

Drug-Induced Nutrient Deficiencies Among Older Adults

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ABSTRACT

The relationship between polypharmacy and malnutrition is based on several mechanisms. Long-term abuse of multiple drugs results in anorexia, which generally causes minor or more serious impairment of the digestive tract. Conversely, malnutrition often decreases the biological availability of drugs and changes their pharmacokinetic and pharmacodynamic properties. Polypharmacy and malnutrition are significant geriatric syndromes that need to be assessed and treated in all older adults; furthermore, they must be evaluated together rather than separately. Practitioners should be aware of the potential impact of individual medication classes as well as extreme polypharmacy on nutritional status and work to reduce the impact through targeted interventions.

Keywords: Malnutrition; Older people; Polypharmacy; Potentially inappropriate medications

ABBREVIATIONS:

ADL: Activities of Daily Living; ONS: Oral Nutritional Supplementation; PIM's: Potentially Inappropriate Medications

INTRODUCTION

Malnutrition and polypharmacy (polypharmacy) are very frequently occurring phenomena in contemporary medicine, and they may significantly influence the quality of life and mortality of patients, particularly older adults. As increasing age is often associated with a greater disease burden, the number of drugs taken to manage chronic conditions also increases with age. Malnutrition develops either independently due to disease, or as a consequence of aging that is related to sarcopenia, decreased physical activity, and loss of appetite.

The relationship between polypharmacy and malnutrition is based on several mechanisms. Long-term abuse of multiple drugs results in anorexia, generally as a minor or more serious impairment of the digestive tract. Conversely, malnutrition very often decreases the biological availability of drugs and changes their pharmacokinetic and pharmacodynamic properties. This gives rise to a vicious circle, wherein polypharmacy, particularly in excess, degrades the nutritional status of the patient. The patient's degraded nutritional status subsequently demands increased doses of drugs, which increases the frequency of

undesirable side-effects. These relationships are shown (Figure 1).

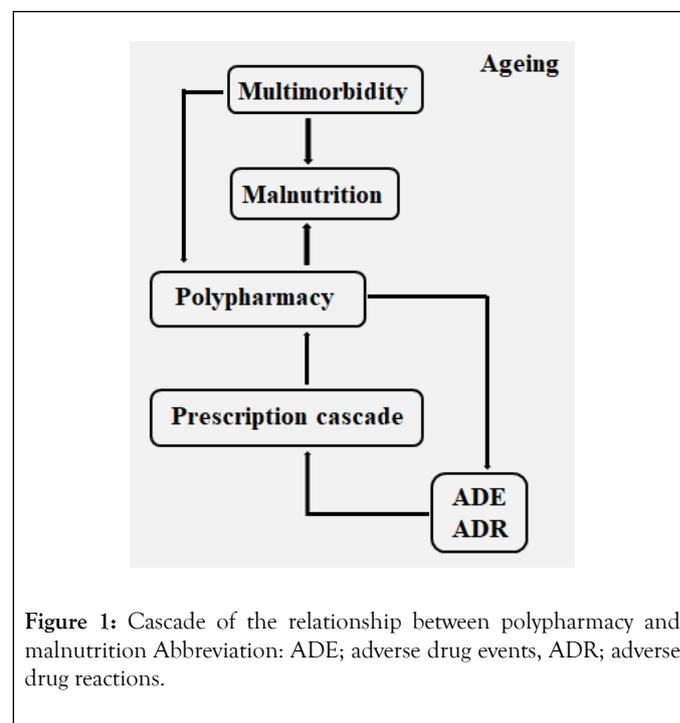


Figure 1: Cascade of the relationship between polypharmacy and malnutrition Abbreviation: ADE; adverse drug events, ADR; adverse drug reactions.

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According to a large European study [1], the countries with the highest rates of polypharmacy include the Czech Republic and Finland, whereas the lowest prevalence of polypharmacy is found in Norway and the Netherlands.

The occurrence of malnutrition among inpatients and outpatients and its dependence on multimorbidity and age are well known. Unfortunately, the interrelation of polypharmacy and malnutrition has been far less investigated. However, there have been a few published studies focusing on this relationship [2,3].

MALNUTRITION

Malnutrition has been associated with an increased financial cost burden and the risk of morbidity, hospitalizations, and mortality. Older adults are at increased risk of experiencing nutritional deficiencies, even if they have adequate food intake [4]. Schrader et al. have reported that 60% of inpatients are at risk of malnutrition and 30% are malnourished [5]. Malnutrition is associated with poor health outcomes, such as increased reliance on assistance for performing activities of daily living (ADL), prolonged hospitalization, difficulty in returning home from the hospital, and increased rates of mortality rate. Furthermore, malnutrition is also associated with deteriorated physical and cognitive functions. Drugs may be involved in the development of malnutrition.

Drugs that cause malnutrition

Pharmacotherapy is one factor that affects the nutritional state of older adults. Due to multiple comorbidities, older people typically receive multiple drugs; however, the effect of drugs as a cause of under nutrition is often overlooked. Over 250 medications have the potential to negatively affect nutritional status through alterations in taste, intestinal absorption, and the metabolism or elimination of vitamins and minerals [6,7].

