Based on new NCISM syllabus for B.A.M.S. Second Professional

As per the competency-based Ayurveda Medical Curriculum

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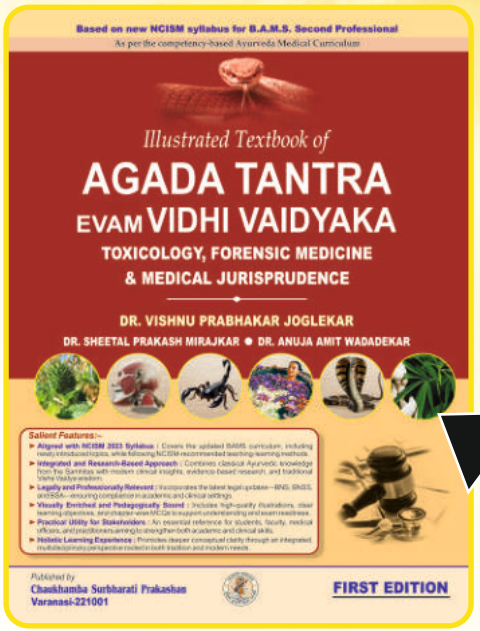

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Illustrated Textbook of

AGADA TANTRA EVAM VIDHI VAIDYAKA

FIRST EDITION

TOXICOLOGY, FORENSIC MEDICINE & MEDICAL JURISPRUDENCE

DR. VISHNU PRABHAKAR JOGLEKAR

DR. SHEETAL PRAKASH MIRAJKAR • DR. ANUJA AMIT WADADEKAR

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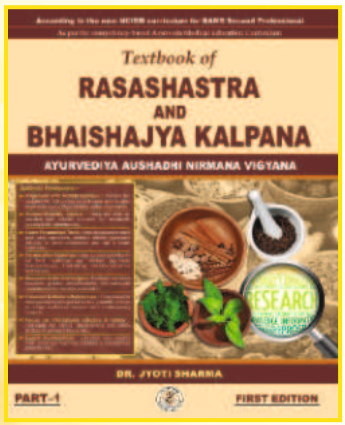
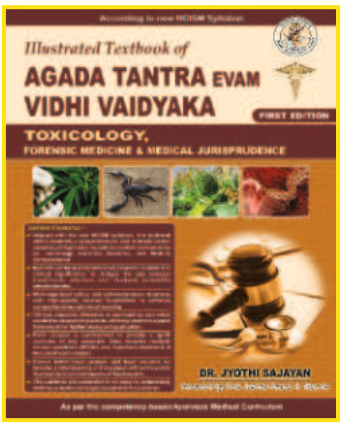
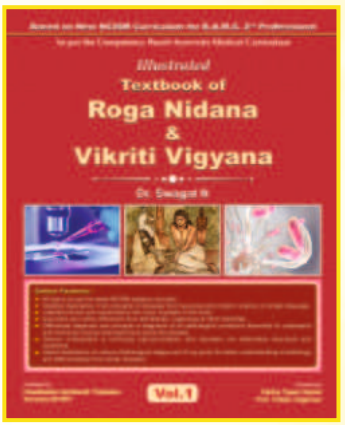
Dr. Vishnu Prabhakar Joglekar, is a distinguished and retired Professor of Ayurveda, formerly associated with Tilak Ayurved Mahavidyalaya, Pune. He holds an M.D. in both Kayachikitsa and Agadtantra and has dedicated his illustrious academic career to teaching a wide spectrum of Ayurvedic disciplines, including Sanskrit, Padartha Vijnan, Swasthavritta, Manas Roga, Research Methodology and Medical Statistics, as well as Medical Education Technology and Clinical Data Management.Widely regarded as one of the most renowned experts in Agadtantra in India, Dr. Joglekar is highly admired and respected across Ayurvedic institutions and departments nationwide. With a reputation for academic excellence and visionary leadership, he has served as a respected editorial and review board member for reputed journals such as J-AIM and JOAY. He was also the Executive Editor of the Textbook of Agadtantra, a landmark publication sponsored by the Ministry of AYUSH.A pioneering thinker in modern Ayurvedic education, he played a key role in designing the prestigious Vaidya Scientist Fellowship Program. He currently serves as an Advisor to the AYUSH Centre of Excellence at CCIH, Savitribai Phule Pune University, where he continues to inspire innovation and interdisciplinary research in Ayurveda. **He can be reached at <joglekar.vp@gmail.com>**

Dr. Sheetal Prakash Mirajkar (Koparde), working as Associate Professor in the Department of Agadtantra at Government Ayurvedic College, Dharashiv (Osmanabad), Maharashtra. She brings over 18 years of UG and 9 years of PG teaching experience and has served as a research guide for the past 9 years. She holds a B.A.M.S. and an M.D. in Agadtantra and is currently pursuing her Ph.D. at Tilak Ayurved Mahavidyalaya, under MUHS, Nashik.She received the Best Paper Presenter award for her study titled "*A Randomised Controlled Clinical Trial to Evaluate the Efficacy of Champak Agad in the Management of Dengue Fever*" at an international webinar hosted by Sri Sri College of Ayurvedic Science, Cuttack (September 2023). She also served as a Medical Officer at COVID Care Centers at Govt. Ayurvedic College and Terna Engineering College, Osmanabad.

Dr. Anuja Amit Wadadekar, is an Associate Professor in the Department of Agadtantra at PDEA's College of Ayurveda and Research Centre, Nigadi, Pune. She holds a B.A.M.S., an M.D. in Agadtantra, and is currently pursuing her Ph.D. at the College of Ayurved, Bharati Vidyapeeth (Deemed to be University), Pune. Her academic journey reflects a strong commitment to Ayurvedic education, particularly in the field of Agadtantra. Since December 2016, she has accumulated over 8 years of teaching experience and has served for 3 years as a research guide. She has also worked as a consultant in Agadtantra at Ayurved Rugnalaya, Sterling Multispeciality Hospital, Nigdi, with a clinical focus on skin and hair disorders. Dr. Wadadekar is known for integrating traditional Ayurvedic principles with practical clinical insights, making her contributions valuable to both students and practitioners. Her dual role as an academician and clinician allows her to offer a well-rounded and holistic perspective on Ayurvedic toxicology..







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- ŚĀRṄGADHARA SAṂHITĀ by ŚĀRṄGADHARA : Text with English commentary by Prof. Ravindra Angadi
- ŚĀRṄGADHARA SAṂHITĀ by ŚĀRṄGADHARA : Text with English commentary by Prof. R. Vidyanath
- BHAIṢAJYA RATNĀVALĪ by GOVIND DAS SEN : Text with English commentary by Prof. Ravindra Angadi (in two parts)
- A TEXT BOOK OF BHAIṢAJYA KALPANĀ (as per NCISM UG & PG Syllabus) by Prof. Ravindra Angadi
- A TEXT BOOK OF RASAŚĀSTRA (as per NCISM UG & PG Syllabus) by Prof. Ravindra Angadi
- MĀDHAVA NIDĀNA (AYURVEDIC DIAGNOSTICS) : Text with Madhukosh Sanskrit Tika and English commentary of Madhukosh along with Modern perspectives) : Translated by Kanjiv Lochan
- RASATARAṄGIṆĪ OF SADĀNANDA ŚARMĀ : Text with Descriptive English commentary by Prof. Ravindra Angadi

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Syllabus
Agad Tantra evam Vidhi Vaidyaka
(SUBJECT CODE : AyUG-AT)

Sr. No.	List of Topics	Term	Marks	Lecture hours	Non-Lecture hours
1.	**Concept of Agada Tantra (Clinical Toxicology)** 1.1 Agada Tantra and Clinical Toxicology 1.2 Scope of Agada Tantra 1.3 Definition of visha and poison, synonyms, visha guna, difference between visha, madya and oja guna, visha gati, classification of visha and poison, sthavara and jangama visha adhishtana. 1.4 Difference between poison, venom and toxin. 1.5 Routes of administration of poison. 1.6 Mode of action of visha (visha gunanusara karma) and poison (Introduction to toxico-kinetics). 1.7 Factors modifying the action of poison. 1.8 Visha vardhaka bhava and visha sankata. 1.9 Vishavega, vegantara and sthavara visha veganusara lakshana and chikitsa. 1.10 Visha peeta and vishamukta lakshana.	1	13	8	1
2.	**Visha Chikitsa (Management of Poisoning)** 2.1 Diagnosis of poisoning in living & dead. 2.2 Chaturvimshati upakrama. 2.3 General principles of management of poisoning. 2.4 Duties of medical officer in case of suspected poisoning.	1		5	4
3.	**Vishakta aahara parikasha and Viruddha ahara** 3.1 Sources of exposure of visha with contemporary relevance. 3.2 Vishakta aahara pariksha. 3.3 Adulteration and tests for its detection. 3.4 Techniques used in the detection of poisons. 3.5 Viruddha-ahara with contemporary relevance. 3.6 Food poisoning and amavisha.	1		3	2
4.	**Garavisha and Dushivisha** 4.1 Garavisha 4.2 Dushivisha 4.3 Contemporary aspects of garavisha and dooshivisha. 4.4 Role of garavisha and dooshivisha in the mani-festation of diseases 4.5 Research updates in garavisha and dooshivisha.	1	12	7	4
5.	**Visha Upadrava and diseases caused due to exposure to Visha/ poisons** 5.1 Visha upadrava 5.2 Drug-induced toxicity 5.3 Occupational hazards 5.4 Allergic mannifestation 5.5 Endocrine disrupters	1		4	2
6.	**Environmental Toxicology** 6.1 Vishakta Vayu, jala and bhumi (air, water and land pollution) 6.2 Effect of biological, chemical and nuclear warfare. 6.3 Ecotoxicology & biomagnification. 6.4 Toxicovigilance.	2		2	5

Sr. No.	List of Topics	Term	Marks	Lecture hours	Non-Lecture hours
7.	**Dermatological manifestation of visha/poisons.** 7.1 Contact dermatities and its management. 7.2 Sings and symptoms and management of abhyanga visha, leps visha, vastra visha, paduka visha, abharana visha etc. with contemporary relevance. 7.3 Signs and symptoms and management of dermatological manifestations due to cosmetics, chemicals, occupational and other allergens. 7.4 Dermatological manifestation due to dooshivisha and garavisha. 7.5 Dermatological manifestation due to bites and stings.	2	11	6	2
8.	**Therapeutic utility of Agada yoga** 8.1 Dooshivishari agada 8.2 Bilwadi agada 8.3 Dashanga agada 8.4 Murvadi agada 8.5 Panchashirisha agada 8.6 Vishaghna mahakashaya (Charaka Samhita) 8.7 Ekasara gana (Sushruta Samhita).	2		1	0
9.	**Sthavara visha - Poisons of Plant origin** 9.1 Cardiac Poisons - Vatsanabha, Karaveera, Digtitalis, Tobacco and Cerbera odollam. 9.2 Neurotoxic Poisons - Kupeelu, Ahiphena, Dhattura, Bhanga. 9.3 Irritant Poisons - Jayapala, Gunja, Bhallataka, Arka, Snuhi Langali.	2	17	4	2
10.	**Sthavara Visha - Poisons of Metallic origin** 10.1 Arsenci. 10.2 Mercury. 10.3 Lead. 10.4 Copper	2		4	2
11.	**Jangama Visha** 11.1 Sarpa visha 11.2 Loota visha 11.3 Vrischika visha 11.4 Mushika visha and its contemporary relevance. 11.5 Alarka visha and its contemporary relevane. 11.6 Keeta visha 11.7 Vector borne diseases.	2		10	6
12.	**Kritrima visha** 12.1 Inorganic Acids - Sulphuric acid, Hydrochloric acid, Nitric acid. 12.2 Organic Acids - Oxalic acid, Carbolic acid, Formic acid. 12.3 Alkalies - Potassium hydroxide and Sodium hydroxide. 12.4 Asphyxiants - Carbon monoxide, Carbon dioxide. 12.5 Non-metallic poisons - Phosphorous, cyanide 12.6 Hydrocarbons - Kerosene. 12.7 Agrochemical Poisoning - Organo-phosphorus compounds, Carbamates, Organo-chlorine Compounds, Aluminium phosphide. compounds, Aluminium phosphide. 12.8 Household poisons.	3		2	0

Sr. No.	List of Topics	Term	Marks	Lecture hours	Non-Lecture hours
13.	**Substances of abuse** 13.1 Madya and madatyaya, Alcoholism. 13.2 Addiction - Alcohol, Bhang, Opioids, Tobacco and Digital addiction. 13.3 Drugs of abuse -Lysergic acid diethylamide (LSD) and 3,4 - Methylenedioxy metham-phetamine (MSMA) 13.4 Narcotic Drugs and Psychotropic Substances (NDPS) Act.	3	12	4	3
14.	**Agada Tantra perspectives on cancer** 14.1 Toxic carcinogens. 14.2 Toxicities due to chemo and radiotherapy and its Ayurvedic approach. 14.3 Agada and visha dravya prayoga in the prevention and management of cancer along with its research updates.	3		2	4
15.	**Forensic medicine (Vyavahara Ayurveda) and Medical jurisprudence (Vidhi vaidyaka):** 15.1 Forensic Medicine and Medical Jurisprudence. 15.2 Introduction to Indian Penal Code, Indian Evidence Act and Criminal Procedure Code.	1	10	1	0
16.	**Vaidya sadvritta : Duties and Responsibilities of medical practitioner** 16.1 Vaidya sadvritta, medical ethics and code of conduct, Charaka oath and Hippocratic oath. 16.2 NCISM - constitution, objectives and functions. 16.3 Duties, right and privileges of a registered medical practitioner. 16.4 Consent, professional secrecy and privileged communication. 16.5 Professional negligence, professional mis-conduct and unethical practices. 16.6 Defenses in medical negligence suits. 16.7 Medical records. 16.8 Consumer Protection Act.	1		6	4
17.	**Legal Procedures** 17.1 Courts and their powers 17.2 Inquest, evidence and witnesses 17.3 Court procedures : summons, oath, recording of evidence and conduct money. 17.4 Conduct of a medical professional in the court of law.	1		4	4
18.	**Personal identity** 18.1 Identification data 18.2 Age 18.3 Race, religion and sex 18.4 Moles, tattoos, scars, occupational marks & hairs. 18.5 Hand writing, dactylography, DNA typing and superim posittion.	1		2	2
19.	**Thanatology** 19.1 Death 19.2 Signs of death. 19.3 Medicolegal autopsy and exhumation. 19.4 The Transplantation of Human Organs and Tissues Act (THOTA).	2		6	2

Sr. No.	List of Topics	Term	Marks	Lecture hours	Non-Lecture hours
20.	**Asphyxial deaths** 20.1 Hanging. 20.2 Strangulation and suffocation 20.3 Drowning.	2		4	2
21.	**Injury** 21.1 Basics of Injury 21.2 Mechanical Injury 21.3 Firearm Injury 21.4 Thermal Injury 21.5 Dowry death.	2	12	5	3
22.	**Pregnancy, delivery and abortion** 22.1 Medico-legal aspects of pregnancy, delivery, infanticide and battered baby syndrome. 22.2 Abortion, Medical Termination of Pregnancy (MTP) Act and Pre-Conception and Pre-Natal Diagnostic Techniques (PCPNDT) Act. 22.3 Medico-legal aspect of artificial insemination and surrogacy.	3	6	2	3
23.	**Sexual offences** 23.1 Rape 23.2 Medico-legal aspects of sexual offences 23.3 Protection of Children from Sexual Offences (POCSO) Act.	3		2	1
24.	**Forensic psychiatry** 24.1 Common symptoms associated with psy-chiatric disorders 24.2 Lucid interval 24.3 Civil and criminal responsibilities of a mentally ill person 24.4 Mental Health Act (MHA).	3		2	2
25.	**Forensic science laboratory** 25.1 Hierarchy and major divisions of forensic lab services. 25.2 Newer techniques and recent advances-polygraphy, narcoanalysis, DNA profiling.	3		1	0
26.	**Laws, Acts, Rules and Regulation** 26.1 Clinical Establishment Act 26.2 State AYUSH registration board rules and regulations.	3	7	3	2
	26.3 Medicare Service Persons and Medicare Service Institutions (Prevention of violence and damage of loss to property) Act, 2008. 26.4 Drugs and Cosmetics Act and Rules-Schedules related to poison. 26.5 The Occupational Safety, Health and Working Conditions Code, 2020 26.6 Employees State Insurance Act, 1948. 26.7 Rights of Person with Disability Act, 2016.				
Total Marks			**100**	**100hr**	**60hr**

Contents

List of Abbreviations

A.Hr.	-	Ashtanga Hrudya
A.Hr.Chi.	-	Ashtanga Hrudya Chikitsa sthana
A.Hr.Su.	-	Ashtanga Hrudya Sutra sthana
A.Hr.U.	-	Ashtanga Hrudya Uttar sthana
A.P.	-	Ayurveda Prakash
A.S.	-	Ashtanga Sangrah
A.S.Chi.	-	Ashtanga Sangrah Chikitsa sthana
A.S.Su.	-	Ashtanga Sangrah Sutra sthana
A.S.U.	-	Ashtanga Sangrah Uttar sthana
B.R.	-	Bhaishajya Ratnavali
B.R.R.S.	-	Bhruhat Rasa Raj Sundar
Bh.P.	-	Bhavprakash Nighantu
Bh.P./M.Kh.	-	Bhavprakash Nighantu - Madhyam Khand
BNS	-	Bharatiya Nyaya Samhita, 2023
BNSS	-	Bharatiya Nagarik Suraksha Samhita, 2023
BSA	-	Bharatiya Sakshya Adhiniyam, 2023
Ch.Chi.	-	Charak Samhita Chikitsa sthan
Ch.I.	-	Charak Samhita Indriya sthana
Ch.Ni.	-	Charak Samhita Nidan sthana
Ch.S.	-	Charak Samhita
Ch.Su.	-	Charak Samhita Sutra sthana
Ch.Vi.	-	Charak Samhita Viman sthana
CrPC	-	Criminal Procedural Code
D.N.	-	Dhanvantari Nighantu
H.S.	-	Harita Samhita
IEA	-	Indian Evidence Act
IPC	-	Indian Penal Code
K.Arth.	-	Kautilya Artha shastra
P.N.	-	Priya Nighantu
R. N.	-	Raj Nighantu
R.J.N.	-	Rasa Jala Nidhi
R.R.S.	-	Rasa Ratna Samuchchaya
R.S.S.	-	Rasa Sar Sangraha
R.T.	-	Rasa tarangini
S.S./ Su. Sa.	-	Sushruta Samhita
Sh. P.	-	Sharangdhar Samhita Purva Khand
Sh. S.	-	Sharangdhar Samhita
Su. Ch.	-	Sushruta Samhita Chikitsa sthana
Su. Sa. Ka.	-	Sushruta Samhita Kalp sthana
Su. Sh.	-	Sushruta Samhita Sharir sthana
Su. Su.	-	Sushruta Samhita Sutra sthana
Su. U.	-	Sushruta Samhita Uttar sthana
Y.R.	-	Yoga Ratnakar

1 Concepts of Agad Tantra (Clinical Toxicology)

1.1 Agad Tantra and Clinical Toxicology

Introduction to Agad Tantra

Agad Tantra is a branch of Ayurveda developed in ancient times for which recorded history is not available.

अगदतन्त्रं नाम सर्पकीटलूतामूषकादिदष्टविषव्यञ्जनार्थं विविधविषसंयोगोपशमनार्थं च। Su. Su. 1/8/6

This branch of Aayurveda is also known as —

- Visha Tantra
- Damshtra – chikitsaa
- Visha Vidyaa
- Visha Vaidyaka
- Visha gara vairodhika prashamana
- Jaangulika

The word Agad Tantra is derived from two words: Agada and Tantra. Agada itself is derived from the word Gada. The word Gada has two meanings: disease and poison. Agada means anything that conquers a poison, and Agada tantra is the system of knowledge for conquering poisons.

The word Visha has two different origins.

A substance that reaches to the farthest corners of the body is called Visha (from Vishvak - everywhere) and a substance which produces despair (from Vishaada - despair). Both descriptions fit poisons:

- Visha Vaidyaka is the science of the use of medicines to treat poisons.
- Damshtraa means fangs or poisonous teeth. As most of the poisoning in ancient times was from bites of poisonous snakes, this term was used to describe the science of toxicology.
- **Jangulika** is a term used by Kautilya in Arthashastra. A Jaanguli means a person who catches snakes and his tricks in trade were called as Jaangulika Vidyaa.
- Probably the description in Charaka Samhitaa is the most comprehensive. Visha means poison. Gara means a mixture of substances that have turned poisonous and Vairodhika means anything which produces a sensitivity reaction causing vitiation and mobilization of bodily humors or Doshas. A science, which deals with the treatment of all the above categories, is **Visha – Gara – Vairodhika Prashaman**.

Introduction to Clinical Toxicology

Toxinology or the identification and characterization of poisons is an area of study helpful in harvesting the wealth of India. Treatment of poisoning of both varieties, that is field treatment and hospital treatment, is essential in both rural and urban settings, as explained previously.

Every day new drugs are introduced into the market. Toxicity testing of these drugs is a large area of activity. Environmental toxicity is also a major area for students of Agadatantra. Scientific preparation and standardization of Agada drugs are areas of research. Conceptual research can be enhanced through the study of Agad Tantra.

Clinical toxicology involves the research, prevention, and treatment of diseases caused by chemicals, drugs, and toxins. Special attention is paid to levels of chemical exposure and the effects that exposure can have on people. Clinical toxicology is especially useful when dealing with people who are poisoned or have overdosed, so it is beneficial for medical professionals and first responders. Clinical toxicology can be broken down into two parts: clinical chemistry and toxicology.

Chemical compounds are all around us, from drugs to pollutants, and depending on the compound and dosage, they can have different effects. Clinical chemistry involves analyzing the composition of bodily fluids, using molecular diagnostics, and interpreting test results. It involves medical testing and using chemical processes to evaluate patient health. Clinical chemistry is used in both inpatient

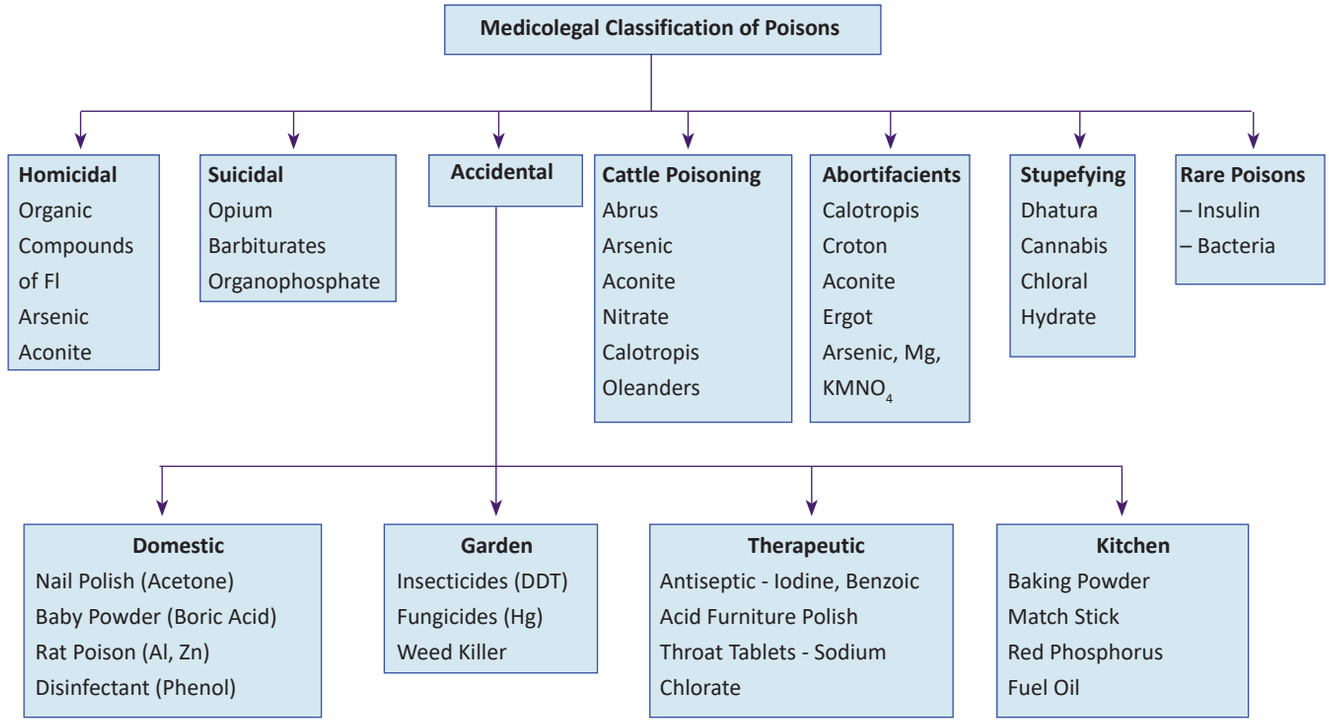


Chart No. 1.2

Table No. 1.6

Toxicity rating	Description	Fatal Dose range	Example
1.	Practically non toxic	>15gm/kg	Water
2.	Mildly toxic	5-15gm/kg	Ammonia
3.	Moderately toxic	500mg-5kg	NaOH
4.	Toxic	50-500mg/kg	Oxalic acid
5.	Highly toxic	5-50mg/kg	Mercury
6.	Super toxic	<5mg/kg	Phosphorus

Characteristics of suicidal poison

1. Vegetation- flora and fauna.
2. Cheap
3. Easily available
4. Easily mixed with foods and drinks
5. It must be pleasant in taste and smell
6. Fatal dose must be small and short
7. Must be painless and should be in comfortable zone.

Characteristics of ideal homicidal poisoning

1. Easily available, odourless, colourless, tasteless.
2. Easily mixed with food and drinks
3. Fatal dose- small.
4. The fatal period must be long because in homicide the culprit will always want to escape liability.
5. Absence of antidote.
6. Autopsy findings + laboratory methods should not be able to detect.
7. Symptoms as that of common diseases.

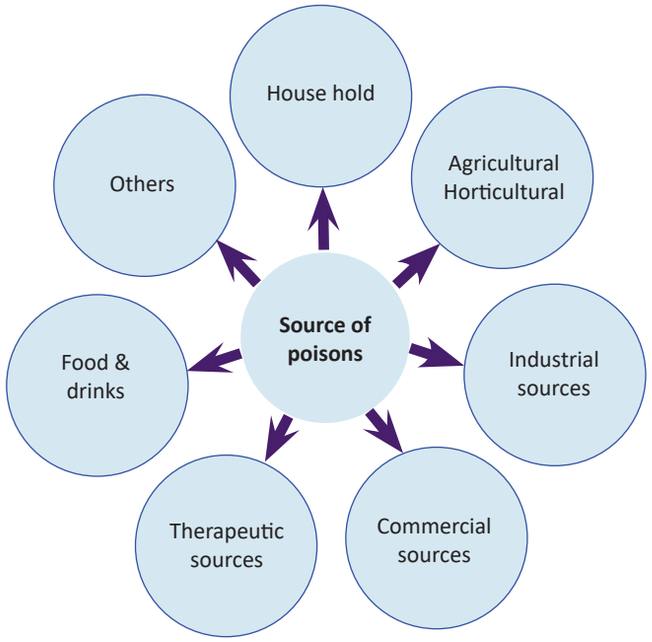


Fig. 1.3 : Sthavara and Jangama Visha Adhishthana

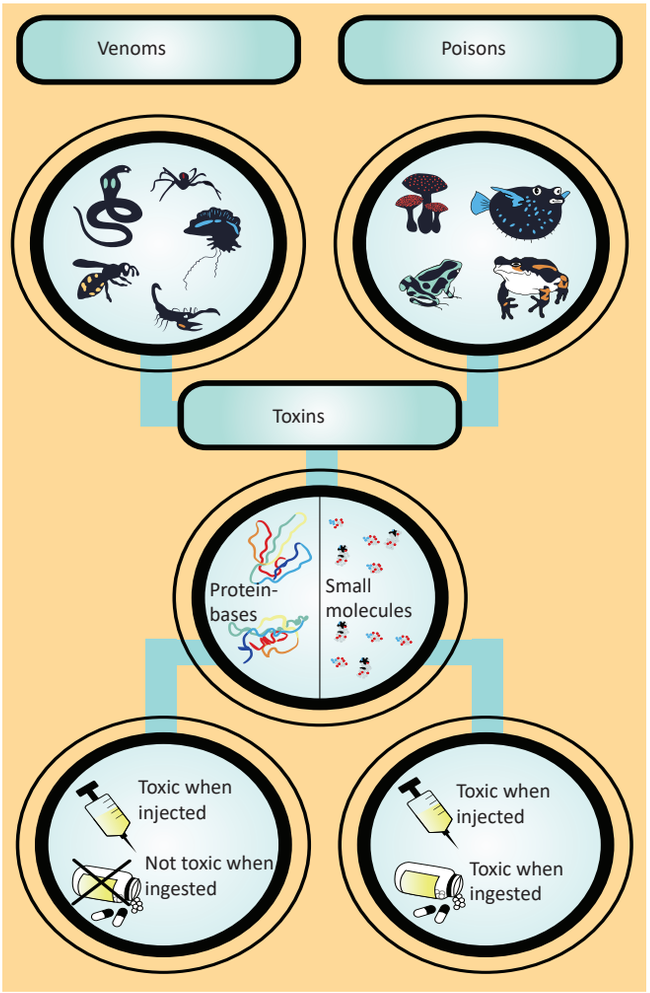


Fig. 1.4

'Poison is different as there is no wound involved. It can be absorbed into the bloodstream through the skin, inhaled or ingested,' he says.

Toxins are produced by numerous microorganisms and invertebrates as well as by higher plants and animals. Venoms are produced by many groups of animals, from coelenterates to vertebrates. While toxins and venoms are the primary toxicological concern in natural ecosystems, they are frequently of importance in agroecosystems and military deployments. They belong to a very large number of chemical classes and consequently are usually classified according to the groups of organisms producing them, for example, mycotoxins, algal toxins, and insect venoms. Plant toxins are representative of a larger group of phytochemicals known as secondary plant chemicals or plant allelochemicals. They may be acutely toxic, have chronic toxicity, or may be toxic at one dose but therapeutic at a lower dose. Some drugs of abuse are plant toxins abuse. A representative selection of the more important members of each category is provided.

1.5 Routes of Administration of Poison

Poisons can enter the body through various routes of administration. The route of exposure plays a significant role in determining the effects of the poison and the appropriate treatment.

