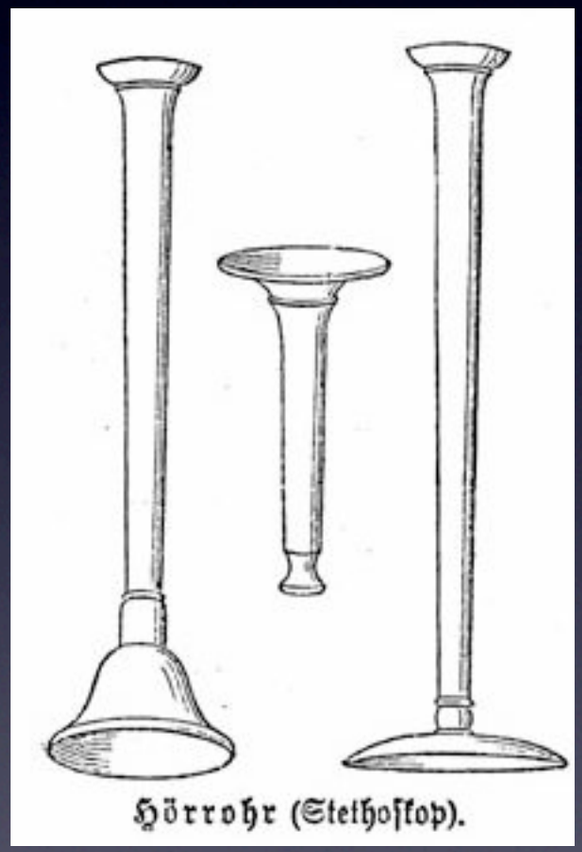
An Internet based resource for instruction of cardiac auscultation

James P. Loehr, M.D.
Associate Professor of Pediatrics
Division of Pediatric Cardiology
The University of North Carolina at Chapel Hill
Chapel Hill, NC

Heart sounds

- Stethoscope invented by Laennaec in 1816
- Initially a simple tube
- Binaural stethescope invented about 1851
- Sprague-Rappaport 1940s
- Littman 1960s

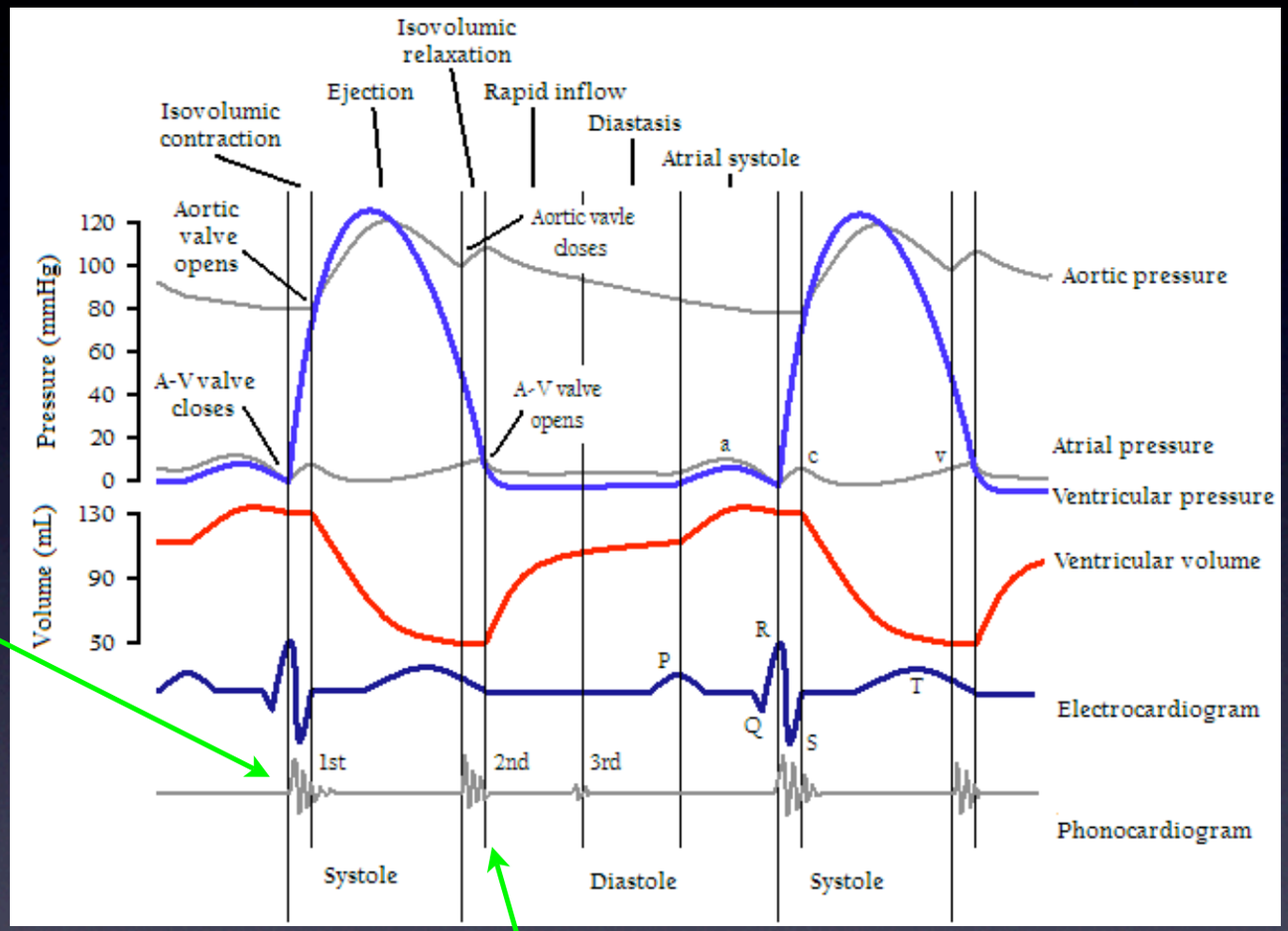


Equipment variability

- http://www.forusdocs.com/reviews/Acoustic_Stethoscope_Review.htm
- Differences in size, weight convenience, frequency response

Heart sounds

First heart sound: mitral and tricuspid valve closure

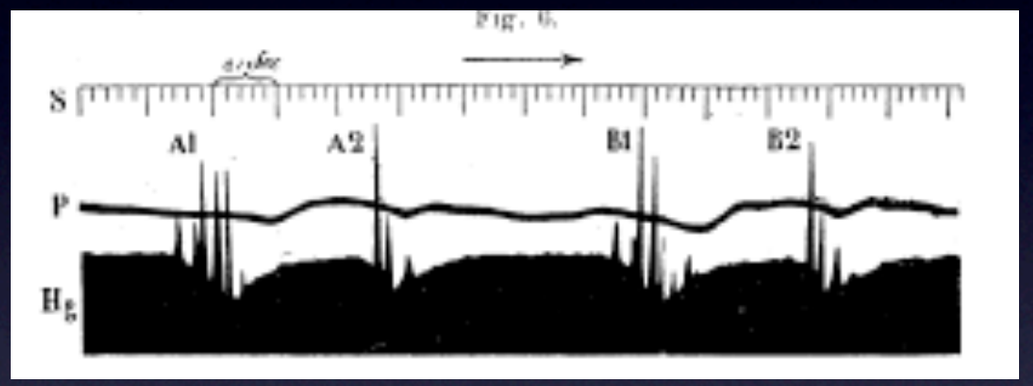


Second heart sound: pulmonary and aortic valve closure

Phonocardiography

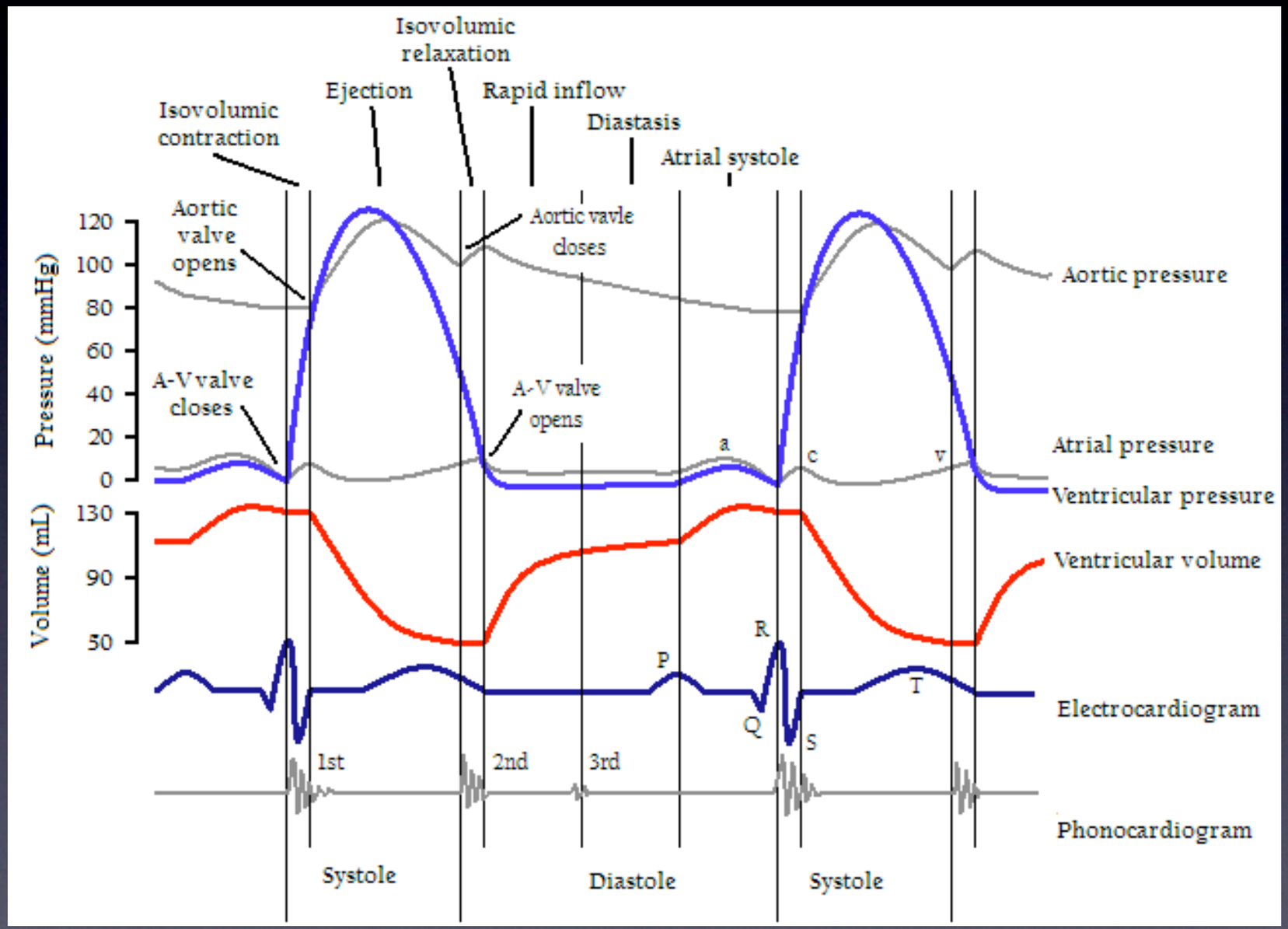
- Records transmitted sounds
- Used to try to relate sounds to cardiac cycle
- For instruction, a device was needed that:
  - Recorded heart sounds for review
  - Demonstrated the sounds visually as well as audibly for classroom use
  - Looping helpful for review; a concept ahead of its time

Einthoven: ECG and phonocardiogram transmission



J. Telemed. Telecare
11(7):336-338 (2005)

Heart sounds



Note phonocardiogram at bottom

Phonocardiography

Cambridge

AUDIO-VISUAL *heart sound* RECORDER

WHEN

$\frac{+1}{=3}$

Mathematically, of course, 1 plus 1 does not equal three, but the Cambridge Audio-Visual Heart Sound Recorder makes a seeming paradox—true! The simultaneous, instantaneous viewing and hearing of the heart sounds give more than the simple sum of the two . . . they provide the plus factor!

