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Clinical implications of polymers and lipids in designing drug delivery systems in geriatric use

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ABSTRACT



This paper will emphasize some of the clinical implications of polymers and lipids in designing drug delivery systems in the geriatric population. This article will give us an overview of the advantages and disadvantages of polymers and lipids in formulating DDS in individuals over 65 in the United States. Lipid polymer hybrids can be advantageous in systemic drug bioavailability to patients who have decreased drug carrier capacity. Older adults may benefit from lipid polymer hybrids as it enhances drug delivery and drug targeting process. Most of the older adults use a minimum of 4 to 6 medications for a variety of medical ailments and conditions. Polypharmacy may be an advent situation in some of the cases, which can be reduced by innovative drug delivery options.

Keywords: Geriatrics, Lipids, Polymers, Drug delivery, Polymer hybrids, Polypharmacy, Drug carrying capacity.

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INTRODUCTION

In the United States, the population age 65 and over numbered over 56.4 million in 2020 (estimated for which data are available) and represents 16% of the total population [1]. The average life expectancy of individuals has increased over the decades and it is 78.9 years. Women tend to outlive men over 4 years on average [2]. Older adults have a minimum of one chronic condition and many have multiple chronic conditions (Shah et al., 2017) [3,4]. The top five chronic ailments were hypertension (58%), hyperlipidemia (47%), arthritis (30%), Ischemic Heart Disease (28%), and diabetes (26%) [5]. Individuals on average take 4 to 6 medications daily and have seen by a doctor two to three times a year. Older adults tend to take vaccinations more than the general population especially the

pneumococcal (70%) and influenza (73%) [6,7]. More than 30% of individuals over 65 are obese. Physical activity is followed by close to half of the individuals in 65 to 74 age groups and only 26% of people over 75 engage in any physical activity [8,9]. Older adults average more office visits with a doctor or other health care professionals than young individuals [10]. People who are over 75 about 25% have 10 or more visits to a doctor in a year. The majority of individuals over 65 have Medicare or Medicaid insurance [11,12]. Body metabolism decreases as we age and an individual's regular physiological activities decrease which affects all the organ systems [13,14]. A series of functionalities are lost in tissue and cellular levels as individual age [15, 16, 17].

Trends in the use of polymers and lipids in drug delivery systems for geriatrics

Lipid and Polymer hybrids may improve the drug bioavailability in the vulnerable population due to a decrease in the body's physiological activities (Lasic, 2001) [18, 19]. The release of drug to a systemic site can increase the drug activity that can decrease the drug side effect impact on the individuals with decreasing glomerular filtration rate [20, 21]. As individuals age the GFR reduces through age and the condition can be considered normal for higher age even the rate is 30 ml/min (Glassock & Winearls, 2009) [22, 23]. Targeted drug release can lower the risk of drug-food and drug-drug interaction [24]. Oral administration of medications may be less effective as the gastric activity is reduced with age. Polypharmacy can be minimized when drugs are taken through a special mode of administration improving the therapeutic index while reducing side effects. Successfully targeting specific cells for the release of the payload of drugs

can benefit older adults at a higher rate than the regular means of medication administration [25, 26].

These lipid-polymer hybrids are prominent in building confidence in the modern approach to improving the health and wellbeing of individuals [27, 28, 29]. These hybrids are beneficial for the enhancement of oral absorption and bioavailability, targeting delivery systems, effectively increasing biological membrane permeability, on-site release, and overcoming the polypharmacy aspect of multiple drug resistance in the older adult population [30, 31, 32].

Clinical implications by using lipid/polymer-based delivery systems for geriatrics

Older adults are easily susceptible to disease conditions especially infections that are caused due to reduced immune response [33, 34, 35]. There are inadequate evidence and knowledge about how geriatric patients respond to liposome-polymer hybrid and the effectiveness of any medication at large given the overall condition of the physiology of an older adult, most clinical trials omit testing individuals over 65 (Fahy et al., 2011) [36, 37, 38, 39, 40].

Geriatric individuals can respond differently than the younger generations to drug targeted therapy [41, 42, 43]. Pharmacokinetics and Pharmacodynamics are affected due to age-related physiological changes, which are inevitable as reversing age is not possible [44, 45, 46]. Older adults are at a higher risk to develop adverse effects due to concomitant drugs and comorbidities (Clark, 2015) [47, 48, 49]. Nanoparticles such as the lipid polymer hybrids may deplete or reduce pulmonary function, as they are easily permeable into the human body and carried across by systemic circulation [50, 51]. The mode of administration of drug and therapeutic index plays a pivotal role in bringing a focused approach to the therapy of a particular ailment [52, 53], and it may or may not be successful in an individual with comorbid conditions and most of the older adults have these conditions (Bartlam, Lally and Crome, 2010) [54, 55, 56]. These lipid-polymer hybrids may benefit individuals who have an earlier diagnosis of any form of cancer or life-sustaining conditions, provided the benefit does not overtake the risk (Hutchins, 1999) [57, 58, 59, 60].

CONCLUSION

In conclusion, lipid-polymer hybrids are some most sophisticated approaches in drug delivery systems [61, 62, 63], which can enhance and improve the quality of therapeutic advancements in treating geriatric patients [64, 65, 66]. The procedural conduct may increase over time with enhancements in modern therapies. Most of the clinical studies are conducted on the individual with an inclusion criterion between 18 to 64 years [67, 68, 69]. In recommendation we can educate older adults on the importance of being part of these studies in creating novel models for all generations [70, 71].

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