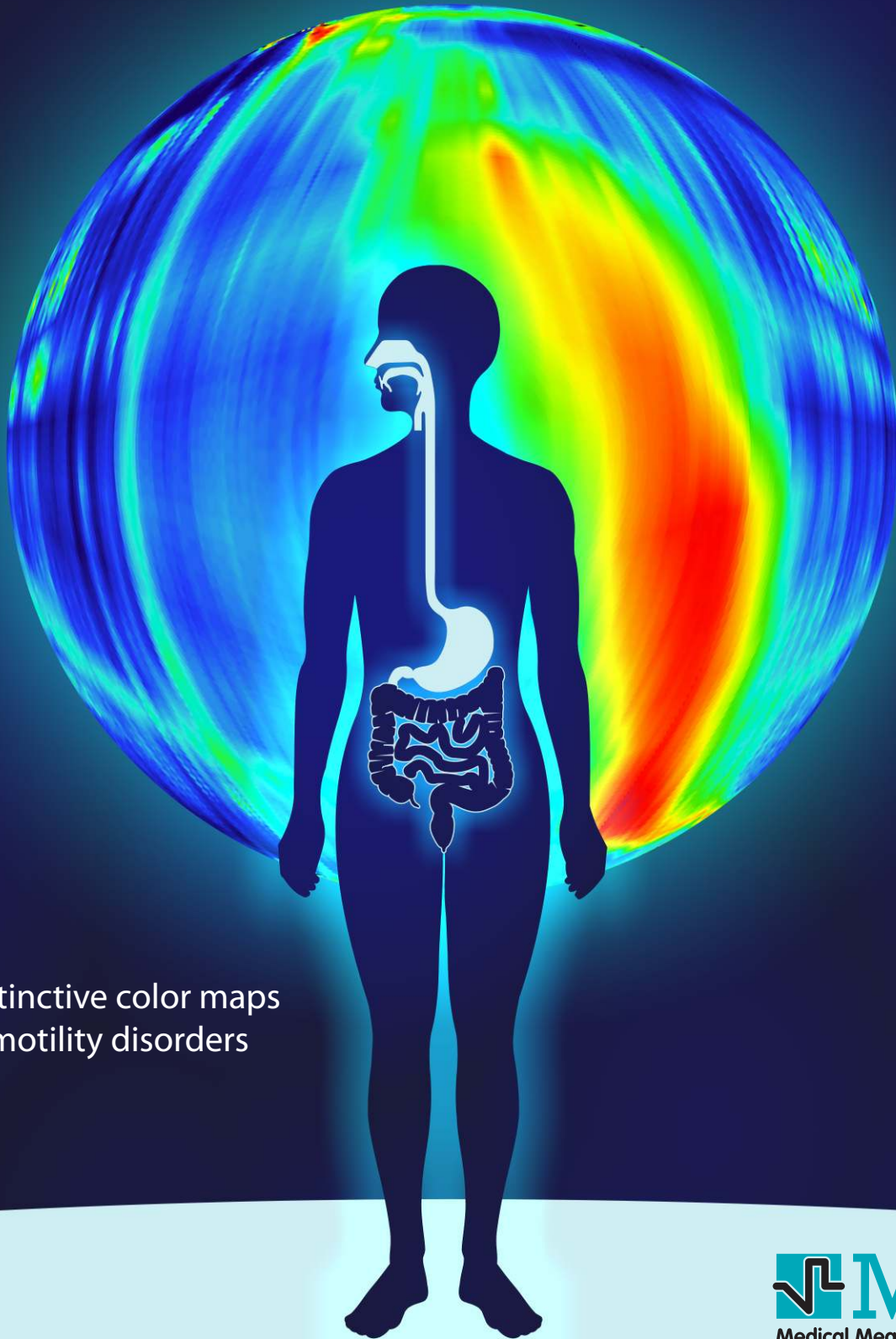


HRM ATLAS

A collection of
High Resolution Esophageal Manometry Patterns



Distinctive color maps
of motility disorders

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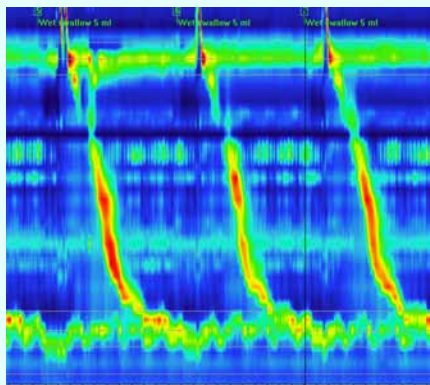
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High Resolution Manometry is an advanced technique to perform gastro-intestinal investigations in the esophagus with the Solar GI measurement system. Medical Measurement Systems (MMS) introduced High Resolution Manometry (HRM) in 1995 under the name Clouse¹ Contour Plots. Pressure recordings allowed easy interpretation of the tracings visualised as Clouse Contour (HRM) plots in the analysis program of MMS.

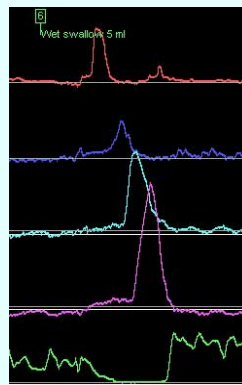
In this document we will describe the interpretation of the HRM plots. We will compare conventional 4-8 channel esophageal manometry with 20-36 channel HRM investigations. Examples of primary and secondary esophageal motility disorders will be displayed.

Important advantages of HRM can be:

- prevent misdiagnosis of achalasia (pseudo relaxation of the LES),
- perform UES/LES investigations (also with water catheters).



HRM plot (Clouse Contour Plot)



Conventional plot

Feedback on this document

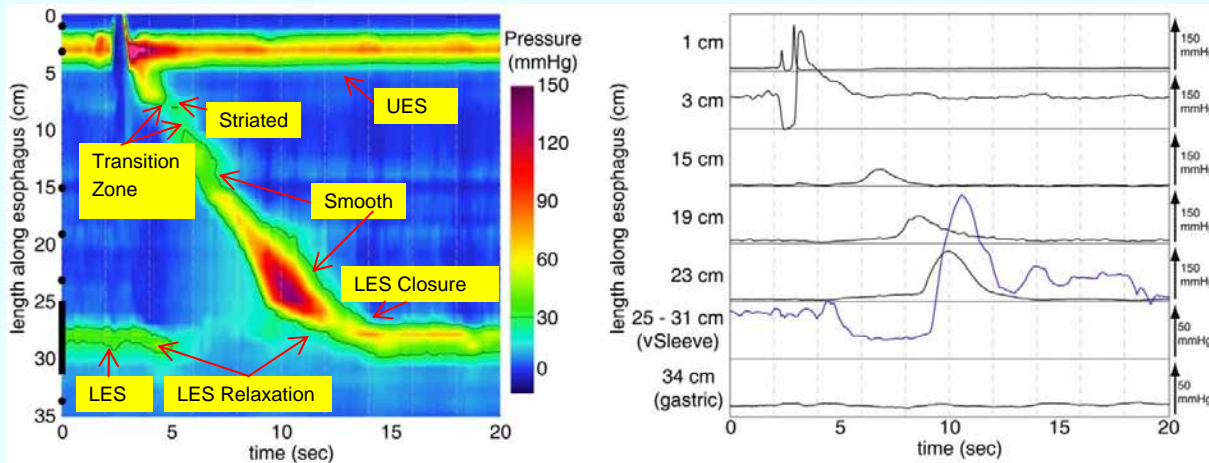
MMS welcomes your opinion and ideas to improve our manuals. Please send your questions and remarks to our Training & Education department:

education@mmsinternational.com

¹ Clouse RE †, Staiano A. The effects of cisapride on the topography of esophageal peristalsis.

