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A Critical Review of *Sthavara Visha 'Vatsanabha'*: A Cardiotoxic Poison.

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ABSTRACT:

Herbal Medicines has been extensively used in India and other country for centuries. It is a common misconception among the public that *Ayurvedic* medicines are safe and devoid of adverse reaction. According to Toxicological text, some plants possess cardio toxic effects. *Vatsanabha is a Sthavara visha* which possesses anti-inflammatory & analgesic activities, and is capable of inducing severe arrhythmia and neurotoxicity. Cardio toxic effects of *Vatsanabha* are cause due to overdose of formulation or without purification of *Vatsanabha*. Fatality of *Vatsanabha* dose can happen on account of accidental ingestion or consumption of herbal decoction made from the aconite roots. Roots are used as diuretic, anti-periodic, anodyne, antidiabetic and antipyretic in very small doses. Aconite, in the form of tincture when applied locally can acts as a peripheral stimulant to sensory nerves producing tingling sensation followed by depression and numbness. If taken internally it stimulates the vagus nerve center and slows the heart origin. To clarify its potential risk following action, toxicological characteristics of *Vatsanabha* are reviewed along with its possible mode of action.

Keywords – Aconite, Aconitine, Cardio Toxic, *Sthavara Visha*, *Vatsanabha*

INTRODUCTION

Aconitum ferox (*Vatsanabha*) is a species of monk's hood in the family of Ranunculaceae. It is also known as the Indian Aconite which is abundant at Sandakphu which is the highest point of the Darjeeling Hills in the Indian State of West Bengal[1]. All parts of aconite plant are poisonous and the root tubers are the most potent. Dry root is conical or tapering 5-10 cm long, 1.5-2cm thick at the upper end and dark brown in color.[2] It contains large quantities of alkaloid pseudaconitine, which is deadly poison.[3] Its major alkaloid aconitine has chemical formula $C_{34}H_{47}NO_{11}$ and soluble in chloroform or benzene, slightly in alcohol or ether, and only very slightly in water. It is a neurotoxin that opens TTX (tetrodotoxin)-sensitive Na^+ channels in the heart and other tissues, and used for creating models of cardiac arrhythmia.[4] Toxicity mainly affects CNS, heart and muscle tissues, primarily resulting in cardiovascular complication. Several case reports describe cardio toxic poisoning with aconite or its constituents, resulting in ventricular tachycardia, ventricular fibrillation, atrial fibrillation and death.[5] The symptoms of poisoning are

usually seen within 45 minutes to 1hour, with numbness of mouth and throat and vomiting after an hour. Respiration slows and blood pressure synchronously falls to within 30-40 beats per minute. Death may be due to Respiratory failure or Ventricular fibrillation.[6]

History Of Aconite

The word aconite is derived from Greek work Akoniton , which stands for spear or lancet .Its toxic properties were possibly first noticed and utilized by tribes to make arrow and spear heads poisonous.[7] Aconite (*Vatsanabha*) found its place in *Ayurvedic* pharmacopeia for centuries back with its first mention in *Atharva veda*.[8] *Vatsanabha* the *Ayurvedic* synonym to aconite has derived its name from Sanskrit for resemblance of its tuber to the umbilicus (*Nabhi*) of the calf.[9] Aconite poisoning following use of herbal remedies has been reported from Hong Kong, India and Nepal.[10] There are many incidence reported around the world as toxic manifestations of aconite(*Vatsanabha)* may affect cardiac rhythm to a fatal extent.[11]It is observed when it is purified with cow urine, aconite(*Vatsanabha*) is converted to a compound with cardiac stimulant property whereas raw aconite showed cardiac depressant properties.[12, 13]

Traditional Description of Aconite (*Vatsanabha*):

In *Ayurveda*, *vishadravya* are classified into two types depending on their source. *Sthavara Visha* includes the poisonous drugs from mineral and plant origin. *Jangama Visha* includes toxic effects of animal and insect bites (snake, scorpion, rats, spider etc.).[14] There are ten *adhisthana* of *sthavar Visha*, in which *Vatasanabha* falls under the category of *kanda visha*.[15]

VishaDravya: The *sthavara* or *jangama dravyas* that induce toxic symptoms in the body when inhaled or consumed in unpurified form are called as *VishaDravya*.[16]

In *Rastrangini, out of* nine *Mahavisha*, *vatsanabha* is the only one, which is widely used and is considered best for *rasa kriya* and *rasayana*.[17]

General Description of Plant:[18]

1. Botanical name - *Aconitum ferox*
2. Family-Ranunculaceae
3. Vernacular name

English name - Monk's hood, Aconite

Gujarati name - Basnag, Bachnag Hindi name - *Bachnag, MeethaVish, MeethaTeliya*

Amruta - Acts as nector if used in suitable dose, after purification. *Vatsanabhi, Garala (fra),Stokaka, Pranahara, Kshveda*.

