Plasmapheresis in a wide range of diseases.

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Reanimatology

- Purulent-septic complications
- Pancreatitis, Peritonitis
- Traumas, Burns, Poisonings
- Infectious diseases
- Respiratory distress syndrome
- Multiple organ insufficiency
Aggravation

The main reason of aggravation is the syndrome of endogenous intoxications with secondary immune suppression.
Pathogenic factors of endotoxicosis

1. Bacterial endo- and exogenous toxins.

2. Inflammatory toxic metabolites.

3. Activation of proteolysis.

4. Activation of lipid peroxydation and decrease of anti-oxidation protection.

5. Middle molecular weight compounds (oligopeptides).

Complications of endotoxicosis

• 1. Increased vascular permeability (microvascular leaking).

• 2. Hypoproteinemia, hypooncotics, hypovolemia.

• 3. Toxic pulmonary edema – respiratory distress syndrome, acute respiratory insufficiency.

• 4. Disseminated intravascular coagulations syndrome.
Detoxication vs. Crisis

• In this situation *only detoxication* both with toxins and other pathological products removal allows to deal with crisis in the course of the illness.
Plasmapheresis

• The leading role belongs to plasmapheresis, which allows (together with endotoxins elimination) to replace removed plasma volume with donor plasma.
## Severity stages of RDS and treatments methods (n - patients)

<table>
<thead>
<tr>
<th>Stage severity RDS</th>
<th>Convenient treatment</th>
<th>Detoxication</th>
<th>Σ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate</td>
<td>52</td>
<td>47</td>
<td>99</td>
</tr>
<tr>
<td>Severe</td>
<td>15</td>
<td>29</td>
<td>44</td>
</tr>
<tr>
<td>Extremely severe</td>
<td></td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Σ</td>
<td>67</td>
<td>86</td>
<td>153</td>
</tr>
</tbody>
</table>
Results

In moderate RDS group there were no lethal outcomes.

The duration of hospital stay was significantly lower for patients who underwent detoxication than for the ones of control group (28.9±1.5 versus 40.3±3.3 days; p < 0.05), and there were no destructive processes in lungs.
Lethality rate in different severity stages of respiratory distress syndrome and treatments methods

<table>
<thead>
<tr>
<th>Stage severity RDS</th>
<th>Convenient treatment</th>
<th>Detoxication</th>
<th>ECMO Detoxication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Severe</td>
<td>73.33%</td>
<td>31.03%</td>
<td></td>
</tr>
<tr>
<td>Extremely severe</td>
<td></td>
<td></td>
<td>30%</td>
</tr>
</tbody>
</table>
Acute Lymphocytic Leukemia, Sepsis, Multiorgan failure
Dasha on her way to recovery
Autoimmune Illnesses

Accumulation of:

- autoantibodies,
- allergens,
- immune complexes,
- cytokines
- others pathological metabolites,

Define the severity and irreversibility of their course
The possibilities of plasmapheresis

It is possible to remove

- autoantibodies,
- cytokines,
- allergens,
- and immune complexes

during allergies and autoimmune diseases

*only with the help of Plasmapheresis*
A Course of Plasmapheresis

• A course of Plasmapheresis
• 4 procedures per 1-2 days.
• During one procedure we removed 700-900 ml of plasma.
• Replacement solutions were crystalloids only.
• Next course in 6 months.
Success of Plasmapheresis
Values of immunoglobulines during course of plasmapheresis

<table>
<thead>
<tr>
<th></th>
<th>IgA</th>
<th>IgG</th>
<th>IgM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Donors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before PA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>After PA</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- IgA
- IgG
- IgM
Values of circulating immune complexes during course of plasmapheresis and in a week
Values of circulating immune complexes during treatment (basic group)

1, 2, 3 – Courses of plasmapheresis. Intervals in 6 months.
Values of circulating immune complexes during treatment
Values of cytokines during course of plasmapheresis and in 6 months

- TNF
- IFN
- IL10

- Before PA
- After PA
- In 6 months
Remission

With the help of plasmapheresis it is possible to achieve more sustained remission with reduced doses of steroids at 40%
Daily doses of corticosteroids