With this most versatile instrument, the Doctor hears the heart sounds faithfully reproduced through binaural ear phones while viewing the pattern on the long persistence screen of a cathode ray tube.

Any portion of the heart sounds may be permanently recorded upon thin magnetic discs. These paper-thin but durable records may be filed as part of a patient's history or mailed for consultation. They may be "played back" (both heard and viewed) for study or for consultation.

CAMBRIDGE ALSO MAKES . . .

"TRANS-SCRIBE," "VERSA-SCRIBE" AND "SIMPLI-SCRIBE" ELECTROCARDIOGRAPHS; ALSO, THE EXTERNAL DEFIBRILLATOR, AUDIO-VISUAL HEART SOUND RECORDER, DYE DILUTION CURVE RECORDER, OPERATING ROOM CARDIOSCOPE, MULTI-CHANNEL RECORDERS, CENTRAL MONITOR SYSTEMS, RESEARCH pH METERS AND THE HUXLEY ULTRA MICROTOME.

Send for Bulletin 155

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Silver Spring, Md., 955 61st Avenue

PIONEER MANUFACTURERS OF THE ELECTROCARDIOGRAPH

CAMBRIDGE
CARDIAC DIAGNOSTIC INSTRUMENTS

Advertisement in Circulation Research, 1962

Phonocardiography

Innovative technology

- Portable; could be taken to the patient
- Permanent analog record
- Simultaneous oscilloscope display
- Played back as loops, similar to digital echocardiography decades later

UNC Recordings

- Performed on patients by Robert Herrington, M.D. and Stewart Schall, M.D.
  - 1969-1975
- Recordings were then used for instruction of medical students, nurses, and house officers

Patient Recordings

- 70 patients with a variety of cardiac conditions, including several with innocent murmurs
- Congenital heart disease
- 13 with Rheumatic heart disease

PDA	5
ASD	3
VSD	6
PS	6
AS +/- AI	5
ToF	2

Rheumatic heart disease

- Sharp decline in developing world
  - Principal confounding diagnosis during IVIG trials for Kawasaki Disease in 1980s
  - Role of improved living conditions
  - Decline in frequency of rheumatologic strains of Group A Streptococcus
- Severe issue in developing world
  - 2-3% of school age children in some countries have RHD

Phonocardiography Recordings

- Almost all had four recordings performed to demonstrate localization
  - Right upper sternal border (A)
  - Left upper sternal border (B)
  - Left lower sternal border (C)
  - Cardiac apex (D)

Digitization of recordings

- Obtained permission from UNC healthcare to record and display recordings without identifying information
- Recordings performed at the Beasley Multimedia Center of the UNC Music Department
- Recordings vary in quality and are not modified
  - Good headphones or speakers are very helpful...like high quality stethoscopes

heartsounds.unc.edu

UNC Heart Sounds Project

Index | Photos | About | Learn

About

Welcome to the UNC Heart Sounds Project. For more information on the project, click here, or just dive into the archived sounds to the right!

Listening to sounds requires Javascript and Flash 8 or higher. Use the controls below the table to navigate the archives, and click the column headers to re-sort the table.

Special thanks to the Will Bosley and the Beasley Multimedia Center for techincal assistance and time digitizing the original recordings.

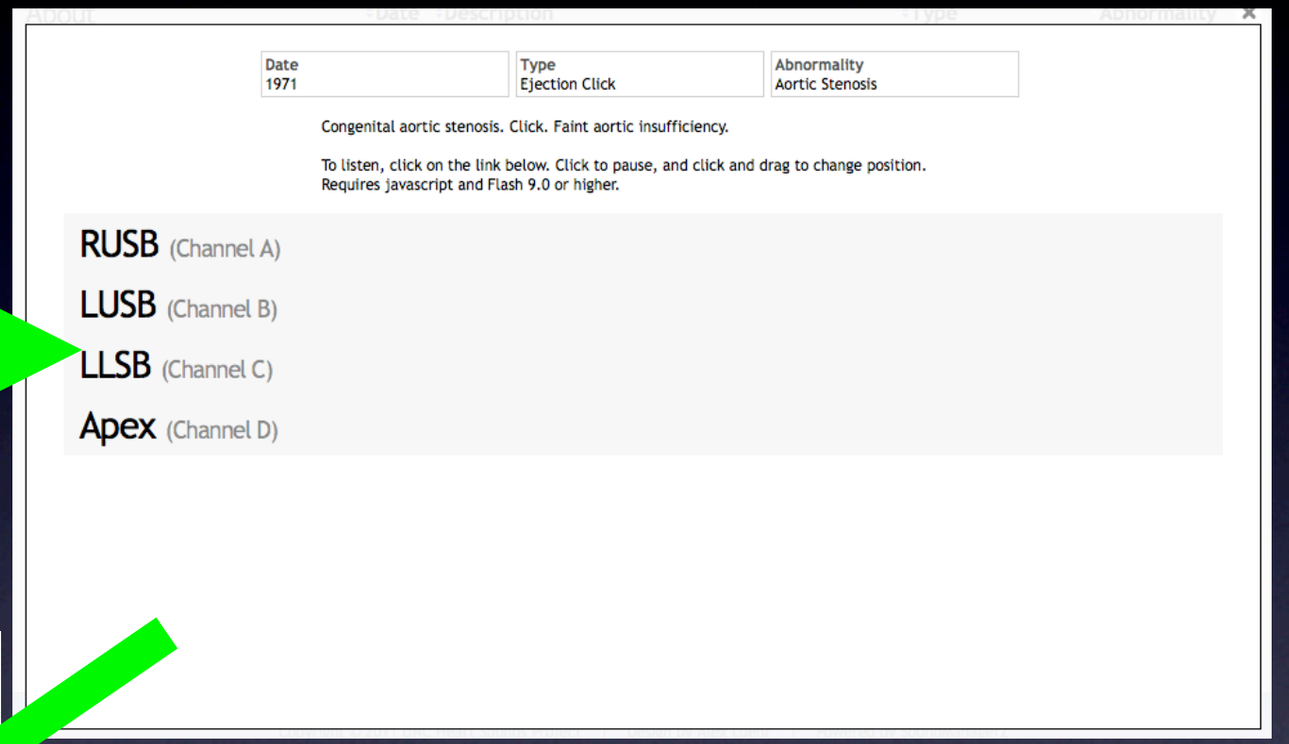
Date	Description	Type	Abnormality
1975	1. Fair PDA murmur of premature infant (1400 gm) ("rocky" or "gravely")	Systolic	Aortic Stenosis
1972	2. ASD and partial anomalous pulmonary venous drainage - very large L -> R shunt atrial level	Continuous	Patent Ductus Arteriosus
1969	3. Double outlet RV, pulmonary stenosis, total anomalous venous return	Systolic	Total Anomalous Pulmonary Venous Return
1971	4. S/P ToF repair with aortic RV fistula	Continuous	Tetrlaogy of Fallot
1969	5. No description	Unknown	Unknown
1972	6. VSD and AI not well heard	Systolic	Ventricular Septal Defect
1972	7. Post-op AS (operateed 1965) with sigfnificant residual stenosis, 15 year old	Systolic	Aortic Stenosis
1969	8. Freq. Det. Off, recorded at level 5	Unknown	Unknown
1972	9. 10 year old S/P aortic valve surgery	Unknown	Unknown
1972	10. PS, PI, s/p pulmonary valvuloplasty, 8 year old girl	Systolic and Diastolic	Pulmonary Stenosis and Insufficiency
1972	11. ASD with atypical murmur; soft pulmonary ejection murmur, split S2 varies slightly, diastolic murmur loudest at apex	Systolic and Diastolic	Atrial Septal Defect
1973	12. VSD with valvar and infundibular PS, ejection click appears on expiration	Systolic	Ventricular Septal Defect and Pulmonary Stenosis
1973	13. RHD with good AI, MI, Austin Flint, aortic ejection murmur	Systolic and Diastolic	Rheumatic Heart Disease
----	14. 5 year old with aortic stenosis, paradoxical splitting, W.P.W.	Unknown	Unknown
1970	15. VSD	Systolic	Ventricular Septal Defect

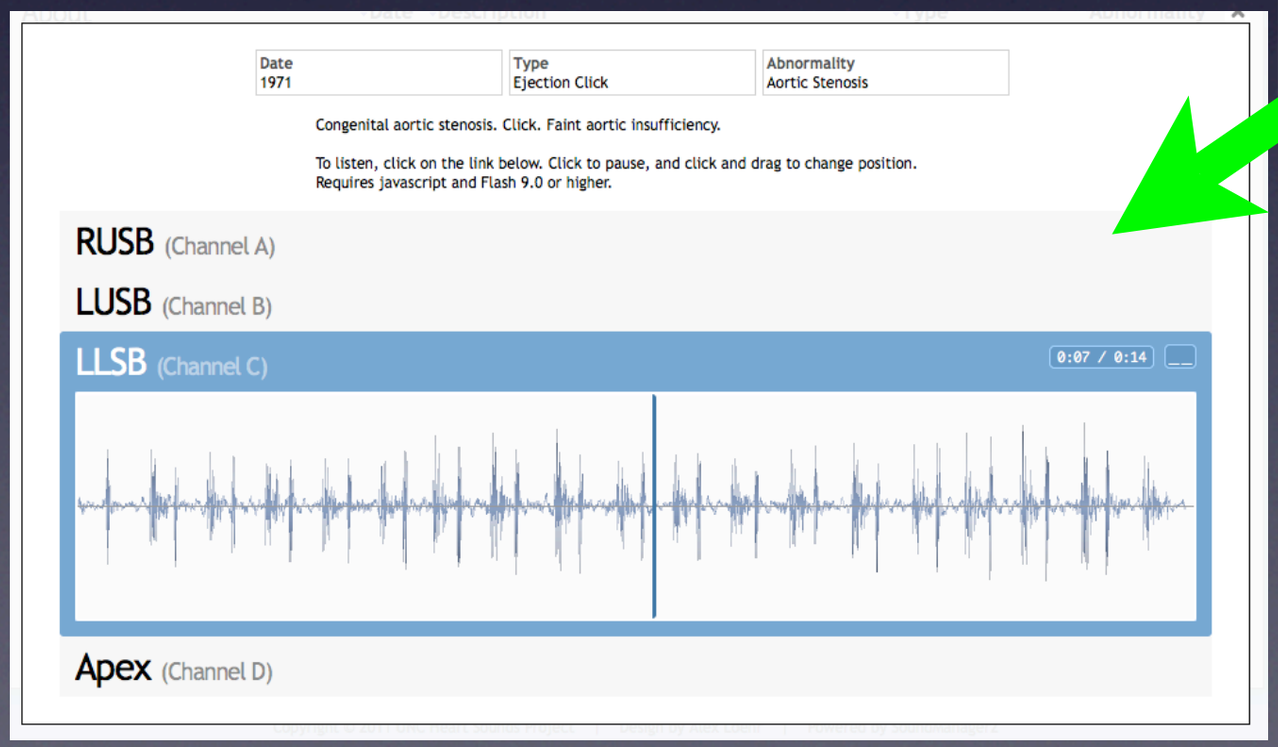
15 Entries Per Page Displaying Page 1 of 5

Site constructed by Alexander Loehr

heartsounds.unc.edu

Selecting a patient history brings the user to this page...



