

# CytoSorb® Guide

## Practice Manual



**CytoSorbents™**

# Literature / Disclaimer

- \* Akil et al., Use of CytoSorb® Hemoadsorption in Patients on Veno-Venous ECMO Support for Severe Acute Respiratory Distress Syndrome: A Systematic Review. J Clin Med 2022; 11(20):5990
- \* Boss et al., Extracorporeal cytokine adsorption: Significant reduction of catecholamine requirement in patients with AKI and septic shock after cardiac surgery. PLoS One 2021; 16(2): e0246299
- \* Bottari et al., Impact of CytoSorb® and CKRT on hemodynamics in pediatric patients with septic shock: the PedCyto study. Front in Ped 2023; 11:1259384
- \* Doukas et al., Intraoperative Hemoadsorption (Cytosorb®) during open thoracoabdominal aortic repair: A pilot randomized controlled trial. J Clin Med 2023; 12:546
- \* Grafe et al., The effect of CytoSorb® application on kidney recovery in critically ill patients with severe rhabdomyolysis: a propensity score matching analysis. Ren Fail 2023; 45(2):2259231
- \* Haidari et al., Effect of intraoperative haemoadsorption therapy on cardiac surgery for active infective endocarditis with confirmed Staphylococcus aureus bacteraemia. Interdisc CardioVasc & Thor Surg 2023; 36(1):ivad010
- \* Jansen et al., CytoSorb® hemoperfusion markedly attenuates circulating cytokine concentrations during systemic inflammation in humans in vivo. Crit Care 2023; 27(1):117
- \* Kogelmann et al., Impact of CytoSorb® Hemoadsorption Therapy on Fluid Balance in Patients with Septic Shock. J Clin Med 2024; 13(1); 294
- \* Matejic-Spasic et al., The role of hemoadsorption in cardiac surgery – a systematic review. BMC Cardiovascular Disorders 2024; 24(1):258
- \* Mehta et al., Impact of Intraoperative Haemoadsorption on Outcomes of Patients undergoing Aortic Surgery: A Single-Centre, Prospective, Observational Study. Interdisc CardioVasc & Thor Surg 2024; 38(4):ivae050
- \* Mitzner et al., Adjunctive hemoadsorption therapy with CytoSorb® in patients with septic / vasoplegic shock: A best practice consensus statement. J Clin Med 2023; 12:7199
- \* Nemeth et al., Use of intraoperative haemoadsorption in patients undergoing heart transplantation: A proof-of-concept randomized trial. ESC Heart Failure 2024; 11(2):772-782
- \* Pieri et al., Extracorporeal Blood Purification with CytoSorb® in 359 Critically Ill Patients. Blood Purif 2023; 52(9-10):759-767
- \* Rugg et al., Hemoadsorption with CytoSorb® in Septic Shock Reduces Catecholamine Requirements and In-Hospital Mortality: A Single-Center Retrospective 'Genetic' Matched Analysis. Biomedicines 2020; 8(12):539
- \* Schmoekel et al., Intraoperative hemoadsorption for antithrombotic drug removal during cardiac surgery: Initial report of the International Safe and Timely Antithrombotic Removal (STAR) Registry. J Thrombosis & Thrombolysis 2024: epub
- \* Soltesz et al., Influence of Venoarterial Extracorporeal Membrane Oxygenation Integrated Hemoadsorption on the Early Reversal of Multiorgan and Microcirculatory Dysfunction and Outcome of Refractory Cardiogenic Shock. J Clin Med 2022; 11(21):6517
- \* Turan et al., Hemoadsorption Therapy for Critically Ill Patients with Acute Liver Dysfunction: A Meta-Analysis and Systematic Review. Biomedicines 2024; 1281):67



Visit  
[cyto.zone/literature](https://cyto.zone/literature)  
for an overview of all references.

The statements in this document do not constitute diagnostic or therapeutic recommendation. It is a "best practice" collection, based on the current level of knowledge and expert opinion. The use of the CytoSorb® Therapy is the responsibility of the treating physician. The Quick Setup Guide does not replace the instructions for use of any components used in the setup.

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# CytoSorb® 300

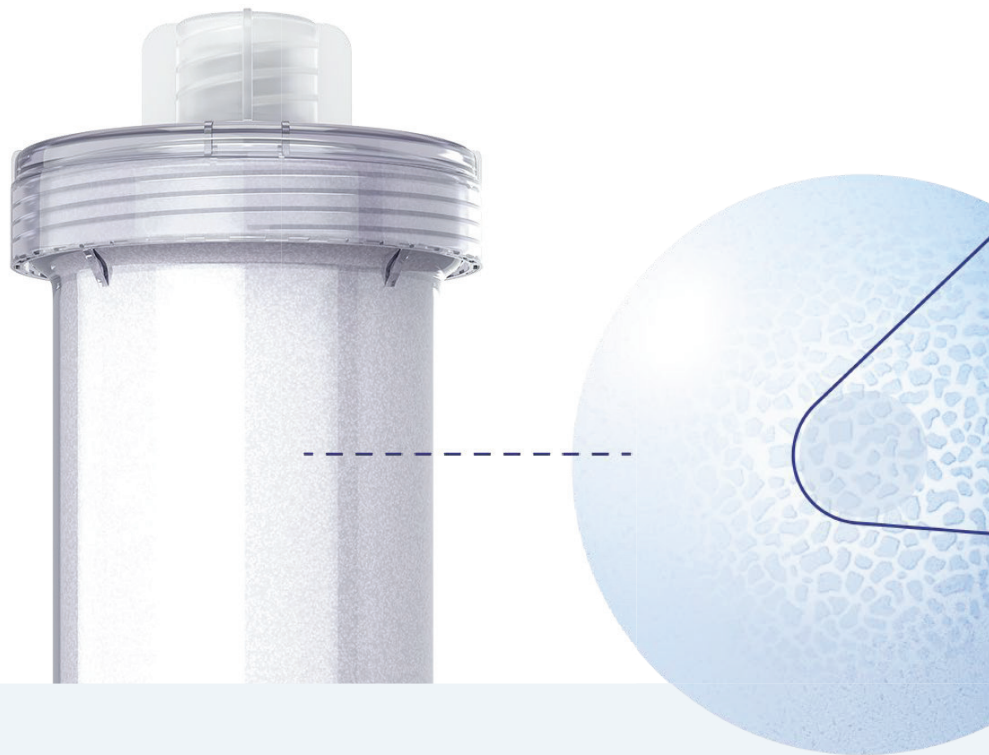




## Protect your patients with CytoSorb®

CytoSorb® Therapy extracorporeal blood purification is used:

- in conditions where excessive levels of cytokines, bilirubin and / or myoglobin exist.
- intraoperatively during cardio-pulmonary bypass (CPB) surgery for the removal of P2Y<sub>12</sub>-inhibitor ticagrelor and / or Factor-Xa-inhibitor rivaroxaban.



### Adsorption criteria

Hydrophobic attraction  
to surface



Concentration dependent

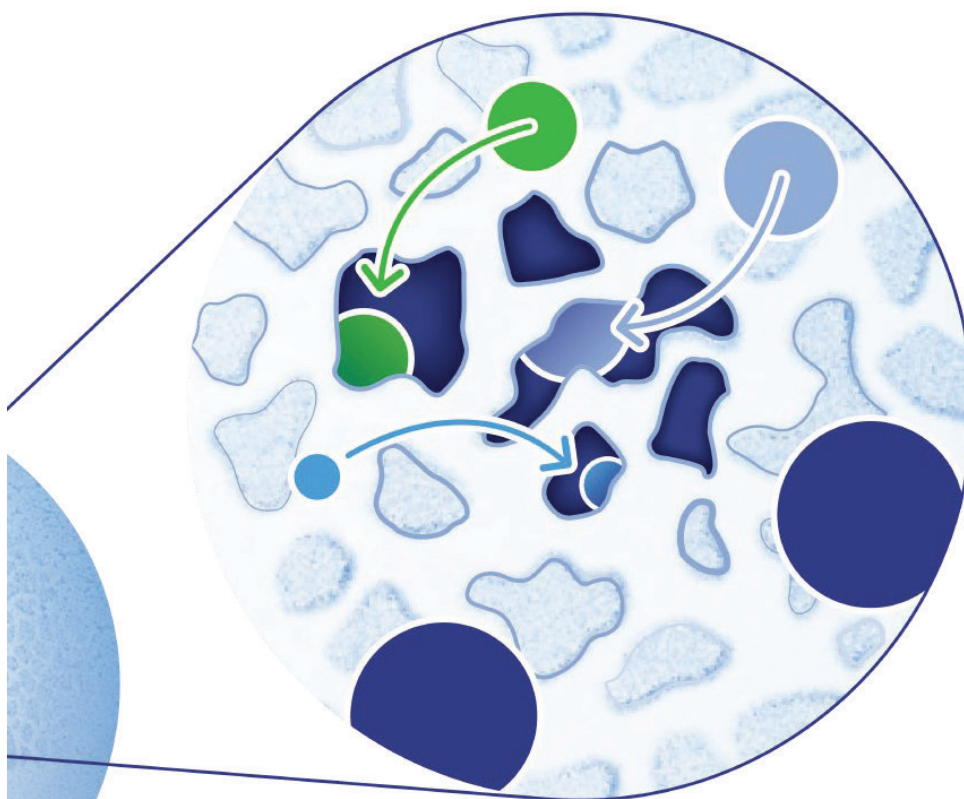


before



after

CytoSorb®  
Mode of action

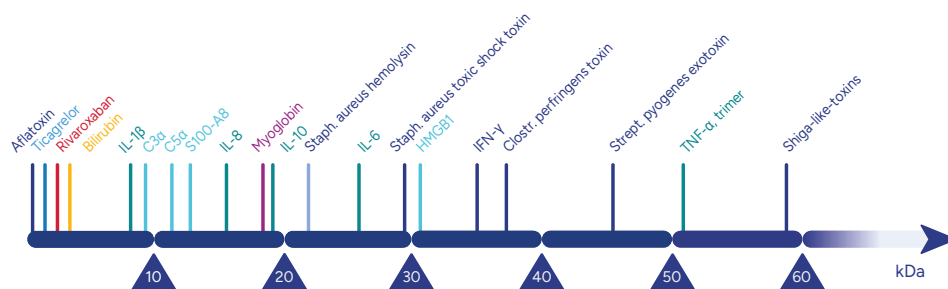


Size selection  
<60 kDa



## How CytoSorb® works

CytoSorb® is a technology complementary to dialysis that removes a broad range of substances that conventional dialysis does not remove.



## CytoSorb® specifically removes

- Cytokines
- Bilirubin
- Myoglobin
- Ticagrelor
- Rivaroxaban



## Beads matter

CytoSorb® is a whole blood adsorber with high efficiency and rapid clearance thanks to:

- **proprietary porous polymer beads** preventing or reducing surface activation, blood clotting, cell adhesion, hemolysis, and complement activation.
- **millions of optimally-sized pores and channels** in the beads providing a huge internal surface area and massive adsorption capacity (<60 kDa).
- **tightly packed beads** with high flow, low resistance matrix with uniform blood flow, optimizing blood and bead contact.
- **safe and easy setup** with just isotonic saline flushing, no heparinization needed during priming.