Before treatment

In 6 months

Basic group

Control group
Atherosclerosis

Elimination of products of lipid metabolic disturbances allows to control development of atherosclerosis and its complications.
ANTIPHOSPHOLIPID SYNDROME

Anticardiolipline antibody
Antiprotrombine antibody
Antibody against β2-glicoprotein 1

Platelets aggregation
High level of D-Dimer
Hypercoagulation
Thrombosis of coronary vessels
CASCADE PLASMAPHERESIS

<table>
<thead>
<tr>
<th></th>
<th>Orig.</th>
<th>Flitrate</th>
<th>Concentr.</th>
<th>After CPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cholesterol</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LDL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TG</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>K ater.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Plasmapheresis eliminates serious toxic effects of radio- and chemotherapy in oncology.
## COMPLICATIONS DURING RADIATION THERAPY OF PANCREATIC CANCER

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Radiation therapy + plasmapheresis (n=22)</th>
<th>Radiation therapy (n=39)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nausea/vomiting</td>
<td>4 (18%)</td>
<td>21 (54%)</td>
</tr>
<tr>
<td>Weight loss</td>
<td>9 (41%)</td>
<td>34 (87%)</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>-</td>
<td>5 (13%)</td>
</tr>
<tr>
<td>Anorexia</td>
<td>-</td>
<td>10 (25%)</td>
</tr>
<tr>
<td>Anemia &lt; 95 g/l</td>
<td>-</td>
<td>6 (15%)</td>
</tr>
<tr>
<td>Leucopenia &lt;3x10⁹/л</td>
<td>-</td>
<td>13 (33%)</td>
</tr>
<tr>
<td>Thrombocytopenia</td>
<td>-</td>
<td>3 (8%)</td>
</tr>
<tr>
<td>Fever &gt; 38⁰C</td>
<td>-</td>
<td>3 (8%)</td>
</tr>
<tr>
<td>Blood transfusion, platelets suspensions</td>
<td>-</td>
<td>8 (21%)</td>
</tr>
<tr>
<td>Interruption of ЛТ</td>
<td>-</td>
<td>4 (10%)</td>
</tr>
</tbody>
</table>
LEVELS OF CYTOKINES DURING PLASMAPHERESIS

-5  5  15  25  35  45  55  65  75
TNF  IL2  IFN

original  After PA  After LAC
SOCIAL SIGNIFICANCE

High efficiency shown in cases of chronic intoxication, including drug addition and alcoholism. It is proven that there is not only medical, but also high social significance.
OBSTETRICS PROBLEMS

Great perspectives are present during the treatment of pregnancy toxemia, the Rh-incompatibility, “hidden” genital infections, antiphospholipidic syndrome with recurrent pregnancy loss and reliably help to prevent the disturbances of fetal development.
PREECLAMPSIA

- Endotoxicosis
- Medium molecular oligopeptides
- Violation of vascular permeability
- Toxic interstitial edema
- Proteinuria, hypoproteinemina
- Chronic DIC
- Violations of the placental circulation
- Endotoxicosis and Fetal hypoxia
ECLAMPSIA

- Endotoxicosis
- Violations of vascular permeability
- Hypoproteinemia, hypovolemia
- Toxic pulmonary edema (RDS, ARF)
- Acute renal failure (anuria)
- Acute liver failure
- Toxic encephalopathy (coma)
- Toxic myocarditis
- Unstable hemodynamics
- DIC
ECLAMPTIC COMA, MULTIORGANIC FAILURE
2 DAYS AFTER...
SYNDROME OF HIDDEN GENITAL INFECTIONS

- Placentitis
- Violations of the utero-placental circulation
  - Amnionitis, hydramnion
- Hypoxia and intrauterine fetal growth retardation
  - Miscarriage
- Intrauterine fetal death
Rh CONFLICTS

Rh-negative mother
Rh-positive fetus
Mother’s antibodies - fetal red blood cells
Hemolytic disease of fetus
Hemolytic jaundice
Intrauterine fetal growth retardation
Hepatopathy, encephalopathy
Intrauterine death
INFERTILITY

