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Dual-clamp method increases the actual blood flow rate in single-needle hemodialysis

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Objectives : Single-needle hemodialysis (SNHD) is a technique in which a single puncture needle is used to remove and return blood, and is a particularly beneficial technique for patients with vascular access complications. In Japan, blood flow was controlled using only one clamp on the venous line (conventional method = CM) and the actual blood flow rate decreased due to blood recirculation. We then developed the dual-clamp method (DCM), in which an additional clamp was introduced on the arterial line to suppress recirculation when the venous line clamp was open. The aim of the present study was to evaluate whether the DCM actually improved the blood flow rate and recirculation in vitro.
Methods : The actual blood flow rate and recirculation were measured at a fixed return blood switching pressure of 400 mm Hg and a fixed blood flow rate of 200 ml/min, and at varying remove blood switching pressure (RBSP) values from 50 mm Hg to 350 mm Hg in 100 mm Hg increments in both the DCM and the CM.
Results : A maximum actual blood flow rate of 81.2±0.31 ml/min and minimum recirculation rate of 13.8% at a RBSP of 250 mm Hg was noted with the CM. With the DCM, the maximum actual blood flow rate was 87.1±0.31 ml/min and the minimum recirculation rate was 7.6% at a RBSP of 250 mm Hg. Furthermore, an actual blood flow rate of 117.9±0.33 ml/min was achieved with the DCM when the blood flow rate was increased to 350 ml/min. If a patient weighing 40 kg underwent hemodialysis under these conditions, the Kt/V would be 1.2, which would be sufficient to continue dialysis with SNHD.
Conclusions : The dual-clamp method is expected to ensure higher blood flow with suppressed recirculation as compared with the conventional method in single-needle hemodialysis.