## Proven Safety

CytoSorb® has been shown in clinical studies to have:

- concentration dependent removal. <sup>(1)</sup>
- **no activation of the coagulation and complement systems.** <sup>(2, 3)</sup>

### References:

1. Song M et al., Blood Purif 2004; 22(5):428-434
2. Bernardi MH et al., Crit Care 2016; 20(1):96
3. Gleason TG et al., Sem Thorac Cardiovasc Surg 2019; 31(4):783-793

# Critical Care



## Decision support for initiating CytoSorb® Therapy: Timing, duration, criteria

The score can be taken 6 hours after diagnosis of septic shock / start of standard therapy to define severity and support decision making in regards to initiation of CytoSorb® Therapy.

	0 Points	1 Point	2 Points
Lactate mmol/l	< 2.0		≥ 2.0
Lactate change / 6 hours	↓ decrease	↑ ≤ 50%	↑ > 50%
NE* µg/kg/min (MAP** ≥ 65)	< 0.1		≥ 0.1
NE* change / 6 hours	↓ decrease	↑ ≤ 50%	↑ > 50%
2nd catecholamine / 2nd vasopressor	No	Yes	
Hydrocortisone use	No	Yes	
Volume Bolus 30 ml/kgbw***	No	< 2 Boli	≥ 2 Boli

\* Norepinephrine

\*\* Mean Arterial Pressure

\*\*\* Kilogram Body Weight



Visit  
[cyto.news/cytoscore](https://cyto.news/cytoscore)  
for the digital version of the CytoScore



## Note

Final prospective validation of the score is still pending, however first retrospective evaluation of the score observed outcome benefits, when CytoSorb® Therapy was initiated in septic shock patients with the following criteria:

- **Indication of CRRT\* due to AKI\*\***
- **CytoScore at hour 6 of > 6 points**
- **Initiation of CytoSorb® Therapy < 12 hrs. after diagnosis of septic shock / start of standard therapy**

Reference: Kogelmann K et al., J Clin Med 2021; 10: 2939

\* Continuous Renal Replacement Therapy

\*\* Akute Kidney Injury





### Therapy goal

- Promotion of shock reversal through:
  - Attenuation of hyperinflammation
  - Reduction in vasopressor needs
  - Improvement in micro and macro circulation



### Patient selection

- Refractory vasoplegic shock
- High (and increasing) need for vasopressors
- Inadequate response to standard care
- Biomarkers (if available):
  - Interleukin-6 (IL-6) > 500 pg/ml
  - Procalcitonin (PCT) > 3 µg/l
  - Ferritin > 1000 µg/l



### Timing

- Ideally < 12 hours after diagnosis / start of standard therapy
- Don't wait until lactate is > 8 mmol/l



### Dosing

- Continue until sufficient hemodynamic stabilization is achieved
- Change after 12 hours if instability persists



### Visit

[cyto.zone/flow-sep/eng](https://cyto.zone/flow-sep/eng)

for the digital version of the Flowchart  
vasoplegic shock

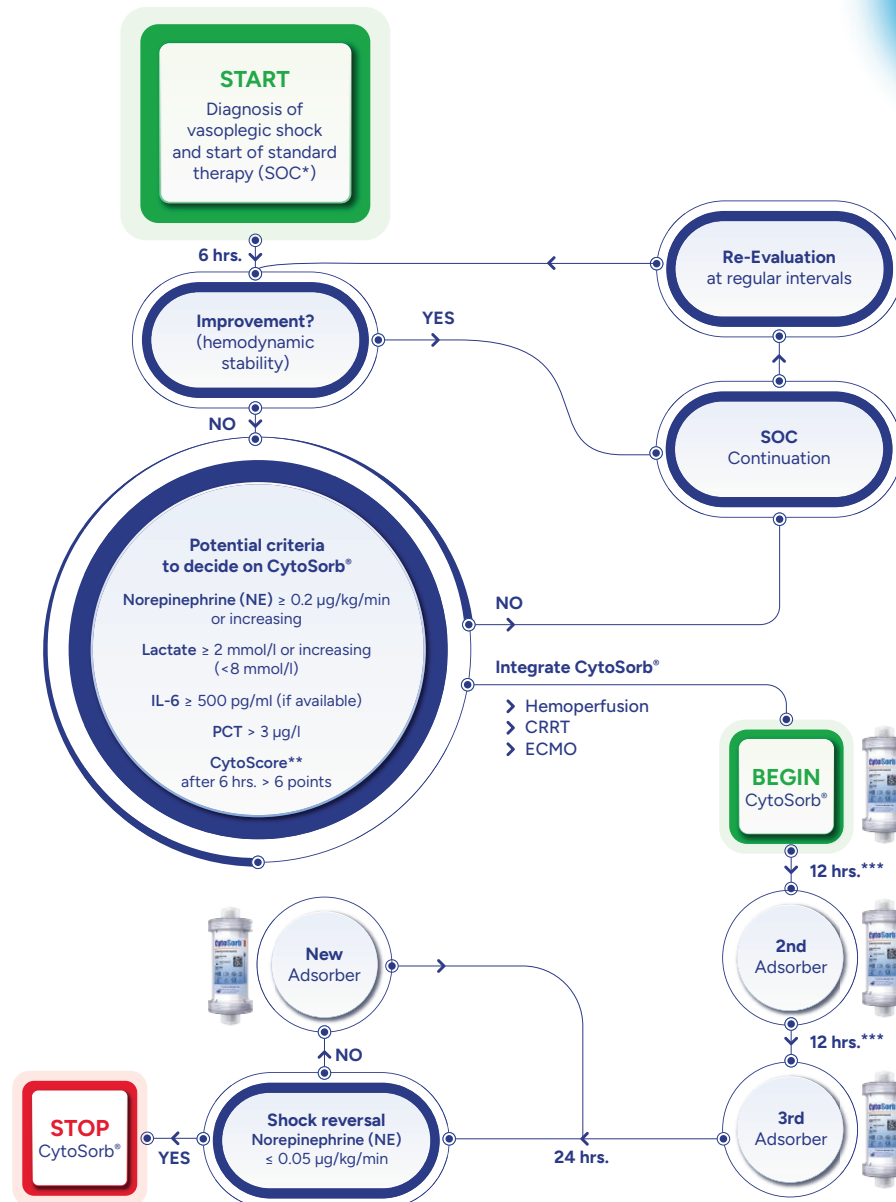
\* SOC: Standard of Care

\*\* Reference: Kogelmann K et al., J Clin Med 2021;10: 2939

\*\*\* Depending on the individual clinical course (e.g. persistent, pronounced reduction in the vasopressor dose under CytoSorb®), the indicated times can also be extended to longer intervals, or the therapy as a whole can also be terminated earlier. Sufficient control of the underlying cause is a prerequisite of therapeutic success.



## Best Practice Flowchart vasoplegic shock



# Liver





### Therapy goal

Support of liver function (bridge to recovery) through:

- Rapid reduction of liver toxins including bilirubin
- Attenuation of hyperinflammation

Stop of further deterioration while bridging to transplant



### Patient selection

- Bilirubin > 10 mg/dl (> 170 µmol/l)
- Hepatic encephalopathy (HE) grade ≥ 2
- Acute Liver Failure or Acute-on-Chronic Liver Failure grade 2-3
- Concomitant vasoplegic shock not responding to standard therapy (best to be used within first 24 hrs.)
- Onset of liver failure after surgery or transplantation
- Intractable pruritus



### Timing

Integrate CytoSorb® in hemoperfusion, continuous renal replacement therapy (CRRT) or ECMO



### Dosing

Consider changing the adsorber after 8 hours until sufficient stabilization / clinical improvement is seen



### Visit

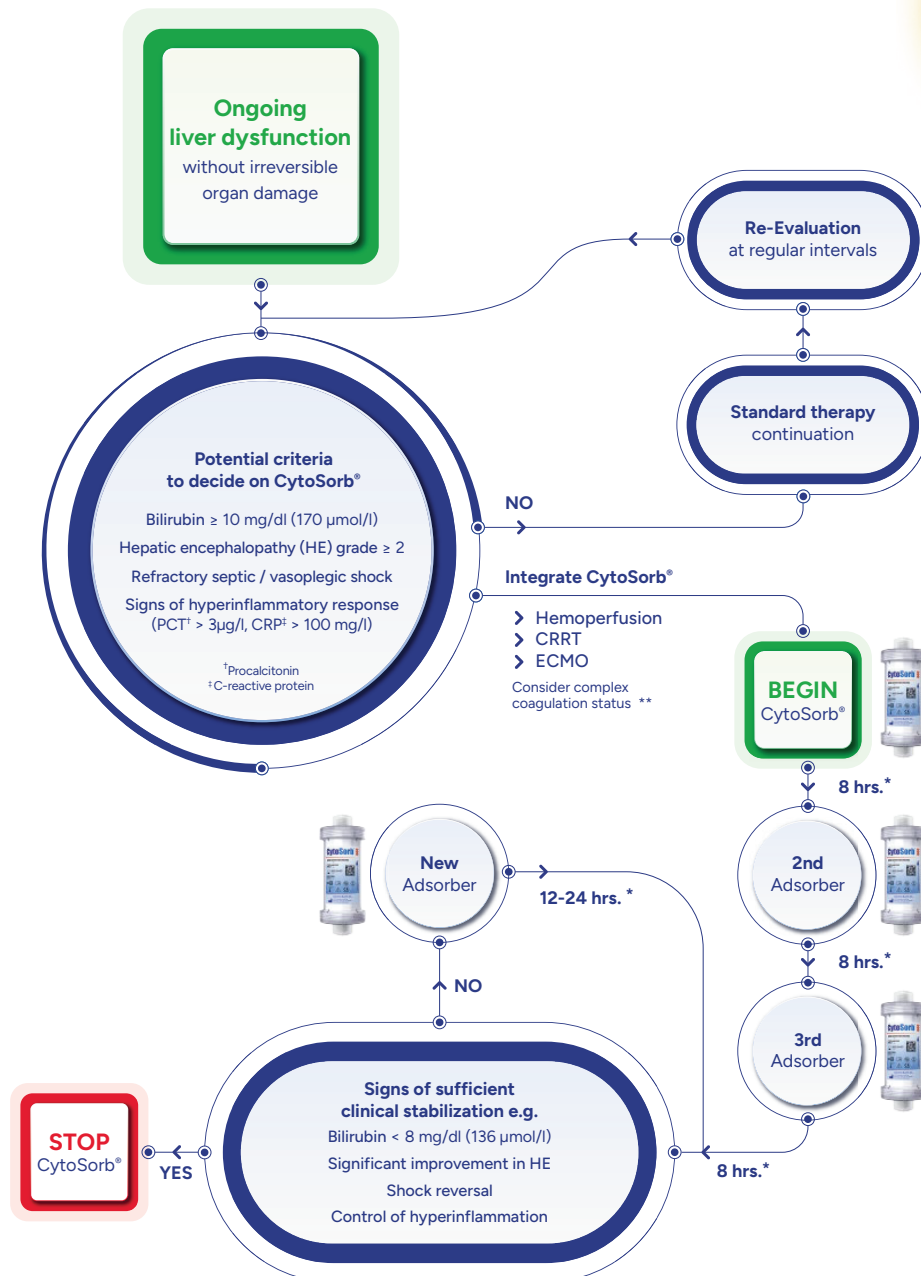
[cyto.zone/flow-lvr/eng](https://cyto.zone/flow-lvr/eng)

for the digital version of the Flowchart  
liver dysfunction

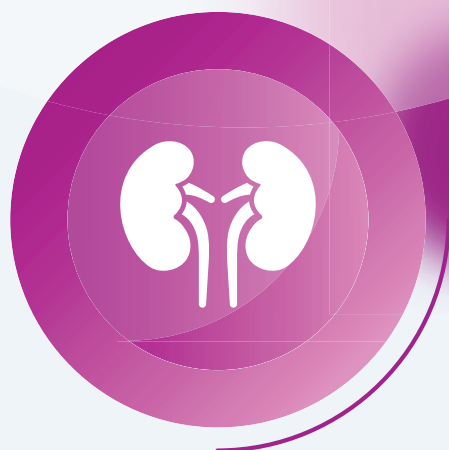
\* Depending on the individual's clinical course (e.g. persistent pronounced reduction in bilirubin levels) it may be possible to deviate from the indicated times to longer intervals or even terminate the therapy earlier. If feasible, please consider consecutive pre-and post-adsorber blood sampling as aid for assessing saturation of the adsorber. Sufficient control of the underlying cause is a prerequisite for therapeutic success.

