The amount of SHED blood and Immunological response

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The amount of SHED blood and Immunological response

- “Is there a correlation between the volume cardiotomy suction, “SHED blood” and the immunological response after CPB?”

  Master project in the Perfusion school in Aarhus 2009

  AND

- Can filtering of the “SHED-blood”, with a leukocyte depleting filter, limiting the immunological response after CPB?

  University hospital. Linkoping 2011
The amount of SHED blood and Immunological response

SHED blood is well described with Cardiac surgery using cardiopulmonary bypass (CPB) and provokes a systemic inflammatory response, mainly triggered by

- artificial surfaces of the extracorporeal circuit
- blood contact with endothelia in the pericardial area

SHED blood in more complicated cardiac surgery can be large volumes and can be highly activated and this SHED blood is transfused directly into the CPB-circuit.
When the inflammatory response is activated, pro-inflammatory cytokines releases, for example interleukins etc

- IL1, IL6, IL8, IL12 and TNFα

These cytokines, the most important inflammatory messenger in acute infection, provide very quick response to endothelial damage and triggers the immune system into action.
AIM.

The aim of these studies was to investigate if there was a correlation between the amount of "SHED blood" from the pericardial area and the immunological response in patient after CPB.

Can a leukocyte depleting filter, on the coronary suction, limiting the immunological response in the patient after CPB.
Material and Methods:

We included prospectively totally 40 patients which would undergo elective surgery with a combination of CABG and valve replacement/repair or double valve surgery or more in our department of cardiovascular surgery from 2008-2010.

- NFILT (n=20)
- FILT (n=20)

Exclusion criteria were emergency surgery, preoperative use of steroids, non-steroidal anti-inflammatory drugs or other immunosuppressive drugs.
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**Table 1. Demographic data – mean(range)**

<table>
<thead>
<tr>
<th></th>
<th>NFILT-group</th>
<th>FILT-group</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Numbers</strong></td>
<td>19*</td>
<td>19**</td>
</tr>
<tr>
<td><strong>Age (Year)</strong></td>
<td>69.6 (52 – 81)</td>
<td>68.9 (51 – 82)</td>
</tr>
<tr>
<td><strong>Gender (Male/Female)</strong></td>
<td>14 / 6</td>
<td>13 / 7</td>
</tr>
<tr>
<td><strong>BSA (m2)</strong></td>
<td>2.02 (1.44 – 2.37)</td>
<td>1.96 (1.69 – 2.25)</td>
</tr>
<tr>
<td><strong>Euroscore</strong></td>
<td>6.15 (2 – 11)</td>
<td>6 (2 – 10)</td>
</tr>
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</table>

* 1 patient excluded due to SHED volume out of measuring

** 1 patient excluded due to preoperative NSAID use
In the NFILT group we measured the amount of SHED blood. We used a separate cardiotomy reservoir with 30 mikrom filter for collecting the SHED blood and measure the amount before transfuse it to the circuit.

In the FILT group we used the same reservoir as in NFILT group for measuring the amount of SHED blood, but filtered this blood through a leukocyte depleting filter, before transfusing it to the circuit.
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The immunological blood samples that we analysed were

- CRP
- Leukocytes
- Pro-inflammatory cytokines,
  - Tumor Necrosis Factor alfa (TNFα)
  - Interleukin 6 (IL6).

Blood samples were taken via the arterial line, at two occasions, the first sample at the beginning of anaesthesia and the second sample after discontinuing CPB.
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Results
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The amount of measured SHED blood from the pericardial area varied during these study surgical procedures.

Figure 1. Volume SHED blood per patient

In the NFILT group, from 0,6 Litres up to 8,2 L, with a mean at 2,7 L

In the FILT group from 0,55 Litres to 9,1 L with a mean at 2,8L
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Figure 2. SHED blood volume

- Double (n=14)
- Triple (n=5)
- >Triple (n=1*)
- Double (n=12)
- Triple (n=5)
- >Triple (n=3)

Legend:
- Post X-clamp
- Per X-clamp
- Pre X-clamp

NFILT
FILT

8/16/2012
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Table 2. Hematological blood analyses - Mean(Range)

<table>
<thead>
<tr>
<th>Analyses</th>
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<th>FILT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-CPB</td>
<td>Post-CPB</td>
</tr>
<tr>
<td>Hb</td>
<td>130 (102-160)</td>
<td>98 (79-121)</td>
</tr>
<tr>
<td>EVF</td>
<td>39 (29-48)</td>
<td>29 (22-36)</td>
</tr>
<tr>
<td>Albumin</td>
<td>36 (31-42)</td>
<td>24 (21-28)</td>
</tr>
</tbody>
</table>
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Table 3. Postoperative Immunological analyses (mean, (range))

<table>
<thead>
<tr>
<th>Analyses</th>
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<th>FILT</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRP</td>
<td>&lt;10</td>
<td>&lt;10</td>
</tr>
<tr>
<td>LPK</td>
<td>14.47 (6.4-31.1)</td>
<td>14.54 (6.9-20.3)</td>
</tr>
<tr>
<td>IL 6</td>
<td>60.75 (9.57-136.69)</td>
<td>98.56 (26.09-267.54)</td>
</tr>
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</table>
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Figure 3. Inflammatory mediators (LPK against Volume)
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Figure 4. Immunological mediators IL6 against Volume
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Figure 5. Immunological mediators TNFα against Volume
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Conclusion

- To begin with, we noticed that more complicated heart surgery gives very variable amounts of "SHED blood" in the coronary suction from the pericardia area.

- In NFILT group we note a tendency towards a correlation between the amount of "SHED blood" and the immunological response in IL6 and TNFα, but in this study it is not significant.

- Finally in FILT group, we note that a leukocyte depleting filter, on the coronary suction, may have a limiting effect on the immunological response in patients, as regards LPK and TNFα, again not significant.

………but we believe