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혈액투석 중인 말기신부전 환자에서 인공신경망을 통한 혈중 적혈구 수치 예측 알고리즘 개발과 적절한 에리스로포이에틴 용량 처방에 대한 연구

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In patients with kidney failure with replacement therapy (KFRT), optimizing anemia management in these patients is a challenging problem because of the complexities of the underlying diseases and heterogeneous responses to erythropoiesis-stimulating agents (ESAs). Therefore, we propose a ESA dose recommendation model based on sequential awareness neural networks. Data from 466 KFRT patients (12,907 dialysis sessions) in seven tertiary-care general hospitals were included in the experiment. First, a Hb prediction model was developed to simulate longitudinal heterogeneous ESA and Hb interactions. Based on the prediction model as a prospective study simulator, we built an ESA dose recommendation model to predict the required amount of ESA dose to reach a target hemoglobin level after 30 days. Each model's performance was evaluated in the mean absolute error (MAE). The MAEs presenting the best results of the prediction and recommendation model were 0.59 (95% confidence interval: 0.56–0.62) g/dL and 43.2 μg (ESAs dose), respectively. Compared to the results in the real-world clinical data, the recommendation model achieved a reduction of ESA dose (Algorithm: 140 vs. Human: 150 μg/month, $P < 0.001$), a more stable monthly Hb difference (Algorithm: 0.6 vs. Human: 0.8 g/dL, $P < 0.001$), and an improved target Hb success rate (Algorithm: 79.5% vs. Human: 62.9% for previous month's Hb < 10.0 g/dL; Algorithm: 95.7% vs. Human:73.0% for previous month's Hb 10.0–12.0 g/dL). We developed an ESA dose recommendation model for optimizing anemia management in patients with KFRT and showed its potential effectiveness in a simulated prospective study.