

<http://dx.doi.org/10.4172/2472-1921.100004>

Renal anemia and L-carnitine therapy in hemodialysis patients

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Received: October 25, 2015; **Accepted:** October 28, 2015; **Published:** November 04, 2015

Renal anemia is a common complication in hemodialysis (HD) patients, and resulting mainly from reduced erythropoietin production [1,2]. Renal anemia can result in reduced exercise tolerance, impaired cognition, depression, dyspnea, heart failure and increased mortality in HD patients [1,2]. Erythropoietin therapy is a standard treatment for renal anemia; however, 5–10% of HD patients show erythropoietin resistance [1,3].

The most common cause of erythropoietin resistance is reduced iron availability, including absolute and functional iron deficiency [2]. Heparin, a 25-amino-acid peptide predominantly produced by liver, decreases the release of iron from storage tissues and causes a reduction in iron absorption from the gut (3). Therefore, heparin is involved in the pathogenesis of erythropoietin resistance [3]. Inflammation increases heparin production, limiting the availability of iron for erythropoiesis and thus providing a direct link between inflammation and erythropoietin resistance [1]. The reduction of inflammation is a reasonable approach for treating erythropoietin resistance.

Carnitine deficiency, like anemia and inflammation, is prevalent in HD patients and causes by low dietary intake, impaired de novo carnitine renal synthesis, and loss of free carnitine from body during hemodialysis [4]. It has been shown that dialysis patients with anemia have lower serum carnitine than nonanemic renal patients and need higher doses of erythropoietin [5]. To date, all studies (i.e. 8 trials) on the effects of L-carnitine supplement on inflammation, except one, showed that L-carnitine could significantly reduce serum inflammation markers in HD patients [6]. In addition, according to available literature, the majority of trials indicated that L-carnitine administration might have a beneficial effect on renal anemia management in dialysis patients. Eight trials showed that

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Citation: Tabibi H. Renal anemia and L-carnitine therapy in hemodialysis patients. *J Clin Nutr Diet.* 2016, 1:1

L-carnitine supplement in dialysis patients increased hemoglobin concentration [7-12] and decreased erythropoietin requirement [5,9,10] or erythropoietin resistance index [13]. However, some studies reported that L-carnitine supplement had no effect on hemoglobin concentration or erythropoietin requirement [14-17]. Therefore, L-carnitine supplement can be used as an adjuvant therapy to improve erythropoietin efficiency for the treatment of renal anemia in dialysis patients, especially those with carnitine deficiency or erythropoietin resistance.

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