A. Enteral Routes

1. **Oral:** It is the most commonly used method in which the poison is taken from the mouth. Poison taken from this route directly affects GIT, the upper respiratory tract, the stomach, and other organs.
2. **Sublingual:** In this method of administration, the poison is **placed beneath the tongue** and spread over the buccal mucosa (the lining of cheeks and the back of lips). It shows rapid absorption and directly passes into the systemic circulation.
3. **Rectal:** In this method of administration, the poisons are inserted into the anus where they are absorbed into the bloodstream directly through the mucous membranes.

B. Parenteral Routes - Routes other than enteral are called parenteral:

1. **Intravenous:** In this method of administration, the poison is injected into the body through **veins**, providing a direct route for the poison to get into the blood and thus circulate throughout the body very quickly showing the symptoms almost instantaneously leading to severe conditions and immediate death.

(See Fig. next page)

2. **Intra-dermal:** In this method of administration, the poison is absorbed through the **surface of the skin**. This is commonly found in cases of chronic poisoning. The release of poison in this method is slow and therefore it is not used in suicide and homicide.

2 Visha Chikitsa (Management of Poisoning)

2.1 Diagnosis of Poisoning in Living and Dead

An accurate diagnosis of poisoning is necessary for both treatment of poisoning and medicolegal aspects. Once accurate information is available about the type of poison, how much, how long ago, and in what way it has entered the body, it is possible to treat the patients properly. After the death of the patient, it is necessary to make a proper diagnosis of poisoning to meet various legal requirements. Along with this, the physician must know the purpose of consuming poison whether - the person has consumed the poison to commit suicide, another person has used the poison intending to kill him, or the poisoning has occurred by accident–for the fulfilment of legal formalities.

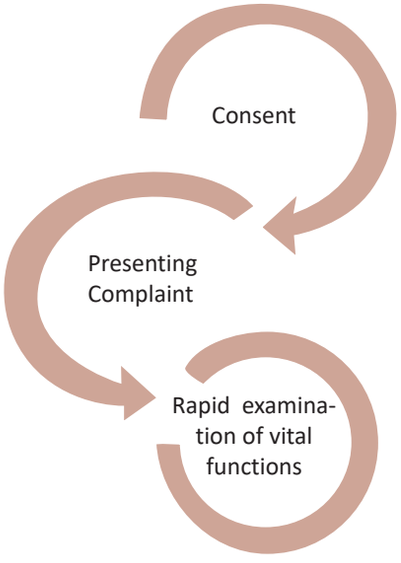


Chart No. 2.1

Diagnosis of poisoning in living

Any good registered medical practitioner should develop the skill to diagnose a case of poisoning. The process needs an integration of various components of information so that a working diagnosis is formed. As poisoning differs from diseases, the priorities in the case of poisoning are different from those in managing diseases.

A detailed or confirmative diagnosis can wait until the patient is stabilised for a detailed examination.

Patients will fall into two categories - as

Chart No. 2.2

High-risk Unstable Patients

We will deal first with high-risk unstable patients. Consent in such patients is somewhat tricky. If the patient is conscious, check if she/he is a major or minor. The major take his/her consent. If minor, take consent of the guardian. If the patient is unconscious, take the consent of the accompanying person and prepare an information sheet for police within an hour.

For high-risk unstable patients, the sequence is -

Here we will be dealing with only the assessment. Other two points will be addressed in point 2.2 on the treatment of poisoning.

For initial examination, the sequence of procedures should be as follows :

Mnemonic ABCDEFG

A. **Airways**
B. **Breathing**
C. **Circulation, Coma**
D. **Depression of C NS**
DEFG. **Don't Ever Forget Glucose**

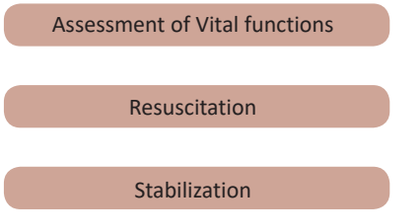


Chart No. 2.3

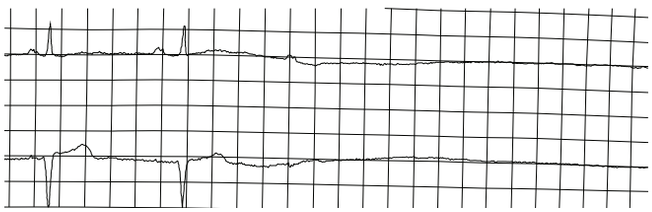
A. **Airways:** Ensure that airways are patent and air is reaching the lungs. For this, a mouth gag and tongue depressor can be used. Look for loose dentures or anything that can block airways. A skilled practitioner may use a laryngoscope and see that the vocal cords are intact and there is scope for air to enter the trachea.

B. **Breathing:** The simplest way to check breathing is to observe chest movements and feel the air at the nostrils. Both can be simultaneously achieved by keeping your cheek near the patient's nostrils while you are looking at the patient's chest horizontally. In this way, very small chest movements can be detected.

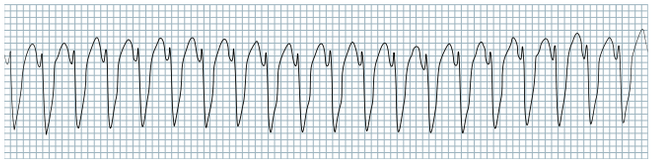
C. **Circulation:** Temporal pulse can be easily felt while you are looking for chest movements. Just put your fingers at the temporal region. Another quick sign to look for is cyanosis is at the tips of fingers for peripheral cyanosis and, if it is the tip of the tongue and lips for central cyanosis. In hospital settings, ECG is extremely useful for the detection of life-threatening arrhythmias where instant action can save lives.

Important arrhythmias are—

A. Asystole or cardiac arrest. ECG is flat

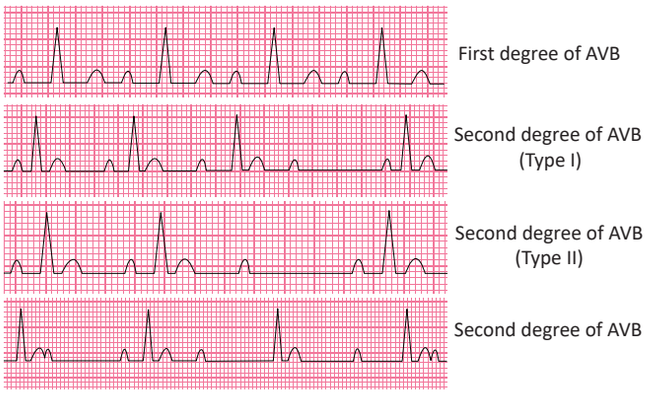


B. Ventricular Tachycardia

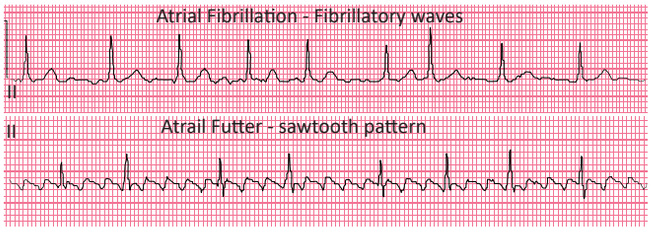


C. Ventricular Fibrillation

D. Heart Blocks



E. Atrial flutter and Tachycardia



F. Bradycardias and abnormal rhythms

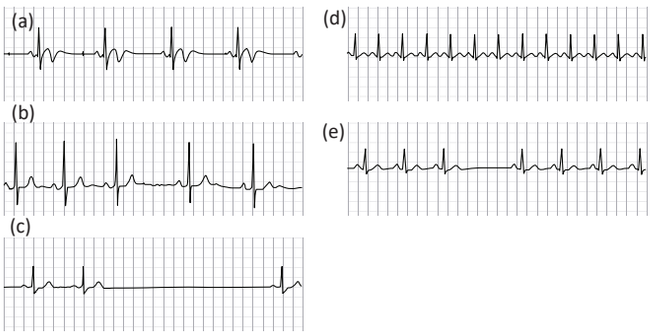
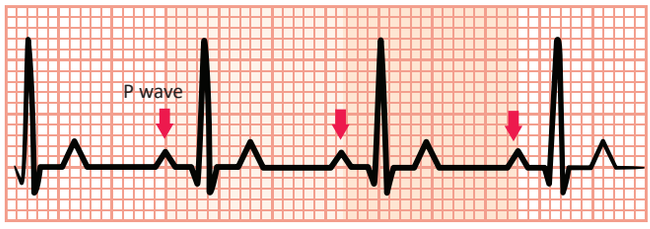


Fig. 2.1: a, b, c, d, e, f

a. Sinus bradycardia
b. Sinus tachycardia
c. Sinus arrhythmia
d. Sinus block
e. Sinus arrest
f. Ectopic beats

Normal sinus rhythm



Graph 2.1

iv. Scorpion stings, particularly Teekshna visha
v. Spider envenomation

22. **Chest cavity:** The smell of volatile poisons cyanogen, opium, etc. can be detected.
23. **Lungs:** Voluminous, congested, presence of Tardieu's spots. In case of asphyxiants and inhaled poisons. The cut section gives blood-stained frothy fluid in case of opium and other asphyxiants.
24. **Heart:** Presence of subendocardial haemorrhagic spots in cases of arsenic, phosphorus, mercuric chloride, etc.
25. **Brain and spinal cord:** Congestion and edema of brain and spinal cord in cases of cerebral and spinal poison (e.g. strychinine) respectively. Brain may be congested. Oedematous with occasional haemorrhagic points at places in cases of asphyxiant poisons.
26. **Uterus and Vagina-** Staining, congestion haemorrhage, ulceration in cases of attempted abortion by use of local abortifacient agents.

2.2 Chaturvimshati Upakrama 24 Modalities (चतुर्विंशति उपक्रम)

मन्त्रारिष्टोत्कर्तननिष्पीडनचूषणाग्निपरिषेकाः।
अवगाहरक्तमोक्षणवमनविरेकोपधानानि।।
हृदयावरणाञ्जननस्यधूमलेहौषधप्रशमनानि।
प्रतिसारणं प्रतिविषं सञ्ज्ञासंस्थापनं लेपः।।
मृतसञ्जीवनमेव च विंशतिरेते चतुर्भिरधिकाः।
स्युरुपक्रमा यथा ये यत्र योज्याःशृणु तथा तान्।।

Ch.Chi. 23/35-37

These are the 24 modalities described by Dridhabala in his Pratisanskarana of Charaka Samhita.

We will describe each of them and then summarize their actual utility in Vishachikitsa.

Table 2.4

मन्त्र	अरिष्ट	उत्कर्तन	निष्पीडन
चूषण	अग्नि	परिषेक	अवगाह
रक्तमोक्षण	वमन	विरेक	उपधान
हृदयावरण	अञ्जन	नस्य	धूम
लेह	औषध	प्रशमन	प्रतिसारणं
प्रतिविषं	सञ्ज्ञासंस्थापनं	लेपः	मृतसञ्जीवन

1. Mantra

Definition

Chanting of combination of consonants and vowels just like words in language.

But 4 things differ (SATS) –

- Stress on syllables
- Accent
- Tone and
- Style of pronunciation

Indication: Primary treatment of poisoning.

Contraindication: Non-availability of specialist.

Mechanism of action: Mantra creates a hope in the mind of stricken patients

Apparatus: Not specific

Procedure: Perfom pooja with:

- Gandha,
- Malya,
- Upahar,
- Bali,
- Japa and
- Homa.

2. Arishtabandhana

- **Definition:** Tying of tourniquet on extremities.
- **Indication:** 1.Immediately after venomous bites, 2. Only on extremities.
- **Contraindication:** 1. On head, neck or trunk, 2. After 100 mantra period.
- **Mechanism of action:** Delays systemic circulation of poison by mechanical obstruction.
- **Apparatus:** Mantra, bamboo string soft cloth or soft leather thong or soft tree bark, silk cloth.
- **Procedure:** Tie one of the above materials 4 fingers proximal to the bite, making sure it is not too tight or not too loose.

3. Utkartana

- **Definition:** Excision of bitten part is termed utkartana.
- **Indication:** 1. After arishtabandhan in venomous bites/stings, 2.Within 100 matra in bites/stings, 3. Only when bitten part is tip of finger or toe
- **Contraindication:** On marma points, joints and vessels.
- **Mechanism of action:** Incision at the site of bite facilitates easier removal of unabsorbed poison.

- **Contraindication:** In viper bite (Mandali sarpa)
- **Mechanism of action:** It produces blockage in capillary circulation. Prevents venom to enter systemic circulation.
- **Apparatus:** Suvarna Shalaka, Loha Shalaka, spindle of leaves of *Calatropis procera* dipped in clarified butter and rock salt (Patra pottalee).
- **Procedure:** Tip of heated Shalaka is touched to the site of bite till the signs of twaka dagdha is seen. Bite spot be burn with red-hot, iron or ember from burning red hot tip of log.

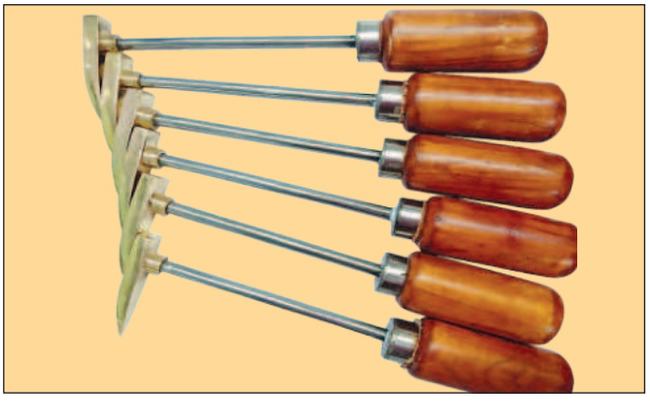


Fig. 2.9 : Agnikarma shalaka

7. Parisheka

- This procedure involves washing of affected area with running plain water or medicated water, which can be cold, warm, lukewarm or bearably warm depending on the condition of patients.
- In snake bite affected part, even organ can be irrigated with water medicated with Chandana and Usheera.

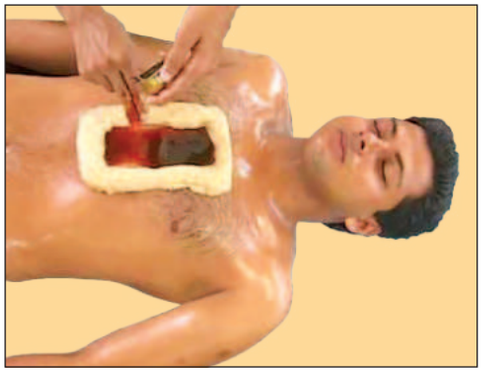


Fig. 2.10 : Parisheka

8. Avagaha

- **Definition:** Bathing of a part or whole body in a tub.
- **Indication:** 1. Animate and inanimate poison. 2. Presence of severe pain or pain caused by retention of urine.
- **Contraindication:** Not any mentioned in Ayurvedic text.
- **Mechanism of action:** Same as parisheka but sustained for long time. Hot avagaha for symptomatic treatment of coldness of limbs/body.
- **Apparatus:** Tubs of various size.
- **Procedure:** Affected parts or whole body should be imersed in appropriate decoction for one muhurta (24 min).

Fig. 2.11 : Avagaha

Emergency measures or care of vital functions: In modern medicine the same principle is followed and 1st things to be checked are ABCDEFG —

- Airways
- Breathing
- Circulation and Coma
- Depression of CNS.
- Don't Ever Forget Glucose

Primary evaluation is done while the resuscitation efforts are going on.

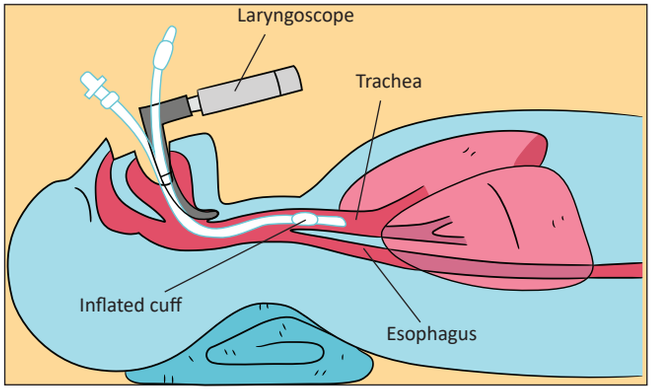


Fig. 2.17 : Endorauneal intubation

In case of drowning, water from stomach and respiratory tract is removed by putting the patient in prone position and exerting pressure on abdomen.

For Airways patency they are :

1. Cleaned with a moist cloth or suction machine
2. Mouth gag is placed in between the teeth
3. Plastic/metal air way is put in the mouth.

   If these measures are not sufficient due to oedema of vocal cords etc. then
4. Endotracheal intubation has to be done. This is a procedure requiring skill and experience and usually it is done by an anaesthetist.

   If intubation is also not possible due to any reason (i.e. extensive acid burns) then as the last resort.
5. Tracheostomy is done and tracheostomy tube is put into trachea. The procedure requires considerable skill. Usually an incision is taken at the junction of two semilunar cartilages of trachea. An opening is made and tracheostomy tube is inserted.

[In case of small children one can insert a wide bore needle (No. 18 or 19) directly into trachea. This is a desparate measure and should be done with proper care. It may save valuable lives.

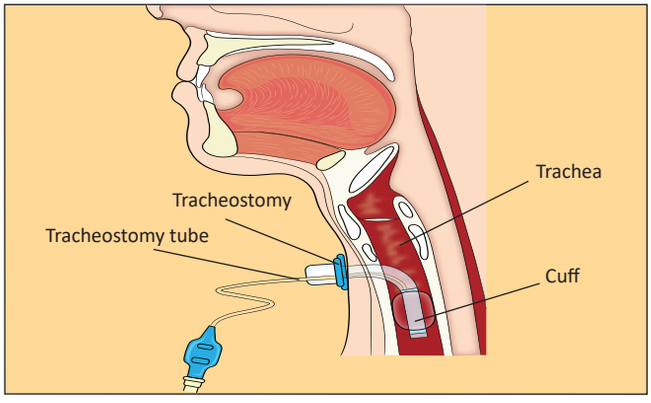


Fig. 2.18 : Tracheostomy

Breathing: If the respiratory rate is low or there is no spontaneous breathing, one has to assist the breathing.

In hospital setting: An Ambu bag and mask can be used. The bag is periodically deflated and air is sucked out from the lungs of patient

A pulse oximeter will show the O_2 percentage. If this falls, O_2 has to be given.

If prolonged assisted respiration is necessary, patient is attached to a respirator.

A heart lung machine (if available) can also be used.

Fig. 2.19 : BVM technique/Ambu bag

In field setting: The best way is to give mouth to mouth breathing. A small gauze piece or handkerchief is placed on the mouth of patient. Care giver takes a deep breath and blows the air through mouth of the patient. Nose should be carefully closed while blowing. A respiratory rate of 10 – 12 / minute should be achieved.

If a single person is giving resuscitation, 30 chest compressions followed by 2 rescue breaths.

Ayurvedic treatment of Dhoopana is effective in cases of depression of respiratory centre. Dashang Dhoop or Dashupushpa Dhoop may be used.

3 Vishakta Aahara Pariksha and Viruddha Aahara

3.1 Sources of Exposure of Visha with Contemporary Relevance

Exposure means contact. No matter how dangerous a substance or activity is, without exposure, it cannot harm anybody.

The Classical Relevance of Source of Exposure of Visha

In Ayurvedic classical texts, various sources of exposure to Visha are explained, as Anna, and Panadi.

अन्ने पाने दन्तकाष्ठे तथाऽभ्यङ्गेऽवलेखने।
उत्सादने कषाये च परिषेकेऽनुलेपने।।
स्रक्षु वस्त्रेषु शय्यासु कवचाभरणेषु च।
पादुकापादपीठेषु पृष्ठेषु गजवाजिनाम्।।
विषजुष्टेषु चान्येषु नस्यधूमाञ्जनादिषु। Su.K. 1/25-27

The poison is administered (to the King) by using the following tools:

- Anna (Food kinds of stuff),
- Pana (Various types of drinks),
- Danta-kashth (Tooth sticks/ brush),
- Abhyanga (Massage oil),
- Avalekhan (Comb),
- Utsadan (Udvartana – as per Dalhana means anointment/massaging pastes),
- Kashay (Various types of decoctions),
- Parishek (as per Dalhana, it is Snaana, means water bath or bath by using decoctions),
- Anulepana (after bath paste i.e. unguents),
- Strakshu (means Pushpmala; According to Dalhana – garland),
- Vastra (Clothing),
- Shayya (Bed),
- Kavacha (Armour – material used for protection of the body),
- Aabharana (i.e. Aabhushana means Ornaments),
- Paduka (Wooden footwear),
- Padapethika (As per Dalhana it is Padadhara – foot stool/rest),
- Gaja Vajenama prushtheshu (Material on the back of elephant and horses),
- Nasya (Snuff or nasal drops),
- Dhooma (Smoke inhaled),
- Anjana (Collyrium), etc.

Signs and symptoms produced by these poisoned tools and their respective treatment would be described further.

Table No. 3.1 : Signs & symptoms produced by various poisoned substance

Source	Clinical Picture		Treatment	Contemporary Relevance
अन्न	हृत्पीडाभ्रान्तनेत्रत्वंशिरोदु:खं	Chest pain, headache, nystagmus	नस्यअञ्जनप्रलेप हृदिचन्दनलेप	Acute food poisoning
पान	दाहं मूर्च्छामतीसारंतृष्णामिन्द्रियवैकृतम्। आटोपं पाण्डुतां काश्र्यं	Burning sensation, syncope, thirst, hallucinations, Bloating, Pallor, weight loss	विरेचनं ससर्पिष्कं तत्रोक्तंनीलिनीफलम्। दध्नादूषीविषारिश्च पेयो वा मधुसंयुत:	Beverages containing preservatives and pesticides
दन्तकाष्ठ	जिह्वादन्तौष्ठमांसानांश्वयथु	Oedema of lips, Glossitis, Gingivitis	प्रच्छान प्रतिसारणम्	Contaminated toothbrush
अभ्यङ्ग	स्फोटजन्मरुजास्रावत्वक्पाक:स्वेदनं ज्वर:। दरणंचापिमांसानाम्	Blisters, discharge, Dermatitis Ulcers with necrosis, Sweating, fever	अनुलेपनम्परिषेक, चन्दनादिपान	External applications like oils, crea ms, moisturizers, Perfumes

culture, food and beverage, environmental monitoring, and materials science.

iii. **Raman spectroscopy**: Raman spectroscopy is an analytical technique used for studying molecular vibrations, rotational, and other low-frequency modes in a system. Named after Sir C.V. Raman, who discovered the effect in 1928, Raman spectroscopy provides information about the vibrational and rotational energies of chemical bonds in a molecule.

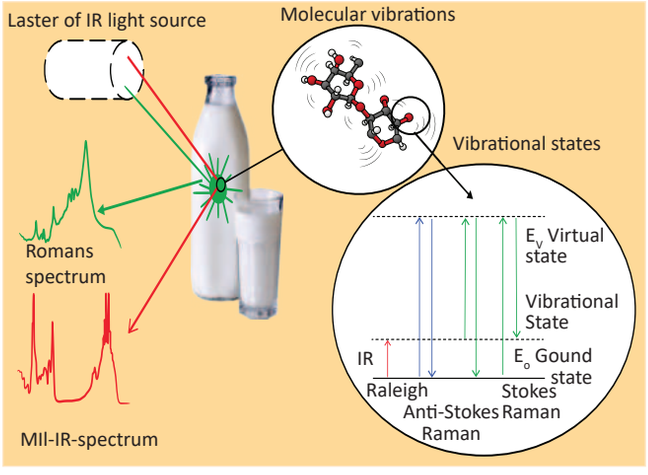


Fig. 3.2

Table 3.4 : Details of Raman Spectroscopy

Raman Scattering	Properties
Conventional	The sample is excited by a monochromatic light source and inelastic light scattering occurs. Two types of light are produced: Stokes (energy loss) and anti-Stokes (energy gain) scattering. Can be plagued by fluorescence.
Resonance Raman (RR)	The sample is excited with a frequency of light that is within the molecular absorption bands of the sample. Excitation of this type is in resonance with the electronic transition.
UV resonance Raman (UVRR)	Used to excite specific chromophores such as nucleic acids and aromatic amino acids. Deep UVRR measurements below 260 nm are not plagued by fluorescence interference.
Surface-enhanced Raman scattering (SERS)	Requires proximity adsorption onto a roughened metal surface, a colloidal solution or a roughened electrode (usually Ag or Au). The enhancement is explained by two processes; an electromagnetic enhancement effect (thought to dominate), and a charge transfer mechanism, known as chemical enhancement. Has a fluorescence quenching effect. Can be coupled with RR to 'tune' for a specific chromophore for additional resonance

3.5 Viruddha-Aahara with Contemporary Relevance

प्राणाः प्राणभृतामन्नं तदयुक्त्या निहन्त्यसून।
विषं प्राणहरं तच्च युक्तियुक्तं रसायनम्।।

Bh.P./M.Kh. 2nd Part Madatyayadhikara 20/2

Anna (Food) is the Prana (life) of animals. But if consumed unwisely, it turns into poison and kills, and if consumed tactfully, it becomes Rasayan.

Viruddha Aahar and its Type

The concept of Virudha-Ahara is very much crucial in the formation of the pathology of the disease. Acharya Charaka describes the term virudha-ahara as the combination of a certain diet, which interrupts the metabolism and inhibits the process of formation of diseases. All these combinations of foodstuffs have opposite properties to that of the tissue and are called as a Viruddha Anna/Ahita ahara/Visha ahara or incompatible diet.

Definition

यत् किञ्चिद्दोषमास्त्राव्य न निर्हरति कायतः।
आहारजातं तत् सर्वमहितायोपपद्यते।।

Ch.Su.26/85, A.Hr.S. 7/54

Foodstuffs that increase the doshas in their native places (Sthana) but do not remove them from the body. All such foods are against or injurious to the body.

उत्क्लेश्यदोषान्न हरेद् द्रव्यं यत्तत्समासतः।
विरुद्धं तद्धि धातूनां प्रत्यनीकतया स्थितम्।। A.S.Su. 9/25

The nature of causing 'Utklesha' means agitating and moving doshas from their respective native places without expelling them from the body, which is called as Viruddha. In short, Viruddha is a property of possessing contradictory qualities to that of the Dhatus. These substances stay in the body despite being antagonistic to the Dhatus in the body.

विरुद्धमपि चाहारं विद्याद्विषगरोपमम्। A.Hr.Su. 7/29

The effects of an incompatible diet are like poison.

4 Garavisha and Dooshivisha

4.1 Garavisha

❖ **Derivation/Nirukti –** 'गृ' धातु + 'अच्' प्रत्यय

The 'Gara' word is derived from the root word "gru" with the suffix "ach" which means 'to drink' that generally indicates the liquid form. From one aspect, Gara means poison.

Definition: Brihatrayee and laghutrayee have described Garavisha.

गरसंयोगजं चान्यद्गरसंज्ञं गदप्रदम्।
कालान्तरविपाकित्वान्न तदाशु हरत्यसून्।। Ch.Chi. 23/14

(See table below)

❖ **Charaka Samhita**: Gara visha is a samyogaja visha (artificial poison) that exerts a toxic effect after an interval of some time and as such does not kill the patient instantly. It produces many diseases. Gara visha is Kalantara-avipaki; it means Gara visha cannot be digested early, it takes a long time to digest and it's not fatal.

❖ **Shushruta Samhita**: The pulverized bodies of insect poisoning, as they do, the characteristic features of Dooshi visha (enfeebled poison) which is laying inherent in human body; is turned into a Gara or chemical poison if administrated internally with any medicine or externally with any plaster/lepa.

❖ **Vagbhata**: Combination of parts of the body and excreta of different animals, incompatible drugs, ashes, and poisonous substances which have mild potency; is known as Garavisha.

❖ **According to Laghutrayee Bhavprakash, Yog-ratnakar and Sharangdhar Samhita**: Kritrim visha is of two types; one is prepared by a combination of two poisonous substances called Dooshi visha. Another prepared by a combination of two non-poisonous substances is called Garvisha.

❖ **Chakrapani, Kashyapa Samhita and Madhava Nidana** described the Samyogaja visha as one of the two types, one which is prepared by a non-poisonous substance called as Gara visha and another which is prepared by poisonous substance is called kritrim visha.

सौभाग्यार्थं स्त्रियः स्वेदरजोनानाङ्गजान् मलान्।
शत्रुप्रयुक्तांश्च गरान् प्रयच्छन्त्यन्नमिश्रितान्।। Ch.Chi. 23/233

Women of evil nature mix their sweat, secretions and faeces with food to subdue their husbands. Thus, Garavisham is administered through food to subdue enemies.

गरमाहारसम्पृक्तं यच्छन्त्यासन्नवर्तिनः। A.Hr.U. 35/49

Garavish (artificial poison) is given through food.

Table 4.1

Charaka	Sushruta	Vagbhata
Combination	Combination of poisonous insect parts	Combination and contamination
Chronic	Acute आशुतर Subacute आशु Sub chronic चिरात् Chronic चिरतरात्	May include attenuated poisons
गरसंयोगजं चान्यद्गरसंज्ञं गदप्रदम्। कालान्तरविपाकित्वान्न तदाशु हरत्यसून्।। Ch.Chi. 23/14	योगैर्नानाविधैरेषां चूर्णानि गरमादिशेत्।।24।। दूषीविषप्रकाराणां तथा चाप्यनुलेपनात्।।25।।	नानाप्राण्यङ्गशमलविरुद्धौषधिभस्मनाम्। विषाणां चाल्पवीर्याणां योगो गर इति स्मृतः।
Wives for seduction Enemies for destruction		Internal spies gives through food

5 Visha Upadrava and Diseases Caused by Exposure to Visha/Poisons

5.1 Visha Upadrava

Acharya Vagbhata has stated in his classical book Ashtanga Sangraha a separate chapter about Visha Upadravas. Sushruta has talked about Visha upadrava in the context of Dushi Visha and while explaining the management of snake poisons. These Upadravas are the aggravation of symptoms as quoted besides many others as stated by Vagbhata in a person afflicted by Dushi Visha (slow poison) or Visha at a later stage which again means a form of Dushi Visha. Understanding these Upadravas in the present clinical aspect is very much appreciated. Apart from venomous bites, as a possibility we can also consider the prolonged use of contaminated substances in the form of food, air, water, land, medication etc. to be akin to Visha and their ill effects as the Upadrava.

