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CARDIAC DISORDER IN HEMODIALYSIS: BENEFITS OF CHINESE HERBS

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Abstract:

Background: A major cause of mortality in hemodialysis patients is cardiac disease. Most complementary and alternative therapies, including Chinese herbal medicine, have been useful in the treatment of cardiac disorders.

Materials and Methods: A 46 year old Asian woman with chronic renal failure was admitted to the clinic for hemodialysis. In the course of the fifth session of standard dialysis, she developed shock followed by a ventricular tachycardia which rapidly degenerated into cardiac arrest, from which she was resuscitated through cardio-pulmonary resuscitation. The following therapeutic strategies were applied: low discharge oxygen inhalation; stricter water and salt restriction; dialysate temperature set at 36.0 ^{O}C; rhEPO 3000u, per week, low molecular weight iron dextran, 200mg/day, intravenously for five days; the patient received Chinese herbal concoction orally.

Results: The patient obtained efficient standard dialysis without any cardiac syndrome.

Conclusion: Chinese herbs are useful in the management of cardiac disorders in hemodialysis. Chinese herbs may provide more benefits by adjusting dialysis strategies.

Key words: Hemodialysis; Cardiac arrest; Chinese herbs.

Introduction

A major cause of mortality in hemodialysis patients is cardiac disease. According to the reports of the International registries (Van *et al.*, 2001; Cheung *et al.*, 2004); sudden cardiac arrests accounts for about 10% -30% of deaths from all causes.

Many complementary and alternative therapies, including Chinese herbal medicine, have proved useful for the management of cardiac disorders (Amy and Steven, 2002; Fu *et al.*, 2010). The case we reported shows the positive role of Chinese herbal medicine for cardiac disorders during dialysis. For specific dialysis patients, the individual therapeutic program including Chinese herbal therapies may provide benefits.

Case report

The patient was a 46 year old Asian woman with a history of chronic renal failure. Her medication included ferrous sulphate 300mg, three times daily; folacin 10mg, three times daily; rhEPO 3000u, two times weekly; hydrochlorothiazide, 15mg, three times daily; nifedipine, 10mg, three times daily; and salt restriction.

She was admitted to the hospital for consideration of hemodialysis with the IgA nephropathy as the primary disease for 4 years. No history of heart disease, smoking and drinking was elicited. On physical examination, the pulse was regular at 82 beats/min, blood pressure was 140/90 mmHg, and the jugular venous pressure was normal. Body mass index (BMI, weight/height^2) was 20.7. There were no pulmonary abnormalities. The heart bwats were normal; there was a soft ejection systolic murmur over the second right intercostals space. Her serum potassium and sodium were 5.3mEq/L and 140mEq/L, Hemoglobin level was 7.7g/dl. Creatinine

and BUN levels were 875.3umol/L and 32.3moml/L. Serum PO_4 level was 6.2mg/dl, Serum calcium level was 9.4mg/dl, $Ca \times PO_4$ product was 58.28 mg^2/dl^2. The ECG showed sinus rhythm, left ventricular hypertrophy. On chest x ray, there was moderate cardiomegaly. Echocardiographic results: IVS 9.6mm, LVDd 58.5mm, FS 24%, EF 49%. There were no other significant laboratory findings.

A day after admission, arteriovenous fistula for hemodialysis was operated at the wrist in an end-to-side fashion. 14 days after the operation, three sessions of profiled hemodialysis were performed. A calibrated roller pump on the arterial tubing was set to provide 200ml/min through the dialyzer. On the dialysate side, a calibrated roller pump pumped dialysate from a reservoir at 500ml/min, with dialysate temperature at 37.0 ^OC. Euvolemic weight was determined clinically to be 69.5kg. The net ultrafiltration was 2L and held constant to keep at a constant weight of 69.5kg. All treatments were performed on Fresenius 4008B dialysis machine (Fresenius Inc., Germany). After profiled dialysis, the patient crossed over to the 4-h standard dialysis (two sessions/week). She had felt well the days prior to the fifth standard dialysis.

In course of the fifth standard dialysis, she developed shock followed by a ventricular tachycardia which rapidly degenerated into cardiac arrest, from which she was resuscitated by cardio-pulmonary resuscitation. After this cardiac arrest, the speed of arterial roller pump could not go beyond 150ml/min for the attack of cardiac syndrome: mild dyspnea, palpitation, hyperhidrosis and a few bilateral basal tales were heard. The cardiac syndrome and pump speed were in very close and positive correlation clinically. As a result of inadequate dialysis, her serum creatinine and potassium levels before eighth dialysis session increased to 806.0umol/L and 5.7mEq/L. Hemoglobin level was 7.2g/dl. Echocardiographic results: LVDd 59.6mm, FS 22%, EF 45%. Kt/V was 1.0 which means inadequate dialysis.

