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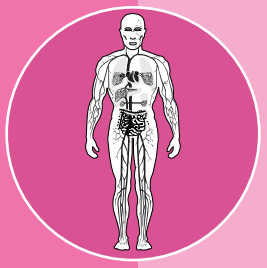

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Aryavaidyan is intended to encourage scientific writing and intellectual interactions among scholars, academicians, practitioners and students of ayurveda and allied subjects like Siddha, Unani, modern medicine, etc.

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तद्विद्याचार्यसेवा च बुद्धिमेधाकरो गणः ।।

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Phone : 0483 -2742225, 2746665
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HEPATOPROTECTIVE ACTIVITY OF SOMANĀTHITĀMRABHASMA IN PARACETAMOL INDUCED LIVER TOXICITY IN ALBINO- RATS

Sudheendra Honwad, T. Shridhara Bairy, Ravi M. and B. Ravishankar*

Abstract: The hepatoprotective activity of Somanāthitāmrabhasma was tested against paracetamol induced hepatotoxicity in albino rats. Administration of Somanāthi tāmrabhasma (67.5 mg/1kg. bd. wt.) markedly prevented paracetamol induced elevation of levels of SGOT, SGPT and alkaline phosphate. A comparative histopathological study of liver exhibited almost normal architecture as compared to the control group. Treatment with the trial drug found to be significantly reduced the paracetamol induced hepatotoxicity. A comparative histological study of liver from different groups further confirmed the hepatoprotective activity of Somanāthi tāmrabhasma.

Introduction

The liver being the largest glandular organ in the body is responsible for detoxifying the poisonous substances by transforming and removing toxins and wastes.[1] Therefore, maintenance of healthy liver is essential for overall well being.

There are numerous plants and traditional formulations available for the treatment of liver diseases, however only few of them are pharmacologically evaluated for their efficacy. Somanāthitāmrabhasma is a special method of tāmrabhasma preparation used by śudhatāmra, pārada, gandhaka, haritāḷa and manaśśila and is indicated in yakṛt and pḷīha vikāras (liver and spleen disorders).[2] To assess the rationality behind the statement, a study of hepato-protective activity of Somanāthitāmrabhasma was under taken.

Materials and methods

Trial drug:- All the materials required for the preparation of Somanāthitāmrabhasma were procured from SDM Ayurveda pharmacy Udupi after proper authentication. The drug was prepared as referred to in the Rasaratnasamuccaya at the Rasaśāstra and Bhaiṣajyakalpana practical hall of SDM College of Ayurveda Udupi, and subjected to bhasmasiddhiparīkṣas to confirm the quality.

Animals:- Inbred wistar strain albino rats of either sex, body weight ranging from 170-200 g. were obtained from the central animal house of SDM Centre for research in Ayurveda & Allied sciences, Udupi. The rats were maintained at standard housing conditions and fed with standard animal pellet and provided with tap water *ad libidum* during the experiment. [Permission from the institutional animal ethical

**Deptt. of Dravyaguna, S.D.M. College of Ayurveda, Udupi.*

committee (IAEC-SDMCAU/ACA-49/EC 13/10-11) was obtained prior to the study.]

The human dose of Somanāthitāmrabhasma was converted to animal dose by using conversion formula as - human dose × 0.018/200 gram body weight.[3] 1 gram of Paracetamol/kg body weight of rats was used intramuscularly to induce hepatotoxicity[4] and silymarin was used as reference standard drug against test drug Somanāthitāmrabhasma.

Treatment groups:- The animals were divided into 4 groups (n=6/group) as follows

Group I (Test):- The animals in this group were administered with Somanāthitāmrabhasma 13.5 mg + 0.5% CMC solution for first five days then on 5th day after 1 hour of drug administration 1g. Paracetamol/kg bd. wt. was given intra-muscularly, and again on 6th and 7th day the test drug was given as usual.

Group II (positive control):- This group was administered with only 0.5% CMC solution for first five days then on 5th day after 1 hour of CMC administration same as above 1g. paracetamol/kg bd. wt. was given intra-muscularly, and again on 6th and 7th day 0.5% CMC solution was administered.

Group III (normal control):- Administered with 0.5% CMC solution for seven days.

Group IV (standard):- The animals of this group were administered with Silymarin 50 mg/kg bd. wt. + 0.5% CMC solution for first five days, then on 5th day after 1 hour of drug administration, 1g. paracetamol /kg bd. wt. was given intramuscularly, and again on 6th and 7th day Silymarin and 0.5% CMC solution was given as usual.

Assessment

Hepatoprotective activity:- All the animals were killed after 48 hours of paracetamol administration i.e. on 7th day. The blood samples were collected separately by carotid bleeding into sterilized centrifuge tubes and allowed to coagulate for 30 min at 37^0C. The clear serum was separated at 2500 rpm for 10 min and bio-chemical investigations were carried out to assess liver function[5] viz. total bilirubin, total protein and serum alkaline phosphate, etc., the data obtained was analyzed by using modified 't' test and analysis of variance (ANOVA) followed by Dunnett's 't' test for determining the level of significance of the observed effects. P value of less than 0.05 was considered statistically significant.

Histopathology:- After draining the blood, liver sample excised, washed with normal saline and processed separately for histopathological observations.[6] Initially the materials were fixed in 10% buffered neutral formalin for 48 hours and then with bovine solution for 6 hours; paraffin sections were taken at 5mm thickness, processed in alcohol-xylene series and were stained with alum hematoxylin and eosin. The sections were examined microscopically for histopathological changes.

Observations and results

Paracetamol (1g/kg) administered intra-muscularly showed hepatotoxicity after 48 hours as evident from biochemical, pharmacological and histopathological parameters of the study. Paracetamol treatment found to be significantly increased the SGOT, SGPT, Alkaline phosphate, Serum urea and Bilurubin direct. The toxic effect of paracetamol was controlled in the animals treated with test drug by way of restoration of the levels of the liver function biochemistry similar to that of the standard drug silymarin. The effect of the test drug on body weight, liver

weight and on bio-chemical parameters in paracetamol induced hepatotoxicity is shown in Tables 1-3.

TABLE 1
Effect of Somanāthitāmrabhasma on body weight changes in paracetamol induced hepatotoxicity

Group	Mean ± SEM	
	BT (grams)	AT (grams)
Control	186.6±7.032	190.16±8.052
Positive control	189.8±3.00	193±4.85
Standard	194.16±9.34	183.4±8.35**
Test	182.6±4.61	177±5.14*

*p<0.05, ** p<0.01 in comparison of final body weight to initial body weight

Histopathological profile of the Control animal showed normal hepatocytes (Fig I a & b; Positive control animal showed extensive disturbance in the liver cytoarchitecture as necrosis, leukocuyte infiltration, micro & macro fatty changes and sinusoidal dilation (Fig. I c & d). The section of liver taken from the animals treated with standard drug Silymarin showed mild to moderate disturbance in two rats and almost normal cytoarchiteture in the remaining rats indicating very good hepatoprotection (Fig. II a & b). The animals treated with the test drug Somanāthitāmrabhasma exhibited significant liver protection against the toxicant as evident

TABLE 2
Effect of Somanāthitāmrabhasma on changes in liver weight in paracetamol induced hepatotoxicity

Group	Mean ± SEM (weight in gm)	
	Absolute liver	Relative liver
1. Control - 0.5% CMC solution (No hepatotoxicity induced)	6.75 ± 0.49	3.567 ± 0.26
2. Positive control (0.5% CMC solution)	7.18 ± 0.21	3.72 ± 0.262
3. Standard (50 mg/kg of silymarin +0.5% CMC (Carboxy methyl cellulose)	7.20 ± 0.24	3.949 ± 0.16
4. Test (13.5 mg of Somanāthitāmrabhasma + 0.5% CMC (Carboxy methyl cellulose)	6.60 ± 0.42	3.72 ± 0.15

TABLE 3
Effect of Somanāthitāmrabhasma on con bio-chemical parameters in paracetamol induced hepatotoxicity

Group	SGOT (u/l)	SGPT (u/l)	ALP (u/l)	Protein (mg/dl)	Urea (mg/dl)	Creatinine (mg/dl)	Bil. total (mg/dl)	Bil. direct (mg/dl)	Glucose (mg/dl)
1. Control	155.66± 20.0	80.16 ± 18.79	425 ± 73.097	6.4 ± 0.20	42 ± 8.96	0.8 ± 0.03	0.15 ± 0.20	0.09 ± 0.03	140 ± 4.10
2. Positive control	694 ± 6.112*	468 ± 58.97*	1211 ± 197.63*	6.4 ± 0.10*	149.16 ± 68.04*	0.88 ± 0.02*	0.75 ± 0.022*	0.1 ± 0.00*	139 ± 6.27*
3. Standard	402 ± 95.692**	98.4 ± 3.076**	692.4 ± 133.68**	6.02 ± 0.17**	44.6 ± 9.07**	0.74 ± 0.09**	0.18 ± 0.012**	0.1 ± 0.00**	120.4 ± 7.84**
4. Test drug	183 ± 17.609**	119.6 ± 32.41**	456.6 ± 64.45**	7.06 ± 0.17**	40.8 ± 5.19**	0.75 ± 0.022**	0.75 ± 0.022**	0.1 ± 0.00**	128.2 ± 10.66**

* p < 0.01 compared with normal control, ** p < 0.01compared with positive control

by mild cell infiltration and presence of normal hepatic cords and lesser fatty changes (Fig. II c & d).

Discussion

The effect of paracetamol on ponderal parameters i.e., body weight and liver weight, showed significant decrease suggestive of paracetamol metabolism affected in reducing the body weight. Serum enzymes such as SGOT & SGPT got elevated due to paracetamol hepatotoxicity, which was noted in positive control group, indicative of liver inflammation and injury due to toxic effect of paracetamol. The elevation was significantly reversed by both the test and the standard group indicative of hepato-protective activity.

Alkaline phosphate was significantly increased in positive control group compared to normal

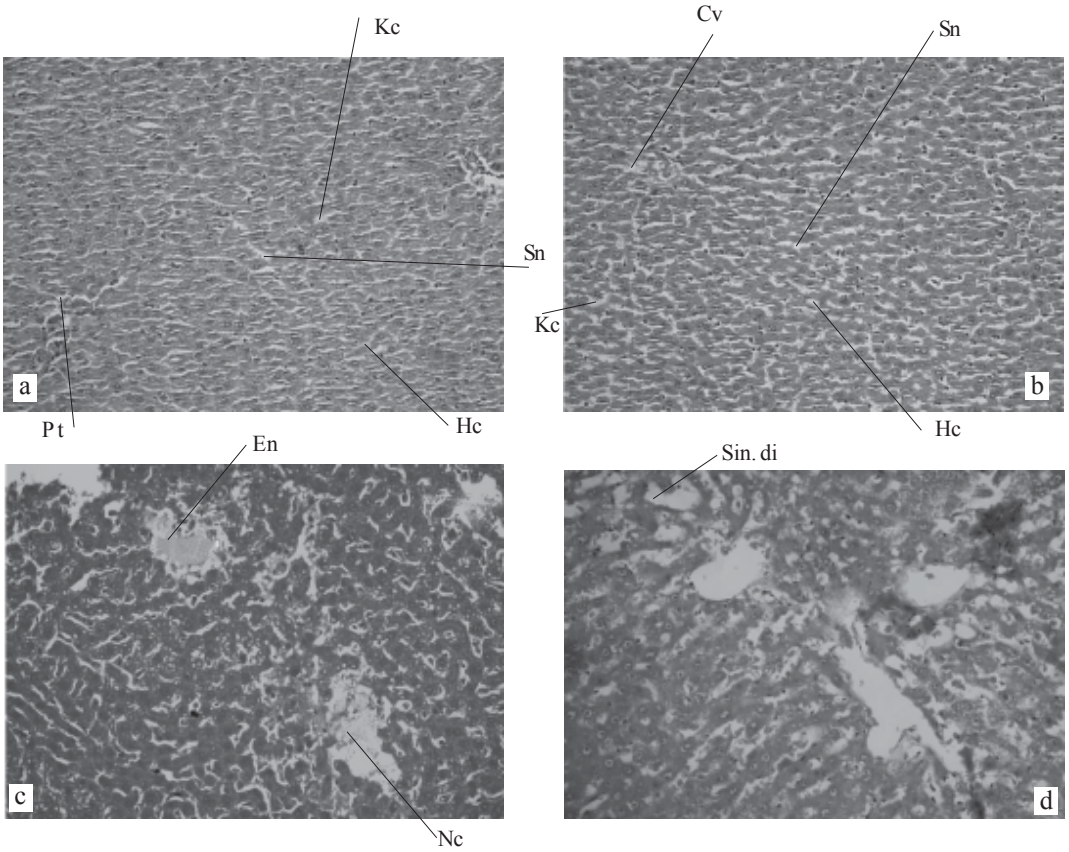

Fig. I a-d : Histopathological profile of the Control animal
a & b Sections of liver showing normal cytoarctitecture; c & d Sections of liver tissues of positive control rats treated with paracetamol showing necrosis hemorrhage and sinusoidal dilatation

Pt - Portal tract; Kc - Kuffer cell; Sn - Sinusoid; Cv - Central vein;
Hc Hepatic cell; En External necrosis

control group, suggestive of cholestasis in the biliary tract leading to liver injury and hence can be considered as one of the bio-marker for the assessment of paracetamol induced hepatotoxicity; this elevation was reversed significantly in the test and the standard group indicative of hepatoprotection.

Bilirubin, a break down product of hemoglobin, is the predominant pigment produced in the liver. Excess bilirubin causes yellowing of body tissuesj (jaundice). There are two tests for bilirubin - direct-reacting (conjugated) and indirect-reacting (unconjugated). Differentiating between the two is diagnostically important as elevated levels of indirect bilirubin are usually caused by liver cell dysfunction (e.g. hepatitis), while elevation of direct bilirubin typically result from obstruction either within the liver (intra-hepatic) or source outside the liver (e.g. gall stone or tumor). In the present study, serum

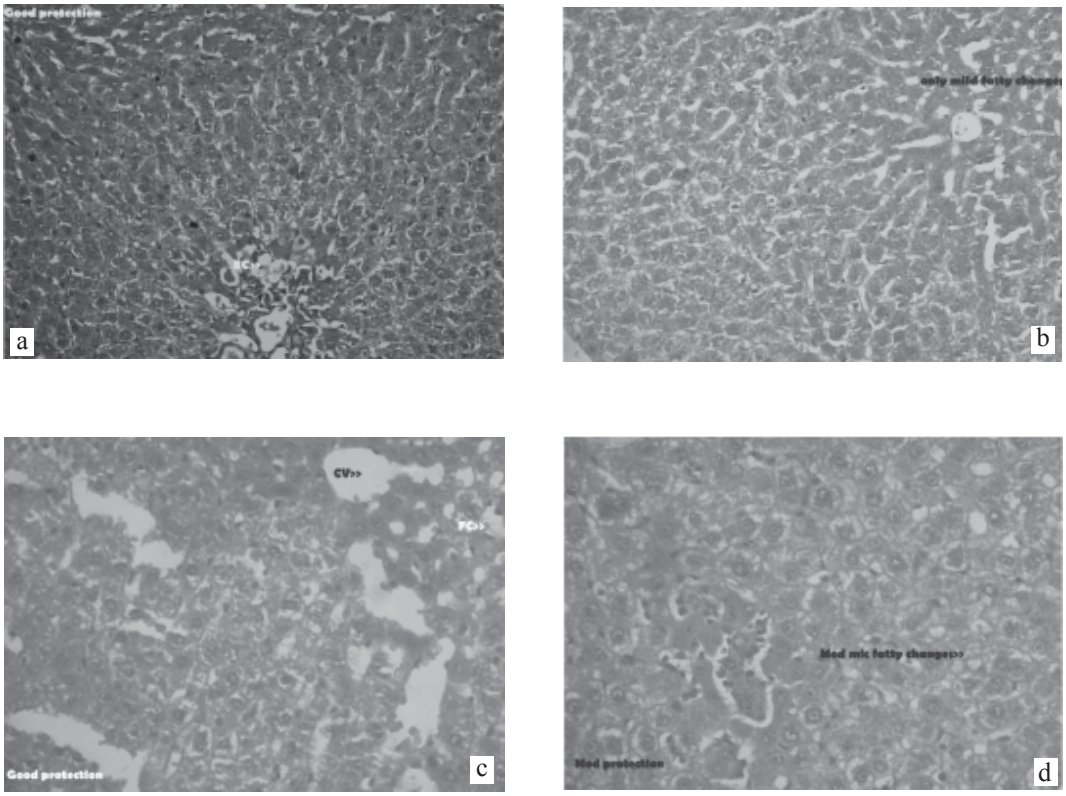

Fig. II a-d : Histopathological profile.
a & b - Sections of liver tissues of silymarin treated rats showing good protection and mild fatty changes;
c & d - Sections of liver tissues of test drug S.T.B. treated rats showing
good rotection and mild fatty changes

bilirubin was significantly increased in positive control suggestive of liver cell dysfunction; decrease in serum bilirubin level in the test and the standard groups was suggestive of hepato-protective activity of test and standard drugs.

Blood urea level is considered as a good indicator of a balance in nitrogen metabolism in the body. High blood levels of ammonia are found in acute hepatitis, cirrhosis and hepatic encephalopathy. The rise in serum ammonia is due to inability of severely damaged liver to convert it to urea. Thus urea synthesis is reduced in chronic liver diseases. In the present study, significant increase in urea level in positive control group was noted whereas in the test and standard groups, the urea level was significantly reduced. Reverse as index liver toxicity and its reversal changes observed in this parameter did not correlate well with the observation of histopathological findings and changes observed in other parameters.

Serum creatinine is formed in muscle through conversion of creatinine phosphate. The concentration in serum depends on the balance between production and excretion. The serum creatinine level is considered as a marker of kidney function. The toxicant paracetamol increased the creatinine level in serum. This elevation may be due to increase in muscle mass or impairment in kidney functions in liver disorders revels the impact of impaired lipid metabolism on kidney function leading to elevation in serum creatinine levels. In the present study, non significant reversal observed in the test and standard groups may be considered as represent reversal of the toxic effect of paracetamol through direct effect on kidney or indirect through correction of other factors. It is possible that both the mechanisms may also be involved.

Thus the analysis of serum bio-chemical parameters shows that administration of paracetamol leads to significant changes in majority of parameters. These altered bio-chemical parameters were found to be reversed in most of the instance though there were some exceptions like non alteration or wrong alteration of serum cholesterol, HDL cholesterol and blood urea. The overall activity profile indicated reversal of almost all impairments. This along with the histopathological examinations provides strong and unequivocal evidence for the presence of hepatoprotective activity in the test formulation which compares quite well with that of the reference standard silymarin.

Conclusions

The test formulation Somanāthitāmrabhasma is indicated for yakṛt and plīha (liver and spleen) disorders in classical Rasa texts. To provide pharmacological basis for the clinical efficacy it was evaluated experimentaly by paracetamol induced hepatotoxicity. The effect of Somanāthi-tāmrabhasma on the toxicant induced changes in ponderal, bio-chemical and histopathological parameters were assessed. Somanāthi-tāmrabhasma was found to have significant protection against paracetamol induced hepatotoxicity. It restored most of the parameters altered by the toxicants. The effect was further substantiated by histopathological exami-nations.