Aliment Pharmacol Ther 1997; 10:875-882;

Clouse RE †, Staiano A et al. Development of a topographic analysis system for manometric studies in the gastrointestinal tract. Gastrointestinal Endoscopy, 1998; 48;4:395-401.

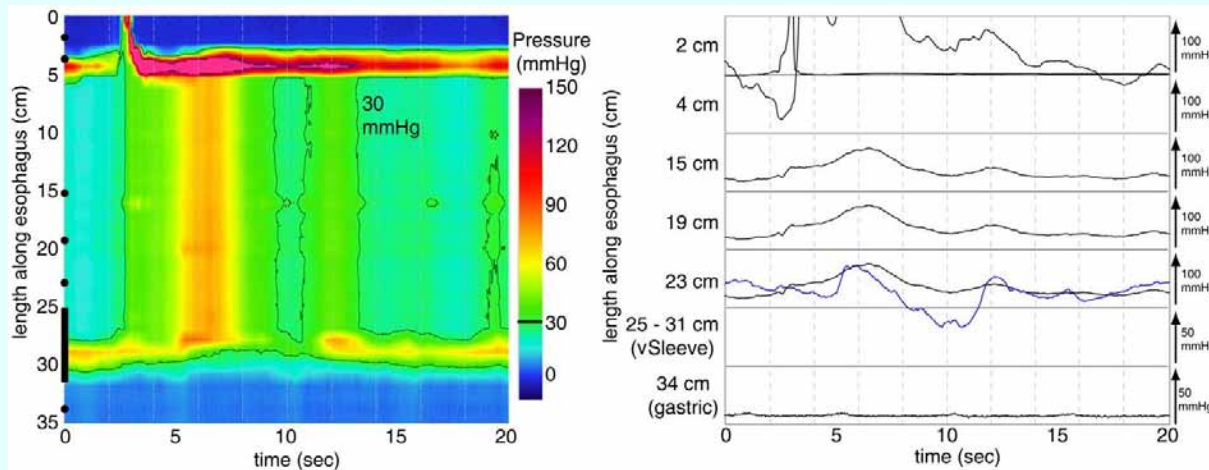


Definitions of basic structures as observed in the HRM tracing as seen on Normal Patient Study. Noticeably is the upper landmark of the UES observed as a straight segment with a break at the point of swallowing. The lower segment is the LES with a break shown during the swallow concurrent with LES relaxation. The middle segment shows the striated muscle, the transition zone, and the smooth muscle of the esophagus. Note that the pressure of the LES at closure is higher than normal due to the hypercontraction as can also be seen on the standard manometric tracing.

On the left is the scaling for the probe depth in cm, the X axis is the time in seconds, and the right scale presents the colors used to represent the various pressures throughout.

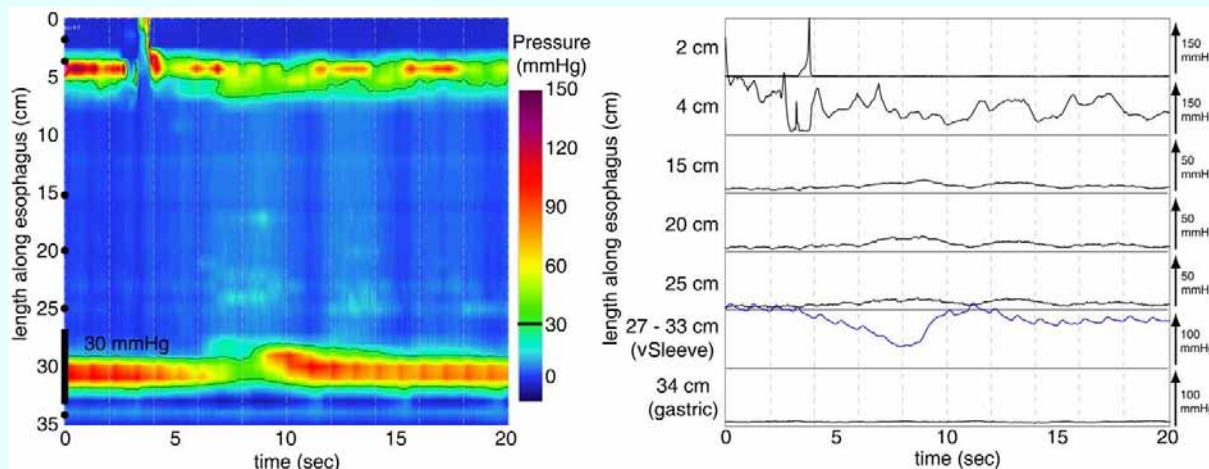
The esophageal peristalsis can easily be observed in HRM as it descends down and to the right. The highest pressure in the esophagus is observed in the distal esophagus as can also be seen on the manometric tracing.

Classic Achalasia with elevated intrabolus pressure [B.2]



Achalasia is defined typically by an elevated LES Pressure and the absence of peristalsis. In the HRM tracing the lack of peristalsis is observed as a vertical line segment (simultaneous contraction) in the esophagus. The elevated LES pressure is noted by the yellow color of the LES (about 60 mm Hg) and the absence of LES relaxation during a swallow confirms Achalasia.

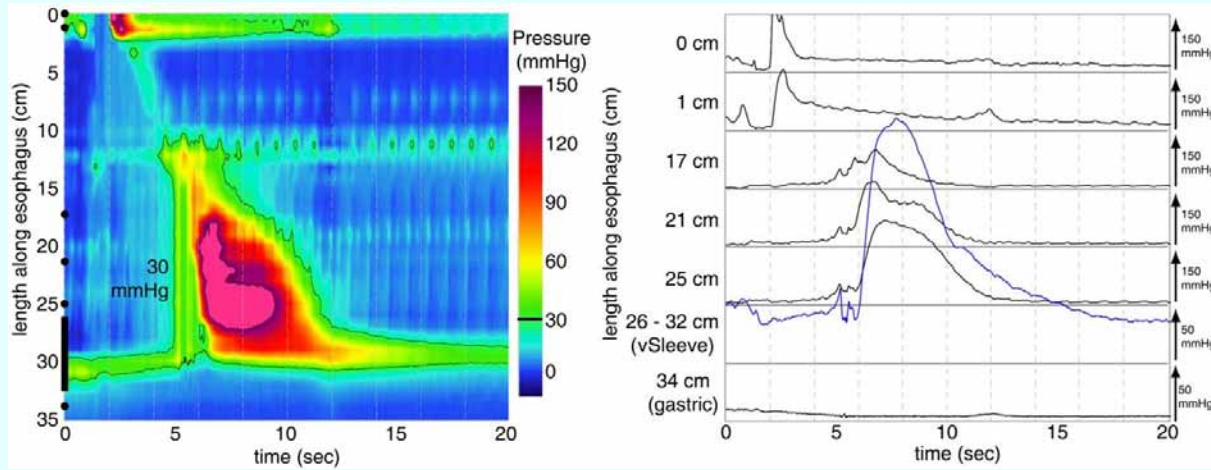
Classic Achalasia with low intrabolus pressure [B.3]



Classic Achalasia seen above has little or no esophageal pressures. The UES swallow opening is easily observed and the minimal attempt for LES opening can also be seen. Noticeably is the elevated LES pressure (about 90 mm Hg) and the incomplete relaxation of the LES during the swallow response.