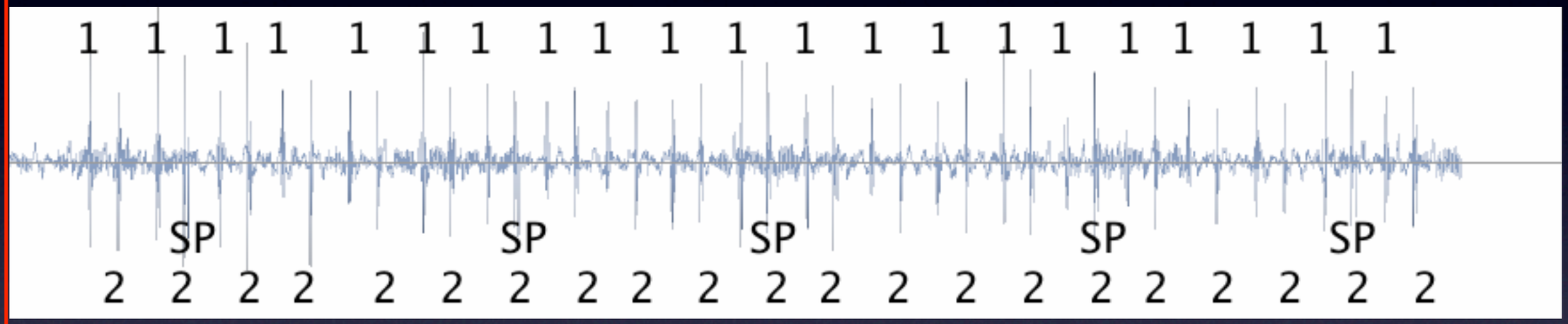


Selecting a recording brings up both the recording and a representation of the phonocardiogram

Second heart sound

- Key auscultatory finding
- Caused by closure of the aortic (A2) and pulmonary (P2) valves
    - Expiration: closure superimposed
    - Inspiration: P2 delayed relative to A2
- Documents presence of the pulmonary and aortic valves
- Persistently single in conditions such as pulmonary hypertension
- Persistently split in atrial septal defects

Normal second heart sound

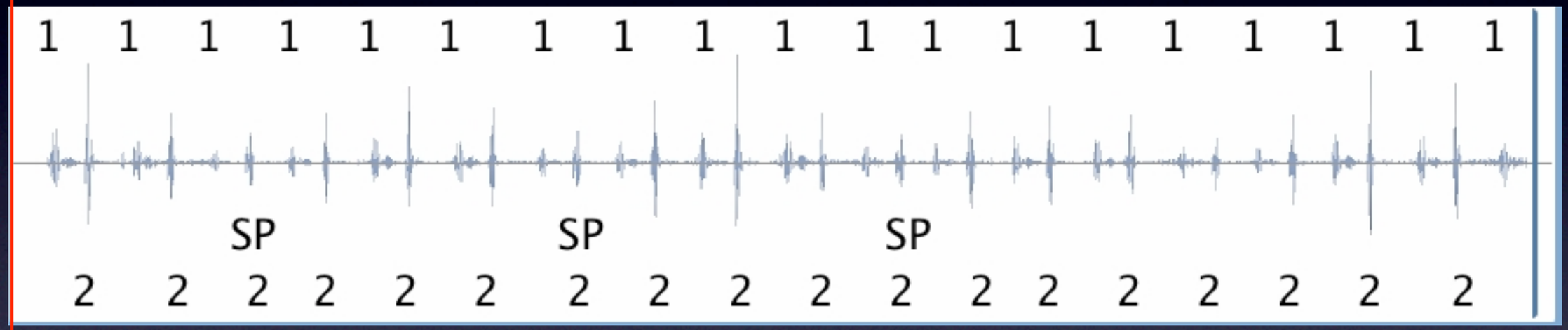


Click to begin

The first and second heart sounds are labeled "1" and "2"; the intermittent (normal) splitting of the second sound is labeled "SP". There is high pitched artifact in this recording, but the second heart sound variation is still evident.

28-C

Normal second heart sound

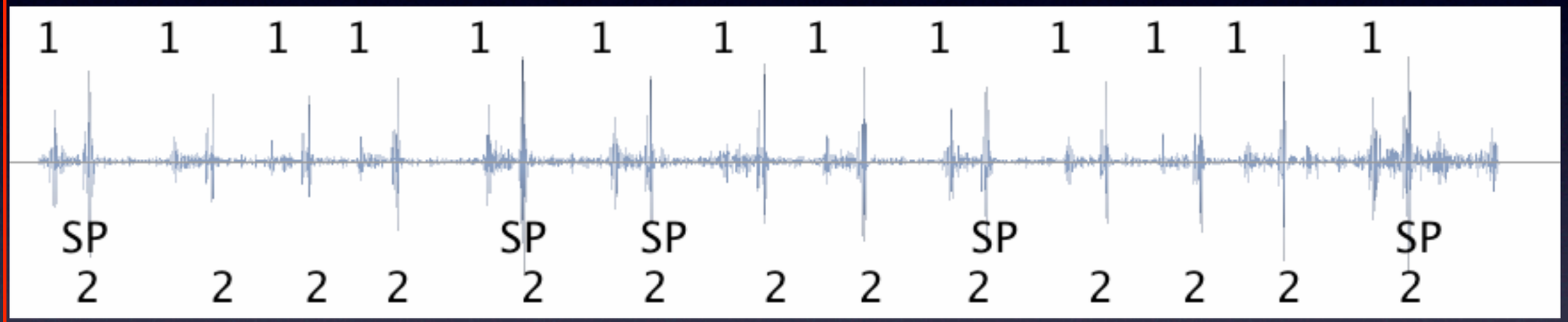


Click to begin

The first and second heart sounds are labeled “1” and “2”; the intermittent (normal) splitting of the second sound is labeled “SP”.

55-B

Normal second heart sound

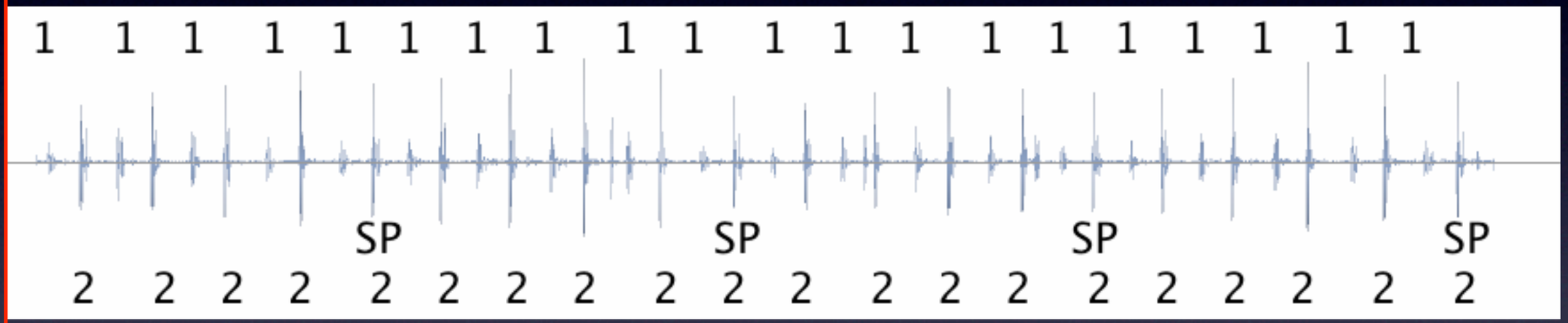


Click to begin

The first and second heart sounds are labeled "1" and "2"; the intermittent (normal) splitting of the second sound is labeled "SP". There is a suggestion of splitting in some of the sounds labeled "2" as well.

62-B

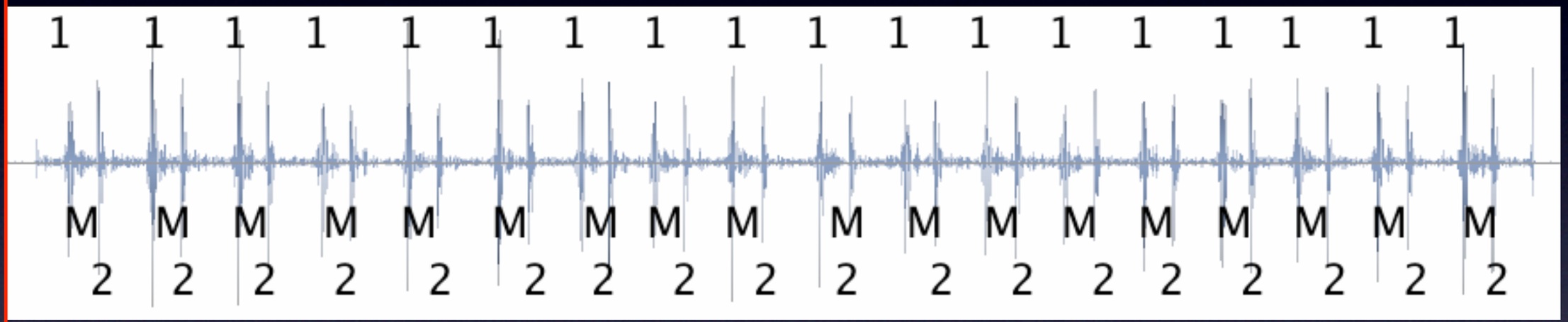
Normal second heart sound



Click to begin

The first and second heart sounds are labeled “1” and “2”; the intermittent (normal) splitting of the second sound is labeled “SP”.

Vibratory murmur

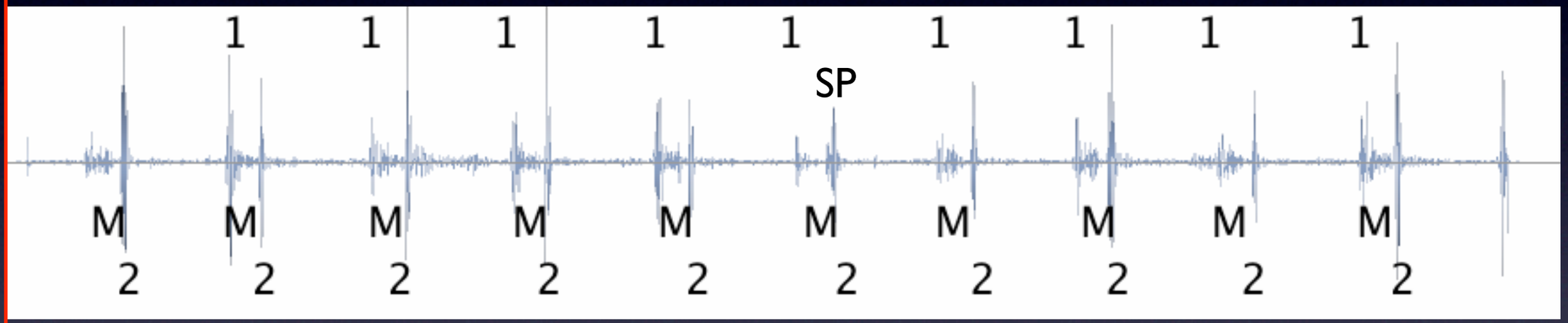


Click to begin

The first and second heart sounds are labeled “1” and “2”; the vibratory murmur is labeled “M”, and occurs between the first and second sound.