The analysis of serum bio-chemical parameters shown that administration of paracetamol leads to significant changes in majority of the parametars. The altered bio-chemical parametrs were found to be reversed in most of the

instances though there were some exceptions like serum cholestrol, HDL cholestrol and blood urea. The overall activity profile indicated reversal of almost all important parameters. This along with the histopathological examination provides strong and unequivocal evidence for the presence of hepatoprotective activity of Somanāthitāmrabhasma. The data generated can be cansidered as basis for the clinical efficacy of the Somanāthitāmrabhasma.

Acknowledgment

Thanks to the staffs of SDM Centre for Research in Ayurveda and Allied sciences Udupi for providing support and co-operation.

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AUṢADHASEVANAKĀLA OF ĀMALAKICŪRṆA AS RASĀYANA AND ITS FREE RADICALS SCAVENGING ACTIVITY IN MALE WISTAR RATS BY SUPEROXIDE DISMUTASE TEST (SOD) - AN EVALUATION

Satej T. Banne, Shraddha U. Naik and S.K. Hiremath*

Abstract: Auṣadhasevanakāla (time of administration of medicine) is one of the important factor in treatment aspect. A study was carried to evaluate the free radicals scavenging activity of āmalaki (*Emblica officinalis* Gaertn.) on the basis of auṣadhasevanakāla and also to evaluate the rasāyana effect of āmalaki on male wistar rats. The serum SOD levels found significantly decreased in group 1 as compared to the control group. The results showed evidence of increased oxidative stress and a compromised antioxidant defense system in animals.

Introduction

Auṣadhasevanakāla (time of administration of medicine) is one of the important factor in treatment aspect.[1] Rasāyanatantra branch deals with delay the process of aging, increase life span, medhā, bala and the natural immunity of the body.[2] Rasāyanas are used to promote health and longevity by increasing defense against diseases, arresting the aging process and revitalizing the body in debilitated conditions.[3] The clinical efficacy of āmalaki (*Phyllanthus emblica* L.) has described in āyurveda and it is referred to as the best vayasthāpana (causing rejuvenation) drug.

Free radical oxidative stress has been implicated in the pathogenesis of a wide variety of clinical disorders, resulting usually from deficient natural antioxidant defenses. Potential antioxidant therapy should, therefore, include natural free radical scavenging antioxidant enzymes capable of augmenting the activity; these enzymes include SOD (Superoxide Dismutase), CAT (Catalase) and LPO (Lipid Peroxide).[4] If diseases are considered to be the result of an imbalance between oxidative stress and antioxidant defense, then it is conceivable that it may be possible to limit oxidative tissue damage, hence prevent or ameliorate disease progression by supplementing antioxidant defense. By virtue of their properties and clinical use in āyurveda, the rasāyana drugs provide potential therapeutic intervention against oxidative threats both in healthy and disease condition.[5]

Materials and methods

Study design:- Of 4 groups of 6 male wistar rats, 3 groups were given Āmalakicūrṇa as per dose calculated by dose conversion table of Paget

**Dept. of Dravyaguna, K.L.E.U'S, Shri B.M.K. Ayurveda Mahavidyalaya, Shahapur, Belgaum, Karnataka.*

an Barnes (1964) and the Control group was given with regular food for a period of 30 days. Āmalakicūrṇa was given at kiñcit sūryodayajāte (during sunrise process) to the first group; at divābhojane i.e. (midday meal time) to the second group and at niśi (night meal time) to the third group. Strict time schedule was maintained throughout the procedure.

Retro-orbital blood samples (about 5 ml of each animal) of all 24 animals were taken in unbreakable non-vacuum blood collection tubes before starting the study and the collected blood samples transferred to centrifuge machine for centrifugation. After 5 minutes of centrifugation, the serum (approximately about 2 ml) was collected at top of the tubes and preserved in deep freezer at 80^0 C. From the next day, administration of Āmalakicūrṇa was started for 30 days. After completion of 30 days retro-orbital blood was collected in unbreakable non-vaccume tubes, transferred it to centrifuge machine and collected the serum. Readings were taken in microplate reader machine (Fig. I a-d).

Estimation of serum superoxide dismutase:-

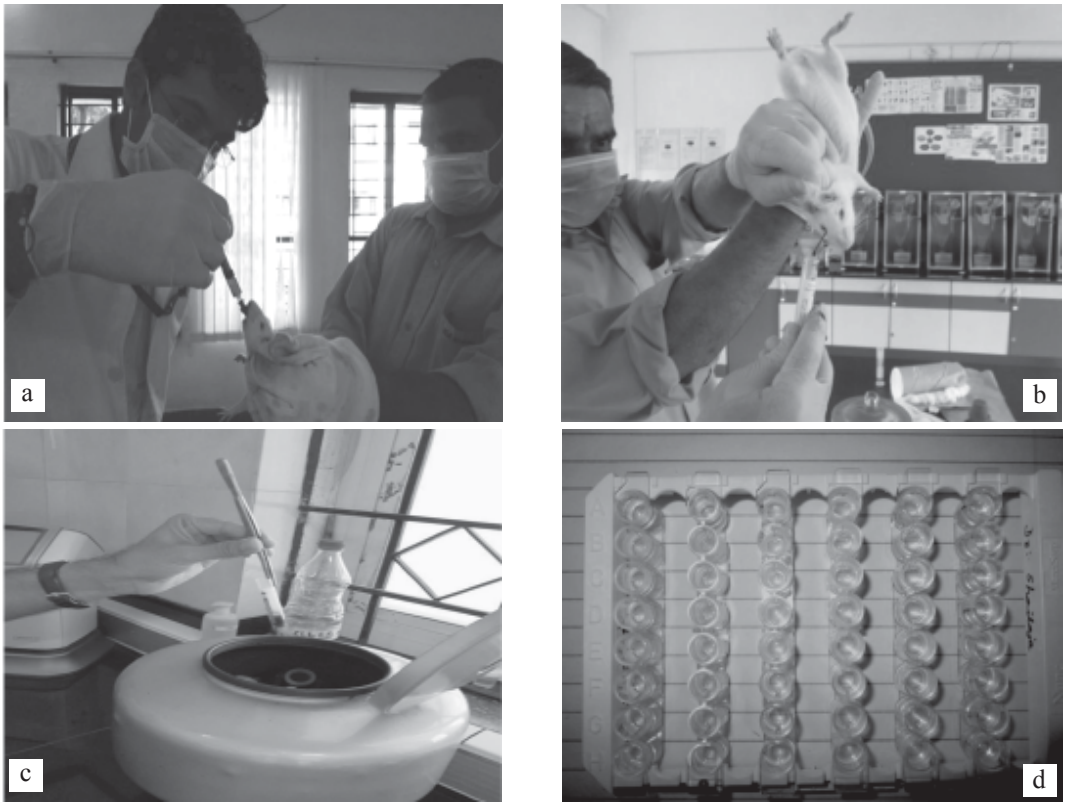

Fig. I a-d : a Administration of Amalaki curna; b Retro-orbital collection of blood samples; c Separation of serum from blood by centrifuge method; d Preparation of serum samples before and after study for reading

Superoxide dismutase was assayed in all the study groups by the method devised by Marklund S., Marklund G. modified by Nandi and Chatterjee. Retro-orbital blood samples were collected from all the subjects.

Principle:- Pyrogallol auto-oxidises rapidly in aqueous or alkaline medium solution and generally this is employed for the estimation of superoxide dismutase. SOD inhibits the auto oxidation of pyrogallol. This principle was employed in a rapid and convenient method for the determination of the enzyme concentration.[6]

Reagents: 1. Tris buffer - 50 ml of Tris buffer (containing 50 mM of Tris buffer and 1 mM of EDTA) was prepared. To this, 50 ml HCL was added to adjust the pH at 8.5 and volume was made up to 100 ml; 2. Pyrogallol - (20 mM concentration) 25 mg of pyrogallol was dissolved in 10 ml of distilled water.

Procedure:- For Control, 0.1 ml of pyrogallol solution was added to 2.9 ml of Tris buffer and mixed. The reading was taken at 420 nm i.e. exactly after 1 minute 30 seconds and 3 minutes 30 seconds. The absorbance per two minutes was recorded and the concentration of pyrogallol adjusted (by diluting the pyrogallol solution) so that the rate of change of absorbance per minute was approximately 0.020 - 0.023 nm.

For Sample, 0.1 ml of serum sample was added to 2.8 ml of Tris buffer and mixed; then started the reaction by adding 0.1 ml of adjusted pyrogallol solution (as per control). It was read at 420 nm exactly after 1 minute 30 seconds and 3 minutes 30 seconds and absorbance per 2 minutes was recorded.

Calculations:- Absorbance reading of control - 'A'; Absorbance reading of sample - 'B';

Units of SOD/3 ml of assay mixture =

$$\frac{A - B}{A \times 50} \times 100$$

Unit × 10 = Units /ml of sample solution.

Definition of unit:- One unit of superoxide dismutase is described as the amount of enzyme required to cause 50 % inhibition of pyrogallol auto oxidation per 3 ml assay mixture.

Normal range:- SOD in serum is 2.93-3.71 units/ml. Analysis of study was done by using Kruskal Wallis ANOVA, Mann-Whitney U test, Wilcoxon matched pairs test, Paired and unpaired 't' test and one way anova. (Table 1)

Results and discussion

The results are shown in Tables 2 - 6.

About 5% or more of the inhaled oxygen (O_2) is converted to reactive oxygen species (ROS) by univalent reduction of O_2.[8] Antioxidant can act by scavenging reactive oxygen species (SOD removing O_2) by inhibiting their formation (e.g. by blocking activation of phagocytes), by binding transition metal ions and preventing formation of OH and or decomposition of lipid hydroperoxides, by repairing peroxyl damage (e.g. α -tocopherol reparing peroxyl radicals and so terminating the chain reaction of lipid peroxidation.)[9]

Many living species have several antioxidant defense systems against oxidative stress induced by reactive oxygen species (ROS). These systems include anti oxidative enzymes such as catalase (CAT), superoxide dismutase (SOD), glutathione peroxidase (GPX), etc. SOD and CAT has been identified to play an important role in life span determination.[10]

The aim of bheṣajasevanakāla (time of administration of medicine) is to get the the

TABLE 1
Superoxide Dismutase (SOD)

Group	Before		After	
	Reading after 1.30 seconds	Reading after 3.30 seconds	Reading after 1.30 seconds	Reading after 3.30 seconds
1. Control group				
Reading	0.257	0.322		
- Head	0.240	0.260	0.114	0.141
- Neck	0.230	0.265	0.162	0.195
- Body	0.203	0.241	0.172	0.208
- Tail	0.209	0.255	0.124	0.149
- Right limb	0.175	0.204	0.175	0.198
- Left limb	0.143	0.169	0.209	0.233
2. Group 1				
- Head	0.251	0.289	0.327	0.382
- Neck	0.209	0.246	0.190	0.244
- Body	0.216	0.249	0.251	0.304
- Tail	0.229	0.257	0.209	0.263
- Right limb	0.247	0.278	0.213	0.268
- Left limb	0.266	0.293	0.236	0.291
3. Group 2				
- Head	0.216	0.249	0.253	0.294
- Neck	0.247	0.278	0.230	0.265
- Body	0.229	0.257	0.266	0.293
- Tail	0.242	0.268	0.240	0.259
- Right limb	0.271	0.295	0.175	0.204
- Left limb	0.266	0.293	0.209	0.255
3. Group 3				
- Head	0.209	0.233	0.124	0.149
- Neck	0.216	0.249	0.209	0.255
- Body	0.175	0.198	0.114	0.158
- Tail	0.175	0.204	0.190	0.242
- Right limb	0.247	0.278	0.251	0.289
- Left limb	0.266	0.293	0.209	0.255

desired action of a drug in pacifying the diseased condition. The main intension of it is to carry a specific amount of drug in required time. It is also useful to maximize the desired effect and minimise the side effects of the drug.

Many of today's diseases are due to 'oxidative stress' that results from an imbalance between formation and neutralization of free radicals. Free radicals are produced in the body as byproducts of normal metabolism as a result of exposure to radiation and some environmental pollutants. As they are highly reactive, they can damage cellular components and are implicated in a variety of diseases. Free radicals are normally neutralized by efficient systems in the body that include the antioxidant enzymes (superoxide dismutase, catalase, and glutathione peroxidase) and the nutrient-derived antioxidant small molecules (vitamin E, vitamin C, carotenes, flavonoids, glutathione, uric acid, and taurine).

TABLE 2
Comparison of four groups with SOD scores by Kruskal Wallis ANOVA

Group	Before			After			Difference		
	Mean	SD	Median	Mean	SD	Median	Mean	SD	Median
1. Control	9.69	2.83	9.08	10.62	2.12	10.77	-0.93	2.00	-0.62
2. Group 1	10.04	1.39	10.15	3.24	0.29	3.22	6.80	1.48	6.82
3. Group 2	11.32	1.02	11.50	9.54	2.99	9.08	1.78	2.87	1.85
4. Group 3	11.08	1.59	11.08	6.36	1.53	6.15	4.72	1.51	4.93
H-value	3.3670			17.4250			16.5560		
P-value	0.3380			0.0010*			0.0010*		
Pair wise comparison (Mann-Whitney U test)									
Control vs Group 1	p=0.8728			p=0.0040*			p=0.0040*		
Control vs Group 2	p=0.2298			p=0.4233			p=0.0782		
Control vs Group 3	p=0.2980			p=0.0082*			p=0.0040*		
Group 1 vs Group 2	p=0.1093			p=0.0040*			p=0.0104*		
Group 1 vs Group 3	p=0.2298			p=0.0040*			p=0.0374*		
Group 2 vs Group 3	p=0.9362			p=0.0547			p=0.0656		

*p<0.05

TABLE 3
Comparison of before and after SOD scores in four groups by Wilcoxon matched pairs test

Variable	Mean			SD			% change	Z-value	p-value
	Before	After	Diff.	Before	After	Diff.			
1. Control	9.69	10.62	-0.93	2.83	2.12	2.00	-9.55	1.1531	0.2489
2. Group 1	10.04	3.24	6.80	1.39	0.29	1.48	67.73	2.2014	0.0277*
3. Group 2	11.32	9.54	1.78	1.02	2.99	2.87	15.76	1.3628	0.1730
4. Group 3	11.08	6.36	4.72	1.59	1.53	1.51	42.62	2.2014	0.0277*

*p<0.05

TABLE 4
Paired 't' test of SOD of all groups

Group	Difference			P value
	Mean	SD	SEM	
Control	0.925	2.00	0.81	0.3092*
Group 1	-6.79	1.48	0.60	<0.0001**
Group 2	-1.78	2.86	1.17	0.1881*
Group 3	-4.72	1.51	0.61	0.0006**

* NS; ** HS

In healthy individuals, a delicate balance exists between free radicals and antioxidants.

SOD finding:- One of the crucial antioxidant defenses of the āmalaki is SOD, which are the only enzyme family with activity against superoxide radicals. It catalyzes the dismutation of superoxide radicals (O_2) into O_2 and H_2O_2. In the present study the serum SOD level was decreased in Group 1 from 10.03 units/ml (before treatment) to 3.23 units/ml. As compared to control where it was increased from 9.69 units/ml to 10.61 units/ml. Thus, it was revealed that the antioxidant activity of āmalaki in Group 1 is more as compared to the Control, where it didn't decrease (highly significant statistically). The serum SOD level found decreased in Group 1 i.e. from 10.03 units/ml (before treatment) to 3.23 units/ml as compared to Group 3, where it found decreased from 11.07 units/ml to 6.35 units/ml (highly significant). Similarly, by comparing other groups with Group 1 it was revealed that the anti-oxidant activity of āmalaki is highly significant. As per Sajan J *et. al,* (2009)[11] & Bethke TD *et.al*, (2010)[12] the rate of drug absorption and peak concentration is greater with morning than other absorption. As stated above in Group 1 the animals were given āmalaki cūrṇa at morning time, thus it can be assumed that there may be increased drug absorption

TABLE 5
Unpaired't' test of SOD Comparison

Group	Mean (average)	Mean ± SEM	Difference	P value
Control Vs Group 1	10.62 ± 0.86, n=6	3.23 ± 0.11, n=6	-7.37 ± 0.87	<0.0001 (HS)
Control Vs Group 2	10.62 ± 0.86, n=6	9.53 ± 1.22, n=6	-1.08 ± 1.49	0.4871 (NS)
Control Vs Group 3	10.62 ± 0.86, n=6	6.35 ± 0.62, n=6	-4.26 ± 1.06	0.0025 (S)
Group 1 Vs Group 2	3.23 ± 0.11, n=6	9.53 ± 1.22, n=6	6.29 ± 1.22	0.0004 (HS)
Group 1 Vs Group 3	3.23 ± 0.11, n=6	6.35 ± 0.62, n=6	3.11 ± 0.63	0.0006 (HS)
Group 2 Vs Group 3	9.53 ± 1.22, n=6	6.35 ± 0.62, n=6	-3.18 ± 1.37	0.0428 (Just S)

HS - Highly significant; NS - Not significant; S - Significant

TABLE 6
Unpaired't' test for all groups SOD comparison - One way anova

Description	SS	DF	MS	F (DFn, DFd)	P value
Treatment (between groups)	199.8	3	66.60	F (3, 20) = 16.80	P < 0.0001*
Residual (within groups)	79.28	20	3.96		
Total	279.1	23			

*Highly significant; SS - Sum of the square; DF - Degree of freedom; MS - Mean sqaure

and peak concentration in blood plasma of rats during experimental study. The antioxidant activity was performed by SOD, the only enzyme known to use free radical (Superoxide O_2) as a substrate. [Bhattacharya *et.al* (1999)][13]

Modern science has recently acknowledged the importance of kāla (time) and is termed as Chronopharmacology. The drug optimization can be achieved through Chronopharmacology. It is the science that deals with the variations in the pharmacological actions of various drugs over a period of 24 hours of the day. The biochemical, physiological and pathological variations of the 24 hour period in humans have well described in the āyurvedic texts when the modern science was not much aware of it until the 20th Century. The pharmacokinetics and pharmacodynamics of a medication and nutrients are directly affected by the endogenous biological rhythm. The effectiveness of many drugs varies depending on the dosage administration time associated with 24 hours biological rhythm under the control of circadian clock.[14] Circadian rhythms are self-sustaining endogenous oscillations occurring in a period of 24 hours. The circadian rhythms are related to the normal sleep-wake cycle. These rhythms are controlled by Suprachiasmatic nuclei (SCN) that are situated in the hypothalamus and the pineal gland. This master clock network regulates the circadian clocks located in cells, tissues and organ-systems. The chronopharmacologic approaches tend to reduce the side effects and make the drug more bio-available. The conventional homeostatic approach is replaced by the proper study of chronopharmacology. The chronopharmacological principle is used in the therapy of Myocardial Infarction, diabetes, hypertension, bronchial asthma, arthritis, hypercholesterolemia, etc.[15]

To increase free radicals, only one factor to cause aetiopathology is not sufficient; there are some other factors responsible for producing oxidative stress which lead to increase in free radicals. Other factors may be in the form of interactions along with infection, inflammation, protease/antiprotease imbalance, oxidative stress, environmental pollution and apoptosis. Also, genetic factors and diet can affect the pathogenesis of producing free radicals.

