Continuous Hemodiafiltration with a Cytokine-Adsorber During Sepsis

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Disclosure

Speaker contract with CytoSorbents Europe
Introduction

• Sepsis is a well-recognized worldwide healthcare issue, ultimately resulting in significant mortality, morbidity and resource utilization during and after critical illness.
• Although mortality related to severe sepsis and septic shock have reduced slightly in the past decade, it remains more than 20%.
Causes of Sepsis

• Bacterial infections are the most common cause of sepsis, but sepsis can also be caused by fungal, parasitic, or viral infections

• The infection can originate from anywhere in the body
Causes of Sepsis

Sepsis
Systemic inflammatory response syndrome (SIRS) resulting from infection (bacterial, viral, fungal, or parasitic)

Severe Sepsis
Sepsis associated with at least one acute organ dysfunction, hypoperfusion, or hypotension

Death

Multiple Organ Dysfunction Syndrome (MODS)
Presence of altered function of two or more organs in an acutely ill patient, such that homeostasis cannot be maintained without intervention

Septic Shock
Sepsis with hypotension, despite adequate fluid resuscitation, along with the presence of perfusion abnormalities or organ dysfunction
Risk factors for developing sepsis

• Elderly
• Newborn
• Chronic illnesses such as Diabetic, cancer
• Immunocompromised such as after organ transplant, Splenectomy or those with HIV or AIDS
• Patients receiving immunosuppressive therapy such as chemotherapy
• Malnourished
• Debilitated patients
# Systemic Inflammatory Response Syndrome

**Criteria for the systemic inflammatory response syndrome (SIRS)**

Two or more of the following:

- Temperature > 38°C or < 36°C
- Heart rate > 90 beats/min
- White blood cell count (WBC) > 12 K or < 4 K, or >10% bands
- Respiratory rate > 20 or PaCO$_2$ < 32 mmHg
CytoSorb- Adsorber

1. Extracorporeal cytokine adsorber, approved in the European Union and broadly indicated for use in any clinical situation where cytokines are elevated

2. Represents a potentially major advance in the control of deadly inflammation in critically-ill patients and those undergoing complex cardiac surgery
CytoSorb-Adsorber

<table>
<thead>
<tr>
<th>Technical data of the CytoSorb® adsorber according to the manufacturer information</th>
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<tbody>
<tr>
<td>Extracorporeal blood volume:</td>
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<tr>
<td>Blood flow rates min-max:</td>
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<tr>
<td>Max. treatment duration:</td>
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<tr>
<td>Anticoagulation:</td>
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<td>Sterilization:</td>
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<td>Further details:</td>
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<td>Storage conditions:</td>
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CytoSorb-Adsorber
Case Study 1

Admission of a 72-year-old patient on March 19, 2016:
Scalding during cooking

Diagnosis:
2a-2b gradual scalding of 8% body surface

Affected areas:
Thorax on the right, back, thigh on both sides, Buttocks on both sides, right foot, lower left leg
Secondary diagnoses

- Parkinson's disease of the akinetically-rigid type stage III with dysarthrophonia
- Omarthrosis on both sides
- Coronary heart disease
**Operations**

**Day 2:** Tangential debridement of the left thigh grafted with split skin graft

**Day 5:** Puncture tracheotomy
Course of IL-6

ng/l

0 50 100 150 200 250 300

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29
Course of IL-10
Case Study 2

Admission of a 47-year-old patient on March 11, 2014:
Pneumococcal sepsis with intravascular coagulation

**Diagnosis:**
Waterhouse Friderichsen syndrome after dental treatment in pneumococcal sepsis
Condition after splenectomy after two-time splenic rupture after traffic accident 1989

**Affected areas:**
Both feet and lower legs, right hand
History diagnostics

- Catecholamine-compulsorily circulatory insufficiency
- Pneumonia (3 MRGN Pseudomonas)
- Transfusion-related anemia and thrombocytopenia in disseminated intravascular coagulation
- Herpes Simplex Infection
Operations

