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Research Article

AYURVEDIC MANAGEMENT OF FOOT DROP DUE TO ORGANOPHOSPHATE POISONING: A CASE STUDY

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ABSTRACT

Background: Acetyl cholinesterase inhibition by organo-phosphorus pesticides or organophosphate nerve agents can cause acute parasympathetic system dysfunction, muscle weakness, seizures, coma, and respiratory failure. Prognosis depends on the dose and relative toxicity of the specific compound and pharmacokinetic factors. Inability to raise the front part of the foot due to weakness or paralysis of the tibialis anterior muscle. The muscle that lifts the foot, and foot drop occur due to peroneal nerve injury. In Ayurvedic science, the complications and side effects of organophosphate poisoning may be co-related with *Kaphavruta Vyana Vata*. Methods: It is a single case study. A 27-year male patient came to our OPD with complaints of weakness in bilateral lower limbs for since 4 years. He also complained of impairment in memory and speech deformity. The condition can be correlated with *Kaphavruta Vyana Vata* and he was treated with Panchakarma treatment including *Dhanyamla Dhara*, *Mustadi-rajya Yapana-Basti*, *Sarvanga Abhyanga*, *Shashtika Shali Pinda Sweda* along with *Shamana Chikitsa* for one month. Result: Symptomatic assessment of the patient was carried out after one month and during this course, the patient had improvement in symptoms, and the overall quality of life of the patient was significantly improved. Discussion: The patient has been treated with the above-mentioned therapy for symptomatic relief for the management of *Kaphavrutha Vyana Vata*.

Keywords: *Dhanyamla Dhara*, Foot drop, *Kaphavrutha Vyaana Vata*, *Mustadi Raja Yapana Basti*, Organophosphate poisoning.

INTRODUCTION

Organo-phosphorus compounds are poisonous substance which are absorbed through the skin, gastrointestinal tract and the mucous membranes. This are also absorbed by inhalation. At myo-neural junction the small amount of acetylcholine is produced and spontaneously hydrolyzed to choline and acetic acid. Cholinesterase enzyme is highly responsible for hydrolysis, and thus are present in plasma and on the membranes, or within the cytoplasm of many cells.

Organophosphorus compounds are powerful inhibitors of carboxylic-esterase enzymes it also includes acetylcholinesterase (cholinesterase found in nervous tissue, red cells and skeletal muscle) and pseudo-cholinesterase (found in plasma, heart, liver, brain and pancreas). Organophosphorus compounds bind to the esterase enzyme at the myoneural junctions and synapses of the ganglions, and it is inactivated by phosphorylation. A proportion of the enzyme inhibited by a single dose is restored to activity within a few hours, but some are permanent and can only be replaced by the synthesis of new proteins. These enzymes specifically acetylcholine esterase (AChE) plays vital role in maintaining impulse transfer between nerve and skeletal muscle cells. Organic phosphates are inhibited by acetylcholine esterase in all parts of body, by which acetylcholine get accumulated at the sympathetic, parasympathetic, and somatic sites and transfer to nerve impulses across synapses at the autonomic ganglia at the nerve-muscle junction is prevented.

They have three definite toxic actions:

1. A muscarine-like effect that affects the post-ganglionic parasympathetic activity and as pin-point pupils, broncho-spasm, increased salivation, excessive sweating, urinary bladder (get contracted), and cardiac symptom (tachycardia and hypotension).
2. Nicotine-like stimulated occurs. It is followed by paralysis of pre-ganglionic and somatic motor nerves, it causes twitching of the eyelids, tongue, and facial muscles followed by neuromuscular block and paralysis.
3. Central nervous system stimulation occurs. It is followed by depression, it causes headache, restlessness, giddiness, confusion, tremors, slurred speech, ataxia, insomnia, coma and death.¹

Foot drops due to organophosphate poisoning can be co-relate with *Kaphavruta Vyana Vata* and their symptoms are:

According to **Acharya Vagbhata-**

- *Parvashthivak graha* (catching pain in the joint, bones and speaking),
- *Guruta Angeshu* (heaviness of all the parts of the body),
- *Skhalitam Cha gatauo* (great impairment in walking)²

According to **Acharya Charaka**

- *Guruta sarva gaatraanaam* (heaviness in all over the body)
- *Gatisangha* (loss of mobility)³

CASE REPORT

A male aged 27 years came to the outpatient department of Kayachikitsa, Sri Jayendra Saraswathi Ayurveda College, Nazarethpet, Chennai -600123. He presented with the complaints of weakness in bilateral lower limbs, and land lower back pain in the last 4 years.

He was admitted to Neuro ICU with an episode of seizure and altered sensorium. He was allegedly admitted with H/O organophosphate poisoning on 23/11/2019. At the time of admission, he was conscious, oriented, and in a restless state. As part of the treatment, gastric lavage and anti-cholinergic medications were given. He was kept on a liquid diet for 15 days and later on started taking solid food. In the course of treatment at the hospital, he developed weakness in bilateral lower limbs and could not walk on his own without support. He further

consulted an Orthopedic surgeon where he was suggested to take an MRI scan. As the scan revealed no significant abnormalities, he was advised to go for physiotherapy after which he got some improvement in walking. On 23/12/2019 he took a psychiatric consultation following bouts of anger episodes. A primary mental examination revealed that he was able to make eye contact but did not maintain the same. The report was not easily established as he presented with a state of psychomotor agitation and his speech (verbalization, fluency, rhythm) were decreased. The mood of the patient was perplexed. He was advised to take medications for three days and came for review. He also had impairment in memory (both recent & long-term). For the past 2 years, he was able to walk on his own without support (post physiotherapy) sessions. At present, he can walk without support but with difficulty and a tendency to fall about weakness in the bilateral lower limbs. He got admitted to our hospital for better management of the same.

Clinical Findings

Table 1: Ashtavidha pariksha

<i>Ashtavidha pariksha</i>	<i>Interpretations</i>
<i>Nadi</i>	<i>Vata pitta</i>
<i>Mootra</i>	<i>Samyak</i>
<i>Mala</i>	<i>Nirama</i>
<i>Jihwa</i>	<i>Lipta</i>
<i>Shabda</i>	<i>Impaired fluency</i>
<i>Sparsha</i>	<i>Anushna sheeta</i>
<i>Drik</i>	<i>Prakruta</i>
<i>Akruthi</i>	<i>Madhyama</i>

Table 2: Dasha Vidha pareeksha

<i>Dashavidha pariksha</i>	<i>Interpretations</i>
<i>Prakruti</i>	<i>Vata pitta</i>
<i>Vikruthi</i>	<i>Vata Kapha</i>
<i>Sara</i>	<i>Medas</i>
<i>Samhanana</i>	<i>Madhyama</i>
<i>Pramana</i>	<i>Madhyama</i>
<i>Sathmya</i>	<i>Sarvarasa</i>
<i>Satwa</i>	<i>Madhyama</i>
<i>Ahara Sakthi</i>	<i>Pravara</i>
<i>Vyayama Sakthi</i>	<i>Madhyama</i>
<i>Vaya</i>	<i>Madhyama</i>

Table 3: General Examination

BP	110/80 mmHg
PR	89 bpm
RR	20 bpm
Temperature	35.9 c
Weight	73 kg
BMI	25.5 kg/m ²

Table 4: Details of Locomotor Examination

Inspection	Discomfort in walking and sitting for a long duration Restriction of spinal and hip movements. Pain and difficulty while walking
Palpation	Tenderness in L4 to L5 region (+3 grade) Poor muscle tone Pain and stiffness in lower lumbar region (+5 VAS score)
SLR test	Negative at the right leg Negative at the left leg
Radiological investigation	No significant abnormality is seen in the dorsal vertebra, dorsal cord, dorsal disc