\*\* Anticoagulation must be carefully implemented. Do not rely solely on PT or INR values.

## Best Practice Flowchart liver dysfunction



# Kidney





### Therapy goal

- Support of renal recovery through:
  - Rapid reduction of elevated myoglobin levels
  - Attenuation of hyperinflammation



### Patient selection

- Severe rhabdomyolysis with creatine kinase (CK) > 5,000 U/l
- New impairment in kidney function (e.g. glomerular filtration rate (GFR) < 40 ml/min) AND myoglobin > 10,000 µg/l (if available)
- With myoglobin > 30,000 µg/l start of CytoSorb® can be considered independent of renal function



### Timing

- Ideally start within the first 24 hrs. after diagnosis / onset of severe rhabdomyolysis
- In general start early before irreversible damage occurs



### Dosing

- Consider changing the adsorber after 8 hrs. if ongoing reduction of myoglobin levels is required
- Continue until sufficient stabilization or myoglobin levels well below 5,000 µg/l (CK < 1,000 U/l)



### Visit

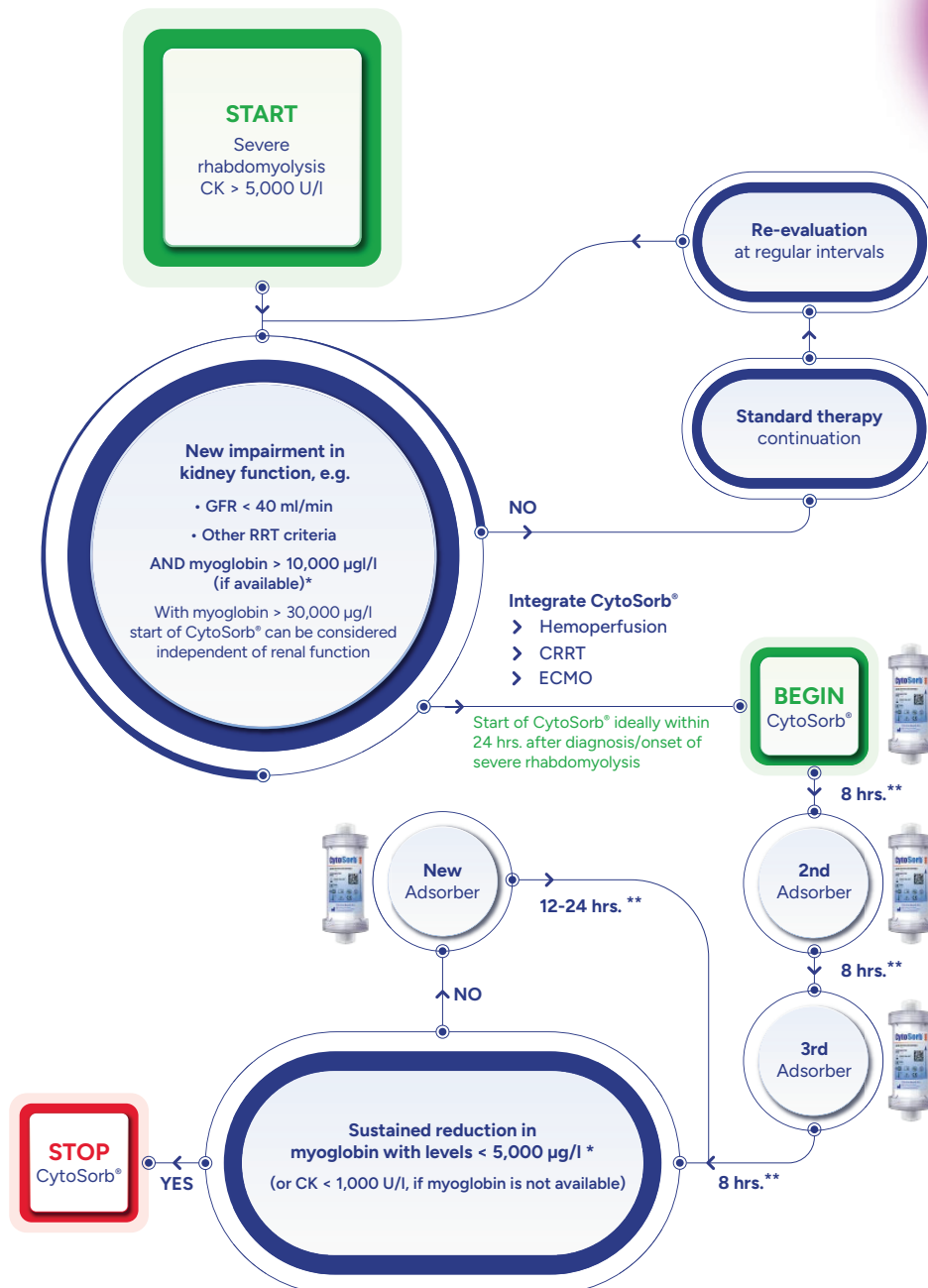
[cyto.zone/flow-rhabdo/eng](https://cyto.zone/flow-rhabdo/eng)

for the digital version of the Flowchart  
rhabdomyolysis

\* If myoglobin values are unavailable, creatine kinase levels or myoglobinuria may provide clues as to the status or progression in the clinical condition, but it should be noted that there is no direct removal of creatine kinase by the adsorber.

\*\* Depending on the individual's clinical course (e.g. persistent pronounced reduction in myoglobin levels) it may be possible to deviate from the indicated times to longer intervals, or even to terminate the therapy earlier. Sufficient control of the underlying cause is a prerequisite of therapeutic success.

## Best Practice Flowchart rhabdomyolysis



# Cardiovascular







### Therapy goal

Reduction of bleeding complications, blood product use, and length of ICU stay



### Patient selection

Patients undergoing cardiac surgery who were pretreated with ticagrelor and / or rivaroxaban, with last dose of

- ticagrelor < 72 hrs.
- rivaroxaban < 48 hrs.



### Timing

Start therapy with the start of cardiopulmonary bypass (CPB). CytoSorb® is easily integrated into the CPB circuit (post-pump to venous reservoir)



### Dosing

Postoperative continuation (with a new adsorber integrated into an extracorporeal circuit) is normally NOT needed if CPB time > 60 min, but can be done if needed.



### Visit

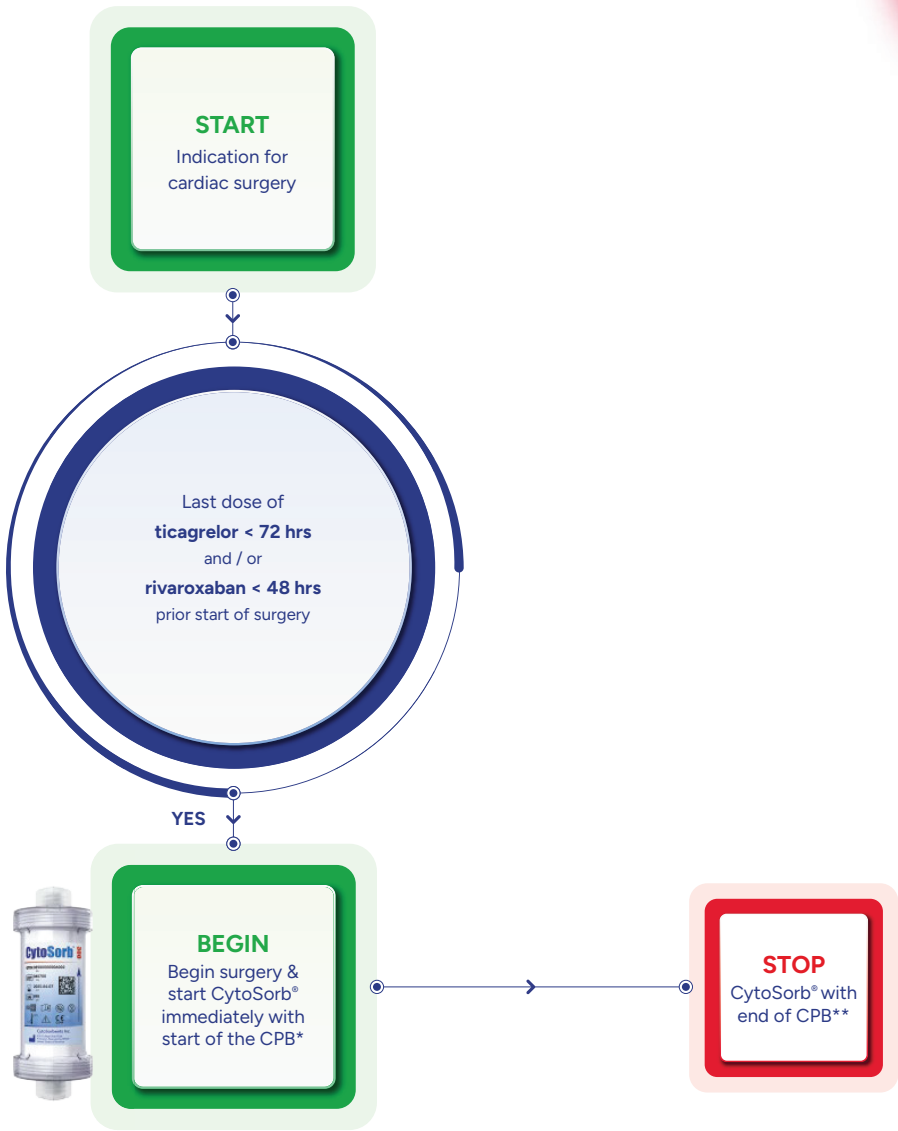
[cyto.zone/flow-atr/eng](https://cyto.zone/flow-atr/eng)

for the digital version of the Flowchart  
antithrombotic removal

\* CytoSorb® integration into CPB

\*\* CPB times should ideally be >60 minutes to allow enough time for sufficient substance removal by CytoSorb®