39-C

Vibratory murmur

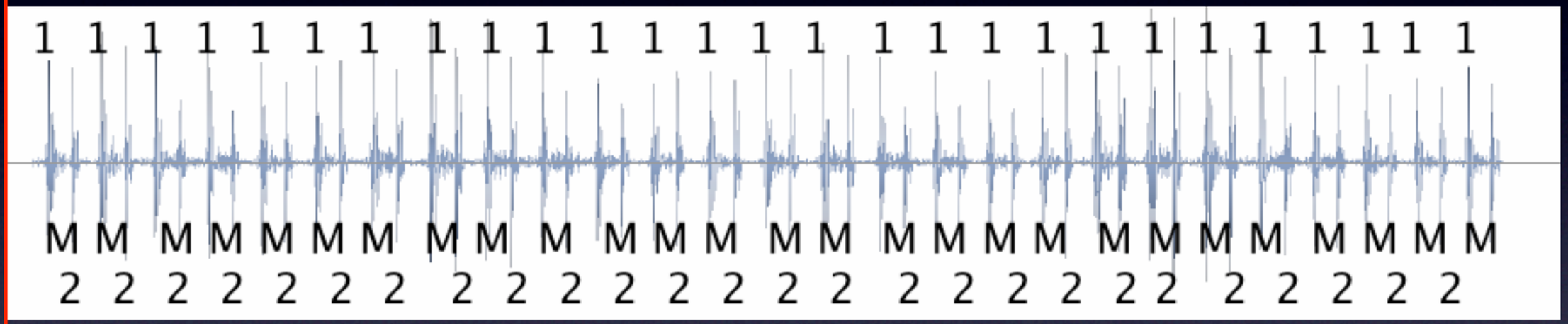


Click to begin

The first and second heart sounds are labeled “1” and “2”; the vibratory murmur is labeled “M”, and occurs between the first and second sound. The occasional (normal) splitting of the second sound is labeled “SP”.

44-B

Vibratory murmur

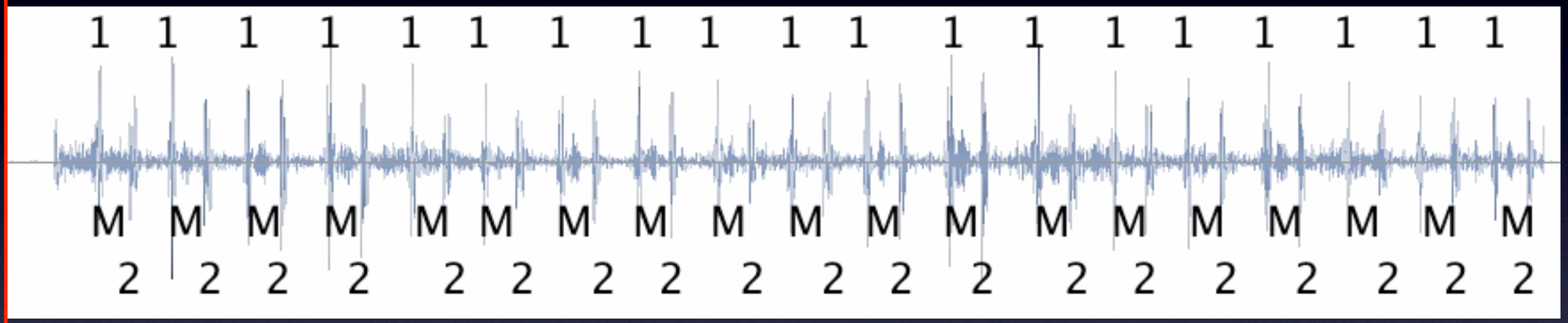


Click to begin

The first and second heart sounds are labeled "1" and "2"; the vibratory murmur is labeled "M", occurs between the first and second sound, and is more difficult to hear in part due to the patient's tachycardia.

50-B

Vibratory murmur

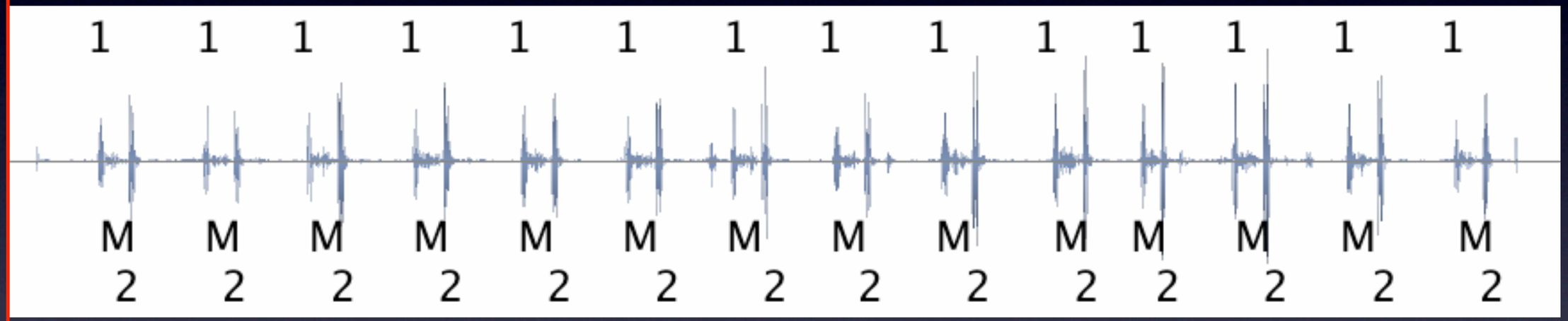


Click to begin

The first and second heart sounds are labeled "1" and "2", with the harmonic murmur labeled "M". Physiologic splitting of the second sound, and background respiratory sounds, are also present.

55-D

Vibratory murmur

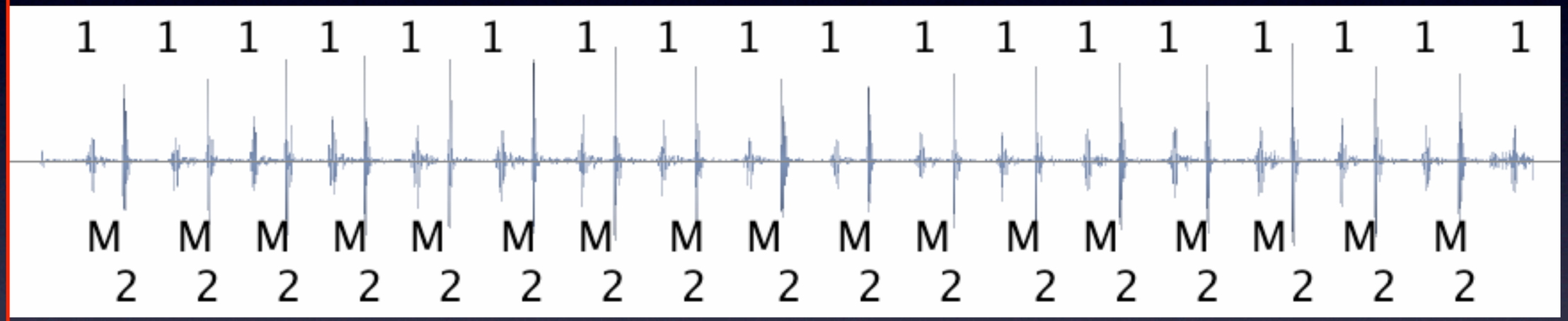


Click to begin

The first and second heart sounds are labeled “1” and “2”; the innocent murmur is labeled “M”. The second heart sound is frequently split in this recording.

57-B

Vibratory murmur

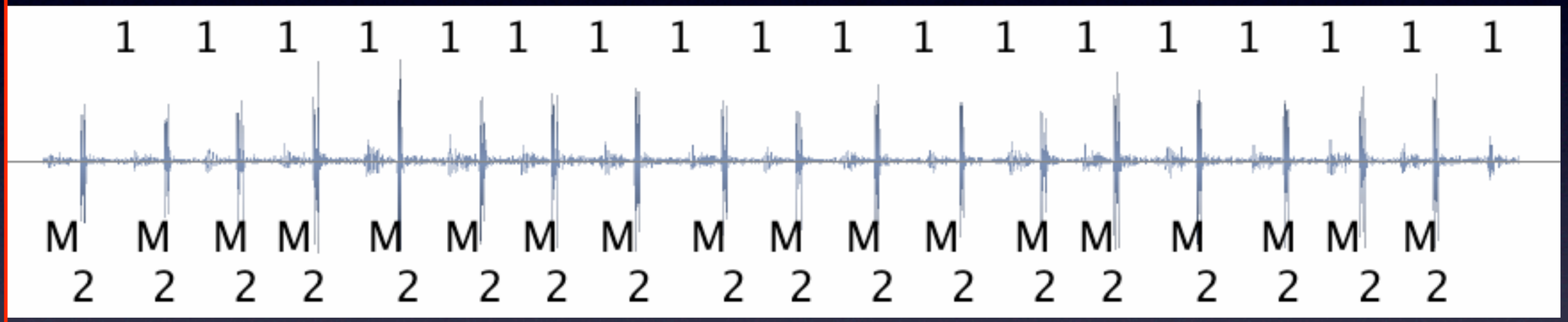


Click to begin

The first and second heart sounds are labeled “1” and “2”; the murmur “M” occurs early in systole.

61-C

Vibratory murmur

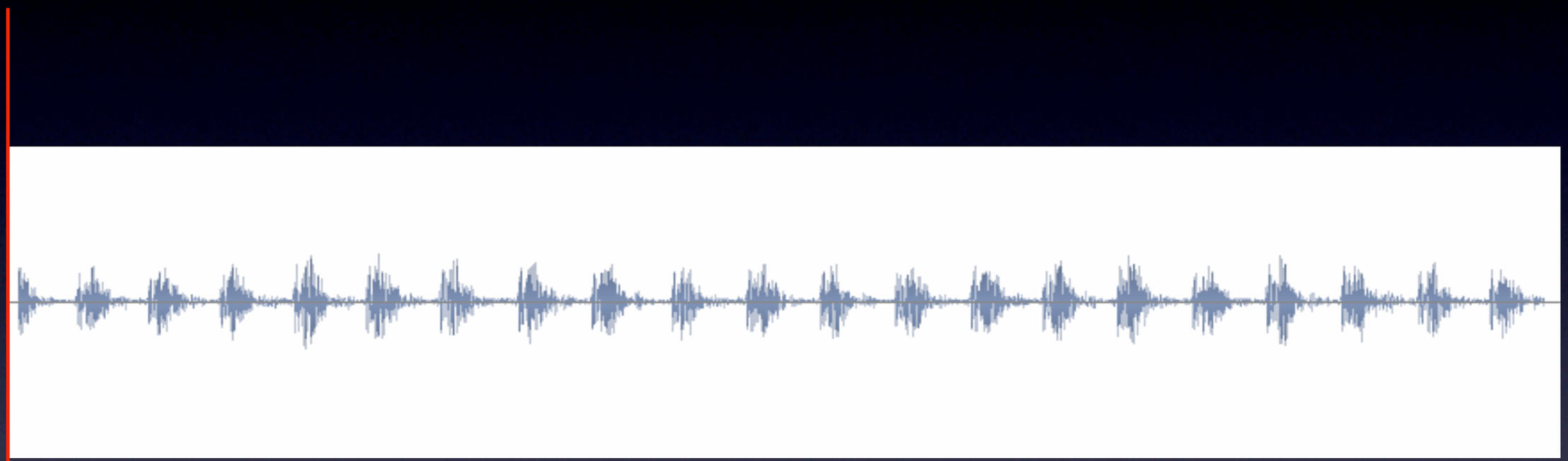


Click to begin

The first and second heart sounds are labeled “1” and “2”; the innocent murmur “M” is softer than in the other samples.