The free radicals scavenging activity of SOD is effective only when it is followed up by increase in the activity of CAT. Since SOD generates hydrogen peroxide as a metabolite, which is more tissue toxic than oxygen radicals, has to be scavenged by CAT. Thus, a concomitant increase in CAT activity is essential if a beneficial effect from increase in SOD activity is to be expected.[16]

Conclusion

The study evaluating the auṣadhasevanakāla of Āmalakicūrṇa as rasāyana and its free radicals scavenging activity on male Wistar rats draws the following conclusions:

- The dose and duration of the trial drug defined found competent enough to act as rasāyana and to scavenge free radicals.
- Āmalaki is effective broad-spectrum antioxidants and free radical scavengers, helping to reduce disease and slow down the aging process.
- Primary antioxidants such as Superoxide dismutase and Catalase are first and most important line of defense against highly reactive, potentially destructive oxygen-

derived free radicals and āmalaki stimulates these enzymes.

- On the basis of auṣadhasevanakāla, āmalaki boosts weakened antioxidant defenses in kiñcit sūryodayajāte kāla (morning time of administration).
- The time of administration of medicine is mainly governed by dominance of particular doṣa which is responsible for biological rhythms and is targeted for the treatment. The drug optimization can be achieved by administering the medicine in an appropriate time. For rasāyanakarma, the ideal bheṣajasevanakāla is kiñcit sūryodayajāte as per experimental evidence. Bheṣaja-sevanakāla is having its own scope and application in the management of diseases. By incorporating proper bheṣajasevanakāla the bioavailability can be enhanced, target the disease site and relieve symptoms.

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MŪTRAMĀRGA-UTTARAVASTI IN THE MANAGEMENT OF BLADDER RETENTION OF SPINAL INJURY – A CASE REPORT

K. Murali and Sunil John*

Abstract: Uttaravasti in other routes are commonly practiced in the field of infertility but mūtramārga-uttaravasti is rarely practiced. A 40 year old school teacher diagnosed with post traumatic Spinal cord contusion at the level C4 - C7 was treated in our hospital for a period of three and a half months. Repeated attempts for removing urine catheter were a failure. So, mūtramārga-utharavasti was tried which provided improvement in spastic bladder from the fourth day itself and catheter was permanently removed. Motor functions of upper limbs improved and found grade I change in hip movements. During follow up she maintained the well functioning bladder.

Introduction

A traumatic Cervical Cord compression/ contusion presents with following major symptoms:

- High cervical (C 3 and above) - motor and sensory deficits that involves entire arms and legs; Dependence on mechanical ventilation.
- Mid cervical - C3 – C5: Tetraplegia. Varied degrees of diaphragm dysfunction; May need ventilator assistance.
- Lower cervical - C5 – C6: Tetraplegia/ Tetraparesis. Bowel/Bladder retention (Spastic bladder). LMN signs at corresponding segment level. UMN signs below the lesion.

The degree of damage, early intervention and surgical reduction are the criteria for good prognosis.

Retention of urine necessitates catheterisation. This can cause several problems like chronic infection (CIUI-Catheter induced urinary infection), loss of bladder internal sphincter tone, bladder neck necrosis, urethral stricture, etc. Some patients express a mental intolerance to the catheter. Many paraplegic and quadriplegic patients come for āyurvedic treatment. Catheter is an inconvenience during the therapeutic procedures. Also svedanakriya, which are essential in vāta-management, increases the chances of urinary infection, especially if fluid intake is reduced.

A strategy is yet to be evolved enabling removal of catheter. An experience in this regard is shared in this report.

The case under consideration reported after surgical correction of the injured spines at private Medical College Hospital at Thrissur. Structural correction with surgery facilitates the prognosis with āyurvedic treatments.

*Department of Kayachikitsa, Government Ayurveda College Hospital, Tripunithura 682 301, Kerala, India

Case report

The patient, a school teacher, felt giddiness during her morning activities and fell down hitting her back of neck at the door on 19/06/2014. She had fever for the last two days and was on medicine which may be the cause for giddiness.

Immediately she was taken to a local hospital in coma stage and was soon referred to a private Medical College, Thrissur. There, an emergency surgical reduction under general anesthesia was done which involved anterior cervical discectomy and fusion with Titanium cage and cervical plate. Titanium cage filled with cancellous iliac crest graft placed and fixed with titanium plate.

She was advised physiotherapy and discharged with urinary catheter. She came to our hospital around three months after the surgery on 04/09/2014.

Examination

Her motor functions of lower limb were grade 0. For the upper limb it was grade II on Shoulder, Grade I on elbow and grade 0 on wrists. Her higher mental functions were normal.

Sensory examinations were normal but some degree of diffused numbness and hyper-sensitivity were noted in lower and upper limbs. There was slight wasting of muscles was noted in the distal ends of both limbs on both sides.

She was on urinary catheter, on trial to remove leads to retention, which means of UMN bladder.

The case was diagnosed as sarvāṅgavāta, with vyāna and apāna involvement. There was no āma or other doṣa association.

Investigations

Blood investigations at the time of surgery and in our hospital were within normal limit.

Urine tests noted values of bacterial infection at the time of admission and before starting uttravasti (Bacteria +++ on 06/12/2014).

MRI:- 19/06/2014 : Grade III anterior subluxation of C5 vertebral body over C6. Evidence of bilateral facet joint locking and spinal cord compression at this level – unstable spinal column. Hemorrhagic spinal cord contusion extending from C4 to C6,7. Evidence of anterior and posterior ligament rupture at C5 – C6 and thin pre-vertebral hematoma.

Treatment

The patient was treated for a period of 3 months and 17 days (04/9/2014 to 21/12/2014). She was on internal and external medications during this period.

Internal medication

The physical state of the patient was indicative of vyāna-prakopa, hence advised Aṣṭavargam Kaṣāyam (90 ml bid); Bṛhatyādi as toyapāka and Candraprabhā gulika (2-0-2) were prescribed to correct mūtrakṛcchra; and considering the apānavāyuvaikṛta, recommended Sukumāra-ghṛta (10 gms).

External treatments

Simultaneously, external treatments started as follows:

1. Udvarttana with Kolakulathādi cūrṇa - 5 days
2. Picu - lower abdomen with Kṣīrabalataila - 7 days.

[Attempt to remove urine catheter, after the adho-nābhi-picu led to retention and recatheterisation on 13/09/2014 with a fresh Foley's catheter]

3. Abhyaṅga with Dhānvantaram kuzhambu - 7 days
4. Cūrṇapoṭalasveda with navadhānya +

abhyaṅga with Dhānvantaram tailam - 7 days

4. Kāyasekam with Balāśvagandhādi taila - 7 days (Considering the māmsaśoṣa in LMN problems)

5. Ṣāṣṭikapiṇḍasveda - 7 days

Subsequent anulomana with Eraṇḍataila were done after each svedanakarma.

6. Yonipicu with Balātaila - 14 days

[Removal of urine catheter, after the yoni-pichu, again led to retention and on 14/10/2014 a fresh Foley's catheter was inserted.]

A gradual improvement in the physical condition especially upper arm activities was observed.

Pañcakarma

1. Mātravasti with Dhānvantaram taila (prepared in relevant pāka)

[Trial to remove urine catheter after the mātrāvasti, failed as it lead to retention and recatheterisation on 01/11/2014; inserted a fresh Foley's catheter.]

2. Vasti as per following schedule:

   a. Mātrāvasti with Gandharvahasta-eraṇḍatailam - 90 ml for 1 day

   b. Vaiśvānaravasti/rūkṣavasti with Gandharvahastādi kaṣāyam 300ml + Vaiśvānaracūrṇam - 20 gm for 3 days.

   c. Mustādi yāpanārdha-mātrika-vasti for 7 days

Attempts to remove the urinary catheter during the course were unsuccessful in the three attempts. Retention of urine forced to reinsertion of catheter in the same days. Patient was feeling the catheter quite troublesome that made us concentrate on apānavāyuvaikṛta management especially in mūtramārga.

Uttaravasti, the subtype of vasti, has proven efficacy in the apānavāta-vikāras. According to the route, this procedure can be through apathyamārga and mūtramārga. The most commonly practiced type is the first one especially in infertility. The latter type is not so much in practice may be due to lack of skill and risk of procedure. In this case, uttaravasti was chosen as there was no other option.

Prior to the intervention, proper aseptic measures had taken; counseling given and got a consent from the patient. A sterilized 'No. 18' Foley's rubber catheter was used as vastinetra and mātravasti syringe as vasti bag. We opted to apply the ghṛta itself for lubricating the catheter.

A urinary bladder usually holds 300-350 ml of urine and its normal capacity is 400-600 ml. A safe, hrasvamātra (10 ml) was chosen for sneha and 50 ml for kaṣāya-uttaravasti.

Mūtramārga uttaravasti was done as per the schedule shown in Table 1. Avapīḍaka-snehapāna is indicated for mūtraja-vāyuvikāras. Avapīḍakasnehapāna was tried to stabilise the improvement (Table 2). Due to lose of expected digestive schedule the snehapāna procedure missed to complete satisfactorily.

Outcome and follow up

After the fourth vasti, the catheter was removed for ever and the patient attained free flow of urine. However, she lost control during long term retention and pressure (when sitting with filled bladder). Interestingly, it was noted that the chronic urinary infection (bacteria+++) reduced (bacteria+) after uttaravasti.

Discussion

Many conventional modalities for the anulomana of urine were tried in between the

course of treatment but did not work. Vasti is the agrya (most ideal) for vātavikāra. Here, the complaints come under vātavaikṛta (vyāna with specific vitiation of apāna). Defecation and micturition comes under apāna-function. So, uttaravasti was selected as a main treatment. Vātānulomana and correction of karmavaikṛta of apānavāyu was the aim of the treatment.

Bladder irrigation with antibiotics is a practice in modern medicine for chronic UTI. Chronic retention of urine in the bladder and long term wearing of catheter will lead to bacterial growth and is the cause of chronic UTI. Mūtrarodha is an abnormal vātakarma.

Urine normally tends to be slightly acidic. Normal values range between 4.6 up to 8.0. Although some controversy remains concerning what pH level is most conducive to bacterial growth in the urinary tract, most evidence indicates alkaline pH (less acidic urine) helps prevent UTIs. The easiest way to alkalinize the urine is with intake of plenty of

TABLE 1
Mūtramārga uttaravasti schedule

Date*	Medicine	Dose	Observations
07/12/14	Vastyāmayāntakaghṛta	10 ml	Complaint of retention. Inserted catheter at 5.30 pm but slipped out due to oily pathways, kept anyway with plasters. Waxy urine in urine bag.
08/12/14	Drākṣādikaṣāya + Guḷūcyādi kaṣāya	50 ml	Complaint of retention. Catheter inserted at 6 pm
09/12/14	Vastyāmayāntakaghṛta	10 ml	Urine oozed out slightly during pressing the abdomen; but Catheter inserted at 5 pm.
10/12/14	Drākṣādi kaṣāya + Guḷūcyādi kaṣāya	50 ml	Micturition at 12 pm and 02.30 pm. Catheter not inserted
11/12/14	Vastyāmayāntakaghṛta	10 ml	Micturition almost normal with better control but during sitting urine oozed out.
12/12/14 13/12/14**	Vastyāmayāntakaghṛta	10 ml	More control but during sitting urine oozed out.

* Time: 10.30 am; ** Stopped due to menstrual period

TABLE 2
Avapīḍakasnehapāna with Vastyāmayāntakaghṛta

Date	1st Dose			2nd Dose		Remarks
	Qty	Time	Food taken at	Qty	Food taken at	
17/12/2014	50 ml	7.00 am	03.30 pm	40 ml	8 pm	Abdominal discomfort
18/12/2014	20 ml	7.30 am	12.00 pm	10 ml	8 pm	Giddiness
19/12/2014	10 ml	7.15 am	04.30 pm	20 ml	8 pm	Giddiness
20/12/2014	20 ml	7.30 am	04.00 pm	40 ml	8 pm	

alkaline drinks. Creating an alkaline pH in the bladder itself can be achieved by bladder irrigation with alkaline solutions. Kaṣāyas and medicated ghṛtas are alkaline in pH. Uttaravasti is a safe invasive procedure for this.

Best absorption of snehadravya for the vāta correction is achieved by mṛdurūkṣaṇa. So in between the sneha-uttaravastis, kaṣāya-uttaravastis were performed. The internal transitional epithelium of bladder is very sensitive so Drākṣādi kaṣāya and Guḷūcyādi kaṣāya were selected as safe, sterile drugs. They are pittahara and āmapācaka.

Vastyāmayāntakaghṛta was the sneha for uttaravasti. This compound is very commonly prescribed in Kerala. The main ingredient in kaṣāya is gokṣura and kalka is śilājatu. It is indicated for both pāna and vasti for all the vastigata diseases.

Conclusion

Voiding and retention of urine is a complicated neuromuscular activity involving higher and lower neuronal centers. Cervical cord injuries may present with either incontinence (LMN) or spastic (UMN) bladder. This can equated with atipravṛtti and saṅga of mūtrāvahasrotas as micturition is apānavātakarma. Pratilomya is causative factor of these conditions and anulomana is the remedy.

Uttaravasti-apathyamārga (through vagina) is commonly practiced by specialists in Prasūtitantra. Mūtramārga-uttaravasti is explained in the classics but not commonly practiced, may be due to its risk factors like vasovagal shock, septic complications, sensitive bladder mucosal erosions, etc. In the study, it was found that it is an easy, cost effective and safe procedure effective in bladder dysfunctions and also in chronic UTI. Urinary infection and bladder retention are off course, different pathologies but as per āyurveda, vāta is common in both.

Varied medicines according to condition and large size trials have to be conducted; because there are no other proved modalities for such neurogenic bladder disorders. Success in removing the catheter is of course due to the cumulative effect of all the vātahara treatments done internally and externally; the systemic effect of vātaśamana could specifically bring to mūtramārga through administration of uttara-vasti. This also validates the common practice of localised kriyākrama after sarvāṅga one.

This experience points to the need of further explorations into the role of uttaravasti in recurrent or chronic mūtrakṛcchra and bladder retention.

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Notes on medicines:

1. Aṣṭavargam kaṣāyam (Sahasrayogam, P 42). Though the indication in the śḷoka is anilāpaha (relieving vata), it is generally prescribed in vyāna and apāna vitiations.
2. Bṛhatyādi (Sahasrayogam, P 29). This is a modified laghupañcamūla. Gokṣura is added

in equal quantity of all other ingredients. This can be given as kaṣāya, ghṛta and toya (pāka)

3. Sukumāraghṛtam (Aṣṭāṇgahṛdayam - Vṛddhicikitsa). This is actually a yamaka, as it contains both ghṛta and eraṇḍataila. It has very wide indications including rasāyana; its vātānulomana property is a significant.
4. Kolākulathādi cūrṇa (Cakradatta - Vātavyādhiciktsa). Indicated in vātavyādhis as lepa in dhānyāmla, it is used for udvartana, upanāha and cūrṇasveda.
5. Kuzhambu. This is medicated tailas in more viscous form, prepared by adding eraṇḍataila with tilataila. Kuzhambu is used for only abhyaṅga.
6. Navadhānyas. There are nine dhānyas (both vrīhi and śimbi varieties) used externally for management of vātavyādhis in Kerala. They are: māśa, mudga, syamāka, kodrava (rāgi), kaṅgu, kulatha, kalāya, tila and śaṣṭika. This combination is used for poṭalasveda.
7. Balāśvagandhādi taila (Sahasrayogam, P. 117). Generally indicated in vātavyadhis associated with kārśya.
8. Balātaila (Aṣṭāṅgahṛdaya, Vātavyādhi-cikitsa).
9. Gandharvahasta-eraṇḍataila (Ayurveda College Pharmacopeia, P 153). This is eraṇḍataila medicated with Gandharva-hastādi kaṣāya with Hiṅgvāṣṭakacūrṇa as kalka.
10. Gandharvahastādi kaṣāya (Sahasrayogam, P 46), This kaṣāya is very famous for vatā-vyādhicikitsa, particularly apānā-nulomana, in Kerala.
11. Vaiśvānaracūrṇa (Aṣṭāṅgahṛdayam, Gulma-cikitsa)
12. Mustādi yāpnavasti - (Aṣṭāṅgahṛdayam, Kalpasthānam). This vātahara-nirūha is indicated in several diseases specifically effective in apānavaiguṇya.
13. Vastyāmayāntakaghṛta (Sahasrayogam, P75). Relevant details are given in the text of the paper.
14. Guḷūcyādi kaṣāya (Aṣṭāṅgahṛdayam, Sūtrasthāna, 15)
15. Drākṣādi kaṣāya (Aṣṭāṅgahṛdayam, Jvaracikitsa)

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STANDARDISATON OF PAÑCAKOLACŪRṆA - AN ĀYURVEDIC FORMULATION

Radhika Rani R.K.,[1] Sreekumar, T.[1] Rosamma M.P.[2] and Mahadevan Subrahmonian.[2]

Abstract: Pañcakolacūrṇa, a combination of five āyurvedic drugs, is indicated in dyspepsia, vomiting, bloated feeling, flatulence and disorders associated with mandāgni. Botanically identified herbs were collected and prepared the powder. This was tested as per the pharmacopoeial standards. The physico-chemical characteristics like total ash, acid insoluble ash, extractable matter in water and alcohol, loss on drying at 105° C and volatile oil were determined. The methanolic extract of the cūrṇa was tested for the presence of flavanoids, sterol, alkaloids and phenol. TLC and HPTLC profile of the methanolic extract of the cūrṇa as well as the ingredient drugs was studied in toluene: ethyl acetate (9:1). The powder was tested for heavy metals, which was found to be within the permissible limit.

Introduction

Pañcakolacūrṇa is an āyurvedic powder formulation used for digestive disorders like āma (indigestion), anāha (flatulence), chardi (vomiting), etc. It improves digestive power and corrects metabolism. It is agnidīpana, pācana, anulomana, rucya, srotośodhana and lekhana in property. There is no reference till date to the standardisation parameters of this cūrṇa.

Materials and method

The formulation is made up of five ingredient drugs (Table 1). The plants were identified by a botanist and collected from Pharmacognosy Department under the Institution. Fresh roots *Plumbago* was cut into pieces and put repeatedly in lime water and washed thoroughly. The raw drugs were thoroughly washed, dried in shade, powdered separately and sieved through sieve no 85. Each of the drugs was mixed together in equal parts to obtain a homogenous mixture of the cūrṇa.

Analytical studies such as determination of organoleptic characters, physico-chemical parameters, chemical constituents, chromatographic profile and detection of heavy metals were done. Detection of phytochemical constituents i.e. qualitative assessment for flavanoids, steroids, alkaloids and phenol in the alcohol extract of the cūrṇa was done as follows:

- Flavanoids - Shinoda test
- Sterol - Leibermann - Burchard's reaction
- Alkaloids - Dragendroff's test
- Phenol - 2 ml neutral ferric chloride added; observed formation of green and blue colour.