Best Practice Flowchart  
antithrombotic removal





### Therapy goal

Stabilization of hemodynamics, reduction of sepsis-related mortality, and protection of organ function



### Patient selection

CytoSorb® Therapy may be considered during cardiac surgery for acute / active high-risk infective endocarditis (IE). Additional criteria for clinical use of CytoSorb® intraoperatively in IE patients may be the following:

- Fever
- Highly elevated inflammatory parameters
- Hemodynamic instability requiring high vasoactive support
- Staphylococcus aureus as pathogen



### Timing

Start therapy with the start of CPB. CytoSorb® is easily integrated into the CPB circuit (post-pump to venous reservoir)



### Dosing

Consider postoperative continuation of CytoSorb® Therapy (with a new adsorber integrated into an extracorporeal circuit) in IE patients when the following signs are observed intraoperatively:

- Development of intraoperative oliguric / anuric renal failure
- Increased norepinephrine / vasopressin requirements
- High-grade intraoperative findings (vegetations and / or aortic root abscess)



### Visit

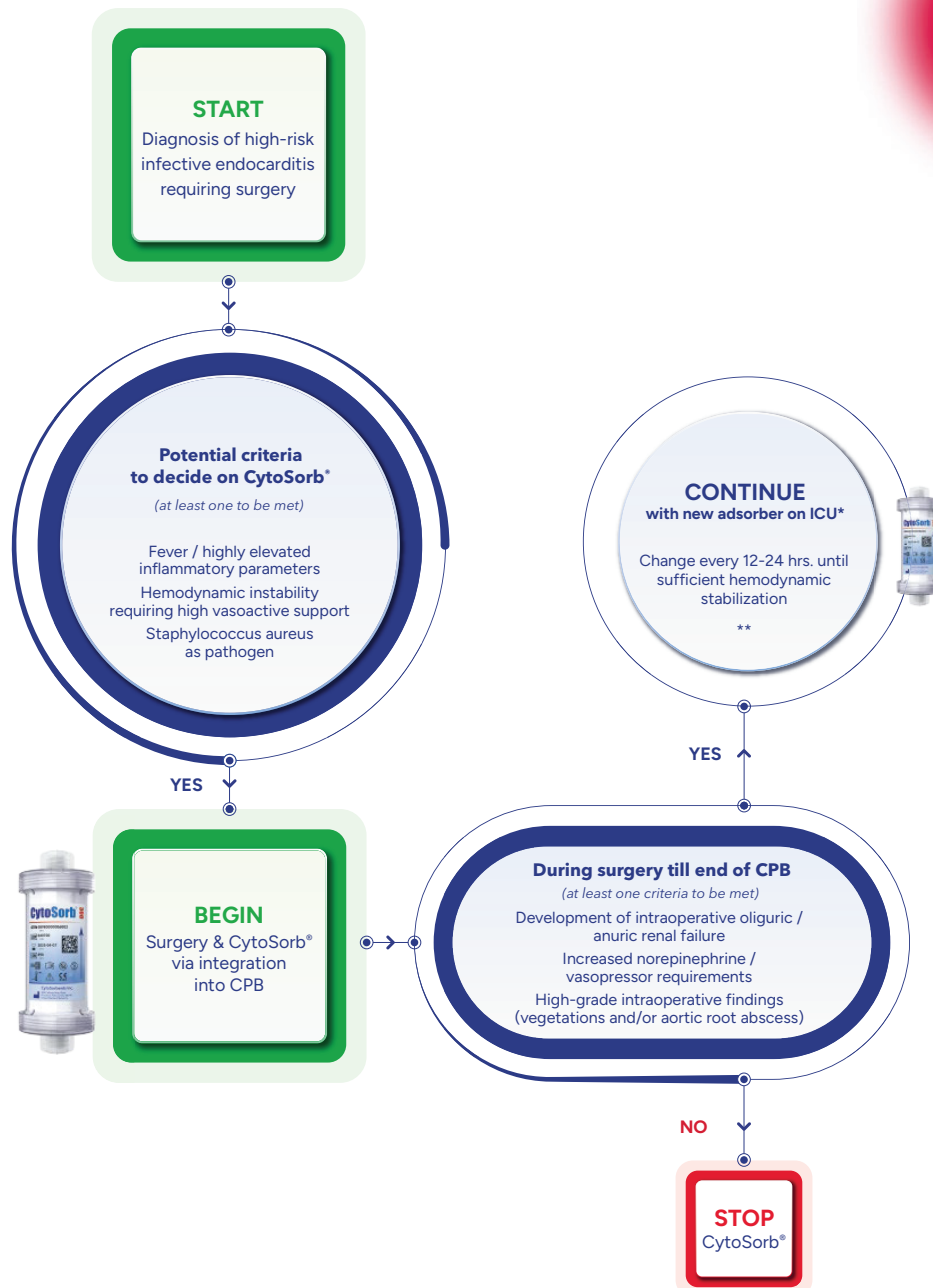
[cyto.zone/flow-ie/eng](https://cyto.zone/flow-ie/eng)

for the digital version of the Flowchart  
infective endocarditis

\* Integration into Continuous Renal Replacement Therapy (CRRT), ECMO, Hemoperfusion

\*\* For details please see CytoSorb® flowchart septic/vasoplegic shock

## Best Practice Flowchart infective endocarditis





### Therapy goal

Reduction of complications through:

- Stabilization of hemodynamics
- Reduction of bleeding risks
- Support lung function



### Patient selection

CytoSorb® Therapy may be considered during cardiac surgery in complex aortic surgery.

Additional criteria for clinical use of CytoSorb® intraoperatively in aortic surgery patients may be the following:

- High preoperative lactate
- Planned deep hypothermic circulatory arrest
- Planned cerebral perfusion
- Hemodynamic instability requiring high vasopressor support



### Timing

Start therapy with the start of cardiopulmonary bypass (CPB). CytoSorb® is easily integrated into the CPB circuit (post-pump to venous reservoir)



### Dosing

Consider postoperative continuation of CytoSorb® Therapy (with a new adsorber integrated into an extracorporeal circuit) in aortic surgery patients when the following signs are observed intraoperatively:

- Development of intraoperative oliguric / anuric renal failure
- Increased norepinephrine / vasopressin requirements
- Unexpected intraoperative findings, significant visceral ischemia



**Visit**

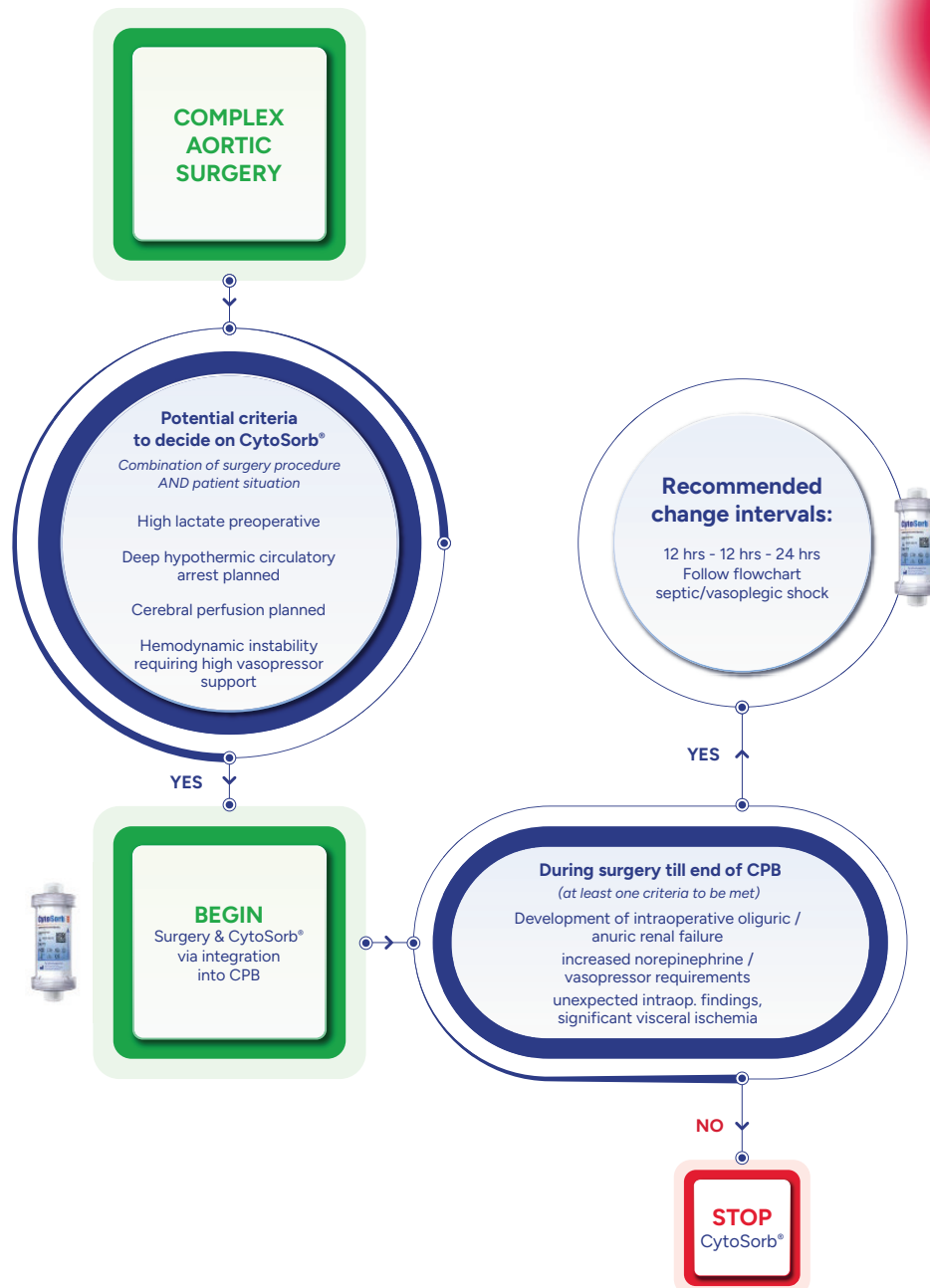
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for the digital version of the Flowchart  
Aortic surgery

\* Integration into continuous renal replacement therapy (CRRT), ECMO, Hemoperfusion

\*\* For details please see CytoSorb® flowchart septic/vasoplegic shock

## Best Practice Flowchart aortic surgery



# Quick Setup Guides



Visit  
[cyto.zone/setup](https://cyto.zone/setup)  
and learn more about  
CytoSorb® integration options



### Basic prerequisites

- CytoSorb® should be installed in a shunt off the main flow as is the current practice with hemoconcentrators
- Installation must never be into the main stream of a cardiopulmonary bypass (CPB) or ECMO circuit
- Pressure or flow monitoring of the CytoSorb® bypass-line is recommended
- The recommended blood flow rate should be between 150 - 700 ml/min, with a minimum of 100 ml/min
- CytoSorb® is to be employed as an adjunctive, not as a causative therapy
- Treatment duration and indication for exchange of adsorber depends on the clinical course.
- The maximum treatment time per adsorber is 24 hours
- Continuous treatment is recommended rather than intermittent
- Contraindications for extracorporeal blood circuits apply





### Consideration for anticoagulation

- Anticoagulation must be effective at the start of treatment.
- In general, no special adaptations of the standard of care protocols for CytoSorb® Therapy are necessary. The specifications of the device manufacturer must be observed.
- Systemic heparinization
  - An aPTT of 60-80 sec or an ACT of 160-210 sec is usually sufficient for CytoSorb®. The aPTT or ACT should be checked regularly.
- Regional anticoagulation with citrate
  - Initial dose, blood flow rate, control and adjustment of calcium and citrate according to protocol used. Citrate and calcium additions are made at the usual sites of the CRRT.
  - The control of ionized calcium (CRRT circuit and patient) a few minutes after the start of treatment and at regular intervals of 2 to 4 hours is recommended.
  - If a hemofilter is not used to remove citrate-calcium complexes, only a time-limited treatment of 2 hours maximum is possible.
- The decision regarding dosage and target levels is the responsibility of the treating physician.
- In case of hemoadsorption (standalone application without hemofilter) use heparin anticoagulation only.

