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REVIEW ARTICLE

Datura - As A Poison & An Antidote

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ABSTRACT

Datura is a herb explained in ayurvedic classics which is attributed with both poisonous and medicinal values. In this review article an attempt is made to compile the critical information related to therapeutic effect from *bruhatrayee*, laghutrayee and different toxicological textbook to substantiate it as both poison and as an antidote. It's entirely different function is due to its active chemical constituents like atropine etc. *Datura* is included under the group of *sthavaravisha* and is one among the *upavisha.* As per modern concept *Datura* is classified under deliriant cerebral poison. Deliriants are substances that cause acute state of confusion with disorientation, delusion and hallucination. *Datura* contains certain alkaloids such as atropine, scopolamine which are muscarinic cholinergic antagonists that exert multiple effects on the CNS. Atropine is both a central and peripheral muscarinic blocker and its actions last approximately four hours. And this atropine which is the main chemical constituent in datura acts by the mode of "Receptor site blockade" which further blocks the effect of anticholinesterase agents such as organophosphates, mushroom poisoning (amatoxin) at muscarinic receptor sites contributing to its action.

Key Words *Datura , Atropine, Antidote, Scropolamine*

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INTRODUCTION

Poison is a substance (solid, liquid, or gaseous) which if introduced in the living body or brought into contact with any part there of will produce ill health or death by its constitutional or local effect or both. Thus almost anything is a poison. "The dose makes the poison" according to 'Paracelsus'[1].

Antidotes are substances that act specifically to prevent, inhibit, inactivate, counteract, reverse or relieve the action or poisonous effects of a toxic agent i.e, they are remedies used to counteract the action of poisons[2]. *Datura metel* by virtue of its chemical composition has the ability to act both as a poison and an antidote.

Datura in detail:

Datura metel is an erect annual herb of 0.6-1.2 m height and belongs to the family Solanaceae. It is found throughout India mostly in waste ground of warmer regions. It is commonly known as 'Jimson weed' or 'Devils snare'. It has bell shaped flowers.[5]All the parts of this plant are poisonous, but the seeds and fruit are considered as poisonous to the most noxious[3].

According to the *rasasastra* texts of *Ayurveda*, *Datura* is included under the group *Upavisha* and is one among the *sthavaravisha*[3].Aspermodern

concept *Datura* is classified under deliriant cerebral poison. Deliriants are substances that cause acute state of confusion with disorientation, delusion and hallucination. *Datura* contains certain alkaloids such as atropine, scopolamine which are muscarinic cholinergic antagonists that exert multiple effects on the CNS[2].

After swallowing the seeds of *datura*, especially crushed, symptoms usually appear within half an hour or immediately[11].It produces gastric irritation, bitter taste, dryness in mouth and throat, burning pain in the stomach, and dysphagia. Death occurs usually due to respiratory failure[2]. *Datura* is classified as per *Raja Nighantu* (based on colour of the flower)as[12]:

i. *Sweta*
ii. *Neela*
iii. *Krishna*
iv. *Lohitha*
v. *Peetha*

Pharmacological properties are discussed in Table 1.

Table 1 Pharmacological properties of Datura

	Ra .Ni	***Kai.Ni***	***Da.Ni***	***B.P***
Rasa	*Katu*	*Madhura* *Tiktha*	*Katu*	*Kashaya* *Madhura* *Tiktha*
Guna	*Ushna*	*Tikshna* *Ushna* *Guru*	*Ushna*	*Ushna* *Guru*
Veerya	*Ushna*	*Ushna*	*Ushna*	*Ushna*
Vipaka	*Katu*	*Katu*	*Katu*	*Katu*

Table 2 Pharmacological action of Datura

	Ra.Ni	***Ka.Ni***	***Da.Ni***	***B.Pr.Ni***
Karma	*Kanduhara* *Twakdoshahara* *Bhramakara* *Jwarahara*	*Jwarahara* *Kushtahara* *Vranahara* *Kaphahara* *Krimighna* *Vishahara*	*Kanthikara* *Kushtahara* *Twakdoshahara* *Kanduhara*	*Jwarahara* *Kushtahara* *Kaphahara* *Kanduhara* *Vishahara*