- Habitual miscarriage -
  - Antiphospholipid syndrome
  - "Hidden" genital infection
  - Endometriosis
- Gonad-and embryotoxic toxicants
- Women isoimmunization to sperm
- Men isoimmunization to their own sperm
Antiphospholipid syndrome

- Damaged endothelium
- Thrombosis (placenta, umbilical cord)
- Hypoxia and fetal malnutrition
- Intrauterine growth retardation
- Habitual miscarriage
- Premature delivery
- Intrauterine fetal death
# Cholestatic hepatosis

**Traditional therapy (n = 44)**

<table>
<thead>
<tr>
<th>Indexes</th>
<th>Norm</th>
<th>Desease onset</th>
<th>Before delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPT (un/L)</td>
<td>5-30</td>
<td>60.03±14.01</td>
<td>134.50±14.74 ***</td>
</tr>
<tr>
<td>GOT (un/L)</td>
<td>5-35</td>
<td>57.44±14.41</td>
<td>87.41±8.93</td>
</tr>
<tr>
<td>Bilirubin (mcM/L)</td>
<td>3-20</td>
<td>15.22±0.95</td>
<td>22.49±1.72 ***</td>
</tr>
<tr>
<td>CAP (un/L)</td>
<td>80-270</td>
<td>278.00±28.52</td>
<td>478.50±58.28 ***</td>
</tr>
<tr>
<td>Cholesterol (mM/L)</td>
<td>&lt; 5.5</td>
<td>6.52±0.38</td>
<td>7.45±0.31</td>
</tr>
</tbody>
</table>

*** - p < 0.001
Membrane plasmapheresis effect at cholestatic hepatitisosis (n=34)

<table>
<thead>
<tr>
<th>Indexes</th>
<th>Norm</th>
<th>Before plasmapheresis</th>
<th>After plasmapheresis</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPT (un/L)</td>
<td>5-30</td>
<td>269.2±30.14</td>
<td>73.06±11.36 ***</td>
</tr>
<tr>
<td>GOT (un/L)</td>
<td>5-35</td>
<td>175.3±25.51</td>
<td>49.38±8.88 ***</td>
</tr>
<tr>
<td>Bilirubin (mcM /L)</td>
<td>3-20</td>
<td>26.11±3.06</td>
<td>11.78±0.70 ***</td>
</tr>
<tr>
<td>CAP (un/L)</td>
<td>80-270</td>
<td>543.00±48.34</td>
<td>427.80±48.30</td>
</tr>
<tr>
<td>Cholesterol (mM/L)</td>
<td>&lt; 5.5</td>
<td>7.34±0.26</td>
<td>5.44±0.27 ***</td>
</tr>
</tbody>
</table>
## Cholestatic hepatosis
### pregnancy outcome

<table>
<thead>
<tr>
<th>Pregnancy complications</th>
<th>Without plasmapheresis (n=44)</th>
<th>With plasmapheresis (n=34)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Premature delivery</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Caesarian</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>Fetal hypoxia</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>Fetal hypotrophy</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>Chronic fetoplacental insufficiency</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>Antenatal fetal death</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Uterine inertia</td>
<td>12</td>
<td>0</td>
</tr>
</tbody>
</table>
Cholestatic hepatosis
Neonatology

Indications to plasmapheresis:

- Hemolytic fetus disease
- Complicated intra-uterine infection
- Septic complications
- Respiratory distress syndrome
- Consequences of severe asphyxia
MEMBRANE PLASMAPHERESIS ON NEWBORN 1,5 kg WEIGHT
Daniel after 3 months
After viral hepatitis, especially HCV, autoimmune chronic hepatitis is inevitably formed with next follow-up into irreversible hepatic cirrhosis. With the help of plasmapheresis it is possible to stop this progression of hepatic injury.
DIABETES

It is possible to prevent the secondary diabetic metabolic disturbances which lead to irreversible blindness, vascular occlusive disorders of the low limbs, heart and brain.
DIABETIC FOOT
AFTER COURSE OF MEMBRANE PLASMAFHERESIS
There is a long list of other human diseases for which *plasmapheresis* can considerably raise treatment efficiency and really find more and more wide application in Russian clinical practice.
Thank you for your attention