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Review Article

An Overview of Conventional and Novel Approaches of Anti-Psychotic Drugs

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ABSTRACT

Psychosis is a severe mental disorder which is characterized by disturbance in thinking and perception. It is accompanied by hallucinations and delusions. It is a disorder which will progress or stabilize over a period of time. Anti-psychotics are used for treatment of these disorders in various forms. There are several formulations of antipsychotics which are available in both conventional and novel forms. Conventional forms are usually tablets, capsules, oral concentrate, injectables etc. They offer several benefits which also comes with certain limitations. They are widely accepted by patients due to their easy availability. To overcome the limitations of conventional dosage forms, novel formulations have come into existence. They are emerging in large scale due to its numerous advantages. Some of the examples of Novel approaches are long acting injectables, nano formulations, transdermal dosage forms, implantable devices, extended-release formulations and microneedle arrays. They are used to provide required effect by minimizing dosing frequency. These formulation approaches are now a days being accepted by various populations and demand is increasing. Recently stimulation techniques for brain are used in treating these mental disorders. The emerging technology and recent advances have led to betterment of curing these disorders.

INTRODUCTION

Psychosis: Psychotic disorders are serious mental condition which are characterized by disturbed thinking and perception. They are often distressing, impacting quality of life and maintenance of self-care. People with psychotic illness often manifest behavioral symptoms. Psychosis is termed as lifelong disorder which may often stabilize or progress over time. They are even genetically inherited. Majorly psychosis disorders are of 2 types: primary and secondary

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psychosis. Psychosis is accompanied with Hallucinations, Delusions and Delusional misidentification syndromes; it also leads to disability and acts as barrier for productivity and participation of subjects. Therefore, it is necessary for identification, evaluation and treatment of target individuals. Medications used to treat psychotic disorders are typical anti psychotics, atypical anti psychotics and combination of muscarinic agonist. Current treatments of treating such disorder have limited efficacy. They are using second generation antipsychotics for treating psychosis.[1] Psychosis is a severe disorder which is affecting most of the population in recent generations. They require close observation and serious evaluation to overcome these scenarios. Various conventional and novel approaches have come into existence to treat psychosis, which are discussed below:

Drug Delivery System: Refers to administering drug for the body to produce required therapeutic effect, the drug delivered to its site of action, at a determined rate and concentration.

Conventional Drug Delivery System: Is termed as earliest methods used for administering drug to produce required therapeutic effect. Common examples of dosage forms used are tablets, capsules, pills, powders, elixir's etc., it is widely used because of its advantages such as easy manufacturing, administration and cost effectiveness, despite of having several advantages it also has major disadvantages such as dose dumping due to flucations in drug release to maintain required concentration of API in Bloodstream, causes adverse side effects and toxicity.

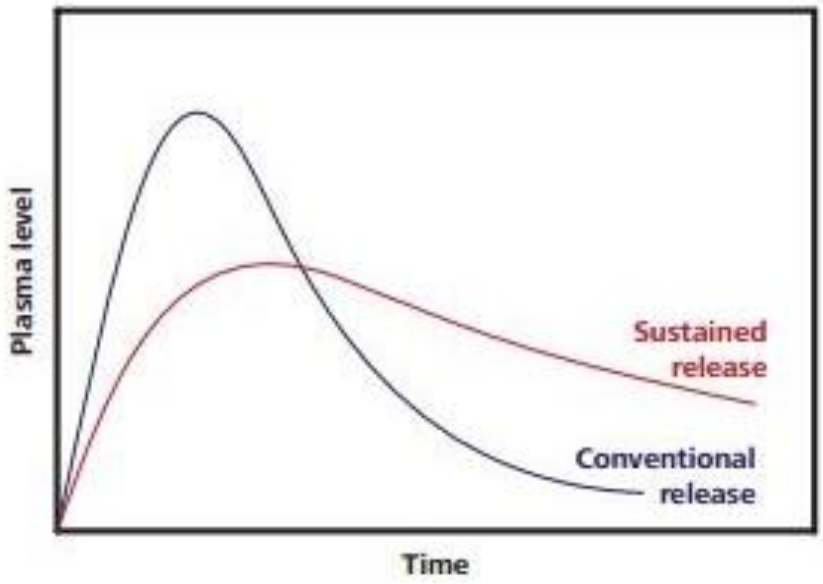

Fig 1: Descriptive graph of Time vs Plasma level giving relationship between Sustained and Conventional Dosage forms.

Novel Drug Delivery System: Is defined as an approach that combines Innovative formulation development with new methodologies for delivering medicinal compounds, it also includes targeting drugs within body which improves control release and drug potency with prolonged pharmacological effect. This offers wide advantages over conventional DDS such as accurate dosing, enhanced efficacy and safety, site-targeting of specific delivery of drug with an

optimum dose, ultimately decreases toxicity and side effects which improves patient safety and comfort of standard of living. There are various types of NDDS in recent years such as Microparticles, Nanoparticles, Liposomes, Noisome, Transdermal drug delivery, micro encapsulation with the aim of delivering drugs to required site.

Conventional Drug Delivery System	Novel Drug Delivery System
These dosage forms provide rapid drug release which causes fluctuations in peak plasma concentration.	These dosage forms provide Control and sustained drug release.
Higher risk of dose dumping.	Minimizes dose dumping by Targeting particular sites.
Increase Dosing frequency for providing required therapeutic effect.	Reduces dosing frequencies.
Less patient compliance.	Better patient compliance.
↑ Toxicity.	↓ Toxicity.

