pocard
SINCE 1992

Adsorption column

TOXIPAK®

for endotoxin removal

POCARD Ltd.
Technopark «Orbita-2»,
building 20/1, Kulakova str., Moscow,
121552, Russia
phone: +7 (499) 550 92 45
e-mail: info@pocard.ru
www.eng.pocard.ru

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Sepsis is a life-threatening condition that develops when the body's response to infection leads to damage to its own tissues and organs. Hyperinflammation, which is directly interrelated with DAMPs (Damage-associated molecular patterns) and PAMPs (Pathogen-associated molecular patterns) plays an extremely important role in pathogenesis.

Lipopolysaccharide (LPS) is an endotoxin, a component of the wall of gram–negative bacteria, which monomer usually ranges from 10 to 70 kDa. In the bloodstream endotoxin is found in the form of associates with a size of 1000 kDa. Therefore, the optimal removal of endotoxin is achieved with selective LPS adsorption. LPS is also PAMPs and a powerful inducer of inflammation, which plays an important role in the development of gram-negative sepsis. In this connection, the visual removal of LPS from the systemic bloodstream (the procedure of selective hemosorption of lipopolysaccharides) can be considered a part of the complex therapy of sepsis.

The procedure of selective LPS adsorption makes it possible to effectively remove circulating lipopolysaccharide molecules from the patient's blood. The procedure is performed as a part of the complex therapy of sepsis:

- surgical control of the source of infection;
- antibiotic therapy;
- infusion-transfusion and vasopressor therapy!

The following factors may indicate to gram - negative sepsis:

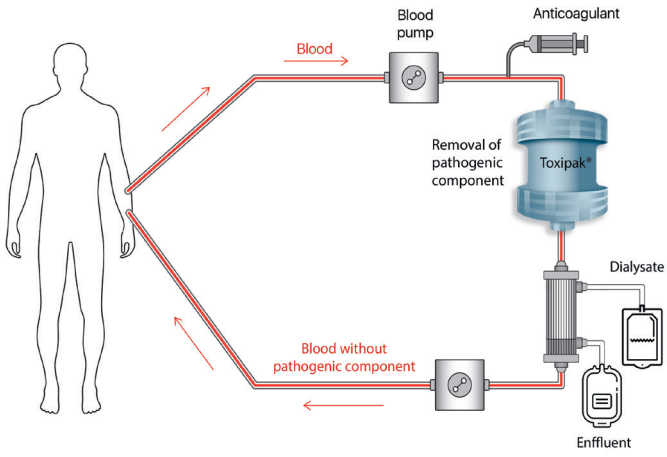
- Microbiological examination of blood;
- Localization of the infectious process in the abdominal cavity and pelvis;
- High level of procalcitonin (≥10 ng/ml);
- Endotoxin activity (EAA) ≥ 0.6;

Recommendations for LPS

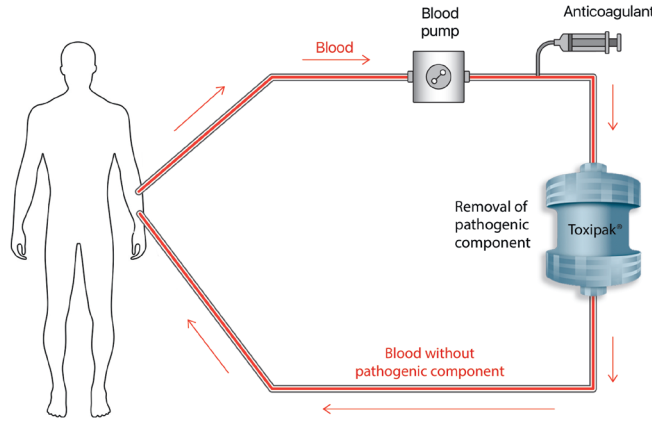
- Early start!
- Duration of the procedure from 2-12 hours
- 2 treatments are recommended with an interval of 24 hours
- Volume of treated blood - at least 2 BV
- Blood perfusion rate 100-150 ml/min
- Regional citrate anticoagulation (RCA) is required

