

EVALUATION OF PRATIVISHA PROPERTIES (ANTIDOTE PROPERTIES) OF TANKANA (BORAX) IN VATSANABHA VISHAKTATA (ACONITE POISONING)

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ABSTRACT

It is a common misconception among the public that *Ayurvedic* medicines are safe and devoid of adverse reaction. Many poisonous plants have been used in *Ayurveda* medicine. Aconite-based *Ayurveda* medicines are commonly used by *Ayurvedic* physicians and traditional practitioners/folk healers in primary healthcare. Aconite poisoning following use of herbal remedies has been reported from Hong Kong, India and Nepal. According to toxicology, *Vatsanabha* (*Aconitum ferox*) is a cardiac poison. In *Vatsanabha* sever toxicity, cardiovascular features include hypotension, sinus bradycardia, and ventricular arrhythmias. Treatment of poisoning in allopathy is mainly supportive. In *Ayurveda* in treatment of *Vatsanabha* toxicity *Tankan* was suggested as an antidote, but its mechanism not known. So a carefully planned analytical study was carried out for analysis of *Vatsanabha* and *Tankan* to evaluate the antidote property of *Tankan*. In this study four samples [*Ashuddha Vatsanabh* (AV), *Shuddha Vatsanabha* (SV), *Ashuddha Tankan* with *Ashuddha Vatsanabha* (ATAV), *Shuddha Tankan* with *Ashuddha Vatsanabha* (STAV)] were studied using Thin Layer Chromatography (TLC). TLC plates were visualised under 254 & 366nm. UV rays and spraying Dragandorff's reagent & further Sodium Nitrite on the plates already sprayed with Dragandorff's reagent. The conducted study shows that *Tankan* delays and also reduces the toxic effects of *Vatsanabha*.

Keyword: *Vatsanabha*, *Tankan*, Aconite, Antidote, Thin layer chromatography

INTRODUCTION

Ayurveda is one of the most ancient systems of life, health and cure. Its antiquity goes back to the *Vedas*. *Ayurveda* is a highly evolved and codified system of life and original concept and fundamental principles like *Tridosha Siddhanta*, *Panchbhautic Siddhanta*, etc. The system's core strength is its holistic approach towards health and disease using natural remedies derived from medicinal plants and minerals.¹ Many poisonous plants like *Ahiphena* (*Papaver somnife-*

roum Linn.), *Bhanga* (*Cannabis sativa* Linn.), *Dhattur* (*Datura metel* Linn.), *Karavira* (*Nerium indicum* Mill.), *Kupilu* (*Strychnos nuxvomica* Linn.f.), *Langali* (*Gloriosa superba* Linn.), *Vatsanabha* (*Aconitum ferox* Wall.), *Jayapal* (*Croton tiglium* Linn.), etc. have been used in *Ayurveda* medicine.² According to *Ayurveda*, "even a strong poison can become an excellent medicine if administrated properly; on the other hand,

even the most useful medicine can act like a poison if handled incorrectly".³ Unexpected adverse reactions can occur due to accidental use of a poisonous herb/medicine/decoction by the patient, misidentification of herbs so that a toxic herb is mistaken to be a harmless variety, improper purification of the poisonous ingredients, overdose, irrational prescription, self-medication and drug interaction with allopathic drugs. The most common aconite-based medicinal plant *Vatsanabha* (*A. ferox* Wall.) is used in *Ayurveda* as an antipyretic, analgesic, anti-rheumatic, appetizer and digestive. Aconite is a strong poison affecting several systems. Pure aconite can cause death at a dose of 2 mg, while 1 g of the aconite plant is fatal.⁴

Vatsanabha –

Monkshood (*Aconitum ferox*), is known to be the strongest poisonous plant of the Himalayas. *Aconitum napellus* or *mithazahar* or *dudhia bish* is growing in Europe and North America. The other species of aconite which grow in the temperate Himalayan region of India and are used as substitutes for official aconite are

1. *Aconitum balfourii*
2. *Aconitum deinorrhizum*
3. *Aconitum spicatum*
4. *Aconitum chasmanthum*

The first two species, namely, *Aconitum balfourii* and *Aconitum deinorrhizum*, were originally included under the name of *Aconitum ferox*.⁵

Active Principles (Alkaloids) of *Aconitum ferox* are Aconitin (acetylbenzoyl-aconine), Pseudo-aconitine (veratroyl-aconine), Aconine, Picraconitine (benzoyl-aconine), Benzoylamine and Nepelline. Of all these active principles (alkaloids) obtained from the In-

dian species of aconite plant, it is said that pseudo-aconitine is the most toxic.⁶

Aconitine first stimulates and paralyzes the peripheral terminations of sensory and secretory nerves, the central nervous system, myocardium, skeletal and smooth nerves, but it does not seem to affect the higher centres of the brain for consciousness usually remains till the end.⁷

Toxicity of Vatsanabh –

A. Local action – If leaves and flowers are handles or rubbed, sensation of tingling and numbness occur on hands. Due to pollen grains, there is pain and swelling in eyes.