Anti-psychotic drugs: Antipsychotic drugs are adversely used to treat psychosis related conditions and their symptoms. They are used to target neurotransmitters to manage symptoms of mental health conditions. Anti-psychotic drugs are not only used to treat psychosis disorders but also for the treatment of other conditions such as bipolar disorders, Tourette syndrome, dementia and depression.

Anti-psychotics are mainly classified as Typical and Atypical antipsychotics.

Although antipsychotics are used for treating various disorders, they offer adverse side effects such as sedation, drowsiness, dizziness, headaches, dry mouth, increase in weight, constipation, seizures, anxiety, changes in blood sugar level.[2]

Most commonly prescribed antipsychotics are Aripiprazole, Olanzapine, Quetiapine, Risperidone, Haloperidol, and Perphenazine.

Conventional Forms of Antipsychotics

Conventional anti-psychotics are usually known as first generation antipsychotics used in treatment of various mental illness particularly schizophrenia. They are even used to treat hallucinations and delusions. Conventional antipsychotics work by blocking dopamine receptors in brain. They do not affect other transmitters in brain. Dopamine is a neurotransmitter which is involved in mood regulation. By blocking these receptors antipsychotics reduce symptoms of psychosis. Blocking these receptors leads to certain side effects such as sedation. Haloperidol is a conventional anti-psychotic medicine which is used to treat schizophrenia and Tourette's disorder which works by blocking dopamine receptors in brain. High doses of haloperidol cause serious movement disorder which may not be reversible. It may also cause drowsiness, headache, insomnia and irregular menstrual periods.

- Examples of conventional anti psychotics include chlorpromazine, haloperidol and fluphenazine.
- It is available in various dosage forms such as tablets, injections and oral concentrate.
- **Tablets** are available in various doses such as 0.5mg, 1mg, 2mg, 5mg and 10mg.

Advantages of tablet formulation are:

- Provides rapid onset of action.
- Convenience for patients.
- Cost effective.
- They have a longer shelf life.

Disadvantages of tablet formulation are:

- Difficulty in swallowing.
- They have limited dose flexibility.
- Tablet formulation may get interacted with other medications.
- Limited bioavailability.

Oral Concentrate: Haloperidol oral concentrate contains a usual dose of 2mg/ml.

Advantages of oral concentrate:

- It can easily be absorbed.
- It can be easily administered.
- Precise dosing adjustments can be easily done.

Disadvantages of oral concentrate:

- Some oral concentrates have an unpleasant taste.
- They have shorter half life when compared to tablets and capsules.
- Risk of dosing errors.

Capsules: They are solid oral unit dosage form that contains active medicaments. General examples include Cariprazine capsule formulation.[3]

Fig 2: Capsules containing Anti-psychotic drug substances.

Advantages Of Capsules:

- They can be easily swallowed.
- Bitter taste of drugs can be masked.
- They offer better bioavailability when compared to tablets.
- They provide quicker release of drug substances from dosage forms.

Disadvantages Of Capsules:

- They are expensive to produce when compared to tablets.
- They usually face stability issues during manufacturing and storage.
- The speed of production is slow compared to tablets.
- Drugs with low melting point can't be formulated into capsules.

Injectables: Parentals are defined as sterile, non-pyrogenic preparations which contain active ingredients either in solid or liquid forms available in single or multi dose containers. They provide rapid onset of action which is usually within 30mins.[4]

- They are available in various forms such as intravenous, intramuscular and subcutaneous.
- Haloperidol, Risperidone, Olanzapine are usually available as parental dosage form.
- They are also available as depot injections which are also known as long acting injections.

Fig 3: Parenteral Preparations of anti-psychotics that are injected to brain.

Advantages Of Parentrals:

- They provide quicker onset of action.
- Drugs that are not absorbed or which are orally inactive are given through parentral route.
- They are useful for localized drug delivery.
- They provide prolonged drug effects.[5]
- Requires high standards of manufacturing.
- They avoid first pass metabolism.
- It can be administered to unconscious patients also.

Disadvantages Of Parentrals:

- Drugs which are once administered can't be reversed.
- They may cause infections at the site of injection.
- They also cause hypersensitivity reactions.
- They are of high cost
- Effective sterilization is required.[6]

Novel Approaches of Antipsychotic Drugs:

Drugs to produce it's required therapeutic effect, sufficient amount of drug must be available at target site at particular concentration and time. Most of the drugs that are available in conventional forms undergoes several obstacles to reach the specific site of action. Various challenges faced by conventional dosage forms are solubility, stability issues in different pH levels, drug degradation problems in different body fluids, high dosing is required which in turn produces side effects. Main disadvantage of traditional medications requires complex dosing which results in missing of any particular dose by patients.[7] To overcome all these limitations, the novel approaches of drug delivery system has come into existence. Novel drug delivery systems are defined as new approach which includes innovative approach, formulation, new technologies for developing pharmaceutical compounds to deliver to required site of action. This involves development of drugs with longer half life and increased therapeutic indices with utilizing newer technologies.[8] Novel drug delivery systems offers several advantages such as reduced dosing frequency, limited side effects, increased efficacy, maintenance of constant drug level in plasma. They are used to enhance safety, efficacy and convenience of drug substances. Several types of novel approaches includes nanoparticles, microparticles, liposomes, niosomes and transdermal drug delivery systems. NDDS have come into existence by understanding pharmacokinetic and pharmacodynamic properties of drug substances.[9]

Common side effects attributed for the usage of anti-psychotics include mild sedation, dry mouth, digestion problems, weight issues and acute dystonia. These various side effects leads to a decrease in market share of anti-psychotics. Various examples of novel approaches of anti-psychotics include Long Acting Injectables (LAIS), Transdermal patches, Oral dispersible tablets (ODT), Extended-release tablets (ER), Nano formulations, Implantable devices etc.,