Chromatographic methods:- 1) TLC studies of methanolic extract of the powder was carried out. The mobile phase used was toluene: ethyl acetate (9:1). The solvent system was selected

1. *Roganidana Department, Vaidyaratnam Ayurveda College, Ollur, Thrissur*
2. *Drug Standardisation Unit, Govt Ayurveda College, Thiruvananthapuram*

TABLE 1
Ingredient drugs of Pañcakolacūrṇa

Sanskrit / Scientific name	Part used
1. Pippali (*Piper longum* L.)	Spike
2. Pippalīmūla (*Piper longum* L.)	Cut stem and root
3. Cavya (*Piper chaba* Hunter non Blume)	Cut stem and root
4. Citraka (*Plumbago zeylanica* L.)	Mature root
5. Nagara (*Zingiber officinale* Roxb.)	Rhizome

in accordance with the reference in Āyurvedic Pharmacopoeia of India indicated for the individual drugs. 2) HPTLC method was developed on CAMAG HPTLC system consisting of Linomat V applicator (Camag, Muttenz, Switzerland) ADC, CAMAG TLC scanner, equipped with Win cats software (version 1.4.6), CAMAG syringe of 100 ìL capacity. Separation was performed on aluminum backed silica gel 60 F254 (20cm x10cm of plate size, layer thickness 0.2 mm, E-Merck, Darmstadt, Germany).

Detection of heavy metals:- This was done by Atomic Absorption Spectrophotometer (Themo electron corporation M series, with standard solutions of Merck, Germany). Flame photometry was done to detect metals like lead, nickel, cadmium, zinc, copper and iron.

Result

Analytical studies:- The organoleptic characters and physico-chemical parameters are showed in Tables 2&3.

Phyto-chemical constituents:- The cūrṇa showed positive reaction for the phyto-chemical constituents tested namely flavanoids, sterol, alkaloids and phenol.

12TLC/HPTLC:- The formulation showed 10 peaks with Rf values as 0.09, 0.20, 0.23, 0.31, 0.37, 0.50, 0.57, 0.66, 0.76, 0.85 (Table 4). The HPTLC profiles of the cūrṇa as well as the individual drugs were compared. Few Rf values of the ingredient drugs were identical to those of the formulation. The identical Rf values observed were as follows: - 4 spots for pippali (0.37, 0.57, 0.66, 0.76), 6 spots for pippalīmūla (0.09, 0.23, 0.31, 0.50, 0.76, 0.85), 7 spots for cavya (0.09, 020, 0.31, 0.50, 0.57, 0.76, 0.85), 1 spot for citraka (0.20) and 5 spots for nagara (0.20, 0.31, 0.66, 0.76, 0.85) (Fig. I)

Detection of heavy metals:- The amount of lead and cadmium observed much below the permissible limit as recommended by the WHO (Table 4).

TABLE 2
Organoleptic characteristics and physico-chemical parameters of Pañcakolacūrṇa

Description	Value (%)
A. Organoleptic characters	
a. Colour : Brown	
b. Odour : Characteristic	
c. Touch : Fine powder	
d. Taste : Pungent	
B. Physico-chemical parameters	
- Loss on drying at 105°C	7.9
- Total ash	8
- Acid insoluble ash	0.02
- Water soluble extractive	8.8
- Alcohol soluble extractive	7
- Volatile oil	2

TABLE 3
TLC study of Pañcakolacūrṇa

Parameters	No. of spots	Rf value
Visible	3	0.067, 0.82, 0.97
UV	6	0.19, 0.33, 0.48, 0.71, 0.82, 0.95
Iodine vapour	3	0.19, 0.44, 0.82

Conclusion

Pañcakolacūrṇa is a brown coloured smooth powder with pungent taste and a characteristic odour of *Piper longum*. The cūrṇa showed 2% volatile oil as it was a freshly prepared one. This value may reduce on storing the cūrṇa for a few weeks. Among the phytochemical constituents tested, sterol was strong positive indicating its higher concentration in freshly prepared cūrṇa. Rf spots of the ingredient drugs identified in the cūrṇa can be used as a reference to check whether genuine drugs have been used in a given sample. The cūrṇa contains heavy metals below the permissible limit. The observed values of standardisation of Pañcakolacūrṇa can be used in the routine quality control analysis for purity and potency of the compound.

TABLE 4
TLC study of Pañcakolacūrṇa

Metal	Quantity (ppm)
1. Lead	0.0241
2. Nickel	0.0491
3. Cadmium	0.0348
4. Zinc	2.2759
5. Copper	0.3061
6. Iron	4.6193

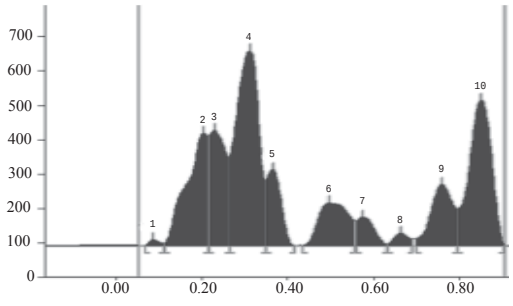

Fig I. HPTLC profile of Pañcakolacūrṇa

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Clinical observation

BUERGER DISEASE - ĀYURVEDIC MANAGEMENT

V.G. Huddar and Ritesh Kumar Lahoti*

Abstract: Thromboangiitis obliterans, a segmental occlusive inflammatory condition characterized by thrombosis and recanalization, affects small and medium size arteries and veins. The disorder was named after Buerger, who in 1924, had reported that tobacco use was a predisposing factor in this disorder. A case of Thromboangiitis obliterans (TAO), presented with complaints of pain, weakness in lower limb, coldness and discoloration in right lower limb with difficulty in walking, was treated in the OPD of Kāyacikitsa. The modalities of treatment adopted were raktamokṣaṇa, sthānika abhyaṅga followed by pariṣeka and Mañjiṣṭhādi kṣāravasti. The patient showed significant improvement. Claudications and resting pain found to be reduced significantly.

Introduction

Thromboangiitis obliterans (TAO) commonly affects small and medium size arteries and veins.[1,2] It is a non-atherosclerotic inflammatory disease affecting small and medium sized arteries and veins of the upper and lower extremities.[3] Cigarette smoking has been implicated as the main aetiology of the disease. It was Buerger who named the disorder 'Thromboangiitis obliterans' and briefly mentioned its relationship with smoking. In 1924, Buerger reported that tobacco use was a predisposing factor.[4] TAO can be distinguished from other types of vasculitis based on - its tendency to occur in young male subjects, its close association with tobacco consumption, the rarity of systemic signs and symptoms, a highly cellular thrombus with relative sparing of the blood vessel wall and the absence of elevated acute-phase reactants and of immunological markers. The prevalence of the disease among patients with peripheral arterial disease ranges from values as low as 0.5 to 5.6% in Western Europe; as high as 45 to 63% in India; 16 to 66% in Korea and Japan; and 80% among Jews of Ashkenazi ancestry living in Israel. Part of this variation in disease prevalence may be due to variability in diagnostic criteria.[5,6]

On the basis of its clinical presentation and pathogenesis it can be correlated with vātarakta in āyurveda. It is such a disease where both vāta and rakta are vitiated simultaneously and the vitiated vāta obstructs raktavaha srotas.[7] The occurrence of vātarakta is also possible when there is avarodha of vāta by the morbid kapha doṣa and medas.[8] Depending up on the doṣa-duṣyasammūrcchana and its site of manifestation, vātarakta is of two types i.e.

*Dept. of Kayachikitsa, KLE University's Shri BMK Ayurveda Mahavidyalaya, Shahapur, Belgaum-590003

uttāna and gambhīra.[9] TAO is compared with gambhīra-vātarakta, and the treatment for gambhīra-vātarakta is virecana, āsthāpanavasti and snehapāna.[10] Treatment mentioned also includes raktamokṣaṇa, anuvāsanavasti and internal medicines. A case study of TAO is reported here which was managed by raktamokṣaṇa, sthānika abhyaṅga followed by pariṣeka, Mañjiṣṭhādi kṣāravasti, oral medicines and pathya.

Case report

A 46 year old male, an engineer by occupation, suffered with Buerger disease was presented in the OPD of Kāyacikitsa with complaints of pain, weakness, coldness and discoloration in right lower limb with difficulty in walking; he was dependent on others to perform routine work since 6 months. Colour Doppler (dated 15/09/14) of right lower limb suggested 'acute thrombus extending from distal portion of superficial femoral artery, distally up to dorsalis pedis artery, mild atherosclerotic changes of right lower limb arteries'. The case was diagnosed as Buerger disease. He was under medication for two months but as did not get significant result, advised to undergo a surgery, which he refused and consulted our hospital. There was no previous history of similar symptoms or a recent infection. Patient's personal history revealed tobacco chewing (minimum 4-6 packs daily) and smoking (3-4 cigars/day) since 25 years. Examination of patient revealed blackish discolouration, comparative coldness of right lower limb and severe tenderness. Dorsalispedis was not palpable and popliteal artery and posterior tibialis were feeble.

Diagnostic criteria

Diagnosis of TAO is suggested when the age group of the patient is 20-50 years, with history of cigarette smoking, low socio economic status; usually the symptoms first occurs in lower limb unilateral or bilateral, and the most frequent finding is absent or diminished posterior tibialis and dorsalispedis artery in feet.

Smoking history; onset before the age of 50 years; infrapopliteal arterial occlusions; either arm involvement or phlebitis migrans; and absence of atherosclerotic risk factors other than smoking. [Shionoya (1998)][11]

Treatment

The following treatments were done for a period of 14 days:

First 3 days:

- Koṣṭhaśodhana with Tṛvṛtlehya (15 gm) and uṣṇajala - in empty stomach
- Sthānika abhyaṅga with Piṇḍataila to right lower limb followed by Daśamūlakṣīra pariṣeka - morning and evening
- Lepa on right lower limb with a paste prepared by devadāru, haridra, śigru, eraṇḍapatra, dāruharidra, vaca, ela, tvak, musta and śatapuṣpa mixed in kañji (rice gruel).
- Pathya - bala + guḍūci + mañjiṣṭha + kṣīrapāka (50 ml) - 12 pm and 5 pm.

Day 4:- Raktamokṣaṇa with jaḷūka under aseptic conditions (50 ml of blood drained).

Day 5 to 12:

- Sthānika abhyaṅga with Piṇḍataila on right lower limb followed by Daśamūlakṣīra pariṣeka - morning and evening.
- Vasti in kālavasti manner i.e. anuvāsanavasti with Madhuyaṣṭyādi taila (60 ml) and Mañjiṣṭhādi kṣāravasti.
- Lepa on right lower limb with a paste prepared by devadāru, haridra, śigru,

eraṇḍapatra, dāruharidra, vaca, ela, tvak, musta and śatapuṣpa mixed in kañji.

- Pathya - bala + guḍūci + mañjiṣṭha + kṣīrapāka - 50 ml 12 pm & 5 pm.

Day 13:

Raktamokṣaṇa with jaḷūka under aseptic conditions (50 ml of blood drained).

Internal medicines:

- Tab. Prabhākaravaṭi - 1 No. (TID after food)
- Tab. Kaiśoraguggulu - 2 Nos (TID after food)
- Guggulutiktakakaṣāya - 30 ml (TID after food)
- Rasāyana lohabhasma + Śilājit cūrṇa - 6 gm (morning in empty stomach).

Result

The patient showed significant improvement in the sign and symptoms. Pain reduced to 70-75%; able to walk about 1-1.5 km without difficulty; dorsalis pedis was feebly palpable compared to before treatment; popliteal artery was well palpable and temperature was normal on lower limb.

Discussion

Buerger disease can be correlated with gambhīra vātarakta which is a vātavyādhi prabheda. The illness is considered to be the finest illustration of an āvaraṇavyādhi*;* as an opening from the nidāna to the upadrava, the illness follows the characteristic presentation of āvaraṇa. Whatever be the grounds, an obstruction in the path of raktadhātu is the core pathology of the disease. Treatments mentioned for vātarakta are abhyaṅga, pariṣeka, ālepa, virecana, basti, snehapānam, raktamokṣa, etc. Sthānika abhyaṅga with Piṇḍataila is helpful in reducing pain. Daśamūlapariṣeka has anti-inflammatory property, which helps in subsiding aggravated vāta. Vasti treatment was adopted in kālavasti manner which helps to remove āvaraṇa and also useful to reduce pain. Raktamokṣaṇa by jaḷūka is considered as the most effective and unique method. Ācārya Śusruta has advocated raktamokṣaṇa by jaḷūka in all inflammatory, suppurative and painful conditions. For systemic treatment, Kaiśoraguggulu, Prabhākarvaṭi and Guggulutiktakaṣāya were given.

Mechanism of action of leeches

Leeches have highly evolved specific mechanism which feed on their hosts by blocking blood coagulation.[12] It was in 1884, John Berry Haycroft, a Birmingham chemist, discovered "hirudin" from the saliva of leech which has anticoagulant property. It is responsible for preventing blood from clotting by inhibiting conversion of fibrinogen to fibrin, and also inhibit platelet aggregation, which further contributes to the process.[13]Apart from these it also has antiseptic qualities. Leech saliva has other proteins which are said to exhibit analgesic effect and reduce numbness. It also contains several other bio-active substances including prostaglandin, vasodilators, anaesthetics and proteins like Calin, Apyrase Hyaluronidase, Egline, Destabliase, Piyavit and kollaginase.[14]

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ĀYURVEDIC MANAGEMENT OF SIDHMAKUṢṬHA WITH SPECIAL REFERENCE TO PLAQUE PSORIASIS - A CASE REPORT

S.K. Hiremath, Anitha B. Yadav and Supreeta Laxmanshetty D.*

Abstract: Psoriasis is a non-infectious chronic T cell-mediated inflammatory skin disorder. Sidhmakuṣṭha, a kapha predominant tridoṣaja skin disorder, resembles with psoriasis. There is no satisfactory treatment is available in the contemporary medicine for psoriasis. A case of sidhmakuṣṭha was successfully treated with śodhana and samanauṣadis.

Introduction

Psoriasis is a skin disorder affected approximately 2% of the world's population. More than one million patients in the USA require UV/systemic immunosuppressive therapy.[1,2] Its prevalence in different populations vary from 0.1%-11.8%.[3] In India, it varies from 0.84% -5.6%.[4]

Sidhmakuṣṭha is explained as one among the mahākuṣṭha manifesting with symptoms like śveta (white), tāmra (coppery) colours, alābupuṣpavarṇa (reddish discolouration), ghṛṣṭa rajo vimuñcyati (peeling of skin in the form of powder on itching) prayo urasi (particularly on the chest).[5] All kuṣṭha are tridoṣaja with predominance of one doṣa; in sidhmakuṣṭha, kapha is the predominant doṣa.[6] The description of sidhma in āyurvedic classics resembles with the modern description of plaque psoriasis.

Psoriasis vulgaris, also known as chronic stationary psoriasis or plaque-like psoriasis, is the common form that affects 85%-90% of people with psoriasis.[7] Plaque psoriasis typically appears as raised areas of inflamed skin covered with silvery-white scaly skin. These areas are called plaques and are commonly found on the elbows, knees, scalp, and back.[7,8] Psoriatic erythroderma (erythrodermic psoriasis) involves widespread inflammation and exfoliation of the skin over most of the body surface. It may be accompanied by severe itching, swelling and pain. It is often the result of an exacerbation of unstable plaque psoriasis, particularly following the abrupt withdrawal of systemic glucocorticoids.[9] This form of psoriasis can be fatal as the extreme inflammation and exfoliation disrupt the body's ability to regulate temperature and perform barrier functions.[10]

Although few studies have assessed the long term prognosis of children with acute guttate psoriasis, one small study has revealed that 33% of patients with acute guttate psoriasis eventually develop chronic plaque disease.[11]

*Dept of Agada Tantra, K.L.E.U Shri B.M.K. Ayurved Mahavidhyalaya, Shahapur, Belgaum - 590003, Karnataka.

Psoriasis can present at any age and has been reported at birth and in older people of advanced age. Accurate determination of the age of onset of psoriasis is difficult.[12] It is equally common in both the sex. Effective therapeutic agents in contemporary medicine are limited in number and may have long-term toxic side effects, which makes alternative system of medicine a good choice. The mainstay of treatment in āyurveda for kuṣṭha is śodhana, which anchors the vitiated doṣas and eliminates them. Parallel to śodhana, śamanauṣadis help to correct the vitiated dhātus and bring them to normalcy.

Case report

A 42 year old male, business man by profession, approached to Nirvisha OPD of KLE Ayurveda Hospital with chief complaints of reddish macular silvery scaly lesions all over the body including scalp since 15 years associated with burning sensation and itching which had aggravated suddenly since 20 days. Patient was a known case of psoriasis since 25 years. He had often onset of rashes and disappearance without any medications. There was no allergy to drugs or food; no relevant family history; no history of hypertension and diabetes mellitus. The patient had consulted a dermatologist and took some steroids but found no relief.

On examination, irregular macular lesions of reddish pink colour seen over the chest, anterior and posterior abdomen, scalp, elbow and back of trunk regions - more specially over neck region. The extensor surface of bilateral lower and upper limbs also were involved. Based on clinical presentation, the case was diagnosed as sidhmakuṣṭha (plaque psoriasis).

The patient was subjected to treatment under two schedules (Table 1). In first admission, dīpana and pācana were given prime importance and treated accordingly; and in second, treated for śarīraśodhana and dhātusāmya.

TABLE 1
Treatment schedules

A. First line of treatment (symptomatic)
- for burning sensation:
  1. Cūrṇa (powder) prepared out of uśira, candana and guḍūci (each in equal quantity) - twice a day after food with warm water.
- for dīpana and pācana:
  2. Trikaṭu cūrṇa (1gm) mixed with Sarjakṣāra (2 pinch) - 1 pinch twice a day mixed with warm water after snehapāna and even mixed with kañji
  3. Śaṅkhavaṭi (2 tab) - twice a day before food

B. First admission (pañcakarma)
1. Snehapāna (ārohaṇakrama) with Mahātiktaghṛta:
   - 30 ml : 1st day
   - 60 ml : 2nd day
   - 100 ml : 3rd day
   - 140 ml : 4th day
   - 180 ml : 5th day

Pathya - Kañji on appetite; kichadi at night; hot water as anupāna; avoid daysleep.

C. Second treatment
1. External application and mrdu bashpa-sveda with Nirguṇḍītaila on 6th and 7th days.
2. Virecana with TrivṛḤ98 tleha - 15gm with hot water on the 8th day; 13 vegas observed.
3. Samsarjana karma -4 annakāla

Śamanauṣadi after pañcakarma
- Triphala cūrṇa with madhu and ghṛta - 1 gm at bed time for 15 days

Results

After first medication, itching and burning sensation found to be completely reduced; scaly patches also reduced; but erythema persisted. The lesions over the hands and back were markedly resolved. (Fig. I) There was no recurrence. The patient was advised to follow the medicines and instructed to avoid fried, fatty, bakery and junk food items. On follow-up, his lesions, erythema and itching found completely absent. The patient expressed his satisfaction with the āyurvedic treatment.

Discussion

Sidhma is a chronic relapsing disorder which is ādibala pravṛtta, santarpaṇajanya, bahudoṣaja and kḷedapradhāna vyādhi. Ācāryas have mentioned saptadravyāṇi (3 doṣas and 4 dūṣyas). The treatment of this psychosomatic disease is a challenging one due to its nature of relapse and reoccurrence. Although psoriasis can occur at any age, its incidence is peak during 3rd or 4th decade of life; may be due to more stress and dietary disturbance during that age. Stress is triggering factor, and here, the patient being a businessman, added the injury.

