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Abstract

Plants are an important part of modern medicine. The word drug is derived from the French word ‘drougue’ meaning dry herb. Historically, Indian, Chinese, Egyptian and Babylonian civilizations have evidences of plants being used to treat human illnesses.

Common drugs obtained from parts of plants and used commonly in therapeutics are atropine, morphine, digoxin, pilocarpine, physostigmine, codeine, bulk laxatives, colchicine and many others. Oils, gums, resins and tannins are other products of plants which are used as part of medicine formulations like cough mixtures, emulsions and suspensions.

Keywords

Alkaloids, Drug, Morphine, Pilocarpine, Anti-cancer drugs

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1. Introduction

Since ancient times plants and herbs are being used by humankind to heal themselves from many maladies. In fact, the word drug is derived from French word ‘drougue’ meaning dry herb. Over three-quarters of the world population relies mainly on plants and plant extracts for health care. Of the 2,50,000 higher plant species on earth, more than 80,000 are medicinal. In India, drugs of herbal origin have been used in traditional systems of medicines such as *Unani* and *Ayurveda* since ancient times. The *Ayurveda* system of medicine uses about 700 species, *Unani* 700, *Siddha* 600, *Amchi* 600 and modern medicine around 30 species. The drugs are derived either from the whole plant or from different parts of a plant, like leaves, stem, bark, root, flower, seed, etc. Some drugs are prepared from excretory plant product such as gum, resins and latex (Joy et al. 1998).

1.1 Historical evidences

The oldest evidence of use of plants for preparation of drugs comes from Sumarian slabs found in Nagpur which are 5000 years old. It contained 12 recipes of drug preparation made from around 250 plants (Kelly 2009; Petrovaska 2012). The earliest Indian records are Vedas, Ayurveda advocates various medicinal preparations of herbal and mineral origin. These are found in ancient monographs Charaka samhita, Sushruta samhita and Vagbhata (Satoskar et al. 2020).

The Chinese material medica ‘Pan Tsao’ written by Emperor Shen Nung circa 2735 BC to 2500 BC contains 365 drugs many of which are used even now a days like camphor, cinnamon bark, ephedra (Bottcher 1965; Wiart 2006; Petrovaska 2012; Satoskar et al. 2020).

Egyptian civilization was very developed in ancient times, Papyri were the first written account of medical experiences from Egypt dating back to 1900 BC. They mention 700 herbal remedies including morphine (Glesinger 1954; Tucakov 1964). A Babylonian clay tablet dating 700 BC mentions about 300 drugs (Satoskar et al. 2020).

Modern medicine originating in the late 19th and early 20th century uses many drugs of plant origin.

2. Commonly used Drugs of Plant origin (Sharma and Sharma 2012)

A. Morphine: It is an alkaloid belonging to the group of opioid analgesic. It is the strongest analgesic known and used clinically. It is obtained from poppy plant, *Papaver somniferum*. Its clinical uses are-

a) As analgesic: Used for relief of moderate to severe deep-seated pain like pain associated with myocardial infarction (heart attack), renal colic, pain after surgeries, trauma and cancer pain.

b) Acute left ventricular heart failure

c) In anesthetic practice

B. Codeine: also belongs to the group of opioid analgesic. Just like morphine, codeine is also obtained from *Papaver somniferum*. It is weaker analgesic in comparison to morphine. Uses are-

a) Mild pain like headache

b) As cough suppressant

C. Atropine: obtained from *Atropa belladonna* or from *Datura stramonium*. It has anti-muscarinic properties i.e., blocks the actions of parasympathetic autonomic nervous system in body. Various clinical uses are-

a) In pre-anesthetic medication before major surgeries to reduce salivary and respiratory tract secretions.

b) For pupil dilatation

c) As an antidote of organophosphorous poisoning

d) To prevent reflex vagal bradycardia

e) Some types of heart block patients

f) To reduce excessive salivation in heavy metal poisoning patients and in Parkinsonism patients.

D. Hyoscine or Scopolamine: obtained from *Hyoscyamus niger* and *Scopolia carniolica*. It is also anti-muscarinic drug just like Atropine. It is used for preventing nausea and vomiting while traveling (motion sickness).

E. Pilocarpine: belongs to the group of directly acting cholinergic drug. It is obtained from the leaves of the shrub *Pilocarpus jaborandi*. Mainly used for initial treatment of open angle glaucoma, to reverse pupil dilatation (mydriasis) produced by atropine, to stimulate salivary secretions in patients after laryngeal surgery and to treat dry mouth (xerostomia) seen after radiotherapy.

F. Physostigmine (Eserine): it is an alkaloid obtained from the dried ripe seeds of *Physostigma venenosum*. It is used just like pilocarpine for the treatment of glaucoma, for reversal of mydriasis and as an antidote in Belladonna (atropine) poisoning.