Long Acting Injectables (LAIS):

Parenteral dosage forms are designed to treat various disorders which provides quicker reaction when compared to other dosage forms. This offers better bioavailability when compared to oral dosage forms by eliminating first pass metabolism and avoids gastrointestinal enzyme degradation.[10] Long acting injectables are defined as formulations that are intended for prolong release of medications from days to months. They are also known as depot delivery systems. They offer numerous advantages such as continuous release of drug over certain period, reduced dosing and effective utilization of administered drug. They provide slow, sustained and continuous release of active pharmaceutical ingredients. It has some limitations such as pain at site of injection, difficulty in drug retrieval, possibilities of dose dumping and preparations are of high cost.[11] Schizophrenia is a chronic central nervous system disorder which requires prolonged drug administration. LAIS are used for control release of drug substance. They include First Generation Antipsychotics (FGA) and Second Generation Antipsychotics (SGA). FGA formulations are based on esterification of oily solutions and SGA formulations are aqueous solutions. Examples include Flupenthixole Decanoate LAIs, Pipotiazine Palmitate LAIs, Risperidone and Aripiprazole. Long acting injectable of Paliperidone requires only 4 shots of injection for one whole year.

Oral Dispersible Tablets (ODTs)

Fig 4: Oral dispersible Tablets disintegrating in Oral Cavity.

Oral dosage forms are widely preferred route of drug administration compared to other routes. Tablets and capsules are the most commonly available dosage forms for oral administration. Most of them have difficulty in swallowing these dosage forms hence ODTs have come into existence. ODTs are defined as uncoated tablets which are placed in oral cavity that disperses within 3 minutes before swallowing. They contain super disintegrants which helps the dosage form to dissolve rapidly when it comes to contact with saliva which results in rapid drug absorption. They can be given to wide range of populations such as pediatrics, geriatrics and mentally retard peoples. This offers various advantages such as accurate dosing, increases bioavailability as drugs are readily dissolved in oral cavity, provides rapid onset of action, easy manufacturing and handling.[12] They are prepared either by direct compression or fusion method. Marketed products of ODTs available are Olanzapine, Aripiprazole.

Transdermal Drug Delivery (TDDS)

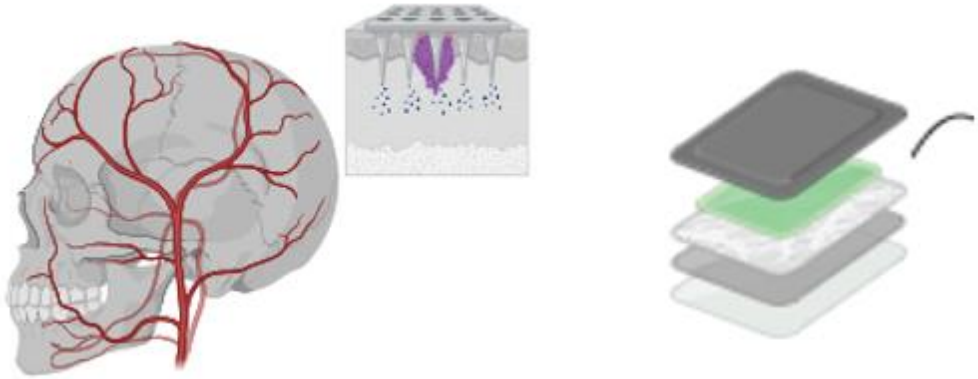

Fig 5: Transdermal patches and various layers present in transdermal patches.

It is defined as drug delivery system where drugs are delivered across skin and required amount of drug reaches systemic circulation. Control release of drug substances can also be achieved through this system. Physiochemical properties which must be considered during formulation of TDDS are drugs must have low molecular weight, small halflife, high lipophilicity, low dose and less oral bioavailability.[13] Various transdermal formulations are formulated such as creams, films, gels, nanosystems, patches, solution and spra.[14] The main advantage of TDDS is it bypasses first pass metabolism and drug substances enters blood stream directly. It decreases adverse side effects by excluding large fluctuations in plasma drug concentration. They also improve patient compliance.[15] Various excipients used in formulation are release liners, penetration enhancers, backing membrane, rate controlling membrane, pressure sensitive adhesives and various solvents.[16] It offers several limitations such as adhesion variability, irritation at site of application and not all drugs can be formulated as patches. Marketed products of transdermal patches include Scopolamine, Clonidine.

Extended-Release formulation:

They are the formulation which release medication for over a period of several days or weeks after single application. They offer number of potential benefits when compared to conventional dosage forms which includes safety and effectiveness. Use of these medications eliminates the need to daily dosing hence increases patient compliance.[17] They contain various types of polymers of different properties which may be of synthetic or biodegradable one for achieving extended release over period of time for producing required therapeutic effect. They are formulated as matrix type where drug is embedded within polymer matrix or formulated as beads. Limitations in formulating these dosage forms are complex manufacturing processes, high cost, stability issues, variation in bioavailability. Various formulations were developed using hydrophilic matrix for achieving extended release. Marketed formulations of extended-release antipsychotics are Quetiapine Fumarate extended release tablets.

Nanoformulations:

Nano systems are the structures which are less than 1 µm in size offering various advantages for delivering medications. Drug is dissolved, entrapped, attached or encapsulated to drug carrier. They carry drugs by covalent conjugations or by encapsulation into core.[18] They consist of biocompatible, biodegradable and nontoxic excipients which in turn reduces toxicity and immunogenicity. They are smaller in size allowing them to cross biological barriers such as BBB.

