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Review Article

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Long Term Effects of Nephrotoxic Medications and the Increased Prevalence of Kidney Disease in the Geriatric Population

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Abstract

The use of nephrotoxic medications is an ongoing challenge within the health care profession. Many over-the-counter (OTC) medications used to treat numerous disease processes are becoming a major concern to the health care community as it relates to continued use and damaging kidneys in vulnerable populations. The geriatric population in particular, is one that is associated with many challenges due to the normal aging process, co-morbidities, the use of multiple medications, the misuse of OTC medications and drug-to-drug interactions. This paper will discuss three common OTC medications that are associated with nephrotoxicity. These medications include aspirin, nonsteroidal anti-inflammatory medications, and herbal medications. The research articles reviewed will explore the relationship of long term effects of the use of nephrotoxic medications and the prevalence of kidney disease in the geriatric population.

Keywords: Nephrotoxicity, Kidney Disease, Nephrotoxic Medications, Geriatrics

The use of nephrotoxic medications can contribute to acute kidney injury (AKI) and is one of the most common causes of AKI in hospitalized patients [1]. However, long term use of nephrotoxic medications are also damaging on the kidneys and may lead to some degree of kidney disease. Unfortunately, many medications can be nephrotoxic while determining the therapeutic dosages and the consideration of renal excretion [2]. In the geriatric population, there are a number of co-morbidities and chronic conditions that negate the use of multiple medications. This increased use of nephrotoxic medications, an aging kidney, and polypharmacy places the aging population at a high risk for kidney disease [3].

Nephrotoxic medications can include aspirin, non-steroidal anti-inflammatory drugs (NSAIDs), and herbal medications that can affect the geriatric population and the prevalence of kidney disease. Many of these over-the-counter medications react with prescribed medications that effect the geriatric population and can have damaging consequences to renal function. Some nephrotoxic medications can be dependent on the dosages that determine the extent of renal damage [2]. Some of the most important considerations in prescribing medication in the geriatric population is the type of medication, degree of renal impairment (if any), the medication dose needed for therapeutic effectiveness, and the length of treatment required for the desired patient outcome. Careful consideration of the intake of nephrotoxic medications in older adults is essential in determining the prevalence of kidney disease in the geriatric population.

Methodology of Literature Review

This paper discusses numerous articles that pertain to the effects of nephrotoxic medications and the prevalence of kidney disease in the geriatric population. In addition, this paper will examine the risk factors associated with kidney disease. The articles reviewed were accessed through CINAHL, MEDLINE, and EBSCO host databases that included peer review articles and academic journals. In addition, key words utilized within the search field included nephrotoxic medications, acute kidney injury, NSAIDs, aspirin, geriatrics, herbal medicine, and the effects of nephrotoxic medications.

Effects of Nephrotoxic Medications

There is a direct relationship between medication and renal injury [4]. However, acute renal injury could be associated with the ongoing use of nephrotoxic medications or a particular disease process. It is first important to determine the causative agent of the progressive kidney damage to distinguish the pathway of treatment. Treatment is aimed at the underlying cause in an effort to prevent further kidney damage and progression of the disease process. Unfortunately, the geriatric population is at an increased risk of kidney damage due to the use of numerous medications and the aging kidney [5]. In addition, the normal aging process is associated with renal structural and functional changes. These changes in the kidneys in combination with co-morbidities, places the aging population at high risk for developing acute kidney injury and later development of chronic kidney disease [5].

Multiple medications can affect the same site in the renal structure, while a single medication can affect different sites, therefore, causing further damage or worsening of kidney disease [2]. To help with this

challenging task and recognizing the damaging effects of nephrotoxic medications, providers must be more aware of prescribing. Routine monitoring of serum creatinine and the development of acute kidney injury to patients exposed to nephrotoxic medications will help in accurately diagnosing this patient population and providing prompt treatment [1]. Unfortunately, there tends to be an unavoidable evil in prescribing medications that can be associated with nephrotoxicity when such medications are necessary for patient treatment [1].