The most important drugs that affect nutritional status include those that cause anorexia. Non-steroidal anti-inflammatory drugs, corticosteroids, bisphosphonates, and potassium preparations are known to cause gastrointestinal mucosal damage.

Second, some drugs cause nausea and vomiting. Opioids, anticancer drugs, and digoxin cause nausea and vomiting by directly stimulating the chemoreceptor trigger zone and the vomiting center via the activation of serotonergic receptors. Therefore, practitioners should be aware of medications that cause gastrointestinal side effects (e.g. nausea, anorexia, and dry mouth) or the potential for drug-drug, drug-disease, or drug-nutrient interactions. Third, some drugs cause taste disorders. The impact of medications on the sense of taste is common (reported in up to 75% of adverse drug reactions) and may lead to weight loss and malnutrition [7].

The detailed mechanism of drug-induced taste dysfunction has not yet been completely elucidated. Small molecule drugs with a thiol group, a carboxyl group, an amino group, and a five-membered ring, or a six-membered ring are susceptible to zinc chelation. Several antihypertensive agents, including thiazide diuretics, angiotensin receptor blockers, angiotensin-converting

enzyme inhibitors, and potassium-sparing diuretics, may lower levels of zinc [6].

Fourth, some drugs cause anticholinergic action. Anticholinergic stimulation may reduce salivation, cause feeding and swallowing disorders, and cause poor nutrition [8]. Assessment of dysgeusia and the evaluation of polypharmacy is a critical part of the workup of weight loss and malnutrition. Reportedly, it was reported that 23% of community-dwelling older adults and 60% of nursing home residents are prescribed a single anticholinergic drug. Furthermore, 13% of community-dwelling older adults and 34% of nursing home residents have been prescribed at least two concomitant anticholinergic drugs. The total anticholinergic load (the cumulative load of potential anticholinergic activity) is a key consideration for anticholinergic drug therapy.

Potentially inappropriate medications

Older adults with polypharmacy often experience low nutrition even when they are consuming adequate nutrients. A cross-sectional study in the U.S. reported higher carbohydrates, cholesterol, and sodium intake among community-dwelling older adults with polypharmacy, but lower intake of vitamins, fiber, and trace elements [9].

Potentially inappropriate medications (PIMs) are associated with many clinical risks, including drug-drug and drug-disease interactions. Therefore, adverse events associated with the use of PIMs may affect the patient's nutritional status. In a study of 294 Finnish elderly people (age ≥ 75 years old), 25.9% of subjects were receiving more than ten drugs simultaneously. Taking more than ten drugs simultaneously was significantly associated with decreased nutritional status, functional ability, and cognitive ability. Also, the use of PIMs in older patients was found to be an independent predictor of poor functional recovery, particularly by restricting the recovery of eating in ADL during rehabilitation. Moreover, an increase in PIMs during hospitalization may negatively affect the nutritional status of the patient upon discharge [10].

Among the PIMs, first-generation antihistamines, antipsychotics, and benzodiazepine hypnotics were significantly increased during hospitalization. Side effects of these drugs include dry mouth, extrapyramidal symptoms, and muscle relaxant effects. Therefore, the nutritional status may have been affected by the impaired formation of food boluses due to dry mouth, impaired opening and closing of the mouth, impaired tongue movement due to extrapyramidal symptoms, and/or dysphagia due to relaxation of swallowing-related muscles. Aggressive rehabilitation for undernourished patients may result in worsened nutritional status. Therefore, rehabilitation should be attempted only after the improvement of the patient's nutritional status.

Drug-induced hypotrophy

Given the impact of polypharmacy and PIMs on nutritional status, active nutritional management programs, such as the Medication Pass Nutrition Supplement Program (Med-Pass), have been proposed and implemented to improve adherence to

oral nutritional supplementation (ONS). Med-Pass is a method that involves having patients take drugs with water and ONS. This method is mainly used for patients with anorexia and poor oral intake. When ONS is distributed with meals, some patients eat adequate meals but do not take adequate ONS.

By contrast, some patients may take adequate ONS but do not consume sufficient meals. With the Med-Pass method, patients are provided ONS instead of water at the time of taking the drug; this ensures the intake of ONS without changing the meal amount. Med-Pass is effective in promoting weight gain, increasing total energy intake, and increasing protein intake among older adults. Regimens such as Med-Pass may allow for better management of malnutrition linked to polypharmacy or PIMs.

Our findings

Malnutrition and polypharmacy increase with age and multimorbidity. Furthermore, the relationship between these factors is based on several mechanisms that are not yet fully understood.

The mutual relationship between malnutrition and polypharmacy is based mainly on their impairment of the gastrointestinal tract and central nervous system.

According to previous observations, the effect of polypharmacy on malnutrition occurs mostly in elderly patients, since these patients are more frequently subject to polypharmacy.

CONCLUSION

Polypharmacy and malnutrition must be evaluated together rather than independently. Polypharmacy and malnutrition are significant geriatric syndromes that need to be assessed and treated in all older adults. Practitioners should be aware of the potential impact of individual medication classes as well as extreme polypharmacy on nutritional status and work to reduce the impact through targeted interventions. Further research is

needed to help define best practice models to prevent and treat the synergistic impact of these syndromes.

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