ज्वरकासवमिश्वासहिध्मा तृष्णाऽतिमूर्च्छनम्।
विशो भेदोऽतिकाठिन्यमानाहो बस्तिमूर्द्धरुक्।
श्वथुः पूतदंशत्वं रक्तस्त्रावो विषानिलः।
इति षोडश निर्दिष्टाः विषार्तानामुपद्रवाः।
गच्छन्त्युपेक्षितानाशं यैर्जुष्टा विषरोगिणः।। A.S.U. 47/2

Table 5.1 : Visha upadrava

ज्वर	Fever
कास	Respiratory inflammation
वमि	Vomiting
श्वास	Asthma / Dyspnea
हिध्मा	Hiccup
तृष्णा	Extreme Thirst
मूर्च्छनम्	Syncope
विशो भेदः	Loose motions
विशो तिकाठिन्य	Hard stools
आनाहो	Bloating
बस्तिरुक्	Pain in bladder region
मूर्द्धरुक्	Headache
श्वयथुः	Oedema
पूतिदंशत्वं	Non healing wounds
रक्तस्राव	Hemorrhage
विषानिलः	Vatavyadhi originating from Visha

Treatment

प्रतिकुर्याद्यथास्वं च रोगेष्वेवं परेषु च।
दोषानुबन्धमालोच्य विषतन्त्राविरोधतः।। A.S.U. 47/36

Treatment should be according to disease and should also include Agadas. Principles of Agad Tantra should be followed in all aspects.

5.2 Drug-induced Toxicity

Drug-induced Toxicity and its Agad Tantra Perspective

Drug-induced toxicity refers to the adverse effects or harm caused by the use of pharmaceutical drugs or medications. These effects can range from mild side effects to severe and potentially life-threatening reactions. Drug-induced toxicity can result from various factors, including the pharmacological properties of the drug, individual patient factors, and the way the drug is administered. Here are some key aspects of drug-induced toxicity.

Table 5.2 : Types

Type	Example
On-target (mechanism-based)	Statins
Hypersensitivity and immunological	Penicillins
Off-target	Terfenadine
Biological activation	Acetaminophen
Idiosyncratic	Halothane

Dose-Dependent Toxicity: Many drugs exhibit dose-dependent toxicity, meaning that the risk and severity of adverse effects increase with higher doses. The therapeutic window is the range of doses where a drug is effective without causing significant harm. Exceeding this range can lead to toxicity.

Table 5.3

Part A

S.No.	Occupational Disease	Employment
1.	Infectious and parasitic diseases contracted in an occupation where there is a particular risk of contamination.	All work involving exposure to health or laboratory work; All work involving exposure to veterinary work; Work relating to handling animals; animal carcasses, part of such carcasses, or merchandise which may have been contaminated by animals or animal carcasses; Other work carrying a particular risk of contamination.
2.	Diseases caused by work in compressed air.	All work involving exposure to the risk concerned.
3.	Diseases caused by lead or its toxic compounds.	All work involving exposure to the risk concerned.
4.	Poisoning by nitrous fumes.	All work involving exposure to the risk concerned.
5.	Poisoning by organophosphorus compounds.	All work involving exposure to the risk concerned.

Part B

S.No.	Occupational Disease	Employment
1.	Diseases caused by phosphorus or its toxic compounds.	All work involving exposure to the risk concerned.
2.	Diseases caused by mercury or its toxic compounds.	All work involving exposure to the risk concerned.
3.	Diseases caused by benzene or its toxic homologues.	All work involving exposure to the risk concerned.
4.	Diseases caused by nitro and amido toxic derivatives of benzene or its homologues.	All work involving exposure to the risk concerned.
5.	Diseases caused by chromium or its toxic compounds.	All work involving exposure to the risk concerned.
6.	Diseases caused by arsenic or its toxic compounds.	All work involving exposure to the risk concerned.
7.	Diseases caused by radioactive substances and ionising radiations.	All work involving exposure to the action of radioactive substances or ionising radiations.
8.	Primary epithelomatous cancer of the skin caused by tar, pitch, bitumen, mineral oil, anthracene, or the compounds, products or residues of these substances.	All work involving exposure to the risk concerned.
9.	Diseases caused by the toxic halogen derivatives of hydrocarbons (of the aliphatic and aromatic series)	All work involving exposure to the risk concerned.
10.	Diseases caused by carbon disulphide.	All work involving exposure to the risk concerned.
11.	Occupational cataract due to infra-red radiations.	All work involving exposure to the risk concerned.
12.	Diseases caused by manganese or its toxic compounds.	All work involving exposure to the risk concerned.
13.	Skin diseases caused by physical, chemical or biological agents not included in other items.	All work involving exposure to the risk concerned.
14.	Hearing impairment caused by noise.	All work involving exposure to the risk concerned.
15.	Poisoning by dinitrophenol or a homologue or by substituted dinitrophenol or by the salts of such substances.	All work involving exposure to the risk concerned.
16.	Diseases caused by beryllium or its toxic compounds.	All work involving exposure to the risk concerned.
17.	Diseases caused by cadmium or its toxic compounds.	All work involving exposure to the risk concerned.
18.	Occupational asthma caused by recognised sensitising agents inherent to the work process.	All work involving exposure to the risk concerned.
19.	Diseases caused by fluorine or its toxic compounds	All work involving exposure to the risk concerned.
20.	Diseases caused by nitroglycerine or other nitroacid esters.	All work involving exposure to the risk concerned.

pollution, paints, pesticides, fertilizers, and other chemicals involve the understanding of toxins (*Visha – Dooshivisha*, *Garavisha*, as well as *Amavisha*), their impact on the body, and the application of detoxification and treatment principles. Here's how Agad Tantra views and addresses such occupational diseases:

- Agad Tantra emphasises on the identification of specific toxins present in the occupational environment. This includes pollutants, chemical residues, and harmful substances associated with paints, pesticides, fertilizers, and other chemicals.
- Exposure to occupational toxins can disturb the balance of *Doshas*, particularly aggravating *Pitta* and *Vata doshas*. Agad Tantra recognises the role of dosha imbalances in the manifestation of diseases.
- Chronic exposure to environmental toxins can lead to the accumulation of *Ama* (toxins) in the body. *Ama* is considered a major factor in the development of diseases in *Ayurveda*.
- Agad Tantra looks at the impact of occupational toxins on different *Dhatus* (tissues) and *Srotas* (channels) in the body. For example, pollutants may affect the respiratory (Pranvaha) *Srotas*, while chemicals can impact the blood or nervous system.
- The primary approach in *Agad Tantra* for occupational diseases involves detoxification or *Shodhana* therapies. *Panchakarma* procedures, such as *Vamana* (emesis), *Virechana* (purgation), and *Basti* (enema), may be employed to eliminate accumulated toxins.
- *Ayurvedic* Anti toxic herbs (*Vishghna Drvya*) and Anti toxic formulations (*Agad Kalpa*) with detoxifying properties play a crucial role in *Agad Tantra*. Specific herbs such as *Neem, Guduchi*, Turmeric, and *Triphala* are known for their ability to support detoxification and enhance the body's natural defenses.
- *Agad Tantra* recommends measures to balance aggravated *Doshas*. Dietary adjustments, lifestyle modifications, and specific *Ayurvedic* formulations are utilised to restore equilibrium.
- Strengthening *Agni* is essential for proper digestion and assimilation of nutrients. *Agad-tantra* focuses on enhancing *Agni* to facilitate the efficient elimination of toxins from the body.
- Ayurvedic principles address the impact of toxins on specific organs affected by occupational exposures. For instance, liver-supportive herbs may be recommended to counteract the effects of chemical exposure on the liver.
- Agad Tantra emphasises preventive measures to minimise the risk of occupational diseases. This includes advocating the use of protective equipment, adherence to safety protocols, and lifestyle practices that reduce toxin exposure.
- *Ayurveda* recognises the unique constitution (*Prakriti*) and imbalances (*Vikriti*) of each individual. *Agad Tantra* treatments are tailored to the specific needs of the person, considering their susceptibility and response to toxins.
- Agad Tantra not only focuses on treating diseases but also on promoting overall well-being. This includes recommendations for a balanced lifestyle, proper nutrition, and practices that enhance resilience to environmental stressors.

Fig. 5.1 : Symptoms of Allergic manifestation

5.4 Allergic Manifestations

Allergy, Types of Allergens

Allergy occurs when a person reacts to substances in the environment that are harmless to most people.

6 Environmental Toxicology

6.1 Vishakta Vayu, Jala and Bhumi (Air, Water and Land Pollution)

Definition

Environmental toxicology is a branch of toxicology that deals with the harmful effects of various contaminants on Living Organisms. It is a multidisciplinary field of science. Contaminants are of anthropogenic origin ('man-made,' e.g., pesticides, polychlorinated biphenyls, dioxins, polycyclic aromatic hydrocarbons, petroleum) and chemicals naturally found in the environment (i.e., animal venom, microbial and plant toxins).

Environmental toxicology plays a vital role in addressing current environmental challenges by providing the scientific knowledge needed for effective pollution control, risk assessment, and the sustainable management of ecosystems and human health.

In this chapter, we will learn about Ayurveda and contemporary aspects of environmental toxicology.

Acharya Sushruta describes Biochemical warfare in his text. He describes the signs and treatment of various environmental Toxicities. He doesn't mention sources. For that, we have to look it up in Kautiliya Arthashastra.

राज्ञोऽरिदेशे रिपवस्तृणाम्बुमार्गान्नधूमश्वसनान् विषेण।
सन्दूषयन्त्येभिरतिप्रदुष्टान् विज्ञाय लिङ्गैरभिशोधयेत्तान्।।
दुष्टं जलं पिच्छिलमुग्रगन्धि फेनान्वितं राजिभिरावृतं च।
मण्डूकमत्स्यं म्रियते विहङ्गा मत्ताश्च सानूपचरा भ्रमन्ति।।
मज्जन्ति ये चात्र नराश्वनागास्ते छर्दिमोहज्वरदाहशोफान्।
ऋ(ग)च्छन्ति तेषामपहृत्य दोषान् दुष्टं जलं शोधयितुं यतेत।।
धवाश्वकर्णासनपारिभद्रान् सपाटलान् सिद्धकमोक्षकौ च।
दग्ध्वा सराजद्रुमसोमवल्कांस्तद्भस्म शीतं वितरेत् सरःसु।।
भस्माञ्जलिं चापि घटे निधाय विशोधयेदीप्सितमेवमम्भः।।
क्षितिप्रदेशं विषदूषितं तु शिलातलं तीर्थमथेरिणं वा।।
स्पृशन्ति गात्रेण तु येन येन गोवाजिनागोष्ट्रखरा नरा वा।
तच्छूनतां यात्यथ दह्यते च विशीर्यते रोमनखं तथैव।।
तत्राप्यनन्तां सह सर्वगन्धैः पिष्ट्वा सुराभिर्विनियोज्य मार्गम्।
सिञ्चेत् पयोभिः सुमृदन्वतैस्तं विडङ्गपाठाकटभीजलैर्वा।।
तृणेषु भक्तेषु च दूषितेषु सीदन्ति मूर्च्छन्ति वमन्ति चान्ये।
विड्भेदमृच्छन्त्यथवा म्रियन्ते तेषां चिकित्सां प्रणयेद्यथोक्ताम्।।
विषापहैर्वाऽप्यगदैर्विलिप्य वाद्यानि चित्राण्यपि वादयेत।
तारः सुतारः ससुरेन्द्रगोपः सर्वैश्च तुल्यः कुरुविन्दभागः।।
पित्तेन युक्तः कपिलान्वयेन वाद्यप्रलेपो विहितः प्रशस्तः।
वाद्यस्य शब्देन हि यान्ति नाशं विषाणि घोराण्यपि यानि सन्ति।।
धूमेऽनिले वा विषसम्प्रयुक्ते खगाः श्रमार्ताः प्रपतन्ति भूमौ।
कासप्रतिश्यायशिरोरुजश्च भवन्ति तीव्रा नयनामयाश्च।।
लाक्षाहरिद्रातिविषाभयाब्दहरेणुकैलादलवक्रकुष्ठम्।
प्रियङ्गुकां चाप्यनले निधाय धूमानिलौ चापि विशोधयेत।।

Su.K. 3/6–17 Jangamavishavigyaniya

Table 6.1 : Signs and treatment of environmental toxicity as per Sushrut Samhita

Environmental Factor	Features	Management
Water	Bad smell, sticky, frothy, with black lines, Death of fish, etc. Oedema in survivors	Davadi ash packets in water storage and rivers
Land	Oedema, burning sensation, shedding of hair, nails etc	Irrigation with Anantadi kashayam
Grass and food	Vomitting, diorrhoea, syncope, loss of function	Symptomatic with Agadas Fumigation through percussion of war drums
Air and smoke	Birds die, Eye discharge, Respiratory distress, Headache	Fumigation with Laakshaadi dhooma

7 Dermatological Manifestations of Visha/Poisons

7.1 Contact Dermatitis and Its Management

Definition: Contact dermatitis is an inflammatory skin process caused by an exogenous agent or agents that directly or indirectly injure the skin.

Types of contact dermatitis: It comes in two types.

- **Irritant contact dermatitis (ICD)**: In this type, injury is caused by an inherent characteristic of a compound—for example, a concentrated acid or base.
- **Allergic contact dermatitis (ACD)**: Agents responsible for this induce an antigen-specific immune response (e.g., poison ivy dermatitis). The clinical lesions of contact dermatitis may be acute (wet and oedematous) or chronic (dry, thickened, and scaly), depending on the persistence of the insult.

Irritant Contact Dermatitis ICD

Definition: Irritant Contact Dermatitis (ICD) is a common form of skin inflammation caused by direct contact with irritating or damaging substances. Unlike allergic contact dermatitis, which involves an immune response to specific allergens, irritant contact dermatitis occurs when the skin's protective barrier is disrupted or damaged by exposure to irritants such as chemicals, detergents, solvents, acids, alkalis, or physical irritants like friction or heat.

Fig. 7.1: ICD

It is well demarcated, and localised to areas of thin skin (eyelids, intertriginous areas) areas where the irritant was occluded.

Appearance: Lesions may range from - skin erythema, oedema, vesicles, and ulcers.

Characteristic:

- Prior exposure to the offending agent is not necessary,
- Reaction develops in minutes to a few hours.
- Chronic low-grade irritant dermatitis is the most common type of ICD.
- The most common area of involvement is the hands.
- The most common irritants encountered are chronic wet work, soaps, and detergents.

Treatment: Treatment should be directed toward avoidance of irritants, use of protective gloves or clothing.

Allergic Contact Dermatitis ACD

Definition: Allergic Contact Dermatitis (ACD) is a type of skin inflammation that occurs when the skin comes into contact with a substance to which it is allergic or hypersensitive. Unlike irritant contact dermatitis, which does not involve an immune response, ACD is characterised by an immune-mediated reaction to specific allergens. It is a manifestation of delayed type hypersensitivity. It is mediated by memory T lymphocytes in the skin.

Fig. 7.2 : ACD

Shodhana (Detoxification): Agada Tantra emphasizes detoxification as a means to eliminate toxins from the body. Panchakarma, a set of therapeutic procedures in Ayurveda, is often recommended for detoxification. However, its applicability in contact dermatitis would depend on the specific circumstances and the individual's constitution.

Bahya Shaman Chikitsa (External Application): Ayurvedic oils, ointments, or pastes with anti-inflammatory and soothing or skin-friendly properties may be applied externally to alleviate skin irritation. Ingredients like neem, turmeric, aloe vera, and sandalwood or Agada (Anti toxic) formulations like Dooshivishari agad, Bilvadi guti, Amruta Ghruta, etc. prove effective in such type of clinical condition.

Shaman Chikitsa (Herbal Medications): Ayurveda relies heavily on the use of herbs for various health conditions. In the case of contact dermatitis, herbs with anti-inflammatory, anti-allergic, and skin-soothing properties might be recommended. Examples include *neem* (*Azadirachta indica*), turmeric (*Curcuma longa*), aloe vera, and licorice (*Glycyrrhiza glabra*). Ingredients of *Vishaghna Mahakashaya, Ekasara Gana, Aragvadhadi Gana* along with various Agad Kalpa like *Dhooshivishari Agad, Bilvadi Guti, Amruta Ghruta*, etc. are also helpful.

Pathyaapathya (Dietary Recommendations and lifestyle Modifications): Agada Tantra might suggest dietary modifications to balance the doshas (Vata, Pitta, Kapha). In the context of dermatitis, avoiding spicy and acidic foods that can aggravate Pitta dosha and incorporating cooling foods may be advised.

Ayurveda places importance on lifestyle factors. Recommendations may include stress management techniques, proper sleep, and avoiding exposure to known allergens or irritants.

Following Ayurvedic formulations are used in the management of Contact dermatitis:

Internal medicines: *Mahatiktak or Panchtiktak Ghrutam*, *Rajanyadi churnam*, *Aragvadhadi Kashayam*, *Dooshivishari Agad*.

External application: *Eladi tailam, Paranthyadi tailam*

7.2 Signs and Symptoms and Management of Abhyanga visha, Lepa visha, Vastra visha, Paduka visha, Abharana visha etc. with Contemporary Relevance

With the aim of "Swasthasya Swasthya Rakshanam", Acharya Sushruta in the first chapter of Kalpasthana, have elaborated methods used in the ancient time for administration of poison. These routes of administration of poison are mentioned in the following verse,

अन्ने पाने दन्तकाष्ठे तथाऽभ्यङ्गेऽवलेखने।
उत्सादने कषाये च परिषेकेऽनुलेपने।।
स्रक्षु वस्त्रेषु शय्यासु कवचाभरणेषु च।
पादुकापादपीठेषु पृष्ठेषु गजवाजिनाम्।।
विषजुष्टेषु चान्येषु नस्यधूमाञ्जनादिषु।
लक्षणानि प्रवक्ष्यामि चिकित्सामप्यनन्तरम्।। Su.K. 1/ 25-27

Students should take a note that in today era, we are exposed to various chemicals through one or other factor. Correlation between these symptoms are seen with the symptoms mentioned in the text. For example, if a person is allergic to any cream/ oil/ lotion, he will have symptoms similar to those mentioned in poisonous abhyanga.

Clinical presentations and the management of paduka visha, abharana visha, vastra visha, lepa visha, abhyanga visha, etc.

Clinical picture and treatment mentioned in Sushruta along with its contemporary relevance respectively is described in the table mentioned below:

Table 7.1

Source	Clinical Picture		Treatment	Contemporary Relevance
अन्न	हृत्पीडाभ्रान्तनेत्रत्वं शिरोदुःखं	Chest pain, headache, nystagmus	नस्य अञ्जनप्रलेप हृदिचन्दनलेप	Acute food poisoning
पान	दाहं मूर्च्छामतीसारं तृष्णा-मिन्द्रियवैकृतम्। आटोपंपाण्डुतांकार्श्यं	Burning sensation, syncope, thirst, hallucinations, Bloating, Pallor, weight loss	विरेचनंससर्पिष्कंतत्रोक्तं-नीलिनीफलम्। दध्नादूषी-विषारिश्चपेयोवामधुसंयुतः	Beverages containing preservatives and pesticides
दन्तकाष्ठ	जिह्वादन्तौष्ठमांसानांश्वयथु	Oedema of lips, Glossitis, Gingivitis	प्रच्छानंप्रतिसारणम्	Contaminated toothbrush

8 Therapeutic Utility of Agad Yoga

8.1 Dooshivishari Agad

पिप्पल्यो ध्यामकं मांसी रोध्रमेला सुवर्चिका।
कुटन्नटं नतं कुष्ठं यष्टी चन्दनगैरिकम्।।

दूषीविषारिर्नाम्नाऽयं न चान्यत्रापि वार्यते।

A.Hr.U. 35/39-40

Table 8.1 : Ingredients, their Properties (Guna) and Therapeutic Utilities (Karma)

No.	Drug	Rasa	Guna	Veerya	Vipaaka	Karma	Rogadhikar
1.	Pippali *(Piper longum)*	Katu	Laghu Snigdha, Tikshna	Ushna	Madhura	Kapha-Vatahara, Rasayana, Deepana, Vrishya	Udara, Pliharoga, Jwara, Kushta, Prameha, Shula, Gulma, Amavata, Arshas
2.	Dhyamaka *(Cymbopogon Martini)*	Katu Tikta	Laghu Ruksha	Ushna	Katu	Kapha-Vatahara, Sthanya janana	Jwara, Daha, Trishna, Chardi, Kasa, Swasa, Krimi, Arshas
3.	Jatamansi *(Nardostachys Jatamansi)*	Tikta Kashaya Madhura	Laghu Snigdha	Sheeta	Katu	Tridoshahara, Balya, Medhya, Kustagna	Kusta, Kandu, Visarpa, Daha
4.	Lodhra *(Symplocos racemose)*	Kashaya Tikta	Laghu Ruksha	Sheeta	Katu	Kaphapittahara Grahi, Chakshushya	Raktapitta, Pravahika, Kusta, Atisara, Netraroga, Jwara
5.	Ela *(Elettaria cardamomum)*	Katu Madhura	Laghu	Sheeta	Katu	Kapha-Vatahara, Hridya, Deepana	Hridroga, Swasa, Kasa, Mutrakrichra, Chardi, Arshas
6.	Suvarchika *(Tribulus Terrestris)*	Madhura	Guru Snigdha	Sheeta	Madhura	Vata-Pittahara, Vrishya, Rasayana	Mutrakrichra, Ashmari, Prameha, Hridroga, Swasa, Kasa, Arshas
7.	Kutannata *(Oroxylum Indicum)*	Madhura Tikta Kashaya	Laghu Ruksha	Ushna	Katu	Kapha-Vatahara, Deepana, Pachana, Grahi	Amavata, Aruchi Atisara, Kasa, Vataroga,
8.	Tagara *(Valeriana wallichii)*	Tikta Katu Kashaya	Laghu Snigdha	Ushna	Katu	Kapha-Vatahara, Vishagna	Apasmara, Anidra, Shiroroga, Netraroga
9.	Kushta *(Saussurea lappa)*	Tikta Katu Madhura	Laghu Ruksha Tikshna	Ushna	Katu	Kapha-Vatahara, Lekhaniya, Vrishya	Kushta, Hikka, Kasa, Swasa, Hridroga, Kandu, Visarpa, Vishagna
10.	Yashtimadhu *(Glycyrrhiza Glabra)*	Madhura	Guru Snigdha	sheeta	Madhura	Tridoshahara Rasayana,Vrishya, Chakshushya	Vrana, Shotha, Chardi, Trishna, Daha, Raktapitta, Hridroga

No.	Drug	Rasa	Guna	Veerya	Vipaaka	Karma	Rogadhikar
11.	Chandana *(Santalum Album)*	Tikta Madhura	Guru Ruksha	Sheeta	Katu	Kapha-pittahara Vrishya, Vishagna Chakshushya	Raktapitta, Bhrama, Daha, Jwara
12.	Gairika *(Red ochre)*	Madhura Kashaya	Snigdha	Sheeta	Madhura	Kapha-Pittahara, Rakta stambaka	Raktapitta, Dahagna, Sheetapitta, Vishagna

Research DVA was able to prolong the nadir time of RBC, WBC, and Hb with early recovery in comparison to carboplatin and the normal group (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9304609/).

Indications

1. Dooshivisha after Shodhana
2. Any kind of toxicity
3. Myelosuppression
4. Reproductive toxicity

Anupaana Honey

Mechanism of Action

Dooshivisha (Cumulative toxicity) is a constricted or denatured harm that functions as a latent poison within the body. It has gentle strength, isn't lethal to a person, and has deferred activity because it is secured by Kapha dosha (mucus). It dwells within the body for a long time and produces diverse untoward impacts. In classical treatises of Ayurveda depicting six tastes (Rasa) it is demonstrated that none of them ought to be utilized in abundance. Excessive long-term utilization may lead to numerous diseases. Acharya Sushruta, Vagbhata, and Bhavaprakasha have given the same title as Dooshivishari agada within the administration of Dooshivisha (total poisonous quality). As per Sushruta, Vagbhata, and Bhavaprakasha, it contains 9, 12, and 10 drugs vespertisely. Acharya Sushruta has not said Kutannata, Nata, Kushta, Yashtimadhu, Chandana; and included Paripelava and Toya. Acharya Bhavaprakasha has not mutinied Kutannata, Nata, Kushta, Yashtimadhu, Chandana; and included Maricha, Baalaka, and Bruhat ela. The doses form isn't specified by Sushruta and Vagbhata, but Bhavaprakasha has said to utilize this definition in Kashaya (decoction) form. Based on Rasa approximately 32% of the ingredients have Madhura rasa (sweet taste), 28% of the fixings have Tikta rasa (severe taste), and 20% have Katu (sharp) and Kashaya rasa (astringent taste). Katu, Tikta, and Kashaya rasa (sharp, severe, astringent taste) pacify Kapha dosha (mucus). Kashaya, Tikta, and Madhura rasa (impactful, severe, sweet taste) appease Pitta dosha, while Madhura rasa (sweet taste) assuages Vata dosha.

Taking into consideration the Rasa (taste) aspect, it's notable that approximately 32% of the ingredients exhibit Madhura rasa (sweet taste), while 28% showcase Tikta rasa (bitter taste). Moreover, around 20% possess Katu (pungent) and Kashaya rasa (astringent taste). This diverse range of tastes plays a pivotal role in addressing dosha imbalances. Specifically, the Katu, Tikta, and Kashaya rasas work synergistically to pacify Kapha dosha, while Kashaya, Tikta, and Madhura rasas pacify Pitta dosha. Additionally, the Madhura rasa aids in pacifying Vata dosha.

Considering the Guna (property), approximately 32% of the ingredients possess Laghu guna (light property), while 24% exhibit Ruksha (rough) and Snigdha guna (unctuous property). Furthermore, 12% boast Guru guna (heavy property), and 8% showcase Tikshna guna (sharp property). The presence of Ruksha, Laghu, and Tikshna guna facilitates the rapid spreading and penetration of the medicines, thereby ensuring faster action. On the other hand, Snigdha and Guru guna provide strength, which is crucial as patient strength may diminish in cases of Visha (poison).

Examining Veerya (potency), it's observed that 58% of the ingredients possess Sheeta veerya (cold potency), while 42% exhibit Ushna veerya (hot potency). Sheeta veerya drugs not only have Pittahara properties but also soothe the blood (Rakta prasadaka) and exhibit restraining action (Stambhaka karma). Conversely, Ushna veerya aids in balancing Kapha and Vata doshas, removing any enveloping effects present in Dooshivisha (cumulative toxicity), and facilitating the digestion of drugs. This comprehensive analysis highlights the intricate balance of tastes, properties, and potencies

9 Sthavara Visha – Poisons of Plant Origin

Introduction

The poison originating from or located in the roots of plants, i.e. Sthavar Visha (स्थावर विष) (A.S.U.40/4). is also known as Moolajam (मूलजं) Maulam (मौलं) (Ch. Chi.23/17), Mouli (मौली) and Sthira Vish (स्थिरविष) (A.S.U.40/10). All types of toxins derived from plants are included in this category.

Sushrutacharya have elaborated *Sthavara Visha* in the second chapter of Kalpasthana, *Sthavara Visha Vidnyaniya Adhyaya*, due to its use/adulteration in the food and drinks (anna and pana). There are **10 adhishthana** of *Sthavara Visha* and their examples as mentioned in the following verse,

मूलं पत्रं फलं पुष्पं त्वक् क्षीरं सार एव च।
निर्यासो धातवश्चैव कन्दश्च दशमः स्मृतः।। Su.K. 2/4

तत्र, क्लीतकाश्वमार गुञ्जासुगन्ध गर्गरककरघाट विद्युच्छिखा-विजयानीत्यष्टौमूलविषाणि; विषपत्रिकालम्बावरदारुकरम्भ-महाकरम्भाणि पञ्च पत्रविषाणि; कुमुद्वतीवेणुकाकरम्भ-महाकरम्भकर्कोटकरेणुकखद्योतकचर्मरीभगन्धासर्पघातिनन्दन-सारपाकानीति द्वादश फलविषाणि; वेत्रकादम्बवल्ली-जकरम्भमहाकरम्भाणि पञ्च पुष्पविषाणि; अन्त्रपाचकक-र्तरीयसौरीयककरघाटकरम्भनन्दननाराचकानि सप्तत्व-क्सारनिर्यासविषाणि; कुमुदघ्नीस्नुहीजालक्षीरीणि त्रीणिक्षीर-विषाणि; फेनाश्म (भस्म) हरितालं च द्वे धातुविषे; कालकूट-वत्सनाभसर्षपपालककर्दमकवैराटकमुस्तकशृङ्गीविषप्रपुण्डरी-कमूलकहालाहलमहाविषकर्कटकानीति त्रयोदश कन्दविषाणि; इत्येवं पञ्चपञ्चाशत् स्थावरविषाणि भवन्ति।। Su.K. 2/5

Out of these poisons, very few are known today. The identity of many plants is yet to be confirmed botanically. From the above table, it can be observed that in Sushruta Samhita under the heading of *Sthavara Visha* mainly plants are described and only 2 *Dhatu visha* are explained. For simplicity in the study, we will be following the classification of poison as per the action described in modern medicine for study in this chapter.

Table 9.1

Part of Tree	No.	
मूल	8	क्लीतकअश्वमारगुञ्जासुगन्धगर्गरककरघाटविद्युच्छि-खाविजया
पत्र	5	विषपत्रिकालम्बावरदारुकरम्भमहाकरम्भ
फल	12	कुमुद्वतीवेणुकाकरम्भमहाकरम्भककर्कोटकरेणुकख-द्योतकचर्मरीभगन्धासर्पघातिनन्दनसारपाक
पुष्प	5	वेत्रकादम्बवल्लीजकरम्भमहाकरम्भ
त्वक् सार निर्यास	7	अन्त्रपाचककर्तरीयसौरीयककरघाटकरम्भ नन्दननाराचक
क्षीर	3	कुमुदघ्नीस्नुहीजालक्षीरी
धातु	2	फेनाश्म, हरितालं
कन्द	13	कालकूटवत्सनाभसर्षपपालककर्दमकवैराटकमुस्तक-शृङ्गीविषप्रपुण्डरीकमूलकहालाहलमहाविषकर्कटका-नीतित्रयोदशकन्दविषाणि
Total	**55**	

9.1 Cardiac Poisons – Vatsanabha, Karaveera, Digitalis, Tobacco and Cerbera Odollam

Cardiac Poisons

Cardiac poisons refer to substances that, when introduced into the body, have the potential to disrupt the normal functioning of the heart. The poisons that affect the heart directly or indirectly through the nerves are called Cardiac Poisons.