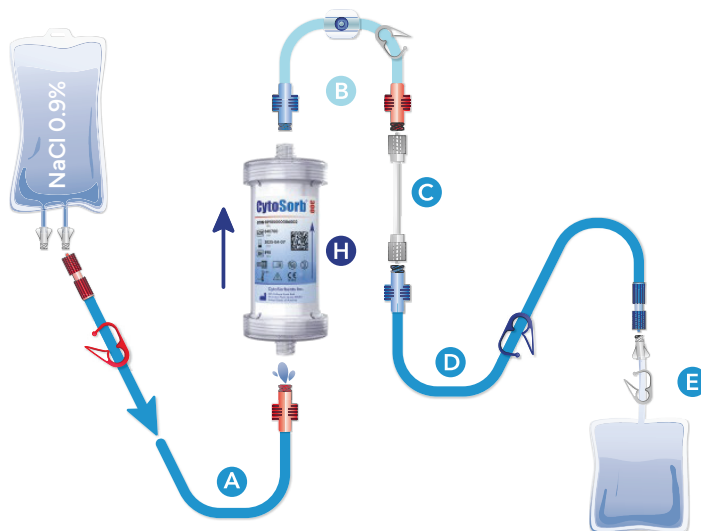


Visit  
[cyto.zone/setup-pre/eng](https://cyto.zone/setup-pre/eng)

### Step 1 Flush before integration

1. Completely prepare the device according to manufacturer's instructions (incl. flushing). If necessary during ongoing renal replacement therapy (RRT) first interrupt the treatment (return blood and disconnect patient according to the manufacturer's instructions for each device).
2. Connect isotonic saline (NaCl) with **A** deaerate and close **red clamp** on **A**.
3. Connect **A** bubble-free with CytoSorb® blood inlet **H** (**bottom**).  
**Observe flow direction!**
4. Connect CytoSorb® blood outlet **H** (**top**) with **B**, **C**, **D** and **E**.
5. Open **red clamp** on **A** and rinse CytoSorb® **H** by gravity with 2 liters isotonic saline (NaCl) and deaerate it by tapping.
6. Close **red clamp** on **A** and **blue pinch clamp** on **B** and **D**.
7. Stop blood pump.

**Caution:** – Never remove both caps at the same time  
– Use only plastic scissor clamps for 6.8 mm lines.



## RRT with CytoSorb® Pre Filter

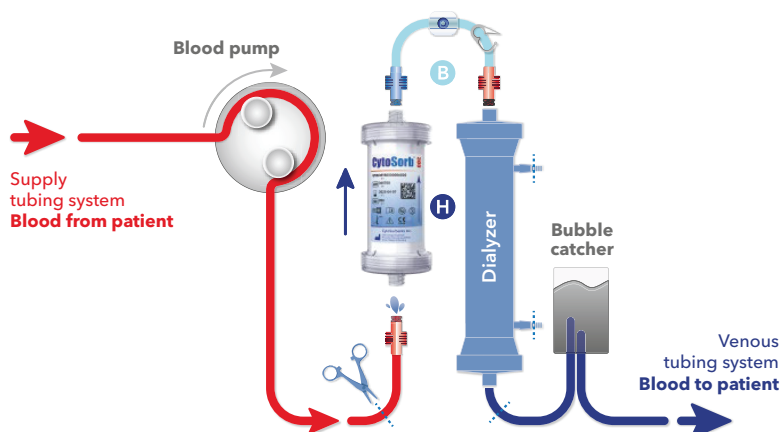


### Step 2 Integration pre filter

1. Clamp all tubes at the dialyzer at **‡** by use of **clamps**. Close **clamp** on **B**.
2. Disconnect **A** from CytoSorb® blood inlet **H** (**bottom**) and discard it.
3. Disconnect **arterial blood tube** from dialyzer blood inlet and connect bubble-free with CytoSorb® blood inlet **H** (**bottom**).
4. Disconnect **C** and **B** and discard **C**, **D** and **E**.
5. Connect **B** bubble-free with dialyzer blood inlet.
6. Remove all **clamps** at **‡** and start blood pump.
7. Start patient treatment as prescribed.

### Step 3 Change or remove an used adsorber

1. Stop current treatment and blood pump. Return blood and disconnect patient according to the manufacturer's instructions for the respective device.
2. Disconnect blood line to adsorber **H** with **scissors clamp** at **‡**.
3. Close pinch clamp at **B** on the hemofilter.
4. Discard used adsorber. (Inlet can be closed with used adapter **B**).
5. To install fresh adsorber, go to **Step 1**.
6. To continue operation without adsorber, connect blood line to hemofilter without bubbles and open all set clamps.



possible configuration

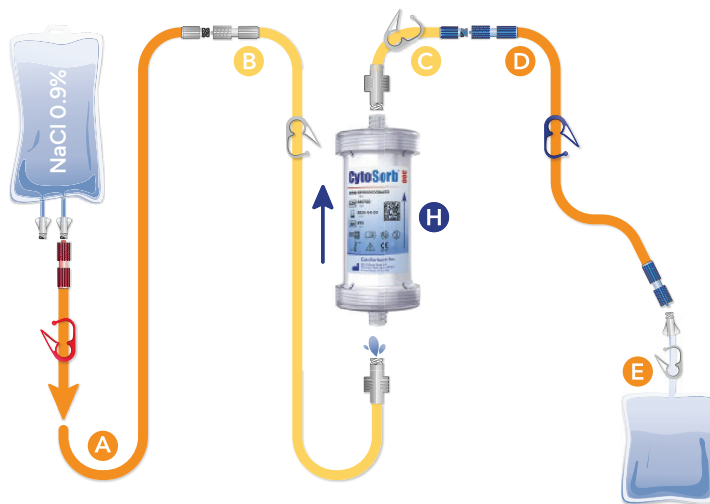


Visit  
[cyto.zone/setup-post/eng](https://cyto.zone/setup-post/eng)

### Step 1 Flush before integration

1. Completely prepare the device according to manufacturer's instructions (incl. flushing). If necessary during ongoing renal replacement therapy (RRT) first interrupt the treatment (return blood and disconnect patient according to the manufacturer's instructions of each device).
2. Connect isotonic saline (NaCl) with **A** and **B** deaerate and close **red clamp** on **A**.
3. Connect **B** bubble-free with CytoSorb® blood inlet **H** (**bottom**).  
**Observe flow direction!**
4. Connect CytoSorb® blood outlet **H** (**top**) with **C**, **D** and **E**.
5. Open **red clamp** on **A** and rinse CytoSorb® **H** by gravity with 2 liters isotonic saline (NaCl) and deaerate it by tapping.
6. Close **red clamp** on **A** and **blue clamp** on **D**. Close **clamps** on **B** and **C**.
7. Stop blood pump.

**Cave:** –Never remove both caps at the same time.  
–Use only plastic scissor clamps for 6.8 mm lines.



## RRT with CytoSorb® Post Filter



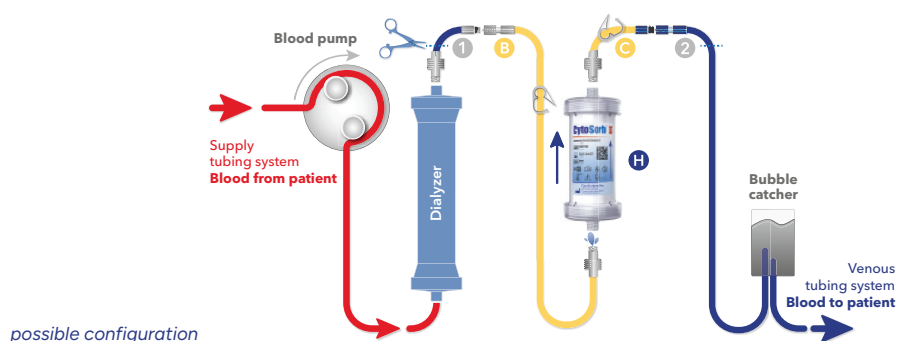
### Step 2 Integration post filter

1. Clamp blood lines at the dialyzer blood outlet ① and before the venous bubble catcher ② at **;** by use of **clamps**.
2. Disconnect saline solution and **A** from **B** and discard it.
3. Connect **B** with blood tube from dialyzer blood outlet ①.
4. Connect **C** from CytoSorb® blood outlet **H** (top) with line to venous bubble catcher ②.
5. Remove all **clamps** at **;** and start blood pump.
6. Start patient treatment as prescribed.

**Caution:** CytoSorb® installed after the dialyzer, in post-dilution mode, in combination with a low blood flow rate may lead to blood clots. Please consider minimum blood flow according of citrate protocol. Pre-dilution is recommended with this set-up.

### Step 3 Change or remove an used adsorber

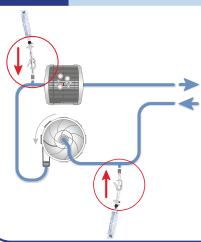
1. Stop ongoing treatment. Perform blood return and patient disconnection according to the manufacturer's instructions for the respective device.
2. Clamp blood lines at the dialyzer blood outlet ① and before the venous bubble catcher at ② by use of **clamps**.
3. Close **clamps** on **B** and **C**.
4. Discard used adsorber. (Connect **B** and **C** before discarding).
5. To install a fresh adsorber, proceed with **Step 1**.
6. To continue operation without adsorber, connect ① and ② without bubbles and remove **clamps** at and restart CRRT procedure.





Visit  
[cyto.zone/setup-ecmo/eng](https://cyto.zone/setup-ecmo/eng)

### 01 Setup: ECMO & ECMO-Connector

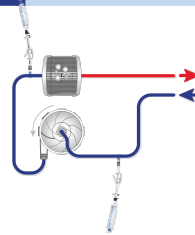


Prepare ECMO system.  
The **CytoSorbents ECMO-Connector** allows a simple and safe addition of CytoSorb® when needed.

