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PHARMACEUTICAL INDUCED DEPLETION OF MINERALS AND TRACE ELEMENTS

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While pharmaceuticals have substantial benefits, millions of people worldwide suffer from their side effects ranging from fatigue to heart failure. Consumers generally accept these side effects are inevitable consequence for restoring health, or providing relief from symptoms. However, studies have shown that drugs can deplete specific vitamins and minerals, and it has been clearly shown in scientific literature that depletion of essential nutrients causes signs and symptoms of ill health, and can lead to disease.

All drugs have the potential to cause adverse drug reactions (ADRs) or side effects - unwanted, negative consequences associated with the use of medications. Every developed country has a problem with ADRs. In Australia each year about 17.5 million people make 95 million visits to their general practitioner and almost 200 million prescriptions are dispensed. Over 10% of patients, almost 2 million people, experience an adverse drug event annually. Approximately 1 million of these are classified as moderate or severe, with around 138,000 cases requiring hospitalisation. The most frequent reason specified for an adverse event is a recognised side effect (65.7% of cases).

Some medical professionals have suggested 20-30% of pharmaceutical side effects are the direct result of drug induced nutrient deficiencies. Worldwide, this equates to millions of people suffering. Other drugs may then be prescribed to address side effects – but without adequate essential micronutrients, the body cannot function properly. Negative influences on health such as high stress, poor diet, lack of exercise and pollution affect many people. Additional vitamin and mineral depletion caused by taking medication compounds the threat to health.

Minerals, particularly trace elements, are of concern here as the body needs them in such small amounts. Disturbing the status of these elements in the body has wide reaching effects on health. Minerals are necessary for growth, muscle response, health of the nervous system, production of hormones, the activation of vitamins in the body, and countless other physiological functions. Generally, minerals and trace elements are found in specific ratios to each other. A deficiency of one leads to the ratios becoming unbalanced, and increases the risk of developing illness.

As biological assays and measurement of blood levels on most of the trace minerals are time consuming, expensive and inaccurate, innovative technology is required to monitor multiple mineral levels in the body. A Sydney based company, Diakyne Ltd, is planning to commercialise its TraceSmart technology for just such a purpose. Diakyne claims TraceSmart will offer a quick, economical and accurate test for more than 50 elements covering essential minerals, trace elements and also testing for toxic elements such as cadmium, lead, mercury and arsenic. Diakyne's expects to have TraceSmart available in the second half of 2007.

Drugs can affect the status of a specific nutrient and/or overall nutritional status in numerous ways. Nutrient absorption, metabolism, distribution and excretion can be affected. Drugs can also influence food intake and digestion, and disturb functioning of the gastrointestinal tract, which can lead to the patients being unable to maintain or improve their overall nutritional status. Nutrient depletion is exacerbated when medications are used over extended periods of time, and when multiple medications are used.

A solution to avoiding certain side effects of both prescription and over the counter medications is to monitor levels of nutrients in the body and to replace the depleted nutrients with dietary sources and/or supplements. Known risk factors for depletion of nutrients need to be communicated to patients.

Commonly used prescription drugs such as corticosteroids, diuretics, oestrogen and hormone replacement therapies, contraceptive pills, ulcer medications, and over the counter medications such as antacids, painkillers and allergy medications deplete nutrients in the body. In light of such medications being routinely used, it is worth noting that a major Australian review study found 2-4% of all hospital admissions and up to 30% of admissions of patients over 75 years old were medication related.

Loop diuretics such as frusemide (Lasix) are prescribed in hypertension and to relieve states of fluid retention (oedema) due to congestive heart failure, kidney or liver disease. They cause the body to lose potassium as well as

water. Potassium is essential for proper functioning of the nervous system; control of fluid balance; regulating heart rhythm; maintaining stable blood pressure and chemical reactions within cells and the transfer of nutrients through cell membranes. Loop diuretics also cause cellular magnesium depletion, creating a viscous cycle where additional potassium is lost and leading to problems such as muscle cramps, fatigue, or cardiac arrhythmia. Calcium, chloride, phosphorous, sodium and zinc are also depleted by frusemide.

Omeprazole (brand names include: Losec, Zoton and Zexium), a proton pump inhibitor, is widely used to treat diseases where stomach acid causes damage, including gastric and duodenal ulcers, gastroesophageal reflux disease (heartburn) and erosive oesophagitis. In Australia, around 7-8% of consultations with general practitioners are for gastrointestinal problems and in recent years, proton pump inhibitors have accounted for 51% of government expenditure on anti-ulcer drugs. Proton pump inhibitors block acid secretion in the stomach. Reduced gastric acid secretion and subsequent elevated gastric pH is an important factor affecting intestinal mineral absorption. Inadequate stomach acid can lead to nutrient deficiencies, as the stomach needs to maintain an acidic environment to facilitate the absorption of minerals in the small intestine. Taking omeprazole can deplete the body's supply of iron, zinc, sodium and calcium.

Implications of nutrient deficiencies can be seen by looking at just one nutrient affected, eg calcium, keeping in mind that health problems are compounded by the depletion of multiple nutrients. A 2006 randomised double bind clinical trial published in the *American Journal of Medicine* found a 41% decrease in calcium absorption in elderly women taking omeprazole.
As well as increasing the risk of bone fractures and osteoporosis, low calcium status is associated with problems inclusive of hypertension, insomnia, irritability, depression, heart palpitations, tooth decay and sciatica. The diverse functions of calcium include maintaining nerve conduction, muscle contraction, regular beating of the heart and normal blood pressure, hormone release and blood coagulation.
Considering 45% of Australians are at risk of calcium deficiency and peptic ulcers affect 20% of the population at some point in life, many people are at risk of nutrient deficiencies from this particular prescription.

The depletion of several trace elements and minerals is one of the problems associated with long term use of the oral contraceptive pill (OCP). Various studies have identified negative impacts on copper, magnesium, selenium, and zinc status and it is hypothesised approximately 70 trace elements necessary for endocrine function are disturbed by the OCP.

Magnesium, just one element known to be depleted by the OCP, is extremely important for the metabolism of other minerals and trace elements including calcium, potassium, phosphorous, zinc, copper, iron, sodium, as well as toxic elements lead and cadmium. Signs and symptoms of magnesium deficiency include: muscular weakness, cramps, loss of appetite, nausea, premenstrual syndrome, fatigue, insomnia, depression, mental confusion, personality changes, hyper-irritability and excitability.
Low magnesium status is associated with several serious disease states including cardiac arrhythmia, hypertension, ischaemic heart disease, congestive heart failure, sudden cardiac arrest, diabetes mellitus, pre-eclampsia and eclampsia, and increased risk of stroke.
Marginal deficiencies of magnesium are very common. It is estimated more than 50% of the population in the developed world consume less than the Recommended Daily Allowance.

Certain groups of the population have a higher risk of nutrient depletion caused by drugs. The elderly are considered to be at particular risk as they are already likely to suffer from nutrient deficiencies. They are also more likely to be taking more than one medication. Other groups with increased risk are those with higher nutrient requirements (eg infants, adolescents, pregnant and lactating women) or those who make lifestyle choices likely to compromise micronutrient intake (eg dieters, alcohol and tobacco users).

GPs and pharmacists are challenged to remember documented nutrient depletions caused by drugs, and all health practitioners are confronted with the prospect of new drugs being involved in unrecognised nutrient depletions in their patients
This health risk to individuals should not be ignored, and can be addressed by monitoring the levels of these nutrients in the body before and during drug therapy, and implementing appropriate protective measures.

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