As uśīra, candana are having tiktarasa, śītavīrya as well as dāhapraśamana actions, the drug reduced burning sensation. Guḍūci has immune-modulatory, antioxidant and erytropoitein activities.[13,14] Oxidative stress in psoriasis leads to tissue injury. Increased autoimmunity results in increased activation of CD4 and CD8 cells and thereby destruction of cells by their phagocytic action.[15] Studies have shown that autoimmunity when affect the dermatomes results in the excessive production of immature keratocytes with a reduced span results in hyperproliferation leading to scaling.[16] Suppression of leucocytes lead to suppression of interleukin production which resulted in reduction of scaling by leucocytic action of guḍūci.

Ācārya Caraka has mentioned that snehapāna with siddhaghṛta should be done in kuṣṭha, prameha and śotha.[17] In Kuṣṭhacikitsa Caraka gives importance to tiktarasa as it is āmapācaka and kḷeda śoṣaka.[16] Trikaṭu is having uṣṇavīrya and kaṭuvipāka; it does dīpana and āmapācana. Sarjakṣāra does the chedana and bhedana of srotas which help in kaphavilayana.

The ingredients in the formulation of Mahātikta ghṛta have tikta and kaṣāya rasa; these two rasas are known for their kaphaśoṣaṅa, kaṇḍūhara, ropana and tvak-māmsa sthirīkaraṇa karmas; thus it leads kapharūkṣaṇa to śrotośodhana. This formulation, by its anulomana property, pacifies vāta and expels excess pitta from the body; and thereby corrects āma and leads to enhancement of jaṭharāgni and dhātvagni. It automatically normalizes the functions of tridoṣa, thus suppresses the lakṣaṇas of sidhmakuṣṭha.

Normally, tailas are vāta-kaphahara, viṣanāśaka, varṇaprasādaka, kaṇḍu, piḍaka and kothanāśaka. Nirguṇḍītaila itself is vātahara; as the patient was having dāha and rāga symptoms with predominance of pittadoṣa, mṛdubāṣpasveda was done followed by sukhoṣṇajalasnāna (bath in lukewarm water); svedana does kaphavilayana.

The anti-inflammatory activity of Triphala reduced pruritus followed by inflammation due to increased blood circulation - the causative factor of erythema.[18] It also reduced the rūkṣata (dryness) caused by lack of sweating due to slow oxidation.[19] Madhu has kaphahara property, therefore, reduces the excessive kḷeda. Ghṛta has vāta-pittahara action. Triphala, given

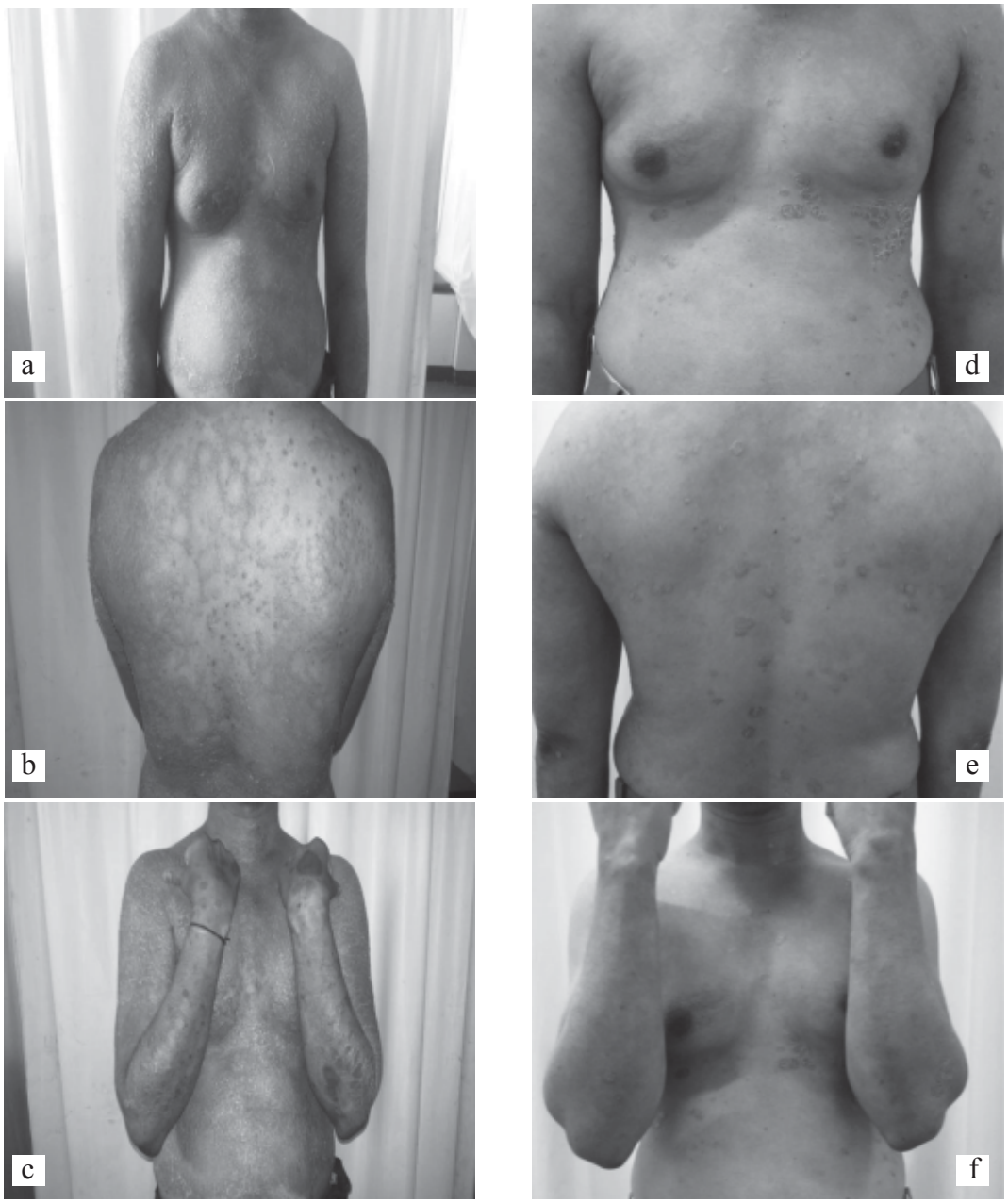

Fig. I. a-f : Images before and after the treatment
a-c Erythematous plaques, maculopapular lesions before treatment; **d-f** After treatment - reduction in Erythema (few maculopapular lesions present)

along with madhu and ghṛta at night, acts as rasāyana; it does śodhana and śamana as well.

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HEAVY METALS IN ĀYURVEDIC HERBS AND TRADITIONAL ĀYURVEDIC FORMULATIONS - A STUDY

Jessy Sebastian, Alex Thomas and D. Suresh Kumar*

Abstract: Many reports have been published in recent times highlighting the heavy metal toxicity of āyurvedic medicines. Almost all these studies are based on āyurvedic medicines prepared from calcined metals and inorganic substances. No information is available on the content of heavy metals in traditional āyurvedic medicines prepared exclusively from herbs. The present study was therefore, undertaken to fill this lacuna. An attempt has also been made to analyze the heavy metal content of some common āyurvedic herbs. The content of lead, arsenic, cadmium and mercury in 126 āyurvedic medicines manufactured by 32 companies was analyzed using ICP-MS. The content of these heavy metals in 34 common āyurvedic herbs was also estimated.

Introduction

Āyurvedic texts give clear instructions regarding the type of land from which medicinal plants are to be collected. For example, Carakasamhita states that herbs should not be collected from polluted places, burial grounds, pits, parks, anthills and salty terrain (Sharma Dash, 2001). Similar views are expressed in Aṣṭāṅgahṛdayam and Śārṅgadharasamhita (Murthy, 2002; Murthy, 2003). It is quite logical to presume that adherence to these conditions must have helped in maintaining quality of herbs collected in those days. Manufacturing āyurvedic medicines has become an industrial activity in modern times. This has given rise to a brisk trade in medicinal herbs. Consequently, herbs are collected indiscriminately from all kinds of environment and this raises the problem of chemical contamination.

In 2004 Saper *et al* published their report on the heavy metal content of āyurvedic medicines. This was followed by several reports of heavy metal contamination in āyurvedic medicines (Van Schalkwyk *et al*, 2006; Saper *et al*, 2008; Raviraja *et al*, 2010; Gunturu *et al*, 2011; Hore *et al*, 2012). Almost all these studies were based on information obtained from āyurvedic medicines prepared from calcined metals and inorganic substances. Not much information is available on the content of heavy metals in traditional ayurvedic medicines prepared exclusively from herbs. The present study was therefore, undertaken to fill that lacuna. An attempt has also been made to analyze the

*Confederation for Ayurvedic Renaissance-Keralam Ltd, KINFRA Small Industries Park, Nalukettu Road, KINFRA Park P.O. - 680 309, Koratty, Thrissur District, Kerala, India

heavy metal content of some common āyurvedic herbs.

Materials and methods

The samples of traditional āyurvedic medicines were purchased from various parts of Kerala and the samples of āyurvedic herbs procured from various suppliers in the country. The herbs were dried overnight in a hot air oven at 50^0C and powdered finely. The powdered herbs were stored in dry plastic covers and kept in a desiccator until taken up for analysis.

Standards and reagents

Multi element standards for ICP-MS were prepared from stock solutions of Pb, As, Cd and Hg at 100 ppm concentrations obtained from Merck KGaA, Frankfurt, Germany. 1 ppm stock solution was prepared from the 100 ppm standard. This solution was further diluted to 5 ppb, 50 ppb,100 ppb, 200 ppb and 250 ppb. Ultrapure nitric acid and hydrochloric acid were procured from Panreac Química S.A.U., Barcelona, Spain. HPLC water (Merck Specialities Pvt Ltd., Mumbai, India) was used for washing laboratory plastic ware and for preparing sample and standard solutions.

Microwave-assisted digestion

250-500 mg of a sample of ayurvedic medicine/ powdered herb was put into a PFA tube. 5 ml of ultrapure nitric acid and 0.5 ml of ultrapure hydrochloric acid were added. The tube was capped and placed in microwave-accelerated reaction system (CEM Corporation, Matthews, North Carolina, U.S.A.) for 1 hour. The instrument was programmed to reach 180^0C in 15 minutes and stay on hold for 35 minutes. The PFA tube was taken out of the digester and allowed to cool down to room temperature. The sample was quantitatively transferred to 50 ml plastic tube and made up to 50 ml, using HPLC water. The sample was saved in the refrigerator until taken up for analysis.

Heavy metal analysis

Pb, As, Cd and Hg in the digested samples were analyzed using an Agilent 7700X inductively-coupled mass spectrometer (ICP-MS) (Agilent Technologies, U.S.A.). The operating conditions of the instrument are shown in Table 1.

TABLE 1
Operating conditions of Agilent 7700X ICP-MS

Parameter	Value
- Plasma gas flow rate	15 L/min
- Auxiliary gas flow rate	1 L/min
- Carrier gas flow rate	1 L/min
- Makeup gas flow rate	1 L/min
- Collision gas flow rate	4.3 mL/min
- RF power	1500 W
- Nebuliser Micromist Torch injector internal diameter	2.5 mm
- Sample depth	10 mm
- Interface cone	Ni sampler cone, Ni skimmer
- CeO^+/Ce^+	0.50 %

The ICP-MS installed in a temperature-controlled room (17-20^0C) was allowed 3 hours to stabilize before analyses were carried out.

Before the procedure, some of the parameters like linearity, range, accuracy, precision, limit of detection and limit of quantification were validated (Table 2).

Detection limits

The minimum detection and instrument detection limits were calculated for Pb, As, Cd and Hg as three times the standard deviation of the concentrations of the blanks and sum of the minimum detection limit and element

TABLE 2
Validation parameters for determination of Pb, As, Cd and Hg

Element ppm	Range	Linear equation	Coefficient	Correlation (RSD%)	Precision ppb	LOD ppb	LOQ ppb
Pb	0.008-50	y = 44763.7306 x +	7758.90	0.9985	0.0415	8.9100	29.7003
As	0.007-25	y = 2381.7508 x +	77.78	0.9992	0.0533	7.9867	26.6225
Cd	0.009-50	y = 9690.4582 x +	30.00	0.9990	0.0459	9.3077	31.0258
Hg	0.009-25	y = 9893.0718 x +	3758.43	0.9988	0.0929	9.4733	31.5777

LOD - Limit of Detection; LOQ - Limit of quantification

concentration of the blank respectively (Anonymous, 2005).

Results

1. **Heavy metals in formulations**

All the 126 āyurvedic formulations analyzed in the study showed presence of Pb, As, Cd and Hg in quantities below the permitted levels by Government of India (Lohar, 2011) (Table 3).

2. **Heavy metals in herbs**

Pb not detected in 12 medicinal herbs, whereas 22 items contained the heavy metal in quantities below the limit set by Government of India (Lohar, 2011). The quantities ranged from 0.05 to 2.84 ppm (Table 4).

Discussion

The branch of āyurveda that deals with calcined minerals and metals is known as Rasaśāstra. It has a large literature dating from the end of the first millennium A.D. The tradition of Rasaśāstra shares some features with alchemy prevalent in medieval Europe (Wujastyk, 2001). Āyurvedic bhasmas are recommended at very low doses, often in divided doses, and for a specific period of time (Raisuddin, 2004). This suggests that our sages might have aware of the dangers of improper administration. The mainstream āyurvedic treatises like Śusrutasamhita, Carakasamhita, Aṣṭāṇgasamgraha and Aṣṭāṇgahṛdaya do not deal with calcined minerals and metals.

The identities of many of the tested products have not clearly described in earlier reports dealing with heavy metal content of āyurvedic medicines. Van Schalkwyk *et al* (2006) have reported eight cases of lead poisoning associated with ingestion of āyurvedic medicines. The identities of only two of these remedies were known, the rest being described as 'a mixture of brown ayurvedic powders and black tablets from India". There are instances where toxic ayurvedic products are described as "ten different āyurvedic tablets" (Dargan *et al*, 2008) or "small brown tablet" (Roche *et al*, 2005).

Samples of common āyurvedic herbs are also found to be free from heavy metal contamination. Among the 34 species tested, 9 were trees and 16 were cultivated plants. The plants represent all the geographical zones of India. The results of the study found to be in agreement with that reported by Nema *et al* (2012) for *Aloe vera, Centella asiatica, Cucumis sativus, Camellia sinensis, Clitoria ternatea, Piper betel* and *Tagete serecta.*

TABLE 3
Content of heavy metals in traditional ayurvedic formulations

Name of formulation	Batch No.	Manufacturer	Content of heavy metals in ppm			
			Lead	Arsenic	Cadmium	Mercury
Kvātha (decoctions)						
1 Amṛtottaram	81006	Arya Vaidya Pharmacy (Cbe) Ltd. Coimbatore - 641 045	0.38	BDL	BDL	ND
2 Bṛhatyādi	81231	Arya Vaidya Pharmacy (Cbe) Ltd.	0.07	0.06	BDL	ND
3 Dhanadanayanādi	81090	Arya Vaidya Pharmacy (Cbe) Ltd.	0.26	0.10	BDL	0.10
4 Drākṣādi	81236	Arya Vaidya Pharmacy (Cbe) Ltd.	0.19	0.54	BDL	0.74
5 Gandharvahastādi	1449	Arogyodayam Herbal Products, Ambikapuram - 678 011	0.45	BDL	BDL	ND
6 Guggulutiktakam	0500	Rajah Healthy Acres (P) Ltd, Chalissery - 679 536	BDL	0.05	BDL	0.23
7 Guḍūcyādi	0093	Rajah Healthy Acres (P) Ltd.	BDL	BDL	BDL	BDL
8 Indukāntam	0321	Rajah Healthy Acres (P) Ltd.	0.06	BDL	BDL	0.51
9 Mahārāsnādi	74310	AryaVaidya Pharmacy (Cbe) Ltd.	BDL	BDL	BDL	ND
10 Mahārāsnādi	508052	Arya Vaidya Sala, Kottakkal	ND	BDL	BDL	ND
11 Mahārāsnādi	1241	E.T.M. Oushadha Sala, Vellangallur - 680662	0.74	BDL	BDL	ND
12 Mahārāsnādi	239	Chyavana Ayurvedics Chittissery - 680 301	1.33	BDL	BDL	BDL
13 Mahārāsnādi	8651	AMPIC Pharmacy Ltd, Chalakudy-680 307	0.52	BDL	BDL	ND
14 Mahārāsnādi	193	Bhuvanswari Ayuvedics, Trichur-680 302	0.26	BDL	BDL	ND
15 Mahārāsnādi	1042	Vaidyaratnam Oushadhasala, Thaikkattussery - 680 322	0.44	BDL	BDL	ND
16 Mahārāsnādi	D2245	Pharmaceutical Corporation (IM) of Kerala, Trichur- 680 014	BDL	BDL	0.06	BDL
17 Mahātiktakam	81094	Arya Vaidya Pharmacy (Cbe) Ltd.	0.09	0.40	BDL	ND
18 Mañjiṣṭhādi	81271	Arya Vaidya Pharmacy (Cbe) Ltd.	0.16	0.21	BDL	0.28
19 Mṛdvīkādi	0705	Rajah Healthy Acres (P) Ltd.	0.29	BDL	BDL	0.07
20 Nayopāyam	81270	Arya Vaidya Pharmacy (Cbe) Ltd.	0.08	0.09	BDL	ND
21 Niśākatakādi	D1127	Pharmaceutical Corporation (IM)	BDL	BDL	0.28	BDL
22 Rāsnādi	81189	AryaVaidya Pharmacy (Cbe) Ltd.	0.19	0.14	BDL	ND
23 Rāsnāsaptakam	D4437	Pharmaceutical Corporation (IM)	BDL	BDL	BDL	BDL
24 Sukumāram	0344	Rajah Healthy Acres (P) Ltd.	5.48	0.05	BDL	0.23
25 Varuṇādi	D2711	Pharmaceutical Corporation (IM)	BDL	BDL	BDL	BDL
26 Vidāryādi	1478	Arogyodayam Herbal Products	0.34	BDL	ND	ND
27 Vyāghryādi	81287	AryaVaidya Pharmacy (Cbe) Ltd.	0.15	0.10	BDL	ND
Curnam (powders)						
1 Aṣṭacūrṇam	0022	Rajah Healthy Acres (P) Ltd.	0.24	0.18	0.05	0.82

