Lecture title: Vitamins: Part 4

Lecturer Affiliation: Chapter tow

Summary:

Vitamin C (ascorbic acid)

Absorption and fate It is nearly completely absorbed from G.I.T. and widely distributed extra - and intracellularly. Plasma concentration and total body store of vit C is related to daily intake. The usual 60 mg/day intake results in about 0.8 mg/dl in plasma and 1.5 g in the body as a whole. Increasing proportions are excreted in urine with higher intakes. Body is not able to store more than 2.5 g. It is partly oxidized to active (dehydroascorbic acid) and inactive (oxalic acid) metabolites.

Physiological role and actions Vit C plays a role in many oxidative and other metabolic reactions, e.g. hydroxylation of proline and lysine residues of protocollagen—essential for formation and stabilization of collagen triple helix; hydroxylation of carnitine, conversion of folic acid to folinic acid, biosynthesis of adrenal steroids, catecholamines, oxytocin and vasopressin and metabolism of cyclic nucleotides and prostaglandins. It directly stimulates collagen synthesis and is very important for maintenance of intercellular connective tissue. A number of ill-defined actions have been ascribed to ascorbic acid in mega doses, but none is proven.

Deficiency symptoms: Severe vit C deficiency *Scurvy*, once prevalent among sailors is now seen only in malnourished infants, children, elderly, alcoholics and drug addicts. Symptoms stem primarily from connective tissue defect: increased capillary fragility—swollen and bleeding gums, petechial and subperiosteal haemorrhages, deformed teeth, brittle bones, impaired wound healing, anaemia and growth retardation.

Therapeutic uses

1. Prevention of ascorbic acid deficiency in individuals at risk and in infants:50–100 mg/ day. Vit C or orange juice can be routinely included in infant diet.

2. Treatment of scurvy—0.5–1.5 g/day.

3. Postoperatively (500 mg daily): though vit C does not enhance normal healing, suboptimal healing can be guarded against. It has also been found to accelerate healing of bedsores and chronic leg ulcers. Requirement of ascorbic acid is increased in post injury periods.

4. Anaemia: Ascorbic acid enhances iron absorption and is frequently combined with ferrous salts (maintains them in reduced state). Anaemia of scurvy is corrected anaemias. by ascorbic acid, but it has no adjuvant value in other

5. To acidify urine (1 g TDS–QID) in urinary tract infections .

6. Large doses (2–6 g/day) of ascorbic acid have been tried for a variety of purposes (common cold to cancer) with inconsistent results. No definite beneficial effect has been noted in asthma, cataract, cancer, atherosclerosis, psychological symptoms, infertility, etc. However, severity of common cold symptoms may be somewhat reduced, but not the duration of illness or its incidence. Improved working capacity submaximal workloads has been found in athletes but endurance is not increased. at

Adverse effects:

1- Ascorbic acid is well tolerated in usual doses. Mega doses given for long periods can cause ‘rebound scurvy’ on stoppage—probably due to enhancement of its own metabolism or tissue acclimatization.

2-The risk of urinary oxalate stones may be increased.

3-High doses may also be cytotoxic when added to iron preparations.

Fat-soluble vitamins

VITAMIN A

Absorption and fate: Retinyl palmitate, the chief retinylester in diet, is hydrolysed in intestines to retinol which is absorbed by carrier transport and reesterified. Aided by bile, it passes into lacteals. Absorption is normally complete, but not in steatorrhoea, bile deficiency and from protein poor diet. Retinol ester circulates in chylomicrons and is stored in liver cells. Free retinol released by hepatocytes combines with retinol binding protein (*RBP* a plasma globulin) and is transported to the target cells. On entering them, it gets bound to the cellular retinol binding protein (*CRBP*). Small amount is conjugated with glucuronic acid, excreted in bile, undergoes enterohepatic circulation. Minute quantities of water soluble metabolites are excreted in urine and faeces. In contrast to retinol, only 30% of dietary β carotene is absorbed. It is split into two molecules of retinal in the intestinal wall; only half of this is reduced to retinol and utilized.

Physiological role and actions

(a) Visual cycle Retinal generated by reversible oxidation of retinol is a component of the light sensitive pigment *Rhodopsin* which is synthesized by rods during dark adaptation. This pigment gets bleached and split into its components by dim light and in the process generates a nerve impulse through a G-protein called Transducin. Retinal so released is reutilized similar pigment (Iodopsin) is synthesized in the cones—responsible for vision in bright light, colour vision and primary dark adaptation. In vit. A deficiency rods are affected more than cones; irreversible structural changes with permanent night blindness occur if the deprivation is long term.

(b) Epithelial tissue Vit. A promotes differentiation and maintains structural integrity of epithelia all over the body. It also promotes mucus secretion, inhibits keratinization and improves resistance to infection. It appears to have the ability to retard development of malignancies of epithelial structures. Vit A is also required for bone growth.

(c) Reproduction Retinol is needed for maintenance of spermatogenesis and foetal development.

(d) Immunity Increased susceptibility to infection occurs in vit A deficiency. Physiological amount of vit A appears to be required for proper antibody response, normal lymphocyte proliferation and killer cell function.