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Herbal Drugs as Anti-Tuberculosis Agents

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Abstract

Tuberculosis is the main cause of morbidity in modern era and came to existence many decades ago and has emerged as pandemic disease. The use of allopathic medicine in complex disease like tuberculosis is associated with the problem of cross resistance and herbal drugs have proven to be most effective in this context. The exploration of therapies for the successful attenuation of the morbid condition associated with tuberculosis is the need of the day.

Introduction

Tuberculosis caused the most widespread public concern in the 19th and early 20th centuries as an endemic disease of the urban poor. According to World Health Organisation (WHO), Tuberculosis, or TB, is an infectious bacterial disease caused by Mycobacterium tuberculosis, which most commonly affects the lungs. It is transmitted from person to person via droplets from the throat and lungs of people with the active respiratory disease.

24th March is celebrated as the world TB day to make the entire world remind about the major pandemic threat that is a mandate issue needing to be resolved at a fast pace. Tuberculosis (TB) is a disease of poverty, and a major cause of morbidity and mortality occurring in developing countries. Tuberculosis (TB) is a bacterial infection caused mainly by *Mycobacterium tuberculosis* (MTB). The pathophysiology of TB has been studied extensively from the last decades.

Scientist from London stated that discovery of new drug especially from plant origin is the need of the day. These new drugs are used for attenuation of complexity of current therapy, improve treatment of MDR TB and control of latent TB.

The WHO intends to integrate traditional medicine into National Health systems (NHS) globally. This is an opportunity for building safe, affordable and effective NHS especially for Third world countries, rich in both medicinal plant resources and traditional medicine knowledge. It is the time for Governments to found research into holistic health models instead of squandering more billions on ‘health genomics’, which will increase intervention and iatrogenic damages to health.

Anti-TB drugs consist of two groups: essential or first line drugs, which are usually used for the treatment of TB patients with susceptible *Mycobacterium tuberculosis*; and reserve or second-line anti-TB drugs used for the treatment of multidrug-resistant TB (MDR-TB). Second-line drugs have many more adverse effects that the first-line anti-TB drugs.

The human being appears to be affected with more diseases than any other animal species. Among various morbidities affecting human, respiratory diseases are more present. Tuberculosis is a disease of antiquities which is thought and has evolved sometime between the seventh and sixth millennia B.C. This spreading disease TB was diagnosed in modern medicine at the beginning of 19th century after the identification of mycobacterium by Robert Koch. But our Indian Systems of Medicine started treating this disease from 5000 BC by use of herbal drugs. TB was diagnosed in Ayurveda and Siddha systems of medicine.

TB Pathophysiology

M. tuberculosis requires the presence of oxygen to grow. It does not reuire any bacteriological stain due to high lipid content in its wall, and thus is never considered as Gram-positive nor Gram-negative; hence Ziehl-Neelsen staining, or acid-fast staining, is used. The mycobacteria do not seem to fit the Gram-positive category from an empirical standpoint (i.e., they do not retain the crystal violet stain), they are classified as acid-fast Gram-positive bacteria due to their lack of an outer cell membrane. M. tuberculosis replicates every 15–20 hours, which is extremely slow compared to other bacteria, which tend to have division times measured in minutes. Specifically, *M. tuberculosis* blocks the bridging molecule, early endosomal autoantigen 1 (EEA1); however, this blockade does not prevent fusion of vesicles filled with nutrients. Consequently, the bacteria multiply unchecked within the macrophage. The bacteria also carried the UreC gene, which prevents acidification of the phagosome. The bacteria also evade macrophage-killing by causing the neutralization of reactive nitrogen intermediates.

Herbal Drugs: Need of the day

The current therapy for TB include antibiotics such as rifambicin, ethombutol, isoniazid and pyracinamide, but the emergence of problem of multiple drug resistant (MDR) and (XDR) strains of mycobacterium is very common with anti TB drugs. The presence of “cross resistance” cause no single drug or combination therapy was able to control TB fully and such drug resistance is developed only against purified chemical compound. Any single purified compound will produce resistance in pathogens. The Mycobacteriae are self equipped to digest the drug by modifying their receptor structure according the chemical structure of the drug. Thus the Mycobacteriae slowly adapt and develop resistance against modern drugs. Herbal drug whether extract or decoction used against any pathogen will not cause the problem of drug resistance. Hence

an effective and appropriate drug therapy as an anti tuberculosis drug need to be discovered which will solve the problem of cross resistance as well as drug resistance.

