Can telemedicine contribute to the expansion of home haemodialysis?

Sir,

Recently in your journal Mackenzie and Mactier described past and present home haemodialysis (HD) and for the future they anticipated that: ‘home HD as universally available cost-effective mode of dialysis may be best secured by centralizing training and support facilities in one centre in each geographical region’ [1].

We agree with the authors’ anticipations and for this reason we are working on a research project called HOMER-D (home rehabilitation treatment-dialysis), which is supported by the European Union.

The ultimate goal of HOMER-D is to develop, apply and validate telematic monitoring services (TMS) for supporting end-stage renal disease patients, who need home, or satellite HD. The system’s architecture includes two main components: the central control station (CCS) to be used by nephrologists and nurses and the modified HD machine in patients’ homes, to be used by patients and their partners. The telemonitoring of patient’s HD and self management actions, and the remote care from doctors in our system is succeeded by bi-directional communication links (Integrated Service Digital Networks—ISDN), between the CCS (UNIX workstation with multimedia PC-terminal) and modified HD machine (multimedia PC-terminal) in the patients’ home.

In this system, an on-line remote supervision of the HD machine related functions and the clinical condition of the patients, through measurements of blood pressure (BP), pulse rate, \( \text{PO}_2 \) (pulse oxymetry) and electrocardiogram (ECG) are managed by the CCS.

For the clinical trials by this form of HD, two HD machines, modified for the project, were installed in the renal unit and the CCS was established in another room in the hospital. In a 4 month period we performed about 100 HD sessions in two patients using this system. During the clinical...
trials, the telemonitoring and the teleconsultation from the observer in the CCS to the renal unit staff were successful. Also the measurements of BP, pulse rate, PO$_2$ and ECG were monitored satisfactorily by the CCS, whenever the supervision seemed necessary. Such clinical trials will take place in other hospitals and in the patients’ home.

Today, there are some optimistic indications for the development of home HD in the future. The main factors which favour the increase of home HD are the technical advances, the current debate about the long-term adequacy of CAPD and the referred benefits of home HD by recent papers. Many reports support that home HD might offer better medical rehabilitation, more independence and that it is the optimal treatment for patients, who can do it. Moreover, the patient on home HD selects the day, the time and the duration of the treatment. Recently, a new form of home HD, nocturnal HD has been reported. This is performed 6–7 nights per week, for 8–10 h during sleep at home. Dialysis functions from patients’ homes were monitored via a modem at the nocturnal haemodialysis centre [2].

Although home HD has been associated with better outcomes, its use is restricted. We think that time is coming for the expansion of home HD. Its success depends on technical advances and patients’ education [3–5]. Telemedicine is changing classical health care, by providing efficient solutions to some medical activities, because patient decisions are finally supervised and confirmed by doctors. The two-way communication between patients and doctors allows patients to ask for advice, as well as doctors’ supervision of a patients’ therapeutic actions [6–8].

The goal of our project is to use the advantages of telematic monitoring services for supporting home HD by medical supervision. According to our preliminary trial, the traditional home HD can be modified by the application of telematic service. However, more clinical trials are needed to evaluate the efficiency, safety and learnability of this system.

**Department of Nephrology**

Aretaeion University

Hospital

Athens

Greece

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**Erythropoietin and oxidative stress in haemodialysis: beneficial effects of vitamin E supplementation**

Sir,

Haemolysis is an important mechanism contributing to anaemia in children undergoing chronic haemodialysis (HD). Chronic renal failure (CRF) and HD are important factors causing a disturbance in the balance between oxidative stress and antioxidant defence mechanisms, which leads to oxidative haemolysis. Recently Cristol et al. [1] presented data on 12 CRF patients receiving erythropoietin and 30 patients not receiving erythropoietin treatment. They measured the serum malondialdehyde (MDA), red blood cell (RBC) α-tocopherol, RBC glutathione levels and the RBC superoxide dismutase (SOD) activities. In patients not treated with erythropoietin, elevated serum MDA and significantly decreased RBC vitamin E level were observed despite normal serum vitamin E concentrations. The decrease in the RBC vitamin E level was more marked in patients treated with erythropoietin. Vitamin E supplementation (500 mg daily) resulted in a significant increase in the RBC vitamin E concentration and a reduction in the erythropoietin dose (from 93 ± 24 to 74 ± 26 U/kg/week), while the haemoglobin (Hb) concentrations remained stable. It was suggested that oxidative stress could be one of the resistance factors to the erythropoietin response in HD and that vitamin E supplementation could lead to a diminished erythropoietin dosage requirement.

We had examined 10 patients with CRF and HD, [2] and found significantly higher concentrations of RBC MDA and significantly lower activities of RBC antioxidant enzymes (SOD, catalase and glutathione peroxidase) than in the controls. Incubation of RBCs for 1 h with acetylphosphoryl-sazone induced a decrease in the concentration of reduced glutathione (H$_2$O$_2$-test) as a consequence of the defect of the pentose phosphate shunt which is responsible for the regeneration of GSH from the oxidized glutathione (GSSG). Simultaneously, an increase in Hb oxidation (metHb and haemichrome production) was also observed in the H$_2$O$_2$-test. We concluded that oxidative haemolysis is probably a multifactorial process in uraemic patients, and may be an important risk factor for anaemia in HD therapy.

In a 12 week-follow-up study in 10 children, the dose of erythropoietin in the first month was 50 U/kg, in the second month was 75 U/kg and in the third month was 100 U/kg. A rapid increase in the reticulocyte count was accompanied by a slower rise in total Hb concentration. The mean level of GSSG increased from 13.2 ± 5.3 to 56.7 ± 15.8 nmol/g Hb in the controls (P < 0.001). Before erythropoietin treatment, the H$_2$O$_2$-test revealed a decreased GSH regeneration, but the defect in regeneration became more pronounced in the first few weeks of erythropoietin therapy (P < 0.001). The levels of Hb derivatives (metHb and haemichrome) likewise increased during the first 4 weeks of erythropoietin therapy. The RBC MDA level was continuously higher and the SOD, catalase and glutathione peroxidase activities were significantly lower than in the controls (P < 0.001). These results are compatible with oxidative haemolysis and a reduction in the erythropoietin dosages to some medical activities, because patient decisions are finally supervised and confirmed by doctors. The two-way communication between patients and doctors allows patients to ask for advice, as well as doctors’ supervision of a patients’ therapeutic actions [6–8].