→ Step 2



### 02 Start ECMO

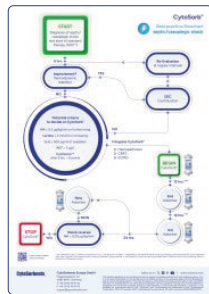


### 03 Evaluation of patient status / condition

#### Vasoplegic shock?

Ongoing hemodynamic instability despite ECMO therapy?

NO



Flowchart septic /  
vasoplegic shock  
[cyto.zone/flow-sep/eng](https://cyto.zone/flow-sep/eng)



↓ YES

NO

#### Decision

Start CytoSorb® Therapy?

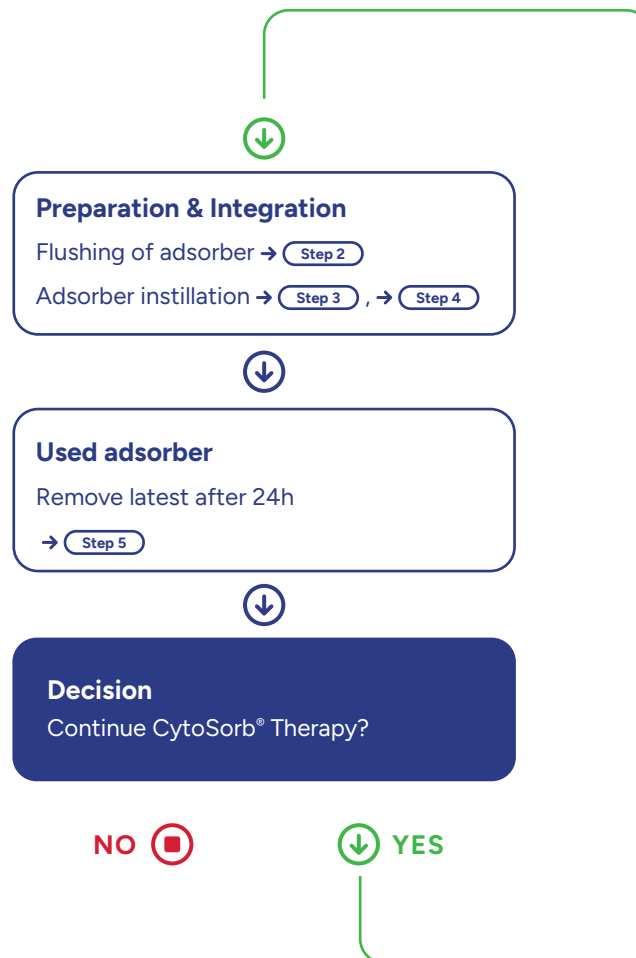
→ YES





04

Application CytoSorb® Therapy

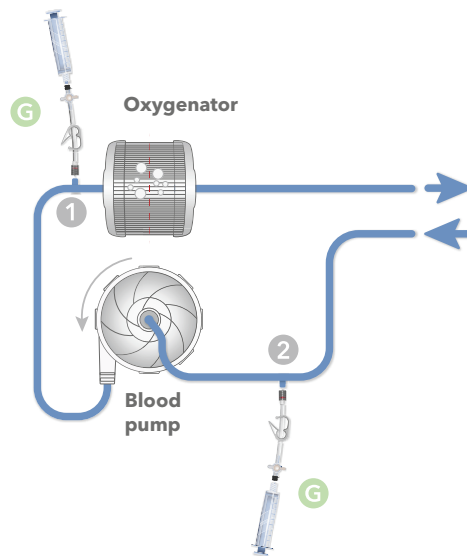




Visit  
[cyto.zone/setup-ecmo/eng](https://cyto.zone/setup-ecmo/eng)

### Step 1 Preparation of the ECMO system

1. Set up the Extracorporeal Membrane oxygenation (ECMO) system dry, according to manufacturer's instructions.
2. Connect the first ECMO connector **G** with Luer-Lock of ECMO mainstream **1** in front of oxygenator membrane. **Note:** Adapter **E** can be used to connect ECMO connector **G** alternatively to DIN-Lock port on the oxygenator.
3. Connect second ECMO connector **G** with blood return port (Luer-Lock connector) to ECMO mainstream **2** in front of the pump.
4. Prime the ECMO system according to the manufacturer's instructions. Flush and deaerate **G** at **1** and **2** and close their clamps and stopcocks. Place a sterile, isotonic saline filled 10 ml Luer-Lock syringe on the Luer-Lock connections of **G** at **1** and **2**.
5. Connect the ECMO system to the patient according to the instructions of the attending physician if indicated.
6. According to the doctor's prescription, CytoSorb® **H** can be installed into the ECMO system. Please follow **Step 2** and **Step 3**.  
**Note:** Never use a connection on the ECMO mainline after the oxygenator for CytoSorb® blood return.



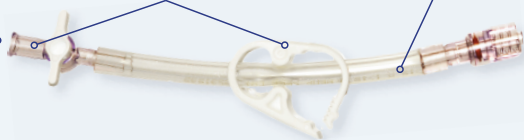
### \* Patented CytoSorb® ECMO-Connector Simple and safe connection

No open ports:  
No air can enter the system

Additional safety mechanisms to  
prevent unintended air intake into  
the ECMO system

Kinking not  
possible

360° rotatable  
torsion-free line.







## Step 2 CytoSorb® rinsing procedure

1. Connect line **A** with isotonic saline solution, deaerate it and disconnect it with the **clamp**. **Note:** Use spike adapter **D** if necessary.
2. Remove the port plug only at the bottom of the CytoSorb® blood inlet **H** and connect the bubble-free, vented line **A**.  
**Observe flow direction (indicated by the arrow on the label).**
3. Remove the port plug from the top of the CytoSorb® blood outlet **H**. Connect tube **B** and irrigation bag **C**.  
**Note:** If CytoSorb® is used in series with a hemoconcentrator (HC), use adapter **F** to connect the HC to the blood outlet of **H**.
4. Open the **clamp** on line **A** and rinse CytoSorb® by gravity and deaerate it by tapping with the palm of your hand. In total 2 liters of isotonic saline solution are required for filling the lines and flushing CytoSorb®.
5. Close the **clamps** on lines **A** and **B** to prevent CytoSorb® **H**, **A** and **B** from running empty.
6. Close the **clamp** on the rinsing bag **C**.

**Cave:** –Never remove both caps at the same time.

–Use only plastic scissor clamps for 6.8 mm lines.

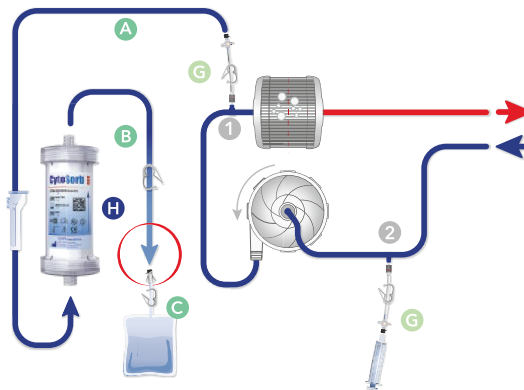




Visit  
[cyto.zone/setup-ecmo/eng](https://cyto.zone/setup-ecmo/eng)

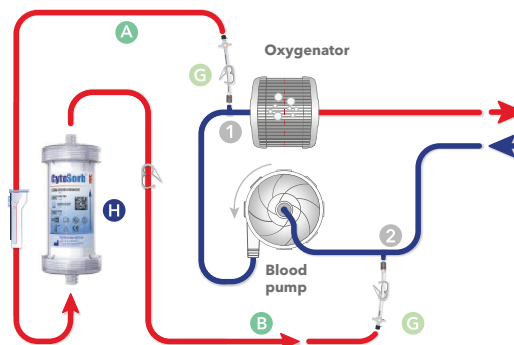
### Step 3 Fill rinsed CytoSorb® with blood

1. Attach the CytoSorb® adsorber **H**, prepared according to **Step 2**, vertically to the ECMO device using the holder.
2. Detach line **A** from the isotonic saline bag and connect it bubble-free to the ECMO connector at **G** on **1** before oxygenator membrane.
3. Open **clamp** and **stopcock** from **G** at **1**. Open **clamp** at **A**, **B** and **C**.
4. Fill CytoSorb® bypass with blood and let isotonic saline solution flow into the rinsebag **C**.
5. As soon as blood becomes visible in tube **B** after CytoSorb®, close the clamp on **B**.



### Step 4 Complete CytoSorb® Bypass

1. Connect the completely deaerated line **B** (from CytoSorb®) with the completely deaerated ECMO connector **G** to **2**.  
**Under no circumstances should air enter the system.**
2. Open **clamp** on line **B**. Open **clamp** and **stopcock** from **G** at **2** (upstream of pump).
3. The blood flow through CytoSorb® can be monitored with the aid of an ultrasound Doppler probe (on line **A** or **B**) if necessary.
4. If necessary, the blood flow can be regulated by the roll **clamp** on line **A**.  
The recommended blood flow rate should be between 150 - 700 ml/min, with a minimum rate of at least 100 ml/min.

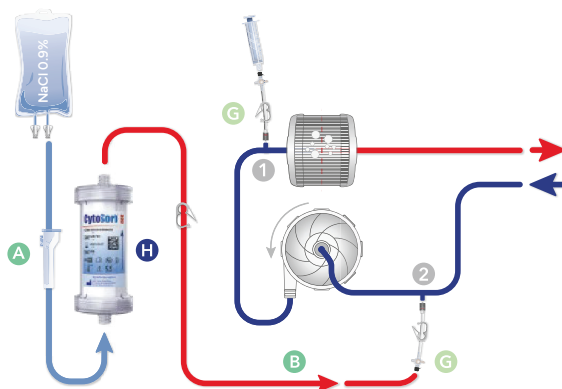


## Integration and exchange CytoSorb® in ECMO



### Step 5 Removal of used adsorbers before installation of fresh adsorbers / Termination of CytoSorb® Therapy

1. Prepare a fresh bag of isotonic saline solution (2 liters, sterile, no bottle to reduce the risk of air aspiration into the system). Fill 2x10 ml Luer-Lock syringes with isotonic saline solution (air-free). Close **clamp** and **stopcock** from **G** on ① and ② and **clamp** on line **A**.
2. Release line **A** from **G** on ① and connect it bubble-free to the fresh isotonic saline bag.
3. Place 10 ml Luer-Lock syringe filled with isotonic saline bubble-free on **G** on ①. Open **clamp** and **stopcock** and rinse **G** on ①. Then close **clamp** and **stopcock** **G** on ①.  
**Under no circumstances should air enter the system.**  
Leave Luer-Lock syringe on ECMO connector **G** (on ①).
4. Open **clamp** and **stopcock** from **G** on ②. Blood is returned from the CytoSorb® **H** into the ECMO system by flushing with isotonic saline solution. As soon as isotonic saline solution is visible in tube **B**, close **clamp** and **stopcock** from **G** on ②.
5. Disconnect line **B** Place 10 ml Luer-Lock syringe filled with isotonic saline solution bubblefree on **G** on ②. Open **clamp** and **stopcock** and rinse **G** on ②.
6. Close **clamp** and **stopcock** from **G** on ② again. **Under no circumstances should air enter the system.** Leave the Luer-Lock syringe on **G** on ②.
7. Discard used CytoSorb® **H**, lines **A** and **B**.