These substances interfere with the intricate processes involved in maintaining cardiovascular health, including the electrical conduction system, muscular contractions, and other vital mechanisms that regulate blood flow and circulation.

Cardiac poisons can have various origins, including natural sources such as certain plants and toxins produced by organisms, as well as synthetic substances and medications that, in excessive amounts or when misused, can lead to adverse

effects on the heart. The effects of cardiac poisons can range from mild disturbances in heart rhythm to severe complications, including arrhythmias, heart failure, and cardiac arrest.

Here are examples of substances that can act as cardiac poisons, either by affecting the heart's electrical conduction, contractility, or other vital processes, potentially leading to serious health complications.

Vatsanabha

Introduction: Vatsanabha is the only plant identified from the group of Mahavisha. It is mainly found in the mountains of the Himalayas. It is used in many Ayurvedic formulations and is known frequently by the term of Visha. All parts of this plant are poisonous. It is least poisonous when the plant is young, most poisonous when it blooms, and moderately poisonous when seeds ripen.

Latin name: *Aconitum ferox*

Family: Ranunculaceae

Vernacular Names:

Sanskrit

Vatsnabh: The shape of the root resembles the umbilicus of a calf.

Visha: Since it is extremely poisonous in nature

Amrut: It contributes very effective results for various diseases if used after purification with intelligence (Yukti) and proper knowledge.

Marathi: Bachanaag

Hindi: Bachanaag, Mithaa visha, Dudhiya Visha

English: Aconite, Monkshood, Wolf's bane, Blue rocket, Helmet flowers, Devil's helmet, Leopard's bane, Women's bane, Step mother's poison.

These poisons can be remembered with the help of the following mnemonic:

TOAD

- Tobacco
- Aconite
- Oleander
- Digitalis

Classification

1. **According to Ayurveda**
   i. Sthaavara – Vanaspatija (vegetable) - Kanda visha (Tuber) – According to Brihatrayee.
   ii. Mahaavisha (one of the main visha) –Maha panchavisha (according to Rasa Ratna Samucchhay, Rasarnav, Rasaratnakar and Rassaar) or Maha navavisha (according to Rasatarangini, Laghutrayee and Nighantukaar).

2. **According to Modern Medicine**
   Cardiac Poison

General Description: According to Ayurveda: Aachaarya Bhaavmishra, had described some guidelines for recognition of Vatsnabh Plant.

Fig. 9.1

सिन्दुवारसदृक्पत्रो वत्सनाभाकृतिस्तथा।
यत्पार्श्वे न तरोर्वृद्धिर्वत्सनाभः स भाषितः।।

B.P. Dhatvadi Varga 192

सिन्दुवारदलः पार्श्वे तरुवृद्धिविवर्जितः।
नीलपुष्पं कन्दविषो क्षुपो हस्तद्वयोच्छ्रितः।। R.T. 24/10

- The shape of the leaves is like Sinduvar (*Vitex nigundo*).
- The shape of the root is like the umbilicus of a calf.
- Other plants do not grow around or near this plant.

The tingling numbness and sweetish taste are also very peculiar.

Some additional features have been mentioned in Rsatarangini. They are as follows;

- Flowers are blue in colour.
- It's a *Kshupa* type of plant (shrub).
- Its height is about 2 *Hasta.*
- Dimensions of *Kanda* are 5 to 7 *Angulee* in length, and diameter is 1 to 1.5 *Angulee*.
- Colour of *Kanda* is *Pandur* (whitish yellow).

Botanical Description

It is a shrub of height 2 to 6 ft. This shrub is annual or perennial.

Fig. 9.8 : Seeds of yellow oleander

Medico-Legal Importance

Same as Rakta Karveer

Digitalis

Botanical name: *Digitalis purpurea, Linn.*

Family: Scrophulariaceae

Vernacular Names

Sanskrit: Hritpatri, Tilpushpi

Marathi, Hindi

English: Digitalis, Foxgloves, Dead men's bells

Fig. 9.9 : Digitalis purpurea

Classification

According to Ayurveda: Sthavar- Vanaspatija Visha (vegetable poison)

According to Modern science: Cardiac poison

Description of Drug

- It is a biennial or perennial herb.
- It is found in Kashmir, Darjeeling, and Nilgiris
- It grows up to 1 to 1.5 m in height.
- **Leaves:** Greyish green coloured, ovate, toothed leaves
- **Flowers:** White- or pink-coloured tubular flowers
- Leave is the main source of glycosides
- Foxglove (*Digitalis purpurea* L.) leaves are frequently confused with borage (*Borago officinalis* L.), which is traditionally used as a food ingredient.

Fig. 9.10 : Borage (Borago officinalis L)

Fatal Period: 1/2 hours to 24 hrs

Fatal dose

- Digitalis leaf: 2-3 grams
- Digitoxin: 3 mg
- Digitalin:15-20 mg
- Digoxin: 5 mg

Electrocardiographic Features of Digoxin Toxicity

- ❖ Virtually any arrhythmia is possible. None specific for digoxin toxicity
- ❖ Classic arrhythmias thought to be associated combine some SVT (↑ ectopy and automaticity) with slow ventricular rate (↓ AV conduction)

"Digitalis effect"

- ❖ Shortening of QT interval
- ❖ "Scooped" or "sagging" ST depressions
- ❖ J point depression
- ❖ Flattened/inverted/Biphasic T waves

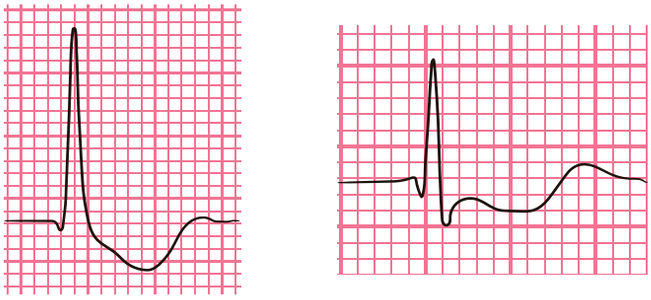


Fig. 9.11

Active Principle

Leaves of *Digitalis purpurea* contain glycosides digitoxin and gitoxin, and seeds contain digitalin. *Digitalis ianata* contains digoxin.

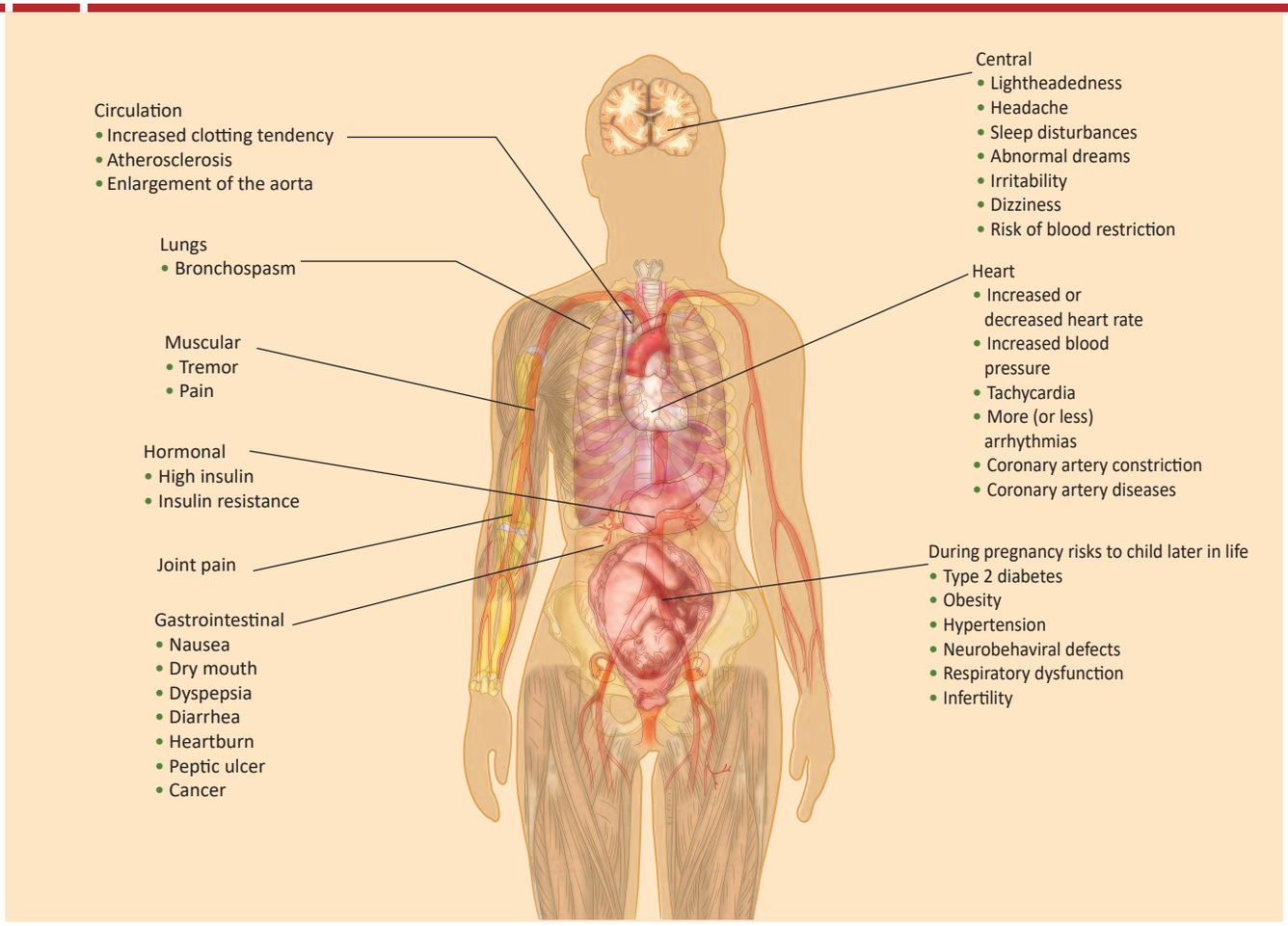


Fig. 9.17 : Side Effects of Nicotine

stopping smoking behaviour by replacing it with another behaviour. Pharmacological nicotine is of various forms and dosages:

- **Nicotine gum**
  - It is designed to be chewed slowly and intermittently.
  - Peak plasma concentration is reached 15 to 30 minutes after starting to chew the gum, as compared with 1 to 2 minutes after initiating smoking.
  - Chewing the gum too rapidly and vigorously can raise nicotine concentrations to uncomfortable levels producing adverse effects.
  - If the gum is inadvertently swallowed, there is no cause for undue concern since the nicotine is released and absorbed slowly producing only low blood concentrations.

Nicotine transdermal patch: The disadvantages of nicotine gum (frequent administrations, unsightly chewing, bad taste, nausea, and dyspepsia) are mostly avoided by transdermal nicotine.

Nicotine spays: The recommended dose is 2 sprays (one in each nostril) every ½ or 1 hour, subject to a maximum of 40 doses (80 puffs) in any 24 hours.

❖ **Other therapies**: Clonidine: Adrenergic hyperactivity in the locus ceruleus (a dark-colored depression in the floor of the 4th ventricle of the brain) is common in many withdrawal syndromes. Clonidine inhibits noradrenergic neurons in the locus ceruleus:

- The usual dose recommended is 150 to 200 mcg/day for 1 month.
- Antidepressants: Doxepin and sertraline are used to treat depression.
- Nicotinic agonist: Lobeline
- Nicotinic antagonist: Mecamylamine

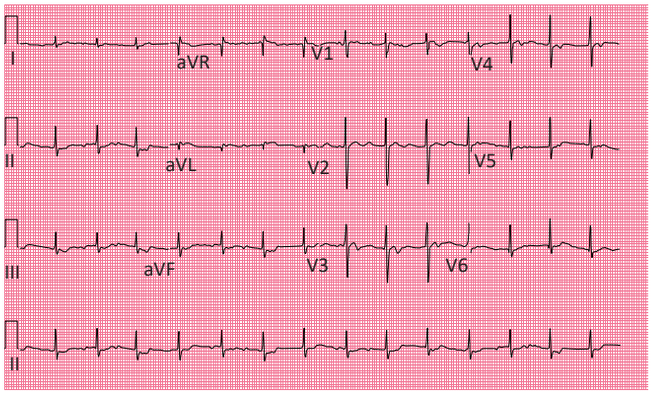


Fig. 9.19

Mechanism of Action

Action is similar to digoxin in nature. Active principle cerberin binds and inhibits Na+, K+ ATPase in cardiac myocytes. The resultant increased intracellular Na+ and Ca2+ levels are responsible for the following three effects.

Increased automaticity leads to cardiac arrhythmias.

Increased vagal tone produces heart blocks and sinus pauses.

Hyperkalemia causes muscle weakness or paralysis and cardiac arrhythmias.

Fig. 9.20 : Seeds of cerabera odollam

Signs & Symptoms

Gastrointestinal symptoms: Bitter taste, vomiting, abdominal pain and diarrhoea.

Cardiovascular system: Chest pain, palpitations, ECG abnormalities like sinus bradycardia, first and second AV block.

Respiratory system: Irregular respiration.

Eyes: Blurring of vision.

Syncope and Death

Laboratory findings: Thrombocytopenia and hyperkalemia.

Differential Diagnosis

- Yellow Oleander poisoning
- Acute Digoxin poisoning
- Treatment of poisoning:

According to Ayurveda:–

According to Modern Science:

Supportive Therapy

Administration of atropine: 0.5 mg IV, repeated every 15 to 30 min.

Temporary pacemaker insertion.

Administration of digoxin immune Fab may be required in severe cases.

Autopsy Findings

All internal organs are congested.

Lungs are edematous and show evidence of subpleural haemorrhages.

Heart shows sub-endocardial and sub-epicardial haemorrhages.

Medico-Legal Importance:

Suicidal poisoning:

This plant is known as **"Suicide Tree".**

It is responsible for more than half of deaths due to plant poisoning in the state of Kerala.

Kernels are ingested as it is or after grinding with jaggery.

Homicidal poisoning: Bitter taste is masked by using alcohol or spicy food.

Accidental poisoning: Bark, leaves, and milky juice are used in folk medicine as an emetic or purgative. This may cause accidental poisoning.

9.2 Neurotoxic Poisons- Kupeelu, Ahiphena, Dhatturaa, Bhanga

Neurotoxic poisons refer to substances or agents that can specifically damage or impair the normal functioning of the nervous system. These toxic substances interfere with the structure or function of nerve cells, leading to a variety of neurological symptoms and, in some cases, severe health consequences. Neurotoxicity can affect both the central nervous system (the brain and spinal cord) and the peripheral nervous system (nerves outside the brain and spinal cord). Neurotoxic poisons may exert their effects through various mechanisms, such as disrupting neurotransmitter release, blocking ion

Medico-legal Importance

It is used for the purpose of criminal abortion.

It is very rarely for homicidal purpose.

Latex is applied on eyes and genital organs for the punishment of adultery.

It is included in Schedule E-1 of drugs and cosmetics rules, 1945

Visha Kalpa

- Snuhi Ksheer Ghrita,
- Vajrakshar,
- Kshar Gutika,
- Snuhyadi tail,
- Bhuktanjari Gutika

Langali (Gloriosa Superba)

Langali *(Gloriosa superba)*, commonly known as the flame lily or glory lily, is a species of flowering plant in the family Colchicaceae. It is native to Africa and Asia and is known for its striking and distinctive flowers. It is cultivated for its ornamental value and is a popular choice in gardens and floral arrangements. It is typically grown from tubers, and the plant can be trained to climb with the help of its tendrils.

Vernacular Names:

❖ **Sanskrit**

- **Langali**: Shape of rhizome is like a plough.
- **Kalihari**: It is used in difficult labour.
- **Garbhanut**: As it causes abortion.
- **Agnishikha**: The colour of flowers is yellow-red like flames of fire.

❖ **Marathi**: Kalalavi

❖ **Hindi**: Kalihari, Kaliyari

❖ **English**: Malabar glory lily, Climbing lily, Tiger's claws.

Classification

According to Ayurveda

Sthavara: Vegetable poison

Kanda visha: (According to Sushruta Samhita)

Upavisha: According to Bhaavprakaash and Rasa-tarangini

According to Modern Medicine

Irritant – Organic – Vegetable poison

General Description

It is a beautiful tender climber, which is seen in rainy season (annually). It is found in various habitats, including grasslands, scrublands, and forests, across parts of Africa and Asia. It prefers well-drained soils and is often found in tropical and subtropical regions

Stem: Narrow, 6 meters in length, areal stem is fleshy and grows from the underground stem.

Leaves: A spiral comes out from the end of leaves. With the help of this tendril, it climbs on other trees. So called as Tiger's claws.

Fig. 9.39

Fig. 9.40 : Langali plant and Rhizomes

Practical Identification

Rhizome: V- or L-shaped underground stem, whitish, soft, fleshy, delicate, and should be teased apart gently just before new growth begins. It looks like a plough (Langal), so the name langali is derived. Each tuber part must contain several axillary buds that ensure the formation of adventitious stems and roots.

Flowers: Large, single and has long stalk. Flowering is at the end of the rainy season. The colour of flowers is bright red. The flame lily is known for

its unique and attractive flowers. The petals are typically yellow or orange with red or maroon tips, resembling flames, which gives the plant its common name.

Active Principle

Leaves and roots of this are most toxic.

Superbine, Colchicine, Gloriosine,

Mechanism of Action

CNS depressant, Uterine Stimulant, spasmolytic

Fatal dose: Uncertain (more than 750 mg)

Fatal period: Uncertain

Signs and Symptoms

As per Classical texts

शुष्का वाऽर्द्रा लाङ्गलिनी स्वल्पापि परिशीलिता।
करोति दारुणं दाहं मोहातिसारविभ्रमम्। –R.T. 24/499

If Langlikanda is consumed in small quantities in wet or dry conditions, the symptoms of severe inflammation (भयंकर दाह), infatuation (मोह), diarrhoea (अतिसार), hallucinations (विभ्रम) are produced.

As per Modern Toxicology

Burning and tingling numbness in mouth and throat. Acute poisoning results in severe vomiting, diarrhoea, abdominal pain, and hypotension. Ataxia, profuse sweating, spasms in muscles, convulsions, and collapse occur. Death is due to respiratory failure.

Colchicine can be absorbed through the skin and irritate.

Colchicine toxicity affects the gastrointestinal system, the central nervous system, and other organs. In severe poisoning acute renal failure, cardio-toxicity and hematological abnormalities are mostly seen.

Shodhana

लाङ्गली शुद्धिमायाति दिनं गोमूत्रसंस्थिता इति लाङ्गली शुद्धिः।

–A.P. 6 / 112, Y.R. Upavisham

If Langali Moola is kept in cow's urine for one day, it becomes pure.

Therapeutic Dose

Moola churna (मूलचूर्ण) – 250 to 500 mg (बल्यकटुपौष्टिक)

For Abortion (गर्भनिष्कासनार्थ) – 3 to 6 gm

In other diseases – 1 to 2 gm

Differential diagnosis: Oxytocin, Aconite poison

Treatment

According to Ayurveda

Symptomatic treatment is given. For diarrhoea give the combination of curds, honey and sugar.

Juice of Lime (लिंबूस्वरस), Buttermilk (तक्र), Tamarind water चिंचापानक (चिकित्सा प्रभाकर Page No 506)

According to Modern Science

Give the symptomatic treatment

Give stomach wash, regulate blood pressure, and monitor the function of all vital organs.

Autopsy findings: No specific findings are seen

Medico-legal importance: The poisoning due to *Gloriosa superba* is mostly accidental as it is confused with sweet potato.

The Kanda Lepa is applied on the skin around umbilicus, perineum and inguinal region for the purpose of labourless delivery and abortion.

For criminal abortion, it is introduced in vagina. This may lead to accidental poisoning.

It is used as an adulterant in aconite.

It is included in **Schedule E**-1 of The Drugs and Cosmetics Rules, 1945.

Visha Kalpa

- Kasisadi Tail,
- Langali Rasayan,
- Bruhat Marichyadi Tail,
- Somraji Tail,
- Karviradya Taila,
- Nasika Churna ,
- Kacchuraksha Tail
- Kalkut Rasa

❖ Summary ❖

❖ **Vatsanabha**, also known as *Aconitum ferox*, is a highly poisonous plant. Mahaavisha, one of the main poisonous substances, is cardiac poison, Aconitine is the most potent poison present in Vatsanabha, along with other alkaloids like pseudo-aconitine, aconine, etc. Aconitine affects the myocardium, smooth muscles, skeletal muscles, CNS, and peripheral nerves by binding to Na+ channels, leading to various cardiac and neurological manifestations. External symptoms include tingling and numbness upon contact, while internal symptoms involve GI, cardiovascular, and neurological manifestations. Ayurvedic treatment involves using Tankan (Borax) and other formulations to counteract poisoning effects. Modern medical treatment

10 Sthavara Visha – Poisons of Metallic Origin

10.1 Arsenic

Introduction

Arsenic is a substance that has been well known to both the 'healer' and the 'poisoner' throughout history. Arsenic is known as the "Poison of Kings" and the "Saviour of Syphilis". Word arsenic is derived from Greek word *arsenikon*, which meant "masculine" or "potent" and referred primarily to orpiment, or yellow arsenic. In 1918, two organic arsenical compounds, Lewisite and Adamsite, vesicant and respiratory irritant agents, were developed by the US Army as chemical warfare weapons, both are still listed by the CDC as potential bioterrorism agents. In the 19th century, women applied arsenic powder to whiten their faces as well as to their hair and scalp to destroy vermin. It was also thought that arsenic consumption by women gave "beauty and freshness" to the skin. This metal is described in Ayurvedic text Sushruta Samhita for the first time as Dhatu visha "Fenashma & Hartala".

Vernacular Names:

- **Sanskrit**
  - Shankhavish,
  - Gauripaashaan,
  - Fenaashma,
  - Malla.
- **Marathi**: Somal
- **Hindi**: Sankhiya, somalkhar
- **English**: White Arsenic, Arsenious oxide, Arsenic trioxide, Vitreous Arsenic.

Classification

According to Ayurveda

- Sthaavar – Khanija Visha.
- Dhatu Visha (According to Sushruta)

According to Modern Science

Irritant – Inorganic – Metallic poison.

Description of Drug

Its chemical formula is As_2O_3 and is in two forms – (i) A whitish powder (ii) In crystal form like porseline.

It has a peculiar luster on its surface.

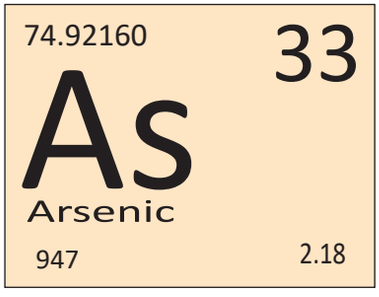
The main toxic component is arsenic and it has no colour, odour and taste.

The specific gravity is 3.669.

Very small amount is soluble in water and it is comparatively more soluble in warm water.

It is 3½ times heavier than water and still its powder floats on surface of water or sticks on the edges of pot.

If arsenic is heated, it gives garlic smell and then it evaporates & fumes disperse in atmosphere.



Fatal Period: 12 – 48 hours average.

Fatal dose: 100 to 200 mg.

Mechanism of Action

Arsenic trioxide is a soluble inorganic arsenic compound which is readily absorbed from the intestine (80–90%). Organic arsenic compounds found in seafood are not well absorbed. Absorption of Arsenic can also occur through the lungs and skin. Most of the arsenic in the blood is bound to red blood cells. On ingestion, biotransformation of inorganic arsenic is done by the liver into a methylated form of arsenic. It is excreted in the urine with a half-life of 3 to 5 days. Arsenic is also excreted in the outer layer of skin cells and sweat. Arsenic binds to sulfhydryl-containing proteins and concentrates in the hair and fingernails.

Fig. 10.2 : Mees lines

Table 10.1 : SIS of Chronic Arsenic Poisoning

Stages	Symptoms
Nutritional & gastrointestinal disturbances	General weakness, Loss of weight, Dyspepsia, Pain in abdomen, Constipation, Redness & softening of gums, Fever
Stage of catarrhal changes	Excessive salivation in throat & trachea, Deformity of voice, Eyes & nose congestion & watering of eyes, Photophobia, Nasal secretion, Cough with expectoration.
Stage of skin rashes	Patchy pigmentation in skin Hyperkeratosis of palms Skin irritation, Vesicular eruption
Stages of CNS disturbances	Tingling and numbness of hand and feet, Muscle tenderness, Headache, drowsiness and impaired vision

The other symptoms are deformities of liver, kidney, bone marrow and heart.

Aldrich Mees lines/Mees lines: are white lines or bands on nails, side to side across the entire nail. (Fig. 10.2)

Diagnosis

Urine level: 24 hr excretions exceeds 100 micrograms

Blood level: Less than 5 microgram/100 ml is normal

Hair level: It can be detected in proximal portions of hair within 30 hrs of ingestion

Radiology: Arsenic is radio opaque, hence abdominal x-ray can reveal the presence

Other Investigations

CBC, SR. Electrolytes,Urine, LFT, RFT, ECG

Differential Diagnosis

Cholera. (hanging drop test)

Bacterial food poisoning (hemogram and stool test)

Gastroenteritis.

Chronic alcoholism.

Table 10.2 : Differential Diagnosis of Arsenic Poisoning & Cholera

Sl.No.	Feature	Arsenic Poisoning	Cholera
1.	History	Circumstantial evidences of arsenic consumption are present.	Generally epidemic of cholera is present.
2.	Vomiting & diarrhoea	Vomiting followed by diarrhoea.	Diarrhoea followed by vomiting.
3.	Pain in throat.	Before vomiting	After vomiting
4.	Vomitus	First contents of stomach then blood & lastly water vomitus comes.	Watery from beginning up to the end.
5.	Stools	Rice-watery with blood	The stools are rice watery from beginning up to last.
6.	Tenesmus and pain around anus	Present	Absent
7.	Eyes	Eyes are congested.	No congesion of eyes.
8.	Voice	Not affected	Rough and whistling
9.	Laboratory investigations	1. radiolopaque shadow in the abdominal X-ray. 2. Chemical analysis shows traces of arsenic.	1. The abdominal X-ray findings shows normal shadow. 2. Microscope findings shows presence of V-Cholerii bacteria.
10.	Circumstantial evidences	Present in individual, family or group	Present in sporadic or epidemic in locality
11.	Motive	Present (homicidal, rarely accidental)	Absent

11 Jangama Visha

The venom produced by a bite or sting (दंष्ट्रा) is called an animate poison (जंगम विष) or a stinger (दंष्ट्राविष/दंष्ट्रज). All kinds of animal poisons are included in this, e.g. snakes/serpents (सर्प), insects (कीट), rats (मूषक), spiders (लूता), scorpions (वृश्चिक), house lizards (गृहगोधिका), leeches (जलोका), fishes (मत्सय), frogs (मंडूक), hornets (कणभ), chameleons (कृकैलास), dogs (श्व/श्वान), lions (सिंह), tigers (व्याघ्र), jackel (गोमायु), hyena (तरक्षु), mongoose (नकुल), etc. (च.सं.चि. 23/9–10, A.S.U. 40/5, A.Hr.U. 35/4–5)

11.1 Sarpa Visha

तत्र दृष्टिनिःश्वासदंष्ट्रानखमूत्रपुरीषशुक्रलालार्तवमुखसन्दंश-विशर्धिततुण्डास्थिपित्तशूकशवानीति। S.K. 3/4

- India has 250 species of snakes
- 50 venomous
- Smallest snake – Worm snake, 15 cm long
- Largest snake - Reticulated python, 11 m long

Perhaps, snakes are the most despised animals in the world. Most of the people get chilled even on the sight of snake itself. Factors like magnitude of the complications, unexpectedness and immediate death warrant instantaneous emergency measures. Snakes enjoy a significant share in the world culture. Worshiping of snakes is still prevalent in India. *Naga panchami*, and *Anyilyam day* in Kerala are best examples.

Ample narrations about snakes are available in 'Brhattrayee'. These references are the most ancient authentic literature, influencing contemporary Ayurveda. Thus, Indian mythology, philosophy, literature etc. throw their shadow in the entire length of the classical texts. Even the origin of visha itself is part of Indian mythology.

Sarpa Bheda

Acharya Sushruta has mentioned two types of snakes, the first is Divya (divine) and the other is Bhouma (terrestrial) sarpa. Among these sixteen sites of poison, snakes have only three like sight, breath and teeth. Divya (divine) snakes contain their poison in sight and breath while Bhouma (terrestrial) snakes in their fangs.

Division of snakes according to Acharya Sushruta:

1. **Divya (Divine) sarpa:** According to Acharya Sushruta, Vasuki sarpa is the best among all the snakes and is also known as the king of all the snakes that hold the whole earth. It shines like the sun and it can destroy the whole world by their sight and breath. They are countless and there is no treatment for their wrath, means they are fatal.
2. **Bhouma (Terrestrial) sarpa**: According to Acharya Sushruta, terrestrial snakes are a total of eighty in counting and are classified into five types:
    1. Darvikara (hooded) sarpa - twenty-six
    2. Mandali (hoodless and painted with circular patches) sarpa-twenty-two
    3. Rajimanta (hoodless and striped) sarpa-ten
    4. Nirvisa (non-poisonous) sarpa twelve
    5. Vaikaranja (hybrid species) sarpa-three

The identification features of darvikara, mandali and rajimanta sarpa.

Darvikara (Hooded) sarpa: Snakes which have marks like wheel, plough, umbrella, swastika and ankusha and which make a phana (hood) are darvikara snakes. They move very fast. Krishnasarpa, Mahakrsish, Krishodara, Sveta-kapota, Mahakapota, Balahaka, Mahasarpa, Sankhakapala, Lohitaksa, Gavedhuka, Parisarpa, Khandaphana, Kakuda, Padma, Mahapadma, Darbhapuspa, Dadhimukha, Pundarika, Bhru-kutimukha, Viskira, Puspahikirna, Girisarpa, Rujusarpa, Svetodara, Mahasira, Alagarda and Aashivisa are darvikara snakes.