B. Internal action – If aconite is ingested in any form, it produces symptoms of tingling and numbness within few seconds. These symptoms are seen first on lips, mouth, tongue, throat and then spreads all over the body. After this salivation, nausea, vomiting, pain in abdomen and sometimes diarrhea are seen. There is dryness of mouth; Patient is unable to swallow causing dysphasia, with profuse sweating, patient feels paralyzed. There is vertigo along with sensory loss in vision, hearing and speech. Because of visual disturbance, diplopia may occur. Patient feels ringing in the ear. There is muscular weakness in limbs and that progresses to ataxia. Patient may feel twitching in muscles and convulsions in last stage. Sometimes cramps in muscles are seen. In aconite poisoning there is alternate contraction and dilation of pupils which is known as **Hippus reaction**. In early stages the Hippus sign is seen but in later stages, pupils get dilated. Because of stimulation of vagus nerve collapse may occur. Pulse becomes slow, low volume and irregular. Blood pressure falls in early stages, respiration is rapid but becomes slow, dyspnea occur with

shallow breathing. The skin becomes cold and clammy with hypothermia. Mind remains clear although there are hallucinations. Death ensues from ventricular fibrillation or respiratory paralysis.⁸ Management of aconite toxicity is supportive, including immediate attention to the vital functions and close monitoring of blood pressure and cardiac rhythm. Inotropic therapy is required if hypotension persists and atropine should be used to treat bradycardia.⁹ Some *Ayurvedic* text states, *Tankan* to be an antidote of *Vatsanabh*, but its mode of action is obscure.¹⁰ *Tankan* is chemically known as Borax ($\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$). It is used in *Ayurvedic* treatment of lack of menstruation, cough, bronchitis etc. It is also used as ingredient in many *Ayurvedic* medicines specially those *kalpas* which contains *Vatsanabh* as its chief ingredient. The concept of having *Vatsanabh* along with *Tankan* in *Kalpas* predicts that the idea of using *Tankan* is might be to minimize toxic effects of *Vatsanabh*. This concept highlights the antidote property of *Tankan* in *Vatsanabh* toxicity.

Antidotes are the substances which counteract or neutralize the effect of poison.

Common modes of action of antidote-

1. Inert complex formation e.g. chelating agents for heavy metals
2. Accelerated detoxification e.g. thiosulphate for cyanide
3. Reduced toxic conversion e.g. ethanol for methanol
4. Receptor site blockade e.g. atropine for organophosphates at muscarinic receptor site
5. Toxic effect bypass e.g. 100% Oxygen in cyanide poisoning.¹¹

Tankan is prepared from Sodium borate ($\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$) – It is heated to remove moisture, and then further heated to get white dry powder. It is pungent in taste, hot in nature. It is good for heart, useful in *Vata* imbalance diseases. It is used in the treatment of cough, bronchitis. It is also used in treating food poisoning. It improves digestion power, relieves bloating. It induces menstruation in women suffering with amenorrhea or oligomenorrhea (Scanty menstrual flow).¹² While going through the literatures, its antidote property in *Vatsanabh* toxicity is not discussed in any *Ayurvedic samhita*. Considering this, the study has been planned to evaluate the antidote property of *Tankan* using thin layer chromatography. .

MATERIAL AND METHODS

Collection and identification of material

In this study we use *Vatsanabh* and *tankan*. Both of the drugs were procure from the local market of Nagpur, Maharashtra, India and authenticated by Professors from Department of *Dravyaguna* and Department of *Rasashastra & Bhaishajyakalpana*, Shree Ayurved Mahavidyalaya, Nagpur, Maharashtra. This analytical study was performed using *ashudha* and purified *Tankan* with *Vatsanabha* . For the purpose *Tankan* was purified first.

Purification of *Vatsanabha*: *Vatsanabha* was soaked in *Gomutra* (cow urine) for 3 days. Daily *Gomutra* was replaced by fresh *gomutra*. After 3 days *Vatsanabha* was taken out and its upper layer of skin was removed with knife. Then *Vatsanabha* was cut into small pieces and dried in sunlight.¹³

Purification of *Tankana*: Raw *tankan* was first powdered, then it was taken in hot iron pot & stirred till it intumescd.¹⁴ This *Tan-*

kan was then powdered very fine and used for analysis.

Analytical Study-

After purification process, analytical study was performed, using thin layer Chromatography. For thin layer chromatography 4 samples were taken i.e. *Ashuddha Vatsanabh* (AV), *Shuddha Vatsanabha* (SV), *Ashuddha Tankan* with *Ashuddha Vatsanabha* (ATAV) , *Shuddha Tankan* with *Ashuddha Vatsanabha* (STAV).