Adverse effects associated with anti TB therapy

Hepatitis---------- Isoniazid

Pain, nausea, vomiting, hepatitis, thrombocytopenia------- Rifampicin

Convulsions, Dizziness, headache, depression, psychotic reactions-------Cycloserine

Arthralgia, hepatitis---------- Pyrazinamide

Vestibular and auditory nerve damage, renal damage---------- Streptomycin

Skin rash, Exfoliative dermatitis---------- Thioacetazone

Vertigo, auditory nerve damage, nephrotoxicity-------- Kanamycin

Diarrhoea, abdominal pain, hepatotoxicity---------- Ethionamide

Eye problems, neuritis ---------- Ethambutol

Glance of herbal anti-tubercular drugs

Botanical Name	Family	Chemical Constituents	Activity	Ayurvedic Name
Allium cepa	Liliaceae	allylpropyldisulphide, sulphurcontaining compounds, including allicin, alliin, flavonoids; phenolic acids and sterols	Antibiotic, antibacterial, antisclerotic, anticoagulant	Palaandu
Aloe vera	Liliaceae	aloin	*Purgative*	Ghritkumaarika
Trichosanthes dioica	Cucurbitaceae	nicotinic acid, riboflavin, vitamin C, thiamine, 5-hydroxytryptamine	Cathartic, febrifuge	*Patola*
Prunus armeniaca	*Rosacece*	Protocatechuic, *p*coumaric, Ferulic acid	antiasthmatic	Peetaalu
Ocimum sanctum	*Labiateae*	apigenin, orientin luteolin, apigenin-7-Oglucuronide	Carminative, stomachic, antispasmodic, antiasthmatic, antirheumatic, expectorant, hepatoprotective, antiperiodic	*Tulsi*

Canscora decussate	*Gentianaceae*	β-amyrin, friedelin,genianine mangiferin, Xanthones	Anticonvulsant, CNS depressant, antiinflammatory, hepatoprotective	Daakuni
Clavija procera	Theophrastaceae	-	Oleanane triterpenoid (aegicerin)	-
Cryptocarya latifolia	Lauraceae	-	Coumarins	-
Colebrookea oppositifolia	Lamiaceae	Flavonoids	Antiinflammatory	Binda
Kalanchoe integra	Crassulaceae	Triterpenoids-friedelin, taraxerol and glutinol and a mixture of long chain hydrocarbons	Hypotensive, antiarrhythmic	Parnabija
Mallotus philippensis	*Euphorbiaceae*	Phloroglucinol derivatives; rottlerin, isorottlerin, iso allorottlerin	Purgative, anthelmintic, styptic	Kampillaka
Kalanchoe integra	Crassulaceae	Triterpenoids-friedelin, taraxerol and glutinol and a mixture of long chain hydrocarbons	Hypotensive, antiarrhythmic	Parnabija
Flacourtia ramontchii	Flacourtiaceae	Phenolic glucoside ester, (−)-flacourtin, ramontoside, β-sitosterol and its β-D-glucopyranoside	Anticholinergic	Vikankata
Leysera gnaphalodes	*Asteraceae*	Non-cytotoxic triterpenoids oleanolic	-	-
Morinda citrifolia,	Rubiaceae	Anthraquinonesalizarin and its glycosides, *nor*damnacanthol. Ursolic acid and β-sitosterol. asperuloside and caproic acid	Antileucorrhoeic, antidysenteric emmenagogue	*Ashoka*

Conclusion

The side effects associated with the allopathic drugs have remarkdly necessities the need of herbal drugs. In this review, authors have tried to make a complete description of all the antitubercular drugs around the globe. The various constituents present in plants makes them as an effective antitubercular drug. The discovery of new drugs has finally begin to emerge, the standard of care for tuberculosis might become possible soon, and the framework for classification of drug-resistant cases will need to be expored. Although

the prevalence of TB in the society exists from large decades, still research needs to be explored for the benefit of the society.

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