# 패혈증 치료에서 CRRT의 역할

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# The Role of CRRT in the Treatment of Sepsis

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Infection causes severe sepsis or septic shock by cascade activation of both pro-and anti- inflammatory cytokines, which result in vicious cycle of tissue injury and immune suppression. The failure of conventional CVVH to improve survival of sepsis might be due to late start of CVVH, which cannot cut the peak of amplified inflammatory response in the late stage of sepsis. However increased removal of inflammatory cytokines by very early CVVH can successfully cut the peak and prevent downstream activation of inflammatory response. In view of this consideration, we prospectively evaluated the impact of very early CVVH on the outcome of severe sepsis or septic shock.

During 4 years study period, 110 patients who admitted to MICU with severe sepsis or septic shock were randomized to either early CVVH group (n=55) or control group (n=55). In the early CVVH group, 48 hrs of CVVH (target ultrafiltration rate, 2,000 mL/hour) using Prisma® (Gambro, Sweden) was started within 1 hour after diagnosis of severe sepsis or septic shock, After 48 hrs, CVVH continued if the patients develop ARF, which met the conventional criteria for dialysis. In the control group, patients were initially treated by supportive care. CVVH started only when the patients develop ARF, which met the conventional criteria for dialysis such as diuretic refractory oliguria and volume overload, severe azotemia, metabolic acidosis and hyperkalemia. Disease severity was assessed by the Acute Physiologic and Chronic Health Evaluation (APACHE) II scores. The primary endpoint was hospital survival at discharge.

Survival rate in the early CVVH group was significantly higher than in the control group (72% versus 48%, $p<0.05$, per-protocol analysis). According to the adjusted Cox analysis, high APACHE 2 score and late development of ARF requiring CVVH were independent risk factors for death. On the contrary, early CVVH could independently reduce mortality by 70%. Early CVVH was also associated with less ventilator support and shorter dopamine use. At enrollment, there were no differences in APACHE II scores, prevalence of shock and oliguria between two groups. In the course of sepsis, oliguric ARF was developed in 57% of patients in the early CVVH group and 50% of patients in the control group. In subgroup of patients with oliguric ARF, late start of CVVH by conventional criteria was associated with significantly higher mortality as compared to the patients treated by early CVVH (78% versus 40%, $p<0.001$). As compared to the early CVVH group,there was average 47 hours of delay in CVVH start in the late CVVH group. This delay is usually due to furosemide trial, which was used to increase urine volume in oliguric patient.

In patients with severe sepsis or septic shock, survival was improved by early CVVH. Earlier initiation of CVVH prior to the development of severe renal damagemay be of major therapeutic value in the treatment of severe sepsis or septic shock. Late start of CVVH waiting for a response to diuretics is not recommended in septic patients with oliguric ARF.