ARTERIOVENOUS FISTULA (AVF) BLOOD FLOW IN CHRONIC HAEMODIALYSIS PATIENTS (CHP): COMPARISON OF RESULTS OBTAINED BY THE DYE-DILUTION METHOD (QAVF) AND BY VARIATIONS IN CARDIAC OUTPUT DURING TEMPORARY OCCLUSION OF THE AVF (ΔQC)

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Material and Methods

Eleven latero-terminal AVF were studied, eight AVF of the forearm and three AVF of the arm. The direction of blood flow in the distal arterial segment of the AVF, studied by ultrasound-Doppler effect was either retrograde (AVF type I), i.e. directed from the hand towards the AVF (six times in the eight forearm AVF), or normal (AVF type II), i.e. directed from the AVF towards the hand in the other five cases. QAVF was measured by rapid injection of a quantity (m) of dye (cardiogreen) into the afferent artery proximal to the AVF and by measurement of the concentration of dye (C) in blood collected from an efferent vein of the AVF. ΔQC was measured by the differences between QC measured at rest in a horizontal position, by thermodilution, 1) before occlusion of the AVF; 2) more than four minutes after occlusion of the AVF.

Dilution Curves

Dye dilution curves had the following characteristics: 1) in a given patient, the surface area beneath the curve was reproducible from one measurement to another; 2) recirculation of the dye occurred very late; 3) the downward part of the curve was exponential; 4) the mean transit time of the dye was four times greater than the duration of one pulse of blood flow. It may be concluded that:

1. Complete mixing of the dye and blood occurred between the site at which the dye was injected and that at which the blood was collected;

2. Despite the pulsatile nature of blood flow, Hamilton’s formula \( Q = m/\int C(t)dt \) could be used to calculate the flow in the mixing chamber. In the case of AVF type I, the flow measured was exactly that of the AVF. In the case of AVF type II, the flow measured was that of the proximal artery of the AVF and thus overestimated the true flow in the AVF by an amount equal to flow in the distal artery, a flow slight or negligible in comparison with the flow in the AVF.
Comparison of $\dot{Q}_{AVF}$ and of $\Delta \dot{Q}_C$

Values for $\dot{Q}_{AVF}$ lay between 0.5 and 4.0 L/min (mean ± standard error of the mean = 2.2 ± 0.5 L/min), values for $\Delta \dot{Q}_C$ lay between -0.4 L/min and 2.6 L/min (0.9 ± 0.3 L/min). For each AVF, $\dot{Q}_{AVF}$ was greater than $\Delta \dot{Q}_C$. The correlation between $\dot{Q}_{AVF}$ and $\Delta \dot{Q}_C$ was significant ($p < 0.01$) but for a given patient $\Delta \dot{Q}_C$ could not be used to accurately predict $\dot{Q}_{AVF}$. It may be concluded that variations in $\dot{Q}_C$ of CHP during temporary occlusion of the AVF: 1) were far less than the value of actual flow of the AVF; 2) could not be used to accurately predict the actual flow of the AVF.