Mandali (Hoodless and painted with circular patches) sarpa: Snakes which have different patches on their whole body, big in size and move slowly

Table 11.1

Type of Snake	Venom	Rasa	Guna	Dosha Predominance
Darveekara	दर्वीकर	Kat'uka कटु	Ruksha	Vata kopana वातकोपन
Mandali	मण्डली	Amla अम्ल	Ushna	Pitta kopana पितकोपन
Raajila	राजिमन्त	Madhura मधुर	S'heeta	Kapha kopana कफकोपन

criterion for Raajila is that the body will be seen decorated with numerous intercepting lines. So a large set of snakes starting from the common rat snake to common krait come under this category.

Another classification is also done as Savisha and Nirvisha sarpas (poisonous and nonpoisonous snakes). In addition, depending on the colour and appearance; Sushruta categorises the snakes into Braahmna, Kshatriya, Vaishya and Shudra. This division may be seen as the influence of 'Chaaturvarnya'–the deep–rooted caste system of ancient India. Practically, no singificance can be found in this arrangement.

Classification of snakes, and the features of venomous and non-venomous snakes and identify their bites.

Classification of Snakes

Modern classification of snakes: There are near about 3500 species of snakes but only 250 species are poisonous. 216 species are found in India and only 52 are venomous. For the medicolegal aspects, snakes can be classified into two categories- poisonous and non-poisonous. But some non-poisonous snakes need to be dangerous, they can also kill small animals.

Fig. 11.1 : Russell's Viper

Nomenclature

- Phylum- Chordata
- Class- Reptilia
- Order- Squamata
- Suborder- Serpentes

Modern Classification of Snakes

Snakes are comprised in the order 'Ophidia' of Phylum Chordata. The characteristics of ophidia are described as limbless reptiles with a stretched-out body covered with horny epidermal scales which are cast off periodically. The scales on the head are called shields and are arranged in specific patterns. On the back, the scales are rather quadrangular in shape and those on the middle of the back (dorsal side) and the sides are termed vertebral and costal respectively. Usually, the scales are smooth, and in certain snakes, the scales are keeled. In general, the scales on the ventral side (underside) are transversally set and are known as ventrals and those on the undersurface of the tail are called subcaudals. On the anus scale, the anus opens. Identification of the snakes is done based on this specific arrangement of the scales.

Fig. 11.2 : Saw-scaled Viper

1. **Non-poisonous snakes**: Rat snakes, vine snakes, sand boa, and mud snakes are examples of non-poisonous snakes.
2. **Poisonous snakes:** They can be classified into five families. These are: 1. Viperidae 2. Elapidae 3. Hydrophidae 4. Colubridae 5. Atractaspididae–

Viperidae: Vipers are included in this family like Russell's viper, saw-scaled viper, gaboon viper, pit viper, and bushmaster. They are mainly found

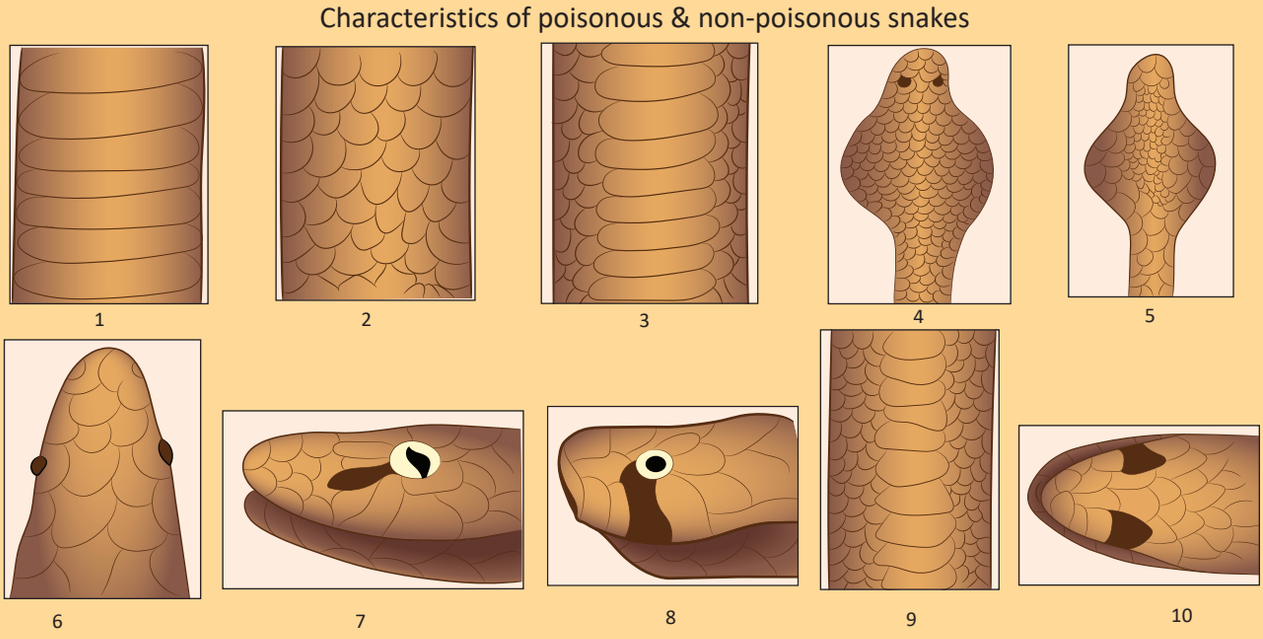


Fig. 1 to 3: Belly scales-large, small and moderate
Fig. 4 & 5: Small head scales of poisonous snakes
Fig. 6: Large head scales of non-poisonous snakes
Fig. 7: Pit viper, pit between eye and nostril, pupil is vertical
Fig. 8: Cobra, King cobra, third labial touches eye, pupil round
Fig. 9: Krait, enlarged central row of scales on back
Fig. 10: Krait, fourth infra labial is largest

Fig. 11.6

According to Sushruta

1. **Sarpita**: Deep punctured, two or more fang marks, the wound of considerable depth, a little amount of bleeding, compact, beak-like ring marks, swelling and disfigurement.
2. **Radita**: Less venom injected, area of bite is marked by reddish, bluish, yellowish, or whitish, lines, sometimes little bleeding, and Itching, less venomous.
3. **Nirvisha**: Non-poisonous, absence of swelling, vitiation of blood, one or more fang marks, steady and calm patients.

According to Vagbhata

1. **Tundahata**: Not caused by the bite, no teeth marks over the affected area, stained by saliva, the wound is caused by rubbing of the mouth.
2. **Vyalidha**: One or two bite marks, no bleeding
3. **Vyalupta**: One or two bite marks, bleeding present over the site of the bite.
4. **Dashtaka**: Three marks accompanied by tearing of muscles over area of bite, bleeding present due to ruptured vessels.
5. **Dashtanipidita**: Four biting marks, Four marks of teeth or fangs, tearing of muscles, rupture of vessels, bleeding, and signs of ulceration.

The fatal dose, fatal period, signs and symptoms of the common cobra, king cobra, Russel's viper, saw-scaled viper, pit vipers and common krait

Clinical Assessment

- History of local pain, diplopia, drooling, breathing difficulty, bleeding, abdominal pain, and vomiting.

2. Specific symptoms based on vitiation of Dosha (विशेष लूता दंश लक्षणे)-A.S.U. 44/24 A.Hr.U. 37/48

Table 11.12

Sr.No.	Luta Types	Symptoms
1.	Vayavya Luta	Roughness in swelling, blue in colour, joint pain
2.	Agneya Luta	Burning sensation, thirst, vesicles, fever
3.	Saumya Luta	Hard swelling, which is white in colour, itching, mild pain
4.	Sannipatik Luta	Burning sensation spread all over the body. It is the combination of all the three doshas.

3. Symptoms based on the site of poison (लूता अधिष्ठानानुसार दंश लक्षणे)-A.S.U. 44/14, Su.K. 8/87

Table 11.13

No.	Site of Poison	Symptoms
1.	Shwas (breath)	Swelling associated with fever and burning sensation
2.	Danta (Teeth)	Swelling associated with pricking pain and burning sensation
3.	Purisha (Excreta)	Foul smell swelling, burning sensation, itching, pricking sensation
4.	Mutra (Urine)	The swelling has red-colored edges, a black center, emits a foul smell, a burning sensation
5.	Shukra (Semen)	A tumour is hard and painful
6.	Lalastrava (Saliva)	Elevated rash, mild pain, itching, and soft to touch
7.	Nakha (nails)	Burning sensation, itching, eruption
8.	Raja/Aartava (Menstrual fluid)	Eruption red in colour resembles like garland

See the table down

5. Symptoms based on Kricchrasadhya and Asadhya of Loota Su.K. 8/96

Table 11.15

No.		Symptoms
1	Krichchhri-sadhya Loota Lakshan	Pain, itching at the site of bite, headache
2	Asadhya Loota Lakshan	Bleeding, fever, burning sensation, diarrhoea, and disorder due to the concentrated action of all the three deranged dosas of the body

4. Stagewise Symptoms of Spider (दिन विशेषात लूतादंश लक्षणे)

Table 11.14

Days	Sushruta Samhita Su.K. 8/81-82	Ashtanga sangraha A.S.U. 44/16-21, A.Hr.U. 37/60-65
दिनार्ध	—	No specific sings
प्रथम First	No discolouration over the affected part, slight itching, pain	Appears like a mark made by a needle without any manifestation of colour, it is very unsteady with mild itching and pain
द्वितीय Second	Raised edges, surrounded by eruptions, change in colour of skin, Itching, depressed in the centre	Elevation at the edge or gets covered by numerous eruptions, with well-manifested colour, depressed in the center, has itching, and appears like a tumor.
तृतीय Third	Fever, red patches, horripilations, pain, discharge from hair follicles	Fever, horripilation, red coloured saucer shaped rashes with severe pricking pain and bleeding appear at the hair follicle
चतुर्थ Fourth	Profound swelling, dyspnoea, giddiness	Profound swelling, great heat, dyspnea, and dizziness.
पंचम Fifth	This gives rise to symptoms of poisoning related to doshas	Gives rise to many symptoms of poisoning
षष्ठ Sixth	Poison invades all vital organs	It spreads to the vital spots
सप्तम Seventh	Destroys life	It destroys the life

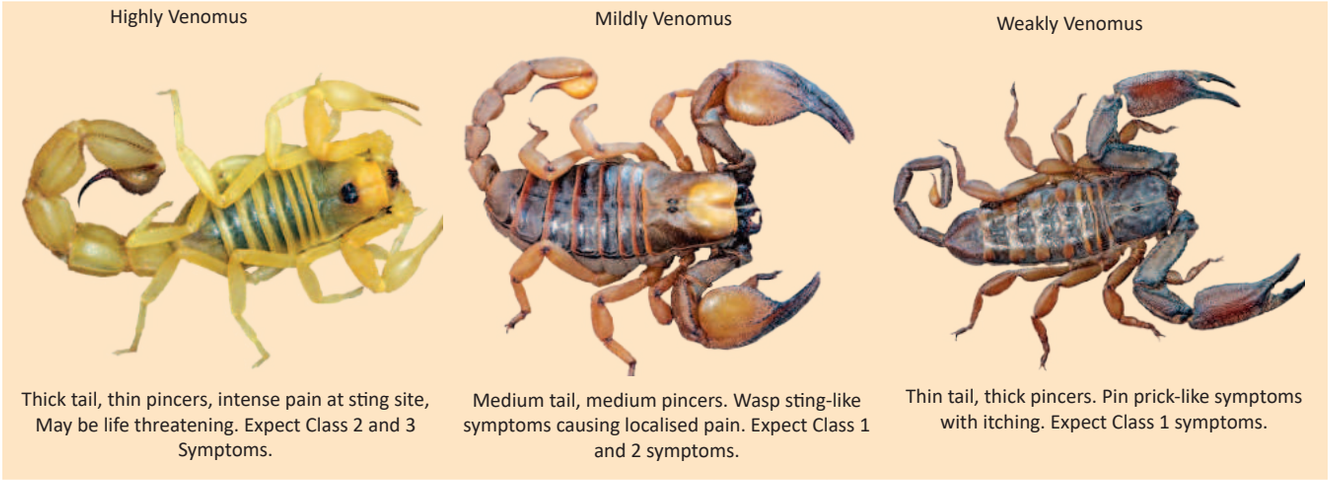


Fig. 11.15 : Venumosity Rule of Thumbs of Scorpions

Table 11.18 : Types of Vrishchika based on Varna (Colour) Visha & Lakshana)
(वृश्चिक प्रकार-वर्ण, सामान्ये लक्षणे)

Sl.No.	Vrishchika Bheda	Varna	Samanya Lakshanas
1.	Manda Visha Vrishchika	• Krishna • Shyava • Karbura • Pandu • Gomutra • Karkasha • Mechaka • Peeta • Dhooma • Varna • Romayukta • Shadvala • Rakta Varna	• Vedana • Kampa • Gatra Stambha • Krishna Rakta • Daha • Sotha • Jwara • Sweda
2.	Madhya Visha Vrischika	• Rakta • Peeta	• Jihva Sotha • Bhojanasya Abarodha • Murcha
3.	Maha Visha Vrishchika	• Shweta • Chitra • Shyamala • Lohita • Rakta Shweta • Rakta Neela • Peeta Rakta • Neela Peeta • Neela Shukla • Rakta Vabru	• Sarpa Visha Vega • Sphota • Daha • Jwara • Manovibhram

Table 11.19 : त्रिविधा वृश्चिका: प्रोक्ता मन्दमध्यमहाविषा

Type	Identification by tail Segments	Clinical Picture	
मन्दविष	Multiple	वेदनाचोर्ध्वमेति वेपथुगात्रस्तम्भ: कृष्णरक्तागम दाहस्वेद दंशशोफ ज्वर	Ascending pain Tremors Lock jaw, stiffness in limbs Black haemorrhage Burning pain. Sweating Oedema at sting site Fever
मध्यविष	3	जिह्वाशोफभोजनस्यावरोध मूर्च्छाचोग्रा	Glossitis Difficulty in swallowing Deep syncope

with the saliva of an infected animal on mucous membranes or open wounds.[1]

The incubation period of rabies (defined as the interval between exposure and the onset of clinical disease) is usually 20–90 days.

Rabies virus spreads centripetally along peripheral nerves toward the spinal cord or brainstem via retrograde fast axonal transport (rate, up to ~250 mm/d), with delays at intervals of ~12 h at each synapse.

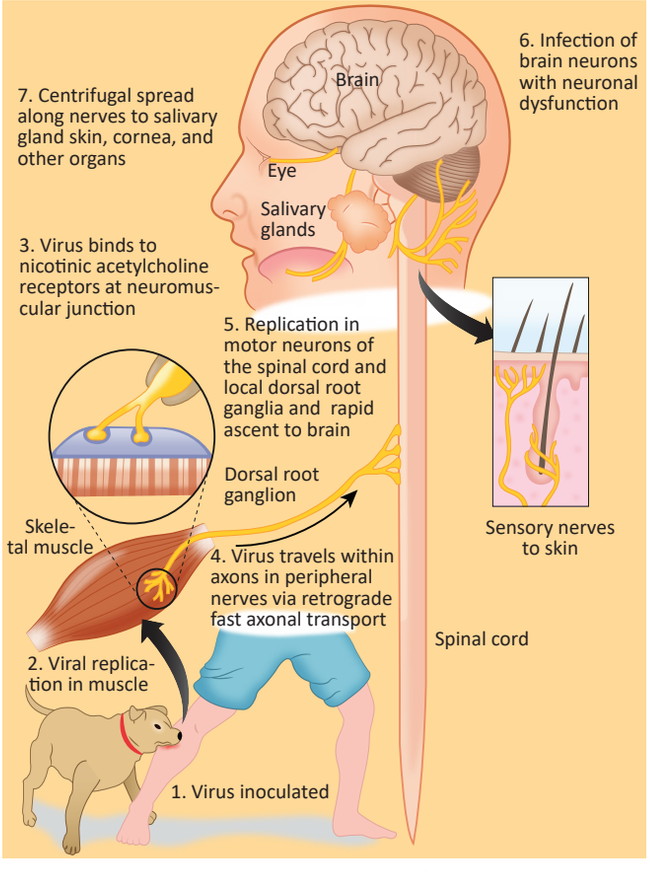


Fig. 11.21 : Pathogenesis of Rabies

Rabies virus spreads centripetally along peripheral nerves toward the spinal cord or brainstem via retrograde fast axonal transport (rate, up to ~ 250 mm/d), with delays at intervals of ~ 12 h at each synapse.

After CNS infection becomes established, there is centrifugal spread along sensory and autonomic nerves to other tissues, including the salivary glands, heart, adrenal glands and skin.

1. A.C. Jackson: *Rabies: Scientific basis of the disease and its management*, 3rd ed. Oxford, UK, Elsevier Academic Press, 2013.

Rabies virus replicates in acinar cells of the salivary glands and is secreted in the saliva of rabid animals that serve as vectors of the disease. The most characteristic pathologic finding in rabies is the Negri body. Negri bodies are eosinophilic cytoplasmic inclusions in brain neurons that are composed of rabies virus.

Table 11.24

Stage	Typical Duration	Symptoms and Signs
Incubation period	20-29 days	None
Prodrome	2-10 days	Fever, malaise, anorexia, nausea, vomiting, paresthesias, pain or pruritus at the wound site
Acute Neurologic Disease		
Encephalitic (80%)	2-7 days	Anxiety, agitation, hyperactivity, bizarre behaviour, hallucinations, autonomic dysfunction, hydrophobia
Paralytic (20%)	2-10 days	Flaccid paralysis in limb(s) progressing to quadriparesis with facial paralysis
Coma, death	0-14 days	
Recovery is rare. *Source:* Adapted from MAW Hattwick: Rabies virus, in *Principles and Practice of Infectious Diseases,* GL Mandell et al. (eds) New York, Wiley, 1979		

Symptoms

Early Symptoms: Prodromal Features– The clinical features of rabies begin with non-specific prodromal manifestations, including fever, malaise, headache, nausea and vomiting. Anxiety or agitation also may occur.

Neurological Symptoms: The earliest specific neurologic symptoms of rabies include paresthesias, pain, or pruritus near the site of the exposure, Encephalitic Rabies: Two acute neurologic forms of rabies are seen in humans: the encephalitic (furious) form in 80% and the paralytic form in

12 Kritrima Visha

12.1 Inorganic Acids – Sulphuric Acid, Hydrochloric Acid, Nitric Acid

1. Sulphuric Acid

(Domain – CK, Must to know, Know-how, **Teaching - Learning methods –** Lecture and PPT, Presentation)

Name of Poison: Sulphuric acid

Chemical formula: H_2SO_4

Introduction: It is used as an electrolyte in storage batteries. It is also used in various industries of leather, fur, wool, food processing, and gas drying. It is used as a laboratory reagent. Photochemical oxidisation of sulphur dioxide to sulphur trioxide which later reacts with water produces sulphuric acid, which is responsible for "Acid rain".

Marathi/Hindi: गंधकाम्ल

English: Oil of Vitriol, Battery acid.

Classification

Ayurvedic: Kritrima visha

According to modern Science: Corrosive – Strong acids – mineral/inorganic acids

Antidote: Ca or Mg oxide or aluminium gel

General Features

Pure: Heavy, colourless, odourless, oily, hygroscopic (readily absorbs water vapour from air)

On mixing with water it reacts, with water giving off intense heat.

Mode of Action

1. Dehydration of tissues in contact.
2. Burning and necrosis of tissue.
3. Coagulation necrosis due to precipitation of proteins.
4. Symptoms of poisoning due to conversion of haemoglobin into acid hematin.
5. Systemic absorption is negligible.

Fatal Dose: 5 to 30 ml.

Fatal Period: 12 to 24 hours

When it comes in contact with body, charring, blackening of skin, clothes and all organic matter occurs.

Fig. 12.1

Acute Toxic Signs & Symptoms

- Burning pain starts from mouth to stomach. The stomach pain spreads all over abdomen and starts acute colicky pain of abdomen.
- The lips are swollen and corroded. Brownish-black trickle mark at both corners of the mouth. These marks are also found on both sides of chin and on neck. (Fig. 12.1)
- The teeth become white like chalk.
- The tongue is swollen and turned blackish-brown in colour, sometimes it is converted into a shapeless ball.
- Constant drooling from mouth which is a sign of oesophageal injury can also be seen.
- Patient suffers from intense thirst but when he tries to drink water, dry vomiting starts.
- The vomitus is acidic and brownish black due to altered blood (coffee ground vomit). Sometimes shreds of charred mucosal membrane of stomach may be present in vomitus.

Oxalic Acid

Introduction

It occurs naturally in plants and vegetables like spinach, sorrel, Rhubarb. It is used in anti-rust products, bleaches, metal cleaners.

Workplace Exposure Limits (for air exposure) oxalic acid

OSHA: The legal airborne permissible exposure limit (PEL) is 1 mg/m^3 averaged over an 8-hour workshift.

NIOSH: The recommended airborne exposure limit (REL) is 1 mg/m^3 averaged over a 10-hour workshift and 2 mg/m^3, not to be exceeded during any 15-minute work period.

ACGIH: The threshold limit value (TLV) is 1 mg/m3 averaged over an 8-hour workshift and 2 mg/m3 as a STEL (short-term exposure limit).

https://www.nj.gov/health/eoh/rtkweb/documents/fs/1445.pdf

Vernacular Names

- **Sanskrit:**
- **Marathi:**
- **Hindi:**
- **English:** Acid of Sugar, Salt of Sorrel

Classification

According to Ayurved: Kritrima visha

According to Modern: Corrosive Organic acid

Description of Drug: Colourless crystals, turn dirty gray after some time

Fatal Period: 1 to 2 hours

Fatal dose: 15 to 30 gm

Chemical formula: $C_2H_2O_4$

Mechanism of Action

Locally moderate corrosive

Systemic: Hypocalcaemia (reaction with calcium in plasma and precipitation of calcium oxalate), Nephrotoxicity (calcium oxalate accumulates and excreted through the kidney.) Shock (all vital organs are affected).

Signs & Symptoms

Local: Whitish or yellowish corrosin of mucusa with underlying congestion (reffered a scalded)

Systemic: Burns and blisters where the acid contacted the skin, lips, tongue and gums

Pain in abdomen, drooling, vomiting and diarrhoea.

This is followed by **Hypocalcaemia (Tetany):**

Muscle spams, cramps

Accoucher's hand

Possitive Chvstek's sign or Trousseau's sign

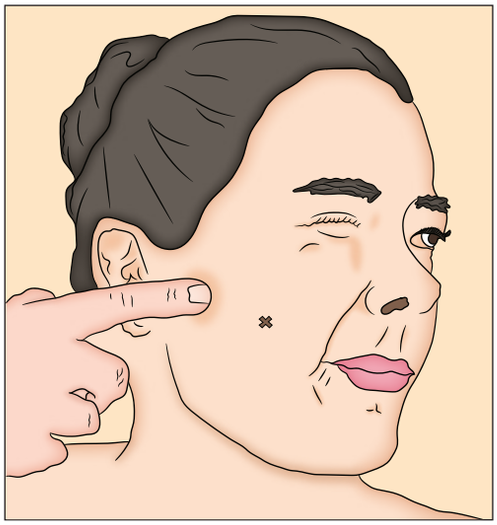


Fig. 12.4: Chvostek's sign

The Chvostek sign is a clinical sign seen in hypocalcemia.

- Abnormal twitching of muscles that are activated (innervated) by the facial nerve.
- When the facial nerve is tapped in front of the ear, the facial muscles on the same side of the face will contract sporadically.

Fig. 12.5: Trousseau's sign

The Trousseau sign of latent tetany is a way to determine if an individual may have hypocalcemia. Trousseau's sign is considered positive when a carpopedal spasm of the hand and wrist occurs after an individual wears a blood pressure cuff inflated over their systolicblood pressure for 2 to 3 minutes.

Table 12.1 : Formic Acid

Feature	Formic Acid
Classification:	Kritrima visha, Corrosive organic acid
Description of Drug:	Formic acid is a colourless liquid having a pungent, penetrating odour at room temperature,
Fatal Period	Acute 1 to 3 hours Chronic: Only if complications are severe
Fatal Dose	15 – 200 ml
Mechanism of Action:	Corrosive actioo on GI mucosa • Causes hemolysis leading to acute renal failure • ATP synthesis is diminished
Source of Exposure:	In nature, formic acid is found in most ants and in stingless bees of the genus Oxytrigona. incorporated in many fruits such as pineapple, apple, kiwi, onion, eggplant A major use of formic acid is as preservative and antibacterial agent in livestock feed Formic acid can be used in a fuel cell Formic acid is also significantly used in the production of leather, including tanning in dyeing and finishing textiles production of rubber Formic acid is also used in place of mineral acids for various cleaning products,[1 such as limescale remover and toilet bowl cleaner. Some formate esters are artificial flavorings and perfumes. Formic acid application has been reported to be an effective treatment for warts.
Signs & Symptoms:	Bowel perforation Shock tracheoesophageal fistula hypotension respiratory distress severe degree of burns hematemesis metabolic acidosis ARDS esophageal stricture
Differential Diagnosis	Mineral acids
Treatment according to Ayurveda	चूर्णोदकपान कामदुधा गैरिक
Treatment according to M.M.	Milk –Folinic acid 1mg /Kg 4th hourly Metabolic acidosis can be corrected with administration of IV bicarbonate during initial few hours to reduce the associated morbidity and mortality. Esophageal stricture is the long-term complication, which may require serial dilatation. Workers of rubber plantation should be educated on safe handling of formic acid.
Autopsy Findings	Bowel perforation, Burns
Medico-legal Importance	Suicidal Accidental

General Antidote

Inj. Atropine - blocks the muscurine affects. For this atropine 2 mg per 15-30 minutes IM/IV should be given until the pupils get dialated. The other symptoms should be closely observed. 12 mg of Atropine can be given safely in first 2 hours.

Fig. 12.11

13 Substances of Abuse

13.1 Madya & Madaatyaya (Alcohol & Alcoholism)

Mada Definition (मद परिभाषा)

1. **योनिसंस्कारनामाद्यैर्विशेषैर्बहुधा च या।**
   भूत्वा भवत्येकविधा सामान्यान्मदलक्षणात्।। Ch. Chi. 24/6

   In Ayurveda, many varieties of madya are described as per its yoni (utpatti) and sanskara. All types of madya are responsible for producing Mada (intoxication).

2. **बुद्धिं लुम्पति यद् द्रव्यं मदकारि तदुच्यते।**
   तमोगुणप्रधानं च यथा मद्यं सुरादिकम्।। Sh. P. 4/22

   Acharya Sharangdhars, has defined Madkari dravya as substances which rubs the intellect. These Dravya are intoxicating in nature and predominant in Tamo guna. e.g. wine.

   Acharya Sushruta has mentioned following qualities of a poison in Kalpasthana 2/19.

Properties of Medya (मद्य गुण)

मद्यमुष्णं तथा तीक्ष्णं सूक्ष्मं विशदमेव च।
रूक्षमाशुकरं चैव व्यवायि च विकाशि च।। SU. 47/03

लघूष्ण तीक्ष्ण सूक्ष्माम्ल व्यवाय्याशुगमेव च।
रूक्षं विकाशि विशदं मद्यं दशगुणं स्मृतम्।। Ch. Chi. 24/3

The qualities of Madya (alcohol) are Ushna, Teekshna, Sukshma, Vishada, Ruksha, Aashukari, Vyavaayee and Vikaasee.Therefore, consumption of large quantity of alcohol shows poisonous effects.

बहुद्रव्यं बहुगुणं बहुकर्म मदात्मकम्।
गुणैर्दोषैश्च तन्मद्यमुभयं चोपलक्ष्यते।। Ch.Chi. 24/26

Madya is prepared from various dravya, hence it contains various qualities and action. All produce intoxication.

Functions of Madya (मद्यकर्म)

सर्वं पित्तकरं मद्यमम्लं रोचनदीपनम्।
भेदनं कफवातघ्नं हृद्यं बस्तिविशोधनम्।।

पाके लघु विदाह्युष्णं तीक्ष्णमिन्द्रियबोधनम्।
विकासि सृष्टविण्मूत्रं... Su.Su. 45/170-171

All types of wine are sour in taste, and appetising. They are Pittakar, and appetising, digestive in nature. They act as mild purgatives, subdue the deranged Vata and Kapha, and are pleasing, exhilarating and diuretic. They are light in digestion and give rise to a kind of re-actionary acidity. They are keen and heat-making, stimulate the sense organs, expand the joints and increase the discharge of urine and stool.

Madya to be Avoided (वर्ज्य मद्य)

सान्द्रं विदाहि दुर्गन्धं विरसं कृमिलं गुरु।।
अहृद्यं तरुणं तीक्ष्णमुष्णं दुर्भाजनस्थितम्।
अल्पौषधं पर्युषितमत्यच्छं पिच्छिलं च यत्।।

Su.Su. 45/198-198

The following kinds of wine should always be rejected. The wines which are thick, bad smelling, or insipid or full of worms, or heavy and acid in digestion, un-pleasant, new, strong and heat-making in their potency, or which have been preserved in an improper vessel, or which have been prepared with a comparatively lesser number of ingredients or have been decanted over-night, or are extremely slimy or transparent, as well as the dregs of all kinds of wine.

Types of Madya (मद्यप्रकार)

सर्वं पैष्टिकं माद्वीकं गौडं च त्रिविधं हि मद्यम्।
Su. U. 45/170 (Dalhan Teeka)

Table 13.1

माद्वीक	Wine from grapes	जगल	Residue in ferment cask
खार्जूर	Wine from dates	बक्कस	Dried yeast from cask
सुरा	Distilled spirits	गौडःशीधु	Distilled spirit from Jaggery

- At 150-200 mg/dl the person is sleepy ataxic and drunk,
- 200-300 mg/dl result in stupor
- Above this unconsciousness prevails.
- Medullary cent are paralysed and death may occur.

CVS

- The effect are dependent on dose.
- *Small* doses produce only cutaneous (especially on the face) and gastric vasodilatation.
- Skin is warm and flushed and there may conjunctival congestion.
- BP is not affected.
- *Moderate* dose cause tachycardia and mild rise in B P due to increased muscular activity and sympathetic stimulation.
- *Chronic alcoholism* may lead to cardiomyopathy, cardiac arrythmias occur due to conduction defects.