66-B

Systolic click

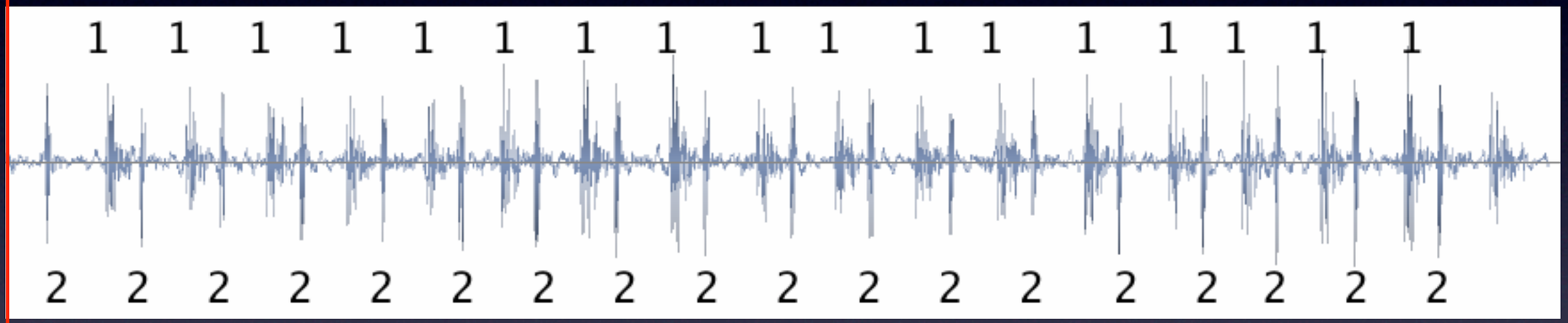


Click to begin

This patient has an additional sound, an early systolic click, at or near the onset of the systolic murmur. The murmur makes the click difficult to hear with all cycles.

6-B

Systolic click

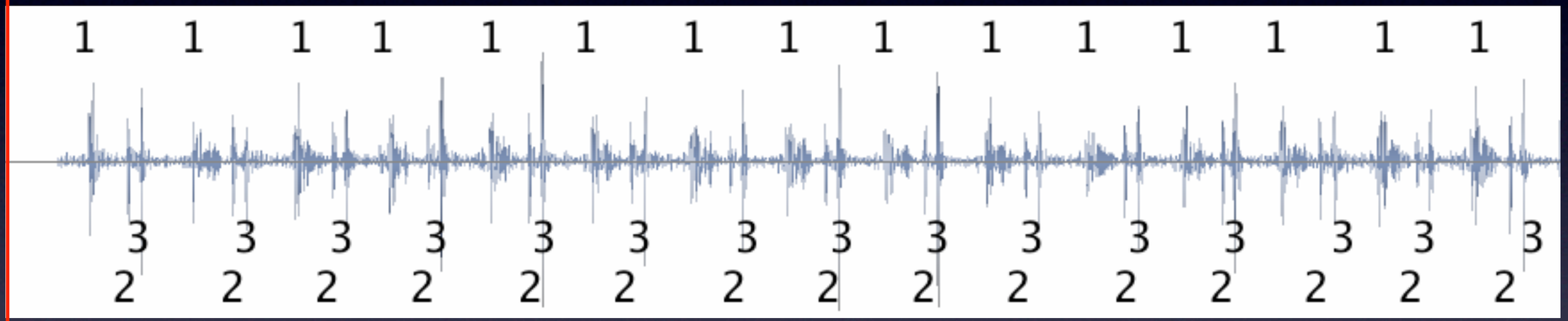


Click to begin

This patient has an additional sound, an early systolic click, following the first heart sound.

23-C

Diastolic filling sound

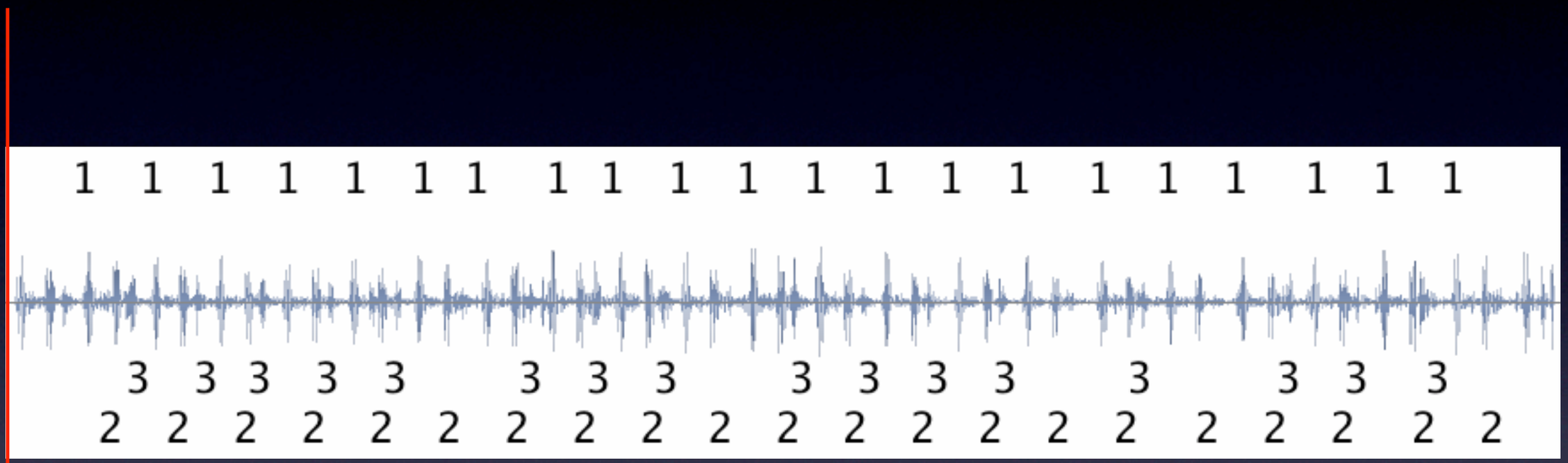


Click to begin

This patient has an additional diastolic sound, or S3, following the second heart sound. Typically this sound is best heard over the cardiac apex.

37-D

Diastolic filling sound

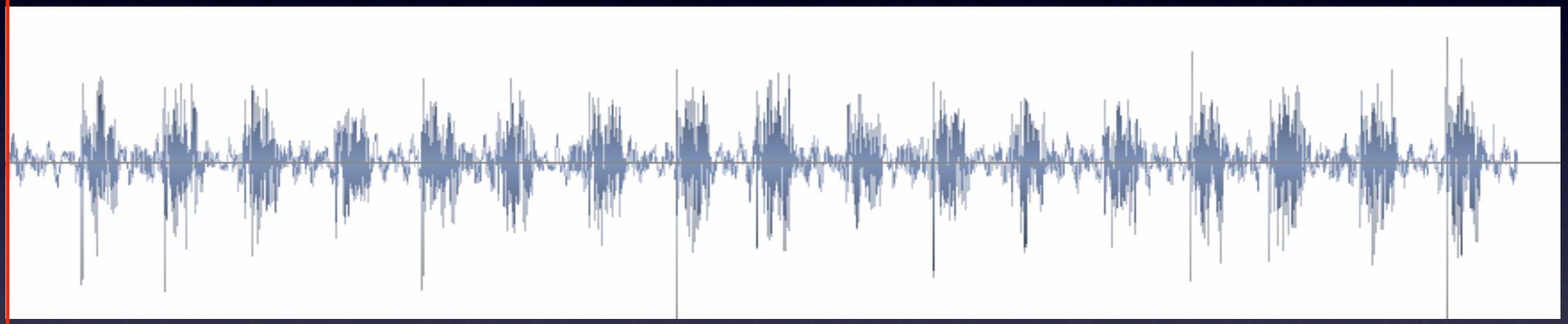


Click to begin

This patient has an additional diastolic sound, or S3, following the second heart sound. Typically this sound is best heard over the cardiac apex.

11-D

Pulmonary stenosis

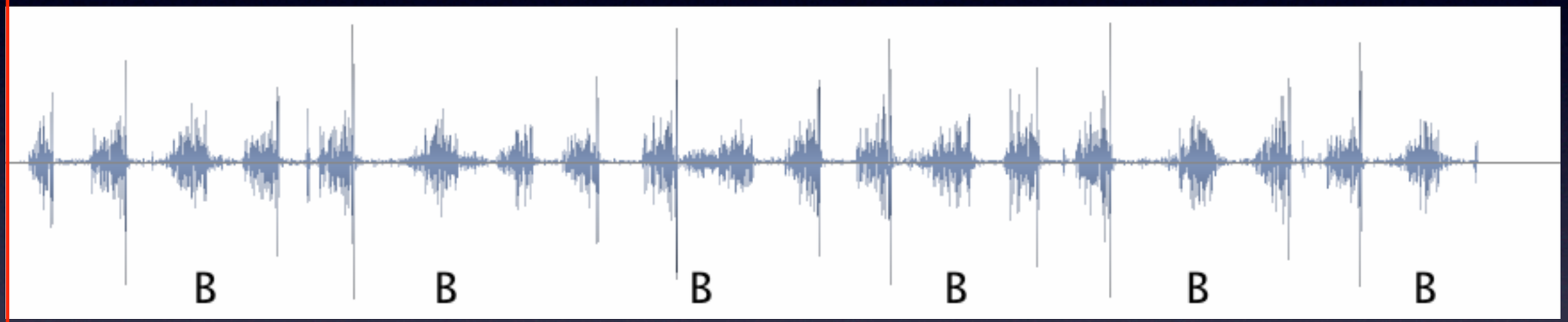


Click to begin

This is a systolic ejection murmur of pulmonary stenosis; a systolic click is often present, but is not prominent in this recording. The murmur has more variable pitch than the murmur of a VSD.

31-B

Tetralogy of Fallot; RV outflow obstruction

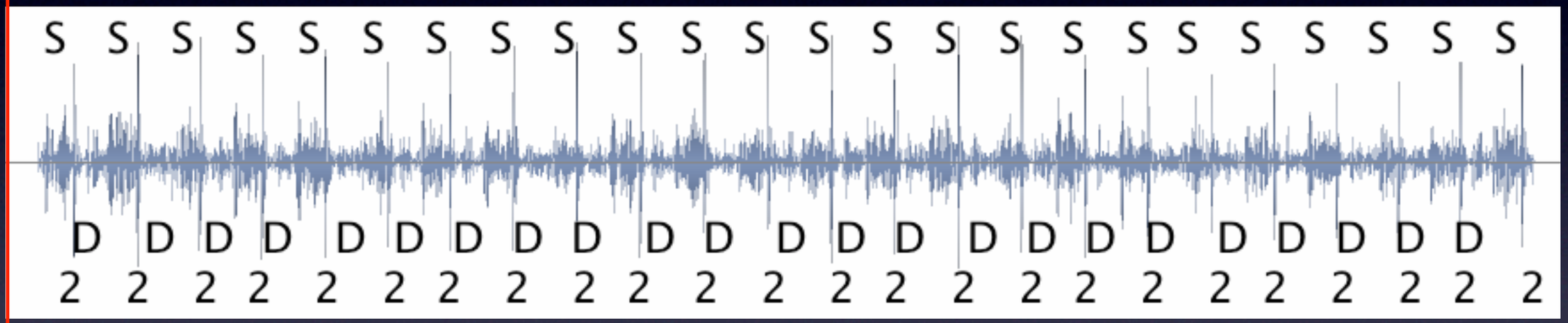


Click to begin

38-B

This is a systolic ejection murmur of right ventricular outflow tract obstruction in tetralogy of Fallot. Note the occasional respiratory arrhythmia associated with the child's breathing "B".