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2	Aṣṭacūrṇam	2512	Oushadhakala Pharmaceuticals Mundur - 680 549	0.24	BDL	BDL	ND
3	Aṣṭacūrṇam	GRACP 1	Sreedhareeyam Ayurvedic Medicines, Kothattukulam	1.36	0.06	BDL	ND
4	Avipattikaram	AVC 033	Divya Pharmacy, Haridwar - 249 401	0.28	ND	BDL	ND
5	Avipattikaram	GRAVP 1	Sreedhareeyam Ayurvedic Med.	0.64	BDL	BDL	ND
6	Daśamula	GRDSP 1	Sreedhareeyam Ayurvedic Med.	1.06	0.05	BDL	ND
7	Rāsnādi	0752	Jayabharatham AryaVaidya Sala, Thiruvananthapuram - 695014	2.95	0.92	BDL	ND
8	Rāsnādi	507525	Arya Vaidya Sala, Kottakkal	0.86	0.56	BDL	ND
9	Sītopalādi	GRSIP 1	Sreedhareeyam Ayurvedic Med.	0.56	ND	BDL	ND
10	Tālīsapatrādi	1172	Rajah Healthy Acres (P) Ltd.	1.63	BDL	BDL	ND
11	Trikaṭu	1241	Rajah Healthy Acres (P) Ltd.	1.16	BDL	BDL	ND
12	Triphalādi	2430	Santhigiri Ayurveda & Siddha Vaidyasala, Trivandrum - 695 589	BDL	BDL	BDL	BDL
13	Vaiśvānara	3349	ValiyeriVaidyasala P Ltd, Calicut-673 010	0.43	0.05	BDL	BDL
14	Vilaṅgādi	0128	Rajah Healthy Acres (P) Ltd.	5.22	0.09	0.12	ND
Taila (medicated oils)							
1	Aṇutailam	176	Arogyodayam Herbal Products	0.12	ND	ND	ND
2	Asanavilvādi	1217	Arogyodayam Herbal Products	0.19	ND	BDL	ND
3	Balāśvagandhādi	1427	Arogyodayam Herbal Products	1.60	ND	BDL	ND
4	Balāśvagandhādi	0004	Rajah Healthy Acres (P) Ltd.	BDL	BDL	BDL	0.21
5	Dhānvantaram	1481	Arogyodayam Herbal Products	5.32	BDL	BDL	ND
6	Dhānvantaram	092	Vaidyaratnam Oushadhasala	ND	ND	ND	ND
7	Kayyonnyādi	1456	Arogyodayam Herbal Products	0.68	ND	BDL	ND
8	Koṭṭamcukkādi	1500	Arogyodayam Herbal Products	1.12	BDL	BDL	ND
9	Kṣīrabala	13017	AryaVaidya Pharmacy (Cbe) Ltd.	BDL	ND	ND	ND
10	Kṣīrabala	1483	Arogyodayam Herbal Products	0.85	BDL	BDL	ND
11	Kṣīrabala	075	Vaidyaratnam Oushadhasala	BDL	ND	ND	ND
12	Mahānārāyaṇa tailam	0127/3-13	Bharath Vaidyasala, Punalur - 691 305	ND	ND	BDL	ND
13	Mahānārāyaṇa tailam	059	Vaidyaratnam Oushadhasala	1.55	ND	ND	ND
14	Muriveṇṇa	1344	Arogyodayam Herbal Products	0.88	BDL	BDL	ND
15	Muriveṇṇa	0399	Vaidyaratnam Oushadhasala	BDL	ND	BDL	ND
16	Nālpāmarādi keram	0400	Vaidyaratnam Oushadhasala	BDL	ND	ND	ND
17	Nārāyaṇatailam	1425	Arogyodayam Herbal Products	0.20	ND	ND	ND
18	Nīlībhṛṅgādi	5101	Vaidyaraj Oushadhasala, Anandapuram - 680 305	1.46	ND	ND	ND
19	Nimbādi	0097/A2/ 2013	Bharath Vaidyasala, Punalur-691 305	1.88	ND	BDL	BD
20	Piṇḍatailam	1718	Vaidyaratnam Oushadhasala	0.16	0.92	BDL	ND
21	Piṇḍatailam	1474	Arogyodayam Herbal Products	0.87	BDL	BDL	ND

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22	Sahacarādi	1402	Arogyodayam Herbal Products	0.12	BDL	ND	ND
23	Triphalādi	1162	Arogyodayam Herbal Products	2.94	BDL	ND	ND
24	Valiya Arimedādi	0372	Rajah Healthy Acres (P) Ltd	1.70	BDL	BDL	0.29
Ghṛta (medicated ghee)							
1	Indukāntam	200M	Madhava Pharmacy (Regd) Shornur - 679 121	BDL	0.08	BDL	ND
2	Pañcagavyaghṛta	PD01	Ma Gou Products Pvt Ltd, Yeswantapura, Malur-563 130	ND	ND	ND	ND
3	Paṭolādi	73	Keraleeya Ayurveda Samajam, Shornur - 679 123	ND	ND	ND	ND
4	Phalasarpis	81259	AryaVaidya Pharmacy (Cbe) Ltd.	ND	BDL	ND	ND
5	Rāsnādaśamūlādi	81369	AryaVaidya Pharmacy (Cbe) Ltd.	ND	ND	ND	ND
6	Sārasvataghṛta	81464	AryaVaidya Pharmacy (Cbe) Ltd.	ND	ND	ND	ND
7	Sukumāraghṛta	81262	AryaVaidya Pharmacy (Cbe) Ltd.	ND	BDL	ND	ND
8	Sukumāraghṛta	CO134	SNA Oushadhasala Pvt Ltd., Trichur - 680 005	0.21	ND	ND	ND
9	Mahātiktakam	79187	AryaVaidya Pharmacy (Cbe) Ltd.	ND	ND	ND	ND
10	Mahātiktakam	3122	Vaidyaratnam Oushadhasala	3.46	0.21	BDL	0.38
Lehyam (Electuaries)							
1	Agastyarasāyanam	D1200	SNA Oushadhasala Pvt Ltd.	0.16	ND	BDL	ND
2	Agastyarasāyanam	81424	AryaVaidya Pharmacy (Cbe) Ltd.	BDL	BDL	BDL	ND
3	Ajamāmsarasāyanam	81474	Arya Vaidya Pharmacy (Cbe) Ltd.	0.16	ND	BDL	ND
4	Cyavanaprāśam	81571	Arya Vaidya Pharmacy (Cbe) Ltd.	0.05	0.41	BDL	0.97
5	Cyavanaprāśam	5190	Vaidyaraj Oushadhasala	0.34	BDL	ND	ND
6	Daśamūlarasāyanam	01739	Kalya Ayur Heal P Ltd, Kalletumkara - 680 683	1.04	ND	ND	ND
7	Elādi	7779	KandamkulathyVaidyasala, Kuzhur-680 734	0.23	ND	BDL	ND
8	Haridrākhaṇḍam	81314	Arya Vaidya Pharmacy (Cbe) Ltd.	0.39	0.22	BDL	ND
9	Madhusnuhīrasāyanam	81592	AryaVaidya Pharmacy (Cbe) Ltd.	ND	ND	ND	ND
10	Nārasimharasāyanam	81493	AryaVaidya Pharmacy (Cbe) Ltd.	ND	0.08	ND	ND
11	Pañcajīrakagulam	M593	Maruthua Pharma, Trivandrum - 695 043	0.29	0.09	BDL	ND
12	Śatāvarīgulam	81268	Arya Vaidya Pharmacy (Cbe) Ltd.	0.08	0.06	BDL	ND
13	Sowbhāgyaśuṇḍhi	81616	AryaVaidya Pharmacy (Cbe) Ltd.	0.09	0.13	BDL	ND
14	Theṅṅinpūkkula Rasāyanam	5097	Vaidyaraj Oushadhasala, Anandapuram-680 305	0.13	BDL	BDL	ND
15	Tṛvṛtleham	5149	Vaidyaraj Oushadhasala	0.09	0.08	BDL	ND
16	Tṛvṛtleham	77844	AryaVaidya Pharmacy (Cbe) Ltd.	0.25	0.18	BDL	ND
17	Vidāryādi	81311	AryaVaidya Pharmacy (Cbe) Ltd.	0.08	BDL	BDL	ND
Āsava and Ariṣṭa (Fermented products)							
1	Abhayāriṣṭam	D904	Kerala Ayurveda Ltd Athani - 683 585	BDL	0.54	BDL	ND

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2	Aravindāsavam	81242	Arya Vaidya Pharmacy (Cbe) Ltd.	ND	ND	ND	ND
3	Aśokāriṣṭam	81433	AryaVaidya Pharmacy (Cbe) Ltd.	BDL	ND	ND	ND
4	Aśvagandhāriṣṭam	81283	AryaVaidya Pharmacy (Cbe) Ltd.	ND	ND	ND	ND
5	Aśvagandhāriṣṭam	SB0026	Dabur India Ltd, New Delhi	BDL	ND	BDL	ND
6	Aśvagandhāriṣṭam	0238	Rajah Healthy Acres (P) Ltd.	0.34	BDL	BDL	0.11
7	Balāriṣṭam	2701	Rajah Healthy Acres (P) Ltd	BDL	BDL	BDL	BDL
8	Daśamūla jīrakādyariṣṭam	1360	Arogyodayam Herbal Products	0.29	ND	BDL	ND
9	Daśamūla jīrakādyariṣṭam	5179	Vaidyaraj Oushadhasala	0.25	ND	ND	ND
10	Daśamūla jīrakādyariṣṭam	AR090413	Mahaushadhi Herbal Remedies Avanur-680 547	BDL	BDL	ND	ND
11	Daśamūlāriṣṭam	0291	Rajah Healthy Acres (P) Ltd.	BDL	BDL	BDL	0.20
12	Daśamūlāriṣṭam	1437	Arogyodayam Herbal Products	3.63	BDL	BDL	ND
13	Daśamūlāriṣṭam	5677	Combined Pharmaceuticals Muringoor - 680 316	BDL	0.07	BDL	ND
14	Daśamūlāriṣṭam	81222	AryaVaidya Pharmacy (Cbe) Ltd.	ND	ND	ND	ND
15	Dhātryāriṣṭam	5114	Vaidyaraj Oushadhasala	BDL	ND	ND	ND
16	Drākṣāriṣṭam	81054	AryaVaidya Pharmacy (Cbe) Ltd.	ND	ND	ND	ND
17	Gulgulutiktakāriṣṭam	ARH03	Dhanwanthari Vaidyasala Thodupuzha - 685 584	BDL	ND	ND	ND
18	Khadirāriṣṭam	0256	Rajah Healthy Acres (P) Ltd	BDL	BDL	BDL	0.11
19	Lodhrāsavam	81052	Arya Vaidya Pharmacy (Cbe) Ltd.	ND	ND	ND	ND
20	Lohāsavam	0228	Rajah Healthy Acres (P) Ltd.	1.91	BDL	BDL	0.18
21	Lohāsavam	81227	Arya Vaidya Pharmacy (Cbe) Ltd.	ND	ND	ND	ND
22	Mustāriṣṭam	81308	AryaVaidya Pharmacy (Cbe) Ltd.	ND	ND	ND	ND
23	Parpaṭādyariṣṭam	80173	AryaVaidya Pharmacy (Cbe) Ltd.	ND	ND	ND	ND
24	Parthādyariṣṭam	81309	AryaVaidya Pharmacy (Cbe) Ltd.	ND	ND	ND	ND
25	Pippalyāsavam	80938	AryaVaidya Pharmacy (Cbe) Ltd.	ND	BDL	ND	ND
26	Pippalyāsavam	2827	Rajah Healthy Acres (P) Ltd.	0.46	BDL	BDL	0.16
27	Pippalyāsavam	2Sep2013	Siva Ganga Ayurvedics Chembuchira - 680 684	BDL	ND	BDL	ND
28	Sārasvatāriṣṭam	81208	Arya Vaidya Pharmacy (Cbe) Ltd.	ND	ND	ND	ND
29	Sārasvatāriṣṭam	2174	Rajah Healthy Acres (P) Ltd.	2.68	BDL	BDL	0.19
Drāvakam(distillates)							
1	Iñcidrāvakam	118	Madhava Pharmacy (Regd)	BDL	ND	ND	ND
2	Mahiṣadrāvakam	01759	Kalya Ayur Heal P Ltd.	ND	ND	ND	ND
3	Ayamodakadrāvakam	688	KalyaAyur Heal P Ltd.	7.99	ND	ND	ND
Lepa (pastes)							
1	Eḷanīrkuzhampu	01730	Kalya Ayur Heal P Ltd.	ND	ND	ND	ND
2	Kuṅkumādi	NKRJ	Nagarjuna Herbal Concentrates Ltd., Kalayanthani - 685 588	3.65	ND	BDL	ND

BDL = Below detection limit(0.05 ppm); ND = Not detected

TABLE 4
Content of heavy metals in ayurvedic herbs

	Name of herbs	Supplier	Content of heavy metals in ppm			
			Lead	Arsenic	Cadmium	Mercury
1	*Abies webbiana* Leaves	Pradeep Sharda & Co., Tanakpur- 262 309	0.49	BDL	BDL	ND
2	*Aconitum ferox* Root	Tandan Trading Co., New Delhi- 110 045	0.67	0.27	BDL	BDL
3	*Aegle marmelos* Root	Shiv Shakti Herbal, Sikandrabad -203205	0.49	BDL	BDL	0.38
4	*Andrographis paniculata* Whole plant	Shri Shail Medifarms, Nagpur- 440 022	0.77	BDL	BDL	ND
5	*Anethum graveolens* Seed	Patwa Mahendra Kumar Ratilal, Unjha- 384 174	ND	BDL	0.09	ND
6	*Caesalpinia sappan* Heartwood	Avees Corporation, Trichur-680 001	1.44	BDL	BDL	ND
7	*Cinnamomum verum* Bark	K. Chacko& Bros., Trichur-680 005	0.42	0.40	0.09	BDL
8	*Coriandrum sativum* Seed	Shri Ram Trading Co., Neemuch- 458 441	0.09	BDL	BDL	ND
9	*Coscinium fenestratum* Stem	Shardabrothers, Tanakpur- 262 309	0.45	BDL	BDL	0.28
10	*Cuminum cyminu*m Seed	Patwa Mahendra Kumar Ratilal, Unjha- 384 174	0.63	ND	0.05	ND
11	*Cyperus rotundus* Tuber	Rajkumar& Co., Virudunagar- 626 001	0.19	0.15	0.06	ND
12	*Phyllanthus emblica* Fruit	Chandra Ayurveda Bhavan P Ltd, Vashi-400 705	ND	BDL	BDL	ND
13	*Ficus religiosa* Bark	Malabar Agencies, Calicut-673 001	ND	ND	BDL	BDL
14	*Holarrhena pubescens* Seed	Hindustan Herbs House, Hyderabad- 500 027	0.54	BDL	BDL	ND
15	*Indigofera tinctoria* Leaf	Esskay Herbs, Lucknow-226 003	0.26	BDL	BDL	ND
16	*Inula racemosa* Root	Arjun Herbal Products, Amritsar- 143 002	0.24	0.27	0.28	ND
17	*Mesua ferrea* Flower	Sanjay Trading Co., Calcutta- 700 006	0.08	BDL	BDL	ND

Cont..

18	*Mucuna pruriens* Seed	Sanjay Trading Co., Calcutta- 700 006	ND	ND	BDL	ND
19	*Nardostachys jatamansi* Rhizome	Sharda brothers, Tanakpur- 262 309	2.84	BDL	0.09	ND
20	*Nigella sativa* Seed	Shri Ram Trading Co., Neemuch- 458 441	0.05	BDL	BDL	ND
21	*Neopicrorrhiza scrophu-lariiflora* - Rhizome	Sharda Brothers, Tanakpur- 262 309	2.84	BDL	BDL	ND
22	*Piper longum* Fruit	Hindustan Herbs House, Hyderabad- 500 027	ND	ND	ND	ND
23	*Psoralea corylifolia* Seed	ShriShailMedifarms, Nagpur- 440 022	ND	BDL	0.06	ND
24	*Pterocarpus santalinus* Heartwood	Kunnummal Enterprises, Calicut- 673 632	0.19	BDL	BDL	ND
25	*Rhus succedanea* Gall	Rajkumar& Co., Virudunagar- 626 001	ND	ND	ND	ND
26	*Salacia reticulata* Root	Crudex India, Hyderabad- 500 027	1.20	0.18	0.07	ND
27	*Terminalia arjuna* Bark	MFP Processing & Res. Centre, Bhopal- 462 021	0.32	BDL	BDL	0.10
28	*Terminalia bellirica* Fruit	Ashok Trading Co., Raipur- 492 009	ND	BDL	BDL	ND
29	*Terminalia chebula* Fruit	C.L. Kurien& Co., Trichur-680 001	ND	BDL	BDL	ND
30	*Trachyspermum ammi* Seed	PatwaMahendra Kumar Ratilal, Unjha- 384 174	ND	BDL	0.06	ND
31	*Tribulus terrestris* Fruit	Rajkumar & Co., Virudunagar- 626 001	ND	BDL	BDL	ND
32	*Vigna mungo* Seed	Shri Ram Trading Co., Neemuch- 458 441	ND	BDL	BDL	ND
33	*Withania somnifera* Root	Adinath Trading Co., Neemuch- 458 441	0.27	BDL	BDL	BDL
34	*Woodfordia fruticosa* Flower	Ashok Trading Co., Raipur- 492 009	0.35	BDL	0.07	ND

BDL = Below detection limit (0.05 ppm); ND = Not detected

The present study, reporting the absence of heavy metals in āyurvedic medicines prepared exclusively with herbs is the first of its kind. 126 āyurvedic formulations manufactured by 32 companies were analyzed in the present study and all of them conform to the heavy metal specifications set by Government of India. This study shows that traditional āyurvedic medicines manufactured in the province of Kerala contain heavy metals below the limits set by Government of India.

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DRĀKṢĀDI YOGA IN PĀNAVIBHRAMA - A CRITICAL EVALUATION

Arjun Chand C.P., Lisona Elias, Narayana Prakash B. and Sriman Narayanan S*

Abstract: That which produces mada (intoxication) is called madya, the disease produced due to improper use of madya is called madātyaya. Pānavibhrama is mentioned as a type of madātyaya, a vāta-pitta pradhāna kaphasthānika vyādhi. Body pain, vomiting, fever, fuming in throat, fainting, salivation, head ache, burning sensation, and aversion to madya and food are the symptoms of pānavibhrama. As the three doṣas are involved, selection of drugs should be very appropriate and careful. In Sahasrayoga such a combination is mentioned for the treatment of pānavibhrama. This paper briefly discusses the effect of Drākṣādi yoga in pānavibrama.

Introduction

Since time immemorial madya (alcohol preparations) is a part of social and cultural life of human being. Madya has nectar-like properties when used judicially i.e. following all the norms, otherwise it acts as poison.[1] Now a days, disorders due to alcohol abuse are common that lead to lethal conditions and often cover up as some psychiatric syndromes. The average alcohol-dependent person decreases his/her life span by 10 to 15 years; and alcohol contributes to 22,000 deaths and two million nonfatal injuries each year. At least 20 percent of the patients in mental health settings have found to be alcohol abused or dependent regardless of socioeconomic strata and gende.[2]

That which produces mada (intoxication) is called madya and the disease produced due to improper use of madya is called madātyaya. Madya is advised to take judiciously. Madātyaya is produced when a person takes madya without considering his prakṛti, sātmya, agni, etc. Madātyaya is a tridoṣaja vyādhi and mainly pitta in kaphasthāna is vitiated along with agni. Śusrutācārya explains four kinds of disorders viz. pānatyaya, pānamada, pānajīrṇa and pānavibhrama.[3]

Pānavibhrama

हृद्व्रातोद वमथुज्वर कण्ठधूम
मूर्छाकफस्रवणमूर्धरुजो विदाहः।
द्वेषः सुरान्नविकृतेषु च तेषु तेषु
तं पानविभ्रममुशन्त्यखिलेन धीरः।।[3]

Pānavibhrama is a vāta-pitta pradhāna kapha-sthānika vyādhi. Body pain, vomiting, fever, fuming in throat, fainting, salivation, head ache, burning sensation and aversion to madya and food are the symptoms of pānavibhrama. As

*Department of Manasaroga, SDM College of Ayurveda, Hassaan

the three doṣa are involved, selection of drugs should be very appropriate and careful. Sahasrayoga, the collection of around thousand selected effective formulations for different health issues, mentions such a combination for the treatment of pānavibhrama. Here, madya is in vidagdha (incomplete digestion) stage with increase of kṣāraguṇa (alkaline). Due to this, intake and absorption of food will be less and lead to dhātukṣaya (tissue depletion).