When considering medication dosage modification, impaired drug clearance poses a challenge in the presence of chronic kidney disease [3]. It is essential to consider the kidney function, while the decision to discontinue nephrotoxic medications can have a major impact on the prevalence and associated risks for AKI in the older population [3]. Residual kidney damage is seen as early as six months after the use of nephrotoxic medications in which patients present with a lowered glomerular filtration rate (GFR) hyper filtration, proteinuria, or hypertension [6]. Other side effects that can be associated with long term use of nephrotoxic medications include hypertension, fluid retention, and acute kidney injury [6]. These patients can also present with clinical manifestations that exhibit hemodynamic instability and the need for prompt medical attention.

Aspirin

Although the existence of numerous studies on the effects of aspirin and chronic kidney disease is minimal, it is determined to be associated with nephrotoxicity. In addition, aspirin can cause chronic interstitial nephritis with long-term use [7]. There is a direct relation with aspirin and the inhibition of prostaglandin syntheses. This is similar to the mechanism of action as NSAIDs [7]. There is also lacking research in relation of the use of aspirin in the secondary treatment in patients diagnosed with Type II diabetes and ischemic heart disease [7]. However, the current recommendation is to maintain minimal dosages in the elderly patient with the use of aspirin and those with suspected AKI [7].

Non-Steroidal Anti-Inflammatory Drugs

NSAIDs are also a commonly used over-the-counter (OTC) medication for minor aches and pains and with continued use can be detrimental to the geriatric population. Older adults with kidney abnormalities should be counseled about the safety of OTC drugs and educated on the importance of dose adjustments for some medications [8]. Nonsteroidal anti-inflammatory drugs (NSAIDs) should be consumed with caution in the geriatric population, especially those who exhibit some clinical manifestations of kidney disease. Chronic use of NSAIDs can cause an increased risk of acute kidney injury and further decline of renal function in the geriatric population [9]. The cause of kidney disease in relation to NSAIDS is associated with the homeostatic prostaglandins in the kidney, which lead to the deterioration and alterations in kidney function [8]. This affects the auto regulation of the kidneys and the need to dilate afferent arteriole, which can increase the risk of AKI [3].

Herbal Medications

Herbal medications are commonly used around the country by a number of cultures and ethnicities. Herbal medicine involves the use of natural components that contain a wide variety of multifaceted ingredients that may or may not have varying side effects [10]. Unfortunately, these herbal medications can be known to result in nephrotoxicity [10]. There are many factors of herbal medication that can be associated with nephrotoxicity, which includes the intrinsic toxicity of herbs, alterations in the storage and passage of herbs within the kidneys, contamination of heavy metals, incorrect dosing, and the drug interactions of herbal medicine with prescription and OTC medication [10]. While in some cultures, herbal medicine is common for varying disease treatments, patients must understand the risks associated with such treatment regimen. However, simultaneously respecting the morals and values within that specified culture. The discussion of possible alternatives to the herbs that are prescribed or variations in the ingredients may be of interest to patients if they understand the risks versus benefits of excluding toxic ingredients that can be damaging to their overall health. Ultimately the treatment of herbal medicine can be damaging to the kidneys and should be evaluated in patients with acute kidney injury and with unexplained progression of chronic kidney disease [10].

Conclusion

The effects of nephrotoxic medications are damaging to the kidneys. The damage is worsened with the geriatric population, in which older adults have aging kidneys, exposure to polypharmacy, and co-morbidities in combination with chronic kidney disease. One of the most important factors in minimizing the prevalence of progressive kidney disease is recognizing those high risk patients within the geriatric population. The reduction of exposure of nephrotoxic medications may help prevent and/or slow the progression of kidney disease in older critically ill patients. Careful monitoring of toxicity and medication selection is critical when there is suspected acute kidney injury. When possible, it is essential to prescribe alternatives to the nephrotoxic medications and only use when absolutely necessary.

Patients that are considered to be high risk include those over the age of sixty and a history of hypertension, diabetes, heart failure, or renal dysfunction [6]. In addition, older adults with AKI are at high risk for malnutrition, severe acidosis, and electrolyte imbalances [3]. These pre-disposing risk factors places this patient population at an increased risk of mortality. There are numerous studies conducted in recognizing the changes in renal function associated with potentially dangerous, nephrotoxic medications, in the older population. Identifying and assessing crucial GFR rates, monitoring drug levels, and maintaining the treatment of co-morbidities, can significantly lower the prevalence or progression of kidney disease in this vulnerable geriatric population.

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