Chapter 1

Historical Perspective of Calcium Management in Patients with Chronic Renal Diseases

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I. Introduction

The trade-off hypothesis emphasized the importance of calcium in the regulation of secondary hyperparathyroidism in chronic renal disease (CRD). Subsequently, Slatopolsky et al. in 1971 proved that restriction of phosphate (P) controls secondary hyperparathyroidism. Although the duration of the experiment was 1 year, restriction of phosphorus did control elevation of parathyroid hormone (PTH), because subjects maintained calcium (Ca) levels within the normal range. For the past 30 years, physicians have managed secondary hyperparathyroidism by increasing exogenous calcium intake and dialysate Ca concentrations. Soft tissue calcification was well recognized in 1977 by Kuzela et al. Because of increased exogenous Ca intake, tissue calcification occurs frequently in dialysis and in CRD patients. In 1995 Slatopolsky and others discovered that phosphorus was the major factor in controlling PTH. Because dietary restriction of P is very difficult to achieve, P binding agents (e.g., aluminum and magnesium compounds) were used to regulate P metabolism until these agents were discontinued because they were neurotoxic and caused bone damage. A recent study indicated that lanthanum carbonate deposits in tissues, for example, brain, liver, kidney, skeletal muscle myocardium, and lung, and in five of six nephrectomized rats after taking this compound for 4 weeks. Therefore, lanthanum carbonate should be used with caution.

II. Calcium Metabolism in Normal Subjects

To understand how to manage Ca metabolism in CRD, in normal subjects who ingest 1000 mg of dietary calcium/day, approximately 800 mg of calcium
is recovered in the feces. The intestine absorbs approximately 330 mg of ingested calcium and reabsorbs 70 mg of calcium secreted by the intestine (intestinal secretion is approximately 200 mg and 130 mg of the secreted amount is lost in the feces). A balance study has shown that a low-calcium diet increases and a high-calcium diet decreases fractional calcium absorption that occurs primarily in the ileum. Further, we need to have insight into Ca

Figure 1-1. Calcium balance of women consuming a self-selected diet. (Reproduced with permission of Am J Clin Nutr 1984;40:1368.)

Figure 1-2. Calcium balance of men consuming a self-selected diet. (Reproduced with permission of Am J Clin Nutr 1984;40:1368.)