Nanoparticles consist of various types of materials such as natural and synthetic polymers, lipids, phospholipids and organometallic compounds.[19] They consists of hydrophobic inner core and hydrophilic outer layer. In nano system preparation drug is dissolved inside core and adsorbed onto membrane. Various types of nano formulations available are dendrimers, polymeric nanoparticles, liposomes, nano emulsion and micelles.[20] Advantages of nanoparticles include increased drug solubility, protection against degradation, increased drug permeability which in turn increases bioavailability. They are prepared by using high energy methods such as high pressure homogenizer, ultrasonication, high pressure extrusion. Limitations include insufficient entrapment efficiency and loss of drug due to transition from one state to another state. Marketed formulation available is Quetiapine nano emulsion, Risperidone spanlastics.

Implantable Devices:

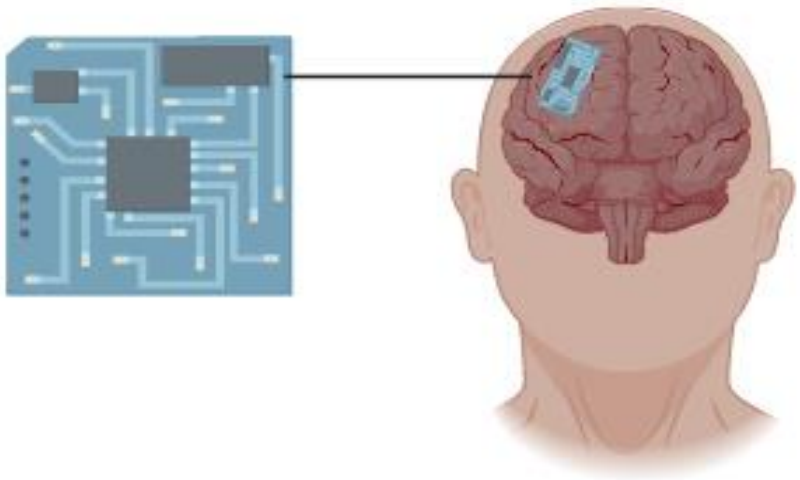

Fig 6: Implantable devices that are inserted into various body parts.

These devices are capable of delivering one or more antipsychotics over controlled period of time. These devices contain a core material containing polymer matrix within which one or more active ingredients of antipsychotics are dispersed within it.[21] The implants were prepared using biodegradable materials. They are used for localized drug delivery by utilizing lower dose and reduce systemic drug exposure. They even reduce adverse side effects. In case of adverse side effects, implants can be removed to avoid undesired effects. Materials selected for implantable devices must be biocompatible, non immunogenic and inert in nature. These implants follow zero order kinetics for drug release. They must be surgically implanted and explanted after drug depletion. They are having certain drawbacks such as infection, pain, discomfort and it is of high cost. Intranasal implants have been invented for treatment of schizophrenia. They consist of two parts inside core made up of active ingredients and water-soluble polymers. They are either injected or implanted to patients to provide sustained release of drug after single administration.[22] Various types of implants are solid implants, in situ forming implants, in situ forming microparticles, polymeric lipid implants and depot formulations.[23] They are prepared using hot melt extrusion method. Marketed formulation available for implants are haloperidol and risperidone implants.

Microneedle Array:

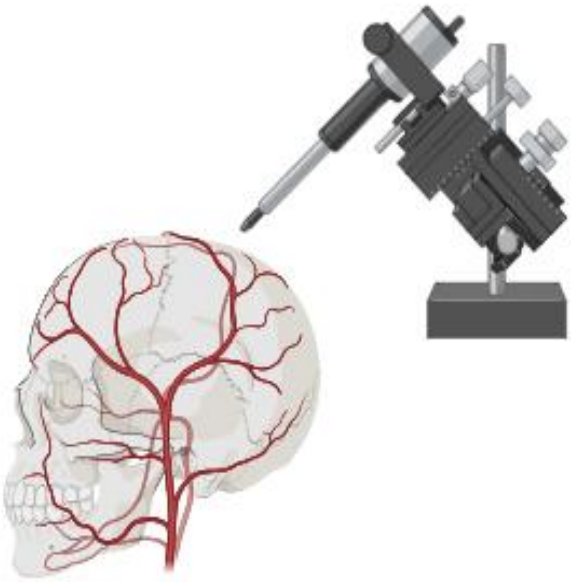

Fig 7: Microneedle array that offers drug delivery to specific site.

They represent an innovative transdermal approach of delivering drug substances for treating schizophrenia. They offer non invasive and alternative approaches for traditional methods such as injections and oral administration. They are less than one millimetre in height. They contain tiny projections that painlessly penetrate through outer layer of skin. Needle length must be adjusted accordingly so that they don't damage nerve ending. They provide safe administration as compared to surgical implantation. Drug enters through dermal tissues for systemic or local effects. This technique bypasses gastrointestinal metabolism and increases bioavailability. There are five types of microarray patches such as dissolving microneedles, hydrogel forming, coated microneedles, hollow microneedles, solid microneedles. They can provide long term drug release. They minimize regular medical visits and increases therapeutic effect.[24] Major disadvantage of micro needles are very less amount of drug can be loaded into microarray tip. More sophisticated process is required for preparation. Ingredients used for preparation are glass, silicone, stainless steel, titanium, and cobalt, synthetic and natural polymers.[25] Marketed formulations include Risperidone Microneedles.

