



# New Drug Delivery Strategies for Treating Fungal Infection

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## Abstract

Systemic Fungal infection of skin is also known as mycosis. Mycosis is a common fungal infection affecting human skin and causes different dermatophyte infections. Fungal infections is panic rate which presenting number of challenge to healthcare professionals. This rising rate is directly related to the growing population of immune compromised individuals thus results from changes in medical practice like use of immunosuppressive drugs and rigorous chemotherapy. Now there are modern aggressive treatment was used to control fungal infection in the body. The purpose of this review is to highlight the different novel diagnostic approaches for treatments for fungal infections.

**Keywords:** Fungal infection; types; characteristics; conventional; novel drug formulation

## Introduction

Fungal infection (fungus) is that kind of infection which is a germ or microbe that causes infections to mammals. Another words fungus referred as mycology and in plural it is called as fungi. Fungus has become rise throughout the past decade. The fraction of weak patients is rising, paralleling the surplus use of immunological disorder therapies. The circumstances incline the patients to

fungal infection have hematopoietic stem cell, transplantation and therapy as well as preterm birth etc. Among the varied opportunist pathogens, fungi express a significant and necessary threat. Fungal microbes are overabundant in nature (Table 1). They are frequent colonizers on varied human tissue layer surfaces, wherever they will live by evading host defenses (Table2).

**Table 1:** Types of Fungal Infection.

Types	Subtypes	Cause
<b>Superficial fungal infection</b>	Dermatophytes (tinea) Yeasts i.e. candida, malassezia, Piedra Moulds	Layers of skin and hair.
<b>Cutaneous fungal infection</b>	Mycetoma Chromoblastomycosis	skin epidermis, and also includes invasive hair, skin and nail problems
<b>Systemic fungal infections</b>	<b>Inhaled fungal infection</b> Histoplasmosis, Coccidioidomycosis <b>Opportunistic infection:</b> Transplant Massive doses of antibiotics Parenteral nutrition	Affect the healthy individuals. Sick or having immunodeficiency disorder

**Table 2:** Conventional and Novel Delivery Systems for treating fungal infections.

Conventional Drug Delivery Systems			Novel Drug Delivery Systems
Solid	Liquid	Semisolid	Ethosomes
Powder	Lotion	Ointment	Dendrimers
Aerosol	Liniment	Cream	Micro emulsions

Plasters	Solution	Paste	Nano suspensions
	Emulsion	Gel	Emulgel
	Suspension	Suppository	Micro sponges
			Nano sponges
			Transfersomes
			Niosomes
			Nanoparticles
			Nano emulsions

### Characteristics of fungi [1]

- Parasite
- Identify by reproduction
- Branched Filaments

### Major Antifungal Agents

- Fluoropyrimidines
- Polyenes
- Azoles
- Echinocandins

e. Polyenes

### Conclusion

The best way to deal with the ideal management of fungal infection is firstly finding and identify the causative agents and suitable treatment could be began as soon as possible (Table 3). But these days novel treatments are used for the superficial fungal infection. Which reduced the toxicity and increase the efficacy of these drugs. They are more capable of release the drug in sustained or controlled or minimizing the adverse effect of drugs such as allergic reaction and itching [1-28]. Thus, novel drug delivery system would be considered as highly efficient and better alternative for infection.