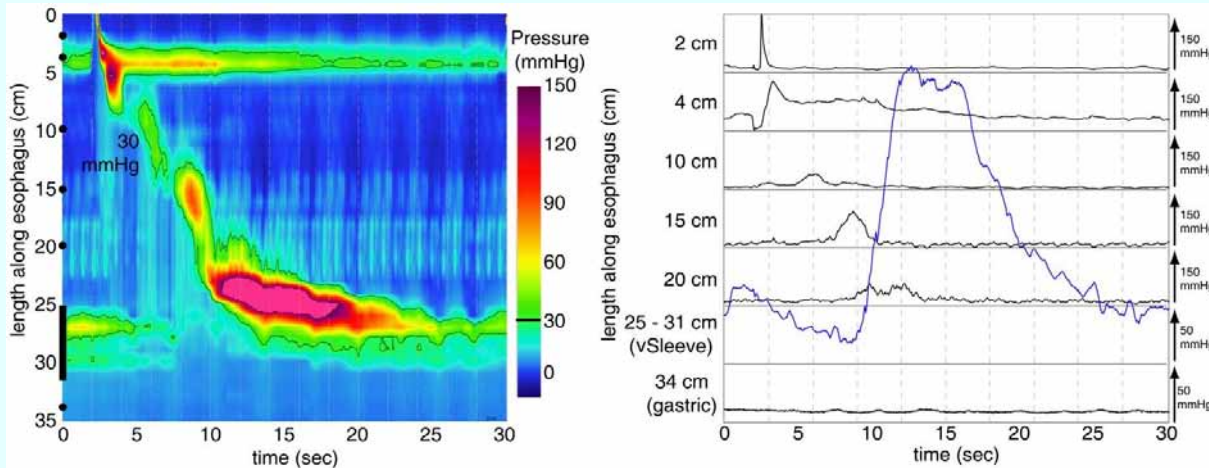
One can easily see in the HRM tracings and the color banding for the LES that there is no esophageal contraction.

Achalasia with distal Spasm [B.4]

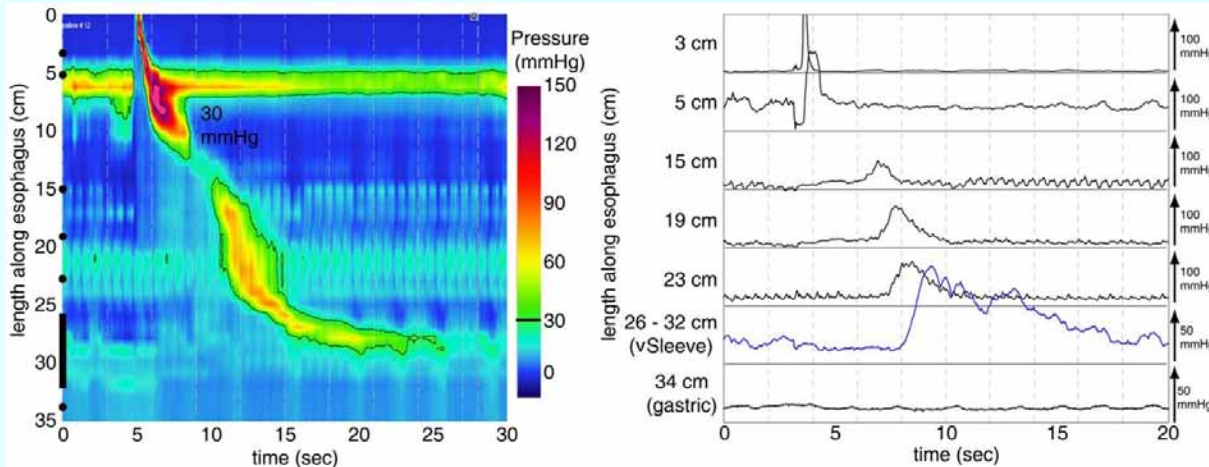


Achalasia is observed by the lack of peristalsis (simultaneous contraction in esophagus) and somewhat elevated LES pressure without relaxation during a swallow). The long duration of the esophageal contraction in the distal esophagus along with the elevated distal esophageal pressures is indicative of spasm.

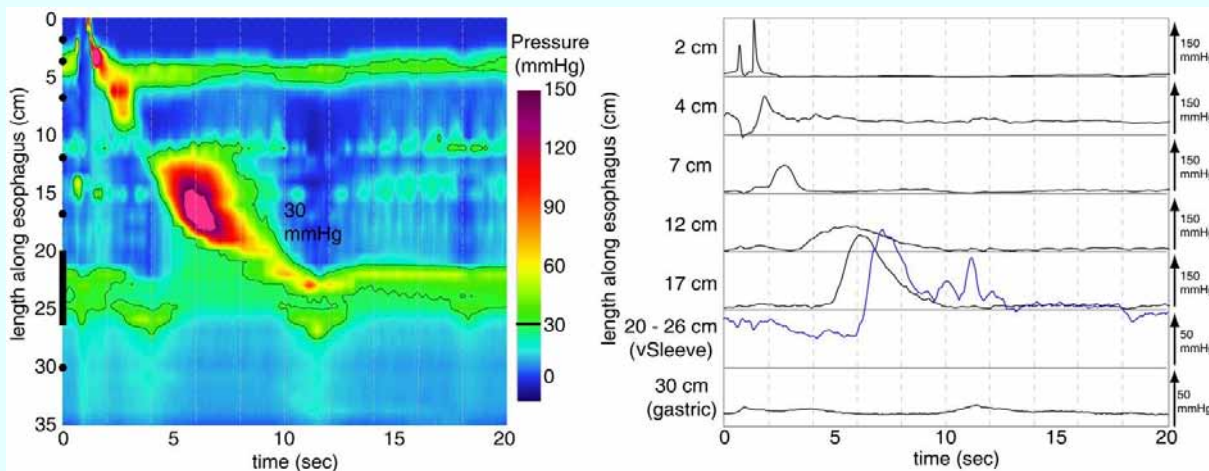
Nutcracker LES [B.14]



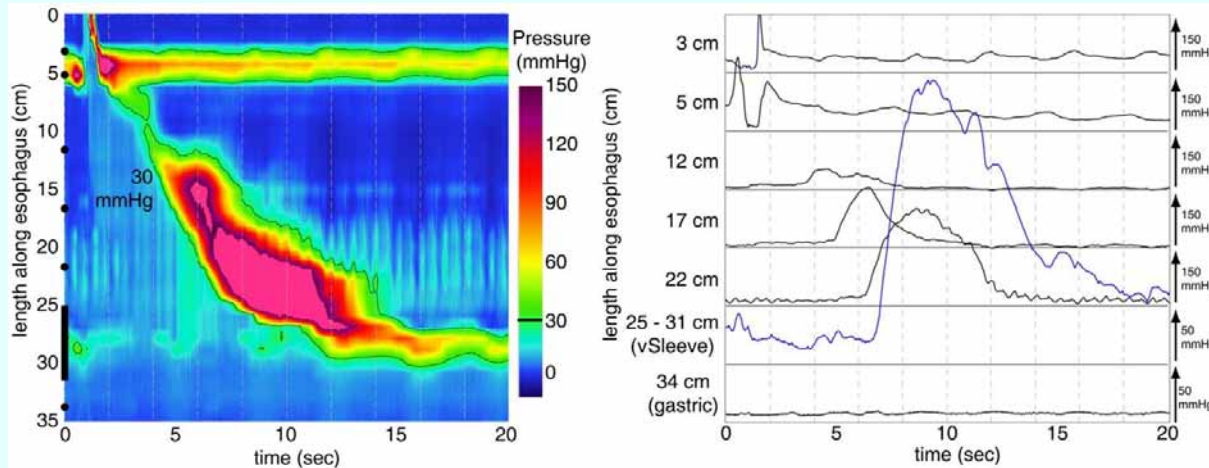
Hypotensive LES (pH +ve GERD) [B.12]