Options for the endotoxin removal procedure

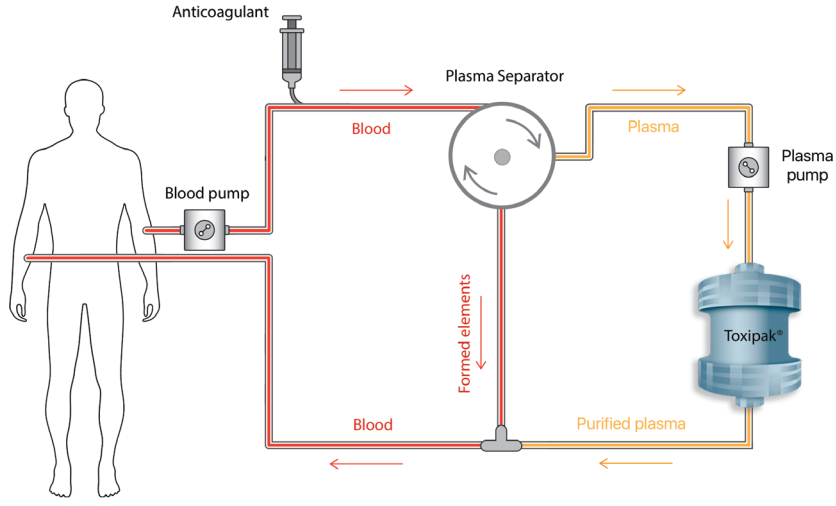
Combined procedure with dialysis CRRT



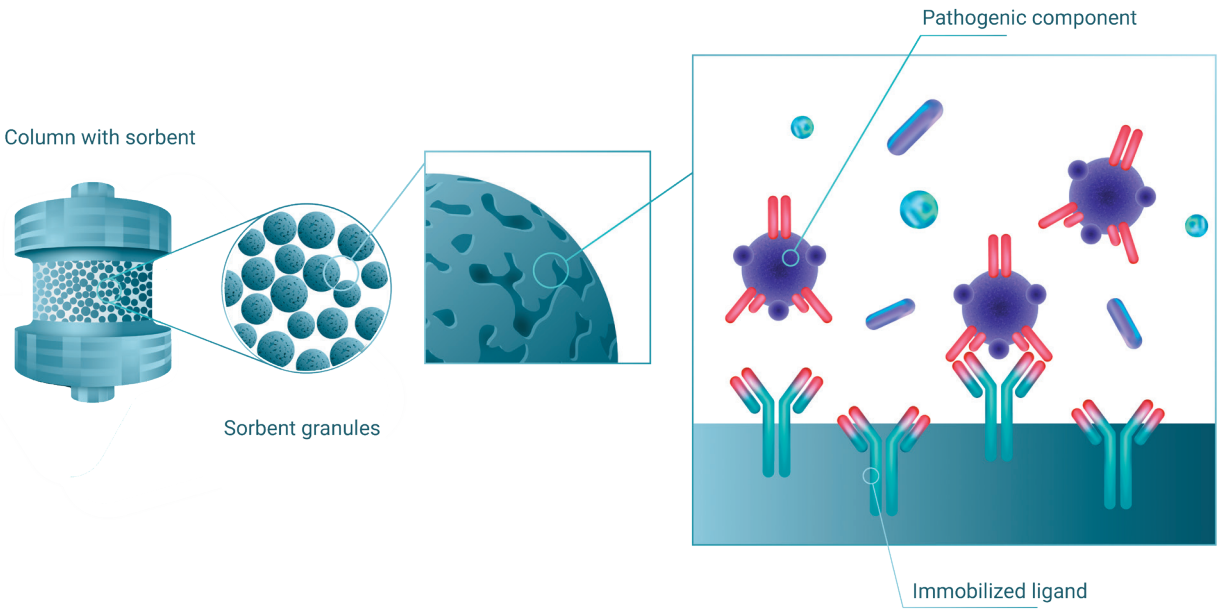
Hemoperfusion



Plasmoperfusion



Structure of the sorption column



Adsorption column Toxipak®

Indications for use:

sepsis and septic shock treatment

Procedure:

Endotoxin removal

Sorbent:

inert agarose matrix with immobilized synthetic ligand specific to lipopolysaccharides of gram-negative bacteria

Column capacity (Endotoxin units):

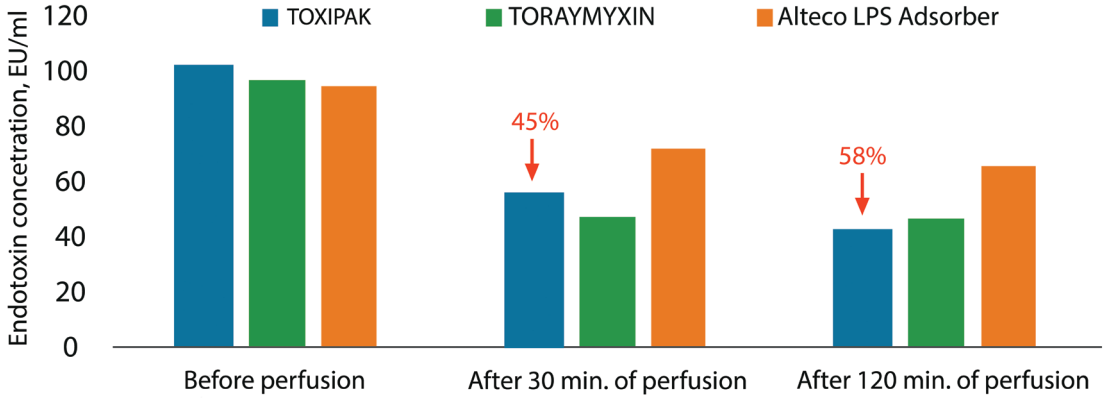
≥ 20 000 from human blood plasma

≥ 800 000 from saline solution

Column volume:

150 ml and 300 ml columns, single use

Endotoxin removal (comparative study in vitro)



Dmitrieva O., Afanasieva O., Levashov P. et al. Comparative study of three systems for extracorporeal endotoxin removal by LPS adsorption (in vitro data) // 2nd Congress of the European Group – International Society for Apheresis, Vienna, Austria. (poster presentation P-03) – March 22-24, 2018.

Clinical experience №1

7 patients diagnosed with sepsis (complications of abdominal surgery).
Procedure parameters: perfusion rate – 50-100 ml/min; volume of treated blood – 1.5-2 BV.

Clinical status, SOFA scale	
Before the procedure	24 hours after the procedure
6.6 ± 0.9	2.6 ± 0.5

Laboratory and clinical parameters after the procedure:

- Endotoxin (LPS) – 64% ↓
- CRP – 14% ↓
- IL-1 – 38% ↓
- Oxygenation index ↑
- Renal fuction ↑

Result: 6 patients did not develop a systemic inflammatory reaction within 24 hours after the procedure. One patient required a repeat procedure on the Toxipak® column to stabilize the condition.

Gendel L. L., Sokolov A. A., Gubanova S. N., et al. First Clinical Experience of using column for LPS-adsorption of Toxipak in treatment of sepsis patients. Messenger of Anesthesiology and Resuscitation, 2017, Vol. 14, no. 5, P. 42-50. (In Russ.)

Clinical experience №2

25 patients: with abdominal (19), urological (4), pulmonological (1) and gynecological (1) sepsis, 9 of which with septic shock.

Procedure parameters: the rate is 60-100 ml/min; the volume of treated blood is 1.5-2 BV.
Procedure parameters: perfusion rate – 50-100 ml/min;
volume of treated blood – 1.5-2 BV

Result: Positive clinical effect in all 25 patients, 22 patients were transferred from ICU, no severe adverse reactions were observed.

	Before the procedure	Next morning
SOFA scale	**9.5 ± 0.9**	**6.9 ± 1.0**
T,C°	38.08 ± 0.20	37.11 ± 0.16
Heart rate	106.4 ± 3.5	92.7 ± 2.5
PO2/FiO2	228.7 ± 16.4	270.6 ± 17.4
Diuresis, ml/day	1593 ± 242	2357 ± 358
Endotoxin, EU/ml	2.88 ± 0.43	1.2 ± 0.19
CRP, mg/l	275.1 ± 45.5	223.9 ± 35.6
PCT, ng/ml	66.1 ± 8.7	29.8 ± 7.8
IL-6, pg/l	234.0 ± 32	73.8 ± 21.3

Sokolov A.A., Gubanova S.N., Popov A.V., et al. LPS adsorption with Toxipak columns in treatment of sepsis // The 12th World Congress of International Society for Apheresis, KYOTO (poster presentation PP6-01) – 2019.

Clinical experience №3

5 burn patients diagnosed with sepsis/septic shock (8 hemosorption procedures).

	Before the procedure	After the procedure	24 hours after the procedure
SOFA scale	**9.5** ± 0.9	**6.9** ± 1.0	**5.1** ± 2.7
Endotoxin, EU/ml	38.08 ± 0.20	37.11 ± 0.16	-
PCT, ng/ml	106.4 ± 3.5	92.7 ± 2.5	14.4 ± 10.2
WBC, *10^{12} cells/ml	228.7 ± 16.4	270.6 ± 17.4	10.6 ± 4.5

Unchanged: erythrocytes, platelets, hemoglobin, hematocrit, total protein, albumin, urea, creatinine, bilirubin.

Laboratory and parameters after the procedure:

- Endotoxin (LPS) – 68% ↓
- CRP – 20% ↓
- IL-1 – 57% ↓

After the repeated procedure, the SOFA scale decreased from 7.3 ± 1.2 to 3.5 ± 2.3.

Result: 4 of 5 patients had no progression of systemic inflammatory response, no relapses of severe sepsis or septic shock were observed, the survival rate of patients during 14 and 28 days of follow-up was 80%.

Clinical Evaluation Report R-0617-01