Regulatory Requirements for Prescribing Anti Psychotics:

Regulatory requirements vary depending on each country and region as they are governed by each nation's health authority. Anti-psychotics are usually prescribed to calm down the patients. CDSCO has the responsibility of monitoring safety and efficacy of drugs along with issuing license for the manufacturer. Anti-psychotics must go through rigorous steps of clinical trials to get approved by agencies such as FDA, EMA and CDSCO. Manufacturers must comply with good manufacturing practices to ensure consistent production of drugs. Poor quality of life, poor quality of care and premature deaths has led to reduce in usage of anti-psychotic drugs. Particular regulations play important role for using certain anti-psychotic drugs. The first regulatory initiative was led by Gupta company in 2008, where there

were 28 approved antipsychotics available in 101 formulations. Later on, it was taken over by Kokate committee in 2014, where there were 34 approved anti psychotics in market available in 138 formulations.[26]

Following are the regulations that need to be followed for using anti-psychotic drugs-

- Population, not been using these drugs before, should not be prescribed until and unless they have diagnosed with proper disorder.
- Gradual reduction in dose is necessary.
- Once medications have been started to use there should be on going evaluation of effectiveness, whether to reduce or continue with same dose frequency.
- People have right to know the treatment concerns of particular disorder whether to accept or decline the medications.
- Residents do not receive the prescribed medications to PRN unless medications are prescribed for particular disorder. PRN order of anti-psychotics is valid upto 14 days.

There were almost 35 FDCs approved psychotics among which 30 drugs were having full name drug data. Of the 30, 13 were antipsychotics, 11 were antidepressants and 6 were sedatives.

Approval process of anti-psychotics includes following steps-

- Laboratory studies and animal testing must be done before testing on humans to evaluate drugs safety and effectiveness.
- Drug developer must submit an investigational new drug application to the required regulatory agency.
- This IND application is followed by clinical trials in humans which consists of 3 phases.
- Once clinical trials are completed the developer submits data to regulatory agencies which includes results from clinical trials, manufacturing conditions, processed label and safety data.
- Regulatory agencies review the application, and drug is approved for marketing.
- After approval drug enters market but remains under surveillance for adverse side effects.

Current Trends Used in Treatment of Psychiatric Disorders:

As determined around the world almost 970 million people are suffering from mental disorder including from childhood to adolescence which may persist throughout the life. As a result mental illness is leading to cause of disability. Currently available anti psychotics are aimed in treating the positive symptoms of psychosis. Brain stimulation is an effective alternative used in treatment of mental disorders. They use electrical activity to modulate brain functions by varying strengths of electrical fields. Repetitive transcranial magnetic stimulation (rTMS) and transcranial direct current stimulation (tDCS) are the approaches that are used to target brain. In rTMS magnetic fields are used to activate cortical neurons. In tDCS electric currents are applied to scalp to either increase or decrease the excitability of cortex neurons. Deep brain stimulation (DBS) is a newly emerged technique. It contains electrode, that are surgically implanted into target site and stimulation is regulated by pulse generator. Apart from these stimulation techniques, they also make use of other forms of treatment for treating psychiatric disorders such as use of rapidly acting therapeutics. These rapidly

acting therapies provide rapid action along with sustained functions. Positive allosteric modulation of GABA type A which enhances inhibition of GABA is considered as new type of treatment for treating various mental disorders that as rapid onset of action. From past 10 years interest in use of Psychedelics has been increased. They are the substance that produces profound changes in thoughts, feelings and perception. They produce hallucinations. They are usually plant-based compounds.[27] They even identify the risk factor of genetics that causes mental disorders for curing it. Genetics can allow for early detection of risk factors and helps in providing precised treatments. Another approach is use of biomarkers, which are known as biological indicators which are found in blood and saliva. Biomarkers reflect changes in body including stress and trauma and reacts to treatment. Different brain imaging techniques like CT, MRI, and PET scan plays a prominent role in understanding various mental disorders. Digital tools such as mobile applications also help in tracking psychosis. Digital tools even include wearable devices and web-based platforms. Digital tool helps in symptom monitoring, medication side effect management and targeting specific areas of disorder. Artificial intelligence also plays a prominent role.[28] One of the recently approved anti-psychotic drugs is Cobenfy which was approved in September 2024. It is used in treating schizophrenia by targeting muscarinic receptors in brain rather than dopamine pathway. Common side effects of using this medication are constipation, heartburn and headache. This approach aims in reducing symptoms like hallucinations and delusions by reducing adverse side effects such as weight gain and drowsiness. They are ought to taken twice daily orally.[29]

AI in Psychiatrics:

Artificial intelligence plays a prominent role in analysing the complex mental disorders. It improves diagnostic accuracy and aims in more precised personalized treatments. They integrate multiple data pattern to detect mental disorders. Electronic health data provides information on patient's history, use of medications and treatment outcomes. Along with maintaining records it also incorporates neuroimaging techniques such as functional magnetic resonance imaging and positron emission tomography. These imaging methods reveal structural and functional abnormalities associated with psychiatrics. Mobile applications associated with natural language processing to analyse speech pattern and detect early symptoms of psychiatric symptoms.[30]

Recent Findings:

From past ten years, treatment of psychosis has seen a significant improvement by creating novel drug agents and new methods of drug delivery systems. They have identified 11 significant developments in field of treatment of psychosis. The developments include-

- Introduction of new anti-psychotics such as Cariprazine, Brexpiprazole, Lumateperone, and Pimavanserin.
- Development of new delivery methods such as long acting injectables, transdermal systems and inhalers.
- Use of M1 and M4 muscarinic receptors agonist along with combination of peripheral anticholinergics.
- Use of second-generation anti psychotics.
- Therapies used in treatment of total symptoms include Cannabidiol, D3 antagonist/5-HT1A partial agonist F17464, Lumateperone (ITI-

007), phosphodiesterase 10A (PDE10A) inhibitors MK-8189 and TAK-063, sodium nitroprusside.