4. **Classification**:

Charakasamhita – SthavaraVisha (poison of plant origin)

*Sushruta*samhita- *Kanda Visha* (tuber poisons)

It is categorized under *'Visha*' group (Acc. To *Rasa shastra*) of herbs.

5. **Habitat**: Alpine zone of Himalayas of Sikkim and Chumbi.

6. ***Rasa Panchak*** (medicinal qualities):**Table 1. *Ayurvedic* properties of *Vatsanabha***

7. Effect on *Tridosha- Tridoshaghna* - balances all the three *Doshas*, especially, balances *Vata* and *Kapha Dosha.*

8. *Vishadhisthan: kanda (*Tuberous root) [20]

SYMPTOMS

Sushruta has explained *Grivasthambha* (neck stiffness) and *Pittavitmutranetra* (yellowish discoloration of eyes, stools and urine) as the toxic effect of *Vatsanabha.*[21]

RasaratnaSamucchaya explains 8 stages of toxic effects of *Vatsanabha*.

These stages refer to spreading of poison in different parts of the body. These Stages also depend on the level of toxicity and dosage of *Vatsanabha*.[22]

1st Stage- *TwakVikara* (Skin rashes)

2nd Stage –*Vepathu* (tremors)

3rd stage –*Daha* (burning sensation all over the body)

4th stage –*Vikrata* (deformity-Disturbance of sense organ)

5th stage - *Phenodgati* (Mouth frothing)

6th stage-*skandhabhanga* (Severe pain and fatigue of shoulders)

7th stage-*Jadyata* (wasting and comatose of whole body)

8th Stage – *Marana* (death)

***Vatsanabha Sodhana* :**

Impure or improperly purified *Vatsanabha* if administered in any form will cause acute burning sensation all over body. It may also cause *murccha (* syncope*)* and cardiac arrest and use of *Vatsanabha* in higher dose may also lead to toxicity and death.[23] Therefore purified *Vatsanabha* has to be put to therapeutic use only after purification.

Following methods are used for its purification -

- Small pieces of *Vatsanabha* immersed in a pot with *Gomutra* (cow's urine), placed under bright sunlight for 3 days, everyday replacing with fresh *Gomutra.* Dry it on 4th day after removing the outer layer and store it.[24]

- Small pieces of *Vatsanabha* kept in a small *Pottali* (small packing with cloth) and do *Swedana* (steam cooking) of it with either *Godugdha* (cow's milk) in *Dolayantra* for 1 – 2 *Yama* (3-6 hours). Let it cool down and once it is cool down, dried and stored.[25]
- Small pieces of *Vatsanabha* are given *Bhavana* (trituration) of *Gomutra* in *Khalwa yantra* (mortar and pestle) for consistent 3 days.[26]
- Small pieces of *Vatsanabha* kept in a small *Pottali* and do Swedana with *Triphala Kwatha* alone or with *Ajadugdha* or with Gomutra in *Dolayantra* for 24 hours. Store it once it is cool down and dried.[27]

Sudhha Vatsanabha* properties[28]*: *Suddha Vatsanabha* possesses *katu, tikta,kasaya rasa ,usnaguna* and *yogavahi* property, it act like *Rasayana.* It mitigates all three vitiated *doshas*. However, especially it acts on aggravated *vata* and *kapha dosha*.

Changes after *Shodhana*

After *Shodhana* process, there is a decrement in the total alkaloid content.[29] But the content of less toxic substances such as aconine, hypoaconine, and benzylhypoaconine increases possibly due to conversion of the toxic aconitine into aconine or hydrolysis of the alkaloids to their respective amino alcohols after *Shodhana* process[30].It has been observed that *Gomutra* converts Aconite(*Vatsanabha*) to a compound with cardiac stimulant property, whereas, raw Aconite showed cardiac depressant properties.[31,32] *Shodhana* by both *Gomutra* and *Godugdha* makes Aconite devoid of cardiac and neuromuscular toxic effects without affecting its antipyretic activity.[33]Soaking and boiling during processing or decoction preparation will hydrolyze aconite alkaloids into less toxic and non-toxic derivatives.