Table 13.6 : Acute Alcohol Poisoning according to Blood Alcohol Concentration: 7 Stages

Stage	BAC mg/100 ml	Stage of Intoxication	Clinical Features
I.	0 to 50 ml	**Sobriety**	No significant effect or mild euphoria. Near normal behaviour
II.	50 to 100 ml	**Euphoria**	Feeling of well being Sociability Decreased inhibition, Increased self confidence Decreased attention span Alteration of judgment Nystagmus Fine movements affected
III.	100-150 ml	**Excitement**	Some mental confusion, emotional instability loss of critical judgment imapairement of memory and comprehension sleepiness, Mild ataxia slowed reaction time
IV.	150-200 ml	**Confusion**	Disorientation, Confusion Vertigo Diplopia Ataxia Slurred speech Staggering gait
V.	200-300 ml	**Stupor**	Tendency to do nothing Inability to walk or stand Vomitting Diminished response to stimuli
VI.	300 to 500 ml	**Coma**	Anaesthesia, depression of responses, deep coma
VII.	More than 500 ml	**Death**	Death due to respiratory failure

14 Agad Tantra Perspectives on Cancer

14.1 Toxic Carcinogens

Everything under the Sun including the Sun can be carcinogenic, depending upon many factors. Exposure to these carcinogens can be extremely harmful to human health and may lead to the development of cancerous cells.

"**Toxic carcinogens**" refers to substances or agents that possess two key characteristics: They are toxic, meaning they can cause harm or damage to living organisms, and they are carcinogenic, meaning they have the potential to induce or promote the development of cancer. This aspect of the definition refers to the harmful effects a substance can have on living organisms. Toxic substances can cause damage to cells, tissues, organs, or biological systems, leading to adverse health effects. **Carcinogens** are substances that can cause cancer or increase the risk of developing cancer. Various chemicals, pollutants, and environmental factors can fall into the category of toxic carcinogens. Prolonged exposure to these carcinogens may lead to genetic mutations or other changes in cells that can result in uncontrolled and abnormal cell growth, a hallmark of cancer. Identifying and understanding toxic carcinogens is crucial for public health, as it allows for the development of regulations, guidelines, and preventive measures to minimize human exposure and reduce the risk of cancer development.

Common examples of toxic carcinogens include –

- **Tobacco Smoke**: Smoking is a major cause of lung cancer and is associated with various other cancers, including those of the mouth, throat, esophagus, and bladder.
- **Asbestos**: Exposure to asbestos fibers, often found in certain building materials, can lead to lung cancer and mesothelioma.
- **Radiation**: Ionizing radiation, such as that from X-rays and nuclear sources, can increase the risk of cancer.
- **Aflatoxins**: These naturally occurring toxins produced by certain molds can contaminate food, particularly nuts and grains, and are associated with liver cancer.
- **Arsenic**: Found in some drinking water sources and certain foods, long-term exposure to high levels of arsenic has been linked to skin, lung, and bladder cancer.
- **Benzene**: This chemical is present in some industrial processes and can be found in cigarette smoke. Long-term exposure is associated with leukemia.
- **Formaldehyde**: Used in the production of various household products, including some building materials and personal care items, formaldehyde exposure has been linked to certain types of cancer.
- **UV Radiation**: Prolonged exposure to ultraviolet (UV) radiation from the sun or artificial sources, like tanning beds, increases the risk of skin cancer.

In conclusion, toxic carcinogens pose a significant risk to human health by potentially causing cancer. Additionally, chemotherapy and radiotherapy, while essential in treating cancer, can also result in toxicities due to their effects on both cancerous and healthy cells. Healthcare providers must prioritize patient safety and well-being by closely monitoring and managing these toxicities during cancer treatment.

of Dooshivisha, garavisha and Viruddha aahar, like purification therapy Snehana, Svedana, Vamana, Virechana, Raktamokshana, etc. as explained in the classical treatment of Dooshivisha, garavisha and Viruddha aahar, which is followed by administration of Agada formulations like – Ajeya ghruta, Ajitagada, Dushivishari Agada, Bilvadi agada, Dashanga Agada, etc. and Rasayana therapy.

During the examination of the patient, if Samata is observed, 'Ama nirharana' is the initial, or first-line management. Shodhanam, Langhana pachanam, and Langhanam are the treatment for prabhutha, madhyama, and alpa dosha respectively. But, in the case of cancer, Rugna bala is Hina (very weak) due to the disease. So shodhanam and langhanam should not be desirable in the particular condition. So, modalities like mridulanghana and pachana are helpful, for that 'Sashunthilajapeya' is given along with mild pachana oushadhas like Drakshadi Kashyam. After getting some 'bala' to the patient strong amapachana drugs like pachanamrutham Kashayam, Sapthasaram Kashayam, etc. can be specified

Pathyapathya described in Visha chikithsa should be monitored, as Guru, Ushna, Tikshna Ahara, etc. will lead to the formation of more Ama and thereby help the advancement of the disease. The presence of Amino acids in the diet enhances the growth and proliferation of Tumour cells and also for Neovascularization (Angiogenesis). So all protein diets should be restricted. Laghu gunatmaka Peyadi, Yusha Kalpna is only advisable in this condition.

Huge number Agadakalpas explained during the treatment of Dooshivisha, garavisha and Viruddha aahar are also useful to reduce or vanish latent toxicity produced due to Radiotherapy and chemotherapy, during treatment, like –

Table 14.3 : Special Agada Formulations

Sl.No.	Name	Properties
1.	Bilvadi Gutika	Hepatoprotective, radiotoxicity protection, vibrio cholerae-ciprofloxacin
2.	Ajithagadam	Nephro toxicity protection
3.	Kalyanaka Ghruta, Ajeya Ghruta	Radio toxicity protection
4.	Dhatakyadi agada, Dushivishari Agada	Ecoli, staphylococcus oreus, strepto coccus mutans
5.	Dooshivishari Agada	Lichen planus
6.	Dhvaswakarnadi, patala paribhadradi, kataka beeja	Promising water pollution controller
7.	Malatyadi agada	Hemotoxicity protection
8.	Bhunimbadi agada, dushivishari agada	Ecoli, staphylococcus oreus, shigella sonnei, salmonella enterica
9.	Sirisha punarnva, tulasi	Reproductive and developmental toxicity

The application of these specific Agada formulations along with this above-mentioned treatment protocol will be helpful for prevention, minimising the side effects of conventional therapies, and improving the quality of life of cancer patients. Here are some Ayurvedic herbs that have been studied for their potential anticancer properties –

Table 14.4

1.	Ashwagandha (*Withania somnifera*)	Anti-cancer effects, anti-tumor and immune-modulating properties
2.	Turmeric (*Curcuma longa*):	Anti-inflammatory and antioxidant properties
3.	Tulsi (*Ocimum sanctum*):	Antioxidant and anti-inflammatory, potential anti-cancer effects
4.	Guduchi (*Tinospora cordifolia*)	Immunomodulatory effects
5.	Triphala	Antioxidant and anti-inflammatory properties, potential anti-cancer effects
6.	Kanchanar (*Bauhinia variegata*)	Anti-tumor and anti-inflammatory property

15 Forensic Medicine (Vyavahara Ayurveda) & Medical Jurisprudence (Vidhi Vaidyaka)

15.1 Forensic Medicine and Medical Jurisprudence

"Forensic medicine" and "medical jurisprudence" are closely related fields that deal with the intersection of medicine and the law. While they share common elements, they have distinct focuses and applications.

1. Forensic Medicine

Forensic medicine, is also known as legal medicine or state medicine. It involves the examination of deceased individuals (autopsies) to determine the cause of death, identify injuries, and collect evidence. This is crucial in criminal investigations, especially in cases of homicides or accidental deaths.

Derivation: The term "forensic" is derived from the Latin word "forensis," which means "about the forum." In ancient Rome, the forum was a public square where judicial activities and legal proceedings took place. This term emphasises the connection between science and the legal system. The word "forensic" in its modern context refers to the application of scientific principles and techniques to legal matters, especially in the context of crime investigation and law enforcement. These methods help investigators establish facts, solve crimes, and support legal proceedings.

Definition: Forensic medicine is a specialised branch of medicine that deals with the application of medical knowledge and techniques to legal issues, criminal investigations, and the determination of cause and manner of death. It involves the examination and analysis of deceased individuals, as well as living individuals who may have been victims of physical or sexual assault, to provide critical information and evidence for legal and law enforcement purposes.

In short – **Forensic Medicine means Medicine as applied to the Legal Profession.**

Vyavahara Ayurveda

व्यवहारार्थः आयुर्वेदः व्यवहारायुर्वेदः।।

The term Vyavahar ayurveda is made up of two words – Vyavhar and Ayurveda.

Vyavahara

स्वधनस्य यथा प्राप्तिः परधर्मस्य वर्जनम्।
न्यायेन यत्र क्रियते व्यवहारः स उच्यते।। Harit Smriti 2/1
नानासंदेहहरणात् व्यवहार इति स्मृतः। Amarkosha 1/6/9

"Vyavahara" is a Sanskrit term that can be loosely translated to mean "transaction," "conduct," or "behaviour." In the context of Ayurveda or traditional Indian philosophy, "Vyavahara" often refers to one's day-to-day conduct, actions, or behaviour in the physical and social world. It encompasses how individuals interact with others, make decisions, and carry out their daily activities.

Ayurveda

हिताहितं सुखं दुःखमायुस्तस्य हिताहितम्।
मानं च तच्च यत्रोक्तमायुर्वेदः स उच्यते।। –Ch.Su. 1/41

Ayurveda emphasises the balance of doshas (Vata, Pitta, and Kapha) and recommends personalised approaches to maintain health and treat diseases. To achieve good health in Ayurveda, it's important to consider not only physical health (Sharirik Vyavahar) but also mental and emotional well-being (Manasik Vyavahar) and ethical conduct (Adhyatmik Vyavahar). Balancing all these aspects of Vyavahar is seen as a key to living a healthy and fulfilling life in Ayurvedic philosophy.

If the term Vyavahara Ayurveda is used in the context of Nyaya Vaidyaka Shastra, the application of Nyaya Shastra from the practical point of view of Ayurvedic principles and the corresponding practice can be called Vyavahar Ayurveda.

2. Medical Jurisprudence

Medical jurisprudence is a broader field that encompasses a range of legal issues related to

Description	Section in IPC	Clause in BNS
Grievous hurt	320	114
Voluntarily causing hurt	321, 323	115
Voluntarily causing grievous hurt	322, 325	115
(3) Grievous hurt causing permanent disability or persistent vegetative state	325	115
Voluntarily causing hurt or grievous hurt by dangerous weapons or means	324, 326	116
(4) Hurt caused by a mob	336	
Voluntarily causing grievous hurt by use of acid, etc	326 A, 326 B	122
Act endangering life or personal safety of others	336- 338*	123
Rape	375	63
Punishment for rape	375	64
Punishment for rape in certain cases	376(1), (2)	65
Rape on woman under 16 years of age	376 (3)	65 (1)
(2) Rape on woman under 12 years of age	376AB	65 (2)
Rape causing death or persistent vegetative state	376A	66
Sexual intercourse during separation	376B	67
Sexual intercourse by person in authority	376C	68
Sexual intercourse by deceitful means or false promise to marry	–	69
(1) Gang Rape	376 D	70 (1)
(2) Gang rape on women under the age of 18	376 B	70 (2)
Repeat offenders	376 E	71
Disclosure of identity of victim	228A*	72
Culpable homicide	299	100
Murder	300	101
Culpable homicide by causing death of person other than person whose death was intended	301	102
Punishment for murder	302	103 (1)&(2)

Table 15.3 : CrPC & BNSS

Description	Section in CrPC	Clause in BNSS
Examination of accused by medical practitioner at the request of police officer.	53	51
Examination of person accused of rape by medical practitioner	53 A	52
Examination of arrested person by medical practitioner at the request of the arrested person.	54	53
Police enquiry and report on suicide, etc.	174	194
Power to summon persons.	175	195
Inquiry by magistrate into cause of death.	176	196
Deposition of medical witnesses.	291	326
Identification report of Magistrate	291 A	327
Reports of certain Govt. scientific experts	293	329

16 Vaidya Sadvritta: Duties and Responsibilities of A Medical Practitioner

16.1 Vaidya Sadvritta, Medical Ethics and Code of Conduct, Charaka Oath and Hippocratic Oath

"Vaidya" is a term used in Ayurveda to refer to a practitioner of Ayurvedic medicine. It is derived from the Sanskrit word "Vaidya," which means a physician or healer. In Ayurveda, the Vaidya plays a crucial role in understanding an individual's unique constitution (Prakriti) and imbalances (Vikriti) to provide personalised health guidance. The title "Vaidya" is a mark of respect and recognition for those who have studied and mastered the principles of Ayurveda. These practitioners may undergo extensive training in Ayurvedic texts, herbal medicine, lifestyle counseling, and other aspects of traditional healing. Ayurvedic consultations with a Vaidya often involve a detailed examination of various aspects of an individual's life, including diet, daily routines, sleep patterns, and mental well-being.

In Ayurveda, an ancient system of medicine, "Sadvritta" refers to a set of guidelines (principles) or code of conduct. These guidelines encompass various aspects of an individual's lifestyle, including daily routines, dietary habits, social behaviour, and ethical conduct. Sadvritta is considered an integral part of Ayurveda, working in conjunction with other aspects of the system. Sadvritta is used along side the word Vaidya to explain the ethical conduct expected of a medical practitioner.

In various classical texts, many verses explain the ethical conduct of a Vaidya. A few of them are stated as follows –

Bhishak Guna (Lakshana) (Qualities of the Physicians)

अभेद्योऽनुद्धतः स्तब्धः सूनृतः प्रियदर्शनः।।
बहुश्रुतः कालवेदी ज्ञातग्रन्थोऽर्थशास्त्रवित्।
अनाथान् रोगिणो यश्च पुत्रवत्समुपाचरेत्।।
गुरुणा समनुज्ञातः स भिषक्शब्दमश्नुते। A.S.Su. 2/8–10

A person, who is unbeatable in debate, unchallenged, steadfast, friendly and polite with all, pleasing in appearance, who has read various sciences, known the appropriate time for every activity, who has mastered the science of Ayurveda, is conversant with Arthashastra (etymology), who looks after the destitute and the sick as his own children and who has obtained permission from his teacher to practice medicine, deserves to be called a Physician.

Bhishak Kartavya (Duties of the Physicians)

भिषगप्यातुरान् सर्वान् स्वसुतानिव यत्नवान्।
आबाधेभ्यो हि संरक्षेदिच्छन् धर्ममनुत्तमम्।। Ch.Chi.1/4/56

परोभूतदयाधर्म इत्यार्तेषु भिषग्वरः।।
वर्तते यस्तु सिद्धार्थः स सर्वमतिवर्तते। A.S.Su. 2/38, 39

The physician, who while treating patients has "compassion for all living beings"as the ideal, surely achieves success and surpasses all.

द्विज गुरुदरिद्रमित्र प्रव्रजितोपनत साध्वनाथाभ्युपगतानां
चात्म बान्धवानामिव स्वभैषजैः प्रतिकर्तव्यमेवं साधु भवति।
Su.Su. 2/8

The twice-born (Brahmana, Kshatriya and Vaishya castes) the preceptor, the poor, the friend, the ascetic, the refugee, the pious, the orphan, and the person coming from a distant place seeking help. The following should be treated free of charge, with medicines supplied by Vaidya.

अधिगत तन्त्रेणोपासिततन्त्रार्थेन दृष्टकर्मणा कृतयोग्येन शास्त्रं निगदता राजानुज्ञातेन नीचनखरोम्णा शुचिना शुक्लवस्त्र परिहितेन छत्रवता दण्डहस्तेन सोपानत्केनानुद्धतवेशेन सुमनसा कल्याणाभिव्याहारेणाकुहकेन बन्धुभूतेन भूतानां सुसहायवता वैद्येन विशिखाऽनुप्रवेष्टव्या।। Su.Su. 10/3

The physician who has completed the study of the texts understood the meaning/interpretations (of the precepts), observed the actions (application of therapies and their effects), made fit (through practical training), recapitulating the teachings of the science always, obtained permission from the king (government), having removed unkempt/ugly

8. **Punishment for manufacturing for sale or for storing or selling or distributing or importing spurious goods (Section 91)**: In case of manufacturing for sale or stores or sells or distributes or imports any spurious goods by himself or behalf of other person, shall be punished as per hurt got –
   - **Not amounting to grievous hurt to the consumer**: Imprisonment up to one year and fine - extend to three lakh rupees;
   - **Resulting in grievous hurt to the consumer**: Imprisonment - extend to seven years and fine up to five lakh rupees;
   - **Results in the death of a consumer**: Imprisonment not be less than seven years, extend to imprisonment for life and, fine - not be less than 10 lakh rupees.

Role of NGO's and Consumer Organizations

There are a number of NGOs and consumer organisations active in India who are working for consumer protection. Their roles involve –

- ❖ Raising awareness of consumer rights among the general public.
- ❖ Educating consumers through periodicals and other publications.
- ❖ Providing consumers with legal help, such as legal counsel.
- ❖ Filing complaints on behalf of consumers in competent consumer tribunals.
- ❖ Inspiring consumers to take action against unfair business practices.
- ❖ Taking the initiative to file cases on behalf of consumers in consumer courts.

❖ Summary ❖

- ❖ Vaidya has to follow the contemporary laws of the land.
- ❖ In this chapter, we look at ancient codes of conduct and discuss the current laws and guidelines that a practitioner has to follow.
- ❖ We also get an overview of duties, rights and privileges of the practitioner.
- ❖ In short, this chapter, is most important in the life of the practitioner.

17 Legal Procedures

17.1 Courts and their Powers

Hierarchy of Courts in India

- Supreme Court, also known as the Apex Court of India, is the highest court of the country.
- High Court: Every state in India has a High Court which deals with the cases of that particular state.
- District Courts or Sessions Courts are the courts of the district which deal with the cases at the lowest level.

Supreme Court: The country has one Supreme Court which is supreme and higher than the High Courts. It is at the top in the Hierarchy of courts in India. It is the responsibility of the Apex Court to administer justice all over India. **The total number of judges in Supreme Court can be 30-34, including the Chief Justice of India.** *The presiding officers of the Supreme Court is known as Justice and not judges or magistrate.*

Judges Bench: As per Article 124 of the Indian Constitution, the Supreme Court shall consist of a Chief Justice and other judges. The strength of Judges in Supreme Court is 34, including the Chief Justice of India.

There are Three Types of Benches in the Supreme Court

- Division Bench: A bench of 2 judges is called a Division Bench.
- Full Bench: A bench of 3 or 5 judges is known as a Full Bench.
- Constitutional Bench: A bench of 7 or more judges is called a Constitutional Bench.
- In its 70 years of history, the Supreme Court has only authorized 17 nine-judges bench judgments.
- The largest bench that has ever adjudicated on a case is 13 in the matter of Kesavananda Bharti v State of Kerela in 1973.

Supreme Court deals with three Jurisdictions:

- Original,
- Appellate and
- Advisory Jurisdictions.

Original Jurisdiction

- Its original jurisdiction extends to any dispute arising between the government and states.
- Enforcement of Fundamental Rights as per Article 32 of the Indian Constitution. The Supreme Court can direct transfer of cases from one high court to another or from a subordinate court to a higher court.
- May withdraw any case pending in the High Court and can dispose it off itself.

Appellate Jurisdiction

- When any one of the parties of the case is not satisfied with the order passed by the High Court, then such order can be pointed out and presented in the Supreme Court.
- When the case involves a substantial question of law or of general importance.
- When the High Court is of the opinion that the case is a fit for an appeal in the Supreme Court.

Advisory Jurisdiction

- The Supreme Court has an advisory jurisdiction on any matter specifically referred to it by the President of India under Article 143 of the Constitution.
- The President can obtain the advice of the Supreme Court if any question of law or fact arises.
- The Supreme Court has been provided the power to refuse to give an opinion on the matter.

High Court

- Each state has one High Court.
- High Courts administer justice at State level.
- Article 214 to 231 of the Indian Constitution deals with the provisions of the High Court.
- The record of judgments of High Courts can be used by subordinate courts for deciding cases.

18 Personal Identity

18.1 Identification Data

Personal identification is defined as establishing the identity of an individual. The need for personal identification arises:

- In natural mass disasters like earth quakes, tsunamis, landslides, floods etc., and
- In man-made disasters such as terrorist attacks, bomb blasts, mass murders, and
- In cases when the body is highly decomposed or dismembered to deliberately conceal the identity of the individual.

The need to identify the dead is obvious for social and medico-legal purposes. Various techniques of biological anthropology are employed in the process of identifying the individuals from the bones or the body parts . The identification of the dead from the bones/ body parts in a legal setting forms an essential component of forensic anthropology . The foremost task in achieving the personal identification is to establish whether the skeletal remains are human or not. If the remains belong to a human being, then various anthropological techniques can be used to identify the dead.

The 'big fours' of personal identification are determination of —

- Age,
- Sex,
- Stature and
- Ethnicity.

These form the features of 'tentative identification'.

The age can be estimated by —

- Examination of the fontenelles/fonticulis in infacy,
- Eruption and sequence of eruption of teeth in childhood,
- Appearance and fusion of ossification centers of bones in juveniles (skeletal age estimation),
- Obliteration of cranial sutures
- General features of the skull in adulthood and old age.

There are other methods which have been developed recently like —

- Pubic symphyseal morphology,
- Phase changes in the sternal rib,
- Number of whole osteons and osteon fragments, and
- Degenerative changes in the skeletal features.

Sex can likewise be determined from various bones/ skeletal remains:

- When whole skeleton is available, the sex can be determined with almost 99-100% accuracy.
- Among individual bones, pelvis is known to provide the most accurate results in the determination of sex (95% accuracy), followed by skull (92% accuracy).
- Several other bones are also used in sex estimation such as femur, tibia, ulna, radius, vertebrae, sternum, metatarsals and metacarpals etc.
- Sex determination form bones are based on their morphological and morphometric features.

A combination of both morphological and morphometric features can provide most accurate results.

The growth process in the children and juveniles may hamper the manifestation of some sexually dimorphic features in the bones, and hence, methods for sex determination are practiced on the adult skeleton —

Stature estimation is also an important part of personal identification. It provides an idea about the size of the person.

Due to the allometric relationship of the body parts with one another, the stature can be estimated from almost all the bones of the skeleton.

Forensic anthropologists worldwide have attempted to estimate stature from various bones.

3. **Dental eruption**
   - Difference between 2 sets of teeth
   - Time of eruption
   - Period when their root calcification is complete
4. **Radiological examination of epiphysial union**
   - Ossification centre appearance and fusion

Table 18.2

Age Estimation in Living	Age Estimation in Dead (Additional Points)
Teeth	Teeth:
Bones	Gustafson's method
Secondary sexual characteristics	Boyde's method
Miscellaneous	Ossification centre demonstration

Medico-legal Importance of Teeth

1. **Dental identification**: **It is second best to "Dactylography"**. Teeth and jaws are protected from mechanical trauma and fire. They are preserved in postmortem decomposition. So, they are useful in:
   - Accidental deaths
   - Homicide
   - Mass disasters like earthquake, explosion, aircraft crash and shipwreck
   - Mutilated
   - Decomposed
   - Skeletons
   - Burnt bodies

Fig. 18.2

2. Age estimation
3. Grievous hurt: loss of teeth due to assault
4. Type of dentures, partial or complete
5. Economic status from condition of teeth
6. Occupational marks
7. Bite marks: Identification of accused from marks left in human flesh or in food stuffs
8. Diagnosis of poisoning: heavy metal poisoning
9. Habits: Stains of beetle leafs (Fig. 18.2)
10. Pink teeth: Indicates asphyxia

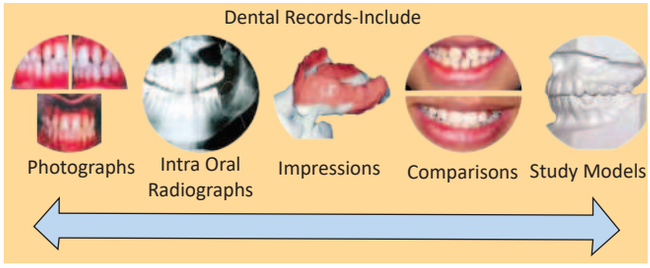


Fig. 18.3

Difference between 2 sets of Teeth

❖ In humans, there are two sets of teeth. Temporary, deciduous or milk teeth and permanent teeth. Their details are as follows:

❖ **Temporary, deciduous or milk teeth**
- Number: 20
- 4 incisors, 2 canines, 4 molars
- 212 or 2102 formula for each half of jaw

❖ **Permanent teeth:**
- Number: 32
- 4 incisors, 2 canines (cuspids), 4 pre-molars (bicuspid), 6 molars (tricuspid)
- 2123 formula for each half of jaw
- The time of eruption of teeth gives a good indication of age up to 18 to 25 years with range of 1 to 2 years

❖ 2 types of permanent teeth:
- Following division is based on the development of the teeth.
- **Suprradded permanent teeth:**
  - Teeth which do not have predecessors
  - They erupt behind temporary teeth
  - Permanent molars
  - 6 in each jaw
- **Successional permanent teeth:**
- They erupt in place of deciduous teeth
- Permanent premolars erupt in place of deciduous molars
- 10 in each jaw

Uses

- ❖ Identifying the suspect in a wanted poster.
- ❖ Additional evidence against a suspect.
- ❖ Warning vulnerable population against serial offenders.

Fig. 18.7 A : Identikit

Fig. 18.8

18.4 Moles, Tattoos, Scars, Occupational Marks & Hairs

❖ Moles

- Melanocytic nevi, commonly known as moles, are benign skin growths that can appear anywhere on the body.
- Characteristics:
  - Benign moles are symmetric, meaning the two halves have the same appearance when a line is drawn within them.
  - Colour: They are typically single-coloured, ranging from skin-coloured to dark brown,
  - Shape: Usually round or oval-shaped.
  - Size: Most moles are small, about the size of a pencil eraser or smaller than 6 mm
  - They begin to appear during childhood and increase in number until early to mid-adulthood.
- Medicolegal importance:
- Identification

❖ Tattoo marks (Fig. 18.9)

- **Definition:** They are defined as Special marks, designs, pictorial diagrams, or allphabetical messages made or written permanently on the skin of the body by multiple punctures made with a needle dipped in the dyes.
- **Site:**

Fig. 18.9

  - Anywhere on the body
  - Commonest site is front of the forearm
  - Other common sites are limbs, back off neck, abdomen.
  - In prostitutes tattoos may be present onbreats and vulva:
  - Tattoo on penis or blue bird tattoo on extensor surface of web of thumb are found in homosexuals
  - Inside the lower lip: Alphabet numbers 3 (cocaine), 8 (heroine), 13 (marijuana) and 999 (very pure heroin) are found in drug abusers or at the site of injection to conceal injection marks
- **Techniques**: (Fig. 18.10)
- Tattoos are made by deep injection of dyes into the dermis by using sharp needles/electric vibrators

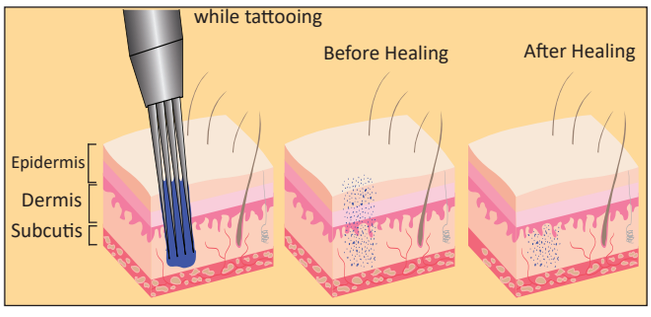


Fig. 18.10

19 Thanatology

19.1 Death

Introduction

The word is "Thanatos" derived from Greek word which refers to death. The study of death is known as "Thanatology". "Forensic thanatology" is the field of forensic science which deals with death and its medico-legal implications.

Death is a process which holds important legal consequences in cases such as inheritance disputes or job vacancies within civil litigation. Insurance claims are another example of civil importance related to death, while criminal significance typically centers around homicide, suicide, or accidental deaths.

Legally, there is no precise definition for death; however, it can be presumed under two circumstances: either a qualified registered medical practitioner has issued a death certificate or evidence indicates that the person was alive within thirty years prior and proof demonstrates that they have not been heard from by those most likely to know them for at least seven years (as outlined in Sec 107 & 108 IEA). (BSA Cl. 110 & 111)

Definition

- Death is defined as permanent cessation of all vital functions, including those of heart, lungs and brain. (Tabers cyclopedic medical dictionary Jaypee brothers 1st Indian edition 2002-pg 537)
- It can be also defined as failure of vital centers which govern the beating of heart and act of breathing; the cessation of life. (Medical dictionary -Dr.NitinMahurkar-Birla publications Pvt ltd-5th edition-pg 160)

Stages of Death

Medically death can be categorised into two stages:

- **Somatic/systemic**: It means the cessation of operations within an individual's living system and has traditionally been characterised by the **irreversible stoppage of breathing, blood circulation,** and **brain activity** - also known as "**Atria Mortis**" (Portals of Death).

  It can be summarised as permanent, irreversible death of living being as a whole. However, with advancements in technology such as heart-lung machines and organ transplants, there has been a shift in how medical and legal professionals define death.
- **Cellular/molecular**: It means stoppage of all cellular or molecular activities. It is the death of individual cell. This occurs 2 to 3 hours after somatic death.
- **Importance of somatic and cellular death**
  - After confirmation of somatic death, a RMP can issue death certificate. Disposal of the dead body according to his beliefs can be done.
  - **Organ transplantation:** The period between somatic and cellular death is known as "**Supravital period**". Organs for transplantation should be removed within this period.
- Liver: 15 min
- Kidney: 45 min
- Heart: within an hour
- Cornea: 3 hours
  - Peri-mortem wounds: Wounds caused in this period. Differentiation of these wounds is difficult as vital reaction continues till cellular death occurs.
- **Suspended animation**
  - **Synonym: Apparent death**
  - **Heartbeat and respiration become weak, so that they cannot be detected in routine examinations.**
  - The determination of irreversible cardio pulmonary failure poses a challenging decision. Several conditions exhibit temporary and reversible cessation of heart and lung functions. These conditions are commonly referred to as "**suspended animation"**.

- ❖ Hypostasis is not likely to occur in infants, elderly individuals, those with haemorrhage or anaemia.
- ❖ In cases of prolonged circulatory failure, it may appear before death (ante mortem) and take a longer time to manifest.
- ❖ If the body is shifted after death but prior to the fixation of hypostasis, a dual pattern may be observed. The original hypostasis may not drain completely due to gravity and instead remain incompletely drained in the new position. After hemolysis occurs, blood pigments remain on the skin without changing location.

Case based Learning

1. In a victim of hanging, if body remains hanging for some time before being removed from the site and placed on their back elsewhere—a new pattern will form on their back and sides while the original hypostatic discolouration will still be visible in their hands, legs and thighs (gloves and stocking pattern).
2. In case of drowning, if a person's body is removed from the water and then laid down onto the back—the original pattern of discolouration caused by hypostasis will appear on the face while less formed patterns develop afresh across other parts of the body.