Thin Layer Chromatography (TLC) ¹⁵

1) For TLC first prepared simulated gastric juice.¹⁶ Simulated Gastric Juice was prepared according to the following procedure of the USP, the national formulary: 3ml. of conc.HCl, 2gm. of NaCl, Dilute to 1litre.

2) By using this juice, we extracted alkaloids from samples i.e. *Ashuddha Vatsanabha* [AV], *Shuddha Vatsanabha* [SV], *Ashuddha Tankan* with *Ashuddha Vatsanabha* (ATAV), *Shuddha Tankan* with *Ashuddha Vatsanabha* (STAV). The contents of samples were taken in separate conical flasks. To each flask 7ml of simulated Gastric Juice was added, was shaken for 20 minutes, allowed to settle for 2 minutes. The superna-

tant was decanted, centrifuged for five minutes at medium speed. Then supernatant was collected. The residue was added back to the same conical flask and was extracted with another 7ml gastric Juice as above and was extracted successively for 5 times in case of all samples.

2) 2ml of chloroform was added to extract and shaken for 5min. lower layer was taken out. The aqueous layer further extracted with 2 into 1ml chloroform as above.

3) Pulled chloroform layer was concentrated to exactly 1ml, and 50uL was taken to spot it on TLC plate (MERK) and was run using Toluene, Methyl acetate, and Diethyl amine(4.17:2.5:1).¹⁷ The plates were visualized under 254 and 366 nm UV rays and by spraying Dragandorff's reagent and further Sodium Nitrite on the plates already sprayed with Dragandorff's reagent. Results obtained are mentioned in Table no. 1, 2, 3, 4. & figures 1 - 4.

Results: Results obtained after analysis are mentioned are as follows

Table 1:- RF values under UV 366nm [Fluorescent]

Extraction Sample	1 st	2 nd	3 rd	4 th
AV	Absent	Absent	Absent	Absent
SV	0.14, 0.01	0.14, 0.01	0.14, 0.01	0.14, 0.01
STAV	0.59,0.14	0.59, 0.14	0.14	Absent
ATAV	0.59	0.59	0.72(VF), 0.62(VF), 0.59(VF)	0.72(VF), 0.62(VF), 0.59(VF),0.34(VF),0.2,0.11,0.8(orange)

*VF – Very Faint

1) In *Ashuddha Vatsanabh* there was no spot observed.

2) Two spots were found in *Shuddha Vatsanabha* with RF values 0.14 and 0.01. First spot at 0.14 was originally cream colored

and another at 0.01 was intense blue coloured. Same spots were found in 1st, 2nd, 3rd and 4th extraction.

3) In STAV sample 2spots were found at different RF values 0.59 and 0.14. These both spots were found in 1st and 2nd extrac-

tion. In 3rd extraction only one spot (0.14) was found. In 4th extraction all spots were absent.

4) In ATAV sample only one spot was found at 0.59 in 1st & 2nd extraction. In 3rd & 4th extraction 3 spots were found i.e. 0.72,

0.62, and 0.59 which were very faint. In 4th extraction 4 more spots were found i.e. 0.34, 0.2, 0.11 which were very faint and at 0.8 which was orange colored.

Table 2: RF values under UV 254nm [Bluish on green background]

Extraction Sample	1 st		2 nd		3 rd		4 th	
	0.72	0.59	0.72	0.59	0.72	0.59	0.72	0.59
AV	×	VB	×	VB	×	×	×	×
SV	SB	VF	SB	×	SB	×	SB	×
STAV	SB	×	SB	×	SB	×	F	×
ATAV	SB	SB	SB	SB	SB	SB	F	VF

*SB- Slight bold, VB – very bold, F – faint, VF – very faint

1) In *Ashuddha Vatsanabha* in 1st & 2nd extraction one very bold spot was found at 0.59 which was absent in 3rd and 4th extraction.

2) In *Shuddha Vatsanabha* one slightly bold spot at 0.72 was found in 1st, 2nd, 3rd & 4th extraction. Second very faint spot at 0.59 was found in 1st extraction which was further absent in 2nd, 3rd & 4th extraction.

3) In STAV sample one slightly bold spot at 0.72 was found in 1st, 2nd & 3rd extraction and it was faint in 4th extraction.

4) In ATAV sample, one slightly bold spot at 0.72 was found in 1st, 2nd & 3rd extraction and it was faint in 4th extraction. Another slightly bold spot at 0.59 was found in 1st, 2nd & 3rd extraction which was very faint in 4th extraction.

