobre experiencias y resultados usando esta técnica en el estudio de un pequeño grupo de 15 enfermos con las características de enfermedad primaria del miocardio u otros hallazgos anormales.

3. Se espera que al continuarse estudios sean jantes se logre un procedimiento de diagnóstico útil y seguro para determinar los cambios histológicos y el fondo etiológico en las enfermedades primarias del miocardio.

**Resumé**

1. Description d’un instrument (Biop tome) réalisé dans le but de faire des biopsies intracardiaques de l’endocarde et du myocarde. La technique pour l’excision des tissus cardiaques grâce à cet instrument, comme elle est pratiquée dans notre laboratoire, est précisée.

2. Nous donnons les résultats préliminaires de notre expérience et des résultats avec cette technique sur un petit groupe de 15 malades ayant des indices cliniques de maladie myocardique primitive ou d’autres signes cliniques anormaux.

3. Grâce à la continuation de telles études, on peut souhaiter qu’un mode utile et sans danger de diagnostic puisse être établi pour la détermination des modifications histologiques et des bases étiologiques des maladies endocardiennes et myocardiques primitives.

**Zusammenfassung**


2. Ein vorläufiger Bericht wird erstattet über unsere Erfahrungen und Ergebnisse bei der Verwendung dieser Technik zur Untersuchung einer kleinen Gruppe von 15 Patienten mit klinischen Merkmalen einer primären Herzmuselerkrankung oder anderen krankhaften klinischen Befunden.

3. Bei Fortsetzung ähnlicher Untersuchung kann man erwarten, daß sich eine nützliche und sichere diagnostische Methode erreichen läßt zur Bestimmung histologischer Veränderungen und damit des ätiologischen Hintergrundes primärer endokardialer und myokardialer Krankheiten.

**References**


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