**Table 3:** Novel drug formulation used of Fungal Infection.

Formulation	Drug	Class	Delivery system	Site of Application	Conclusion	Ref.
Solutions	Amphotericin B	Antifungal	Dendrimer	Intravenous	PAMAM dendrimers increases the aqueous solubility	[2]
	Hydroxypropyl- $\beta$ -Cyclodextrin	Antifungal	Nail lacquer	Topically	An objective to target the drug in an effective concentration across nail plates	[3]
Cream	Miconazole	Antifungal	Liposomes	Topically	Propyleneglycol-phospholipid vesicles provided enhanced skin deposition with minimum skin permeation.	[4]
	Econazole Nitrate	Antifungal	Liposomes	Topically	Barrier damage on epidermis and irritative toxic effects can be overcome.	[4]
	Terbinafine	Antifungal	Nanostructure	Topically	Novel formulation having polymers which provide high efficacy and topical delivery.	[5]
	Clotrimazole	Antifungal	ethosomes	Topically	improved pharmacological efficacy and modified release of drug.	[6]
	Oxiconazole	Antifungal	Gel	Topically	It shows greater rate inhibition than marketed formulation.	[7]
	Ampicillin	Antimicrobial	Liposomes	Topically	Increase stability and biological activity of drug obtained.	[8]
	Ciprofloxacin	Antimicrobial	Liposomes	Topically	Distribution of drug to the site of infection by decrease motility.	[8]
	Gentamicin	Antimicrobial	Liposomes	Topically	Increase efficacy of drug	[8]
	Zidovudine	Antimicrobial	Liposomes	Topically	Enhanced targeting of drug.	[8]
	Niclosmide	Antimicrobial	Dendrimers	Topically	Improved water solubility, Controllable drug release	[8]
	Prulifloxacin	Antimicrobial	Dendrimers	Topically	Improved water solubility	[8]
	Sulfamethoxazole	Antimicrobial	Dendrimers	Topically	Increased antibacterial activity and Sustained drug release.	[8]
Silver Salts	Antimicrobial	Dendrimers	Topically	High payload, Prolonged circulation half-life	[8]	
Ciprofloxacin Hydrochloride			Dendrimers	Topically	prolonged drug release	[8]

	Ciprofloxacin Hydrochloride	Antifungal	Nanoparticles	Topically	Prolonged drug release	[8]
Gel	Sulfamethoxazole	Antifungal	dendrimer	Topically	Increased release rate when increasing the concentration penetration enhancer.	[7]
	Itraconazole	Antifungal	micro emulsion	Topically	This micro emulsion gels have been also identified as non-irritant	[4]
	Econazole	Antifungal	Liposomes	Topically	Increase the solubility of drug and enhanced the permeation.	[4]
	Fluconazole	Antifungal	Niosomes	Topically	Percutaneous absorption of drug increase with niosomes.	[4]
	Itraconazole	Antifungal	Emulgel	Topically	Antifungal activity and drug release higher in formulation	[9]
	Amphotericin B	Antifungal	Liposomes	Topically	Enhance the solubility of drug and decreases the toxicity	[10]
	Amphotericin-B	Antifungal	ethosomes, Transferosomes	Topically	Better antifungal activity and enhance skin permeation	[11]
	Bifonazole	Antifungal	micro emulsion	Topically	It shows good in vitro and antifungal activity	[12]
	Bifonazole	Antifungal	Organogel	Topically	Better spread ability, stability, viscosity and consistency of the formulation.	[13]
	Clotrimazole	Antifungal	Ointment	Topically	Increase spread ability of formulation	[14]
	Fluconazole	Antifungal	liposomes	Topically	Vesicular system entrapped in gel is most promising approach for topical delivery of drug	[15]
	Fluconazole	Antifungal	Gel	Topically	Efficient delivery of drug to skin is beneficial in localizing the drug to desire site.	[16]
	Itraconazole	Antifungal	Emulgel	Topically	Emulgel succeed drug release for sustained drug delivery.	[17]
	Itraconazole	Antifungal	Emulsion	Topically	Emulsion system safe and effective system for sustained delivery of antifungal agents.	[18]
	Miconazole	Antifungal	Nano emulsion	Topically	Nano emulsions are potential vehicle for increased topical delivery.	[19]
	Terbinafine Hydrochloride	Antifungal	GEL	Topically	Formulation can decrease the duration of therapy.	[20]
	Voriconazole	Antifungal	Gel	Topically	Satisfactory for all parameters studies	[21]
	Nystatin	Antifungal	Dendrimers	Topically	PAMAM dendrimers as potential tool for enhancement of nystatin	[22]
Fluconazole	Antifungal	ethosomes	Topically	Enhanced antifungal activity more than liposomes.	[23]	
Croconazole	Antifungal	Micro emulsion	Topically	Excellent activity against different fungus species.	[24]	
Nail lacquer	Amorol	Antifungal	Nanoparticles	Topically	Improve drug delivery using ultrasound to increase permeability of nail.	[25]
	Terbinafine	Antifungal	Niosomes	Topically	Minimum adverse effect and improved the adherence	[26]
Oil	Voriconazole	Antifungal	micro emulsion	Topically	Better antifungal activity against the Candida albicans than its supersaturated solution.	[27]
Dye	Dithranol	Anti-inflammatory	Dendrimers	Topically	Enhanced permeation rate constant and lesser skin irritation.	[28]

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