To continue the CytoSorb® Therapy, please follow steps **Step 3** & **Step 4** to insert a new CytoSorb® adsorber into the ECMO system.



If it is anticipated that no further CytoSorb® Therapy will be carried out, the ECMO connectors **G** together with ① and ② should be removed from the ECMO system.



Visit  
[cyto.zone/setup-cpb/eng](https://cyto.zone/setup-cpb/eng)

### Step 1 Preparation CPB

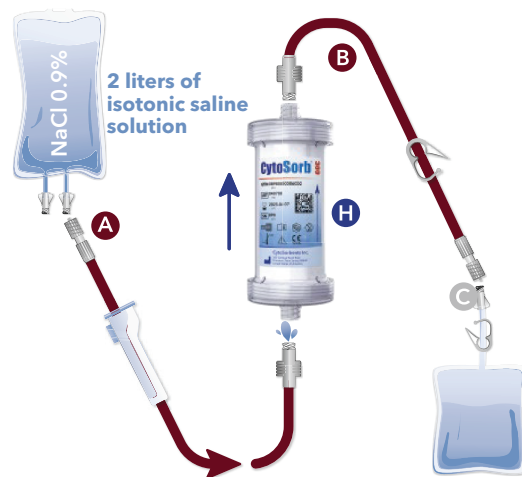
1. Setup the cardiopulmonary bypass (CPB) machine completely according to the operating instructions of the device manufacturer (including priming).

### Step 2 Preparation CytoSorb® Adsorber

1. Connect **A** with isotonic saline and deaerate. Close **clamp** on **A**.
2. Connect **A** bubble-free to CytoSorb® blood inlet **H (bottom)**. Observe the flow direction indicated on the label.
3. Connect CytoSorb® blood outlet **H (top)** with **B** and **C**.
4. Open **clamp** at **A** and flush CytoSorb® by gravity with 2 liters isotonic saline. Rinse isotonic saline solution and vent by tapping with the palm of the hand.
5. Close **clamps** on **A**, **B** and **C**.

Cave: –Never remove both caps at the same time.

–Use only plastic scissor clamps for 6.8 mm lines.

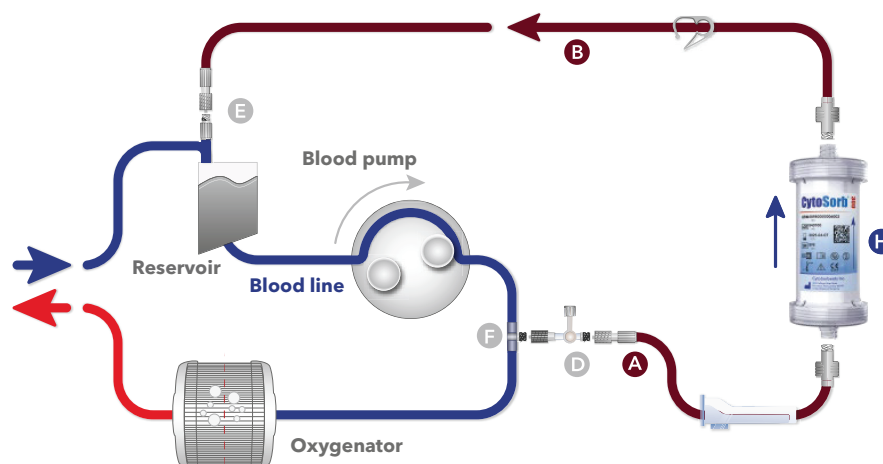


## CPB with CytoSorb® Intraoperative Use



### Step 3 Integration of CytoSorb® in CPB


1. Mount CytoSorb® **H** vertically on the heart-lung machine using the mounting device.
2. Separate **A** from the isotonic saline bag and connect it bubble-free via a high-flow three-way valve to **D** at Luer-Lock on the main line after the blood pump.
3. Connect **B** to reservoir **E** via a high-flow Luer-Lock connection.
4. If necessary, regulate the blood flow in the bypass by use of the **roller clamp** on **A**.





Visit  
[cyto.zone/setup-hemo/eng](https://cyto.zone/setup-hemo/eng)

### Step 1 Set-up

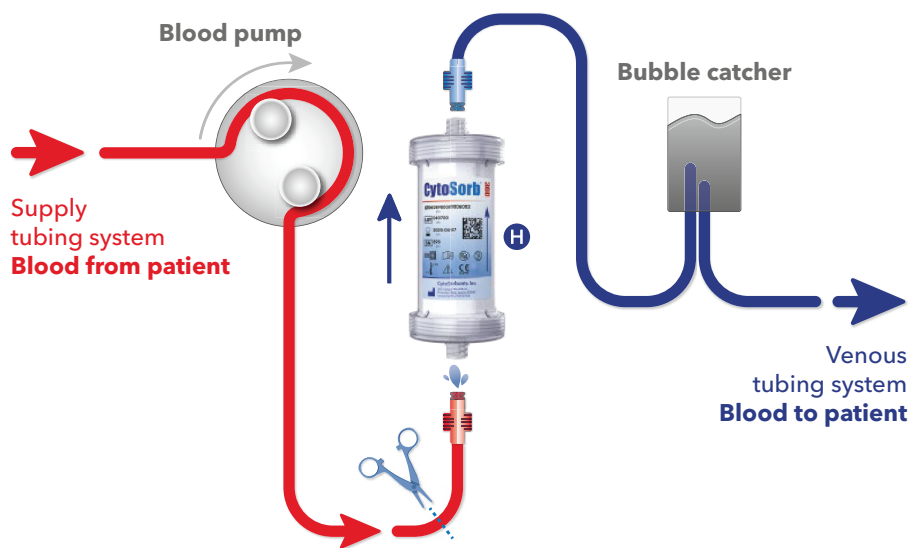
1. Set-up the device according to the manufacturer's instructions (dry).
2. Mount CytoSorb® H vertically into holder.
3. Start blood pump and deaerate **arterial tubing system** (Inbound line to adsorber must be refilled and air-free).
4. Stop blood pump and **clamp arterial tubing system** at  by using **scissor clamp**.
5. Only remove the port plug on the CytoSorb® inlet **H** (**bottom**).
6. Connect CytoSorb® **H** bubble-free with **arterial tubing system**.  
**Observe flow direction!**

**Cave:** –Never remove both caps at the same time.

–Use only plastic scissor clamps for 6.8 mm lines.

7. Now remove the blood outlet port plug (**top**) and connect CytoSorb® **H** with **venous tubing system**.
8. Remove **scissor clamp** from **arterial tubing system**.
9. Start blood pump (approx. 100 ml/min) and rinse system with 2 liters of isotonic saline solution.
10. Remove CytoSorb® **H** from the holder and deaerate it by tapping.
11. Start patient treatment as prescribed.

CytoSorb®  
Hemoperfusion



Cytosorb® can be used independently on **CRRT** devices in "hemoperfusion mode" or with a standalone hemoperfusion system like Cytosorbents PuriFi, as shown on the next pages.



Visit  
[cyto.zone/setup-purifi-video/eng](https://cyto.zone/setup-purifi-video/eng)

**PRIMING PARAMETERS**

**No Alarms**

Volume Priming **2000<sup>ml</sup>**

Type of Treatment **Adult**

Treatment Time **24:00<sup>h:m</sup>**

> Select yellow Parameter Field  
> Adjust and Confirm with Rotary Dial

**Back** **Begin Setup**

Switch on PuriFi and adjust treatment parameters. Choose setup mode: Connection to vascular access or ECMO. Details on page 54

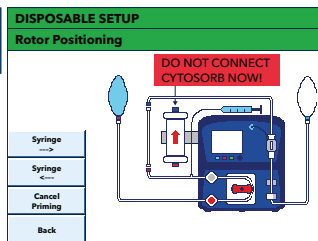
**Begin Setup**

**01**



Mount the CytoSorb® adsorber.

**02**



Setup bloodlines as shown on screen. Start with the **access blood line** with the pump segment.

**03**



**1. Confirm pump segment and inline transducer placing**



## CytoSorb® PuriFi Standalone



04



Connect heparin syringe to heparin line and place syringe in slider.

2. Confirm heparin syringe is connected and in place

Open clamp on heparin line.  
Press Syringe <--- to prime line.

3. Confirm heparin line clamp is open and primed

05



Connect **blood return line**, transparent bypass adapter and **access blood line**.

4. Confirm the connection to the CytoSorb® bypass adapter

06



Mount chamber (bubble catcher) on **blood return line**.  
Push down return chamber.

5. Confirm the return chamber placing

07



Insert **blood return line** in air sensor and automatic clamp.

6. Confirm air sensor and return clamp line placing



Visit  
[cyto.zone/setup-purifi-video/eng](https://cyto.zone/setup-purifi-video/eng)

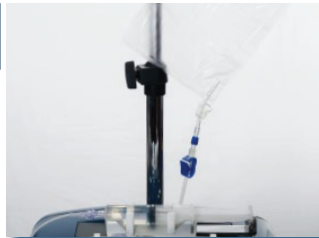
08



Insert hydrophobic filter to metal connector.  
Secure it with the **blue luer** cap.  
Check tightening!

7. Confirm connection of pressure  
line to return pressure transducer

09



Connect **blood return line** to waste bag.

8. Confirm connection of the  
return line to the waste bag

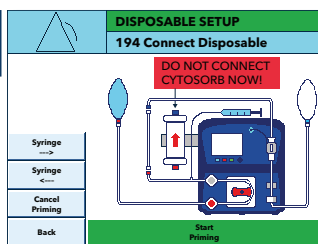
10



Connect **access blood line** to isotonic saline bag.

9. Confirm connection of  
access line to isotonic saline bag

11



To initiate priming press:

Start Priming

Don't touch system while  
<Test in Progress> is displayed.

## CytoSorb® PuriFi Standalone



12



Connect:

- **Red connector** on adsorber inlet
- **Blue connector** on adsorber outlet

Don't remove both adsorber port plug caps at the same time. Keep adapter caps.

10. Confirm lines connected  
to CytoSorb®

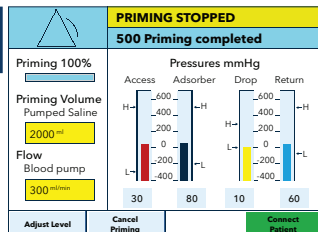
13



Connect **blood return line** to isotonic saline bag to have both lines on the same bag.

11. Confirm return line connection  
to isotonic saline bag

14



After priming is completed:

- to circulate prior to connection press the button below the display:

START  
STOP

- to initiate treatment press:

Connect Patient



Visit  
[cyto.zone/setup-purifi-video/eng](https://cyto.zone/setup-purifi-video/eng)

15



Choose mode of connection



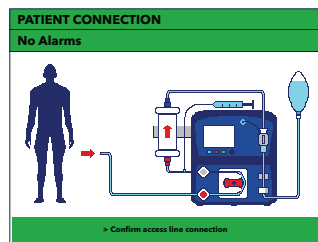
> Serial patient connection

Connect access line, system fills, connect return line. Connection without isotonic saline bolus.