Mild Functional Obstruction [B.15]

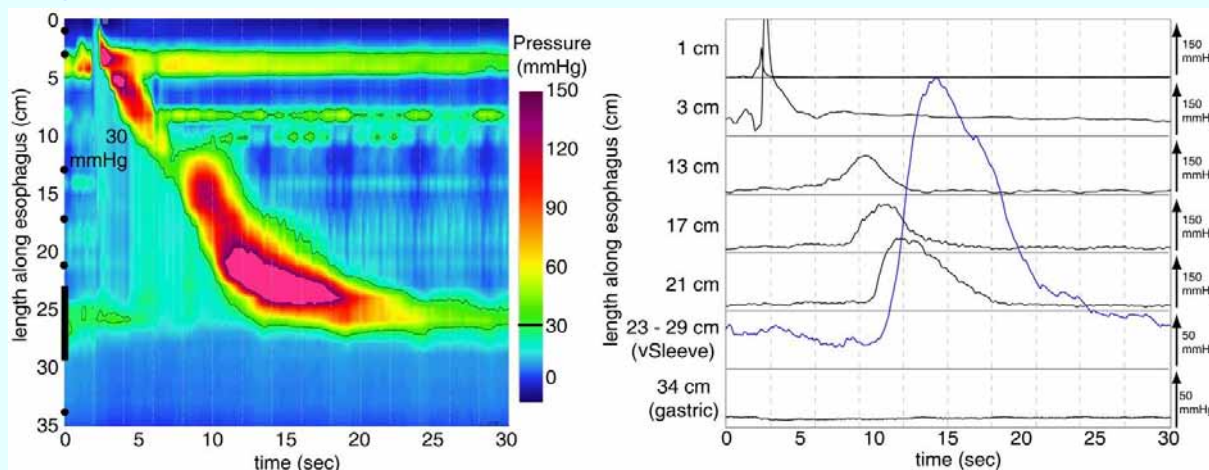


Classic Nutcracker [B.5]



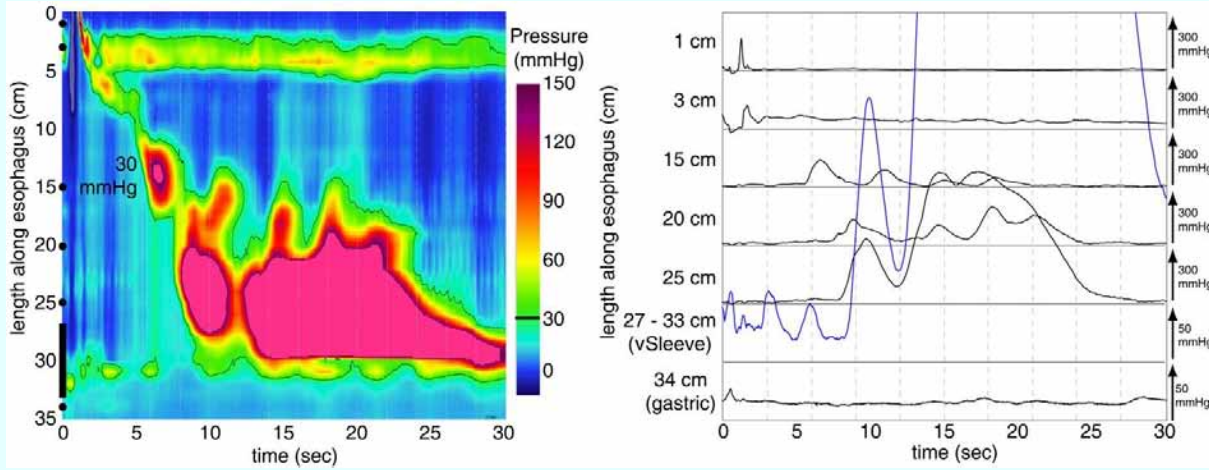
Nutcracker is defined as esophageal pressures greater than 180 mm Hg in the distal esophagus. On the HRM tracing this is easily observed by the color throughout the distal smooth muscles. Note that peristalsis is present and the LES is functioning properly but with some pressure elevation perhaps due to hyper contraction on LES closure. The HRM tracing shows this easily through the use of colors representing pressures. One can also observe spikes in the HRM tracing that are artifacts produced by heart beats.

Segmental Nutcracker [B.6]

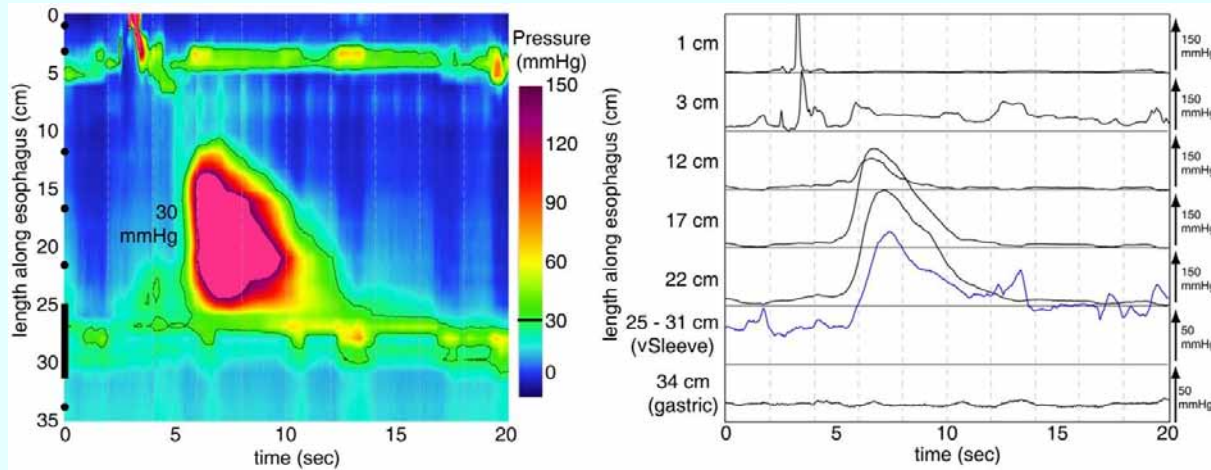


This Segmental Nutcracker HRM tracing shows the typical high pressure in the distal esophagus. Also the segmental nature is observed in the upper section where pressures continue to be observed in the striated muscles of the esophagus. Noticeably as well is the lack of a clear transitional area between the striated and smooth muscles. LES pressures are quite normal and there are good relaxations of the LES.

