

[Test Your Knowledge: CRS and the Role of Bone-Mineral Axis & Anemia](#)

There has been longstanding recognition of the relationship between CKD and cardiovascular morbidity and mortality. More recently, the term “cardiorenal syndrome” has been used to describe the interplay between heart and kidney dysfunction. In a recent *AJKD* article by [Charytan et al](#), the possible interaction between factors involved in renal osteodystrophy and anemia of CKD are discussed, along with their associations with cardiac dysfunction. The following questions based on the article will test your knowledge on this topic:

1. Match the Acute Dialysis Quality Initiative subtype descriptions of cardiorenal syndrome with the physiologic description.

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|--------------------------------|--|
| A. Cardiorenal Syndrome Type 1 | i. Chronic abnormalities in cardiac function leading to kidney dysfunction |
| B. Cardiorenal Syndrome Type 2 | ii. Systemic conditions causing simultaneous dysfunction of the heart & kidney |
| C. Cardiorenal Syndrome Type 3 | iii. Chronic abnormalities in kidney function leading to cardiac disease |
| D. Cardiorenal Syndrome Type 4 | iv. Acute worsening of kidney function causing cardiac dysfunction |
| E. Cardiorenal Syndrome Type 5 | v. Acute worsening of cardiac function leading to kidney dysfunction |

2. In a recent study by [Bacchetta et al](#), supplementation with a single dose of vitamin D resulted in which of the following results relevant to anemia?

- A. Reduction in hepcidin levels
- B. Increase in ferritin levels
- C. Increased tissue sensitivity to EPO
- D. Increased transferrin saturation
- E. Reduced GI iron absorption

3. Which of the following factors are thought to contribute to vascular calcification?

- A. Suppression of the renin-angiotensin-aldosterone system
- B. Down-regulation of the Pit-1 receptor
- C. Transformation of vascular smooth muscle cells to osteoblastic-type cells
- D. Vitamin D supplementation
- E. Administration of sevelamer as a phosphorus binder

4. Which of the following was a clinically significant finding from trials to evaluate treatment of renal osteodystrophy on cardiovascular outcomes?

- A. Treatment with paracalcitol in the PRIMO trial is associated with regression of LVH

B. Treatment with cinacalcet in the EVOLVE trial was associated with a reduction in hospitalizations for heart failure

C. Sevelamer, when compared to calcium-containing binders in the DCOR trial, was associated with reduced vascular calcification and reduction in cardiovascular events

Post prepared by Dr. John O'Bell, AJKD Blog Contributor.

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Solutions to AJKD Blog's [Test Your Knowledge: CRS and the Role of Bone-Mineral Axis & Anemia](#)

Based on [Charytan et al](#) AJKD article

1. A-v; B-I; C-iv; D-iii; E-ii

(See Table 1 from [Charytan et al](#) article)

2. A. Reduction in hepcidin levels

Hepcidin is an important mediator of iron trafficking. It is found at increased levels in chronic disease, resulting in reduced iron absorption from the GI tract and reduced iron trafficking from the liver and bone marrow. [In this study](#), a single dose of vitamin D was associated with a 34% reduction in hepcidin levels in healthy volunteers, suggesting a potential relationship between vitamin D deficiency and anemia of CKD.

3. C. Transformation of vascular smooth muscle cells to osteoblastic-type cells

Hyperphosphatemia is felt to cause endothelial dysfunction and apoptosis in vascular smooth muscle cells. Activation of the Pit-1 receptor has been noted, which encourages transformation of vascular smooth muscle cells to osteoblastic-type cells that contribute to vascular calcification. Vitamin D deficiency is thought to be contributory to vascular calcification. Part of the rationale behind the use of sevelamer as a phosphorus binder is that it reduces vascular calcification, not increase, but this has not been demonstrated to show improved cardiovascular outcomes when compared to calcium-containing binders.

4. B. Treatment with cinacalcet in the EVOLVE trial was associated with a reduction in hospitalizations for heart failure

The three trials mentioned above were largely negative with regard to cardiovascular endpoints; however there was an 18% reduction in hospitalizations for congestive heart failure in the [EVOLVE trial](#), which included 3883 patients on hemodialysis. There was no difference between the groups with regard to the primary cardiac endpoint in this trial.