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IMPLANTABLE DRUG DELIVERY SYSTEM

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Short Communication

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INTRODUCTION

Drug development involves discovering, designing, modification of molecules to maximize desirable therapeutic characteristics and minimizing side effects. All drugs present in the market which are under clinical trials suffer from one or the other side effects, which may be minimized by the effective means of administration ^[1, 2].

Orally administered

Drugs must be protected against denaturation in the gastro intestinal tract and should be capable of absorption across the wall of stomach and intestine ^[3, 4].

IV administration

Duration of drug action is short for therapeutically active agents and therefore frequent injections are required ^[5].

Topical administration

Percutaneous absorption of most drugs is limited due to physicochemical characters of drug and presence of highly impermeable stratum corneum ^[6].

Implantable drug delivery system

Devoid of aforementioned limitations associated with oral, IV, topical drug administration.

Implant is a single unit drug that has been designed to deliver a drug moiety at a therapeutically desired rate over a prolonged period of time. Intended for implantation subcutaneously in the body for continuous release of drug over extended period of time ^[7].

Advantages

- Convenience-Implantation therapy permits to receive medication outside the hospital.
- Compliance-Compliance is increased immensely.
- Potential for controlled release-Implant deliver drug by Zero order controlled release kinetics, avoids risk of toxicity, reduce dosing frequency, and increase patient compliance.
- Potential for intermittent release-Externally programmed pumps can facilitate intermittent release.
- Potential for bio responsive release-designed to release of drugs in response to external or biological stimulus.
- Flexibility-Flexibility is possible in choice of materials, method of manufacture, degree of drug loading and drug release.
- Commercially available – new drug product can extend the market protection of drug for additional years.
- Increase patient compliance- A person can forgot to take a tablet, but drug delivery from an implant is largely independent of patient input.
- Effective for extended period-extend the release of drug.
- Stability-Stable for longer period.
- Targeted local delivery at a constant rate- deliver drug at constant rate ^[8 - 12].

Disadvantages

- Invasive
- Termination
- Danger of delivery failure
- Limited to potent drugs
- Possibility of adverse reactions
- Biocompatibility
- Investment in terms of cost ^[13-15].

Benefits provided by the Implants

- site specific drug administration
- sustained release by the zero-order release rate of a therapeutic agent [16-18].

DISCUSSION

Mechanism Of Drug release from Implants

Controlled drug delivery Therapeutic agent is automatically delivered for longer period of time it follows zero order kinetics. Sub dermal delivery system can provide constant and efficacious blood levels of drug for a desired period of time [19-22].

Various mechanism of drug release from Implantable delivery devices

- Diffusion controlled
- Chemical controlled
- Swelling controlled
- Osmotically controlled
- Magnetically controlled [23-33].

Types of Implants

- Biodegradable
- Non Biodegradable [34-35].

Preparation of Implants

- Compression
- Moulding
- Extrusion [36-38].

Implantable infusion pumps

Vapour pressured powered devices

It consists of first and second chamber. Basic principle at a given temperature, a liquid is in equilibrium with its vapour phase exerts a constant pressure .refilling is done for every three months with help of hypodermic syringe.

Ex: Long term heparin based anti coagulant treatment [39-55].

Peristaltic Pump

It consists of flexible tube, housing, and rollers. with help of roller the lumen of tube compresses. Which causes flow of fluid towards the exit.

Solenoid pump

It consists of implantable infusion devices ,an external physician console Hand held unit with which patient can initiate programmed doses of drug .it uses a solenoid driven reciprocating to move infusate from reservoir out through the deliver cathet.

- **Command system:** operate from a radio signal originating in a physician console. Command system is used to change basal delivery rate ,to turn the device on and off and to set limits on medication usage.
- **Telemetry system:** It involves transmission of data from a remote location. used for confirmation of battery voltage and rate of infusing medication.
- **Power system:** It must be small in size and long lasting, contains rechargeable Ni cadmium cells to store energy and operate the system between recharges.

Evaluation of implants

Assay of drug content

Three implants from each batch was taken add 45ml of dichloromethane used to dissolve polymers, above mixture is taken in separating funnel .0.5-1 ml of extracted solution, 1ml of o-phthaldialdehyde reagent solution was added finally 1.5 ml of iso propane added to prevent precipitate volume is adjusted to 5 ml with distilled water after 45 min measure the absorbance on Beckman du-7 spectrophotometer at 333 nm.

Weight variation and diametric variation

mean weight standard deviation and diameter of 10 samples from each batch were determined. It should be within limits.

Invitro Dissolution

Dissolution kinetics was studied under sink condition by placing one implant in varying volume of phosphate buffer pH 7.4. agitated in a horizontally shaking water at 37 °c temperature, Samples are withdrawn at varying time intervals. Equal volume of fresh medium was added to replace aliquots removed for assay and the amount of drug release was corrected for dilution. triplicate measurement were performed for each batch of implants prepared.

Invivo release

Norden describes rabbit osteomyelitic model assess in vivo release of drug from implant. osteomyelitis was induced in the tibia of 9 New zealand rabbits using pseudomonas aeruginos, one implant was surgically placed immediately adjacent to the tibia injection site in each rabbit [56-65].

Applications

- Biomedical, human and veterinary application.
- Cancer treatment, Osteoporosis, Ocular diseases. Contraception, Narcotic antagonists, Dental application, immunization and Brain tumors [66-75].

CONCLUSION

Implantable drug delivery is one of the innovation parts that frequently neglected in the advancement of new medication conveyance by the formulation, research and development in many pharmaceuticals. At present much research is being conducted in the region of implantable drug delivery systems. By utilizing new sorts of drawn out discharge drug conveyance frameworks, will avoid the need for various dosing. It is expected that in upcoming years, change of new implantable frameworks will help cost diminishment of medication treatment, expand the adequacy of medications, and improve tolerant consistence, and improve patient compliance. Implanted drug delivery Systems have ability to reduce the frequency of patient driven dosing and to deliver the compound in targeted manner. Implantable drug delivery devices are devoid of limitations associated with oral, intravenous, topical drug administration.

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