G. Digoxin, Digitoxin and Ouabain: they are cardiac glycosides. Digoxin, and digitoxin are obtained from the leaves of plant *Digitalis lanata*. Digitoxin is mainly obtained from the leaves of *Digitalis purpurea*. Ouabain is sourced from seeds of plant *Strophanthus gratus*. Amongst all the three drugs, Digoxin is commonly used. Main uses are-

- a) Congestive heart failure
- b) Cardiac arrhythmias like atrial flutter and fibrillation
- c) Dilated heart

H. Vinblastine, Vincristine (*Vinca* alkaloids): they are obtained from the shrub *Vinca rosea*. They arrest the cell division in the metaphase by binding to microtubular protein tubulin. Used as anti-cancer drugs in Leukemias, cancer of breast, cervix, ovary and lungs.

I. Colchicine: it is an alkaloid obtained from *Colchicum autumnale*. It is used to terminate an acute attack of gout.

J. Quinine: it is an alkaloid obtained from *Cinchona* bark. Used in prevention and treatment of malaria, to treat nocturnal leg cramps seen in the patients suffering from varicose veins, diabetes and arthritis and along with Clindamycin for the treatment of Babesiosis (a tick-borne disease).

K. Artemisinin derivatives: they include artemisinin, artesunate, artemether and arteether. They are obtained from Chinese herb *Artemisia annua*. They are used to treat *P. falciparum* malaria.

L. Reserpine: it is an alkaloid obtained from the plant *Rauwolfia serpentine*. It was discovered in India and was earlier used as anti-psychotic, and anti-hypertensive drug. It was very commonly used in early times to reduce high blood pressure but now its use has declined.

M. Cocaine: it is an alkaloid from the leaves of the coca tree (*Erythroxylon coca*). It is drug of substance abuse though it has local anesthetic actions but is not used clinically.

N. Gossypol: it is polyphenolic compound obtained from the cotton seed (*Gossypium* species). It is used occasionally as male contraceptive.

O. Taxanes (Paclitaxel, docetaxel, cabazetaxel): these are derived from the bark of Pacific yew tree- *Taxus bacata*, *Taxus brevifolia*. They are used as anti-cancer drugs for breast, ovaries, lung, head and neck cancers.

P. Epipodophyllotoxins (Etoposide, teniposide): these are semisynthetic derivatives of podophyllotoxins obtained from the roots of *Podophyllum emodi* (American mandrake). It is also used as anticancer drug for cancers of lung, testis, breast, and leukemias.

Q. Emetine: obtained from *Cephaelis ipecacuanha*. Dehydroemetine is its synthetic derivative. Rarely used now-a-days due to high toxicity and availability of better drugs, can be used in severe amoebic dysentery, and in amoebic liver abscess when other drugs cannot be given.

R. Bulk laxatives: these are natural or semi synthetic polysaccharides and cellulose derivatives used to treat constipation. They include Isapgol (dried seeds of *Plantago ovata* Forsk), *Psyllium* husk (*Plantago*), Sabza (dried seeds of *Ocimum basilicum*), and Haliv (seeds of *Lepidium sativum*).

S. Irritant purgatives: Anthroquinone group are of plant origin. They include *Senna*, *Cascara*, and *Aloe*. Used to treat constipation and irritable bowel syndrome.

T. Nicotine: it is an alkaloid obtained from the leaves of tobacco plant *Nicotina tabacum*. It is not used as a drug but is abused widely in form of tobacco smoking and chewing.

U. Oils: two types of oils from plant origin are used as medicines.

a) Essential oils (volatila oils): these are obtained from leaves or flower petals by steam distillation. They are steam volatile, have aroma, no caloric or food value, do not become rancid on prolonged stay. They are mainly used as carminatives (expel gas), astringents in mouth wash or as flavoring agents; example, *Eucalyptus* oil, clove oil, peppermint and ginger oil. Some of them remain solid at room temperature and sublime on heating like camphor, and menthol.

b) Fixed oils: they are non-volatile, have caloric or food value, form soaps with alkalis and become rancid after prolonged stay e.g., groundnut oil, coconut oil and olive oil. They are obtained after crushing of seeds. Some of them are used in medicines like castor oil as purgative, arachis oil as demulcent (relieve inflammation or irritation).

V. Gums: these are colloidal exudates of the plants. They either swell up or form adhesive mucilage in water. They are used as emulsifying or suspending agents while preparing emulsions, suspensions and nasal sprays e.g., *Acacia* Gum, gum tragacanth.

W. Tannins: these are non-nitrogenous phenolic derivatives obtained from plants which are soluble in water. They are mainly used as astringents e.g., Tincture catechu and tincture rhubarb.

X. Resins: these are polymers of volatile oil and are insoluble in water e.g., benzoin (used as inhalant in common cold), tincture benzoin (as antiseptic protective covering over bruises), and shellac used for enteric coating of tablets.

Balsams are also types of resin e.g., Tolu balsam is used as an expectorant in cough mixtures.

3. Conclusion

Thus, we see that in modern medicines many drugs are obtained from plants and with renewed interest in Ayurveda, many more will be discovered. A holistic approach in treating various diseases where combination of drugs from modern medicine (allopathy), ayurveda, yoga and naturopathy is need of time.

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