Pharmacokinetics

The active constituents like atropine, scopolamine, hyoscyamine and other tropanes with their anticholinergic effect acts as antimuscarinic agent thereby relaxing smooth muscles, decreasing secretion of saliva, sweat and digestive juice, dilatation of pupil of eye etc. Atropine and hyoscine are rapidly absorbed from GIT.When applied to eye they freely penetrate cornea. Passage across blood brain barrier is limited. About 50% of atropine is metabolized in liver and rest is excreted unchanged in urine. It has a half-life of 3-4 hours[7].

Pharmacological action of atropine[7]

We can predict the actions of atropine from the knowledge of parasympathetic nervous system responses. Prominent effects are seen in organs which normally receive strong parasympathetic nerve supply. It completely binds muscarinic receptors. Thus interrupt the parasympathetic innervation. It also blocks

the few sympathetic cholinergic neurons such as those innervating sweat glands. It does not block nicotinic receptors. Consequently, there is little or no action at skeletal muscular junction or autonomic ganglia. It is both a central and peripheral muscarinic blocker and its actions last approximately four hours[5]. Therapeutic uses of Atropine are given in Table 3.

Table 3 Therapeutic uses of atropine[5]

System	Therapeutic action
Gastrointestinal tract	Act as an antispasmodic. Atropine antagonises the spasmogenic action of morphine on small and large intestine
Bronchi/Respiratory system	Atropine relaxes the smooth muscles of the bronchi and bronchioles. Bronchodilator in asthma condition by inhibiting reflex bronchoconstriction mediated by vagus nerve.
CNS	It depress vestibular excitation and has anti-motion sickness property by blocking the relative over-activity in basal ganglia. It supress tremor and rigidity of parkinsonism.
Cardiovascular system	At low doses it cause bradycardia due to blockage of M1 receptors on inhibitory pre- junctional neuron. High dose of atropine causes tachycardia due to blockage of SA node cardiac receptors.

Scopolamine[7]

It is also an antimuscarinic agent. It is a central nervous system depressant at therapeutic dose and is commonly used therapeutically for motion sickness.

Clinical toxicology

Datura when ingested causes delirium. In lower dose it causes CNS stimulation because of combined action of atropine, hyocyamine and scopolamine. It causes depression at higher doses. Scopolamine especially produces a state of excitement followed by state of depression where hallucination canoccur[7].

When leaves of datura are smoked it acts as a hallucinogenic and hypnotic. Ingestion of seed causes severe anxiety, confusion, delirium etc. Clinical symptoms of overdoses may include blurred vision, clumsiness or unsteadiness, dizziness, confusion, difficulty in breathing, tachycardia, arrhythmia, fever and urinary retention[3].

Diagnosis

The diagnosis of *datura* poisoning is generally made clinically by anticholinergic symptoms, dryness in mouth, mydriasis, tachycardia, hallucination, dysphagia, diplopia, drunken gait, dry hot skin, dysuria etc[2].

Even minute traces of atropine in blood can be detected by GC/MS. If dilated pupil did not constrict within 15- 30 min, after instillation of 2-3 drops of 1% pilocarpine, it is indication of anticholinergic poisoning[2].

Datura a *sthavara visha* is used in management of *alarkavisha*, *mushikavisha*, *sarpavisha* and *kukkudavisha*.Reference regarding *datura* used in *alarka* and *mushikavisha* is in *susruthasamhithakalpasthana* and *ashtangasamgrahauttarasthana*[10].Reference

regarding *kukkudavisha* is in *cakradatta*, *vishachikithsaadhyaya*. A *lepa* is mentioned and it is prepared from *datura*, *udumbara* etc.

For *sarpa visha* the leaf paste applied over the bite site is practiced in folklore medicines.

In *ashtangasangraha* it is mentioned that nothing is equal to poison to neutralize the poison[10] .In *Ayurvedaprativisha* concept cannot be co-related with antidote.