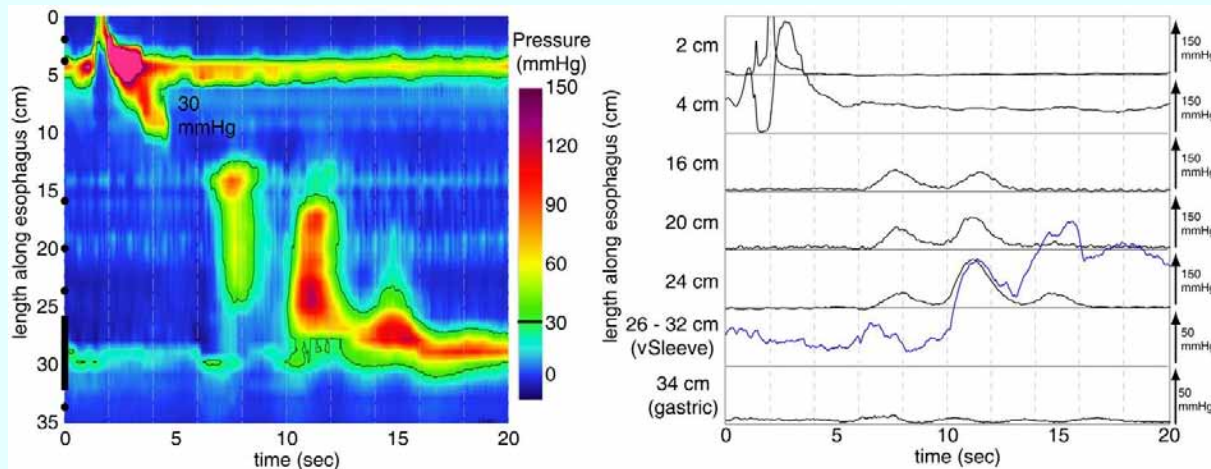
Spastic Nutcracker [B.7]



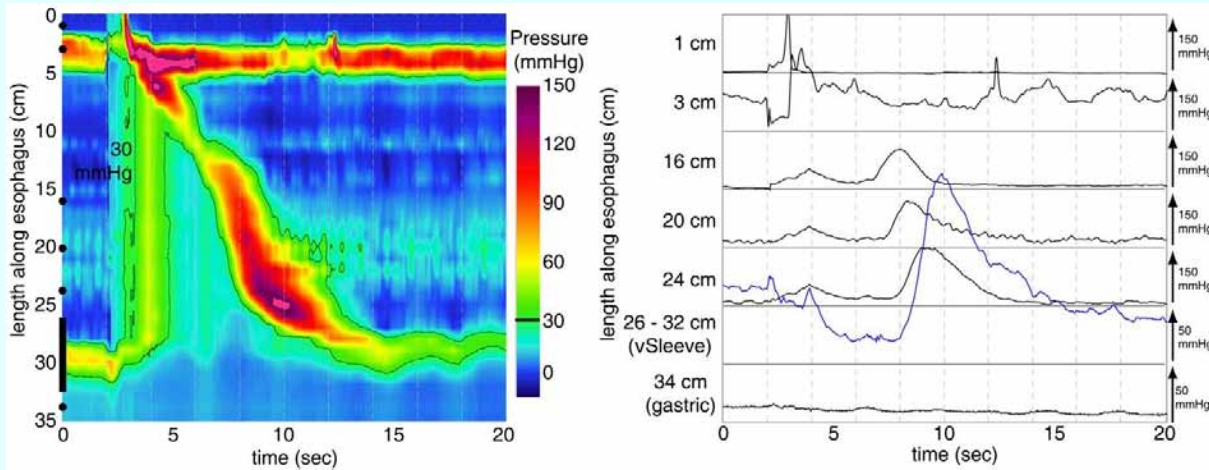
Classic Spasm [B.10]



Diffuse Esophageal Spasm [B.11]

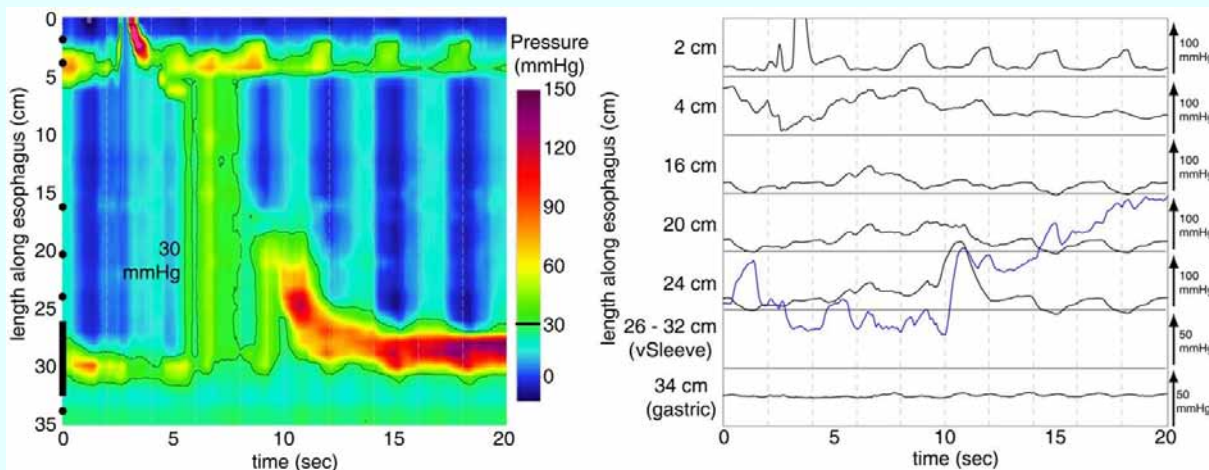


Spasm variant (Eosinophilic Esophagitis) [B.8]

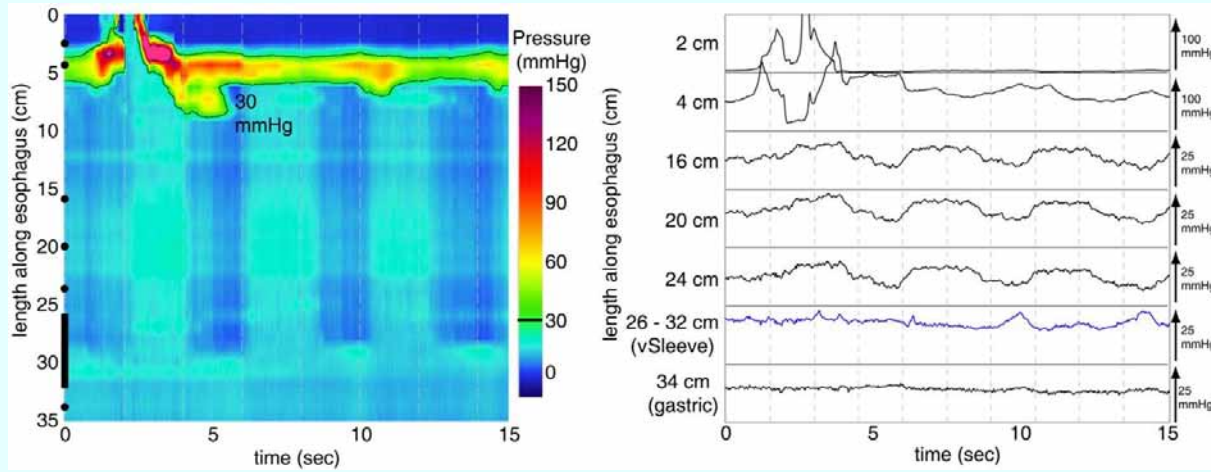


In this HRM tracing one sees simultaneous contraction of the esophagus with low pressures as well as extended duration of the contraction of the esophagus and growing pressure amplitude. Noticeably is the lack of a clear UES relaxation, elevation of the LES pressure and little or no LES relaxation. Note that the standard manometric tracing appears to show a nice looking LES relaxation (sleeve sensor) that is not apparent in the HRM tracing.

