HEPARIN CONCENTRATION DURING HAEMODIALYSIS WITH
HEPARINISATION BY AUTOMATIC INFUSION PUMP

A. TOURKANTONIS*
Dialysis Unit, I Medical Clinic, Free University of Berlin, Germany

Low heparin concentrations in the circulating blood permit haemodialysis in patients with
haemorrhagic diathesis and potential bleeding lesions.

Regional heparinisation (Anderson and Kolff, 1959; Lindholm and Murray, 1964;
Soulier et al., 1958; Gordon et al., 1956 a, b) maintains a short clotting time in the patient’s
blood which reflects a low heparin level (Kessel et al., 1962; Kuchenbuech and Kessel, 1965).
Lindquist et al. (1964) achieved similar short clotting times in arterial blood by administering
heparin as a continuous infusion. We have determined the heparin concentrations in arterial
blood and blood from the dialyser during this latter procedure.

Method
Our studies were carried out during 36 haemodialyses—12 with an Alwall dialyser, 15 with
a ‘twin coil’ and 9 with a ‘single coil’ (Travenol) kidney. The volumes required to fill the
dialysers were 900, 600 and 300 ml respectively. To every 300 ml of priming blood we
added 1500 I.U. of heparin** before the start of dialysis. The blood flow rate was 200
ml/min. and the duration of dialysis 6 hours. Heparin in physiological saline (4000 I.U. in
50 ml) was delivered into the arterial blood between the patient and the dialyser with a
constant infusion pump*. The infusion rate was regulated according to the blood clotting
times by capillary method (Piper, J., 1946) and varied between 0.2 and 1.0 ml/min. (0.16 to
0.8 mg/min. of heparin). The heparin concentrations were determined hourly on arterial
blood just as it left the patient (before heparin injection point) and on blood leaving the
dialyser (Hiepler, 1959).

Results
Fig. 1 shows the average heparin concentration in the arterial and dialyser blood during
dialysis with the 3 machines. After 1 hour the average heparin concentration was below
10 μg/ml except with the Alwall kidney. The greater priming volume of this machine
resulted in a higher initial dose of heparin and the early blood levels were therefore somewhat
higher. The lowest arterial levels were obtained with the single coil kidney. With all 3 machines
the dialyser blood concentrations were higher throughout.

Since low arterial concentrations of heparin can be maintained throughout dialysis,
neutralisation with protamine sulphate is not necessary. The relatively low concentrations
of heparin in the dialyser blood are sufficient to inhibit coagulation in a blood flow of
200 ml/min. The total heparin doses required were, on average, 14,500 I.U. for the Alwall
dialyser, 13,300 for the ‘twin coil’ kidney, and 12,700 for the ‘single coil’ kidney.

* Therapeutic University Clinic, Athens, Greece. Stipend holder of the Free Univ. of Berlin and the
Berlin Senate.
** Liqueemin R Deutsche Hoffman-La Roche A. G. Grenzach, Germany (1 mg = 100 I.U.)
* Unita I, Braun A. G., Melsungen, Germany.
In spite of the constant, low concentrations, the total heparin consumption can vary from dialysis to dialysis (Bennhold and Kessel, 1964) (Fig. 2). The continuous heparin infusion can be well controlled by determination of the coagulation times by the capillary method. If the clotting time of the arterial blood is 10 minutes, the heparin concentration may be estimated at 10 μg/ml.

Fig. 1. Average heparin concentrations in arterial (• --- •) and dialyser (•——•) blood during haemodialysis using continuous heparinisation with an infusion pump.

Fig. 2. Heparin concentrations and total heparin consumption during 5 dialyses on one patient with continuous heparinisation with an infusion pump. (Arterial • --- • and dialyser •——• blood.)
HEPARIN CONCENTRATION IN HAEMODIALYSIS WITH INFUSION HEPARINISATION

Comment
The heparin concentrations in the arterial blood were usually just as low as in the use of regional heparinisation (Kessel et al., 1965). Low concentrations were achieved rapidly and held constant, but no coagulation occurred in the dialyser blood.

Continuous heparinisation is feasible for all dialyses and is particularly useful in patients in danger of bleeding. With this technique the number of clotting controls during haemodialysis can be reduced.

Summary
In 36 haemodialyses using continuous heparinisation with an infusion pump after Lindquist et al. (1964), heparin concentrations in the arterial blood were just as low as in regional heparinisation. Continuous heparin infusion is therefore to be recommended as the substantially simpler method.

REFERENCES