Drākṣādi yoga

द्राक्षा कपित्थफल दाडिमपानकं यत्।
तत्पानविभ्रमहरं मधुशर्कराढ्यम्।।[4]

Drākṣa (*Vitis venefera*), kapithaphala (*Limonia accidissima*) and dāḍima (*Punica granatum*) are prepared in pānaka form with large quantity of madhu (honey) and śarkara (sugar). Analysis of the formulation is shown in Tables 1&2.

Treatment:- The treatment of pānavibhrama should be aiming to neutralize kṣāra, vātapitta śāmaka without vitiating kapha, agnidīpana and dhātuprīṇana (nourishing).

Discussion

Pānavibhrama is vātapittapradhāna tridoṣaja vyādhi. Drākṣa and kapitha are vātapittśāmaka and dāḍima is tridoṣaśāmaka. Dāḍima and kapitha are having amḷarasa, which neutralizes the kṣāratva of madya. Drākṣa and dāḍima having madhurarasa help as dhātuprīṇana. Dāḍima and kapitha are having kaṣāyarasa and laghuguṇa, hence it does not increase kapha. All the three together is amḷarasa dominant and vātapitta śamana in action without increasing kapha as having kaṣāya rasa and laghuguṇa in combination. Large quantity of madhu and śarkara help to nourish the dhātu and create a madhurapradhāna stage in āmāśaya. Snigdha and guru properties reduce the absorption of alcohol from intestine. Madhu help to manage sthānikadoṣakopa and is śrotośodhaka. Dāḍima and kapitha are rocana and dīpana. All the drugs are of hṛdya in property.

TABLE 1
Analysis of formulation[5-9]

Drug	Rasa	Guṇa	Vīrya	Vipāka	Karma
Drākṣa	Madhura	Snigdha, mṛdu, guru	Śīta	Madhura	Vātapittaśāmaka, triṣṇāghna, anulomana, santarpaṇa
Kapitha	Kaṣāya, amḷa	Laghu, rūkṣa	Śīta	Kaṭu	Vātapittaśāmaka, rocana, hṛdya, viṣaghna, triṣṇāghna
Dāḍima	Madhura, amḷa, kaṣāya*	Laghu, snigdha	Anuṣṇa	Madhura	Tridoṣahara, rocana, dīpana, hṛdya, triṣṇāhara, tarpaṇa, balya
Madhu	Madhura, kaṣāya*	Laghu (guru) rūkṣa	Śīta	Kaṭu (API)	Kaphapittaśamana, śodhana, viṣaghna, dīpana, prasādana Indi: Chardi, dāha, kṣaya, tṛṣṇa
Śarkara	Madhura	Snigdha, guru	Śīta	Madhura	Vātapittaśāmaka, dhātuvardhaka, hṛdya. Indi: Aruci, bhrama,chardi, dāha, daurbalya, madātyaya, moha, mūrccha, viṣa

*anurasa

TABLE 2
Constituents[10-14]

	Drug	Constituents
1.	Drākṣa	Thiamine, niacin, riboflavin, pyridoxine, pantothenic acid, folic acid, biotin, carbohydrates, fructose, glucose, bioflavonoid, citric acid, lipids, phenol compounds
2.	Kapitha	Calcium, potassium, riboflavin, protein, carbohydrate
3.	Dāḍima	Calcium, potassium, magnesium, thiamine, riboflavin, nicotinic acid, protein, fat, carbohydrates, citric acid, glucose, fructose, maltose
4.	Madhu	Dextrose, fructose, sucrose, protein, calcium, riboflavin, magnesium, niacin, acetic acid, citric acid
5.	Śarkara	Sucrose, fructose, fats, proteins, citric acid, thiamine, riboflavin, niacin, pantothenic acid

Modern perspective:- The action of supplement of fructose in stimulating alcohol metabolism has proven. Commonly seen deficiencies like thiamine, calcium and magnesium deficiencies are being corrected by these drugs. Presence of fats, carbohydrates, proteins helps to inhibit the absorption of alcohol. Bioflavonoid present in drākṣā and citric acid in drākṣa and madhu help to convert aldehyde to acetaldehyde.[15]

Conclusion

Sahasrayoga, the classical text credited to Kerala āyurveda tradition, contributes a multi beneficial formulation in pānavibhrama, a commonly facing health problem. It corrects the psychological and physical symptoms of pānavibhrama. It not only corrects the symptoms but also does supplementation of the vitamin and mineral deficiencies.

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SVARṆAMĀKṢIKA - A AURIFEROUS CHALCOPYRITE

Seema M.B.,[1] V.A. Dole[2] H. Pampanna Gouda[3]

Abstract: Proper identification method of svarṇamākṣika (*Auriferous chalcopyrite*) justifying the acceptable properties (grāhyalakṣaṇas) as per Rasaśāstra has not yet been established; either the iron pyrite or copper pyrite are being used. This does not fulfill the criteria set by Rasaśāstra. Here an attempt is made to identify an acceptable form of svarṇamākṣika for a standard practice on the basis of prāptisthāna, synonyms and physical appearance. Various tests were conducted to identify the genuine svarṇamākṣika.

Introduction

"Mākṣikadhātu: sakalāmayaghna".[1] Use of mineral drugs in therapeutics is in practice from the period of Caraka and Śusruta. During that period, herbal and animal products were more frequently used than the use of mineral drugs which was limited to certain diseases that too in the form very fine powder. Use of copper is mentioned since ancient times, especially in Yajurveda and Atharvaveda period. Four types of copper ores are cited such as piṅgaḷa, harita, pāṭala and lohita in the context of copper mines as referred to in Arthaśāstra. [2]

Till recently, svarṇamākṣika was commonly understood as Iron pyrite[3] and unfortunately this is in practice in some areas even today. However, in Ayurvedic Pharmacopoeia of India, svarṇamākṣika is recognized as copper pyrite.[4]

Identification of any mineral are depended on physical appearance, organoleptic characters, synonyms, occurrence, colour of end product, etc. The present observation is made on the basis of the following points: a) synonyms, b) occurrence, c) colour, d) upadhātu and anukalpa of svarṇa, e) test and f) gold and other content in svarṇamākṣika.

Based on synonyms:- The one which is formed from temperature of Sun (tāpya)[5], obtained near bed of the river Tāpi[6] (tāpija, nadīja), resembles colour of honey[6] (mākṣika), that which shines like gold and the qualities are similar to gold[6] (svarṇamākṣika), that which having many colours[7] (bṛhat varṇa) and that which contains tāmra, gandhaka and loha[8] (tāmragandhayasa). These indicate colour, occurrence and content of the svarṇamākṣika.

Based on occurrence:- The words like tāpija, nadīja and tāpya are seen, but the source is not identified.[9] Later, Svarṇaparvata, Tāpi nadi, Kirātadeśa and Yavanadeśa are seen mentioned

1. *Dept. of PG studies in Bhaishajya Kalpana, SDM college of Ayurveda, Kutpady, Udupi, Karnataka, India;* 2. *Dept. of Rasasastra and Bhaisajyakalpana, Center for Post Graduate Studies & Research in Ayurveda, Tilak Ayurved Maha Vidhyalaya and STRC Hospital, Pune;* 3. *Dept. of P.G. studies in Samhita and Siddanta, SDM college of Ayurveda, Udupi*

to denote the occurrence of the svarṇamākṣika.[10] The svarṇamākṣika available in Kanyākubja is considered as superior quality and the other rajatamākṣika occurring near Tāpi river inferior one.[11] Today, procurement of svarṇamākṣika is mainly done from Rajasthan (Khetri copper mines).[12] On comparison of the old Indian Geographical map (during the Rasa-granthas period) with the present available map, it is understood that both copper and gold mines are found in the East Singhbhum (yavana). (Table 1)

Based on colour:- Colour also plays an important role in identification of a material. Some references indicate the colour like honey and gold. The one which is having nine colours is considered as superior quality and available at Kanyākubja and the other having five colours considered of inferior quality, available near Tāpi river.[13] Externally, black with many colours and golden colour lines are seen when broken into pieces. The svarṇamākṣika having many colours is considered to be superior.[14]

Upadhātu and anukalpa of svarṇa: - Svarṇamākṣika is considered as upadhātu of svarṇa and it is used in case of non-availability of svarṇa.

Based on test:- Appearance of black colour when rubbed on the palm and appearance of golden line when rubbed on touch stone is one of the criteria for superior quality.

Svarṇamākṣika contains gold (collected from Karnataka - Hatti gold mine) found passed all the tests which are mentioned in Rasagranthas except more silica content. (Fig Ia-f) The svarṇamākṣika containing gold is called Auriferous Copper Pyrite.[15] Tests for acceptance of svarṇamākṣika collected from Rajasthan-ketri copper mine and Karnataka- Hatti gold mines are shown in Table 2.[16-18]

Based on gold and other contents:- As per Āyurveda Prakaśa, a small quantity of gold is present in the svarṇamākṣika.[6] It not only having small quantity of gold, but is a combination of other constitution too[6] like iron, copper, sulphur, etc.[8] EDAX Analytical report[19] indicating the presence of gold in svarṇamākṣika collected from gold mine (Karnataka- Hatti) is shown in Fig II.

Conclusion

Identification of drugs is important in any

TABLE 1
Comparison of svarṇamākṣika occurrence in India

Place of copper ores		According to classical text
Jharkhand - *East. Singhbhum*, Hazaribag, Gaya, Palamu.	Jharkhand - *East. Singhbhum*,	Jharkhand - *Yavana* (*East. Singhbhum*)
Rajasthan - Jaipur Jhunjhunun, Sikar, Alwar, Ajmer, Pali, Sirohl, Udalpur, Dungarpur, Chittaurgarh, Bhallwara.	Karnataka - Raichur, Kolar	Uttar Pradesh - kanyaakubja (Kannunj)
Madhyapradesh- Berul, Balaghat	Andra Pradesh - Chitoor	MadhyaPradesh-Tapateeteera (Berul, Balaghat? (Sourastra?), Nepal – kirata China

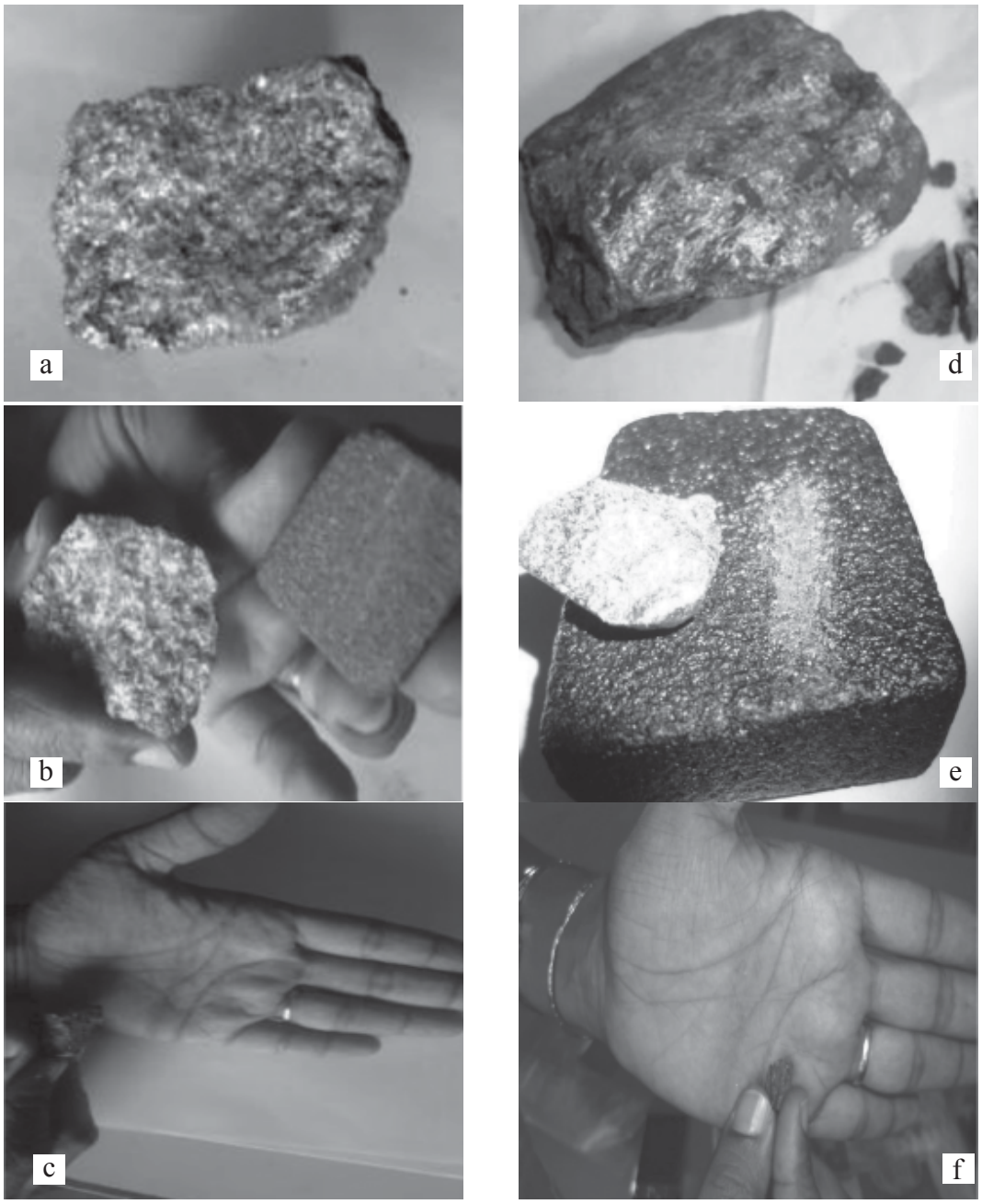

Fig. I a-f : Tests for acceptance of svarnamaksika
a-c Svarnamaksika collected from gold mine (Karnataka- Hatti gold mine)
d-f Svarnamaksika collected from copper mine (Rajasthan-ketri copper mine)

pharmaceutical preparation. Copper pyrite is recognized as svarṇamākṣika; however, it is commonly mistaken as Iron pyrite. Presence of gold in svarṇamākṣika was known to the ancients and they also stated to use this mineral as a substitute to gold wherever is required. The Copper Pyrite containing gold as trace element is called as Auriferous Copper Pyrite.[15] Auriferous Chalcopyrite is the better option for medicinal use than Chalcopyrite.

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TABLE 2

Grāhya and agrāhya lakṣṇas of svarṇamākṣika collected from copper and gold mines

Grāhyalakṣaṇa	Agārhya lakṣaṇa
1. Collected from Rajasthan - ketri copper mine:	
- Produces black colour when rubbed on palm - Apperance of bule and gold colour when broken - Golden colour with black on external apperance - No angles	- Light weight - Looks like iron - Having more silica part - Does not produce gold colour line when rubbed on touch stone
2. Collected from Karnataka - Hatti gold mines:	
- Produces black colour when rubbed on palm - Produce gold colour line when rubbed on touch stone, indicating the gold content - Apperance of bule and gold colour when broken - Golden colour with black on external apperance - No angles - Heavy in weight	- Having more silica part

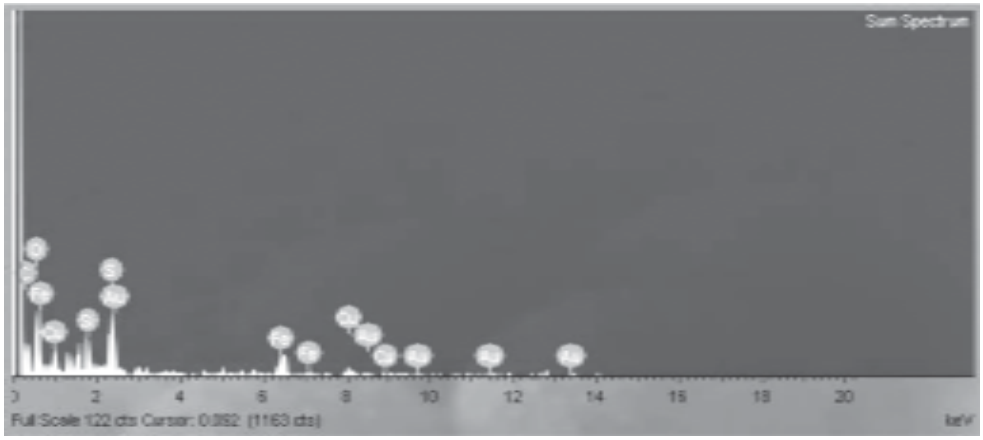

Fig. II. EDAX Analytical report indicating the presence of gold in Svarṇamākṣika collected from gold mine (Karnataka- Hatti gold mines)

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SĀRASVATACŪRṆA AND SPEECH THERAPY IN THE MANAGEMENT OF GADGADA - A COMPARATIVE STUDY

Ravishankar K[1], Chandrakanth Joshi[2] and Akhilesh P.M.[3]

Abstract: Speech development is a critical barometer of both cognitive and emotional development. Language development occurs most rapidly between 2 to 5 years of age. During this period of learning of speech, usually child begins repetition of consonants, often followed by repetition of words. Stuttering is major problem of children as it can lead into disability in later ages. In modern system of medicine, there is no solution and no specific drug for stuttering other than speech therapy. This clinical study was aimed to see the efficacy of Sārasvatacūrṇa and to compare the efficacy with that of Speech Therapy. Both Sārasvatacārṇa and Speech Therapy found to be equally effective in stuttering.

Introduction

Speech is the ability to convey thoughts, ideas, or other information by means of articulating sound into meaningful words.[1] Fluent speech is essential for psychological development of the child and for proper convey of thoughts. It enables one person to convey knowledge to a roomful of other people.

How the humans evolved to have the ability to talk while our close cousins, the great apes, have not? No definite answer can be given to that question though theories have been put forth. One widely accepted theory has to do with the human's assumption of an erect (standing) position and the change that this brought to the anatomy of the skull. The most important change wrought by humans' upright stance is the position of the larynx in relation to back of the oral cavity. As man became erect his larynx moved deeper into the throat and longer resonating cavity that is responsible for the low vocal tones that man is capable of sounding. A more sophisticated auditory center provided the means by which speech by others of the same species could be recognized. Over time, and with greater control of the articulating surfaces, consonant sounds were added to the vocabulary.[2]

Any fluent problem in speech will create a disturbance in the emotional and social behavior of the children. The present study was taken on fluency disorder of speech i.e. stuttering in children, a most trouble shooting problem in childhood that can leads to the disability in the

1. *PG Dept. of Kaumarabhritya, SDM College of Ayurveda & Hospital, Kuthpady, Udupi, Karnataka.*
2. *Dept. of Prasootitantra & Streeroga, Bapuji Ayurveda Medical College, Shivamogga, Karnataka.*
3. *Father Muller College of Speech & Hearing, Mangalore, Karnataka*

later ages.[3] Speech therapy[4] has different modeling techniques for attainment of fluency in speech. The descriptions of disease in classics are found to be very minimal.