Spasm variant (post-fundoplication) [B.9]

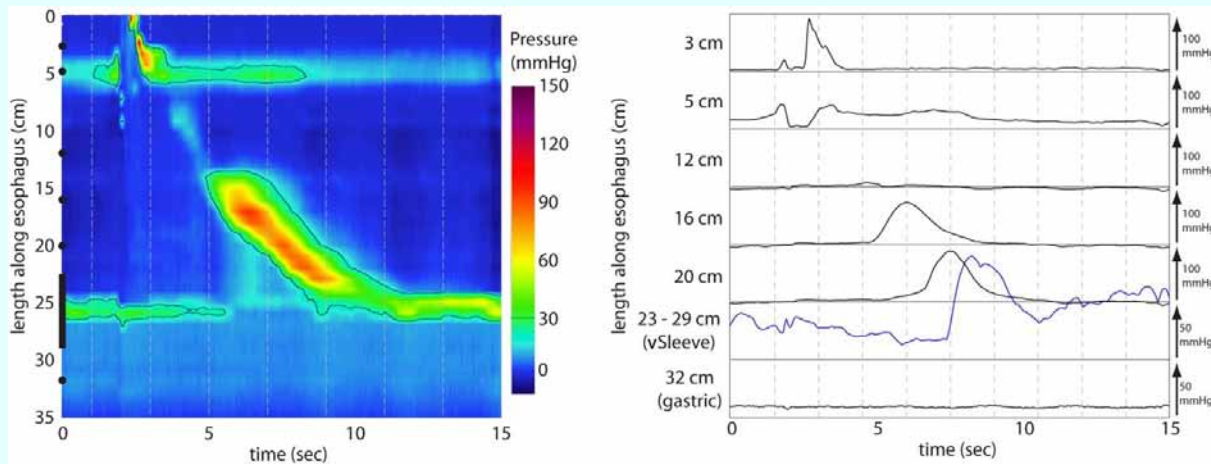


Scleroderma [B.13]

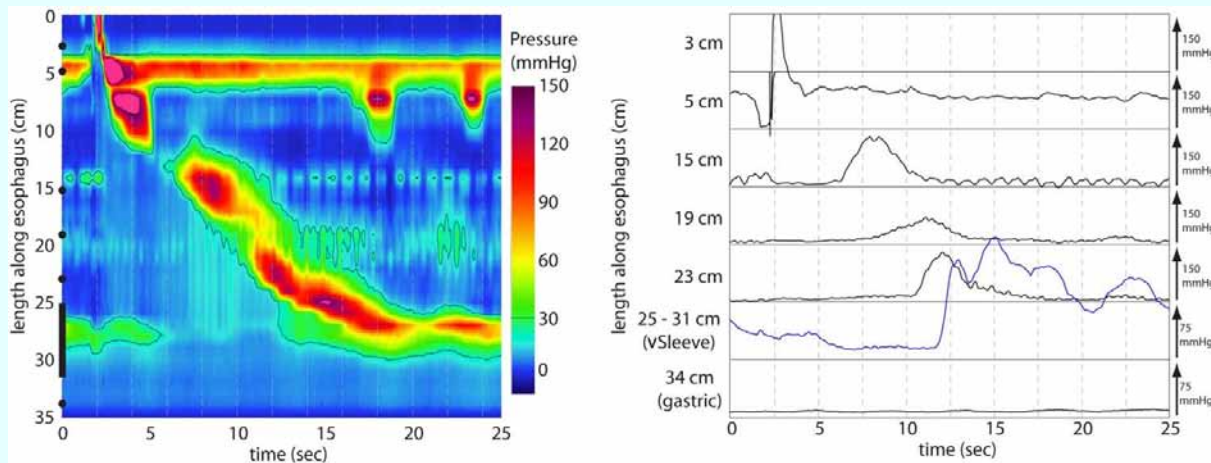


Proximal esophagus and transition zone abnormalities

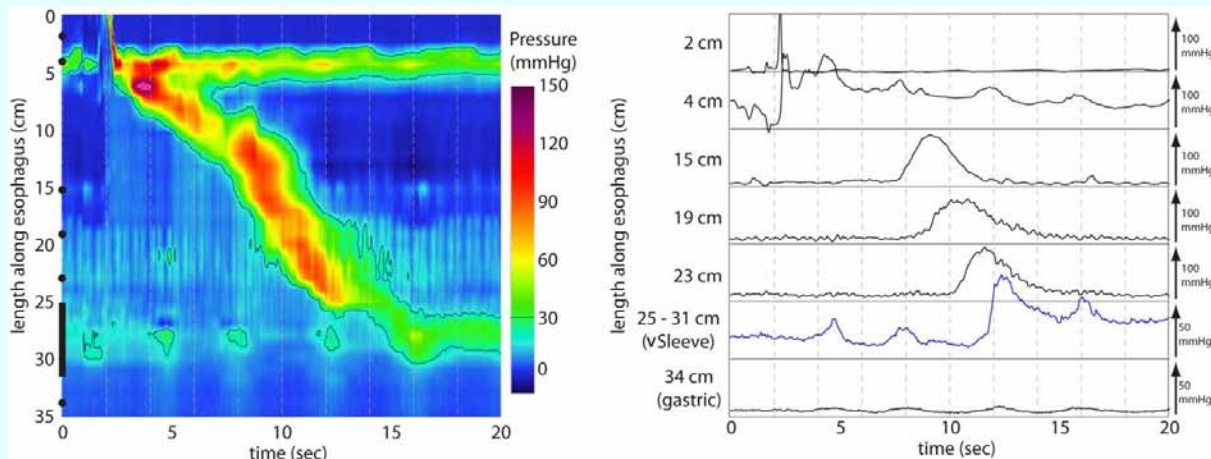
Low Proximal Contractile Integral [B.16]



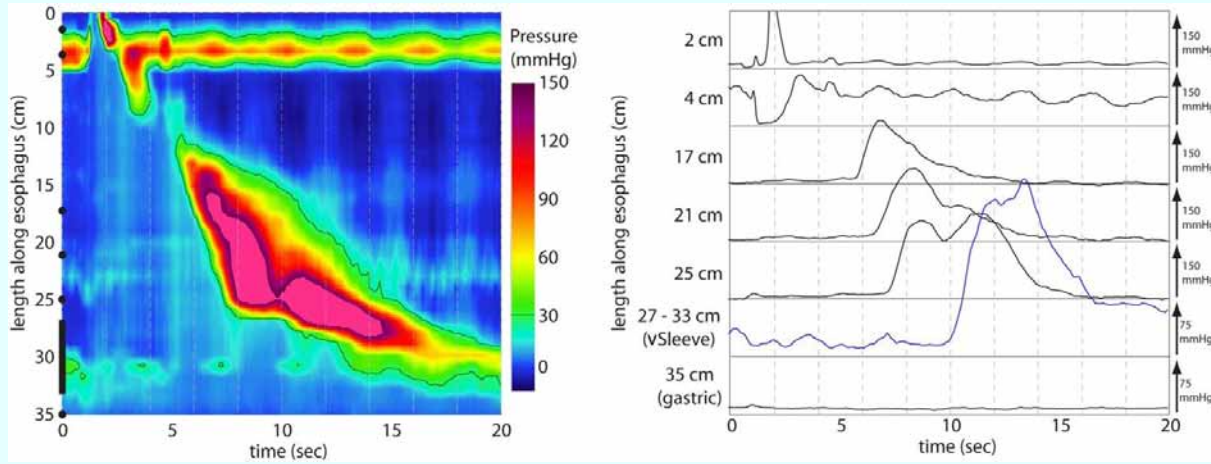
High Proximal Contractile Integral [B.17]



