

Cytokine absorption and continuous renal replacement therapy for septic shock and acute kidney injury

Krisztina Körtvélyesiné Bari¹, József Balla^{1,2}

¹Fresenius Medical Care Dialysis Centre Debrecen, Hungary

²Division of Nephrology, Department of Internal Medicine, Faculty of Medicine, University of Debrecen, Debrecen, Hungary

Introduction

Recently, the Cytokine Absorption Therapy (CAT) filter has received regulatory approval for septic patients in Hungary. Technically, CAT can be combined with continuous renal replacement therapy (CRRT) (Figure 2.). Nevertheless, the practical combination of these two technologies has not yet been systematically studied and understood.

Objectives

To reduce the patient's need for catecholamines and transfusion in order to improve their general condition and to remove toxic substances and excess fluid curing a life-threatening condition.

Methods

We received an emergency renal consultation request for a 5 - year old girl with erysipelas rapidly progressing to a septic shock and Acute Kidney Injury (AKI) with massive volume-related weight gain (VRWG). She had an initial insect bite on the right lower extremity with rapidly advancing oedema and erythema proximally. Despite administration of appropriate antibiotics, she progressed to septic shock with multi-organ failure with AKI, severe VRWG and necrotic changes on the right lower extremity (RLE) within hours (Figure 1.). She received one initial plasma exchange with fresh frozen plasma thereafter CRRT was initiated with continuous veno-venous haemodialysis and regional citrate anticoagulation (RCA). As the clinical picture strongly suggested a bacterial toxin-mediated process, the CRRT circuit was supplemented by a CAT filter. As a result of a 72-hour period of the CVVHD-CytoSorb® therapy without any incidents, cardiovascular stability improved on lower vasopressor doses, FiO₂ decreased from 0.95 to 0.4, airway pressures PIP/PEEP from 27/10 to 24/8 cmH₂O and respiratory rate from 25 to 15 /min, respectively. In addition, levels of major laboratory parameters decreased (Table 1.) as well as plasma concentrations of pro-inflammatory and immunomodulatory cytokines. This attenuation of the inflammatory response correlated with the clinical improvement. The need for platelets decreased dramatically 48 hours after CAT filter therapy and the diffuse erythroderma, purpura, and petechiae started to fade. CVVHD was continued for another 8 days due to pronounced fluid overload, reaching normal rates of diuresis on day 17, three days after successful extubation and termination of the initial empiric antibiotic combination therapy. Blood cultures, urine, and stool remained negative. Her RLE healed and she recovered well from respiratory failure and AKI.

Conclusion

A timely removal of cytokines under continuous renal replacement therapy associated with cytokine absorption therapy can promote recovery of patients from septic shock.

References

1. Van der Linde GW, Grootendorst A. First case of toxic shock treated with haemoabsorption by CytoSorb in the Netherlands. *Neth J Crit Care* 2016 24(2): 27-29
2. 8. Schädler D, Porzelius C et al: A multicenter randomized controlled study of an extracorporeal cytokine hemoabsorption device in septic patients *Crit Care* 2013;17-(Suppl 2):P62 *Crit Care*. 2013; 17(Suppl 2): P62.
3. Use of hemoabsorption in a case of pediatric toxic shock syndrome Andrea Berkes, Edit Szikszay, János Kappelmayer, Adrienne Kerényi, Tamás Szabó, László Ujhelyi, György Balla, József Balla, Case Report in *Critical Care*, Volume 17 (2017), Article ID 3818407, 5 pages, <https://doi.org/10.1155/2017/3818407>



Figure 1. Diffuse erythroderma, purpura, petechiae with severe generalised oedema (A), Erythroderma, livid swelling, confluent bullae and diffuse desquamation of the right leg (B, C).

Therapy	1.day	2.day	3.day	4.day	10.day
Medicines	Cefador, Anthisztamin	Vancocyn, Mycosist, Clindamycin	Dopamin, Dobu- trex, Arterenol, Humaglobin, Furosemid,		Catecholamine requirement ceased
Treatment			Plasma exchange	CVVHD- CYTOSORB	Treatment end

	1.day	2.day	3.day	4.day	10.day
Leukocytia	15,44 G/L	8,67	6,96	1,91	3,78
Hgb	107 g/L	104	106	102	110
BUN	10,5 mmol/L	11,1	24,3	18,8	7,6
Creatinin	196umol/L	134	210	163	78
CRP	260,98 mg/L	140,9	113,54	50,5	76
Procalcitonin	218,46 ug/L	95,07	20,54	4,06	2,8

Hosp Day # Sample Type	Pre-CytoSorb Treatment	Post-CytoSorb Treatment	% Remaining	% Removed
	Day 3	Day 6		
IL-6	394,97	78,89	19,97	80,03
IL-8	264,43	222,37	84,09	15,91
IL-10	343,98	130,34	37,89	62,11
IFN-g	604,63	0	0,00	100,00
GM-CSF	1256,17	995,26	79,23	20,77
MIP-1a	13,27	3,12	23,51	76,49
TNF-a	16,27	5,08	31,22	68,78

Table 1. Lab results and efficacy of applied therapies



Figure 2. CRRT and CAT with citrate anticoagulation