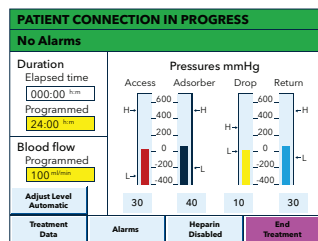


> Parallel patient connection

Connect access and return line at the same time. Connection with isotonic saline bolus.



> Confirm return line connection



Wait till lines are filled with blood.

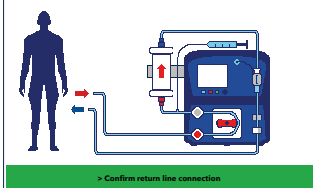
# CytoSorb® PuriFi Standalone



16

## PATIENT CONNECTION

No Alarms



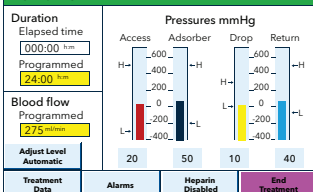
> Confirm return line connection

> Confirm return line connection

17

## TREATMENT IN PROGRESS

No Alarms



Adjust treatment parameters and start CytoSorb® Therapy.

To start the blood pump press the button below the display:

**START STOP**

Adjust alarms once the system has stabilized while running on the patient.

Plan adsorber exchange latest after 24h.



Visit  
[cyto.zone/setup-purifi-video/eng](https://cyto.zone/setup-purifi-video/eng)

(A) CytoSorb® adsorber

(B) Access (arterial)  
inline pressure sensor

(C) Pre adsorber  
inline pressure sensor

(D) Return (venous) pressure  
sensor and auto-leveling  
bubble trap

(E) Air blood detector /  
Venous clamp

(F) **Blood return line** line is connection  
either to a waste bag, a isotonic  
saline bag or the patient as specified  
in setup steps

(G) **Access blood line** line is connected  
to isotonic saline bag or patient as  
specified in setup steps

(H) Isotonic saline bag for priming  
1x2 or 2x1 liter

(I) Blood pump

(J) Heparin line and  
heparin syringe pump





## Setup modes

### Blood line setup Vascular

Direct connection to vascular access (e.g. Shaldon line) with disconnect alarm on **blood return line**, if return pressure is <10 mmHg in case of a disconnect.

### Blood line setup ECMO.

Connection to an ECMO system. The system is optimized for ECMO pressure conditions. No disconnect alarm on the **blood return line**.

PRIMING PARAMETERS	
No Alarms	
Volume Priming	2000 <sup>ml</sup>
Type of Treatment	Adult
Treatment Time	24:00 h:m
> Select yellow Parameter Field > Adjust and Confirm with Rotary Dial	
<b>Back</b>	<b>Begin Setup</b>

### Choose:

1. Volume for priming of the adsorber
2. **Adult** or **Pediatric** blood line set
3. Planned treatment time

TREATMENT IN PROGRESS				
No Alarms				
Duration Elapsed time	Pressures mmHg Access    Adsorber    Drop    Return 			
Blood flow Programmed	100 ml/min			
Adjust Level Automatic				
Treatment Data	Alarms	Heparin Continuous	End Treatment	

1
2
3
4

- 1 Help function
- 2 Mute / Reset alarms
- 3 Start / Stop pump
- 4 Rotary dial to change and confirm selected parameter

### CE Certified / notified body / QM-System

YES / 0344 – DEKRA/ISO 13485

### Intended use

The CytoSorb Device (CytoSorb®) is a non-pyrogenic, sterile, single-use device containing adsorbent polymer beads designed to remove cytokines, and / or bilirubin, and / or myoglobin and / or P2Y<sub>12</sub> inhibitor ticagrelor and / or rivaroxaban as blood passes through the device. CytoSorb is placed in a blood pump circuit.

### Adsorbent volume / extracorporeal blood volume

300 ml / 150 ml

### Adsorbent / surface

Proprietary and patented cross-linked divinylbenzene polymere, exclusively produced by CytoSorbents in the USA / 45,000m<sup>2</sup>

### Adsorption spectrum / biocompatibility

Adsorption midsize hydrophobic molecules up to a size of approximately 60kDa / Biocompatibility tested as required in ISO10993

### Mode of operation covered by IFU

Any extracorporeal blood circuit (Hemoperfusion (HP)), intermittent hemodialysis (HD), continuous renal replacement therapy (CRRT), cardiopulmonary bypass (CPB), extracorporeal membrane oxygenation/extracorporeal life support (ECMO / ECLS).

### Blood flow rates min-max

100 - 700 ml/min

### Pressure drop $\Delta P$ (Hct 32% $\pm$ 3% at 37°C $\pm$ 1°C)

Qb $\leq$ 700 ml/min	140 mmHg
Qb $\leq$ 500 ml/min	90 mmHg
Qb $\leq$ 200 ml/min	30 mmHg

Qb = blood flow





#### Priming fluid, procedure and duration

Flushing with 2 liters of sterile isotonic saline (NaCl 0,9%) / Priming takes approximately 5 minutes. CytoSorb® contains pre-loaded physiological isotonic saline with a pH level of 6.8 pre-flush. Heparin priming is NOT required to coat the bead surface prior to use.

Use on heparin induced thrombocytopenia (HIT) patients if anticoagulated with citrate. Citrate can be used on a CRRT System.

#### Max. pressure limit

760 mmHg

#### Max. treatment time per device

Change CytoSorb® after 24 hours maximum. Change CytoSorb® every 12 hours for the first 24 hours if indicated by ongoing hemodynamic instability.

#### Anticoagulation

Heparin or citrate

#### Sterilization / shelf life / storage conditions

Gamma sterilization / 3 years / 1°C to 40°C

#### Further details

Latex- and PHT free product

#### GMDN-Code / EMDN Code

34422 - Hemoperfusion system adsorption column / F010702

# Classification of drugs



Insignificant in-vivo removal	Low in-vitro removal
Negligible clearance increase (<25%) or low percentage removal (<30%)	<30% percentage removal, but no in-vivo data available
Dose adjustment seems unnecessary*	Dose adjustment seems unnecessary*
Amikacin	Adrenaline / Epinephrine
Anidulafungin	Metformin
Basiliximab	Noradrenaline / Norepinephrine
Cefepime	Paracetamol (Acetaminophen)
Ceftazidime	Theophylline
Ceftriaxone	
Ciclosporine A	
Ciprofloxacin	
Clarithromycin	
Clindamycin	
Everolimus	
Flucloxacillin	
Ganciclovir	Antiinfectives
Meropenem	Medication in italics: animal data
Methylprednisolone	* General view on clinically expected drug removal per category, based on available data. Therapeutic drug monitoring (TDM) is always recommended in principle, if available, to control dosing.
Metronidazole	
Mycophenolate mofetil (MMF)	
Piperacillin	
Prednisolone	Modified after: Scheier J et al. Mechanistic Considerations and Pharmacokinetic Implications on Concomitant Drug Administration During CytoSorb® Therapy. Critical Care Explorations 2022;4(5):e0688; More data might be available in the meantime. References available on request.
Tacrolimus	

**Classification of drugs**  
according to expected clinical  
significance of CytoSorb® adsorption



Significant in-vitro removal	Significant in-vivo removal
>30% percentage removal, but no in-vivo data available	>25% clearance increase or >30% percentage removal
Dose adjustment may be necessary*	Dose adjustment seems necessary*
Agatrobán	Amitriptyline
Amiodarone	<i>Amphotericin B</i>
Amlodipine	Apixaban
Carbamazepine	Bivalirudin
Dabigatran	<i>Cefiderocol</i>
Diazepam	Clozapine
Digoxin	Digitoxin
Edoxaban	Flecainide
<i>Gentamycin</i>	<i>Fluconazole</i>
Ibuprofen	Imipramine
Iodixanol	Lamotrigine
Levosimendan	<i>Levofloxacin</i>
Methylene blue	<i>Linezolid</i>
Oxcarbazepine	<i>Posaconazole</i>
Phenobarbital	Quetiapine
Phenytoin	<i>Teicoplanin</i>
<i>Remdesivir/ GS-441524</i>	Ticagrelor
Rivaroxaban	<i>Tobramycin</i>
Valproic acid	<i>Vancomycin</i>
Verapamil	
<i>Voriconazole</i>	

# CytoSorb® Kits



**The complete package** for CytoSorb® integration into all renal replacement therapies (RRT), cardiopulmonary bypass (CPB) and ECMO circuits

### CytoSorb® 300 Adsorber

- + Priming Set
- + Integration Set
- + Quick Setup Guide

#### **Simplifies CytoSorb® preparation and integration according to Instructions for Use (IFU)**

- ✓ Customized integration into all standard extracorporeal circuits\*
- ✓ Time saving preparation

#### **Always at your fingertips: Faster processes from order to use**

- ✓ Simplified logistics and warehousing
- ✓ Reduces individual accessory orders
- ✓ Optimised outer packaging improves CO<sub>2</sub> footprint



**Visit**  
[cyto.zone/setup](https://cyto.zone/setup)  
and learn more about  
CytoSorb® integration options

## Complete package for CytoSorb® integration



A CytoSorb® Kit and a bag of isotonic saline solution and you're ready to go! The customized kits include the CytoSorb® adsorber and all accessories for integration in hemodialysis, hemofiltration, CPB or ECMO according to manufacturer specifications. This gives you all the well-proven and documented benefits of CytoSorb® Therapy in one easy-to-use kit.

↓ Kits	Packaging unit	RRT Pre-Filter	RRT Post-Filter	CPB	ECMO*
<b>CytoSorb® Pre-Filter Kit</b>	<b>10 Kits</b>				
CytoSorb® 300 Adsorber		✓			
CytoSorb® Pre-Filter Integration Adapter (1a)		✓			
CytoSorb® Pre-Filter Priming Set (1b)		✓			
<b>CytoSorb® Post-Filter Kit</b>	<b>10 Kits</b>				
CytoSorb® 300 Adsorber			✓		
CytoSorb® Post-Filter Integration Adapter (2a)			✓		
CytoSorb® Post-Filter Priming Set (2b)			✓		
<b>CytoSorb® CPB Kit</b>	<b>10 Kits</b>				
CytoSorb® 300 Adsorber				✓	✓
CytoSorb® CPB/ECMO Priming Set				✓	✓
<b>CytoSorb® ECMO Connector *</b>	<b>6 Adapter</b>				
CytoSorb® EC Connector Set					✓

Availability of treatment kits and accessories may vary by country. Please contact your CytoSorbents sales representative / distributor for more information.

\* The separate ECMO connectors are used on ECMO systems during priming to create an interface for accessories. This allows for quick and easy CytoSorb® adsorber integration and replacement at any time.

# Your CytoSorbents Contact

Service-Hotline  
**Daily 7 am to 11 pm**  
CET/CEST

 +49 30 - 65 499 145  
 [hotline@cytosorbents.com](mailto:hotline@cytosorbents.com)



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B1031R13ENG2024

**CytoSorbents™**