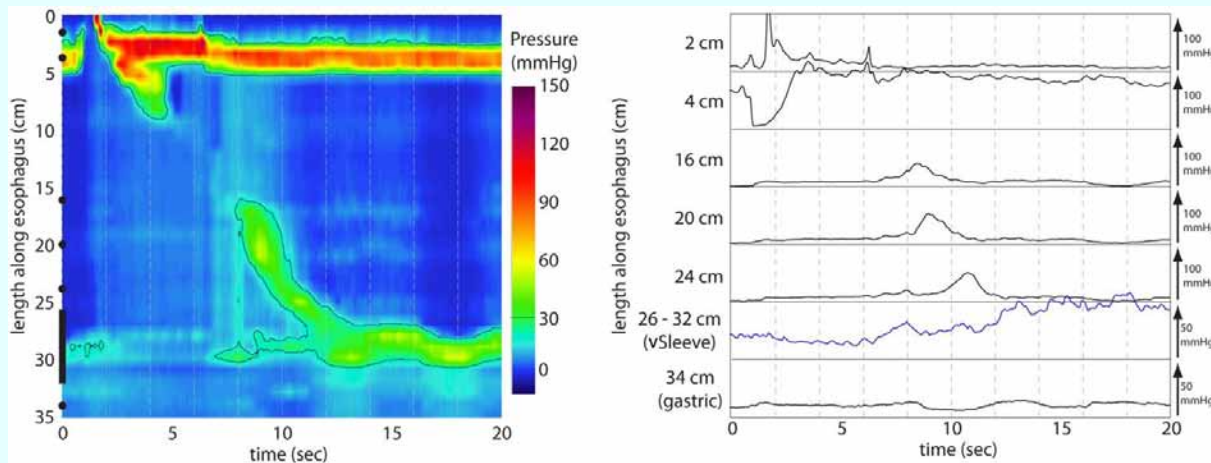
Low Proximal Contractile Velocity [B.18]



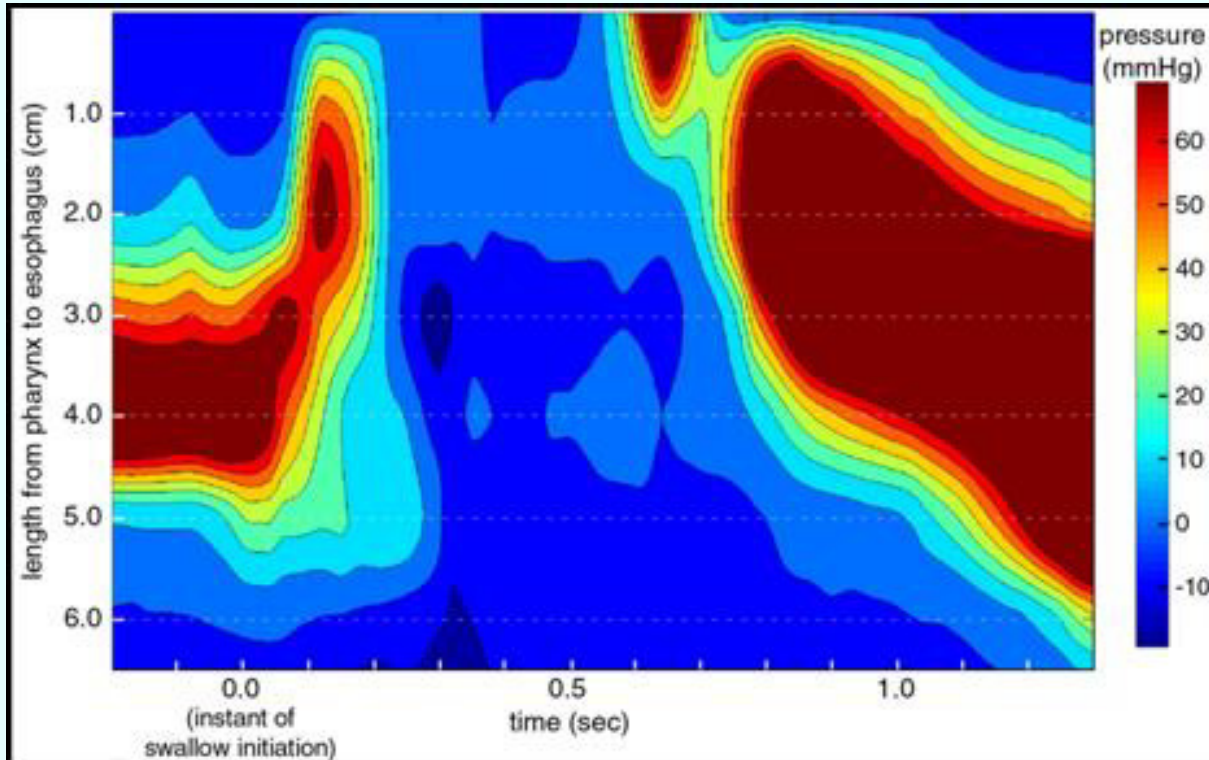
High Proximal Contractile Velocity [B.19]



Wide Transition Zone [B.20]

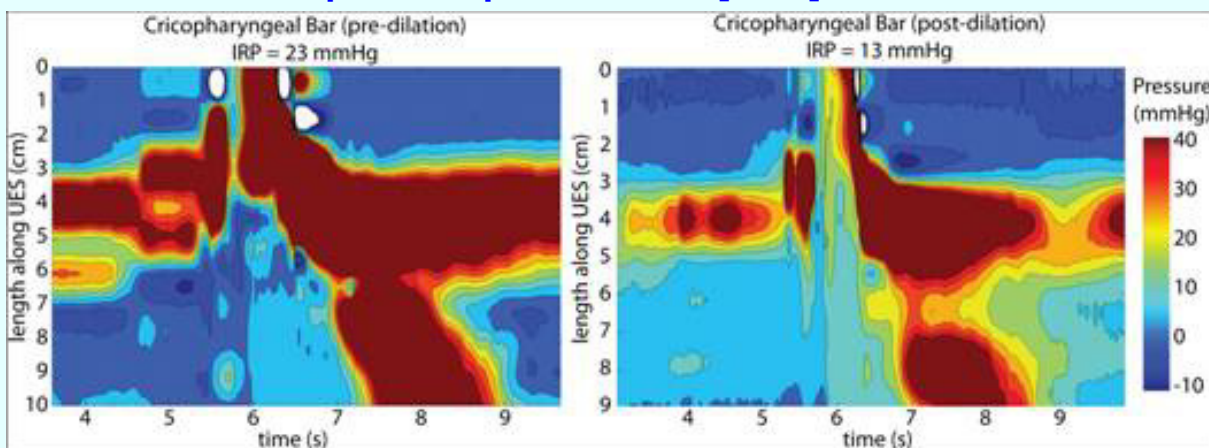


Normal [B.21]

