

Atrial Dissociation and Uniatrial Fibrillation

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Three cases of atrial dissociation are illustrated with electrocardiograms. The coexisting atrial rhythms observed in published cases permit us to offer a convenient classification. Two possible explanations of this rare phenomenon are discussed.

ATRIAL dissociation has been repeatedly observed in the exposed heart of the experimental animal. There is no reason to believe that the phenomenon may not occur spontaneously in the human heart.

The purposes of this communication are to present tracings and to draw attention to this little-discussed phenomenon and to include examples of what we have chosen to call uniatrial fibrillation.

LITERATURE

Numerous authors have claimed to demonstrate independent rhythms in the 2 atria. Hering1 in 1900 first recorded dissociation of the atria in the experimental animal, whereas Wenckebach2 in 1906 was first to report it in man. Neither of these authors illustrated his claim with published electrocardiograms.

A number of these publications invite special comment. Schrumpf3 published the first illustrative electrocardiogram; his tracing appears reasonably convincing, but Lewis4 quite properly setting the sceptical pace for all subsequent critics, refused to accept it and pointed out that "it is necessary to be hypercritical in dealing with exceptional curves of this kind, owing to the important conclusions which they would otherwise justify." The 3 tracings published by Bay and Adams5 are further good examples of the double P-wave type. As an argument in favor of the reality of atrial dissociation in their cases, they pointed out that the secondary atrial waves in 2 of their records showed a phasic arrhythmia affecting the normal P waves.

Condorelli's tracing of simultaneous fibrillation and sinus rhythm6 affords excellent experimental basis for clinical claims of uniatrial fibrillation. By ligating the left anterior atrial artery he produced atrial dissociation on 2 occasions with sinus rhythm persisting in the right atrium and controlling the ventricles, while the left atrium was fibrillating.

The tracing of Lombardini and Aviles7 shows a remarkable, rapid and regular atrial wave at a rate of 765 per minute with superimposed normal sinus P waves at a rate of 90. There is no constant relationship between the P waves and the "micro-flutter" waves; complete A-V block is also present with an idioventricular rhythm at a rate of 23. They stated that the flutter contractions were distinctly audible on auscultation and they assumed that microflutter occupied the left atrium while sinus rhythm controlled the right.

A tracing published by Bellet8 shows inverted P waves at a rate of 82 in lead II with a P-R interval of 0.12 second, while simultaneous atrial deflections, probably representing flutter, occurred at a rate of 300 in a simultaneous esophageal lead.

In the interesting tracing published by Moreira9 fibrillation is evident in V1, while P waves at a rate of about 106 are seen in other precordial leads as well as superimposed on the fibrillatory waves in V1. Ventricular response is completely irregular, indicating that the ventricles are responding to the atrial fibrillation rather than to the sinus impulses. The tracings presented by Dagnini10 and De Castro11 are less convincing examples of uniatrial fibrillation.

Electrocardiograms published by other authors12-16 and referred to in other reviews on atrial dissociation appear to represent intratrial block rather than atrial dissociation.

CASE REPORTS

Since strophanthin excess can produce atrial dissociation experimentally,17 the possible role of

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digitalis intoxication in its clinical production must be considered. For this reason, in the case histories that follow, digitalis dosage has been accorded detailed attention.

Case 1. J. McN., a 5½-month-old child, was admitted to Philadelphia General Hospital with congestive heart failure associated with a ventricular septal defect. Serial tracings confirmed the presence of digitalis intoxication, but the dosage of digitalis was uncertain. Atrial dissociation was recorded on numerous occasions by 2 different direct writing machines and 1 photographic mirror galvanometer. From approximately 100 feet of tracings representative examples were taken. Figure 1 shows a sinus arrhythmia at a rate of 83 with irregularly recurring p waves appearing before, during, or after the sinus P waves. These waves appear to initiate short bursts (0.10–0.32 second) of rapidly occurring waves (1500 per minute) of low voltage (0.01–0.05 mv.). Figure 2 at a higher magnification demonstrates the smaller waves. This illustrates repetitive short paroxysms of “unialtrial” fibrillation with sinus P waves controlling the ventricular rate. The rate of these rapid, diminutive waves is similar to that of the intermediate form of fibrillatory waves described by Prinzmetal, which produce a “glassy” baseline in the standard electrocardiogram.