Mitral stenosis

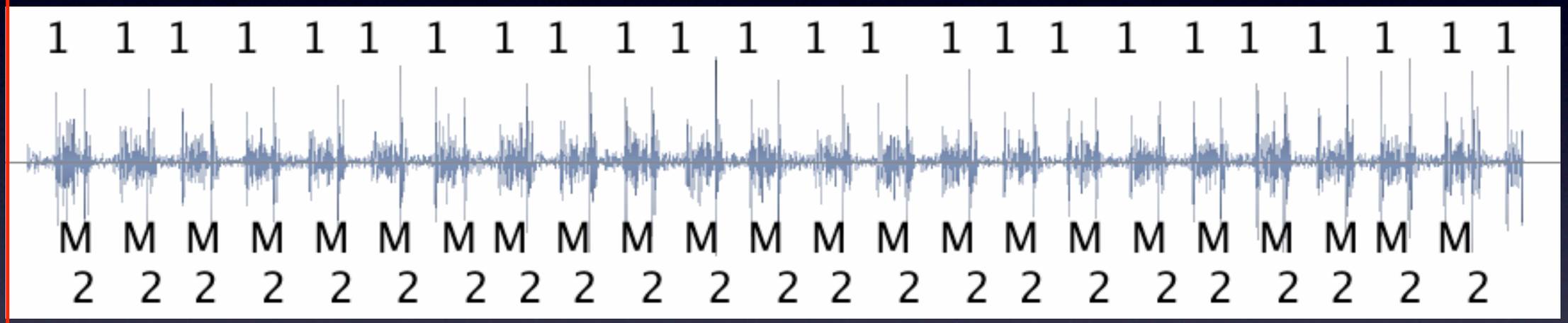


Click to begin

42-D

This patient with rheumatic heart disease has a diastolic sound "D" of mitral stenosis, which is heard best over the apex. There is a louder systolic murmur "S" which is not commented on, but in this situation is most likely mitral regurgitation.

Mitral Regurgitation

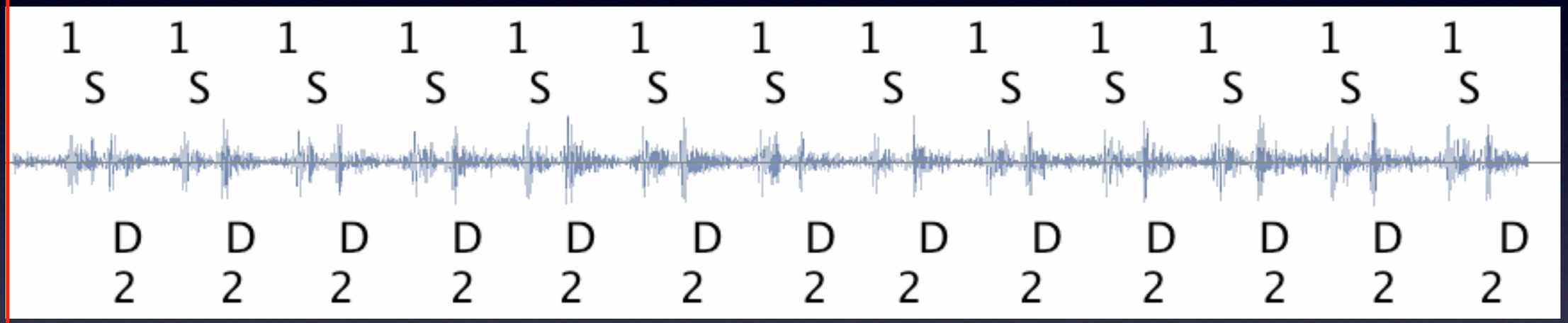


Click to begin

This is a holosystolic murmur of mitral stenosis, heard in a patient with a history of rheumatic fever.

42-C

Aortic Insufficiency

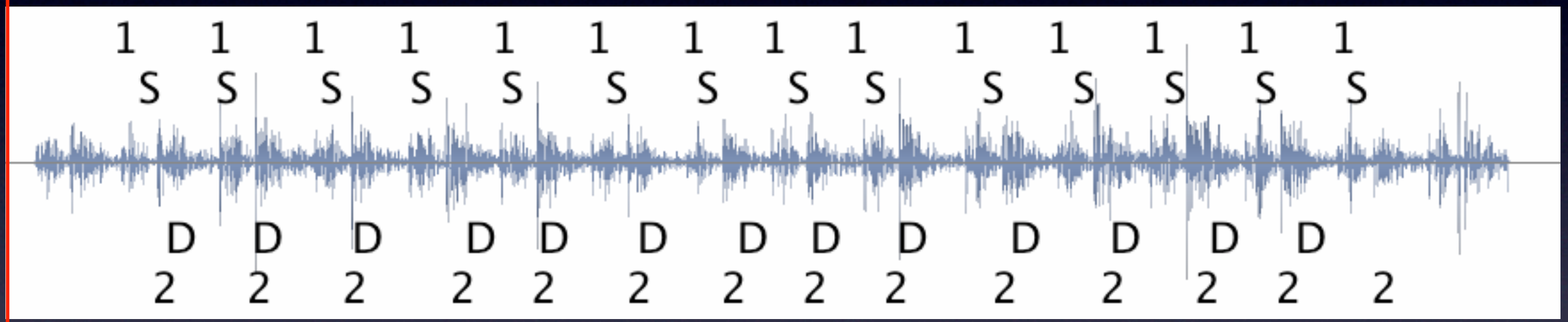


Click to begin

13-C

The aortic insufficiency murmur is a diastolic (following the second heart sound) decrescendo murmur. This patient also has a softer systolic ejection murmur, possibly mild aortic stenosis. Cause: rheumatic heart disease.

Aortic Insufficiency

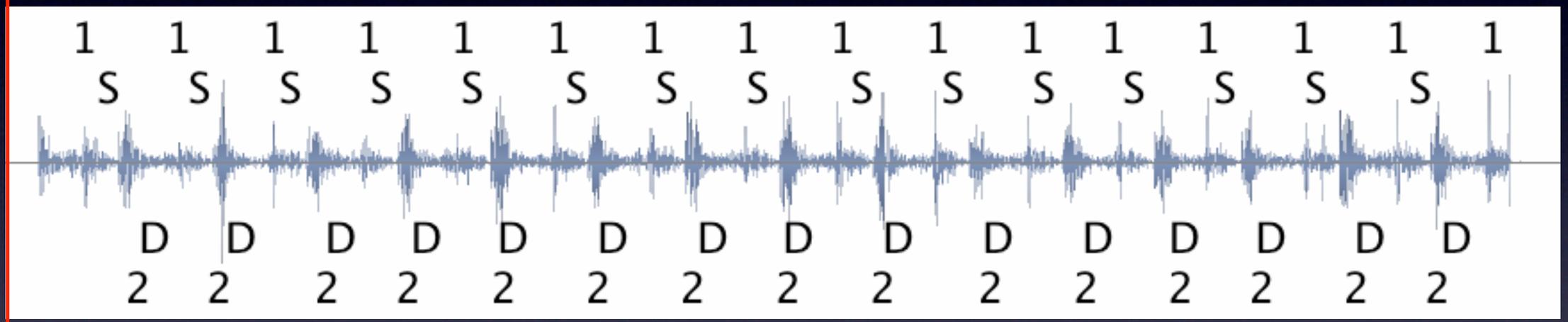


Click to begin

53-B

The aortic insufficiency murmur is a diastolic (following the second heart sound) decrescendo murmur. This patient also has a systolic ejection murmur, possibly aortic stenosis. Cause: rheumatic heart disease.

Aortic Insufficiency

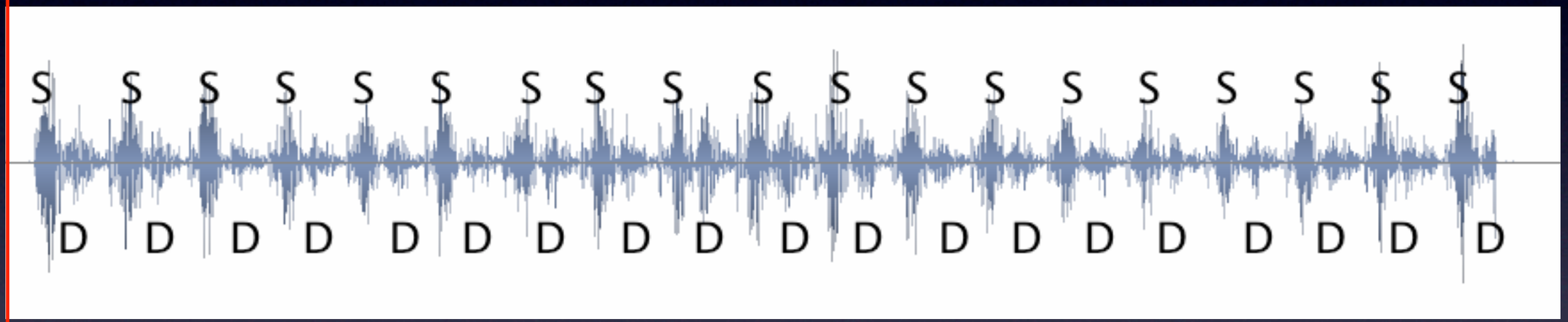


Click to begin

53-C

The aortic insufficiency murmur is a diastolic (following the second heart sound) decrescendo murmur. This patient also has a systolic ejection murmur, possibly mild aortic stenosis. Cause: rheumatic heart disease.

Aortic Stenosis and Insufficiency

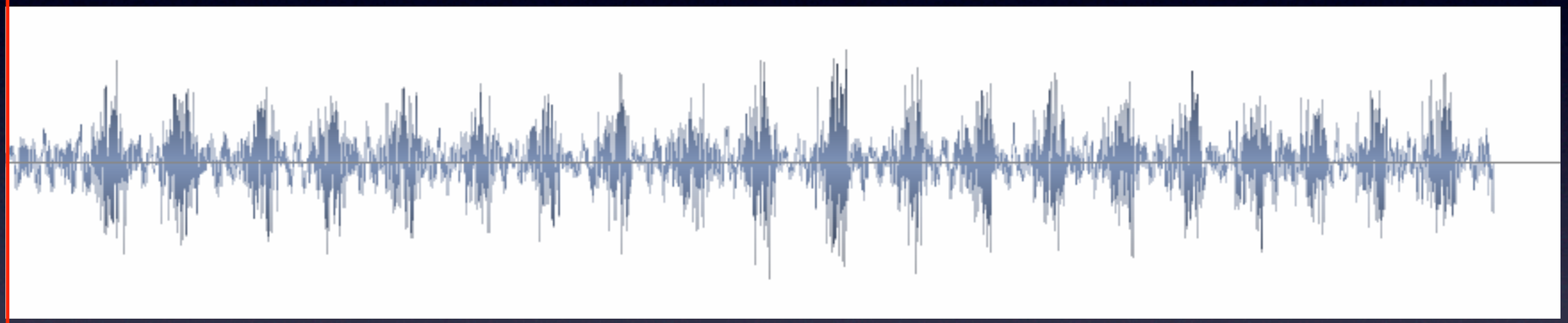


Click to begin

There is both a systolic ejection murmur of aortic stenosis "S" and a diastolic decrescendo murmur of aortic insufficiency "D".