**Day 7:** Amputation in the area of both lower limbs in the middle third with septic microembolism of both feet and lower limbs

**Day 10:** Debridement in the area of the right lower limb

**Day 20:** Revision of both stumps and defect cover with split-thickness skin graft, amputation of the right thumb
Operations

**Day 28:** Debridement of the right hand and secondary closure

**Day 35:** Debridement, residual defect cover on both lower limb stumps with split-thickness skin graft
Course of IL-6
Course of IL-10
Case Study 3

Admission of a 21-year-old patient on 06.03.2014, 0.30 am:
Apartment fire with explosion

Diagnosis:
2b-3 graded burn of 60% body surface

Affected areas:
Arms on both sides, face, thorax, back, thigh on both sides, genitalia

Inhalation trauma second grade (bronchoscopically secured)
Secondary diagnoses

- Depression
- Epilepsy
- Well-known drug abuse (Crystal Meth)

History diagnostics
- Thigh thrombosis left
- Heparin-induced thrombocytopenia (HIT)
Operations

Day 2: Epifascial debridement, MEEK 1:6/1:4 Abdomen and upper arm on both sides, ventral thorax and lower arms on both sides

Day 4: Epifascial debridement back, lower arms on both sides and MEEK transplant 1:4 on the back and 1:3 lower arms on both sides

Day 7: Tangential debridement of both hands, split-thickness skin graft 1:1.5, tangential debridement, thigh left with split-thickness skin graft 1:5, tangential debridement thigh right with MEEK transplant 1:4/1:3, split-thickness skin graft 1:1.5
Operations

**Day 16:** Epifascial necrectomy neck, groin region on the right, covering with 1:1 split-thickness skin graft

**Day 22:** Tangential debridement back, shoulders on both sides, thorax, axillae on both sides, left upper arm and cover by cultivated keratinocytes

**Day 27:** Tangential debridement of the remaining necrosis on both arms

**Day 31:** Tangential debridement back, shoulder, arms on both sides, split-thickness skin graft 1:3
<table>
<thead>
<tr>
<th>Day</th>
<th>Germ</th>
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<tbody>
<tr>
<td>6</td>
<td>Candida albicans</td>
</tr>
<tr>
<td>16</td>
<td>Stenotrophomonas maltophilia</td>
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<tr>
<td>16</td>
<td>Enterobacter cloacae</td>
</tr>
<tr>
<td>19</td>
<td>Acinetobacter baumannii (4MRGN)</td>
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<tr>
<td>19</td>
<td>Green Streptococci</td>
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<tr>
<td>19</td>
<td>Coagulase negative staphylococci</td>
</tr>
<tr>
<td>36</td>
<td>Staphylococcus aureus</td>
</tr>
<tr>
<td>36</td>
<td>Klebsiella pneumoniae (3MRGN)</td>
</tr>
<tr>
<td>48</td>
<td>Klebsiella pneumoniae (4MRGN)</td>
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</tbody>
</table>
Course of cytokines

Measured cytokines:
1. Proinflammatory: IL-6
2. Anti-inflammatory: IL-10
Interleukin 6

ng/l

0 500 1000 1500 2000 2500 3000 3500 4000

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42

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Interleukin 10

pg/ml

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Use of the CytoSorb-Adsorber
Discussion

• CytoSorb seems effective in reducing postoperative systemic inflammatory response syndrome
• In the present study, a successful outcome in a case of septic shock and multiorgan failure where CytoSorb was used as an adjuvant therapy is reported
• CytoSorb therapy in septic shock patients with multi-organ failure might be an option as rescue therapy
• However, further studies with prospective randomized control design would be necessary to establish the benefit of this therapy as an adjuvant treatment in septic shock
Conclusion

• Treatments have been considered safe and well-tolerated
• CytoSorb significantly reduced IL-6, a predictor of mortality in sepsis and surrogate for cytokine storm
• Improved hemodynamics as evidenced by a reduction in noradrenaline and a significant impact on the patients survival time
References


Thank you!

Bergmannstrost
BG Klinikum Halle

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