Invited Speaker Plenary 2: Vitamin D & Bone Health

**Vitamin D: new insights into an old secosteroid**

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**Background** - Adequate vitamin D is well known to be important for bone health, primarily due to its ability to increase calcium and phosphate absorption from the diet, as well as promote good muscle function, but there is an increasing body of evidence which indicates that vitamin D may be important in a number of other conditions. Vitamin D is formed in skin when UV light opens up the B-ring of 7-dehydrocholesterol to form pre-vitamin D, which, at body temperature, converts into vitamin D. Thus vitamin D is not strictly a vitamin and is better termed a seco-steroid – a steroid with one of its rings disrupted. Some vitamin D is obtained from the diet but there are not many rich sources. Fortification with vitamin D is limited in Australia. Once made in skin, vitamin D is converted into 25-hydroxyvitamin D (25OHD) in the liver, with a near linear relationship between vitamin D and 25OHD. Vitamin D status is assessed by measuring 25OHD. In kidney and other tissues, 25OHD is converted into the hormonal form, 1,25-dihydroxyvitamin D, also called calcitriol.

**Adequate vitamin D** - Accumulating evidence indicates that adequate 25OHD concentrations are higher than the lower limit of most “normal” ranges, which is around 30nmol/L. Calcium absorption increases with increasing 25OHD concentrations up to 80nmol/L and then plateaus. Inadequate calcium absorption results in secondary hyperparathyroidism. Parathyroid hormone levels could be suppressed by high dose calcium and vitamin D in subjects with 25OHD concentrations below 50nmol/L but not those with higher 25OHD concentrations. Evidence of impaired lower extremity muscle function has been demonstrated in subjects whose 25OHD was below 40-60nmol/L. Thus in relation to bone and muscle, adequate vitamin D levels are at least 50nmol/L.

**Vitamin D and calcium** - While vitamin D is clearly important for calcium absorption, less well known is that adequate calcium is probably important to help conserve vitamin D. Low calcium intakes accelerate degradation of vitamin D compounds, probably due to secondary hyperparathyroidism. Supplemental calcium alone has been reported to increase 25OHD concentrations.

**Vitamin D and cancer** - Negative correlations have been reported between sunlight exposure/vitamin D intakes (in USA)/25OHD concentrations and the prevalence of or mortality from certain cancers including breast, prostate, colon, ovary and even melanoma. Whilst this association does not indicate any causative relationship, there are numerous studies which demonstrate decreased development of neoplasia or increased survival of animals with implanted tumours if animals are also treated with D compounds. There are a number of mechanisms possibly involved in these protective effects, including local production of calcitriol by tumour cells or invading macrophages, enhanced differentiation and reduced proliferation of tumour cells, a pro-apoptotic effect of active D compounds on tumour cells and reduced angiogenesis. When added topically to mouse skin, calcitriol or analogs decrease UV-induced DNA damage, sunburn cells and immune suppression.

**Other disorders** - Decreased development of type I diabetes has been reported in populations supplemented after birth with vitamin D. There is a clear latitude gradient for multiple sclerosis. In each case, animal models confirm the effects. Calcitriol has been shown to enhance the antimicrobial activity of cells through induction of genes coding for antimicrobial proteins.

**References**