Case 2. D. W., a 58-year-old Negro woman, was first seen in the Cardiac Clinic at Mercy Hospital, Baltimore, in July 1954 for congestive heart failure. Her blood pressure was 140/94, and the electrocardiogram showed left ventricular hypertrophy and strain. She was started on digitalis, 0.1 Gm. t.i.d. for a week and was then maintained on 0.1 Gm. daily. On August 25, 1955, she complained that she had felt her heart fluttering for the past few days. For 2 days she had taken an extra tablet of digitalis. The clinical impression was atrial fibrillation with a ventricular rate of 68 per minute; unfortunately no electrocardiogram was taken. On October 29 she had no complaints but the rhythm was described as “regular for as many as 7 beats, followed by a shower of irregular beats.” An electrocardiogram taken a week later (fig. 3) showed first degree A-V block (P-R 0.22 second) and a more marked pattern of left ventricular hypertrophy and strain. On a subsequent occasion this patient was deliberately intoxicated with Digoxin, which produced incomplete A-V block with Wenckebach phenomenon, but no disturbance of the atrial rhythm.

Lead V₆ (fig. 3) shows the appearance, acceleration, and decay of excitability in an ectopic atrial focus. The first few p waves, as isolated phenomena, may be considered as nonconducted ectopic atrial beats; after a few seconds, when the rate has in-

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Fig. 1. Lead II. The short vertical lines represent the bursts of rapidly occurring waves of low voltage.

Fig. 2. Lead II. A higher magnification of a representative cutting clearly demonstrates the waves of unialtrial fibrillation (p). Rate, 1500 per minute; duration, 0.10 to 0.32 second; voltage, 0.01 to 0.05 mv. The sinus P waves continue undisturbed.
increased to between 150 and 200, they may well be considered to represent atrial tachycardia; after 2 or 3 more seconds when they reached a rate of 750, their rhythm must certainly be called fibrillation or, in view of their regularity, microflutter. Thus in a few brief seconds "the unitary nature of the auricular arrhythmias," as propounded by Prinzmetal,\textsuperscript{18} is spontaneously illustrated. Sinus P waves meanwhile continue uninterrupted and are absolutely regular.*

* The capture of this tracing emphasizes the value of training the electrocardiographic technician to observe with an intelligent eye what is being recorded. In the present instance an unusually long strip was secured because the interested technician perceived that something unusual was occurring and so continued the tracing until the phenomenon had subsided.

\begin{figure}
\centering
\includegraphics[width=\textwidth]{figure3}
\caption{Lead V\textsubscript{a}. The 3 strips are continuous. After a few normal sinus beats secondary atrial waves (p) appear, at first nearly 1 second apart, but rapidly increasing in incidence until at the beginning of the bottom strip they have attained a rate of 750 per minute; they then slow and disappear quickly. Meanwhile sinus P waves continue throughout with undisturbed regularity.}
\end{figure}

\textit{Case 3.} M. D., a 57-year-old Negro woman was seen in the Mercy Hospital dispensary on July 9, 1953, with symptoms of congestive heart failure; her blood pressure was 178/126. She was digitalized with digitoxin and followed for a few weeks but then was not seen again for nearly 2 years. In June 1955 she returned, having taken no digitalis for 3 months. This time she was digitalized with gitaligin; she received 9 mg. in a week and lost over 11 pounds and then became anorexic. Gitaligin was reduced to 0.5 mg. daily. When next seen 2 weeks later, she was nauseated and maintenance therapy was changed to digitoxin 0.05 mg. daily until August 31. At this time she again complained of shortness of breath of 2 weeks' duration, and the dose of digitoxin was increased to 0.1 mg. daily. Eight days later an electrocardiogram showed A-V dissociation. On September 15, the heart was irregular at a rate of 60 and digitoxin was stopped for 1 week. On Sep-
tember 20 an electrocardiogram showed sinus bradycardia at a rate of 55 with partial A-V block (P-R 0.28 second). In lead V₁ a secondary set of atrial waves, independent of the P waves, was present (fig. 4). Digitalis was withheld until September 28, when another electrocardiogram showed a P-R interval of 0.20 second and occasional ventricular premature beats. Gitaligin 0.5 mg. daily was then started. Several subsequent tracings have failed to reveal any signs of atrial disturbance.

**DISCUSSION**

A variety of terms has been used to describe dissociation between the atria; intra-auricular,²⁻⁸ interauricular,⁹, ¹², ¹⁹ interatrial,²⁰ atrial²¹ dissociation, and interatrial block.²⁰⁻²³ There is clearly need for consistency and it would seem to us that the simplest, least ambiguous, and most acceptable term is **atrial dissociation**. Intra-atrial block refers to a distinct and different condition of abnormally widened and notched P waves, well exemplified by P-mitrale.