Table 5: Neurological Examination

Higher mental functions	All other parameters are normal except speech. The patient has difficulty with fluency, memory was also affected		
Sensory system	Sensory system intact.		
Motor system			
Muscle Bulk	Normal		
Co-ordination	Coordinated		
Gait	High stepping		
Reflex	All reflex is normal except plantar response (exaggerated)		
Involuntary movements	Absent		
Strength/Power	All power of muscles normal Except Ankle		
	Ankle	Rt	Lt
	Dorsi-flexion	1/5	1/5
	Plantar flexion	1/5	1/5

Cerebellar symptoms - NAD
 Extra-pyramidal symptoms - NAD
 MMSE Score 24/30 so the patient is having mild cognitive impairment
 The examination is done with retention and recall of objects.

Diagnosis: *Vata Roga (Kaphavrutha Vyaana Vata)*

Therapeutic Intervention: The patient was advised of the following treatment:

External treatments

1. *Dhanyamla Sarvanga Dhara* for 30 mins for 5 days.
2. *Sarvanga Abhyanga* with *Sahacharadi taila* for 30 mins for 5 days.
3. *Nadi Sweda* for 30 mins for 5 days.
4. *Yoga Basti*
 - a) *Anuvasana Basti* with *Sahacharadi Mezhupakam* 200 ml
 - b) *Niruha basti* as *Mustadi Rajyapana basti* (*Makshikam* 100 ml, *Saindhava* 15g, *Dhanwantharam Mezhupakam* 100ml, *Sukumaram ghritam* 100ml, *Satapuspakalkam* 30g, *Aja mamsa rasa* 100 ml)
5. *Shastikashali Pinda Sweda* for 30mins for 3 days.

Table 6: External treatment

Day 1-5	<i>Dhanyamla Sarvanga Dhara</i>
Day 6-10	<i>Sarvanga Abhyanga</i>
Day 6-10	<i>Nadi Sweda</i>
Day 6,7,9,11,13	<i>Anuvasana Basti</i>
Day 8,10,12	<i>Niruha Basti</i>
Day 13-15	<i>Shastikashali Pinda Sweda</i>

Table 7: Internal medications given

Medicine	Dosage	Anupana	Duration
<i>Sahacharadi Kashayam</i>	15ml-0-15ml	45ml of warm water	Before food
<i>Sahacharadi 21 Avarithi</i>	10 drops (BD)	With <i>Sahacharadi Kashayam</i>	Before food
<i>Balaristham</i>	30ml-0-30ml		After food

Condition of the patient at the time of discharge

The patient's condition was improved and was discharged with stable vitals

- BP 120/80 mm Hg
- PR -72/ min.
- RR - 18/min SPO2- 98
- Temperature – 96.8

OBSERVATION AND RESULT

By the completion of treatment, the patient had a significant reduction in the weakness of bilateral lower limbs, pain and stiffness of the lower back region, and heaviness. The gait was also improved. During this course, it was observed that the patient could stand and walk properly. The vitals were recorded normally. The patient got complete symptomatic relief. The symptoms before and after the treatment are mentioned in Tables 8, 9 and 10.

Table 8: Symptoms Before and After Lower Extremities

Assessment parameters	Before treatment	After treatment
weakness in bilateral lower limbs (ankle)	1/5	4/5
Pain in the lower lumbar region	3 +	0
Stiffness in lower back region	3 +	0
Heaviness in both legs	4 +	0
Pain and difficulty while walking and standing	5 + (VAS score)	1 + (VAS score)

Table 9: Symptoms related to Speech

Speech	Before treatment	After treatment
Fluency	Impaired	Improved
Repetition	Normal	Normal
Comprehension	Normal	Normal

Table 10: Symptoms related to Memory

Memory	Before treatment	After treatment
Immediate	Intact	Intact
Recent	Impaired	Intact
Remote	Impaired	Intact