For the purpose of efficient dialysis, the following therapeutic strategies were applied: low discharge oxygen inhalation just before and during dialysis; stricter water and salt restriction to decrease ultrafiltration volume; dialysate temperature set at 36.0 ^OC; rhEPO 3000u, three times weekly; low molecular weight iron dextran (CosmoFer), 200mg/day, intravenously for five days. At the same time, the patient was orally administrated Chinese herbal concoction. The prescription was as follow: Huang Qi [Astragalus membranaceus (Fisch.) Bunge] 100g, Ren Shen [Panax ginseng C. A. Mey.] 10g, Fu Zi [Radix Aconiti Lateralis Preparata] 10g, Gan Jiang [Rhizoma Zingiberis] 10g, Shan Zhuyu [Fructus Corni] 30g, Ting Lizi [Semen Descurainiae] 15g, Mai Dong [Radix Ophiopogonis] 30g, Chuan Xiong [Rhizoma Chuanxiong] 20g, Wu Weizi [Fructus Schisandrae Chinensis] 15g. These crude drugs were mixed in 800ml water and decocted till 100^OC for 30 minutes twice. 200ml liquor was got finally. The concoction was taken orally by 200ml/day.

24-hour Holter recording was adopted during dialysis. The arterial pump speed was increased by 10ml/min every session without cardiac syndrome and with normal Holter recordings. After eight sessions of dialysis, the arterial pump speed was increased to 200ml/min. During this period, the net ultrafiltration volume was kept within 1L at a constant weight. The serum creatinine and potassium levels before the sixteenth dialysis session were 326.5umol/L and 4.6mEq/L. Hemoglobin level was 11.2g/dl. Echocardiographic results: LVDd was 54.6mm, FS was 27%, EF was 60%. Kt/V was 1.62. The patient obtained efficient standard dialysis without cardiac syndrome.

Discussion

Cardiovascular risk in uremic patients is very high. Left ventricular hypertrophy (LVH) is extremely frequent in uremic or dialysis patients. LVH and/or LV dysfunction, with volume and pressure load as crucial determinants, is the strongest predictor of mortality in dialysis population (Switalski *et al.*, 2000;Ansari *et al.*, 2001). Withdrawal of excess fluid by ultra-filtration, as the main goal of dialysis therapy, might result in hemodynamic instability with symptomatic hypotension (Galetta *et al.*, 2001). The incidence of symptomatic hypotension during dialysis is 0.3% per session (Daugirdas, 2001). The main causes are severe hypovolemia with an inadequate compensatory cardiovascular response (Zucchelli and Santoro, 1993). In this case, by water and salt restriction, the net ultrafiltration volume was kept within 1L compared with 2L previously.

There was evidence that myocardial contractility improved and inflammatory response is reduced during hemodialysis by

lowering dialysate temperatures, which improves vascular stability finally (Levy *et al*., 1992). So we changed dialysate temperature from 37.0 ^{O}C to 36 ^{O}C. There have been surprisingly few studies examined cardiac arrest and sudden death in dialysis populations. Moss reported on the cardiac status of dialysis patients (not exclusively during dialysis) (Moss *et al*., 1992). 34 percent (seventy-four) experienced cardio-pulmonary resuscitation; 8 percent (6 of 64) survived till discharge, and only two (3%) were alive 180 days later. Another study in Taiwan, 24 cases of cardiac arrest during hemodialysis was reported (Lai *et al*., 1999). All cases underwent cardio-pulmonary resuscitation. 29.2 percent (Seven) of patients survived but died within 24 hours. These data meant that sudden cardiac death still possess a major challenge during the process of dialysis. Some preventative strategy, such as cardioverter-defibrillator device implantation, was not fully studied in dialysis patients (Green *et al.*, 2011). There's need to direct more attention towards testing alternative interventions together with conventional therapeutic strategies that prevent cardiac arrest or reduce its lethality.

During the investigation of Chinese herbs traditionally used in the treatment of cardiac disorders, significant activities of some Chinese herbs were observed. Previous researches show that these Chinese herbs can improve both systolic and diastolic cardiac function, inhibit cardiac hypertrophy. Possible mechanisms include: (i) inhibition on left ventricular remodeling and apoptosis (Wang *et al.* 2002; Zhao *et al.* 2007); (ii) up-regulation of SERCA 2a gene expressions in left ventricular tissues (Su *et al.* 2009); (iii) downregulation of cardiac chymase signaling pathway and chymase-mediated Ang II production (Liu *et al.* 2012). These properties have prompted the compound prescription use in this case.

In Traditional Chinese Medicine, deficiency of heart Qi or abnormal heart Qi metabolism remain a major cause of initiation and development of cardiac disorders. With Heart Qi Deficiency, the circulatory system suffers greatly. It is said that blood nourishes the Qi, and Qi leads the blood. In short, if the Heart Qi is deficient, the blood is not properly directed. The Chinese herbs used in this case can strengthen the heart Qi and regulate heart Qi disorders.

We observed that, adjustments of dialysis strategy, together with Chinese herb administration, has proved to be beneficial. A major limitation of this study include among others: some laboratory data, including potassium, calcium, and bicarbonate concentrations, cannot reflect the serum values immediately pre-shock, were the "most recent available". Misclassification of hyperkalemia or hypokalemia, for example, would likely bias the association between pre-shock serum potassium level (as determined here) and arrest. Second, this study is only a case report, the conclusion need to be confirmed in large number of patients.

Notably, no previous reports of similar cases was reported in the current literature. The case supports the notion that these Chinese herbs are useful in the management of cardiac disorders in hemodialysis. While adjusting the dialysis strategies, Chinese herbs may provide more benefits.

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