- Therapies used in treating negative symptoms include PDE10A inhibitor LuAF-11167, 5-HT2A inverse agonist Pimavanserin, sigma-2/5-HT2A antagonist Roluperidone (MIN-101), and d-amino acid oxidase (DAAO) inhibitor TAK-831.

- Treatment of positive symptoms include dopamine D1/D2 antagonist LuAF-35700, and DAAO inhibitor sodium benzoate.[31]

- Currently available antipsychotics target dopaminergic pathway.

CONCLUSION: Psychosis is one of the major disorders which is emerging in recent days in wide range of population. Group of psychiatric disorder include schizophrenia, bipolar disorder, and depression. Anti psychotics are the major class of drugs that are used in treatment of psychosis. Current market share of anti-psychotics includes 16.14 billion. Historically, Chlorpromazine was the first discovered anti-psychotic drug in early 1950's. With the introduction of Chlorpromazine, researchers have led to invention of first-generation anti psychotics. After introduction of first-generation anti psychotics, various developments led to the invention of second-generation antipsychotics. Clozapine was the first second generation antipsychotics. Conventional forms of antipsychotics available are tablets, capsules, oral solutions and parenteral dosage forms. They are convenient dosage forms which are used by wide range of populations. Various advantages of these types include offer better patient compliance, easily available, easily manufactured. Inspite of offering these benefits it also comes with several limitations such as poor absorption, fluctuations in peak plasma concentration and requires frequent dosing. By considering these limitations, novel approaches for treating psychosis came into existence. Novel methods for treating these mental disorders play a significant role in providing desired treatment for patients. Novel methods include use of Extended-release formulations, long acting injectables, Transdermal formulations, Nano formulations, Implantable devices and Microneedle Arrays. These formulations offers several benefits such as increased bioavailability, reduced dosing, maintains peak plasma concentration, helps in controlled release of formulation, improved patient compliance. Apart from these benefits various limitations include complex manufacturing conditions, stability issues, some of the methods are not feasible, they are not widely accepted by populations, and they are of economically high value. These novel approaches have improved the treatment efficacy by offering several benefits.

REFERENCES

1. Arciniegas DB. Psychosis. CONTINUUM: lifelong learning in neurology. 2015 Jun 1;21(3):715-36.
2. Stroup TS, Gray N. Management of common adverse effects of antipsychotic medications. World Psychiatry. 2018 Oct;17(3):341-56.
3. Meszár V, Magyar G, Pásztor GM, Szatmári B, Péter K, Marton L, Dombi ZB, Barabássy Á. Cariprazine Orodispersible Tablet: A New Formulation for Cariprazine. Pharmacopsychiatry. 2024 Jul;57(04):180-5.
4. Rajesh M. Parenterals–A Versatile and Promising Drug Delivery System.
5. Divya K, Divyasree R, Vamsidhar M, Bhavani K, Bhanja SB, Sudhakar M, Panda DS, Panigrahi BB. Emulsion, micro emulsion and nano emulsion: a review. World journal of

pharmacy and pharmaceutical sciences. 2021 Jan 29;10(4):641-60.
6. Gulati N, Gupta H. Parenteral drug delivery: a review. Recent patents on drug delivery & formulation. 2011 May 1;5(2):133-45.
7. Tabatabaei MS. Oral Novel Drug Delivery Systems. Novel Drug Delivery Systems: Fundamentals and Applications. 2025 Jan 13:103-66.
8. Liew KB, Koh EV, Kong XE, Ismail NA, Abu Bakar RA, Kee PE, Khalid SH, Phang HC. Recent Advancements in Nanopharmaceuticals for Novel Drug Delivery Systems. Pharmaceutical Nanotechnology. 2025 Apr;13(2):271-86.
9. Khan MG. Topic–the novel drug delivery system. World Journal of Pharmaceutical Sciences. 2017 May 13;6:477-87.
10. Gonella A, Grizot S, Liu F, López Noriega A, Richard J. Long-acting injectable formulation technologies: challenges and opportunities for the delivery of fragile molecules. Expert opinion on drug delivery. 2022 Aug 3;19(8):927-44.
11. Chaudhary K, Patel MM, Mehta PJ. Long-acting injectables: current perspectives and future promise. Critical Reviews™ in Therapeutic Drug Carrier Systems. 2019;36(2).
12. Dey P, Maiti S. Orodispersible tablets: A new trend in drug delivery. Journal of natural science, biology, and medicine. 2010 Jul;1(1):2.
13. Peddapalli H, Rajagoni A, Pagilla P, Perumala J, Puppala S, Sunand K, Bakshi V. Design and development of transdermal patches of antipsychotic drug: in vitro and ex vivo characterization. International Journal Of Applied Pharmaceutical Sciences And Research. 2020 Jul 1;5(03):45-53.
14. Abruzzo A, Cerchiara T, Luppi B, Bigucci F. Transdermal delivery of antipsychotics: rationale and current status. CNS drugs. 2019 Sep;33:849-65.
15. Nguyen TT, Van Giau V, Vo TK. Current advances in transdermal delivery of drugs for Alzheimer's disease. Indian journal of pharmacology. 2017 Mar 1;49(2):145-54.
16. Al Hanbali OA, Khan HM, Sarfraz M, Arafat M, Ijaz S, Hameed A. Transdermal patches: Design and current approaches to painless drug delivery. Acta Pharmaceutica. 2019 Jun 30;69(2):197-215.
17. Siegel SJ. Extended release drug delivery strategies in psychiatry: theory to practice. Psychiatry (Edgmont). 2005 Jun;2(6):22.
18. Jeevanandam J, San Chan Y, Danquah MK. Nano-formulations of drugs: recent developments, impact and challenges. Biochimie. 2016 Sep 1;128:99-112.
19. Ferreira MD, Duarte J, Veiga F, Paiva-Santos AC, Pires PC. Nanosystems for brain targeting of antipsychotic drugs: An update on the most promising nanocarriers for increased bioavailability and therapeutic efficacy. Pharmaceutics. 2023 Feb;15(2):678.
20. Jeevanandam J, San Chan Y, Danquah MK. Nano-formulations of drugs: recent developments, impact and challenges. Biochimie. 2016 Sep 1;128:99-112.
21. Haley J, Palmieri A, inventors; Celanese EVA Performance Polymers LLC, assignee. Implantable Medical Device for the Delivery of an Antipsychotic. United States patent application US 18/315,590. 2023 Nov 16.
22. Utomo E, Li L, Gao J, Anjani QK, Picco CJ, Moreno-Castellanos N, Donnelly RF, Domínguez-Robles J, Larrañeta E. Reservoir-type intranasal implants for sustained release of risperidone: a potential alternative for long-term treatment of schizophrenia. Journal of Drug Delivery Science and Technology. 2024 Sep 1;99:105973.