Table 3: RF value after Spraying Dragendorff's Reagent

Extraction Sample	1 st			2 nd			3 rd			4 th		
	0.72	0.62	0.59	0.72	0.62	0.59	0.72	0.62	0.59	0.72	0.62	0.59
AV	F	B	VB	×	×	F	×	×	×	×	×	×
SV	×	×	×	×	×	×	VF	×	×	×	×	×
STAV	VVF	×	×	F	×	×	F	×	×	×	×	×
ATAV	VVF	SB	×	VVF	SB	×	VVF	SB	×	×	×	×

*F – faint, B – bold, VB – very bold, VVF – very very bold, SB – slight bold

1) In *Ashuddha Vatsanabha* 3 spots were found in 1st extraction. 1st faint spot was found at 0.72 which absent in 2nd, 3rd and 4th extraction. Second bold spot was found at 0.62 which also absent in further extraction. Third very bold spot was found at 0.59

which become faint in 2nd extraction and then absent in 3rd & 4th extraction.

2) In *Shuddha Vatsanabha* only one very faint spot at 0.72 was found in 3rd extraction. There was no spot in 1st, 2nd & 4th extraction.

3) In STAV sample only one spot was found at 0.72 which was very very faint in 1st extraction and becomes faint in 2nd & 3rd extraction and absent in 4th extraction.

4) In ATAV sample 2 spots were found. First very very faint spot was found at 0.72 in 1st, 2nd, 3rd extraction and absent in 4th extraction. Second slightly bold spot at 0.62

was found in 1st, 2nd & 3rd extraction and absent in 4th extraction.

Table 4 RF value after Spraying Dragendorff's Reagent & Sodium Nitrite

Extraction Sample	1 st				2 nd				3 rd				4 th			
	0.7	0.6	0.5	0.4	0.7	0.6	0.5	0.4	0.7	0.6	0.5	0.4	0.7	0.6	0.5	0.4
	2	2	9	6	2	2	9	6	2	2	9	6	2	2	9	6
AV	F	B	V B	VF	×	VF	B	×	×	×	×	VF	×	×	×	×
SV	SB	×	×	×	SB	×	×	×	B	×	×	×	F	×	×	×
STAV	SB	×	×	VF	SB	×	×	VF	SB	×	×	VF	SB	×	×	VF
ATAV	B	×	B	F	B	×	B	F	B	×	B	F	B	×	F	×

* F – faint, B – bold, VB – very bold, VF – very faint, SB – slight bold

1) In *Ashuddha Vatsanabha* 4 spots were found in 1st extraction. First faint spot at 0.72 was found in 1st extraction and absent in 2nd, 3rd & 4th extraction. Second bold spot at 0.62 was found in 1st extraction and it was very faint in 2nd extraction and absent in 3rd & 4th extraction. Third very bold spot was found at 0.59 which was bold in 2nd extraction, very faint in 3rd extraction and absent in 4th extraction. Fourth very faint spot at 0.46 was found in 1st extraction and absent in 2nd, 3rd and 4th extraction.

2) In *Shuddha Vatsanabha* only one spot was found at 0.72 which was slightly bold in 1st & 2nd extraction, bold in 3rd extraction and faint in 4th extraction.

3) In STAV sample, 2 spots were found. First slightly bold spot was found at 0.72 in 1st, 2nd, 3rd & 4th extraction. Second very faint spot was found at 0.46 in all 4 extractions.

4) In ATAV sample 3 spots were found. 1st bold spot at 0.72 was found in all 4 extractions. Second bold spot was found at 0.59 in

1st, 2nd and 3rd extraction & it becomes faint in 4th extraction. Third faint spot at 0.46 was found in 1st, 2nd, 3rd extraction and absent in 4th extraction.

DISCUSSION

Vatsanabha is known to be the strongest cardiac poison. Management of aconite overdosing is supportive, including immediate attention to the vital functions and close monitoring of blood pressure and cardiac rhythm. However it is a very well known ingredient of many *Ayurvedic* formulations and is prescribed as an antipyretic, analgesic, appetizer and a digestive. These formulations usually contain *Shuddha Vatsanabha* along with *Shuddha Tankan*. Some *Ayurvedic* text states, *Tankan* to be an antidote of *Vatsanabha*, *Tankan* is good for heart and *Vatsanabha* is a cardiac poison. Also our study confirms that *Shuddha Tankan* not only delays but also reduces the toxic effects of *Vatsanabha*. Thus by using *Tankan* the medicinal properties of *Vatsanabha* can be utilised without causing appreciable harm to the body.

CONCLUSION

The conducted study shows that *Tankan* delays and also reduces the toxic effects of *Vatsanabha*. But role of *Ashuddha* and *Shuddha Tankan* is not clear in this study because it is a qualitative analysis. It needs further quantitative analysis like HPTLC to prove the efficiency of *Tankan*.

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