Lecture Code : JS07-S2
Session Name : KSN-KMA-KMDF Joint Symposium
Session Topic : The Future of Medical Devices for Hemodialysis
Date & Time, Place : June 20 (Fri) / 16:40-18:40 / Room 3 (GBR 103)

비침습적 심폐기능 영상모니터링을 통한 혈액투석 중 저혈압 위험도 예측지표와 선제적 예방 프로토콜 개발

Tong In Oh
Kyung Hee University, Republic of Korea

20–30% of patients undergoing hemodialysis (HD) experience intradialytic hypotension (IDH). IDH can cause acute symptoms such as nausea, vomiting, headache, seizures, and altered mental status. Over time, it may contribute to chronic diastolic dysfunction due to fluid overload-induced hypertension and left ventricular hypertrophy, ultimately increasing mortality in HD patients. These complications often interrupt treatment sessions, reducing dialysis efficiency. To prevent hypotension and its associated complications, dialysis centers typically use non-invasive blood pressure (NIBP) monitoring. However, the sudden and unpredictable fluctuations in blood pressure during dialysis highlight the need for novel approaches that can provide real-time hemodynamic monitoring. Electrical Impedance Tomography (EIT) is a non-invasive imaging modality that reconstructs the internal distribution of electrical conductivity and permittivity in the body using surface electrode measurements. In this study, we employed a high-speed lung volume measurement device (AirTom-R, BiLab, Korea). Impedance images were captured at 100 frames per second. From these EIT images, cardiac volume signals (CVS) were extracted to calculate stroke volume (SV), heart rate (HR), and cardiac output (CO). Thoracic fluid content (TFC) was estimated based on changes in electrical admittivity at end-exhalation. Additional hemodynamic parameters included stroke volume variation (SVV), blood volume variation (BVV), and the low-frequency component of heart rate variability (HRV). Hemodynamic variables before and after IDH episodes or clinical interventions were compared using paired t-tests. Results showed that hemodynamic indices such as SV decreased by 40–50% within the 10 minutes preceding IDH onset. Significant changes in EIT-derived parameters were also observed in response to IDH episodes and therapeutic interventions (Figure 1). These findings demonstrate the feasibility of high-speed EIT for real-time monitoring of hemodynamic changes during HD. Future studies should focus on the predictive value of EIT for IDH, potentially enabling personalized and proactive

management of HD patients through continuous physiological monitoring.

Keywords: EIT, hemodialysis, intradialysis hypotension, hemodyanmic monitoring, stroke volume

그림 1.png

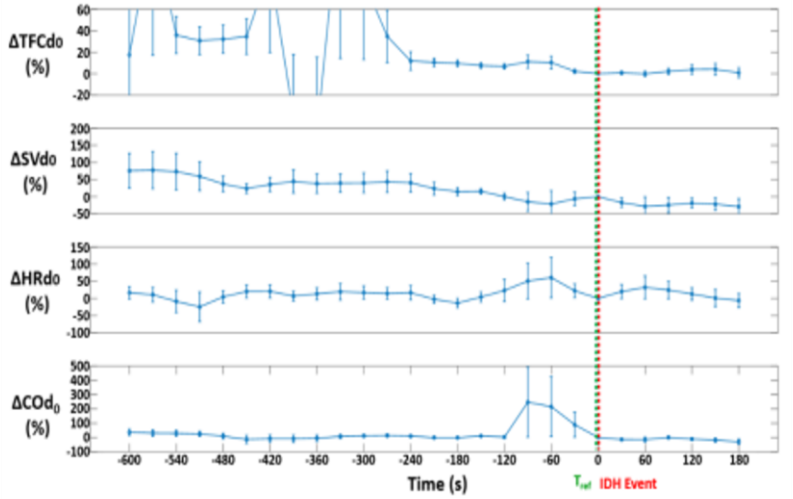

Figure 1. Changes in hemodynamic indices associated with the onset of IDH