- ❖ Hypostasis in internal organs follows similar patterns as seen on external skin surfaces. Dependent loops found within jejunum or ileum might sometimes be mistaken for mesenteric infarction or intestinal strangulation since hypostatic discolourations are interrupted rather than continuous like strangulation tend to be.
- ❖ Additionally noteworthy are instances where myocardium located behind posterior walls of left ventricles could resemble infarctions caused by hypostasis.
- ❖ Haemorrhages occurring behind esophagus at larynx level might also look like strangulation but it can be easily distinguished by incising great veins ahead of dissection procedures taking place later down-the-line during post-mortem examinations.
- ❖ Differential Diagnosis: External hypostasis may be confused with bruiser if the body is examined late. Discolouration due to putrefaction also needs to be distinguished from hypostasis.

- ❖ **Medico-legal importance**
  - Sign of death.
  - Estimation of time since death.
  - May indicate posture of body at the time of death.
  - Cause of death can be determined from colour and distribution.
  - Differentiation from bruising and internal organ disorders.

5. Rigor mortis

- ❖ **Definition**: Rigor mortis is a state of muscle in dead body with shortening and stiffening because of enzyme breakdown. It is a physico chemical phenomenon.
- ❖ **Synonyms**: Death stiffening; Cadaveric rigidity.

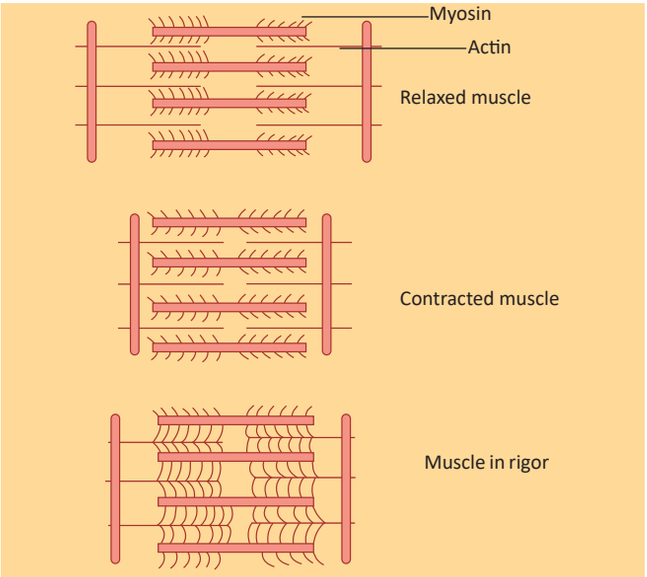


Fig. 19.6: Muscle contraction

Mechanism:

- **Muscle Anatomy:** Voluntary muscles are composed of bundles of long fibers, each containing densely packed myofibrils. These myofibrils are the contractile units and consist of two types of protein filaments: actin filaments (thin) and myosin filaments (thick). They form a loose physico-chemical combination known as actomyosin, which is physically shorter than the separate filaments.
- **Muscle Contraction Physiology:** In the relaxed condition, actin and myosin filaments interdigitate to a small extent. Under the influence of a nerve impulse, actin filaments are

Fig. 19.10: Marbeling

- **Site:** The superficial veins especially over the roots of the limb, thighs, sides of the abdomen, shoulders, chest and neck.
- **Colour:** Greenish- brown or purplish-red lines
- **Time:** It is prominent in 36 to 48 hours.

2. Formation of Foul-smelling Gases

- Due to action of body and various bacterial enzymes, following foul smelling gases are formed.
- H_2S, CO_2, CO ammonia, phosphorated hydrogen, mercaptans and methane.
- Gases are formed in the stomach and intestines in 12 to 18 hours in summer, and the abdomen becomes tense and distended.
- In the early stages, the gases are non-inflammable.
- With the progression of decomposition, such an amount of hydrogen sulphide is formed, which can be ignited to burn with a blue flame.
- On opening the abdomen, the gas escapes with a loud explosive noise.

3. Pressure Effects of Gases

- **Post-mortem purge:** Due to the presence of gas in the abdomen, the diaphragm is forced upwards compressing the lungs and heart, and bloodstained froth exudes from the mouth and nostrils which can be mistaken for the bleeding following ante mortem injury.
- The compression of heart forces out its contents.
- Pressure of the gases may force food from the stomachin to the fauces, and this may fall into the larynx.

- **Bloating up of body and features:**
  - From 18 to 36 or 48 hours after death, the gases collect in the tissues, cavities and hollow viscera under considerable pressure, and the features become bloated and distorted.
  - Swelling due to gases is most marked in the face, genitalia and abdomen.
  - The subcutaneous tissues become emphysematous, due to which even at hin body appears obese.
  - The eyes bulge from their sockets,
  - The tongue is forced out between the swollen and discoloured lips.
- **Changes in genitalia:**
  - The breasts, scrotum and penis are greatly distended.
  - The sphincters relax and urine and faeces may escape.
  - The anus and uterus may prolapse after two to three days.
  - Post-mortem delivery of a foetus may take place.
  - Blood-stained fluid (tissue lique-faction stained by hemolysis) may leak from mouth, nostrils, rectum and vagina.

Fig. 19.11: Putrefactive blisters

- **Changes in skin & wounds:**
  - **Putrefactive blisters**: The gas formation in the blood vessels may force blood-stained fluid, air or liquid fat between the epidermis and dermis forming small blisters. Blisters are formed first on the lower surfaces of trunk and thighs, where tissues contain more fluid due to hypostatic edema. (Fig. 19.11)

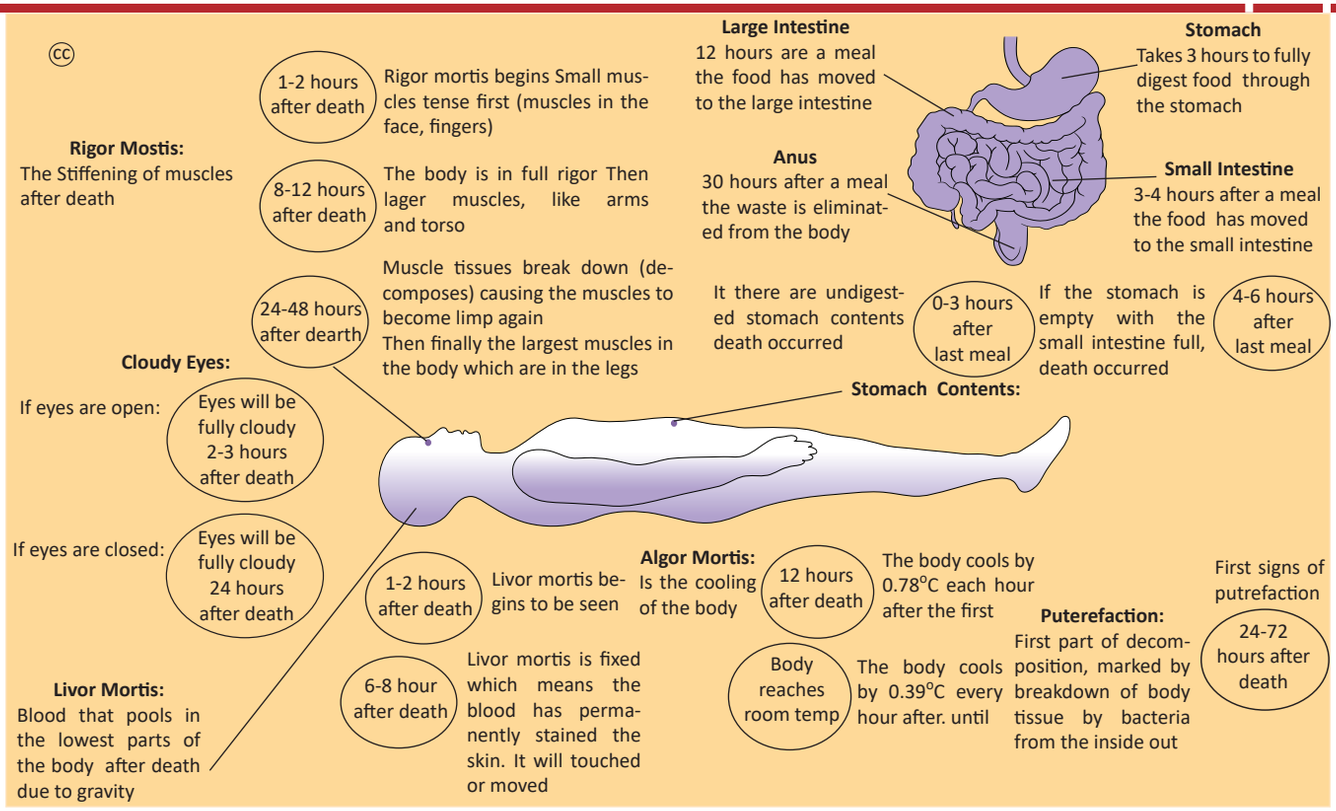


Fig. 19.16: TSD by Michele Taylor

19.3 Medico-legal Autopsy and Exhumation

Introduction

Word "autopsy" is made up of two words namely, Autos –Self and Opis–View. Hence autopsy means see for one self. It is also known as

necropsy which means (Necro – dead and Opis -view) investigation of a dead body.

Post-mortem, i.e. post – after, mortem – death; is also used as a synonym for autopsy. It doesn't give clear indication regarding the extent of the examination. In soime countries, body is disposed only after external examination.

Definition: It is a special type of scientific examination of a dead body carried out under the laws only on the requisition of police or magistrate in cases of unnatural deaths. It is done mainly for the protection of the citizens and to assist the identification and prosecution of the guilty in these cases.

Types of Autopsy

1. Medicolegal autopsy
2. Clinical/pathological autopsy
3. Psychological autopsy
4. Virtual autopsy
5. Endoscopic autopsy

1. Medico-legal Autopsy

- ❖ It is done on requisition by investigating officer or magistrate.
- ❖ Consent of relatives is not needed for this autopsy.
- ❖ It is done in following cases of death:
  - Violent
  - Sudden and unexpected (E.g. death of a person of young age or without any prior history of illness)
  - Death occurring under a suspicious condition
  - Employment–related deaths
  - Death in prison or psychiatric hospital
  - Death within 24 hours of hospital admission
  - Death within 24 hours of administration of general anaesthesia
  - If doctor has not seen patient in last 24 hours

2. Clinical Autopsy

- ❖ It is done for academic or scientific purposes to understand the exact cause of death.

20 Asphyxial Deaths

Introduction

Term Asphyxia is derived from a Greek word meaning pulselessness.

Common Causes of Asphyxia

Definition: Asphyxia is a mode of death in which an interference with respiration occurs due to any cause (mechanical, pathological, environmental or toxic) resulting in reduced blood O_2 level (appreciably below the normal working level) and retention of CO_2 in the blood and body tissues.

Fig. 20.1

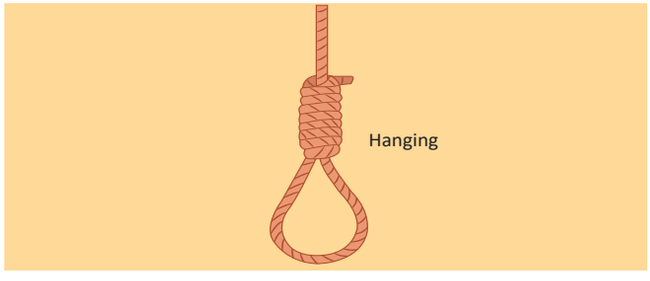


Fig. 20.2

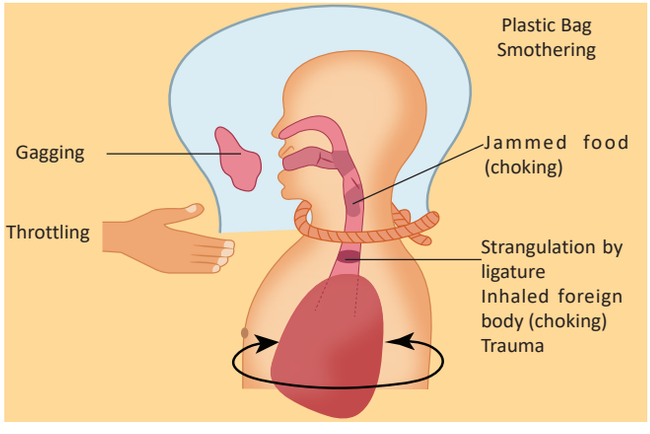


Fig. 20.3

Fig. 20.4 : Types of asphyxia

Causes of Asphyxia

1. Mechanical

- ❖ Mechanical interference to the air passage:
  - External:

	Methods	Compression over
1.	Hanging, strangulation and throttling	Neck
2.	Smothering	Nose & mouth
3.	Traumatic asphyxia	Chest

  - Internal: drowning, choking

2. Pathological

- ❖ Air entry into lungs is prohibited by disease
- ❖ E.g. laryngeal edema, tumors

3. Environmental

- ❖ Respiration affected due to atmospheric causes
- ❖ E.g. high altitude, insufficient O_2 in environment, irresperable gases

4. Toxic

- ❖ Cessation of respiratory movements due to paralysis of respiratory centre.

Patho-physiology of Asphyxia

Classical Signs of Asphyxia

- ❖ **Cyanosis**: Bluish discolouration of skin (Fig. 20.3)
- ❖ **Petechial haemorrhage**: Also known as Tardieu's ecchymosis, they are round, red, pin point sized spots. (Fig. 20.4)

3. According to manner of Death

- Homicidal e.g. lynching
- Suicidal
- Accidental e.g. autoerotic
- Judicial (Capital punishment)

Nature of Ligature Used

Various threads or materials made up of cotton, hemp, rope of any thickness like saree, dhoti, belt are used for the pupose of hanging.

Types of Knots: Generally knot is in form of simple slip knot. Rarely granny or reef knot are found. Depending on the type of note local s/s vary in case of death due to hanging.

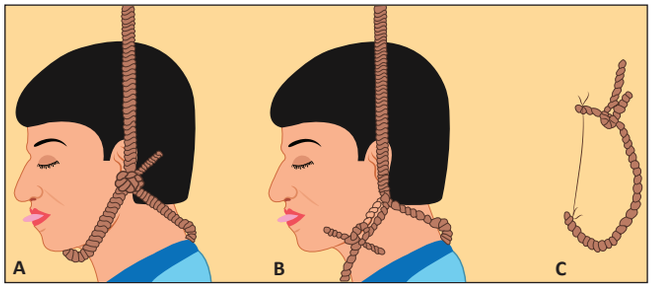


Fig. 20.8: Types of knot A: fixed loop B: Running loop

1. According to Noose—
   - Fixed noose
   - Running noose
2. According to manner of Death—
   - Simple knot
   - Other.

Symptoms

Stage of Dyspnoea

- Respiratory movements, B.P., pulse rate increases.

Stage of Convulsion

- B.P., pulse rate increases.
- Face deeply congested.

Stage of Exhaustion

- B.P. falls, pulse imperceptible.
- Respiratory center gets paralysed.

Fatal period- 5 to 10 min.

- In case of judicial hanging, death is instantaneous.

Mechanism of Death

Polson has described following weight as sufficient for a person's death to occur:

Jugular veins	2kg
Both carotid artery	5kg
Trachea	15kg
Vertebral artery	16-18kg

From above table, we can understand the cause of death in partial hanging is due to constriction of organs mentioned above.

Causes of Early Death

- **Asphyxia**: Most common. When upper part of neck is compressed, root of tongue is pushed upwards and backwards causing occlusion. Compression of lower part of neck causes direct occlusion of windpipe.
- **Venous congestion**: Compression causes blockage of jugular vein, which leads to stoppage of cerebral circulation. It leads to rapid rise in venous pressure in head.
- Combination of asphyxia and venous congestion is responsible for death in 77% cases.
- **Cerebral Ischemia**: Pressure over carotid artery prevents blood from going to the brain.
- **Shock**: Reflex vagal inhibition due to pressure on vagus nerve/carotid sinus causes sudden cardiac arrest.
- **Fracture or dislocation of cervical vertebrae**: Sudden drop of 2 meter causes fracture dislocation of upper cervical vertebrae. This causes compression/laceration of spinal cord. Stretching leads to separation of pons and medulla. Tear in intima of carotid artery is seen.

Causes of Delayed Death

- Aspiration pneumonia
- Infection
- Oedema of Lungs
- Oedema of Larynx
- Hypo toxic encephalopathy
- Infection of Brain
- Abscess of Brain
- Cerebral softening

Post-mortem Appearance

Before starting postmortem, photograph of the body should be taken. If ligature is present, it should be cut after conserving knot.

21 Injury

21.1 Basics of Injury

Introduction

In *Gangadhar Tika*, Abhighat is defined as an assault with any weapon like Lathi, feast, rocks, etc. Whereas *Chakrapanidatta* explains it as injury due to Lathi etc.

अभिघातोऽभिहनं शस्त्र दण्ड मुष्टि लोष्ट्रादिभिः।

(*Gangadhar Tika*)

अभिघातो लगुडाद्यभिघातः। (*Chakrapanidatta)*

In Brihattrayi, wounds are defined as *Vrana.*

तस्य लक्षणं द्विविधं— सामान्यं, वैशेषिकं च।

तत्र सामान्यं रुक्।

'व्रण' गात्रविचूर्णने, व्रणयतीति व्रणः।

विशेषलक्षणं पुनर्वातादिलिङ्गविशेषः।। Su.Chi. 1/6

वृणोति यस्मादूढेऽपि व्रणवस्तु न नश्यति।

आदेहधारणात्तस्माद्व्रण इत्युच्यते बुधैः।। Su.Su. 21/40

Features of *Vrana* as per *Sushruta Samhita*:

1. There is discontinuity in *Sharir Dhatu.*
2. Parts of body are crushed.
3. It causes a long-term deformity in the form of scar.
4. It is painful.

Important Legal Terms

1. **Injury**: According to Sec. 44 IPC (BNS Cl. 2/14), injury means any harm caused illegally to any person in body, mind, reputation and property*:
   - **Harm to body:** E.g. if A inflicts burns on B's body.
   - **Harm to mind:** E.g. if X threatens Y on phone.
   - **Harm to reputation:** E.g. if B spreads false rumors about C's character like C is a widow and she is pregnant with an illegitimate child.
   - **Harm to property:** E.g. X burns C's car or relatives of patients breaks furniture of hospital after the death of the patient.

*According to BNS, 2023 , "Injury" means any harm whatever illegally caused to any person, in body, mind, reputation or property (Ch 1 preliminary/ definitions/14).

2. **Wound**: It is a medical term. Wound means a break in the natural continuity of any tissue in the living which is caused by violence or trauma.
3. **Trauma**: Trauma is a Greek word which means a physical or psychological injury caused by external force.
4. **Hurt**: According to Sec 319 IPC, (BNS Cl. 114) "hurt" means any pain, disease, infirmity/ deformity in the body part:
   - A simple injury is an injury which is neither extensive nor serious and which heals rapidly without leaving any permanent deformity/ disfiguration.
   - Simple injury is used as a synonym of hurt.
   - **Pain:** Mental pain is not included in this definition. Only bodily pain which is caused by an injury is considered. E.g. X slaps Y OR a doctor gives injection without consent.
   - **Disease:** When a disease is produced due to an injury. E.g. lacerated wound gets infected or gastroenteritis due to food poisoning. In this case, time difference between the act causing injury and disease should be such that the appearance of disease due to injury can be proved. E.g. anaphylaxis reaction after the injection of penicillin by the doctor.
   - **Infirmity:**Infirmity means inability of an organ to perform its usual function. This includes temporary mental impairment.

Mechanism of Injury

Following factors affect effects of force and appearance of injury:

❖ Velocity

- As per laws of physics, force generated by an impact depends on the mass and velocity of an object causing injury.

2. Fracture of pelvis: Bruise over thigh
3. Fracture of femur: Bruise over lower outer thigh
4. Blunt injury to thigh: Bruise over knee
5. Kick over calf region: Bruise over ankle

❖ Age of Bruise

1. **Mechanism**: Healing of bruise or contusion occurs by destruction and removal of extravagated blood.

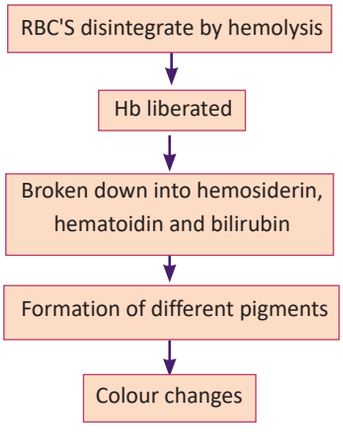


Chart No. 21.1

2. **Rate of healing**: Rate of healing is faster in following cases;
   - If affected area is more vascular.
   - If area of contusion is smaller.
   - In case of young and healthy individual.
3. **Colour changes**: Colour changes start at periphery and extend in wards to the centre.

Table 21.3

Colour	Pigments Responsible for Colour Changes	Duration from Injury
Red	Oxyhemoglobin	Fresh
Blue	Haemoglobin	Few hours to 3 day
Bluish black to brown	Haemosiderin	4 to 7 days
Greenish	Haematoidin	7 to 10 days
Yellow	Bilirubin	10 to 14 days
Normal	Oxyhemoglobin	2 weeks

* **Sub-Conjunctival Haemorrhage** : Usual colour changes do not occur due to diffusion of atmospheric oxygen. They change red to yellow.

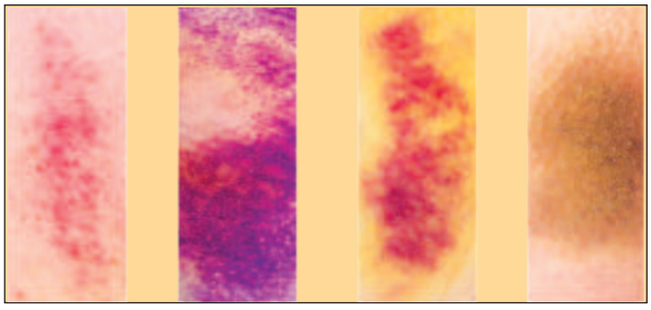


Fig.21.9: Colour changes in contusion

4. **Contusion and Postmortem Lividity**: In early stages, postmortem lividity may be confused as a contusion. Differences are enumerated in following table:

Table 21.4

Trait	Bruise / Contusion	Postmortem Lividity
Cause	Extravasation of blood due to rupture of vessels	Stasis of blood in toneless capillaries after death.
Location	Anywhere on the body	On dependent parts of the body
elevation of Surface	Present	Absent
Colour	Varies according to age of bruise	Purple, may vary in some cases of poisoning
On incision	Extravagated blood is present, which cannot be washed off	Oozing of blood which can be washed off easily
Histology/ Signs of inflammation	Present	Absent

5. **Ante-mortem contusion and Postmortem contusion**:

Table 21.5

Trait	Ante-mortem Contusion	Postmortem Contusion
Cause	Extravasation of blood due to rupture of vessels due to blunt force	Severe blow within a few hours after death
Location	Anywhere on the body	Anywhere on the body, especially over an area of post-mortem lividity/ bony prominences

Associates	Particulars	Range
Cardboard/ Wad	Present in shotgun only	2 metres
Shot/Slug	Present in shotgun only	Depends on range

Following factors influence a firearm injury

1. Type of weapon
2. Type of cartridge
3. Type of projectile
4. Muzzle velocity
5. Range of firing
6. Angle of firing
7. Time since firing
8. Ricocheting of bullet
9. Part of body struck
10. Nature of target

Range of firing & firearm injuries

Range of firing can be classified into three types as follows:

1. **Contact/close wound** (Fig. 21.25)
   - When muzzle end is in contact with the body part, it is responsible for contact wounds.
   - **Shape:** Round or oval
   - **Size:** Large
   - **Margins:** Irregular

Fig. 21.25

❖ **Other signs and symptoms**

- Greater subcutaneous damage
- Extrusion of fat
- Unburned powder in and around
- Abrasion, Contusion, and grease collars.
- Muzzle impression is observed
- Burning in surrounding area

❖ **Medico-legal importance**: Common in suicidal deaths.

❖ **Wound of entry** (Fig. 21.27)

- **Number:** Large single wound of entry
- **Size:** Larger than the diameter of missile
- **Shape:** Cruciate, cruciform
- **Margins:** Everted
- Fat is protruding
- Cavities like abdomen and cranium may be burst open
- Tract is burnt due to contact with flames
- Presence of carboxyhaemoglobin (COHb) is responsible for cherry red colour of wound
- **Recoil abrasion:** Imprint of muzzle end is found on the body part in contact
- Residues of gun powder are present
- **Back splatter:** Cloth, hair, tissue or blood enters the muzzle end due to negative pressure

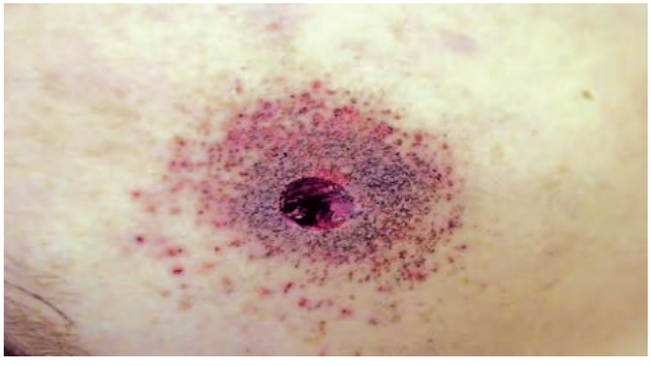


Fig. 21.26

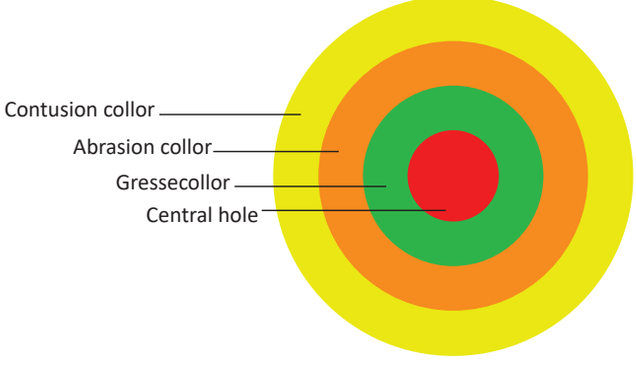


Fig. 21.27

Table 21.18

Degree of Burns	Duputytre Classification	Wilson -Hebra Classification
1st	Redness / Erythema	1st degree burns/ Epidermal burns
2nd	• Blister formation • Also known as vesicle/ Bulla • Made up of white avascular epidermis with red hyperemic border • Contains exudates rich in protein and chlorides • Base is red • Cause- capillary dilation and oozing of fluid • Singeing of hair is seen • Location-epidermis • No scar formation	
3rd	• Epithelium is completely destroyed • Pain fibers are exposed • Most painful burns • Location -upper layer of dermis • Scar with no contraction	2nd Degree/ Dermo-Epidermal burns
4th	• Painless - as nerve fibers are destroyed • Location- whole dermis is destroyed • Appearance - burns appear brownish black, shriveled and bordered by red line • Scar with contractions • Responsible for dis-figuration/impaired function	
5th	• Muscles are destroyed • Deep fascia involved • Scarring and deformity	3rd degree/ Deep burns
6th	• Carbonisation of whole limb • Complete charring including bones	

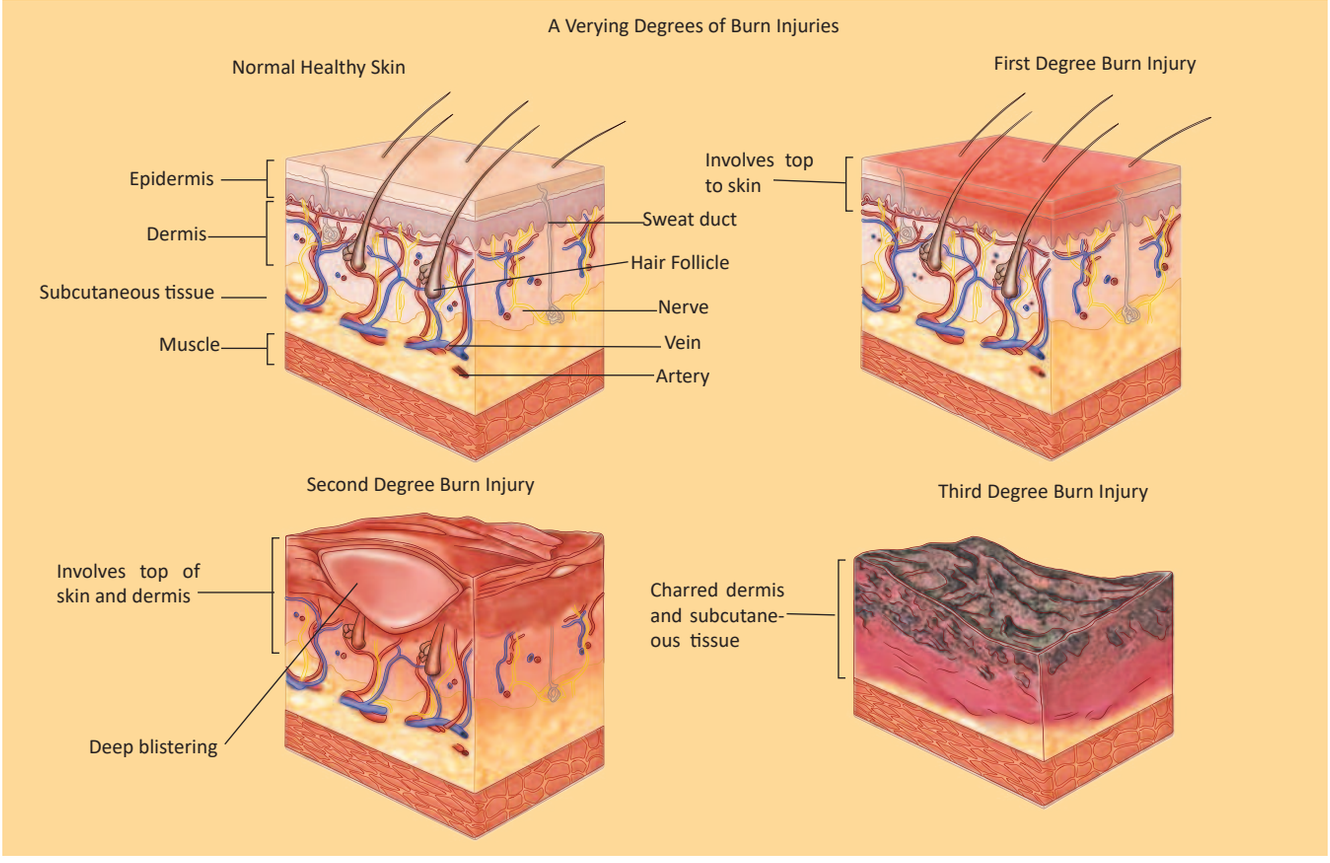


Fig. 21.29

22 Pregnancy, Delivery and Abortion

22.1 Medico-legal Aspects of Pregnancy, Delivery, Infanticide and Battered Baby Syndrome

Pregnancy

Pregnancy is a physiological condition of having a developing embryo or foetus in the body, from the time of fertilisation of an ovum by the sperm until the birth of the child.