In previous publications dealing with atrial dissociation, various symbols have been used to designate the 2 sets of atrial waves: They have been labeled P and P',²⁴⁻²⁶ P' and P'',¹³ P₁ and P₃,³ and P and p.¹⁹ P', however, is the accepted label for atrial waves that substitute for, rather than appear in addition to, the normal sinus P wave. P' thus represents an atrial wave arising from an ectopic focus that controls the 2 atria if not the whole heart, as in an ectopic atrial beat or in paroxysmal atrial tachycardia. We therefore propose that the symbol p, as used by Lian and Globlin,¹⁹ is most suitable for the secondary atrial waves that appear in parallel with existing P (or P') waves in atrial dissociation.

When a clinical record is interpreted as atrial dissociation, critics are quick to point out that the second system of waves may be artifacts—such as interference from a dial telephone, from an electric saw or buzzer, from hiccoughs, from contact with another person whose QRS complexes are registered on a diminutive scale. Katz²⁷ summarized the situation as follows: "While this possibility exists, the evidence presented in the cases reported is far from convincing, since the phenomena described could readily be explained by artifacts." White,²³ more recently, has concurred: "Its occurrence in man, although suggested and described, has not been conclusively proved."

If dissociation between the atria occurs, 2 mechanisms seem possible: (1) each atrium in toto is separately autonomous (this has as its experimental precedent the production of atrial dissociation by interruption of interatrial pathways)⁶, ¹⁴, ²⁸ or (2) a part of 1 atrium is independent from the rest of the mass of atrial muscle, as experimental dissociation of a small part of atrial muscle has been observed in the dog's heart after intoxication with strophanthin²⁷ and yohimbine.²⁹ The second possibility presupposes that the dissociated areas of the atria must be mutually protected against each other's impulses by "entrance" and "exit" blocks. Whether the whole or only a part of 1 atrium is involved in the ectopic rhythm, it would seem appropriate to apply the term uniatrial to this pararrhythmia.

Subsequent examples of atrial dissociation, based on published electrocardiographic evidence, can be conveniently classified into 4 groups:

1. Two parallel sets of atrial waves each maintaining its own independent rhythm (a situation that the French authors picturesquely call "la double commande").²⁻⁵, ¹⁹, ²⁴⁻²⁶, ³⁰, ⁺¹

2. Flutter in one atrium, fibrillation in the other.⁺²⁻⁺⁵

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**Fig. 4.** Lead V₁. A secondary set of p waves is present independent of the sinus P waves.
3. Sinus or nodal rhythm in the right atrium, flutter in the left atrium.7,8
4. Sinus or nodal rhythm in the right atrium, fibrillation in the left atrium4,9,10,11 that can be either fixed or repetitive.

Of the cases presented here, the first 2 belong in group 4 of this classification, while case 3 belongs in group 1.

**Summary**

The inconsistent terminology hitherto used to describe the phenomenon of dissociation between the atria is commented upon and appropriate terminology is recommended for consistent usage.

Three cases of atrial dissociation, 2 with uniattrial fibrillation, are presented and illustrated with electrocardiograms. A classification is offered based upon the coexisting atrial rhythms. Previous examples of atrial dissociation are reviewed. A paroxysmal repetitive form of uniattrial fibrillation is presented for the first time.

**SUMMARIO IN INTERLINGUA**

Es notate le manco de systema in le terminologia usate usque nunc in describer le phanomeno del dissociation inter le atrios. Un terminologia appropriate es recommendate in le interesse de un usage plus systematic.

Es presentate tres casos de dissociation atrial. Duo es characterisate per fibrillation uniattrial. Le casos es illustrate per electrocardiogrammas. Es proponite un classification super le base del coexistente rythmos atrial. Previe exemplos de dissociation atrial es passate in revista. Un forma repetitive paroxymal de fibrillation uniattrial es presentate pro le prime vice.

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Medicine, and this is one of the most valuable of the teachings of history, cannot remain equal to its great task without preserving for the physician his double character of scientist and worker for the people, according to the classic concept. If in the exercise of his art he is guided by his knowledge of the laws of nature, then his technical knowledge, his calm judgment, and his objective reasoning should furnish him with the rules which will determine the application of these natural laws in practice. It is only thus that the clinician can be clinical in the true sense of the word.—Arturo Castiglioni (1874–).
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