DISCUSSION

In this case study, *Shodhana Chikitsa* with *Basti Karma* (*yoga Basti*), *Sarvanga Dhanyamla Dhara*, *Sarvanga Abhyanga*, and *Shastikashali pinda Sweda* with *Shamana Chikitsa* protocol has been advised. *Dhanyamla Dhara* is a type of *Sarvanga Dhara* to be precise- a type of *Parisheka Dhara*. The predominant *Rasa* of *Dhanyamla* is *Amla*. According to the classics, *Amla Rasa*

stimulates the *Agni* (digestion power). It is hot in potency (*Ushna virya*). It mitigates vitiated *Vata Dosha* and *Kapha Dosha*. This property enhances the activity of *Agni* leading to *Ama Pachana* and enhancing their appetite. It can be managed with the property of *Vata Anulomana*, *Shula Prashamana*, *Nadi Uttejaka*, *Vedana Sthapaka*, and *Mashtishka Balakaraka*. *Dhanyamla* is also beneficial for emaciated or weakened patients due to its *Jeevana*, *Bala Prada*, and *Veerya Prada*.⁴

Abhayangam is highly effective in reducing mental tension and increasing the body's muscle strength and functional efficiency. It reduces nervous weakness and pacifies the *Vata dosha*. *Sahacharadi Taila* has *Snigdha Guna*, *Ushna Virya*, and *Vata Kaphahara* but overall, it is *Tridoshaghna* and very effective in *Adho Kaya Vatarogas*. It is having specific property of *Gati viseshatvam* due to its *Madhura* and *Tikta Rasa*. It also possesses *Vatahara*, *Brimhana*, anti-inflammatory, and analgesic action.^{5,6}

Nadi Sweda is a form of sudation therapy that comes under the *Bhaspa Sweda*. The vapors coming through the tube are made to reach the afflicted parts of the body after *Abhayangam*. *Nadi Sweda* is preferred when there is pain, swelling, or stiffness of the body.

Rajayapana Basti is the *Sadhyo Balajananam* and *Rasayan* properties, it increases the power of the body and promotes strength of the body quickly.⁷ *Rajayapana Basti* is having *Vatashamaka* and *Rasayana* effects. *Bala* (strength of body) depends upon the *Udana Vata* and its functions are the manifestation of speech, effort, enthusiasm, strength, and complexion.⁸ It normalizes and enhances the action of *Udana vata* and enriches the *Rasa Dhatu*. *Deepana*, *Pachana* properties of *Rajayapana Basti* help to correct the Agni, as it is very essential for the formation of the *Dhatu* and the process of metabolic transformation.⁹

Shastikashali Pinda Sweda comes under *Snigdha Sankar Sweda*.¹⁰ It decreases stiffness due to massage and heat applied over the local area. Nutrients of *Shastika Shali* get absorbed and give strength to muscles, increased blood flow and increasing movement, *Sweda* makes the body supple, removes stiffness of the joints due to diseases of vitiated *Vata* type, cleanses the *Srotas* of the body, and improves blood circulation. It maintains the metabolism. Indications of *Shastika Shali Pinda Sweda* are diseases of the nervous system, neuropathy, muscular dystrophy, muscle wasting, and restless leg syndrome.¹¹

CONCLUSION

The patient foot dropped due to organo-phosphorus was treated very well, and on the basis of observation of symptoms related to lower extremity, speech, and memory before and after treatment, result was noted. There were significant changes in parameters before and after treatment which can be interpreted as *Shamana*, and Panchkarma therapy is very effective in the management *Kapha Aavruta Vyana Vata* (foot drop due to organo-phosphorus poisoning). However, it can be recommended as a protocol brief research study be carried out with more patients to evaluate and analyze results.

Patient Consent: Informed consent from the patient was taken before commencing the treatment and for publishing the case study without disclosing the patient's identity.

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