23. Kaurav H, Kapoor DN. Implantable systems for drug delivery to the brain. Therapeutic delivery. 2017 Dec 1;8(12):1097-107.
24. Li L, Zhao L, Li M, Tao Y, Sabri AH, Moreno-Castellanos N, Ghanma R, Greer B, Anjani QK, McCarthy HO, Donnelly RF. Schizophrenia Treatment Based on Sustained Release of Risperidone from Poly (lactic-co-glycolic) Acid Implantable Microarray Patch. ACS Applied Materials & Interfaces. 2025 Mar 6;17(11):16616-31.
25. Halder J, Gupta S, Kumari R, Gupta GD, Rai VK. Microneedle array: applications, recent advances, and clinical pertinence in transdermal drug delivery. Journal of Pharmaceutical Innovation. 2021 Sep;16:558-65.
26. Bogowicz P, Mehta A, Choudhary S, Brhlikova P, Roderick P, McGettigan P, Farooqui HH, Sharma AN, Pollock AM. Sales and regulatory status of fixed dose combination psychotropic drugs in India: a retrospective longitudinal study. Journal of Pharmaceutical Policy and Practice. 2024 Dec 31;17(1):2372089.
27. Scangos KW, State MW, Miller AH, Baker JT, Williams LM. New and emerging approaches to treat psychiatric disorders. Nature medicine. 2023 Feb;29(2):317-33.
28. Stein DJ, Shoptaw SJ, Vigo DV, Lund C, Cuijpers P, Bantjes J, Sartorius N, Maj M. Psychiatric diagnosis and treatment in the 21st century: paradigm shifts versus incremental integration. World Psychiatry. 2022 Oct;21(3):393-414.
29. Bukhari SM, Btool S, Abbas J, Hussain A, Mehdi H, Raza M. Cobenfy (xanomeline-trospium): a breakthrough FDA-approved therapy redefining schizophrenia treatment. Annals of Medicine and Surgery.:10-97.
30. Avula VC, Amalakanti S. Artificial intelligence in psychiatry, present trends, and challenges: An updated review. Archives of Mental Health. 2024 Jan 1;25(1):85-90.
31. Krogmann A, Peters L, Von Hardenberg L, Bödeker K, Nöhles VB, Correll CU. Keeping up with the therapeutic advances in schizophrenia: a review of novel and emerging pharmacological entities. CNS spectrums. 2019 Aug;24(S1):38-69.
32. Ameer MA, Patel P, Saadabadi A. Neuroleptic medications. InStatPearls [Internet] 2024 Feb 21. StatPearls Publishing.
33. Goff DC. Maintenance treatment with long-acting injectable antipsychotics: comparing old with new. Jama. 2014 May 21;311(19):1973-4.
34. Newcomer JW, Weiden PJ, Buchanan RW. Switching antipsychotic medications to reduce adverse event burden in schizophrenia: establishing evidence-based practice. The Journal of clinical psychiatry. 2013 Oct 23;74(11):20578.
35. Seemüller F, Lewitzka U, Bauer M, Meyer S, Musil R, Schennach R, Riedel M, Doucette S, Möller HJ. The relationship of Akathisia with treatment emergent suicidality among patients with first-episode schizophrenia treated with haloperidol or risperidone. Pharmacopsychiatry. 2012 Nov;45(07):292-6.
36. Greenblatt DJ. Intramuscular injection of drugs. New England Journal of Medicine. 1976 Sep 2;295(10):542-6.
37. Brandt PA, Smith ME, Ashburn SS, Graves J. IM injections in children. The American Journal of Nursing. 1972 Aug 1:1402-6.
38. de Sousa IP, Bernkop-Schnürch A. Pre-systemic metabolism of orally administered drugs and strategies to overcome it. Journal of Controlled Release. 2014 Oct 28;192:301-9.
39. Misra A, Shahiwala A. Novel drug delivery technologies. Springer: Berlin/Heidelberg, Germany; 2019.

