

Hemodynamic Monitoring During Hemodialysis Using Noninvasive Impedance Cardiography

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Introduction

Cardiovascular disease is the leading cause of morbidity and mortality in ESRD. Monitoring and treating the hemodynamics and cardiovascular instability during dialysis could improve this significantly.

Cardiac output (CO) decreases significantly during Hemodialysis (HD) and autonomic dysfunction is also common in dialysis populations. Measurement of SVR and its change during hemodialysis may have prognostic significance. Impedance Cardiography (ICG) a new noninvasive technology can be used to monitor hemodynamic parameters during HD.

Methods

We have evaluated the hemodynamic data on 37 random patients in our dialysis unit. The average age was 66.6 years, 23/37 were female, 15/37 had diabetes, 8/37 Caucasian, and 29/37 were African American.

Impedance cardiography, which converts the changes in thoracic electrical impedance to changes in volume over time, was used to measure the hemodynamics (BioZ[®] ICG Monitor, CardioDynamics, San Diego, CA, USA).

Four surface electrodes were placed, two on the neck and two on the chest opposite to each other. Measurements were taken at predialysis, 10 minutes, 2 hours into dialysis and at the end of the treatment.

Results

Blood pressure decreased in 28 patients and increased in 9 patients during the period of dialysis. Among the patients whose BP decreased, 20/28 patients (71.4%) had decreased SVR. Among the patients with decreased SVR, 8/20 (40%) had decreased cardiac output and 12/20 (60%) had increased CO. Remaining 8/28 (28%) patients had increased SVR but decreased CO.

16/28 (57%) patients had decreased CO, among them 8/16 (50%) had increased SVR and remaining 8/16 (50%) had decreased SVR. 12/28 (42%) patients had increased CO but decreased SVR.

Among the 9 patients who had increased BP during dialysis, 6/9 (66%) had increased SVR and 3/9 (33%) had decreased SVR. 6/9 (66%) had increased CO and 3/9 (33%) had decreased CO. Ultrafiltration volume, presence of diabetes, age, sex, and medications did not seem to influence the parameters.

Conclusion

In summary, the hemodynamic changes during hemodialysis probably have multifactorial causes and are due to a combination of SVR and CO changes. Individual attention may be needed for the proper management.