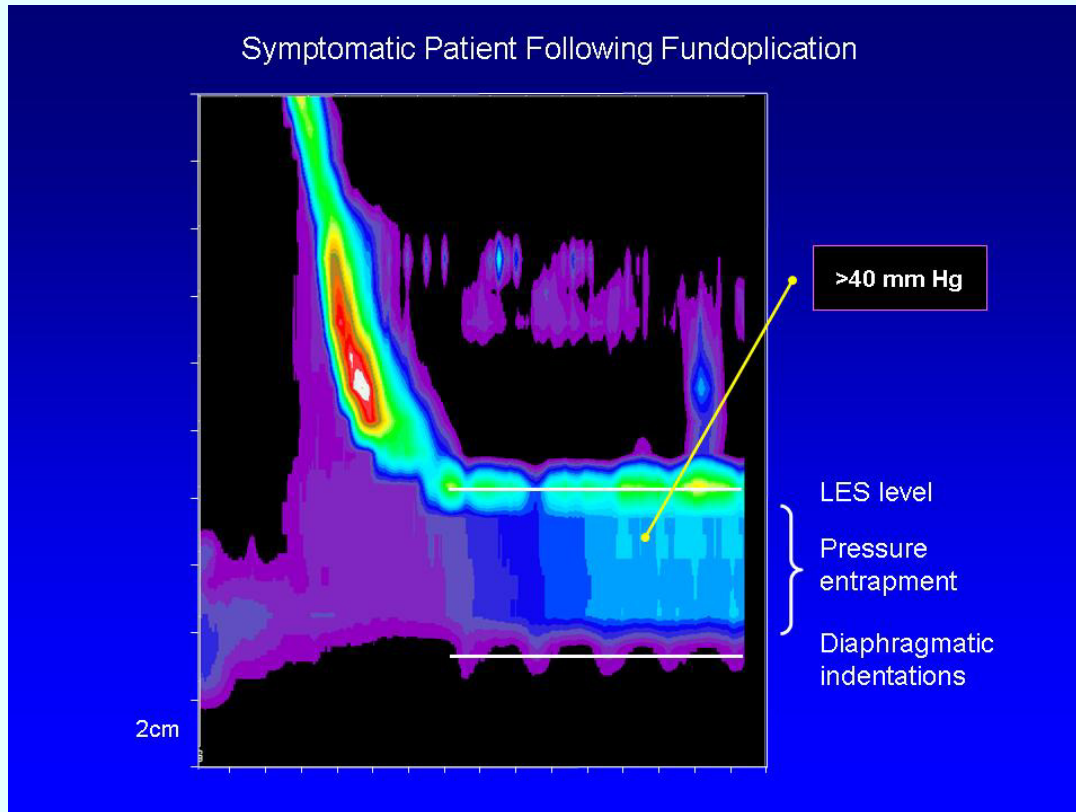


Isobaric contour representation of deglutitive UES relaxation.

UES relaxation of pre- and post-dilation [B.22]

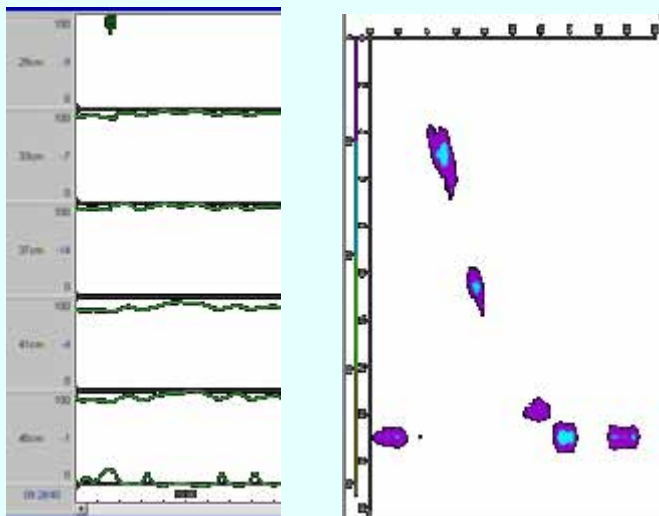


Nissen Fundoplication [A.1]



Detection of peristaltic fragments [A.2]

Detection of Peristaltic Fragments in “Aperistaltic” Conditions [A.2].



The classification of esophageal motility disorders in this document is according to the following authors.

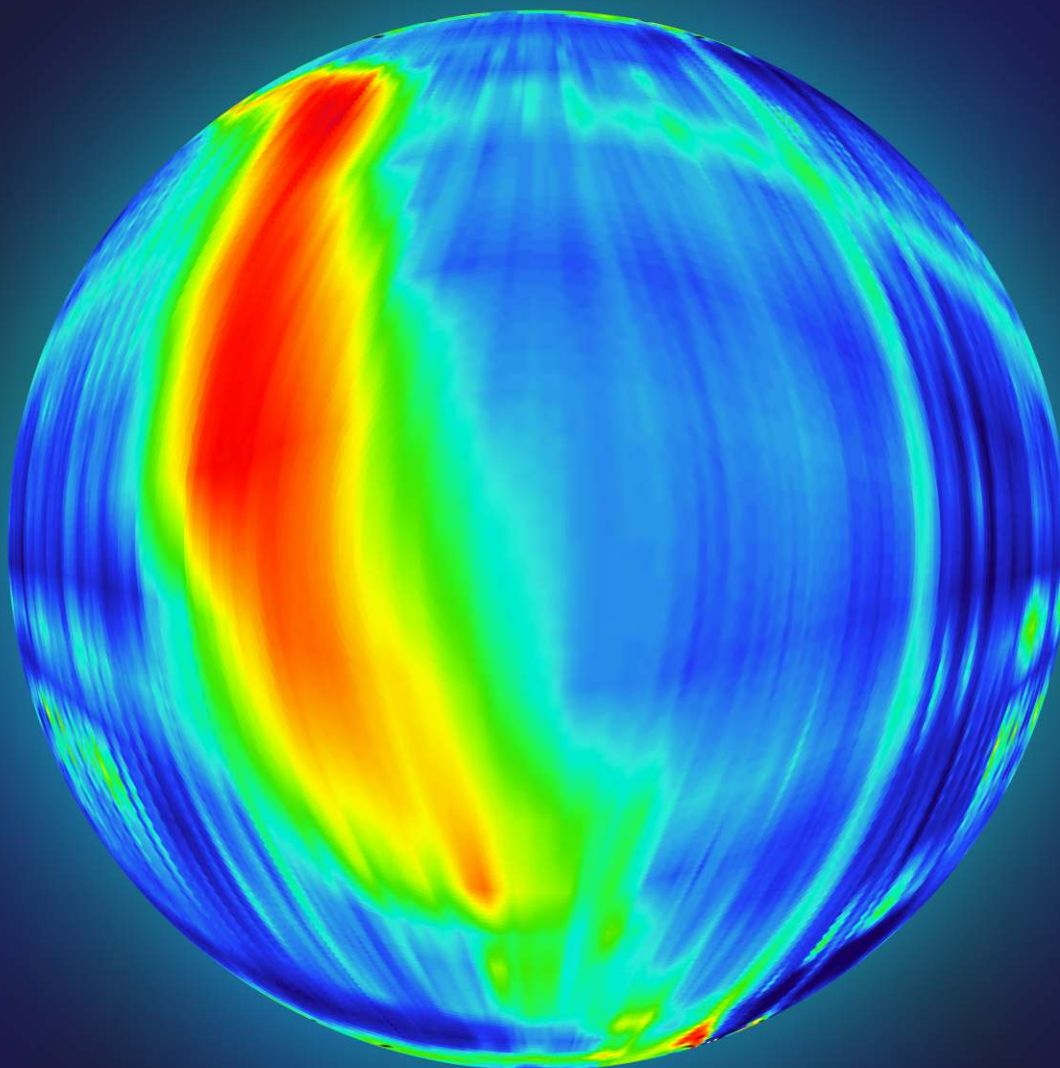
- A. Ray E. Clouse, Barnes-Jewish Hospital, St. Louis, MO, USA († 2007)
- B. Sudip K. Ghosh, University of Cincinnati, OH, USA



HRM system (water perfused)



HRM system (solid state)



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