Therapeutic Dose : 1/16 *ratti* to 1/8 *ratti* (6 to 12 mg)[34]

Chemical Constituents:

The tuber of *Vatsanabha* contains 0.4 -0.8 % diterpene alkaloids and concentration of aconite in fresh plant is 0.3% and 0.2% in tubers and 0.2% and 1.2% leaves. The highest concentration of aconite is found in winter. Major alkaloids are aconitine,pseudaconitine ,bikhaconitine, diacetyl pseudaconotine, aconine, piroaconine, veratrypseudaconitine, chamaconitine, veratryl gamaconine and di-Ac-Y aconitine.[35]

Mode Of Action

In Ayurveda, *Hrudaya* (Heart) comes under the category of *Sadyaparanhar Marma* [36]. Due to the *visha* qualities (*guna*) of *Vatsanabha, tikshnadi guna* reaches *Hrudaya marma* due to vitiation of *Raktdhathu*. As per *Vagbhat*a, *visha* have opposite qualities to that of *ojas. Ojas* resides in the *Hrudaya* (Heart). Therefore *Vatsanabha* first vitiates *Rakt Dhatu* (blood) and then reaches *Hrudaya* (heart). [37]

Aconitine can interact with the voltage dependent sodium-ion channels, which are proteins in the cell membranes of excitable tissues, such as cardiac and skeletal muscles and neurons. These proteins are highly selective for sodium-ions. Aconitine binds to the channels at neurotoxin binding site 2 on the alpha sub unit. Normally, the sodium channels close very rapidly, but the depolarization of the membrane potential causes the opening (activation) of potassium channels and potassium efflux, which results in repolarization of the membrane potential. In short Aconitine increases the permeability of excitable membrane for sodium ions and prolong the sodium influx during the action potential as a consequence sensible nerve ending and motor endplates are first activated but later blocked.[38]

Fatal dose [39]

• Indian aconite root: 1.3-2gm
• Tincture: 5ml
• Liniment: 1ml
• Pure aconitine: 2mg
• Aconitine nitrate: 4mg

Fatal Period

• Usually 1-5 hrs
• Doses below Lethal Dose: produce alarming symptoms immediately
• Non-fatal cases: numbness & tingling sensation persist

Recovery Period

Recovery time is dependent on amount of intoxication. Mildly intoxicated patients
may take 1–2 days while patients with cardiovascular complications may take 7–9
days to recover.

Cause of death

Death may be due to Respiratory failure or Ventricular fibrillation.

Other Toxic effects[39] **Table 2. Sign & symptoms of aconite poisoning**

Antidotes:

According *to Rasa vagbhata* has mentioned specifically that the treatment of poisoning is possible up to the 5th *vega* only. First *Vamana* (Emesis) should be induced using *Vamankari Aushadhi* (Emetic drugs) followed by *Lepa, Kwatha* or *Anjana* of *Vishaghna Gana*.[40]

If toxic symptoms is due to over dose of formulation contains *Vatsanabha* or without purification of *Vatsanabha* in that condition *Tankana Bhasma* (Borax calx) along with *ghrita* is given is considered as main antidote.[41]

Use of Emetics or Gastric lavage with a solution containing charcoal, tannic acid or milk is advised. Immediate attention given to vital organs and close monitoring of BP and cardiac rhythm. In case of bradycardia, administration of 1mg atropine is indicated. For cardiac arrhythmias, 50ml of 0.1 % Novocain given intravenously, in slow manner is useful. Oxygen and artificial respiration may be resorted to, if necessary.[42]In case of overdose dose effects of aconite containing *Ayurvedic* medicine without advise of *Ayurvedic* physician shows symptoms of abdominal pain and heaviness in the abdomen, numbness around mouth, nausea tingling sensation of palm and sole, extremities were cold and clammy, fatigue, Hypotension and Bradycardia may also seen in Aconite poisoning.[43]

DISCUSSION

Vatsanabha is well known ingredient of *Ayurvedic* formulation and is prescribed as an antipyretic, analgesic, anti-rheumatic, appetizer and digestion. There are chances that use of larger than recommended dose of *Ayurvedic* medicines containing aconite can produce drug reactions. According to *Ayurveda* "even a strong poison can become on excellent medicine if administrated properly, on the other hand even the most useful medicine can act like a poison if handled incorrectly.[44]

In modern, mode of action of *Vatsanabha* is understood through disturbances in sodium potassium channel.