Speech pathologies are grouped into three categories - dysfluency, articulatory problems and voice disorders.[5] Stuttering is the dysfluency type of speech pathology characterized by repetition of syllable or word, block, prolongation, hesitations, hard contacts associated with physical concomitants.[6]

Āyurveda classifies speech problems into three categories mūka, minmina and gadgada. These are considered as the vātavyādhis.[7] The āvaraṇa pathology is specifically mentioned for gadgada where kapha does the āvaraṇa for vāta in śabdhadhamani.[7]

Objectives:- 1) To evaluate the efficacy of Sārasvatacūrṇa in the management of gadgada; 2) to compare the efficacy of Sārasvatacūrṇa and speech therapy in the management of gadgada.

Material and methods

44 children with the complaints of dysfluencies were selected and categorised into 2 groups i.e., Group A and Group B containing 22 children in each group.

Source of data:- Kaumārabhṛtya OPD, Alva's Ayurveda Medical College & Hospital; and Marthoma College of Special Education Hospital OPD, Cherkala, Kasaragod.

Inclusion criteria

- Age group between 7 - 16 years
- Having symptoms of developmental stuttering
- Showing features of dysfluencies i.e. a) repetition of syllables/words, b) prolongations, c) silent pauses, d) hesitation, e) hard contacts, f) physical concomitants

Exclusion criteria

- Below 7 and above 16 years of age
- Congenital abnormalities
- Acquired neurological stuttering
- Psychogenic stuttering
- Mental retardation
- Systemic diseases which interfering with the course of treatment.
- Cluttering.

All the children were assessed by standard international method SSI-3 (Stuttering Severity Index-3).

Sārasvatacūrṇa

The cūrṇa was prepared in Alva's Pharmacy, Mijar, Moodbidri. Sārasvatacūrṇa is referred to in Gadanigraha, Cūrṇādhikara.[8] It contains ingredients of the following combination: 1) kuṣṭha (*Saussurea costus*), 2) aśvagandha (*Withania somnifera*), 3) saindava (rocksalt), 4) pippali (*Piper longum*), 5) marica (*Piper nigrum*), 6) jīraka (*Cuminum cyminum*), 7) kṛṣṇajīraka (*Carum carvi*), 8) śuṇṭhi (*Zingiber officinale),* 9) pāṭa (*Cissampelos pariera*), 10, ajamoda (*Apium graveolens*) and 11) vaca (*Acorus calamus*).[9] [Quantity - Vaca 10 parts; all the remaining drugs 1 part each.] The cūrṇa is prescribed to administer with madhu and ghṭṛa.[10]

Intervention

Group 'A' were administered with Sarasvata-curna 2gm (for <10yrs), 3 gm (for >10yrs) along with unequal quantity of honey and ghee, in the morning before food. Children in group 'B' underwent speech therapy which included relaxation and breathing techniques, Metroneme and Stabilization. Complete history and clinical

examination of all the children were carried out and recorded in a specially designed proforma.

Duration of the study

Children of both the groups were advised to continue treatment for 4 months and advised to come for observations every month. Assessment was done before, during and after the treatment. 1 month follow up was done for both the groups.

Observations and results

Out of 44 children, 2 were dropped out (1 from each group) as they did not continue the treatment. The remaining 42 children were constituted 21 in each group. The demographic data such as age, sex, symptoms of stuttering and other parameters are shown in Table 1&2

Effect of the trial drug:- Sārasvatacūrṇa[11] group showed highly significant result (P<0.001) in repetition, prolongation, block, hesitation and physical concomitants. Test showed moderate significance (P <0.02) in hard contacts. The overall effect of Sārasvatacūrṇa on stuttering (SSI-3 grade) was highly significant (P<0.001). (Table 3)

Effect of speech therapy:- This group showed highly significant result (P<0.001) in repetition, prolongation, block and physical concomitants; also significant result (P<0.05) in hesitation and hard contacts. The overall effect on stuttering (SSI-3 grade) was highly significant (P<0.001). (Table 4)

Comparison:- The test group showed highly significant (P <0.001) result on repetition and prolongation. On the mean of difference of two groups, it was concluded that the speech therapy was more significant. Test was insignificant (P>0.05) in block, hesitation and hard contacts. This shows that there was no

TABLE 1
Distribution of subjects according to age, sex, symptoms and other parameters

Parameters	No	%
1. Sex		
- Male	35	83.33
- Female	7	16.67
2. Age (years)		
- 6-8	8	19.05
- 8-10	8	
- 10-12	3	7.14
- 12-14	5	11.90
- 14-16	18	42.86
3. Other parameters:		
- With psychological problems	5	11.90
- Without psychological problem	37	88.10
- School going	38	90.48
- Non school going	4	9.52
- School performance:		
- Good	17	40.48
- Average	17	40.48
- Poor	8	19.04
- Family history of suttering	12*	23.57
- To consanguineous parents	3	7.14
- With delayed in developmental milestones	9	21.43

*7 in group A and 5 in group B

TABLE 2
No. of children with symptoms of stuttering in each group (n=42)

Parameters	Group A		Group B	
	No.	%	No.	%
1. Repetition	21	100	21	100
2. Prolongation	8	38.1	7	33.33
3. Block	16	76.19	12	57.14
4. Hesitation	5	23.81	4	19.05
5. Hard contacts	5	23.81	5	23.81
6. Physical concomitants	17	80.95	15	71.43

TABLE 3
Effect of the treatment in group A (Sārasvatacūrṇa)

Parameters	Mean X	SD	SE	't'	P
1. Repetition	4.0	3.755	0.8194	4.8816	<0.001
2. Prolongation	1.375	0.5175	0.1830	7.5151	<0.001
3. Block	4.0625	3.1722	0.7931	5.1226	<0.001
4. Hesitation	1.8	0.4472	0.1999	9.0004	<0.001
5. Hard contacts	6.0	3.0822	1.3784	4.3529	<0.02
6. Physical concomitants	1.4118	0.5073	0.123	11.4745	<0.001
7. SSI-3 Grade	1.0476	0.4976	0.1086	9.6478	<0.001

TABLE 4
Effect of the treatment in group B (Speech therapy)

Parameters	Mean X	SD	SE	't'	P
1. Repetition	9.5714	4.915	1.0725	8.9332	<0.001
2. Prolongation	5.1429	1.215	0.4592	11.1992	<0.001
3. Block	6.250	4.0028	1.1555	5.4028	<0.001
4. Hesitation	3.0	1.6330	0.8165	3.6742	<0.05
5. Hard contacts	3.0	1.8708	0.8366	3.5858	<0.05
6. Physical concomitants	2.2	1.1464	0.296	7.4325	<0.001
7. SSI-3 Grade	1.1429	0.4781	0.1043	10.9547	<0.001

difference in the effect of treatment in both the groups on block, hesitation and hard contacts. The test was moderately significant (P<0.02) on physical concomitants. It implies there was slight difference in the effect of both the treatments. Test was insignificant (P>0.05) on overall assessment (SSI-3 grade) (Table 5). The effect of the treatment in stuttering severity, and the overall effect in both the group are shown in Tables 6&7.

TABLE 5
Inter group comparison

Parameters	Mean diff.	SE	't'	P
- Repetition	5.5714	1.3497	4.1279	<0.001
- Prolongation	3.7679	0.4703	8.0117	<0.001
- Block	2.1875	1.3545	1.615	>0.05
- Hesitation	1.2	0.7521	1.5955	>0.05
- Hard contacts	3.0	1.6124	1.8606	>0.05
- Physical concomitants	0.7882	0.3069	2.5683	<0.02
- SSI-3 Grade	0.0953	0.1505	0.6332	>0.05

Conclusion

Gadgada and stuttering can be correlated by observing the causative factors, symptomatology and characteristic features such as lupta pada or vyañjana, etc.

Sārasvatacūrṇa having tīkṣṇaguṇa; tikta, kaṭu rasa; uṣṇavīrya; kaṭuvipāka; and medhya-vāta-kaphaśāmaka action, is useful in samprāpti vighṭana of gadgada. Vaca, being the main ingredient of the trial drug, acts on speech mechanism by which it improves the fluency. Comparatively, both speech therapy and Sārasvatacūrṇa showed equal results as per

TABLE 6
Overall relief in both groups

% of relief	Relief	No. of children	
		Group A	Group B
0 and <25	No relief	2	1
>25	Mild relief	14	15
>50	Moderate relief	4	5
>75	Good relief	0	0
100	Excellent relief	1	0

TABLE 7
Effect on stuttering severity in group A

Stuttering severity	BT		DT		AT	
	No	%	No	%	No	%
1. Mild	5	23.81	10	47.62	13	61.90
2. Very mild			1	4.76	4	19.05
3. Moderate	13	61.90	8	38.10	13	61.90
4. Severe	3	14.29	2	9.52		
5. No symptom					1	4.76

BT = Before treatment; DT - During treatment; AT - After treatrment

clinical and statistical analysis.[10] Both treatments found equally effective in stuttering.

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LEPA KALPANA - A COMPREHENSIVE REVIEW

Jayakrishnan. P.S., Rohini D. Bharadwaja and Reghuveer*

Abstract: Lepa, an important bahiparimārjanacikitsa, helps in pacifying the vitiated doṣas locally situated in the bāhyarogamārga. Lepas are semisolid preparations intended for external application to the skin or certain mucous membranes for emollient, protective, therapeutic or prophylactic purpose. The active ingredients penetrate the skin either via transepidermal or transfollicular pathways.

Introduction

Skin, having a surface area of 1.6 - 2 m^2 is a fascinatingly complicated system, designed to protect against external harms (bacteria, UV radiation, etc) regulate body heat, and manage nutrient levels and water loss. The active ingredients in the lepa formulation penetrate the skin either via transepidermal or transfollicular pathways. Lepas are intended for local effect but they also cause systemic effects. It is called 'kalimbu, mezhugu or vannai' in Siddha; merham or jimad in Unani and commonly told as paṭṭu or pūccu in Malayalam.

Definition: - One which is sticking to the body is called lepa.[1a] Drugs which are grinded with or without a liquid media and made to paste over the body is called lepa.[2]

Synonyms: - Alepa, lipta, lepa and lepanam.[1a] Types of lepa according to various texts are as follows:

- Śusrutasamhita - pralepa, pradeha, alepa
- Aṣṭāṅgasaṅgraha - Snaihika, nirvāpana, prasādana, sthambhana, vilayana, pācana, pīḍana, śodhana, śoṣaṇa and savarṇīkaraṇa
- Śārṅgadharasamhita - Doṣaghna, viṣaghna, varṇya

Śusrutasamhita[3a]

- Pralepa:- Cold in nature, applied as a thin coat, allowed to dry or not and is indicated in pittadoṣapradhāna tvakrogas.
- Pradeha:- Applied either uṣṇa in vātakapha conditions or śīta in pitta conditions. It is allowed not to get dried. It does śodhana, ropaṇa and vedanāpaha of śopha. It can be used in swelling with or without wound. Kalka, when used in wounds stops the srava, causes mṛdutva, does māmsa apakarṣaṇa and vraṇaśuddhi and hence called as nirudha ālepana.
- Ālepa:- In between the above two and used in raktapittādhika and avidagdha śopha. It is tridoṣaśasamana, dāhakaṇḍu rujāpaha and tvak prasādakara. It is used in śodhana of doṣas in marma and guhyadeśa.

Aṣṭāṅgasaṅgraha

Vāghbaṭa has explained mukhalepa in Sūtrasthāna while explaining Gaṇḍūṣavidhi; 3 types are explained viz. doṣaghna, viṣaghna and

*Department of Rasasastra and Bhaishajyakalpana, K V G Ayurveda Medical College, Sullia, Karnataka.

varṇya.[4a] Pradeha and pralepa are referred to in Vraṇapradhiṣedha adhyāya. Application of kalka is advised in conditions where wounds are present. Here he explains 10 types of ālepa[4b] viz. snaihika (in vātikaśopha), nirvāpaṇa (in pittaviṣakṣāra and agnijanyavraṇas), prasādana (to remove vraṇāntaraduṣṭi), stambhana in rakta stambhana), vilayana (in kapha-medo śopha), pācana (in pācana of śopha), pīḍana (drugs of rūkṣa picchila dravyas are used here), śodhana (for śodana of vraṇas), ropana (in vraṇa śoṣaṇa) and savarṇīkarana (to regain the normal texture of skin).

Śārṅgadharasamhita[1b]

- Doṣaghnalepa (¼ aṅgula thick):- Śothādi roga nāśanam - Daśāṅgalepam, Jaṭāmayādi lepam, Nagarādi lepam, Gṛhadhūmādi lepam, Arśohara lepam, etc.
- Viṣaghnalepa (⅓ aṅgula thick):- Bhallātakādi viṣanāśanam - tila + goat's milk+ghee, nimbapatra, Vilvādi gulika, haridra, etc.
- Varṇyalepa (½ aṅgula thick):- Mukha varṇyakaram vyaṅganāśanam - rakta-candana, haridra, mañjiṣṭha, etc.

Aṣṭāṅgahṛdaya[5a]

Vāghbaṭa has explained mukhalepa particularly in Sūtrasthāna. Application of uṣṇa mukhalepa is indicated in patients of vāta-kapha disorders. Atyarthaśītaḷa lepa is indicated in all other conditions. 3 types are explained i.e. a) doṣahara (¼ aṅgula), b) viṣahara (⅓ aṅgula) and c) varṇakṛt (½ aṅgula).

Preparation

Classical preparation of lepa is explained to be made by grinding the wet drugs using the stone. If the drug is dry, suitable dravadravya has to be added. Selection of base is very important in the preparation of lepa. Milk, butter, ghee, oil and other unctuous stuffs are used as bases to prepare varṇyalepa; e.g. Śālmalīkaṇṭakalepa. Ciñcapatrasvarasa, amḷa kañji, gomūtra, nimbu svarasa are also used as base depending upon the condition.

Mode of application

It is advised to apply lepa in the pratiloma direction to enter its potency into romakūpas. It is said that lepa soaked for long time is not good for application; and that never allow lepa to get dry[3c] (except in vraṇapīḍana), else its effect would diminish and cause pain. It is said that application of lepa on the same layer i.e. without removing the earlier one, causes rise in temperature, vedana, dāha and ghanatva. Śuṣakalepa has no potency hence should not be reused; and it should be removed only after making it ārdra.[3b&c] After removal, application of a little oil and a slight massage are advised.[5b]

Thickness of lepa

Śārṅgadhara has advocated one fourth, one third and half anguli thickness of application for doṣaghna, viṣaghna and varṇya lepa respectively; whereas Śusruta opines that the thickness should be equal to the thickness of a wet buffalo's skin[3b] i.e. 4-5 mm approximately. Lepa having thickness less than 4-5 mm is considered as 'thin lepa' and greater is considered as 'thick lepa'. Caraka has stated that when uṣṇa action of a drug is expected, the application should be thick; whereas in śīta (softening and soothing), the application should be thin.[6a] Lepas should be applied uniformly.

Time of application

Pradeha should be applied in day time in diseases which are cured. In conditions of pitta, raktābhighāta and viṣa, day time is better. Night time is preferred in conditions like apakvaśopha, gambhīraśopha and raktaśḷeṣma-samudbhava śopha; in other cases, application night time, causes rogavriddhi.[1c]

Precautions

The lepa material should be extremely fine; and fresh drugs should be used to get the advantage of volatile oil contents. If a lepa is prepared with a base of bad odour, some non-irritating and soothing aromatic materials of herbal origin have to be added to counteract the bad odour. It should cover the skin so as to produce sufficient skin hydration which helps skin permeation of the drug.

Shelf-life

If a freshly prepared lepa contains herbal or animal origin drugs, it should be used within 24 hours, otherwise the drugs get decomposed and the application may harm the skin. If a lepa is prepared out of mineral and metallic drugs, the drugs do not have any expiry period. Now a days, lepas are prescribed in the form of cūrṇas or gulikas (having more shelf life) to be mixed along with suitable base. Except sikta, ghṛta and taila, all other āyurvedic bases have propensity to go rancid within 24 hours.

Probable mode of action

Lepas are having pārthiva amśa more. It is told to be applied in pratilomagati to reach all the romakūpas. These romakūpas are originated from the 4 dhamanis which are tiryakgata, which in turn divide into thousands of small ones and become innumerable.

Advantages

- It can be applied directly at the site of action; and removed if any irritation exists.
- Avoidance of gastro-intestinal incompatibility
- Provide suitability for self-medication.
- Easy to dispense.

Disadvantages

- Drugs of larger particle size not easy to absorb through the skin.
- Drugs like raktacandana, candana, etc. are very difficult to get powdered.
- Most of the lepa are applied with a base of bad odour (gomūtra, amḷa kañji, etc.) and some are irritants also.
- Application of lepas restrict the patients from freely moving around. Since lepas are not tied, they cannot go out from the home thus restricting social interactions.
- Application of mukha lepa gives the person an awkward look.

Importance

In the context of śophacikitsa, lepa is considered very important and is regarded as the first line of treatment.[3a] Just like agni gets extinguished (śānta) on pouring water, doṣa gets pacified after lepana.[4c] In all the aspects of śophacikitsa viz. śodana, ropana, utsadana, etc., lepa plays an important role.[3d]

Clinical practicing

Kalka is the only one pañcavidha kaṣāya kalpana used in lepakalpana. Lepas are having pārthiva amśa more; basically lepa can prescribe to use in two forms in clinical practice i.e. solid and liquid form.

Solid form is prescribed as cūrṇa or gulika, which is advised to apply along with water, sneha or other suitable bases. Liquid form is medicated oils, ghee or emulsions, which is administered by mixing with some powders viz. rice flour, etc. depending upon the condition of the patient.

Advances

Ointments:- These soft semisolid preparations used for external application or mucous membrane can be correlated to malahara kalpana.

Malahara kalpana:- Malahara kalpana is basically evolved from lepakalpana. All lepakalpanas are not malaharas but all malaharas can be classified under lepas. In our classics

even though the word malahara is not described, drugs like sarjarasa, madhucchiṣta, etc. has advocated in the preparation of external applications (like tailas and ghṛtas) to get a semisolid consistency. The derivation of the term malahara is believed to be from Unani system of medicine. It is coined form a Persian word malham. Piṇḍataila mentioned in vāta-rakta cikitsa holds a good example here.[6a] The proportion of madhuciṣta can be varied to bring desirable changes in its consistency. Since Piṇḍataila is advocated in conditions where śīta guṇa is needed, its application as a lepa by increasing the proportion of madhucidṣta will accelerate its efficacy. Vipādikārighṛta taila mentioned in kuṣṭhacikitsa is also an example to this concept.[6b]

Discussion and conclusion

Lepa, an important bahiparimārjana cikitsa, helps in pacifying the vitiated doṣas locally situated in the bāhyarogamārga. In broad sense lepakarma is done in therapies like talam, biḍālakam, etc. Even in emergency conditions like viṣa, pakṣāghāta and sanyāsa the application of lepa is effective.

Śusruta's classification is based on the mode of applicability. Vāgbhaṭa mainly emphasizes on the guṇa and karma of lepas; whereas Śārṅgadhara classifies based on the specificity to certain diseases. Caraka has mentioned 32 pradeha yogas in the Sūtrasthāna. References to the use of lepa promoting varṇa are available from the Vedic period.

On judicious use, even the toxic drugs may be therapeutically utilized for the cosmetic purposes. The use of Haritālādi lepa is a proven example in conditions of Hirsuitism, induced by PCOD in women. It is proved to be safe, economic and effective treatment for facial hirsutism.[7] Application of Laṅgāli kalka as a lepa in the umbilicus to expel the foetus is a proven example for its systemic action.

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