HUMORAL AND CELLULAR IMMUNE RESPONSE INDUCED BY NOVEL SARS-COV-2 VACCINES

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Background – COVID pandemic

• Severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2)

• 2020- global public health crisis

• Respiratory symptoms, multi-organ manifestations

• No effective treatment

• Vaccine development – different platforms
COVID-19 vaccines used in Hungary

• Inactivated $\rightarrow$ whole virus
• mRNA and vector $\rightarrow$ spike protein

• Spike protein binds to ACE2 receptor on the target cells
• Neutralizing antibodies are directed against Spike1 protein RBD
Investigation of the immune response after vaccination

<table>
<thead>
<tr>
<th>Investigated groups</th>
<th>Number of collected samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>mRNA-based vaccine (Pfizer-Biontech)</td>
<td>106</td>
</tr>
<tr>
<td>vector vaccines (AstraZeneca, Sputnik V)</td>
<td>77</td>
</tr>
<tr>
<td>inactivated virus vaccine (Sinopharm)</td>
<td>34</td>
</tr>
<tr>
<td>unvaccinated healthy</td>
<td>9</td>
</tr>
<tr>
<td>unvaccinated PCR-confirmed disease-experienced</td>
<td>29</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>255</strong></td>
</tr>
</tbody>
</table>

Peripheral blood samples were taken 2-3 months after second vaccination/infection
Measurement of the IgG antibodies directed against the spike protein of SARS-CoV-2

The mRNA vaccine induced the highest anti-SARS-CoV-2 S1 IgG antibody production

<table>
<thead>
<tr>
<th>Group</th>
<th>mRNA</th>
<th>Vector</th>
<th>Inactivated Virus</th>
<th>Unvaccinated, Disease- Experienced</th>
</tr>
</thead>
<tbody>
<tr>
<td>IgG pos%</td>
<td>95.88</td>
<td>87.67</td>
<td>58.06</td>
<td>69.23</td>
</tr>
<tr>
<td>IgG neg%</td>
<td>4.12</td>
<td>12.33</td>
<td>41.94</td>
<td>30.77</td>
</tr>
</tbody>
</table>

The measurements were performed using the Euroimmun ELISA technique.
Examination of the neutralizing antibody against SARS-CoV-2 spike protein

The mRNA and vector vaccine groups had the highest amount of neutralizing antibody

NeutraLISA –ACE2 receptor S1 RBD inhibition assay (Euroimmun)
Investigation of the SARS-CoV-2 S1 protein specific T cell immune response

The mRNA and vector vaccines induced as high IFN-gamma production as the natural infection

SARS-CoV-2 S1 protein specific T cell IFN-gamma release assay (IGRA) (Euroimmun)
Conclusion 1.

• The mRNA-based vaccine induced the highest anti-SARS-CoV-2 antibody level

• The mRNA and vector vaccines showed similarly good results in the cellular response and neutralizing antibody production

• Lower effectiveness of the inactivated virus vaccine may be due to the vaccine components and older age of the recipients
Background – natural autoantibody

• Personalized natural autoantibody network
• First line of defense, maintainence of the immune homeostatis
• Recognizing evolutionarily conserved structures → protection against autoimmunity
• Autoimmune phenomena → molecular mimicry
• Possible connection between vaccine/infection induced humoral response and natural autoantibodies
Measurement of anti-citrate synthase (CS) natural autoantibody in anti-SARS-CoV-2 IgG positive and negative groups

Total cohort

mRNA vaccine

SARS-CoV-2 IgG positive group had higher anti-CS IgG autoantibody level
Level of natural autoantibody against Heat shock protein (Hsp) 60 in anti-SARS-CoV-2 IgG positive and negative groups

In the SARS-CoV-2 IgG positive group anti-Hsp60 IgG autoantibody level was higher

Anti-Hsp60 IgG autoantibody in-house ELISA
Investigation of natural autoantibody against Hsp70 in anti-SARS-CoV-2 IgG positive and negative groups

In the SARS-CoV-2 IgG positive group showed higher anti-Hsp70 IgG autoantibody level

Anti-Hsp70 IgG autoantibody in-house ELISA
Final conclusion

• The mRNA vaccine elicited the strongest humoral and cellular immune responses against the spike protein of SARS-CoV-2

• COVID-19 vaccine or SARS-CoV-2 infection induced IgG isotype antibodies positively correlated with natural autoantibody levels

• The natural autoantibodies may serve as potential screening targets to predict the strength of antigen-induced immune response
Thank you for attention!

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