45-B

Ventricular septal defect

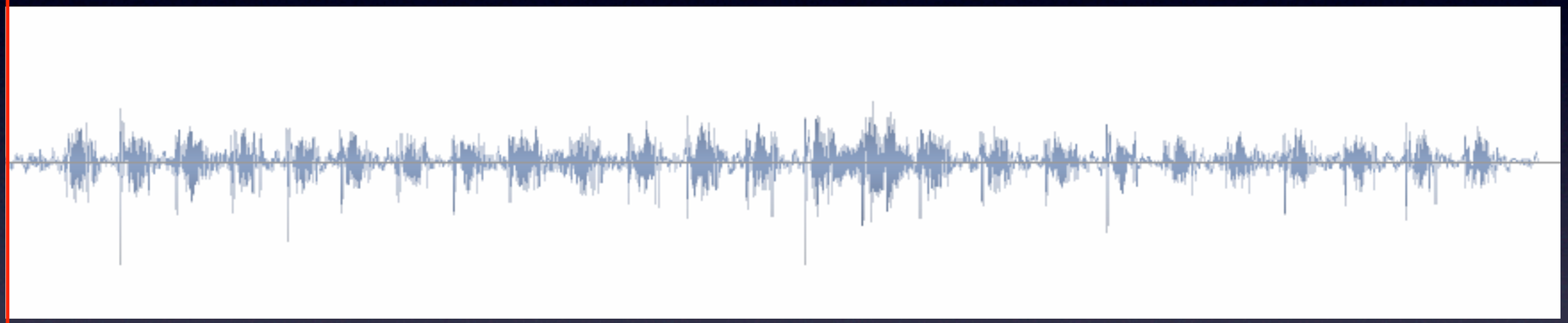


Click to begin

This is a harsh holosystolic murmur of a ventricular septal defect.

35-C

Strange sounds...

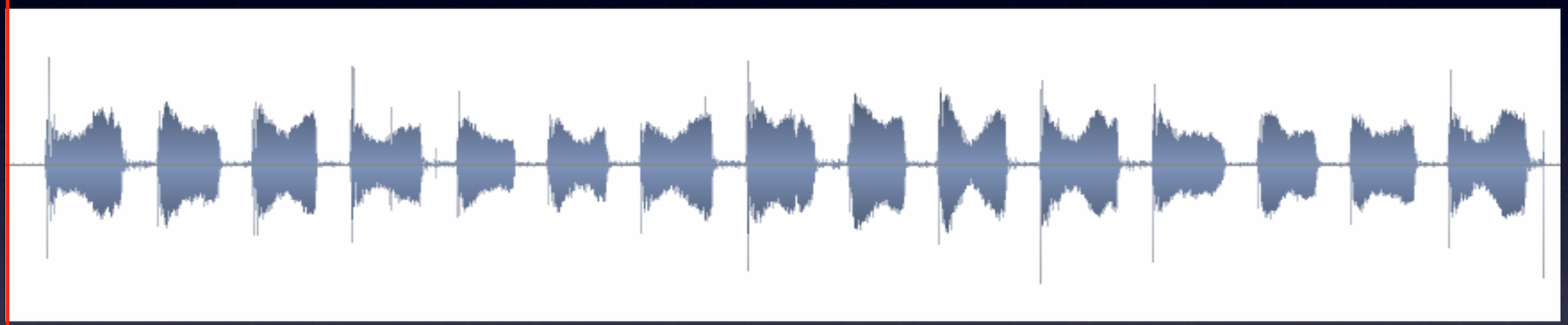


Click to begin

A “honking” sound of a patent ductus arteriosus.

26-C

Strange Sounds...

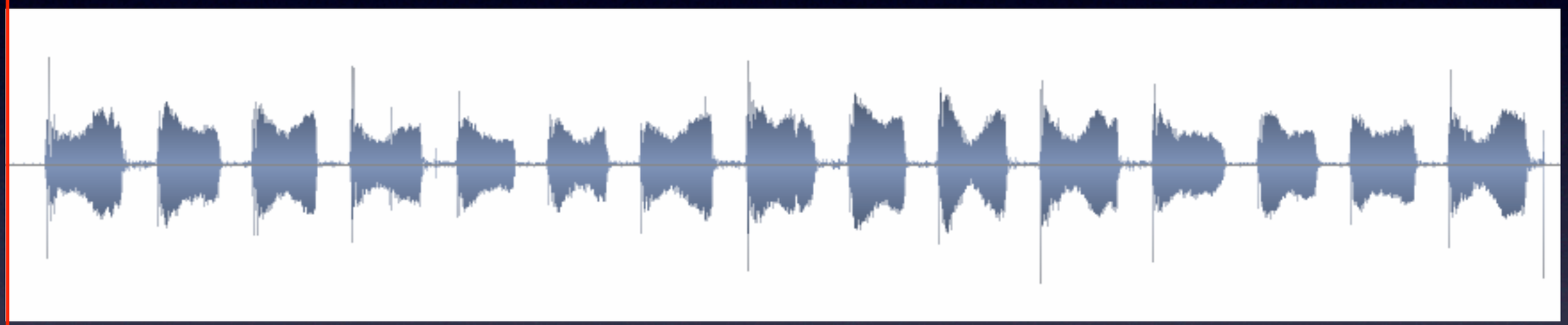


Click to begin

"Everted mitral valve cusps."

36-B

Strange Sounds...



Click to begin

"Everted mitral valve cusps."

36-B

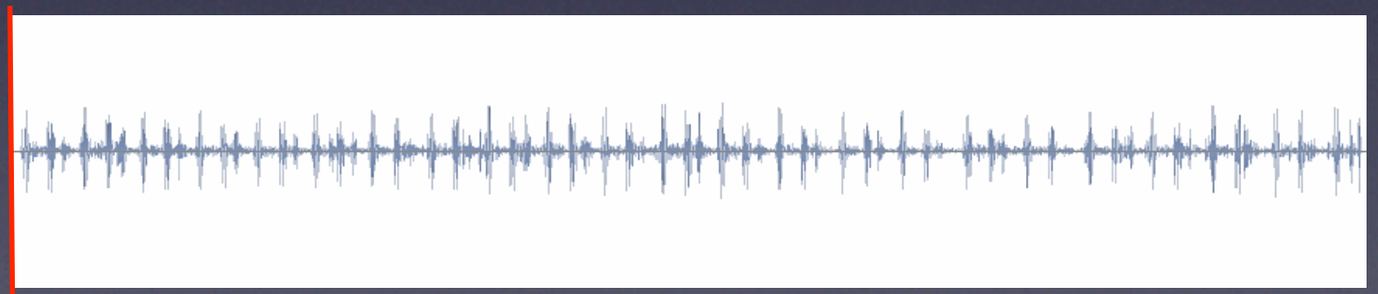
Localization

Diastolic filling sounds are best heard at the cardiac apex

Click to begin

11-C LLSB

11-D APEX

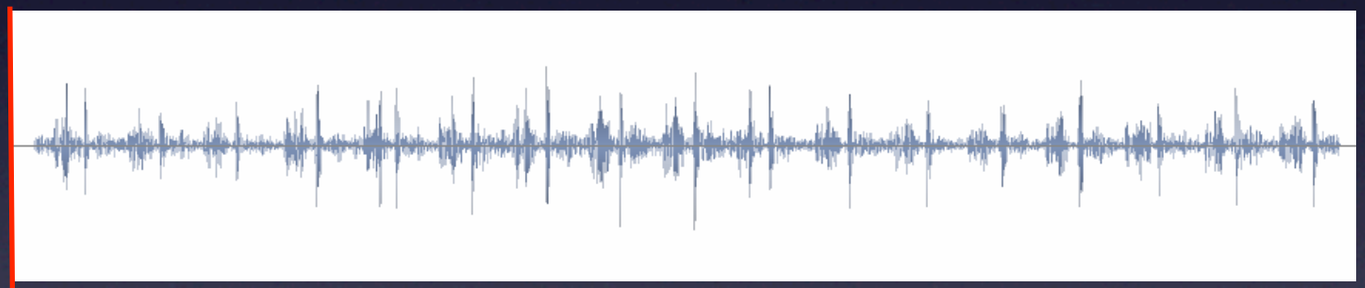


Localization

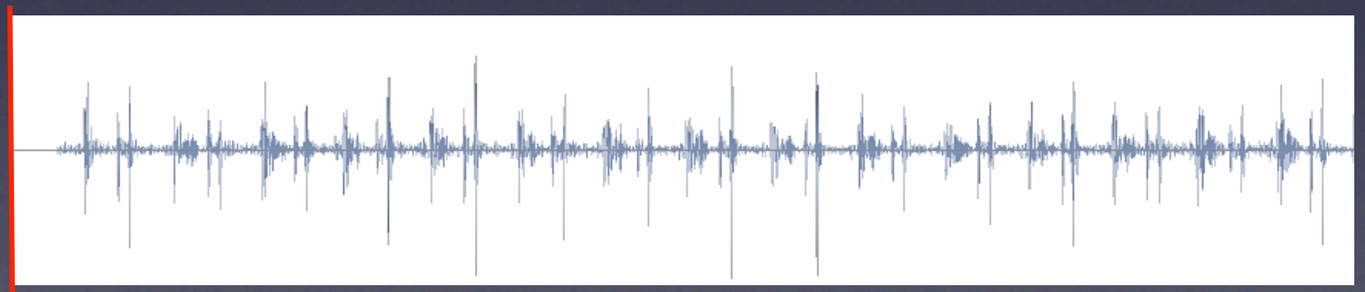
Aortic insufficiency murmur best heard at the RUSB; there is an additional S3 at the apex!

