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Cannabis Consumption and the Kidney: Caveat Emptor!

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Abstact

The growing popularity and emerging legalization of cannabis in various parts of the world should encourage clinicians to carefully consider the evidence of known adverse cannabis effects in contrast to proposed marijuana medicinal merits. Though more research is needed, it is known that smoking cannabis can lead to renal toxic effects in some that is considerably increased by the use of synthetic cannabinoids (spice drugs). The studies in this regard are noted and our conclusions include the critical maxim that clinicians should consider potential renal toxic effects of these substances in their patients especially when confronted with acute kidney injury of unknown etiology in adolescents and young adults.

Introduction:

Cannabis (marijuana, pot) has been a popular illicit drug for centuries and widespread efforts are now occurring in the United States and other countries to legalize cannabis with claims of medicinal value caused by smoking this plant [1-3]. Discussion of potential adverse effects of cannabis on humans often focuses on neuropsychiatric effects as well as potential adverse effects in the pulmonary or cardiovascular systems. Clinicians should also understand that cannabis poses potential risks to the kidney as well and more research is needed in this area. Thus, this article considers current knowledge of cannabis and the kidney that can be complicated by the negative effects of cannabis from tobacco in those who typically smoke both drugs at various times [4].

Renal endocannabinoid system toxicity

Cannabis consumers should be warned against any type of intravenous pot administration. One 1976 report detailed the effects of intravenous cannabis in two individuals who subsequently developed low blood pressure, thrombocytopenia, rhabdomyolysis and renal insufficiency; though they recovered without identified complications, their course was a warning against such use [5]. Another report looked at four youths who intravenously injected cannabis-seed tea and subsequently developed fever, chills, hypovolemic shock and non-oliguric renal failure along with various gastrointestinal and neurological complications [6]. Fortunately, these young patients also recovered over many weeks but the potential renal toxic effects from cannabis use was identified [6].

Concern over potential toxic effects of cannabis consumption on the kidneys is partially based on the current understand that cannabis stimulates natural or endogenous receptors called cannabinoid (CB)1 and CB2 receptors located in many organs of the body with known deleterious effects from chronic stimulation such as central nervous system toxicity [1]. These CB1 and CB2 receptors are also located in the kidneys via the renal endocannabinoid system with potential deleterious effects based on the duration of such stimulation and the person's susceptibility to such stimulation [1, 7].

As research seeks the use of CB1 receptors for possible benefit of renal disease, animal research (i.e., rat, mouse) in obesity and diabetes mellitus (type 1 and 2) also note that CB1 receptor stimulation can lead to renal damage with renal inflammation and fibrosis [8,9]. Smoking cannabis can induce arteritis in some persons with subsequent cardiovascular and cerebrovascular disease; research is needed to identify if such inflammation can effect renal vasculature as well [1].

Renal toxicity of synthetic cannabinoids

Research has demonstrated the potential renal toxic effects of synthetic cannabinoids (cannabimimetics; cannabinoid designer drugs; synthetic cannabinoid receptor agonists) that have been available since the early part of the 21st century that are part of various designer drug movement developed in the 1960s [1]. Syn-

thetic cannabinoids (called spice drugs, K2 drugs, legal highs, other names) bind to the same cannabinoid receptors as endogenous cannabinoids (i.e., 2-arachidonoyl glycerol [2-AG]; anandamide) and phytocannabinoids (i.e., delta-9-tetrahydrocannabinoid or THC) [1,10-12].

These dangerous chemicals are very potent cannabinoid receptor agonists and provide up to 10 times the strength of delta-9-THC stimulation [13]. Thus, the "alarm" has been heightened on use of these chemicals for many decades [14]. They are developed by clandestine or underground laboratories that make different drugs as previous ones become banned [15]. Synthetic cannabinoids produce a wide range of serious adverse effects including hypertension, intoxication, hallucinations, fertility/pregnancy complications, suicidality, psychosis, acute kidney injury, renal failure and even death [1,16-23].

Synthetic cannabinoid use can lead to acute kidney injury with renal biopsy revealing severe acute tubular necrosis as reported in recent literature [24]. Clinicians should suspect synthetic cannabinoid use in cases of unexplained acute kidney injury (AKI) especially in youth [23-25]. The cause (s) of renal injury is not clearly known in consumption of these spice drugs but kidney damage may be due to a direct toxic effect, genetic factors and/or unknown nephrotoxin (s) [26]. Tests useful in identifying toxic chemicals in those taking synthetic cannabinoids include mass spectrometry and liquid chromatography [26].

Conclusion:

Clinicians should be aware of the potential adverse effects of cannabis and synthetic cannabinoids in assessing adolescents and young adults with unexplained renal injury. Though some advocate the potential benefit of phytocannabinoids for disease in humans, more research is needed into the potential renal toxic effects of consumption of cannabis as well as synthetic cannabinoids [1].

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