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Review



A Comprehensive Review On Novel Drug Delivery System For Targeting Nocturnal Asthma Based On Chronopharmaceutical Approach

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	Abstract
Published on: 17 Oct 2024	<p>Nocturnal asthma occurs when asthma symptoms intensify during night, impairing sleep quality and daily functioning. Chrono-modulated drug delivery systems have emerged as a potential technique for targeting nocturnal asthma due to their ability regulate the drug delivery with disease patterns and circadian rhythms. Numerous physiological processes, such as drug absorption, distribution, metabolism, and elimination, are regulated by the circadian rhythm. Drug delivery systems that use chrono-modulation release controlled dosages of medication at predetermined intervals to correspond with the body's natural rhythm. Two-thirds of patients with asthma have nocturnal asthma, which is characterized by an increase in symptoms such as wheezing, tightness in the chest, increased responsiveness of the airways, and deterioration of lung function during the night. Between midnight and 8:00 am, and particularly around 4:00 am, these symptoms manifest. The chrono-therapeutic pulsatile systems release the drug in a pulsatile manner at a predetermine off-release period (lag time) in a specific site in order to emulate the chrono pathological Symptoms. Emphasise formulation and evaluation methods as well as the biomedical applications of chrono-modulated drug delivery systems in the review.</p>
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<p>Keywords: Nocturnal asthma, chronotherapy, pulsatile drug delivery system.</p>	

INTRODUCTION

Controlled and targeted drug administration has supplanted traditional dose forms in recent years. In order to target the precise spot, this system has focused on a continuous, variable, and sustained drug delivery method. Nevertheless, some medical disorders only manifest at particular times of the day or night, making it impossible for the traditional dosage form to release in a way that is appropriate. These conditions need the medication to be released as a "pulse" following a predefined lag period; the drug must be produced so that the lag time is followed by a complete and quick drug release. The term "chrono modulated drug delivery system" refers to this type of technology. It is also referred to as a pulsatile drug delivery system or a chrono regulated drug delivery system (Fig 1).

Two-thirds of asthma patients have nocturnal asthma, which is characterized by an increase in symptoms such as wheezing, tightness in the chest, increased reactivity of the airways, and deterioration of lung function during the night. Between midnight and 8:00 am, and particularly around 4:00 am, these symptoms manifest. Given that the patient is asleep, taking medication at midnight is inconvenient. For the best course of treatment, maintaining a steady medication level is not always necessary. A medication should only be administered in the very minimum amount necessary. Based on the BCS categorization, it is classified as class 3. The intention was to have a 6-hour lag time, meaning that the medication would be released at 4:00 am after being taken at nightfall.

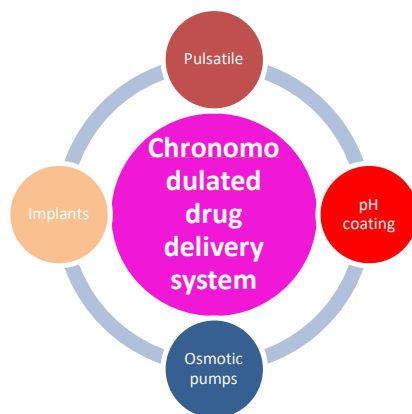


Fig 1: Types of Chronomodulated drug delivery system

Advantages of chronotherapy

- Drugs are not used in chronotherapy.
- A person receiving chronotherapy is more likely to benefit from numerous hours of sleep. Patients who receive chronotherapy frequently report feeling better and having more confidence.
- Because chronotherapy has a beginning, middle, and end, it differs from other forms of treatment. Thus, the point at which it will work may be predicted with ease.
- It provides you with a new routine, such as rising and sleeping earlier, which will be very strange for a few days but will give you time to mentally acclimate.

Disadvantages of chronotherapy

- A non-24-hour sleep wake syndrome occurs when the patient sleeps during the course of the treatment or for more than 24 hours afterward.
- During chronotherapy, people become less productive, and staying up late until the other schedule is comfortable can be difficult.
- Having medical supervision is essential when using this therapy.

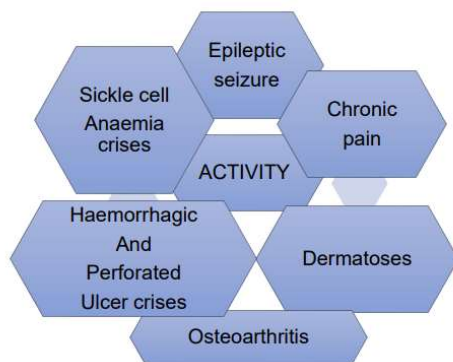


Fig 2: Effect of circadian rhythms in physiology

The body of research on circadian rhythms in physiology, pharmacology, molecular biology, and the health sciences has grown significantly in the last several years (Figure 02). When it comes to drug delivery,

traditional controlled-release formulations rely on one or more reservoirs or systems to maintain the in vivo drug concentration at the therapeutic level for an extended amount of time. While this is necessary, it is insufficient to treat disorders affecting the circadian rhythm.

DISCUSSIONS

Pulsatile drug delivery refers to a targeted drug release system that delivers medication in a pulsatile manner, mimicking the natural pulsatile pattern of certain physiological processes in the body. This type of drug delivery system is designed to release the drug in a controlled and intermittent manner, rather than providing a continuous flow of medication. The concept behind pulsatile drug delivery is to administer the drug dose at specific intervals or predetermined times in order to optimize therapeutic efficacy and reduce potential side effects. It is particularly beneficial for drugs that exhibit a time-dependent release pattern or have specific requirements for achieving the desired pharmacological effect. Pulsatile drug delivery has several advantages over conventional drug delivery systems. It can improve drug efficacy by delivering the medication at the optimal time, aligning with the natural physiological rhythm of the disease or target site. It can also minimize side effects by reducing fluctuations in drug levels and enhancing drug stability.

CONCLUSION

Current conventional dose forms are ineffective in treating diseases with chronobiological pathogenesis. This issue is resolved by chemotherapeutic drug delivery systems (CDDS), which release drugs in accordance with the circadian rhythm and were developed using sigmoidal drug release. A chrono modulated system can be designed using a variety of strategies, such as a system that is triggered by stimuli, a system that is dependent on external stimuli, and a release system that is time-specific. This technique is beneficial for many diseases that follow circadian fluctuations, such as diabetes, hypertension, asthma, and cardiovascular disease.

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