Prathivisha means the use of poison in the management of other poison. When all other treatment measures fails, *prathivisha* is the last line oftreatment in extreme cases.

Sthavaravisha causes aggravation of *kapha* and it act in upward direction. *Jangamavisha* act in downward direction.The opposite nature of these *sthavara* and *jangama visha* is the theory of prathivisha[1].

But if we consider the concept of antidote, they are agents which counter act the effect of poison. They are mechanical/physical, chemical, physiological/pharmacological and chelating agent. It can also be classified into specific and non-specific antidote[2].

Non-specific antidotes with a mechanical action are those which render the poison inert by their mechanical action .Example are finely powder activated charcoal, bulky food etc[2].

Non specific antidotes with a chemical action are those which counteract the action of poison by forming harmless or insoluble compounds when brought in contact withthem. Example is lime for oxalic acid. Chemicalantidotes themselves are almost harmless, so that if an excess is given, they will not produce any ill effect[2].

Antidotes works in any of following ways[2]:

Common mode of action of antidotes

1. Inert complex formation
2. Accelerated detoxification
3. Reduced toxic conversion
4. Receptor site competition
5. Receptor site blockade
6. Toxic effect bypass

Among this “receptor site blockade” is applicable in atropine as an antidote, ie the main chemical constituent in *datura* which blocks the effect of anticholinesterase agents such as organophosphates, mushroom poisoning(amatoxin) at muscarinic receptor sites[7].

From above explained symptoms or changes occurred after taking *datura* we can substantiate it as a poison. From the definition of poison, any substance (solid, liquid, gas)which if introduced in the living body or brought into contact with any part there will produce ill health or death it is considered as poison. Here *datura* is intake it will cause ill health and if not managed properly it may leads to death by respiratory failure[7].

Antidote and *prathivisha* cannot be equated because all antidotes are nonpoisonous substance, but*prathivisha* by virtue is *visha*. *Datura*can be considered as a *prathivisha* because it is a *sthavara visha* and it also classified under *upavisha*.

DISCUSSION

Datura metel is a commonly used plant for medicinal purpose and a main ingredient in many *ayurvedic* formulations. According to *Ayurveda, datura visha* is explained in *ashtanga sangraha vishaprathiseda adhyaya*. *"Daturakopayukthayena sarvam pashyathi peethakam Kampalalamadhachardhismruthi bhramsha bhramanvitham"*

And in this context, the symptoms after *datura* consumption has been explained as xanthopsia, developing tremors, salivation, toxicity, vomiting, loss of memory and giddiness[8].

It can be considered as a poison and an antidote also.In *charaka chikithsa sthana,visha chikithsa adhyaya*, explanation regarding *moolavisha* i.e., *sthavaravisha* given for *jangamavisha* & *jangamavisha* for *sthavara visha* management is available. It is the *prathivisha* concept and may be equated to *datura* as an antidote mainly in *alarka visha*. While explaining the *samprapthi,alarka visha* affects the *samjavaha srotas*. *Datura* also acts on *samjavahasrotas* causing *smrithinasha*and thereby acts as *deliriant*poison. Among the symptoms of affliction,*lalavan* (profuse salivation) is seen common in *datura visha* and *alarka visha*. *Alarka visha* afflicted person may become *unmatta*whereas the synonym of *datura*is also *unmatta*.

According to *susruthacharya* & *vagbhatacharya* while explaining *alarkavisha* treatment "*Apupa* preparation" with *datura* as an ingredient is explained. The patient does notsurvive if the poison aggravates by itself, hence it should be excited immediately so that it get aggravated[8].

CONCLUSION

As per the concept of *Ayurveda* any strong poison can be used as a powerful medicine if carefully processed and administered. On the flip side even a powerful medicine can turn to be poisonous if not properly handled.

Datura acts as a poison with a fatal dose of 50-100 seeds.it is used as a medicine in many formulations after doing *shodana* in *godugdha* and its use has been specified in *visha* conditions like *alarka visha*, *sarpa visha*, and *kukkudavisha*. From these we can substantiate that *datura* act as both *visha* and antidote.

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