Vatsanabha is considered under the category of *Maha visha* as it possess the *laghu, ruksha, vyavayi, vikasi & tikshna guna* apart from the *visha* under the *upvisha* category. Due to *tikshnadi guna*, it reaches *HrudayaMarma. Hrudayamarma is the site for vyanvayu & sadhak pitta.* Therefore, role of both *vataj* and *pittaj lakshan* can be observed in its symptoms. *Vyanvayu* causes the vititation of *rasa dhatu* in whole body. The vitiated *rasadhatu* causes the vitiation of *kapha dosha*, which is a representative of *oja* in the body. Also it produces the CNS related symptoms. Similarly, *sadhakpitta* causes the further vitiation of *rakta dhatu* which can be observed as *tvakvikara, daha* and *vepathu* as mentioned in *rasa granthas.*

Vatsanabha root should be used after purification in preparations. *Sodhana* is not available in Burhattrayee's, but its detailed *shodhana* can be obtained from the *Rasgranthas.* It is generally purified in *gomutra ,godugdha* & *ajaksheera* mainly by the process of *Swedan*. Out of these *gomu*tra is more efficient than *godudha* .It reduces the toxicity of alkaloids to some extent and converts aconite to a compound with cardiac stimulant property. *Vatsanabha* is strong poison which affects various systems. In Ayurveda specific antidote of *Vatsanabha* is used i.e., *tankan bhasma* with *ghrita* is administered which can be effective as cardio protective whereas *tankan bhasma* being alkaline in nature will help to maintain the pH of human blood & neutralize its toxic effects. A single dose of aconitine 0.6 mg/kg administered intra peritoneal to rabbits damaged the myelin sheath of visual pathway, spinal cord and peripheral nerves. Most of cardiotoxic and neurotoxic effects of aconite (*Vatsanabha*) can study by these mechanisms, including its effect on calcium imbalance.[45]

CONCLUSION

Formulations having aconitum roots as an ingredient are highly effective in various diseases. Practitioners while prescribing such medicines should be aware of the quantity of *Vatsanabha* in a formulation and prescribe such drugs only in recommended dose and follow-up the patient for any toxic symptoms. If any toxic symptom appears, the formulation containing *Vatsanabha* should be immediately stopped and medicine to counteract the toxic symptoms should be started immediately without any delay. The patient should also be aware and not to purchase *Ayurvedic* medicine over the counter (OTC) and avoid self-medication. From the above review, it can be concluded that *Suddha Vatsanabha* has great medicinal value, by the virtue of its properties like *Ushna, Ashukaritwa, laghu, tikshna vishadravyas*. It gets spread rapidly in the body by these properties, in a similar way other *Ayurvedic* formulations can be made more effective. It can also cause toxicity if used without purification, self-medication or its over dosing. Further detailed study can be carried out to study the effect of *Tankan bhasma* as specific antidote in reducing the toxic effects of *Vatsanabha*, which is alkaline

in nature by this action we can study the more combination of *tankan bhasma* and elevates its effects on individual toxic components of Aconite. Further clinical assessment of medicinal properties and its safety profile are required for its clinical applications in future.

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Table 1. *Ayurvedic* properties of *Vatsanabha*

RASA	*Madhura*(Sweet*)*
GUNA	*Laghu, Ruksha, Tikshna, Vyavayi, Vikashi*
VIRYA	*USHNA (*Hot In Potency*)*
VIPAKA	*KATU(*Undergoes Pungent Taste Conversion After Digestion*)*
PRABHAVA	*Rasayana*
KARMA	*Vata-Kaphahara ,Jwarahara,Jangama Vishahara Madakari, Kushhaghnat*

Table 2. Sign & symptoms of aconite poisoning

System	Signs and Symptoms
Gastrointestinal Tract	Pain in abdomen, nausea, vomiting, salivation, diarrhea, bitter sweet tastes, severe burning, tingling of tongue, mouth and throat.
Central Nervous System	Vertigo, restlessness, headache, giddiness, difficulty in speech
Muscular System	Weakness of muscles of the limbs with twitching and spasms
Respiratory System	Respiration slow, labored and shallow
Ocular	Pupils alternately contract and dilate, diplopic and impaired vision occurs