Determination of the Clinical Factors that Contribute to the Development of Microvascular Obstruction (MVO) Following STEMI

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Background - STEMI

Level 1 Database
n = 402

Normal

STEBMI
Background - What is Microvascular Obstruction (MVO)?

- MVO occurs frequently following STEMI (50% of patients)
- Characterized by damage and dysfunction of the myocardial microvasculature with a no-reflow phenomenon in the infarct zone (Abbas et al., 2015)
- Identified by cMRI
Background – Microvascular Obstruction (MVO) ctd

- cMRI is used to identify MVO
- Injection of gadolinium contrast agent
- MVO appears as a central dark focus within a site of myocardial infarct

No Reflow-phenomenon: from Current State of the Art to Future Perspectives, AIMS Medical Science, 2, 374-395, 2015-11-24, Valeria Paradisi, Filippo Masi, Francesco Bartolomucci, Alfredo Marchese, Armando Liso, Fabrizio Resta, Stefano Favale, Martino Pepe, medsci-02-00374,
Background – Causes of MVO

Intravascular Causes
- Distal embolization of atheromatous debris

Extravascular Causes
- Extrinsic compression of the microcirculation due to myocardial edema from ischemia and reperfusion injury
- Increased extravascular compressive forces (LVEDP)

Bulluck, Heerajnarain. (2017). Tissue characterisation by CMR in STEMI.
The development of MVO has become an important predictor of:
- Adverse LV Remodeling
- Heart Failure
- Other Major Adverse Cardiac Events (MACE)

We previously identified that MVO increases with LV mass and that there is a circadian distribution of its occurrence based on the time of coronary occlusion (Bonfig et al., AHA 2019)

More research is needed to evaluate the factors associated with the development of MVO!
Objectives

1. Estimate the association between clinical factors of interest and the odds of MVO development in STEMI.

2. Build a predictive model of MVO development and validate it using data from a cohort of patients.
Methods

**Retrospective Cohort Study**

Inclusion Criteria:
- Patients previously enrolled in clinical trials who have had STEMIs
  - STEMI MVO Database
  - Level 1 STEMI Program Database
- Patient had cMRI
- Age Range: > 18 years

**Patient Cohort**
- 402 Total Patients
  - 170 MVO Absent
  - 232 MVO Present

**What did we explore?**
- Patient Demographics
- Imaging Results
- Procedure Outcomes
- Medications
## Results - Demographics

<table>
<thead>
<tr>
<th>Demographics</th>
<th>MVO Absent (n=170)</th>
<th>MVO Present (232)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at STEMI</td>
<td>59 ± 11</td>
<td>59±12</td>
<td>0.99</td>
</tr>
<tr>
<td>Male</td>
<td>129</td>
<td>192</td>
<td>0.12</td>
</tr>
<tr>
<td>Female</td>
<td>41</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>91 ± 17</td>
<td>90 ± 17</td>
<td>0.88</td>
</tr>
<tr>
<td>Diabetes</td>
<td>27</td>
<td>39</td>
<td>0.91</td>
</tr>
<tr>
<td>Never Smoker</td>
<td>62</td>
<td>87</td>
<td></td>
</tr>
<tr>
<td>Former Smoker</td>
<td>60</td>
<td>95</td>
<td></td>
</tr>
<tr>
<td>Current Smoker</td>
<td>47</td>
<td>49</td>
<td>.27</td>
</tr>
<tr>
<td>White</td>
<td>156</td>
<td>218</td>
<td></td>
</tr>
<tr>
<td>Black/African American</td>
<td>5</td>
<td>5</td>
<td>.59</td>
</tr>
<tr>
<td>Hispanic or Latinx</td>
<td>5</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>
Results – Cardiac Markers of Infarct Size

**CK-MB, p<.001**

- **MVO Absent**: 124 ± 156
- **MVO Present**: 263 ± 199

**Troponin, p<.001**

- **MVO Absent**: 17 ± 31
- **MVO Present**: 70 ± 103
Results – MVO Increases with LV Mass (LVH)

Bonfig et al., AHA 2019
## Results - Medications

<table>
<thead>
<tr>
<th>Medication before STEMI</th>
<th>MVO Absent (n=170)</th>
<th>MVO Present (232)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anti-Platelet, n (%)</td>
<td>65 (38)</td>
<td>67 (29)</td>
<td>0.062</td>
</tr>
<tr>
<td>Anti-Coagulant, n (%)</td>
<td>8 (5)</td>
<td>6 (3)</td>
<td>0.280</td>
</tr>
<tr>
<td>ACE/ARB, n (%)</td>
<td>55 (32)</td>
<td>51 (22)</td>
<td>0.027</td>
</tr>
<tr>
<td>Ca Channel Blocker, n (%)</td>
<td>15 (9)</td>
<td>20 (9)</td>
<td>1</td>
</tr>
<tr>
<td>Nitrate, n (%)</td>
<td>14 (8)</td>
<td>15 (7)</td>
<td>0.63</td>
</tr>
<tr>
<td>Anti-Inflammatory, n (%)</td>
<td>25 (15)</td>
<td>19 (8)</td>
<td>0.057</td>
</tr>
<tr>
<td>Lipid Status (Statin), n (%)</td>
<td>56 (33)</td>
<td>58 (25)</td>
<td>0.10</td>
</tr>
</tbody>
</table>
Results – LVEDP (mmHg)

MVO Absent
- n=144
- 23 ± 8 mmHg

MVO Present
- n=184
- 26 ± 8 mmHg

p < .001
Conclusions

1. Minimizing MVO represents the most important remaining area in infarct size mitigation in STEMI

2. MVO is associated with greater infarct size and adverse LV remodeling

3. MVO is associated with increased LVEDP; suggesting the importance of extravascular compressive forces in causing MVO

4. MVO may be dependent on medications
Future Directions

1. Classify Anti-Inflammatory medications
2. Develop a predictive model for MVO
   • Infarct Size
   • Gender
   • LV mass
   • Time of STEMI
   • LVEDP
   • Medications
3. Further investigate additional clinical factors
Intern Experience

- Minnehaha Falls
  - “Zoom” Court
- Golfing!
- Lunch and Learns
- MHIF Visits
- Daily Check Ins
Future Plans

• Junior Year at Carleton College
  • Graduate in Spring 2022
  • B.A. in Chemistry and Sociology/Anthropology

Summer 2021
MHIF Summer Research Intern Part 2!

Medical School?
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