Medico-legal Aspects of Pregnancy

- Malicious persons may allege either verbally or in writing, that an unmarried woman or widow is pregnant, in which case she would definitely vindicate herself.
- Concealed pregnancy before marriage by a person other than lawfully wedded spouse constitutes a valid ground for divorce.
- Duration of pregnancy assumes importance when legitimacy of a posthumous child is questioned.
- Pregnancy is positive proof of sexual intercourse in a trial for rape.
- Pregnancy may be a motive for the suicide of a married or unmarried woman, or
- Motive for the murder of a married woman by her husband, when it is result of an explicit relationship.
- Woman may feign pregnancy, termed pseudo-cyesis in order to —
  - Avoid capital punishment (Sec.416 Cr.P.C/ 456 BNSS)
  - Compel a person to marriage
  - Secure more maintenance in case of divorce
  - When a women advances pregnancy as a plea to avoid attendance in court as a witness in an important trial. A pregnant woman is entitled to be excused attendance in court only if a physician certifies to the fact that delivery is imminent or that there is fear of the occurrence of serious complication if she were forced to attend court.
  - When a condemned women pleads pregnancy as a bar to hard labour or execution. Under section 416 of the Indian criminal code, the high court is the only judicial court which can postpone the execution of sentence of death.

Signs of Pregnancy

The signs of pregnancy in living may be classified as follow:

- Presumptive
- Probable
- Positive signs

Presumptive Signs

- **Amenorrhea**: Absence of menstruation, a key early indicator of pregnancy.
- **Breast Changes**: Primarily noticeable in first-time pregnancies (primigravidas), including increased tenseness, tingling sensations (typically in the 6th to 8th week), darkening of nipples and areola, and increased erectility.

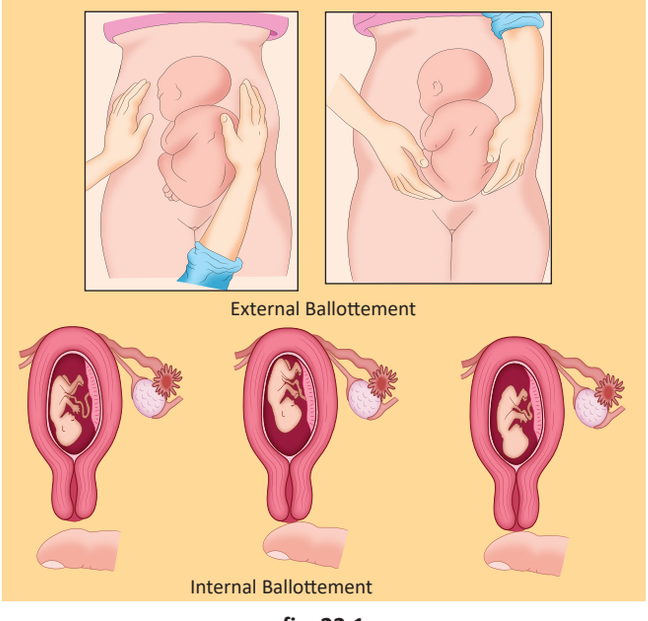


fig. 22.1

- Changes in vagina
- Pigmentation of the skin

23 Sexual Offences

23.1 Rape

Clause 63 BNS/ Section 375 IPC

A man is said to commit "rape" if he—

1. Penetrates his penis, to any extent, into the vagina, mouth, urethra or anus of a woman or makes her to do so with him or any other person; or
2. Inserts, to any extent, any object or a part of the body, not being the penis, into the vagina, the urethra or anus of a woman or makes her to do so with him or any other person; or
3. Manipulates any part of the body of a woman so as to cause penetration into the vagina, urethra, anus or any part of body of such woman or makes her to do so with him or any other person; or
4. Applies his mouth to the vagina, anus, urethra of a woman or makes her to do so with him or any other person, under the circumstances falling under any of the following seven descriptions: —
   - Against her will.
   - Without her consent.
   - With her consent, when her consent has been obtained by putting her or any person in whom she is interested, in fear of death or of hurt.
   - With her consent, when the man knows that he is not her husband and that her consent is given because she believes that he is another man to whom she is or believes herself to be lawfully married.
   - With her consent when, at the time of giving such consent, by reason of *mental illness* or intoxication or the administration by him personally or through another of any stupefying or unwholesome substance, she is unable to understand the nature and consequences of that to which she gives consent.
   - With or without her consent, when she is under eighteen years of age.
   - When she is unable to communicate consent.

Punishment

- Imprisonment less than 10 years
- May extend to life imprisonment
- Simple or rigorous
- Fine
- Imprisonment more than 10 years for —
  - In custodial environment
  - During communal violence
  - On mentally ill woman
  - On woman who is unable to give consent
  - On woman under 16 years
  - Woman under 12 years

Medicolegal Questions

The following controversial questions are likely to arise in case of rape.

Q – Can a healthy adult female be violated against her will?

A single woman of good physical health and in all possession of her senses cannot be raped by a single man unless she is taken unaware or she is thrown accidentally on the ground to render her completely helpless or she has swooned because of exhaustion after long resistance.

Q – Can a woman be raped during natural sleep?

Usually not but not improbable. In a case of virgin it is not possible to rape her during her sleep, because of the painful act of coitus.

Q – Can a woman be raped during unconsciousness?

Rape can be committed on a woman without her being aware of the act during catalepsy, syncope, epileptic coma or hypnotic trance or during

Table 23.1

Genital Injuries	Physical Injuries	Opinion	Rationale why forced Penetrative Sex cannot be ruled out	What can FSL Detect
Present	Present	There are signs suggestive of recent use of force/forceful penetration of vagina/ anus. Sexual violence cannot be ruled out.	Evidence for semen and spermatozoa are yet to be tested by laboratory examinations in case of penile penetration.	Evidence of semen except when condom was used
Present	Absent	There are signs suggestive of recent forceful penetration of vagina/anus.	Evidence for semen and spermatozoa are yet to be tested in case of penile penetration. The lack of physical injuries could be because of the survivor being unconscious, under the effect of alcohol/drugs, overpowered or threatened. It could be because, there was fingering or penetration by object with or without use of lubricant - which is an offence under Sec 375 IPC	Evidence of semen or lubricant except when condom was used
Absent	Present	There are signs of use of force, however vaginal or anal or oral penetration cannot be ruled out.	The lack of injuries could be because of the survivor being unconscious, under the effect of alcohol /drugs, overpowered or threatened or use of lubricant.	Evidence of semen or lubricant
Absent	Absent	There are no signs of use of force; however final opinion is reserved pending availability of FSL reports. Sexual violence cannot be ruled out.	The lack of genital injuries could be because of use of lubricant. The lack of physical injuries could be because of the survivor being unconscious, under the effect of alcohol/drugs, overpowered or threatened. It could also be because, there was fingering or penetration by object with use of lubricant- which is an offence under Sec 375 IPC / Clause 63 BNS	Evidence of semen, lubricant and drug/alcohol

Examination of the accused CrPC 53 A/ BNSS Clause 52

1. When a person is arrested on a charge of committing an offence of rape or an attempt to commit rape and there are reasonable grounds for believing that an examination of his person will afford evidence as to the commission of such offence, it shall be lawful for a registered medical practitioner employed in a hospital run by the Government or by a local authority and in the absence of such a practitioner within the radius of sixteen kilometers from the place where the offence has been committed, by any other registered medical practitioner, acting at the request of any police officer, and for any person acting in good faith in his aid and under his direction, to make such an examination of the arrested person and to use such force as is reasonably necessary for that purpose.
2. The registered medical practitioner conducting such examination shall, without delay, examine such person and prepare a report of his examination giving the following particulars, namely: —

24 Forensic Psychiatry

24.1 Common Symptoms Associated with Psychiatry Disorder

Introduction

In Homo sapiens, degree of development of nervous system is more complex. Hippocrates has described Brain as seat of mind. In *Ayurveda*, detail description of the following *Manas Roga* is available in Brihattrayee. *Unmad, Apsmar, Atatwabhinivesh, Graha, Bhay, Harsh* etc. 12 *Manas Dosha Vikar*, description of *Manas Roga* and personality disorders with reference to *Rajas Tamas Prakriti*. *Unmad Vyadhi* is the most described mental illness in Ayurveda. There is disturbance of *Manas* (mind), *Buddhi* (intellect), *Sandnya* (cognitive function), *Dnyana* (perception of knowledge), *Smriti* (memory), *Bhakti* (preferences), *Sheela* (character), *Cheshta* (psychomotor activity) and *Achaar* (behaviour).

उन्मादं पुनर्मनोबुद्धि सञ्ज्ञा ज्ञानस्मृति भक्तिशीलचेष्टाचारविभ्रमं विद्यात्।। Ch.Ni. 7/5

Etiological Factors

Physical factors: *Utsanna Dosha* (vitiated dosha), *Vishama Cheshta* (difficult postures)

Dietary factors: *Viruddha, Dushta, Ashuchi Bhojana* (antagonistic, defective and impure food)

Psychological factors: *Raja, Tama, Manas Dosha* are responsible for *Manas Roga.* According to *Sushruta, Krodha, Shoka, Bhaya, Harsha, Vishada, Irshya* etc emotions of *Manas* are *hetu* for *manas roga.*

Personality factors: *Alpa Satwa* (weak psyche) is known as predisposing factor for *Manas Roga*, *Bhiruta* (timidity).

External factors: *Abhighata* (trauma), fear

विरुद्धदुष्टाशुचिभोजनानि प्रधर्षणं देवगुरुद्विजानाम्।
उन्मादहेतुर्भयहर्षपूर्वो मनोऽभिघातो विषमाश्च चेष्टाः।।

Ch.Chi. 9/4

Pathogenesis

तैरल्पसत्त्वस्य मलाः प्रदुष्टा बुद्धेर्निवासं हृदयं प्रदूष्य।
स्त्रोतांस्यधिष्ठाय मनोवहानि प्रमोहयन्त्याशु नरस्य चेतः।।

Ch.Chi. 9/5

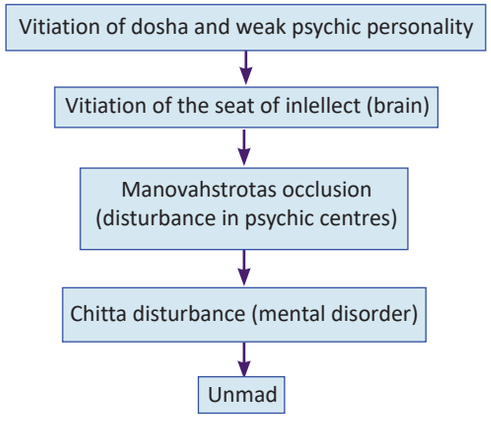


Chart No. 24.1

Types of Unmad

In *Charaka Samhita,* **5 types** of *Unmad* are described.

1. Vatika
2. Paittika
3. Kaphaja
4. Sannipatika
5. Agantuja (Bhutonmad)

इह खलु पञ्चोन्मादा भवन्ति; तद्यथा— वातपित्त कफसन्निपातागन्तुनिमित्ताः।। Ch.Ni. 7/3

Signs and Symptoms

1. ***Vatika:*** Inappropriate laughing, smiling, dancing, singing, movement of body parts etc. psychomotor activities, roughness, emaciation and aggravation of disease after digestion of food. There is continuous changing behaviour and craving for unobtainable things and hatred for possessions.
2. ***Paittika*:** Irritability, anger, excitement, insomnia, violence against self and others, desire for dense shade, cold food and drinks etc.

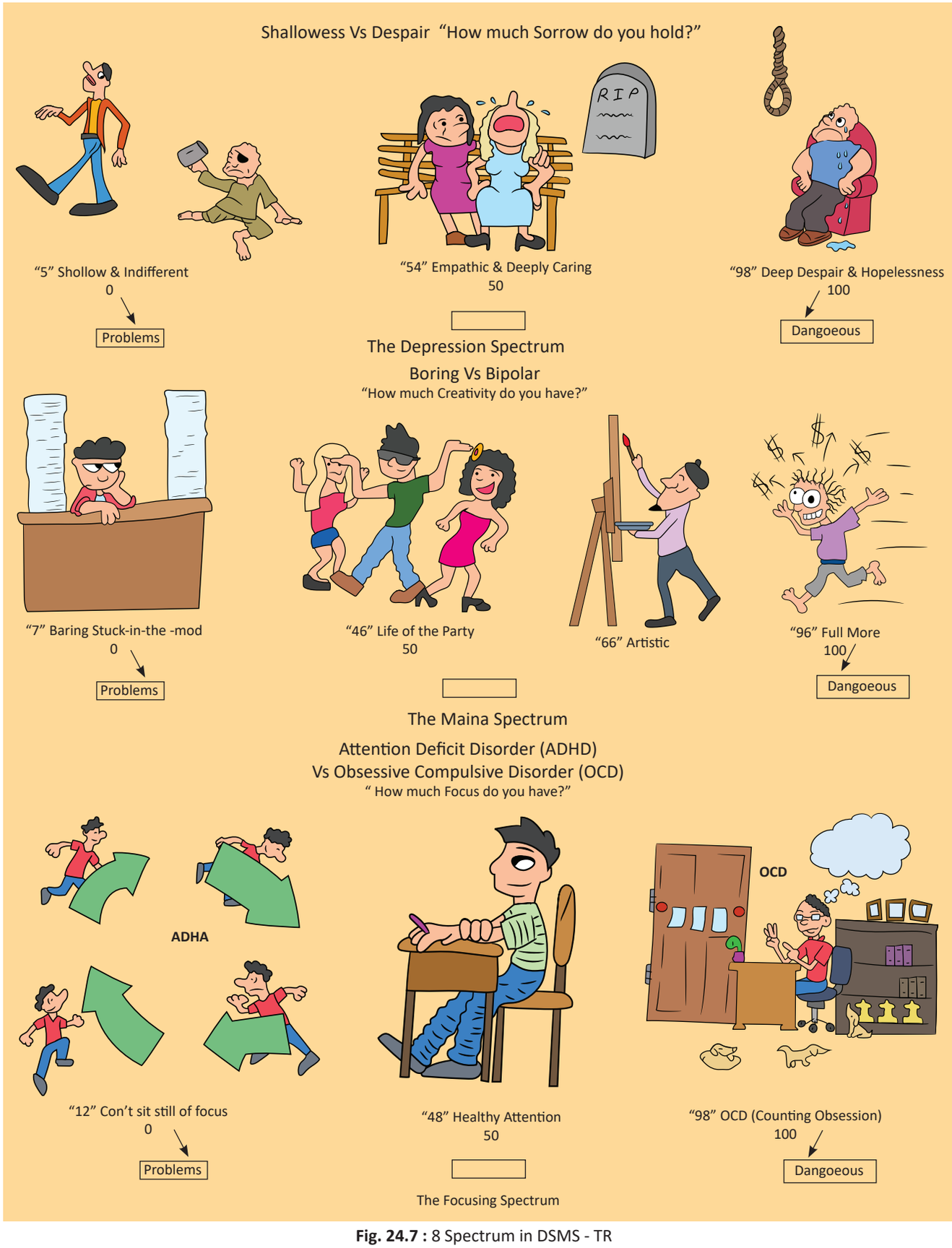


Fig. 24.7 : 8 Spectrum in DSMS - TR

25 Forensic Science Laboratory

25.1 Hierarchy and Major Divisions of Forensic Lab Services

"Locard's Principle of exchange"

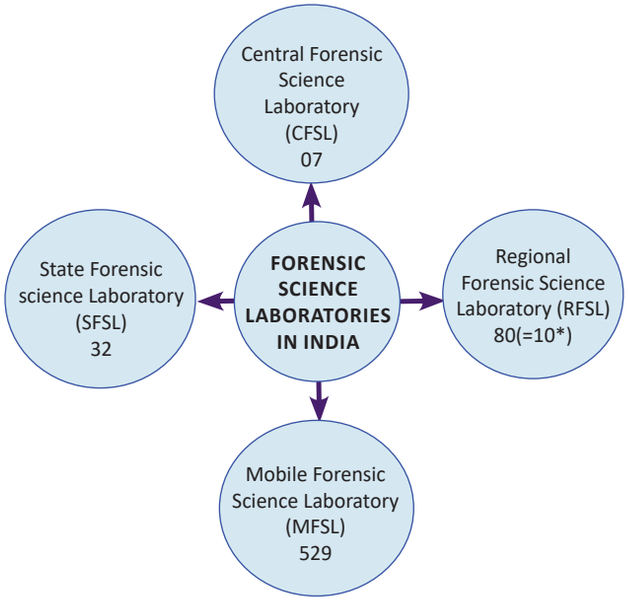
"Every contact leaves a trace"

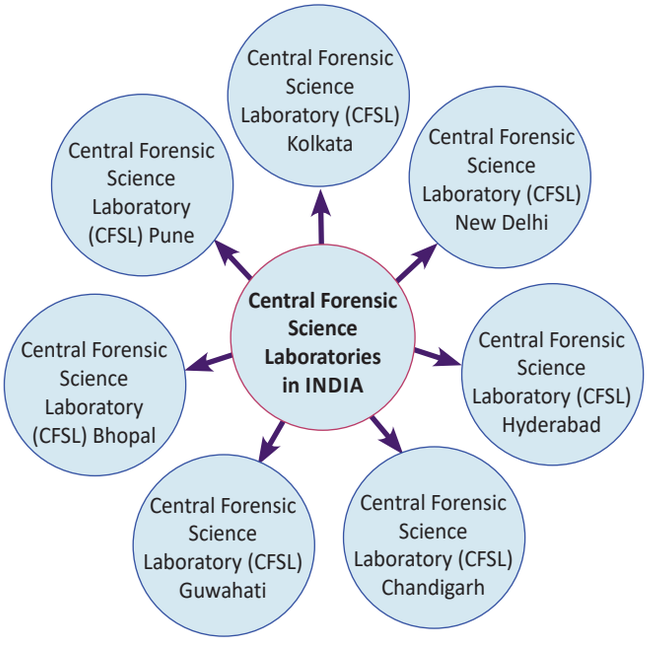
Value of trace evidences was first recognized in 1910 by Edward Locard. He is known as Sherlock Homes of France.

"Locard's Principle of exchange states that when two objects come in contact, there is always exchange of material."

E.g. in robbery, assault fingerprints of accused can be found on the weapon. In sexual offence, semen can be found in the vagina or on medial aspect of thigh.

The Directorate of Forensic Science services (DFSS) was created in 2002 by Ministry of Home Affairs, Govt. of India. It has six Central Forensic Science Laboratories under its control, located at Chandigarh, Kolkata, Hyderabad, Pune, Guwahati and Bhopal. Its mission is to render 'high quality and credible forensic services' to justice delivery system. Seventh central forensic lab which is located at New Delhi functions under Central Bureau of Investigations (CBI). For successful prosecution by judiciary; investigating officers, medical officers and forensic scientists should function in coordination.





List of CFSLs in India

A vital role is played by all the Forensic Science Laboratories (FSL) in solving civil and criminal cases. Their main function is to provide an unbiased scientific opinion on the different types of evidences and in turn, help the judiciary.

Role of FSL

1. Scientific examination and analysis of evidences
2. Evaluation and interpretation of results of scientific analysis
3. Effective use of forensic findings in the court of law
4. Producing the evidence in a form which is admissible in the court of law

FSL Helps Investigating officers by

1. Identification of evidences at the crime scene
2. Collection and preservation of evidences identified at the scene of crime
3. Analysis, examination and testifying of forensic evidences
4. Interpretation of this findings.

26 Laws, Acts, Rules and Regulations

26.1 Clinical Establishments Act

The Clinical Establishments (Registration and Regulation) Act, 2010: On April 15, 2010, the Clinical Establishments (Registration and Regulation) Bill, 2010 was introduced in the Lok Sabha for the first time. It has been enacted by the Central Government to provide for registration and regulation of all clinical establishments in the country to prescribe the minimum standards of facilities and services provided by them. The Clinical Establishment Rules are a set of guidelines and regulations issued by the government of India to regulate the functioning of clinical establishments across the country. Its overarching aim is to ensure that clinical establishments, maintain high standards of quality, safety, and professionalism in their operations.

Objective of the Act

The Act makes it mandatory for registration of all clinical establishments, including diagnostic centers and single-doctor clinics across all recognised systems of medicine both in the public and private sector except those run by the defence forces. The registering authority facilitates policy formulation, and resource allocation and determines standards of treatment. It can impose fines for non-compliance with the provision of the Act. The Act lays down Standard Treatment Guidelines for common disease conditions, for which a core committee of experts has been formed. Further, the Act makes all clinical establishments provide medical care and treatment necessary to stabilise any individual who comes or is brought to the clinical establishment in an emergency medical condition, particularly women who come for deliveries and accident cases.

Chapter I Clause 2 (c), a clinical establishment may be a hospital, maternity home, nursing home, dispensary, clinic, sanatorium, or any other institution that offers services for diagnosis, care, or treatment of patients.

Chapter II details the formation of a National Council.

Chapter III details the formation of State and Union Territory Councils. It also requires the formation of district registering authorities.

Chapter IV details the registration procedure. A provisional registration shall be valid for one year and must be renewed. An establishment may apply for a permanent registration. The registration certificate must be prominently displayed.

Chapter V details the creation of state and national-level Register of Medical Establishment in digital form.

Chapter VI details various offences and penalties.

The National Council for Clinical Establishment

The Act lays down establishment for the a Council Body called The National Council for Clinical Establishment which is responsible primarily for setting up standards for ensuring proper healthcare by the clinical establishment and developing the minimum standards and their periodic review.

Minimum standards to be followed by Clinical Establishment: Section 12 of the Act lays down that for the registration and continuation of a Clinical Establishment, such clinical establishment shall fulfill the conditions namely:

- The minimum standards of facilities and services
- The minimum requirement of personnel
- Provisions for maintenance of records and reporting
- Such other conditions as may be prescribed.

The minimum standards for hospitals are implemented based on the level of care provided by such hospitals.

Recently in September 2014, the National Council for Clinical Establishments under the Chairmanship of the Director General of Health Services, Government of India in consultation with various stakeholders

Appendix-I

APPENDIX 1/1-A: Medical Certification of Cause of Death (for Non-hospital Events)

For Non-Hospital Events **Appendix-III**

FORM NO. 4A

(see rule 7)

MEDICAL CERTIFICATION OF CAUSE OF DEATH

(For non-institutional deaths, Not to be used for still births)

To be sent to Registrar along with Form No. 2

(Death Report)

I hereby certify that the deceased Shri/Smt./Km.....son of /wife of/ daughter of ..... resident of ..... was under my treatment..... from to .....and he/she died on ..... at ..... A.M./ P.M.

<table>
<tr><td colspan="5">NAME OF DECEASED</td><td>For use of Statistical Office</td></tr>
<tr><td>SEX</td><td colspan="4">Age at Death</td><td></td></tr>
<tr><td></td><td>If 1 year or more, age in Years</td><td>If less than 1 year, age in months</td><td>If less than one month, age in days</td><td>If less than one day, age in hours</td><td rowspan="3"></td></tr>
<tr><td>1. Male
2. Female</td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="4">CAUSE OF DEATH
I. Immediate cause
(a) State the diseases, injury or complication which due to (or as a consequences of) caused death, not the mode of dying such as heart failure, asthenia, etc.
(b).....
Antecedent cause
Morbid Conditions, if any, giving rise to the Due to (or as a consequences of) above Cause, stating underlying conditions last
II. Other significant conditions contributing to the
(c) .....
death but not related to the disease or conditions .....
causing it .....</td><td>Interval between onset & death approx.....</td></tr>
</table>

Examination of Weapon

To,

The Investigating Officer Mr. ABC .....

Ref: Your letter no.545/2023 Dated DD/MM/yyyy

Sir,

With reference to the above letter, I hereby submit the report about the weapon name of the Weapon: Knife

Type of the Weapon: Light sharp weapon

Description of the Weapon:- It has metallic blade with both sharp edges, tapering end and a wooden handle with golden hilt

Blade -Length 15cm Breadth 2.5cm Margins: non-serrated Points: 1 sharp point

Thickness or circumference: 2mm Handle- Length 7cm

Breadth or circumference: 5cm

-Texture: smooth Joint: 1 golden hilt

Injuries possible: Incised, stab with blade and abrasion with back of handle Injuries impossible: lacerations Stains if any: blood stains Prints if any: fingerprint on handle

Foreign body if any: Nil Identification mark if any: Mark AD on handle

(Put your signature also on the Weapon)

The weapon is packed, sealed and handed over to the police constable Name Mr. ABC No. 1298 police Station:

Place:- Pune

Date & Time: DD/MM/YYYY ..... AM/PM

Signature of the Student

Signature of the Staff

Appendix-II
Shlokasangraha

1. अगदतन्त्रम्

गदो रोग : अगदो रोगप्रतीकार: तदर्थं तन्त्रमगदतन्त्रम्।
Su.Sa.Su. 1/14

अगदाय तन्त्रम् अगदतन्त्रम्।

2. अगदतंत्र व्याख्या

अगदतन्त्रं नाम सर्पकीटलूतामूषिकादिदष्टविषव्यञ्जनार्थं विविधविषसंयोगोपशमनार्थं च।। Su.Sa.Su. 1/14

सर्पवृश्चिकलूतानां विषोपशमनी तु या।
सा किया विषतन्त्रञ्च नाम प्रोक्ता मनीषिभि:।।
Harit.Sam. Pratham Sthan 2/18

3. विष व्याख्या

जगद्विषण्णं तं दृष्ट्वा तेनासौ विषसंज्ञित:।।
Cha.Sa.Chi. 23/5, A.Hr.U. 35/2

विषादजननत्वाच्च विषमित्याभिधीयते। Su.Sa.K. 3/21

..... विषण्णास्तस्मात्तद्विषसंज्ञामवाप।। A.Sa.U. 40/2

व्यवायि च विकाशी स्यात् सूक्ष्मं छेदि मदावहम्।
आग्नेयं जीवितहरं योगवाहि स्मृतं विषम्।।
Sha.Sa.Pu.Kha. 4/22-23

4. विष योनि

जङ्गमस्थावरायां तद्योनौ ब्रह्मा न्ययोजयत्। Cha.Sa.Chi. 23/6

स्थावरं जङ्गमं चैव द्विविधं विषमुच्यते। Su.Sa.K. 2/3

5. विष क्रिया

विषं हि देहं सम्प्राप्य प्राग् दूषयति शोणितम्।
कफपित्तानिलांश्चानु समं दोषान् सहाशयान।।
ततो हृदयमास्थाय देहोच्छेदाय कल्पते। A.Hr.U. 35/9-10

6. विष वर्गीकरण

स्थावरं जङ्गमं चैव द्विविधं विषमुच्यते। Cha.Sa.Chi. 23/6

स्थावरं जङ्गमं चेति विषं प्रोक्तमकृत्रिमम्।
कृत्रिमं गरसंज्ञं तु क्रियते विविधौषधै:।।
A.Hr.U. 35/5-6, A.Sa.U. 40/15-16

कृत्रिमं विषं द्विविधम्।
एकं सविषं दूषीविषसंज्ञम् अपरमविषं तदेव गरसंज्ञकम्।।
Bha.Pr.Ma.Kha 65/47

❖ विष

हालाहल: कालकूट: शृङ्गाटकश्च प्रदीपन:।
सौराष्ट्रिको ब्रह्मपुत्रो हारिद्र: सक्तुकस्तथा।।
वत्सनाभ इति ज्ञेया विषभेदा अमी नव:। R.T. 24/7-8

❖ उपविष

अर्कक्षीरं स्नुहीक्षीरं लाङ्गली करवीरक:।
गुञ्जाऽहिफेनो धतूर: सप्तोपविषजाताय:।।
Bha.Pr.Ni. Dhatwadi 206

विषतिन्दुकबीजं च त्वहिफेनञ्च रेचनम्।
धत्तूरबीजं विजया गुञ्जा भल्लातकाह्वय:।।
अर्कक्षीरं स्नुहीक्षीरं लाङ्गली करवीरकम्।
समाख्यातो गणोऽयं तु बुधैरुपविषाभिध:।। R.T. 24/163-164

7. विष अधिष्ठान

स्थावरं जङ्गमं चैव द्विविधं विषमुच्यते।
दशाधिष्ठानामाद्यं तु द्वितीयं षोडशाश्रयम्।। Su.Sa.K. 2/3

❖ स्थावर विष अधिष्ठान

मूलं पत्रं फलं पुष्पं त्वक् क्षीरं सार एव च।
निर्यासो धातवश्चैव कन्दश्च दशम: स्मृत:।। Su.Sa.K. 2/4

❖ जङ्गम विष अधिष्ठान

तत्र दृष्टिनि:श्वास दंष्ट्रा नख मूत्र पुरीष शुक्र लालार्तव मुखसन्दंशविशर्धिततुण्डास्थिपित्तशूकशवानीति। Su.Sa.K.3/4

8. विष गति

जङ्गमं स्यादधोभागमूर्ध्वभागं तु मूलजम्।
तस्माद्दंष्ट्राविषं मौलं हन्ति मौलं च दंष्ट्राजम्।। Cha.Sa.Chi.23/17

9. विष संकट

विषप्रकृतिकालान्नदोषदूष्यादिसङ्गमे।
विषसंकटमुद्दिष्टं शतस्यैकोऽत्र जीवति।। A.Hr.U. 35/60

10. शंकाविष:

लक्षण

दुरन्धकारे विद्धस्य केनचिद्विषशङ्कया।
विषोद्वेगाज्ज्वरश्छर्दिर्मूर्च्छा दाहोऽपि भवेत्।।
ग्लानिर्मोहोऽतिसारश्चाप्येतच्छङ्काविषं मतम्।
Cha.Sa.Chi. 23/221-222