• Over 23 million people in the world are afflicted with heart failure, many of whom suffer from GI symptoms, the pathology of which has not been adequately studied.

• In our previous research using a mouse model of increased vascular calcification, we uncovered a link between chronic HF and reduced GI motility.

• GI motility is controlled by interstitial cells of Cajal (ICC), the electrical “pacemaker” cells of the GI system.

• We established that mice affected by vascular calcification and HF have reduced slow wave amplitudes with preserved frequency.

• We wish to examine whether vascular calcification-induced HF is associated with loss of ICC or the connectivity of ICC networks, to determine whether this plays a role in GI dysmotility of these mice.

This image illustrates that the body works as a unit. Specifically, we should note how the sympathetic chain via branching neurons innervate the viscera, including the heart and GI organs. This connection may be explored when examining heart failure and GI motility.
Methods

Introduction

Results

Discussion

18-23 weeks old

Echocardiography to confirm Heart Failure

Dissection of WT and eTNAP

Wild Type eTNAP (endothelial Tissue Nonspecific Alkaline Phosphatase)

3D schematic of GI Tract:

Regions:
ICC – Myenteric Plexus (MY): responsible for slow wave activity (in SI & cecum)
ICC – Intramuscular Plexus (IM): responsible for neuromodulation of smooth muscle

Regions:

The 2 regions were mounted serosal side up. These sections of tunica mucosae of<br>antibody) and Alexa Flour 594 anti-rat (secondary antibody) and were stained with rat anti-c-kit (primary antibody). Samples were viewed under 20x objective. Images were viewed under 20x objective

Video: Olympus BX53 Upright Microscope: Visualization of ICC Networks

Whole Mount Sample Preparation

5x5 mm sections of SI, Cecum and Colon were flattened and mucosal layer was scraped off, leaving muscularis layer intact.

PBS solution

c-Kit Immunofluorescent Staining

Samples were stained with rat anti-c-kit (primary antibody) and Alexa Fluor 594 anti-rat (secondary antibody). These sections of tunica muscularis of the 2 regions were mounted serosal side up.

3D visualization of ICC Networks

C-kit Immunofluorescent Staining

Examining ICC Networks to Study the Effect of Calcification Induced Heart Failure on GI Dysmotility

Senayt Alemu OMS II, Saad Quadri OMS II, Olga V. Savino PhD

New York Institute of Technology College of Osteopathic Medicine, Old Westbury, NY

28-23 weeks old

Interactive!
Click on any of these bubbles to jump to each section

Heart Failure on GI Dysmotility
Examining ICC Networks to Study the Effect of Calcification Induced
When compared to WT mice, eTNAP mice had reduced body weight (p < 0.001), reduced left ventricular (LV) ejection fraction (p < 0.01) and increased LV mass index (p < 0.05).

Upon comparing the immunofluorescent images of c-kit antibody stained ICC networks between WT and eTNAP mice, we did not see any prominent changes in the ICC networks in the small intestine (SI) or the colon.

Quantitative Assessment of ICC Networks

Examining ICC Networks to Study the Effect of Calcification Induced Heart Failure on GI Dysmotility

New York Institute of Technology College of Osteopathic Medicine, Old Westbury, NY

Heart Failure on GI Dysmotility

Echocardiography Findings (Mean ± SD)

<table>
<thead>
<tr>
<th>Echocardiography</th>
<th>WT</th>
<th>eTNAP</th>
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<tbody>
<tr>
<td>CO, ml/min</td>
<td>18.6 ± 6.9</td>
<td>18.7 ± 4.7</td>
</tr>
<tr>
<td>LVPW/BW</td>
<td>0.030 ± 0.005</td>
<td>0.030 ± 0.005</td>
</tr>
<tr>
<td>LVM/BW</td>
<td>0.16 ± 0.01</td>
<td>0.13 ± 0.01</td>
</tr>
<tr>
<td>EF%</td>
<td>26.6 ± 3.3</td>
<td>29.6 ± 3.3</td>
</tr>
<tr>
<td>HR (bpm)</td>
<td>49 ± 15</td>
<td>49 ± 15</td>
</tr>
<tr>
<td>BW (g)</td>
<td>21.6 ± 1.3</td>
<td>21.6 ± 1.3</td>
</tr>
<tr>
<td>N</td>
<td>6</td>
<td>6</td>
</tr>
</tbody>
</table>

Interactive Table: Click on any of these bubbles to jump to each section.
HF.

The sympathetic nervous system is involved in the regulation of the heart rate, blood pressure, and smooth muscle tone. In the context of heart failure, sympathetic overactivity can lead to an increase in heart rate and a decrease in diastolic filling time, which can further exacerbate the condition.

The study suggests that as a consequence of vascular calcification-induced heart failure, the body reacts with sympathetic overactivity, which can lead to a decrease in smooth muscle tone and an increase in parasympathetic activity. This can result in an increase in heart rate and a decrease in diastolic filling, leading to further deterioration of heart function.

Further investigation into the role of the autonomic nervous system in the regulation of slow wave transmission could provide insights into the mechanisms of heart failure and potential therapeutic targets. The study highlights the importance of understanding the role of the autonomic nervous system in the regulation of smooth muscle tone and the potential implications for the development of heart failure.

Acknowledgment

We would like to thank our colleagues for their contributions to this study. The authors would like to acknowledge the support of the New York Institute of Technology College of Osteopathic Medicine, Old Westbury, NY.
Examining ICC Networks to Study the Effect of Calcification Induced GI Dysmotility

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