Click to begin

37-A RUSB



37-D APEX

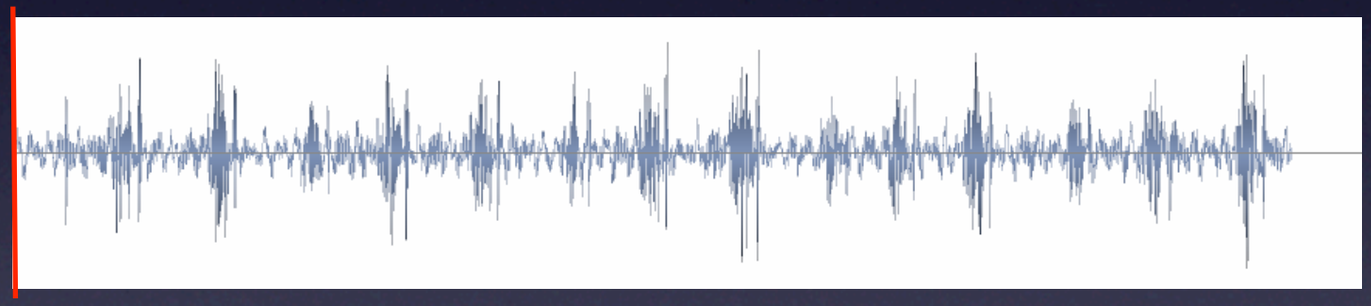


Localization

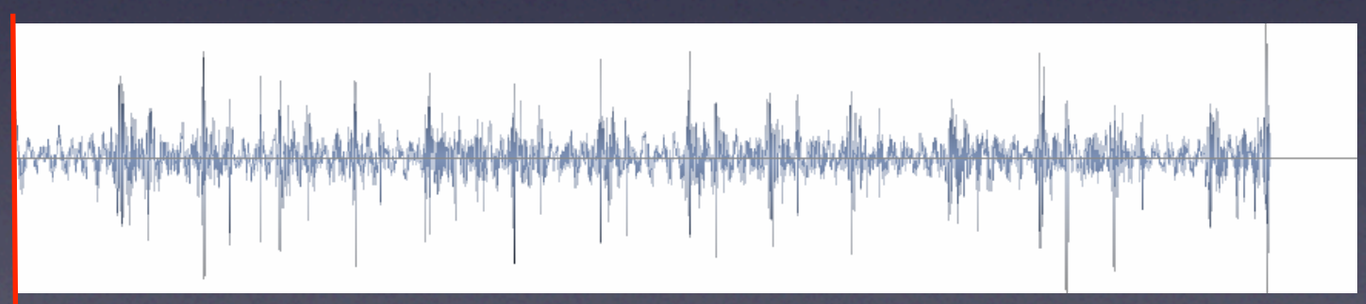
Aortic stenosis murmur best heard at the RUSB

Click to begin

33-A RUSB



33-D APEX

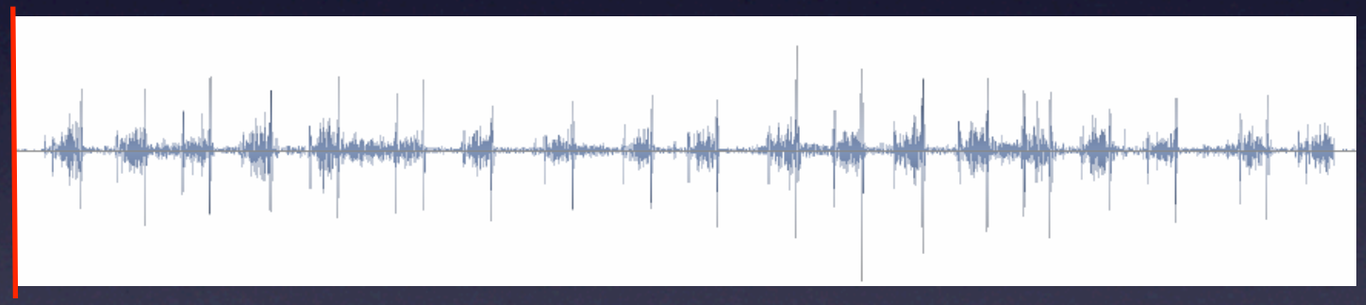


Localization

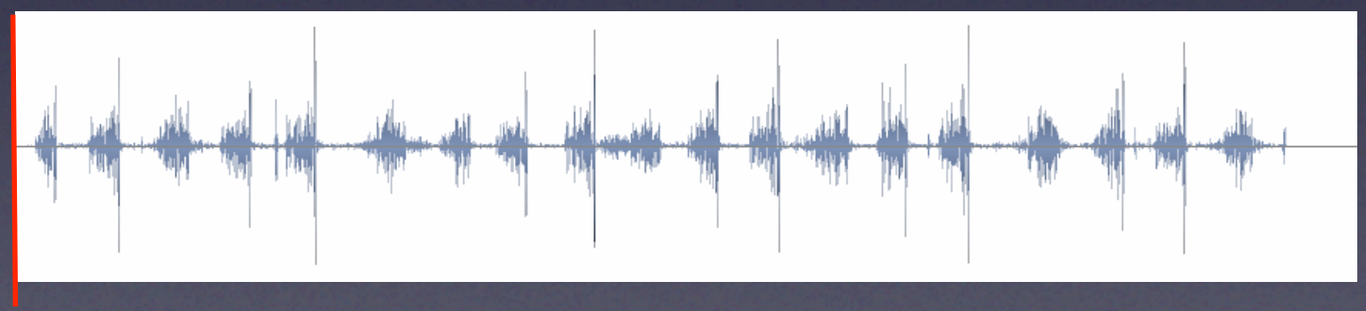
Pulmonary stenosis: murmur best heard at the LUSB

Click to begin

38-A RUSB



38-B LUSB

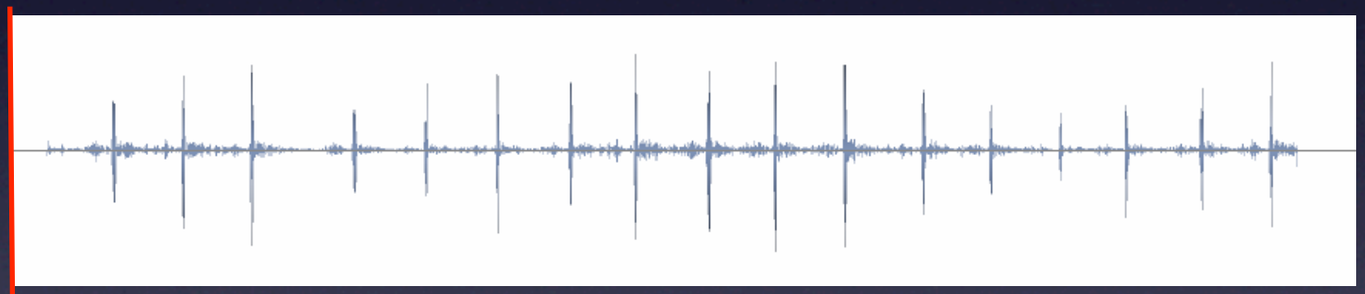


Localization

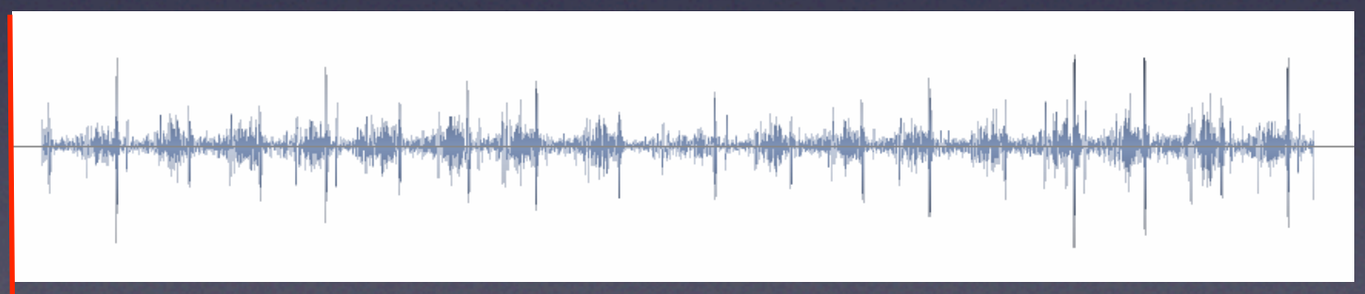
Rheumatic heart disease: early diastolic murmur of AI at LUSB

Click to begin

60-B LUSB



60-D Apex



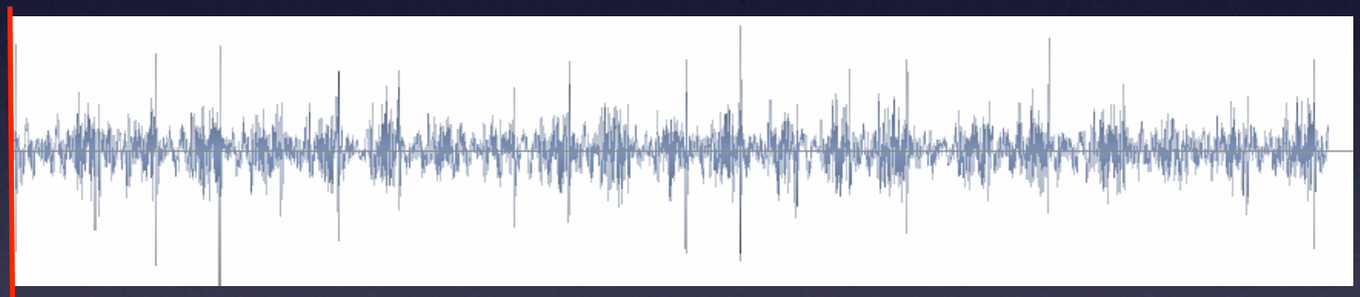
Systolic murmur of mitral regurgitation at apex

Localization

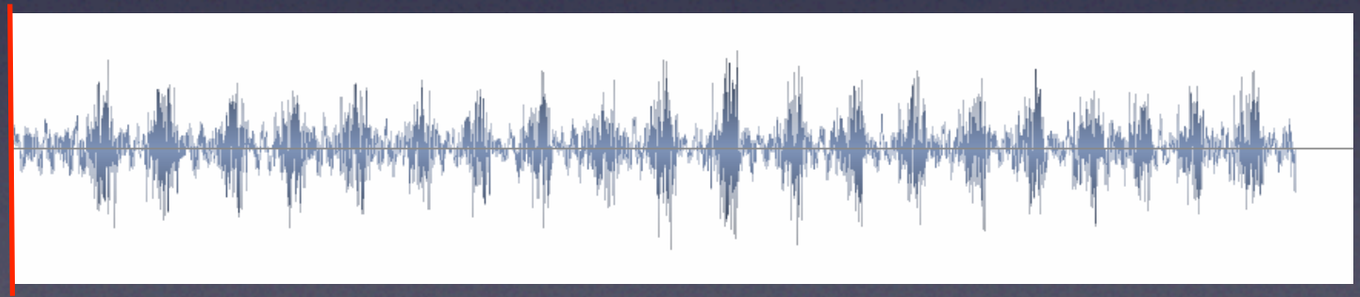
Ventricular septal defect: best heard at LLSB with radiation to apex, but less intensity at LUSB

Click to begin

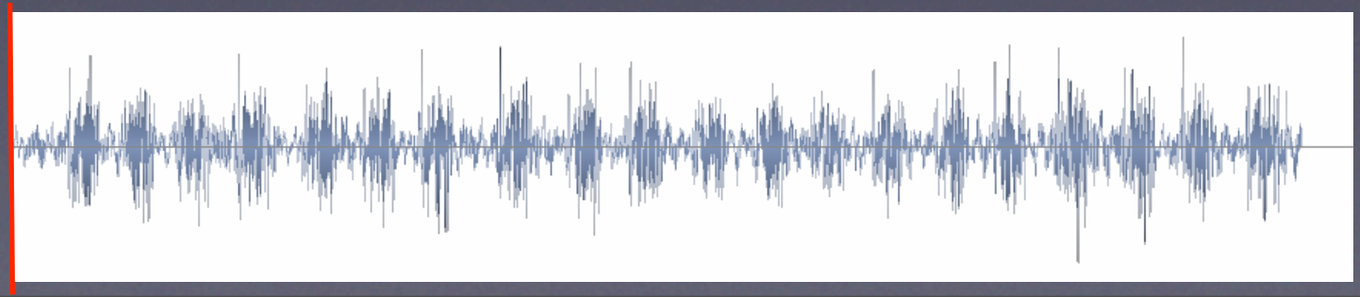
35-B LUSB



35-C LLSB



35-D Apex



Phonocardiography Recordings

- Interesting archive of pediatric cardiology
- Instructional tool for physical diagnosis, thanks to the inspiration of Drs. Herrington and Schall
- The physical examination continues to be important, and improvement of the skills of trainees is vital
- Potential for telemedicine application for murmur diagnosis in developing countries