40. Babadi D, Dadashzadeh S, Osouli M, Abbasian Z, Daryabari MS, Sadrai S, Haeri A. Biopharmaceutical and pharmacokinetic aspects of nanocarrier-mediated oral delivery of poorly soluble drugs. Journal of drug delivery science and technology. 2021 Apr 1;62:102324.
41. Anselmo AC, Gokarn Y, Mitragotri S. Non-invasive delivery strategies for biologics. Nature Reviews Drug Discovery. 2019 Jan;18(1):19-40.
42. Wang L, Wang N, Zhang W, Cheng X, Yan Z, Shao G, Wang X, Wang R, Fu C. Therapeutic peptides: current applications and future directions. Signal transduction and targeted therapy. 2022 Feb 14;7(1):48.
43. Sanofi-Aventis US. ELIGARD (leuprolide acetate for injectable suspension). Full prescribing information. 2010.
44. Kane JM, Eerdekens M, Lindenmayer JP, Keith SJ, Lesem M, Karcher K. Long-acting injectable risperidone: efficacy and safety of the first long-acting atypical antipsychotic. American Journal of Psychiatry. 2003 Jun 1;160(6):1125-32.
45. Garbutt JC, Kranzler HR, O'Malley SS, Gastfriend DR, Pettinati HM, Silverman BL, Loewy JW, Ehrich EW, Vivitrex Study Group. Efficacy and tolerability of long-acting injectable naltrexone for alcohol dependence: a randomized controlled trial. Jama. 2005 Apr 6;293(13):1617-25.
46. Siegel SJ, Winey KI, Gur RE, Lenox RH, Bilker WB, Ikeda D, Gandhi N, Zhang WX. Surgically implantable long-term antipsychotic delivery systems for the treatment of schizophrenia. Neuropsychopharmacology. 2002 Jun 1;26(6):817-23.
47. Walburn J, Gray R, Gournay K, Quraishi S, David AS. Systematic review of patient and nurse attitudes to depot antipsychotic medication. The British journal of psychiatry. 2001 Oct;179(4):300-7.
48. Bai W, Liu ZH, Jiang YY, Zhang QE, Rao WW, Cheung T, Hall BJ, Xiang YT. Worldwide prevalence of suicidal ideation and suicide plan among people with schizophrenia: a meta-analysis and systematic review of epidemiological surveys. Translational psychiatry. 2021 Oct 29;11(1):552.
49. Stępień-Wyrobiec O, Nowak M, Wyrobiec G, Morawiec E, Wierzbik-Strońska M, Staszkiewicz R, Grabarek BO. Crossroad between current knowledge and new perspective of diagnostic and therapy of late-onset schizophrenia and very late-onset schizophrenia-like psychosis: an update. Frontiers in Psychiatry. 2022 Oct 26;13:1025414.
50. Danckwerts M, Fassihi A. Implantable controlled release drug delivery systems: a review. Drug development and industrial pharmacy. 1991 Jan 1;17(11):1465-502.
51. Yapar EA, İnal Ö, Özkan Y, Baykara T. Injectable in situ forming microparticles: a novel drug delivery system. Tropical journal of pharmaceutical research. 2012;11(2):307-18.
52. Wang L, Wang A, Zhao X, Liu X, Wang D, Sun F, Li Y. Design of a long-term antipsychotic in situ forming implant and its release control method and mechanism. International Journal of Pharmaceutics. 2012 May 10;427(2):284-92.
53. Rainer MK. Risperidone long-acting injection: a review of its long term safety and efficacy. Neuropsychiatric disease and treatment. 2008 Oct 1;4(5):919-27.
54. Mudjahid M, Nainu F, Utami RN, Sam A, Marzaman AN, Roska TP, Asri RM, Himawan A, Donnelly RF, Permana AD. Enhancement in site-specific delivery of chloramphenicol using bacterially sensitive microparticle loaded into dissolving microneedle: potential

for enhanced effectiveness treatment of cellulitis. ACS Applied Materials & Interfaces. 2022 Dec 14;14(51):56560-77.

55. Detamornrat U, McAlister E, Hutton AR, Larrañeta E, Donnelly RF. The role of 3D printing technology in microengineering of microneedles. Small. 2022 May;18(18):2106392.
56. Utomo E, Li L, Gao J, Anjani QK, Picco CJ, Moreno-Castellanos N, Donnelly RF, Domínguez-Robles J, Larrañeta E. Reservoir-type intranasal implants for sustained release of risperidone: a potential alternative for long-term treatment of schizophrenia. Journal of Drug Delivery Science and Technology. 2024 Sep 1;99:105973.
57. Bogowicz P, Mehta A, Choudhary S, Brhlikova P, Roderick P, McGettigan P, Farooqui HH, Sharma AN, Pollock AM. Sales and regulatory status of fixed dose combination psychotropic drugs in India: a retrospective longitudinal study. Journal of Pharmaceutical Policy and Practice. 2024 Dec 31;17(1):2372089.
58. Avasthi A, Sharma A, Grover S. Clinical practice guidelines for the management of obsessive-compulsive disorder in children and adolescents. Indian Journal of Psychiatry. 2019 Jan 1;61(Suppl 2):306-16.
59. Brhlikova P, Mehta A, McGettigan P, Pollock AM, Roderick P, Farooqui HH. Regulatory enforcement of the marketing of fixed-dose combinations in India: a case study of systemic antibiotics. Journal of Pharmaceutical Policy and Practice. 2023 Dec 31;16(1):139.
60. Meehl PE. Schizotaxia, schizotypy, schizophrenia. InSchizophrenia 2017 Jul 12 (pp. 21-46). Routledge.
61. Tandon R, Nasrallah HA, Keshavan MS. Schizophrenia,“just the facts” 4. Clinical features and conceptualization. Schizophrenia research. 2009 May 1;110(1-3):1-23.

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