Cardiac MRI assessment of the effects of dietary Eicosapentaenoic acid (EPA) on the adverse consequences of sepsis

Amidou Traore, Thibault Leger, Guilhem Pages, Lucie Cassagnes, Kasra Azarnoush, Jean-Marie Bonny, Luc Demaison

To cite this version:
Amidou Traore, Thibault Leger, Guilhem Pages, Lucie Cassagnes, Kasra Azarnoush, et al.. Cardiac MRI assessment of the effects of dietary Eicosapentaenoic acid (EPA) on the adverse consequences of sepsis. Joint Annual Meeting ISMRM-ESMRMB, Jun 2018, Paris, France. 2018. hal-01824991

HAL Id: hal-01824991
https://hal.archives-ouvertes.fr/hal-01824991
Submitted on 27 Jun 2018

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L’archive ouverte pluridisciplinaire HAL, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d’enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.
CARDIAC MRI ASSESSMENT OF THE EFFECTS OF DIETARY EICOSAPENTAENOIC ACID (EPA) ON THE ADVERSE CONSEQUENCES OF SEPSIS

Amidou Traore\textsuperscript{a}, Thibault Leger\textsuperscript{b}, Guilhem Pagès\textsuperscript{a}, Lucie Cassagnes\textsuperscript{c}, Azarnoush Karsa\textsuperscript{d}, Jean-Marie Bonny\textsuperscript{a} and Luc Demaison\textsuperscript{b}

\textsuperscript{a} AgroResonance - UR 370 QuaPA, F-63122, Saint Genès Champagnene, France, \textsuperscript{b} UCA, UNH, CRNN, F-63000, Clermont-Ferrand, France, \textsuperscript{c} CHU, Department of diagnostic and interventional radiology, 63003 Clermont-Ferrand, France, \textsuperscript{d} Heart Surgery Department, CHU, Clermont-Ferrand, France

Aim

Severe sepsis is a serious syndrome requiring adequate medical care. It results in multi-organ damage with a significant toxicity during the early phase of sepsis, cardiac mechanical activity is increased, but it progressively declines until cardiac failure. In the Western societies, the consumption of omega-6 polyunsaturated fatty acids (PUFA) is too high whereas that of omega-3 PUFAs is too low. Yet the consequences of sepsis could be altered by PUFA-based diet which modulate the inflammatory process. The aim of this study was to determine the effects of a dietary based on eicosapentaenoic acid (EPA, C20:5 n3) a fatty of the n-3 series, on the adverse cardiac consequences of sepsis in a newly developed rat model of early onset sepsis induced by cecal ligation and puncture.

Material and Method

Cardiac MRI

One MRI imaging was carried out at 1.7T (500MHz) with a 72-mm inner diameter volume coil. Ten to 12 contiguous 1-mm slices were acquired to cover the heart from the base to the apex using short axis left ventricular (LV) bright blood imaging protocol based on the navigator self-gated FLASH sequence (TR/TE=6/2.5 ms, FA=8\textdegree, FOV=5x5 cm, 256x256 matrix, slice thickness 1 mm, oversampling 40\times reconstruction of 16 movies per slice. After imaging session, rats were euthanized and the heart removed for analysis of mitochondrial function.

Image analysis

After semi-automated segmentation of the LV (Fig. 1), using Segment software\textsuperscript{1}, the time evolution of EVD\textsubscript{V} (Fig. 2) were obtained. From this curve, morphological and functional parameters, i.e., end diastolic volume (EDV), end systolic volume (ESV), ejection fraction (EF), heart rate (HR) and cardiac output (CO), along with the contraction and relaxation rates, were then derived.

Results

<table>
<thead>
<tr>
<th></th>
<th>Rates of ATP synthesis (nmoles/min/mg of protein)</th>
<th>Lactate release to oxygen consumption ratio (moles/min/g/dry weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deficient sham operated</td>
<td>379 ± 4</td>
<td>0.144 ± 0.0110</td>
</tr>
<tr>
<td>Deficient and Septic</td>
<td>399 ± 58*</td>
<td>0.217 ± 0.0340*</td>
</tr>
<tr>
<td>EPA sham operated</td>
<td>411 ± 47</td>
<td>0.1391 ± 0.0199</td>
</tr>
<tr>
<td>EPA septic</td>
<td>416 ± 35</td>
<td>0.1713 ± 0.0175</td>
</tr>
</tbody>
</table>

Discussion and conclusion

That sepsis tended to increase the rate of contraction indicates that the pathology was in its early hyperdynamic phase with an activation of cardiac function. Since in omega-3 deficient animals, early sepsis induced drop in mitochondrial respiration (p < 0.001) compared to control rats, with no difference observed in EPA animals, the absence of difference in MRI global cardiac function in septic rats may be attributed to the activation of the anaerobic ATP production in the deficient group compensating the decrease in mitochondrial activity and maintaining the cardiac mechanical activity.

---

\textsuperscript{1} http://segment.heiberg.se Riegler, J. et al. (2010)